REFERENCES

Boehlje M.D. and **V. R. Eidman.** 1984. Farm management. John Wiley & Sons. New York. pp. 87-89.

Council for Agricultural Science and Technology (CAST). 2002. Urban and agricultural Communities: opportunities for common ground. Report No. 138. Council for Agric. Sci. Tech. Ames, Iowa.

Dirr, M.A. and **C. W. Heuser, Jr.** 1987. The reference manual of woody plant propagation. Varsity Press, Athens, Georgia. p. 29.

Gale, H. F., Jr., L. Foreman, and **T. Capehart. 2000.** Tobacco and the economy: Farms, jobs and communities. Economic Research Service., U.S.D.A. Agric.l Economic Rpt. No. 789.

Mezitt, E.V. 1978. Propagation of cuttings of lilacs and other hard-to-root species by the sub-irrigation method. Comb. Proc. Intl. Plant Prop. Soc. 28:494-496.

Uva, W.L., T.C. Weiler, and **R.A. Mulligan.** 1998. A survey on the planning and adoption of zero runoff sub-irrigation systems in greenhouse operations. HortScience 33:193-196.

Virginia Agricultural Statistics Service (VASS). 2001. Virginia Agricultural Statistics, Bulletin and Resource Directory, No. 75. Richmond, Virginia.

Rooting of *Pittosporum tobira* 'Variegata' Cuttings as Influenced by Pre-Plant Treatments of Contrast™ (Flutalonil) and Post-Plant Fungicide Treatment Combinations©

Brian Savage

Savage Horticultural Services, 436 N. Ridgewood Ave., Ormond Beach, Florida 32174 U.S.A.

Jim Newman

Bowood Farms, Clarksville, Missouri 63336 U.S.A.

INTRODUCTION

The effective control of fungal pathogens begins with early preventive measures ensuring disease-free propagating materials. This investigation sought to examine differences in percentage rooting of *Pittosporum tobira* 'Variegata' within a block of Contrast™ pre-plant treated (minimum of 24 h prior to cutting) cuttings and nontreated cuttings. Additionally, six various post-plant fungicide treatment combinations were periodically applied to pre-plant treated and nontreated cuttings. Treatments were laid out in a randomized split-block design.

MATERIALS AND METHODS

Pre-plant treatments consisted of Contrast™ 70 WSP - Scotts®, Flutalonil, 0.42 g a.i. per liter (8 oz per 100 gal rate) applied to half a bed of *P. tobira* 'Variegata' stock plants utilized for cutting propagation, while the remaining plants were sprayed with distilled water. These 11.4-liter (3-gal) potted pittosporum stock plants were being grown under 60% shade. Solo™ backpack sprayers with 35-mesh screens and conespray nozzles were used for all treatments starting 1 Jan. 2001. Pre-plant sprays were administered a minimum of 24 h prior to harvesting and sticking cuttings.

Cuttings were planted 17 Jan. 2001 in 116 cm^2 (18 in^2) trays with 7 cm^2 (1 in^2) cells. The propagation medium used contained coir, Canadian peat, and perlite (1 : 1 : 2, by volume). These trays were placed in a translucent polyurethane green-

house with a mean temperature of 27°C (80°F) and 90% relative humidity. Plants were watered every 40 min for 10 sec with Rondo™ nozzles [47 liter h^{-1} (12.4 gal per h)].

The post-plant treatments consisted of median foliar rates of: Banrot® 40WP - Scotts™ [Thiophanate-methyl and Etridiazole at 0.75 g $liter^{-1}$ (10 oz per 100 gal]; Contrast™ 70WSP - Scotts® [Flutalonil at 0.6 g $liter^{-1}$ (8 oz per 100 gal)]; Aliette® 80WDG - Rhone-Poulenc® [Fosetyl-Al at 4.5 g $liter^{-1}$ (3.75 lb per 100 gal)]; Aliette® and Contrast™ [4.5 g and 0.6 g $liter^{-1}$ at (3.75 lb and 8 oz per 100 gal)]; Truban® 30 WP - ScottsR [Etridiazole at 0.45 g $liter^{-1}$ (6 oz per 100 gal)]; and Truban® and Contrast™ at 0.45 g and 0.6 g $liter^{-1}$ (6 oz and 8 oz per 100 gal). All chemicals were sprayed bi-weekly from 28 Jan. 2001 to 9 April 2001, except the Aliette® (Rhone-Poulenc®), and Aliette® and Contrast™ which were applied monthly from 28 Jan. 2001 to 26 March 2001.

Plants remained in the greenhouse for a period of 9 weeks and were then moved outdoors on 12 Mar. 2001 and placed under 60% shade for a an additional 5 weeks. On 18 April 2001 all rooted liners were moved and repotted, during which time the percentage of rooted *P. tobira* 'Variegata' in each test plot was recorded. The experiment was 14 weeks in duration.

Experimental Design. The experiment was a split-block design: Contrast™ pretreated vs. non-pretreated plants, with six post-plant fungicide treatment replications and an untreated control. Both pre-plant treated and untreated blocks contained five replications of each post-plant fungicide treatment, randomized within the two blocks (Table 1).

Data Analysis. Data were statistically analyzed via analysis of variance (ANOVA) and Duncan's New Multiple Range Test were performed to determine significant differences between and within each block and treatment (Table 1). Data were analyzed with Quattro Pro 5.0 software (probability of an α error at 5%).

RESULTS

Pittosporum tobira 'Variegata' cuttings pre-plant treated with Contrast™ exhibited significantly higher rooting percentages than cuttings that did not receive such treatment (Table 1). Pre-plant treatment of stock plants with Contrast™ increased mean rooting by 21% and caused higher rooting percentage in all cases except the Aliette®/Contrast™ combination (Table 1).

There were significant differences in post-plant treatments and their interactions with the pre-plant treated and nontreated blocks (Table 1). Contrast™ treated plots in the pre-plant Contrast™ block yielded higher rooting percentages (83%) than any other treatment. Banrot®, Truban®, and control treatment plots in pre-plant Contrast™ block had significantly higher rooting percentages than other treatments, except the Contrast™ plots within the Contrast™ block (Table 1).

DISCUSSION

Usually the most important consideration in fungicide usage is to do so before infection takes place, because most fungicides work as protectants, not eradicants (Kucharek, 2001). This study sought to augment the propagation of healthy liners using pre- and post-plant fungicide application to enhance rooting and increase production.

Table 1. Comparison of mean percent rooted *Pittosporum tobira* 'Variegata' cuttings receiving pre-plant application of Contrast™ to stock plants and various post-plant fungicide treatment combinations in Flagler County, Florida.

	Percent rooting of cuttings receiving the following post-plant fungicidal applications						
Treatments	Aliette	Aliette /Contrast	Truban /Contrast	Banrot	Truban	Contrast	Control
Post-plant fungicidal applications only	24def*	34d	19ef	18ef	15f	28def	53b
Pre-severance treatment of stock plants with Contrast™ plus post-plant fungicidal applications	29def	29def	31de	47bc	55b	83a	55b

*Duncan's New Multiple Range Test; Means followed by the same letters are not significantly different.
ANOVA: $\alpha = 0.05$; n=5.

All fungicide treatments adequately controlled foliar diseases during the investigation such that no comparative values could be drawn from such data. The high rooting percentage of pre-plant Contrast™ treatments indicates cuttings sprayed before removal from stock plants tend to root more readily than untreated cuttings. Cuttings pretreated with Contrast™ that received additional post-plant applications had the highest percentage rooting. Contrast™ had effective and milder control on rooting liners compared with other fungicide treatments. Even though Contrast™ was sprayed seven times during the course of this study [three more applications than the permissible label level (Scotts, 2001)], no phytotoxicity occurred. Applications of Contrast™ eliminated visible signs of pathogens without inhibiting rooting, which fungicide treatments can cause (Hartmann et al., 1990). Contrast™ displayed no synergy with other fungicide combinations.

Future studies which incorporate soil samples and leaf tissue assays should be performed to ascertain pathogen information (Southern Nursery Association, 2000). *Rhizoctonia* seems to be a major pathogen of the test setting, in view of the products displaying highest levels of control. Diseases such as *Rhizoctonia* may be present in the field and never cause a problem on established stock plants. However, once cuttings of a susceptible plant are taken and placed under mist to root, disease may occur (Spreitler, 1999). The higher rooting percentage in the Contrast™ pre-plant treatment block supports use of such protective/preventive fungicide control measures prior to taking cuttings from stock plants.

The use of frequent scheduled sprays in propagation liner production seems unwise, based on this study's data. The low rooting likely occurred because of an overuse of fungicide treatments, as demonstrated by the percent rooting of the non-treated controls being higher than 10 other test fungicide treatments. The fungal protection these 10 treatments provided may not have outweighed the physiological stress incurred on the cuttings. Such overuse of crop protection chemicals has demonstrated reduced rooting due to chemical phytotoxicity (Hartmann et al., 1990).

Additionally, certain compounds are more likely to cause injury if applied at temperatures in excess of 29°C (85°F). Other fungicides have humidity limitations or should be applied only when foliage is dry. Spray tank mixtures of fungicides may also result in injury that would not occur if the chemical were used solely (Short and Price, 1997). The two fungicide treatment combinations in this investigation led to low rooting due to incompatibility and/or phytotoxicity.

Further investigation into the practical use of pre-plant treatments of Contrast™ and other fungicide treatments are warranted. Removing tank-mixed fungicide treatments and performing soil and plant tissue bioassays for identification of specific plant-pathogens identifications may better distinguish individual fungicide efficacy.

LITERATURE CITED

Hartmann, H.T., D. E. Kester, and **F. T. Davies, Jr.** 1990. Plant propagation — principles and practices. 5th ed., Englewood Cliffs, N.J., Prentice-Hall Inc., pp. 233-234.

Kucharek, T. 1997. Plant disease management guide. Vol. 1., IFAS Pub. Gainesville, Florida.

Scotts-Sierra Crop Protection Company. 2001. Contrast 70 WSP. Scotts-Sierra Crop Protection Company Publication H4586 (990330) 093099. Marysville, Ohio.

Short, D. E., and **J. F. Price.** 1997. The 1997 insect and related arthropods management guide for commercial foliage plants in Florida. SS-ENY-816. Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. **(City state please)** <http://edis.ifas.ufl.edu>.

Southern Nursery Association. 2000. Best management practices guide for producing container-grown plants. Southern Nursery Assoc. Atlanta, Georgia.

Spreitler, R. K. 1999. Dealing with disease in high humidity environments: Strategies for control in fog and mist zones. Comb. Proc. Intl. Plant Prop. Soc. 49: 608-613.