tree is killed to the graft union. We found that Satsuma Group can be rooted via cuttings (own rooted); if frozen back to the ground it will regrow rapidly to a bearing tree rather than be killed to the graft union. This nontraditional method has proved very valuable to the homeowner.

Cornus florida 'Weaver White' is a large-flowered dogwood that has shown increased resistance to powdery mildew and anthracnose. This dogwood selection was found at the University of Florida and we have observed it to be more vigorous than any other dogwood for Florida. Traditionally dogwoods have been grafted but we have had very good success rooting 'Weaver White'. This has been done with early season, semi-hardwood cuttings. The rooted cuttings are difficult to overwinter and must be forced before going dormant. 'Weaver White' is quite vigorous on its own root system, and rooting via cuttings is our preferred propagation method.

CONCLUSION

The choice to propagate a new or different plant brings many opportunities. To find the best method of propagation one must open their mind to the many different ways plants can be propagated. The common or traditional method should be questioned and improvement sought.

LITERATURE CITED

Hartmann, H.T, D.E. Kester, F.T. Davies, Jr., and R.L. Geneve. 2002. Plant propagation — Principles and practices. 7th ed. Prentice Hall. Englewood Cliffs, New Jersey.

The Feasibility of Utilizing Tobacco Greenhouses as Propagation Facilities for Ornamental Plants©

Gregory K. Eaton
Department of Horticulture, Virginia Tech, Blacksburg, Virginia 24061 U.S.A.

INTRODUCTION

Cash receipts for tobacco statewide have decreased from $190.8 million in 1997 to $132.1 million in 2000, and fallen in percentage of all agricultural commodities in Virginia from 8% to 6% over the same period. During the same period from 1997 to 2000, cash receipts for greenhouse, nursery, and forest products in Virginia have increased from $160.2 million to $179.4 million and increased as a percentage of all commodities from 7% to 8%. Consequently, ornamental horticultural crops have displaced tobacco as the most valuable cash crop in Virginia, accounting for 24.5% of all crop cash receipts, compared to 18% for tobacco in 2000 (VASS, 2000).

Farmers in southern Virginia are highly dependent on tobacco income, which accounted for nearly 90% of total value of agricultural production in 1996 (Gale et al., 1997). It would be desirable to establish supplemental and/or alternative agricultural opportunities that would keep Virginia family farms in operation, allowing them to maintain their livelihood while strengthening the agricultural economy and sustainability of communities of this region (CAST, 2002).

This study focuses on the feasibility of utilizing idle tobacco greenhouses as propagation facilities for the production of ornamental woody plant liners. The market for liners of high quality remains strong, and liner production can bring a high net

return on investment. Production of new crops in tobacco greenhouses would help to increase productivity of under-utilized greenhouse capacity and increase farm income. This report describes the initial investigation of the logistical, cultural, and engineering challenges of producing liners in tobacco greenhouses utilizing experimental production of two valuable cultivars of maple (*Acer rubrum* 'Franksred', Red Sunset™ red maple, and 'October Glory') from vegetative cuttings. The results from this study are to be used to create an economic model of woody plant propagation for prospective new producers.

METHODS

Facilities. A commercial tobacco plug greenhouse in Halifax County, Virginia, was chosen for this study. The greenhouse was 11.7 m (35 ft) wide × 91.4 m (300 ft) long and was ventilated with adjustable side curtains, one 0.9-m (36-inch) reverse mounted end fan capable of moving 283 cu. m (10,000 cu. ft) of air per minute, and 31 cm (12 inch) roof-mounted internal fans every 4.6 m (15 ft). We installed a 60% woven shade cloth to shade the 46 m linear (150 ft) of experiment area at the south end of the greenhouse. A Netafim mist irrigation system with a Phytotronics™ controller, 2-cm (3/4-inch) flexible main pipe, hanging mist nozzles, and electronic solenoids were installed to provide mist irrigation to half of the experimental propagation beds. Traditional tobacco float irrigation was retained on the remainder of the beds. The experimental production area consisted of 3 beds of 4.6 m (15 ft) by 15.2 m (50 ft) dimensions on each side of a 0.6-m-wide (2 ft) walkway. The beds were framed by 5 cm × 15 cm (2 inch × 6 inch) boards and lined with 6-mil impermeable black plastic (to produce float irrigation beds), or black landscape fabric (for mist irrigated beds). These were standard production tobacco plug propagation bed design, with limited modification to facilitate mist irrigation.

Planting. Cuttings of 'October Glory" and Red Sunset™ red maple were taken on 5 Aug. and 22 Aug. 2001. These consisted of 0.6-cm-diameter (1/4 inch) shoots of 18 to 20 cm (7 to 8 inch) long with 4 to 6 nodes. Shoots were taken from the top most actively growing portion of trees with 18 to 31 cm (8 to 12 inch) in diameter at breast height (dbh). The semi-hardwood cuttings were immediately placed in bins under ice and transported 241 km (150 mi) to the greenhouse. Cuttings were prepared by stripping leaves from the lower 2 nodes, and making a diagonal cut just below the bottom-most node. Cuttings were rinsed in 1 : 20 diluted bleach for 10 sec, rinsed twice with tap water, and dipped in 1000 ppm IBA : 500 ppm NAA, (Dip-In-Grow™) for 10 sec. They were inserted 5 cm (2 inch) deep in a pine bark and perlite (2:1, v/v) rooting medium in Dyna-flat™ propagation flats on 8-cm (3-inch) centers and watered in. The first cuttings of the two cultivars were arrayed in the propagation beds with 900 of each cultivar divided between two treatments (float and mist irrigation) and in 3 beds of each treatment. Float irrigated flats were placed on Styrofoam trays fitted with a capillary mat to provide subirrigation. Mist-irrigated flats were placed on the greenhouse floor under mist delivered every 7 sec for 15 min between the hours of 8:00 and 20:00. A second planting of 600 semi-hardwood cuttings with 300 per cultivar were arrayed in the propagation beds, under mist treatment only, on 22 Aug. 2001.

Monitoring. Plants were monitored weekly for survival, root initiation, and growth by lifting randomly selected marked cuttings from each bed and measuring the diameter of root system. Greenhouse ambient and soil temperatures were

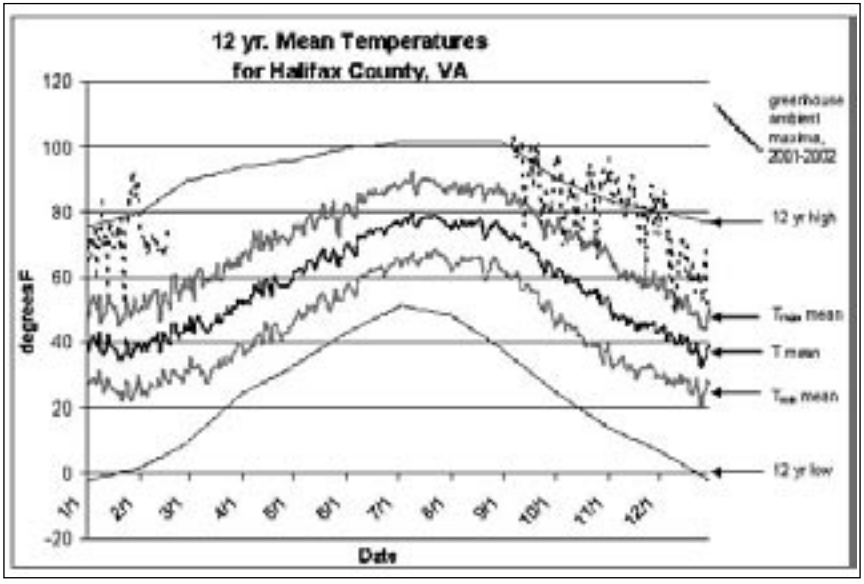

Figure 1. Ambient temperature data for Halifax County, Virginia, including 12-year mean, maximum, minimum, record high and low, and ambient tobacco greenhouse temperature (broken line).

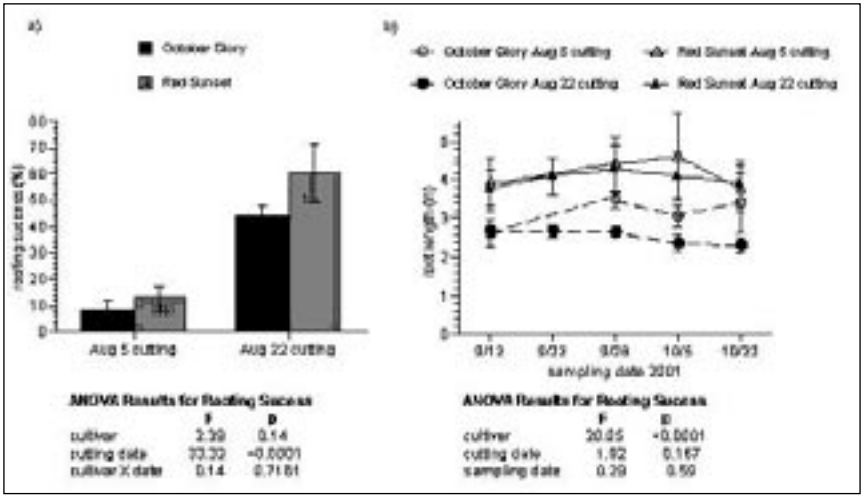

Figure 2. Rooting of 'October Glory' and Red Sunset™ red maple, two cultivars of red maple (*Acer rubrum*) in a traditional tobacco greenhouse. (A) percent of cuttings that were successfully rooted, (B) root growth among successfully rooted cuttings.

measured sporadically with a mercury thermometer and later with an automated data-logger. The cuttings remained in propagation trays until 20 Oct. 2001 when final determinations were made of survival and root development.

RESULTS AND DISCUSSION

Within 10 days of planting the cuttings taken on 5 Aug., 100% of the cuttings in the float irrigation treatment died. The rooting medium remained moist under this irrigation regime, but the leaves remained dry. We concluded that traditional float irrigation as used in tobacco plug production was not adequate for the vegetative propagation of maple liners, although this method of irrigating vegetative cuttings of other plants remains a viable option, especially for the rooting of hardwood cuttings taken in cooler seasons (Mezitt, 1978; Uva et al., 1998).

On 14 Aug. (Day 9), ambient greenhouse temperatures reached 46°C (115°F) and soil temperatures in the propagation flats reached 34°C (94°F). Within several days of these temperatures about 90% of cuttings under the mist irrigation died as well. Data logger temperature recordings of ambient greenhouse temperatures are presented along with 12-year means, maxima and minima for Halifax County (Fig. 1). The temperatures we observed in Halifax County during the summer of 2001 were not an anomaly. Ambient temperatures routinely reach and/or exceed 32°C (90°F) during the afternoon of summer days, leading to greenhouse temperatures routinely higher than daily maxima. We concluded that ventilation of traditional tobacco greenhouses was inadequate for summer propagation of maple liners, and probably for most species of ornamental plants for which softwood or semi-hardwood cuttings are used in vegetative propagation.

The percentage of successfully rooted cuttings taken on 22 Aug. 2001 was 45% for 'October Glory' and 60% for Red Sunset™ red maple (Fig. 2). This is five-fold greater than the first attempt, but still below the industry standard. At final determination, about 30% of cuttings from both crops combined rooted successfully. Commercial operations typically root 75% to 95% of planted maple cuttings (Dirr and Heuser, 1987). The high mortality was attributed to excessive greenhouse temperatures in August. Inadequate ventilation and lack of mist irrigation in traditional tobacco greenhouses create severe risks for production of ornamental plant liners. Producers interested in diversifying tobacco farms to include ornamental plant liner production are advised to consider (A) additional greenhouse modifications such as evaporative cooling systems, larger ventilation fans, and installation of mist irrigation, or (B) constructing separate greenhouse facilities for propagation of liners.

An economic analysis of liner production on tobacco farms is still in development to aid interested farmers in decision-making about diversification into ornamental plant propagation. Several factors encourage us to continue investigating the environmental and economic parameters under which this enterprise would be successful. These include the continuing financial plight of traditional tobacco farms, the strong market for ornamental liners in Virginia, and the launching of an ambitious Center for Advanced Learning and Research in the region. The center was created with funding to develop high value horticultural crops to aid the economic development of this and other rural areas of Virginia.

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-