made from lime-dewatered raw sewage sludge; plant's growth response can be expected to be different when compost is made from polymer dewatered sludge.

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Propagation of *Osmanthus* X *fortunei* by Softwood Cuttings[1]

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Abstract

Moderate rooting (64%) was achieved with nontreated, softwood cuttings of Fortune's osmanthus (*Osmanthus* X *fortunei* Carr.). Treatment of cuttings with 2500 ppm indolebutyric acid (IBA) significantly increased percent rooting (92%). Higher auxin concentrations resulted in rooting comparable to the nontreated cuttings. None of the treatments had any influence on root number or root length.

Index words: rooting, auxin, indolebutyric acid, Fortune's osmanthus

Introduction

Fortune's osmanthus (*Osmanthus* X *fortunei* Carr.), an interspecific hybrid between holly osmanthus [*O. heterophyllus* (G. Don) P.S. Green] and fragrant tea olive [*O. fragrans* (Thunb.) Lour.], is a large, dense, oval to rounded evergreen shrub which reaches a height of 4.6 to 6.1 m (15 to 20 ft) (1, 3). Leaves are dark green and leathery in appearance and small, extremely fragrant, white flowers are produced in the fall. At Raleigh, flowering generally occurs from mid-September through mid-October.

Although common in southern landscapes, specific propagation information is lacking, and nurserymen describe the hybrid as difficult to propagate by cuttings. Rooting trials conducted by the senior author over the last several years utilizing semi-hardwood and hardwood cuttings have resulted either in total failure or very low rooting percentages. However, a study conducted in mid-June 1984 suggested softwood cuttings might be the key to achieving greater success.

The 1984 research utilized cuttings in a transitional growth stage between a softwood and semi-hardwood condition with the best treatment resulting in 36% rooting. Although most propagators would regard such rooting as unacceptable, the results were encouraging as this was the greatest success achieved to date. The 1984 study suggested that softwood cuttings might provide greater rooting and with this objective in mind, the following investigation was undertaken to investigate the feasibility of propagating Fortune's osmanthus by softwood cuttings.

Materials and Methods

Terminal, softwood stem cuttings each 8 cm (3.1 in) long were taken May 13, 1986 from a single plant growing on the campus of North Carolina State University. Stems and leaves of the cuttings were light green. Leaves were fully expanded and the leaf tissue was soft yet sufficiently firm so that the leaves did not appear flaccid. Stem tissue was similar in that it was soft but firm. No

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distinct sound was noted when broken. Application of pressure to the cuttings resulted in breakage but the stem pieces held together, not separating at the break point.

Following collection, the cuttings were trimmed from the base to 7 cm (2.8 in), leaves were removed from the lower and upper portion of each cutting so that only the four largest terminal leaves remained, and the following treatments employed: (A) nontreated, (B) 2500 ppm (0.25%) indolebutyric acid (IBA), (C) 5000 ppm (0.5%) IBA, and (D) 7500 ppm (0.75%) IBA. When treating the cuttings with IBA, the basal 1.5 cm (0.6 in) of each cutting was dipped into an IBA solution for 1 second followed by 15 minutes of air drying before insertion into the rooting medium. IBA solutions were prepared by dissolving reagent grade IBA in 50% isopropyl alcohol. After auxin treatment, cuttings were inserted to a 4 cm (1.6 in) depth in individual, 7 cm^2 (2.8 in^2) plastic rose pots containing a medium of 1 peat:1 perlite (by vol.).

Pots were placed on a single, raised bench in a glass-covered greenhouse maintained at approximate day/night temperatures of $23.9° \pm 5.6°/18.3° \pm 2.8°C$ ($75° \pm 10°/65° \pm 5°F$). Intermittent mist operated 6 seconds every 5 minutes from 7:30 a.m. to 7:00 p.m. daily. A natural photoperiod was provided and light intensity was reduced approximately 40% with a greenhouse shading compound. The experimental design was a randomized complete block using six cuttings per treatment and six replications.

Fifteen weeks after the experiment was initiated, cuttings were harvested and data recorded. Data included the number and length of primary roots greater than 1 mm (0.04 in). Any cutting having one or more roots was classified as rooted. Standard analysis of variance procedures were utilized for data analysis.

Results and Discussion

Use of softwood cuttings provided an excellent means to propagate Fortune's osmanthus (Table 1). Although moderate success was achieved with nontreated cuttings (64%), rooting was significantly increased by treatment of cuttings with 2500 ppm IBA (92%). Higher concentrations resulted in rooting comparable to the nontreated cuttings, and no IBA treatments affected root number or root length.

Results reported herein and many unsuccessful attempts to root semi-hardwood and hardwood cuttings taken at various times of the year strongly suggest that Fortune's osmanthus is best propagated by softwood cuttings. Successful propagation by softwood cuttings lends support to the importance of timing (the time of the year in which the cuttings are taken). Timing is extremely important for successful rooting since only one flush of growth is produced yearly which occurs in the spring. The significance of timing apparently is no different than that for other species in which it can be the single most important factor in successful rooting (2, 3).

An individual attempting to propagate this hybrid should be aware of the description of the cuttings given in the *Materials and Methods.* This is of utmost importance because following budbreak and shoot elongation in the spring, tissue maturation progresses at such a rate that if one is not attentive, the growth stage most conducive to rooting will be quickly past. Once past, one would have little choice but to wait until the following year for the next flush of growth.

Significance to the Nursery Industry

Results indicate that timing is critical for successful rooting of cuttings of Fortune's osmanthus and this hybrid is best propagated by softwood cuttings. Moderate rooting can be achieved with nontreated softwood cuttings, but treatment with 2500 ppm IBA will increase the percentage of cuttings that root.

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Table 1. Effects of IBA treatments on the rooting of softwood cuttings of Fortune's osmanthus.

Treatment	Rooting[z] (%)	Mean no. roots/cutting[y]	Mean root length (mm)[y]
Nontreated	63.9 a[x]	5.7 a	39.8 a
2500 ppm IBA	91.7 b	6.4 a	45.9 a
5000 ppm IBA	66.7 a	5.8 a	47.3 a
7500 ppm IBA	63.9 a	5.5 a	46.3 a

[z]Each value is based on 36 cuttings.

[y]Means are based on the number of cuttings which rooted for a particular treatment.

[x]Mean separation within columns by Waller-Duncan k ratio t test; k = 100, $p \approx 0.05$.