Increasing Production of New Roots by Potted Roses with Root Applied IBA[1]

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Abstract

Dormant bare root rose (*Rosa* × *hybrida* 'Las Vegas') plants with roots dipped in a 500 ppm solution of indole-3-butyric acid (IBA) produced 50% more new roots than untreated plants. However, plants treated with 100 and 500 ppm IBA had fewer open flower buds 8 wks after potting and shorter average shoot length after 18 wks than did controls. Treatment with the potassium salt of IBA (KIBA) at 100 and 500 ppm also stimulated new root production and retarded flower bud development but did not reduce shoot length. Addition of starch-polyacrylate gel to treatment solutions counteracted the root promoting effect of IBA but not of KIBA. Gel itself also caused a reduction in average shoot length.

Index words: IBA, starch-polyacrylate gel, *Rosa* × *hybrida*

Introduction

Most retail nurseries sell potted rose plants for landscape planting. Bare root plants are grown primarily in California, Texas and Arizona and shipped to retail nurseries where they are potted in late winter. One of the main factors influencing establishment of bare root plants after transplanting is the speed and extent of secondary root regeneration by existing primary roots (3, 11, 13). Root regeneration is influenced by time of digging, storage method, carbohydrate reserves and bud development (4, 12, 15). Several chemical treatments have been shown to influence secondary root regeneration. The most consistent of these has been dipping the roots in a solution of indole-3-butyric acid (IBA) (2, 3, 7, 8, 10). One problem with using IBA to stimulate new root production is that no convenient application technique has been developed. Furthermore, the response to root treatment with IBA is not predictable, since the uptake of growth regulator varies with application technique. Moser (6) described the use of starch-polyacrylate gel as a carrier for root-applied IBA. Starbuck (9) found such a gel increased IBA-induced secondary root initiation by peach and pecan trees. The objectives of the experiments reported here were: 1) to determine if IBA and its potassium salt (KIBA) can stimulate root regeneration and subsequent shoot growth of potted hybrid tea roses and; 2) to determine if starch polyacrylate gel can enhance IBA-induced root regeneration by roses if it is observed.

Materials and Methods

On April 17, 1985, 180 'Las Vegas' hybrid tea roses on 'Dr. Huey' rootstock were pruned to 20 cm (8 in) above the bud union and root pruned to fit into 20 cm × 21 cm (8 in × 8.5 in) nursery containers. Roots were dipped before potting in solutions of 100 or 500 ppm IBA or its potassium salt (KIBA) with or without starch-polyacrylate gel added. The gel (SGP 104K, Henkel Corp., Minneapolis) was added to the appropriate solutions at 5 g/l. The roots of each plant were dipped for 1 sec in the appropriate solution or slurry before potting. Plants were potted in Pro-Mix BX, top dressed with 6 g 14-14-14 (14N-6.0P-11.6K) Osmocote and grown on outdoor beds. Three replicates of 6 plants per treatment were arranged in a randomized complete block design. Plant height (above the pot rim) and number of open flower buds (with reflexed calyces) were determined at 8 wks. Plants were harvested August 28 to determine the number and dry weight of new roots and length and dry weight of new shoots.

Results and Discussion

While producing a significantly larger number of roots in response to IBA (Table 1), 'Las Vegas' plants treated with 500 ppm IBA were shorter 8 wks after potting and had a lower weight of new roots and a lower mean shoot length at 18 wks than control plants. Plants also responded to 100 ppm IBA (Table 1) and to 100 and 500 ppm KIBA by producing a larger number of new roots than controls (Table 2). Both IBA and KIBA at 100 and 500 ppm caused a reduction in the total number of flower buds which opened within 8 wks. Total number of flower buds was not affected by any treatment (data not shown). KIBA did not, however, cause a reduction in plant height at 8 wks or in mean shoot length at 18 wks as did IBA at the same concentrations.

Gel alone reduced the number of open buds of 'Las Vegas' plants 8 wks after potting. It also reduced the mean shoot length at harvest, 18 wks after potting (Table 1).

This experiment documents that root-applied IBA induces hybrid tea roses to regenerate a larger number of new roots after potting. The results also indicate that IBA applied to the roots can strongly affect shoot growth up to several months after application. Magley and Struve (6) reported a positive effect of root applied IBA on shoot growth of Pin Oak. In this experiment, however, 'Las Vegas' roses treated with 500 ppm IBA were significantly shorter at 8 wks than controls. This indicates that the IBA dosage most effective in stimulating root production was inhibitory to shoot growth.

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Table 1. Effects of root application of IBA and starch-polyacrylate gel on root and shoot development of potted 'Las Vegas' roses.

Treatment IBA (ppm)	Gel	At 8 weeks height (cm)	At 8 weeks Number[x] open buds	At 18 weeks Number new roots	At 18 weeks Dry wt new roots (mg)	At 18 weeks Mean Shoot length (cm)
0	−	53 ab[y]	3.4 a	82 c	13.9 a	36 a
0	+	50 bc	0.8 b	75 c	12.3 ab	30 b
100	−	54 a	1.1 b	105 ab	12.3 ab	35 a
100	+	49 c	0.6 b	87 c	12.7 a	30 b
500	−	48 c	0.9 b	123 a	9.8 c	31 b
500	+	47 c	0.1 b	92 bc	10.2 bc	29 b
		ANOVA (Significance of F values)				
Source	*df*					
IBA	2	**[z]	*	**	**	NS
Gel	1	**	**	**	NS	**
IBA × Gel	2	NS	NS	NS	NS	NS

[x]With reflexed calyces.

[y]Mean separation by LSD at the .05 level. Means within columns followed by the same letter are not significantly different.

[z]NS, *, ** nonsignificant or significant at the 5% (*) or 1% (**) level.

In a preliminary experiment, 'Mirandy' plants treated with 500 ppm IBA with gel added had a lower number of shoots compared with those treated with 100 ppm IBA/gel. This suggests an effect similar to the correlative inhibitory effect of auxin on lateral bud development (14). A similar explanation might be offered for the pronounced retardation of shoot growth and flower bud development by IBA noted in this experiment. Although KIBA promoted root initiation, it did not inhibit shoot growth as did IBA. If this can be verified by further experimentation, KIBA may prove preferable to IBA as a treatment to stimulate root initiation. Certainly, these studies suggest that the concentration range of IBA in which root initiation by roses can be stimulated without retarding shoot growth may be fairly narrow.

Gel alone significantly inhibited shoot growth. The mean length of shoots on gel control plants was 20% less than that of controls. Askew et al. (1) reported that SGP 104K gel adhering to the roots of treated bare root *Cornus florida* seedlings appeared to interfere with normal root growth after field planting. Thus, gel applied as a root dip may actually contribute, at least indirectly, to water stress in some cases.

Significance to the Nursery Industry

The results of this experiment document that, while IBA is effective in stimulating lateral root development of roses, it can also inhibit shoot growth in the same concentration range. Routine use of IBA root treatment for a given species should be preceded by research to determine the dosage effective in inducing root regeneration without retarding shoot growth.

Based on this study, it appears that KIBA (the potassium salt of IBA) is effective in stimulating the development of secondary roots. KIBA, however, did not cause a reduction in shoot length as did IBA.

Starch polyacrylate gel does not appear to substantially increase the effectiveness of IBA root treatments to roses and may itself cause a reduction in shoot growth.

Table 2. Effects of root application of KIBA and starch-polyacrylate gel on root and shoot development of potted 'Las Vegas' roses.

Treatment KIBA (ppm)	Gel	At 8 weeks Height (cm)	At 8 weeks Number[x] open buds	At 18 weeks Number new roots	At 18 weeks Dry wt new roots (mg)	At 18 weeks Mean shoot length (cm)
0	−	53 ab[y]	3.4 a	82 c	13.9 ab	36 a
0	+	50 bc	0.8 b	75 c	12.3 ab	30 b
100	−	52 a	0.7 b	97 ab	11.0 b	33 ab
100	+	51 a	0.4 b	88 bc	10.4 b	32 ab
500	−	52 a	1.2 b	104 ab	16.4 a	32 ab
500	+	51 a	0.1 b	112 a	10.0 b	34 ab
		ANOVA (Significance of F values)				
Source	*df*					
KIBA	2	NS[z]	**	**	NS	NS
Gel	1	NS	**	NS	*	NS
KIBA × Gel	2	NS	NS	NS	NS	NS

[x]With reflexed calyces.

[y]Mean separation by LSD at the .05 level. Means within columns followed by the same letter are not significantly different.

[z]NS, *, ** nonsignificant or significant at the 5% (*) or 1% (**) level.

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Effect of a Medium-Incorporated Hydrogel on Plant Growth and Water Use of Two Foliage Species[1]

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Abstract

A fully expanded hydrogel, Agrosoke, was used to replace 5% (1 ×) or 10% (2 ×) of the volume of a potting medium to determine its effect on plant growth and water use. Although irrigation frequency was unaffected by Agrosoke, spider plants (*Chlorophytum comosum* (Thunb.) Jacques 'Vittatum') grown in the 2× medium were 50% larger and had more lateral shoots and better root systems than the control, demonstrating improved water use efficiency. Agrosoke had no effect on either irrigation frequency or on fresh weight of Boston fern (*Nephrolepis exaltata* (L.) Schott. 'Rooseveltii'). Leachates from hydrogel-amended media had higher electrical conductivity indicating that more nutrients and other salts were held by these media.

Index words: *Nephrolepis exaltata* 'Rooseveltii,' *Chlorophytum comosum*, irrigation, evapotranspiration, transpiration, hydrogel

Introduction

Plants grown in containers with limited soil require frequent irrigation to maintain adequate medium moisture, particularly during the periods when evapotranspiration (ET) rates are high. Tropical foliage plants generally require high temperatures which are associated with high water demand for maximum growth. Previous research on increasing water-holding capacity of soilless media has been conducted using hydrophilic polymers. Hydrogels absorb various amounts of water during expansion and have been found to increase water retention in potting media, thus reducing irrigation frequency and delaying the onset of wilting (2, 3, 7, 13). Marigold (*Tagetes erecta* L.) grown in a peat-lite medium amended with hydrogel had less internal moisture tension (3), while cineraria (*Senecio cruentus* (Masson) DC.) grown in a similar medium had less water loss only when an antitranspirant was used at the same time (15). Top growth of chrysanthemum was unaffected by hydrogel when used at moderate rates (13). however, high rates of hydrogels in the medium have been found to cause phytotoxicity in some cases (13, 14). Hydrogel did not affect growth or shelf life of weeping fig (10).

Agrosoke (Grosoke International, Texas) is a polyacrylamide hydrogel recently introduced to the U.S. market.

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