Table 2. **Soluble salt levels and pH of growing media amended with 2 sources of composted municipal sewage sludge.**

Sludge Source		Soluble Salts[y]	pH[x]	
Compro	Earthlife	(mmhos/cm)	initial	final
(Percent by volume)				
50		2.07 c	4.8	6.9
60		3.47 b	4.5	6.9
67		4.44 a	6.4	7.0
	50	1.28 d	5.5	6.2
	60	2.53 c	6.3	6.2
	67	2.23 c	6.3	6.2
check[z]		0.55	6.4	6.7

[z]Commercial mix of 20% soil, 40% peat moss, 20% perlite, 20% vermiculite amended with dolomitic limestone to a pH of near 6.5, 0.15 g/liter of FTE and 1.2 g/liter of Aqua-Gro.

[y]by saturated paste extract.

[x]by 1:2.5 dilutionusing 0.1M $CaCl_2$.

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Adventitious Root Formation in *Rosa Multiflora* 'Brooks 56' Hardwood Cuttings[1]

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Abstract

Production of Texas field grown rose bushes is inefficient with less than 60 percent of *Rosa multiflora* hardwood cuttings developing into marketable plants after two years of commercial production. Uniformity of rooting of hardwood cuttings differs between field location and time of year. Treatments consisting of Hare's powder, 0, 3000, 10000 mg/l IBA (0, 300, 10000 ppm), 2N H_2SO_4 acid treatment, NaOH solution pH 10.5 and/or wounding were established to test the effect of selected chemical and mechanical treatments on rooting hardwood *Rosa multiflora* cuttings propagated under field and greenhouse conditions. Results were comparable between field and greenhouse propagated hardwood cuttings. Best treatments were with Hare's powder and wounding, while acid, base and IBA treatments did not enhance rooting. The importance of determining the physiological condition of field stock plants for successful rooting of hardwood cuttings is discussed.

Index words: auxin, propagation, wounding, *Rosa multiflora,* rose

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Introduction

Texas is the second largest producer of field-grown rose bushes in the U.S. with an industry valued at more than 16 million annually. Growers traditionally field propagate hardwood *Rosa multiflora* cuttings in late fall-early winter (Nov.-Jan.), and then T-bud rooted understock during the spring (Mar.-June) under non-irrigated conditions. There are advantages in simultaneously bench chip budding and rooting (1). Under current practices, many Texas growers harvest less than 60% of No. 1 grade, 2-year-old rose bushes that were initially planted as hardwood cuttings. Uniformity of rooting of hardwood cuttings differs from field location and time of propagation (Fig. 1). Poor rooting has been attributed to seasonal timing of cuttings (2) and marginal soil conditions (5). Greatest labor demands are in the fall when 2-year-old rose bushes are dug and processed, and understock are propagated. To take advantage of available labor, particularly when rains delay digging, nurserymen will propagate understock under less than physiologically optimum conditions.

Auxins, acid and base pretreatments have been attributed to enhance rooting of ornamental plants and selected *Rosa* species under glasshouse conditions, utilizing intermittent mist (6, 7).

The objectives of this research was to test selected chemical and mechanical pretreatments on the rooting of dormant hardwood *Rosa multiflora* cuttings under commercial field conditions of east Texas and under intermittent mist in a glasshouse.

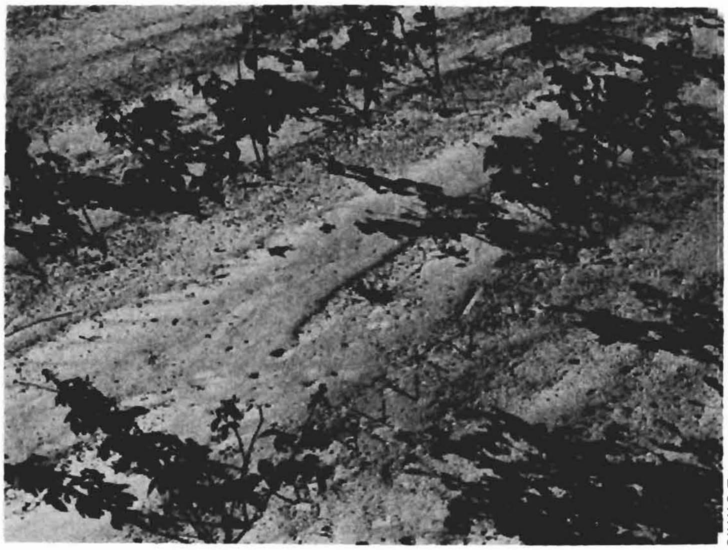

Fig. 1. Poor stand of commercial field rose bushes in Texas.

Materials and Methods

Cuttings from one-year-old dormant *Rosa multiflora* 'Brooks 56' rootstock were collected in December from a commercial field in East Texas. Cuttings were trimmed to 20 cm length (8 in), and all except the uppermost 2-3 lateral buds were removed by knife from rootstock cuttings to prevent growth and suckering of lateral buds.

The 13 propagation treatments consisted of: control; dipping cuttings in Hare's rooting talc; wounding; wounding + 3,000 mg/l IBA; wounding + 10,000 mg/l IBA; 3,000 mg/l IBA; 10,000 mg/l IBA; acid + 3,000 mg/l IBA; base + 3,000 mg/l IBA; acid + 10,000 mg/l IBA; base + 10,000 mg/l IBA; acid + base + 3,000 mg/l IBA; and acid + base + 10,000 mg/l IBA. Wounding the cutting base consisted of mechanically removing a strip of bark 1/3 the stem diameter and 1.5 cm (0.6 in) high. Auxin treatments consisted of 20 second dips in aqueous IBA-potassium salt formulations. Base treatments of NaOH-pH 10.5 and acid treatments of 2N H_2SO_4 were always followed by a distilled water rinse.

Cuttings were both propagated in raised soil beds under non-irrigated commercial field conditions of East Texas and under intermittant mist using a Mist-a-Matic® (A.H. Hummert Seed Co., St. Louis, MO 63103) in a medium of sterilized blasting sand (Bryco, College Station, TX 77840) in a glasshouse for comparison. Long days were maintained in the glasshouse with supplemental incandescent light from 1800 to 0100 HR (6 $E\mu m^{-2}s^{-1}$), and minimum night temperature was 18 °C (65 °F). There were 40 cuttings per treatment replicated 4 times in a randomized complete block design. The greenhouse study was terminated after 2 months. The field study was terminated after 4 months, which was representative of the acceptable commercial period for rooting before T-budding of field understock normally begins. Data included percent rooting, mean number of roots per cutting, and the average length of the 3 longest roots.

Results and Discussion

Treatment responses were comparable between both field and greenhouse propagated *R. multiflora* hardwood cuttings (Tables 1, 2). Best treatments to enhance root initiation and root growth were with either Hare's powder or mechanically wounding, although neither was significantly different than the control. Hare's rooting powder, which contains growth retardants, auxins, carbohydrates, etc. has been successfully used with difficult-to-root species (3). Likewise, partial mechanical wounding of the cutting base may serve as a sink for metabolites, stimulate ethylene production, and/or create a larger area of exposed parenchyma cells which dedifferentiate to form roots (4).

Acid, base and IBA treatments did not enhance rooting (Tables 1, 2). In an earlier report (7) acid and base treatments enhanced rooting under intermittent mist, which was attributed to either loosened cell walls, or increased water permeability, which facilitated absorption of applied auxin and/or facilitated emergence of root initials. However, their rooting experiments were generally terminated within 42 days or less (7). In 16 of 17 species reported in the earlier study (7), it was difficult to assess the influence of acid and base on rooting since all treatments contained auxin and there was not a true control, *per se*. In this study with *R. multiflora*, the longer experiment duration of 2 and 4 months may have masked any earlier treatment differences that occurred. When data was pooled in a study on *Rosa damascena*, base treatments of NaOH had no effect on rooting, while acid pretreatment suggested enhanced rooting under intermittent mist (6). When comparing increasing IBA or NAA concentrations which did enhance rooting, there was no significant enhancement of rooting between pretreated acid vs. non-pretreated *R. damascena* cuttings (6). Likewise, in juvenile *Hedera helix* there was no enhancement of rooting with acid pretreatment (8). High auxin concentration reduced rooting of *R. multi-*

Table 1. Response of *Rosa multiflora* 'Brooks 56' hardwood cuttings to selected rooting treatments under field conditions.[z]

Treatment	Rooting[y] (%)	Mean no. roots per cutting[y] (#)	Mean root length[x] (cm)
Control	97.5 a	19.8 ab	12.4 ab
Hare's Powder	100.0 a	24.0 a	15.9 a
Wounding	100.0 a	25.5 a	15.7 a
Wounding + 3,000 mg/l IBA	77.5 bc	16.3 bcd	9.9 abcd
Wounding + 10,000 mg/l IBA	20.0 f	2.4 f	1.7 e
3,000 mg/l IBA	85.0 ab	18.6 abc	10.9 abc
10,000 mg/l IBA	47.5 de	5.3 ef	6.3 bcde
Acid + 3,000 mg/l IBA	62.5 dc	10.4 de	8.9 bcd
Base + 3,000 mg/l IBA	70.0 bc	12.7 cd	8.7 bcd
Acid + 10,000 mg/l IBA	77.5 bc	10.4 de	10.2 abcd
Base + 10,000 mg/l IBA	37.5 ef	4.5 ef	4.2 de
Acid + Base + 3,000 mg/l IBA	47.5 de	4.0 ef	5.7 cde
Acid + Base + 10,000 mg/l IBA	60.0 cd	9.8 de	7.0 bcde

[z]Means within a column followed by the same letter or letters are not significantly different at the 5% level using Duncan's New Multiple Range Test.

[y]Each value based on 4 replicates of 40 cuttings each.

[x]Values based on 3 longest roots/cutting.

Table 2. Response of *Rosa multiflora* 'Brooks 56' hardwood cuttings to selected rooting treatments under greenhouse conditions.[z]

Treatment	Rooting[y] (%)	Mean no. roots per cutting[y] (#)	Mean root length[x] (cm)
Control	79.2 abc	11.8 b	8.6 abc
Hare's Powder	85.4 ab	18.8 a	10.0 ab
Wounding	88.5 a	14.5 ab	8.2 abc
Wounding + 3,000 mg/l IBA	64.6 bcd	9.5 bc	6.7 bc
Wounding + 10,000 mg/l IBA	14.6 g	1.9 d	5.2 c
3,000 mg/l IBA	20.8 fg	3.7 d	9.3 ab
10,000 mg/l IBA	16.7 g	2.2 d	8.4 abc
Acid + 3,000 mg/l IBA	68.8 abcd	10.8 b	10.7 a
Base + 3,000 mg/l IBA	68.8 abcd	12.0 b	10.2 ab
Acid + 10,000 mg/l IBA	39.6 ef	5.7 cd	6.8 bc
Base + 10,000 mg/l IBA	50.0 de	9.6 bc	6.9 bc
Acid + Base + 3,000 mg/l IBA	58.3 cde	9.8 bc	9.9 ab
Acid + Base + 10,000 mg/l IBA	60.8 cde	9.6 bc	7.9 abc

[z]Means within a column followed by the same letter or letters are not significantly different at the 5% level using Duncan's New Multiple Range Test.

[y]Each value based on 4 replicates of 40 cuttings each.

[x]Values based on 3 longest roots/cutting.

flora, which was exacerbated when cuttings were initially wounded (Tables 1, 2). Enhanced uptake of aqueous solutions may have occurred with wounding which led to IBA toxicity.

Significance to the Nursery Industry

Results of this study show that when *R. multiflora* hardwood cuttings are harvested in December and allowed to root under field or greenhouse conditions or 4 and 2 months duration respectively, there are no benefits of selected chemical and mechanical pretreatments. However, selected treatments may enhance rooting if cuttings are harvested from stock plants in midfall to efficiently utilize available labor. Research is being conducted to determine optimum propagation dates based on seasonal rooting ability and correlations of carbohydrate/nitrogen ratios and position of hardwood cutting selection in *R. multiflora* (2). There is a need for morphological and/or physiological markers that may be quickly assayed by a grower to determine economically optimum periods for propagating cuttings.

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