Keys to Rooting Success

Read on for tips on propagating difficult or slow-rooting or -growing cuttings with foliar rooting sprays and/or plant growth regulators.

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Rooting hormones such as IBA (indole butyric acid) and NAA (napthaleneacetic acid) have been staples in the greenhouse and nursery industry for years to readily promote rooting success of slow- or difficult-to-root cuttings. Most commonly, IBA or IBA + NAA have been applied as a powder or solution to the basal end of cuttings before sticking them into liner trays. In recent years, water-soluble IBA (i.e., potassium salt formulated K-IBA or acid form IBA) sprays onto the foliage of cuttings once in the propagation environment have gained popularity among growers. This reduces labor and material costs, the potential to spread diseases, and possible plant desiccation or leaf distortions from IBA dissolved in alcohol.

The focus of our first experiment was to quantify rooting success in terms of root dry mass of a single foliar application of IBA compared to a traditional basal dip of IBA + NAA. In a second experiment, we compared the effect of a foliar applied IBA to a foliar spray containing kinetin (KN) + gibberellic acid (GA_3) + IBA alone or as a follow up application 14 days after an initial IBA spray on shoot and root biomass of young plants.

THE STUDY

Bedding plants that are considered difficult or slow-to-root were selected for this study. Herbaceous stem-tip cuttings of dahlia 'Venti Passion Fruit' (*Dahlia pinnata*), geranium 'Sunrise Lavender + Red Eye' (*Pelargonium* × *hortorum*), osteospermum 'Serenity Lavender Frost' (*Osteospermum ecklonis*), scaevola 'Scalora Brilliant' (*Scaevola* hybrid) were used for Experiment 1, and brachyscome 'Radiant Magenta' (*Brachyscome hybrida*), lantana 'Dallas Red' (*Lantana camara*), and scaevola 'Blue Fan' were used for Experiment 2. All cuttings were stuck into a porous substrate that consisted of peat moss, perlite and vermiculite and in 72-cell trays (28-mL) with the exception of geranium, which was stuck into 72-cell trays (44-mL).

Trays were placed in a glass-glazed greenhouse at Michigan State University (East Lansing, Michigan) with a vapor pressure deficit of 0.3 kPa and an average air and root-zone temperature of 72 and 75° F, respectively. A 16-hour photoperiod (6 a.m. to 10 p.m.) consisted of natural days and supplemental lighting via high pressure sodium lamps. The daily light integral (DLI) ranged from high (~11 $mol \cdot m^{-2} \cdot d^{-1}$) to very high (~15 $mol \cdot m^{-2} \cdot d^{-1}$) in Experiment 1 and was moderate (8 $mol \cdot m^{-2} \cdot d^{-1}$) in Experiment 2. Overhead mist containing 60-ppm nitrogen was provided as necessary from 5 to 12 a.m. based on the light intensity and was discontinued as the study progressed.

HORMONE TREATMENTS

For Experiment 1, prior to sticking cuttings into the tray, the basal end of a subset of cuttings of each genus were either dipped in a solution containing 100-ppm IBA + 50 ppm NAA or 200-ppm IBA + 100 ppm NAA (Dip'N Grow Liquid Rooting Concentrate;). Another subset of cuttings received a foliar

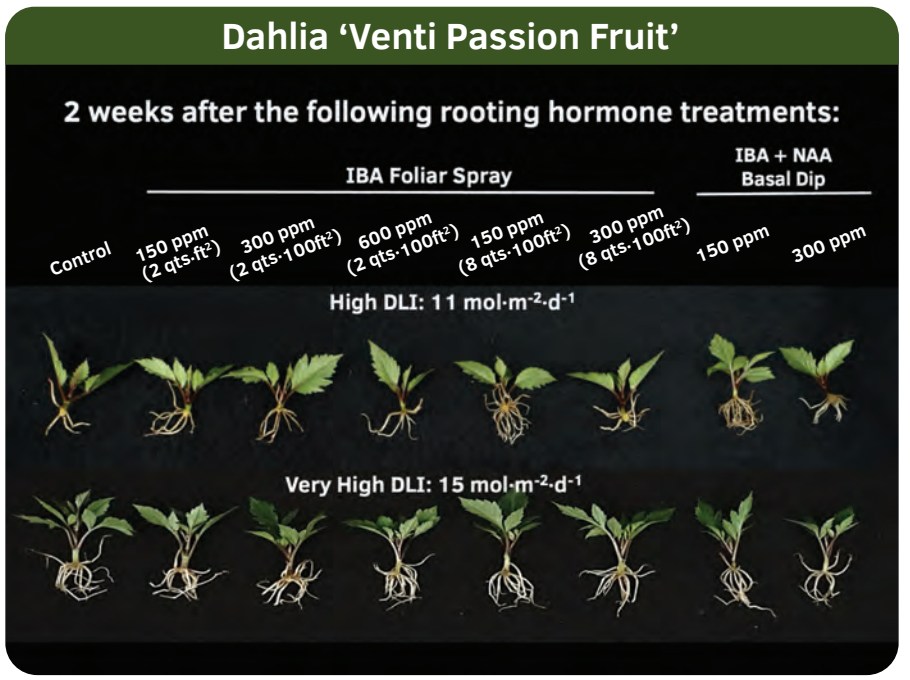

Figure 1. Rooting of dahlia 'Venti Passion Fruit' after two weeks under an average DLI of 11 or 15 $mol \cdot m^{-2} \cdot d^{-1}$ and treated with a foliar spray application of 0-, 150-, 300- or 600-ppm IBA at 2 or 8 quarts per square foot or dipped in a 150- or 300-ppm solution of IBA + NAA.

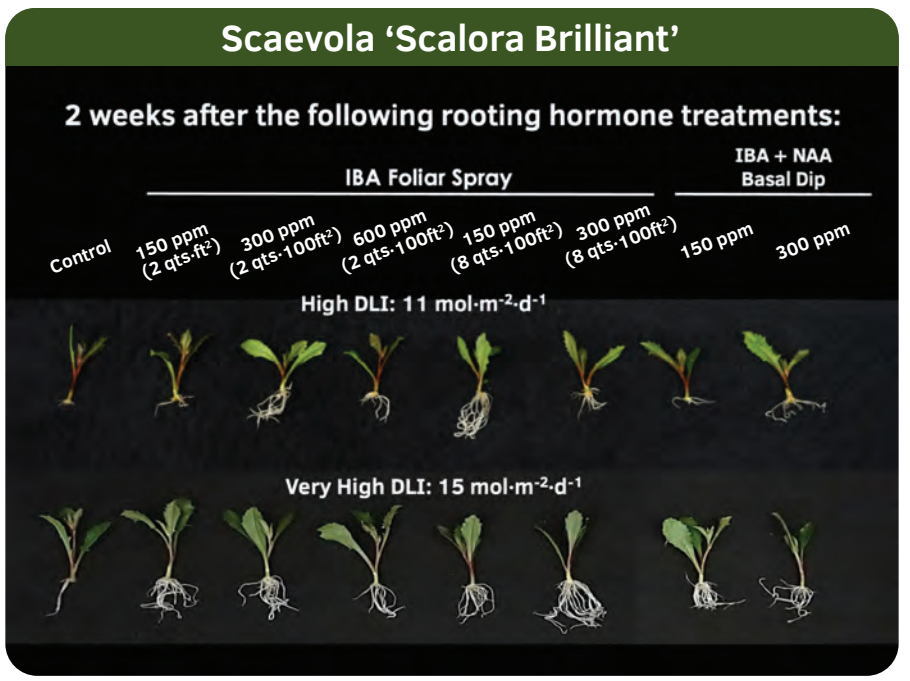

Figure 2. Rooting of Scaevola 'Scalora Brilliant' after two weeks under an average DLI of 11 or 15 $mol \cdot m^{-2} \cdot d^{-1}$ and treated with a foliar spray application of 0-, 150-, 300- or 600-ppm IBA at 2 or 8 quarts per square foot or dipped in a 150- or 300-ppm solution of IBA + NAA.

spray of reverse-osmosis water (0 ppm; control) or 150-, 300- or 600-ppm IBA (20% IBA Advocate) at 2 qts/100 ft^2 or 150 or 300 ppm at 8 qts/100 ft^2 approximately 20 hours after cuttings were manually stuck into trays. Mist was discontinued for approximately three hours to allow cuttings to absorb the rooting hormone.

For Experiment 2, cuttings received a foliar spray application of reverse-osmosis water (0 ppm; control), 6.25 or 15.6 mL·L^{-1} KN + GA_3 + IBA [0.010% KN, 0.005% GA_3, and 0.005% IBA (Crest)] at 2 qts/100 ft^2, 150- or 300-ppm IBA (Advocate) at 2 qts/100 ft^2 or 8 qts/100 ft^2 approximately 20 hours after cuttings were stuck into the trays. For treatments receiving 300-ppm IBA at 2 qts/100 ft^2, a subset of cuttings received a spray application of 6.25 or 15.6 mL·L-1 KN + GA_3 + IBA at 2 qts/100 ft^2 14 d after sticking cuttings.

After 14 (Experiment 1) or 21 days (Experiment 2) of propagation, 10 cuttings per genus per treatment were removed from trays and the substrate was gently rinsed from the roots. For Experiment 1, the root dry mass and time to produce a marketable liner were recorded. For Experiment 2, the stem length, root and shoot dry mass were recorded.

RESULTS

No visible signs of phytotoxicity were observed on any cutting treated with a foliar or basal rooting hormone. For Experiment 1, dahlia and geranium had comparable rooting (root dry mass) and were pullable after three weeks when dipped in 200-ppm + 100-ppm IBA + NAA or sprayed with 150- or 300-ppm IBA at 2 or 8 qts/100 ft^2 under a high DLI of 11 mol·m^{-2}·d^{-1} (Figure 1).

Cuttings were not pullable for four to five weeks if they did not receive a rooting hormone application. Under the same DLI, the root dry mass of osteospermum was 62 to 145% and scaevola was 112 to 136% greater when cuttings received a foliar application of 300-ppm IBA at 8 qts/100 ft^2 compared to a basal dip of 150-ppm IBA + 50 ppm NAA or 200 ppm IBA + 100-ppm NAA, respectively (Figures 2 and 3).

Under a very high DLI of 15 mol·m^{-2}·d^{-1}, the root dry mass was reduced regardless of hormone treatment, with only dahlia and geranium having some response to rooting hormone (Figure 1). However, in all cases, providing rooting hormone via a foliar spray or basal dip resulted in a greater root dry mass than no rooting hormone.

For Experiment 2, the stem length varied among genera. For instance, the stem length of brachyscome was 21% shorter when treated with 6.25 or 15.6 mL·L^{-1} KN + GA_3 + IBA than those cuttings treated with 300-ppm IBA at 8 qts/100 ft^2. In contrast, stem length of scaevola was 24% greater when treated with 6.25 mL·L^{-1} KN + GA_3 + IBA than those cuttings treated with a 300-ppm foliar spray of IBA at 2 or 8 qts/100 ft^2, whereas lantana stem length was unaffected (Figure 4).

For brachyscome, lantana, and scaevola, rooting improved when the cuttings received a foliar application of 150- to 300-ppm IBA at 8 qts/100 ft^2, similar to Expt. 1. The shoot dry mass was generally greater for brachyscome, lantana, and scaevola when KN + GA_3 + IBA was used alone or with IBA (Figure 4).

CONCLUSION

Under a moderate to high DLI, dahlia, geranium, osteospermum and scaevola cuttings treated with 300-ppm IBA at 2 to 8 qts/100 ft^2 had comparable or greater root growth than cuttings that were dipped in IBA + NAA. Not surprisingly, for all genera propagated under a very high DLI of 15 mol·m^{-2}·d^{-1}, rooting was reduced compared to cuttings rooted under a DLI of 8 to 12 mol·m^{-2}·d^{-1}. A foliar application of 150- to 300-ppm IBA at 2 to 8 qts/100 ft^2 produced full, well-rooted liners of brachyscome, osteospermum, lantana and scaevola within three weeks of stick. A follow up application of 6.25 mL·L^{-1} KN + GA_3 + IBA two weeks after a 300-ppm foliar spray of IBA at 2 qts/100 ft^2 may increase shoot growth of slow growing genera without affecting root growth but needs to be further investigated for longer propagation times and application frequency. gpn

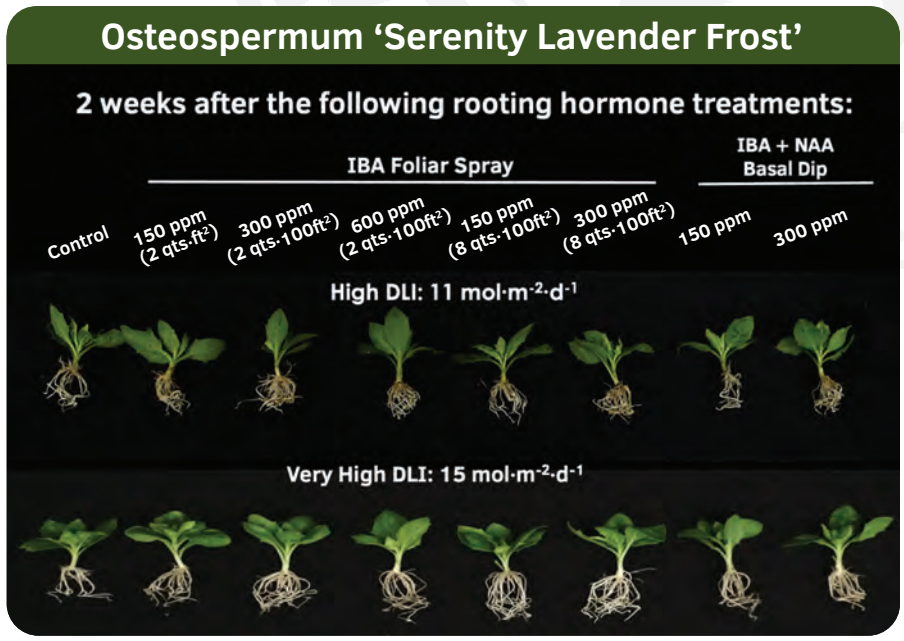

Figure 3. Rooting of Osteospermum 'Serenity Lavender Frost' after two weeks under an average DLI of 11 or 15 mol·m^{-2}·d^{-1} and with a foliar spray application of 0-, 150-, 300- or 600-ppm IBA at 2 or 8 quarts per square foot or dipped in a 150- or 300-ppm solution of IBA + NAA.

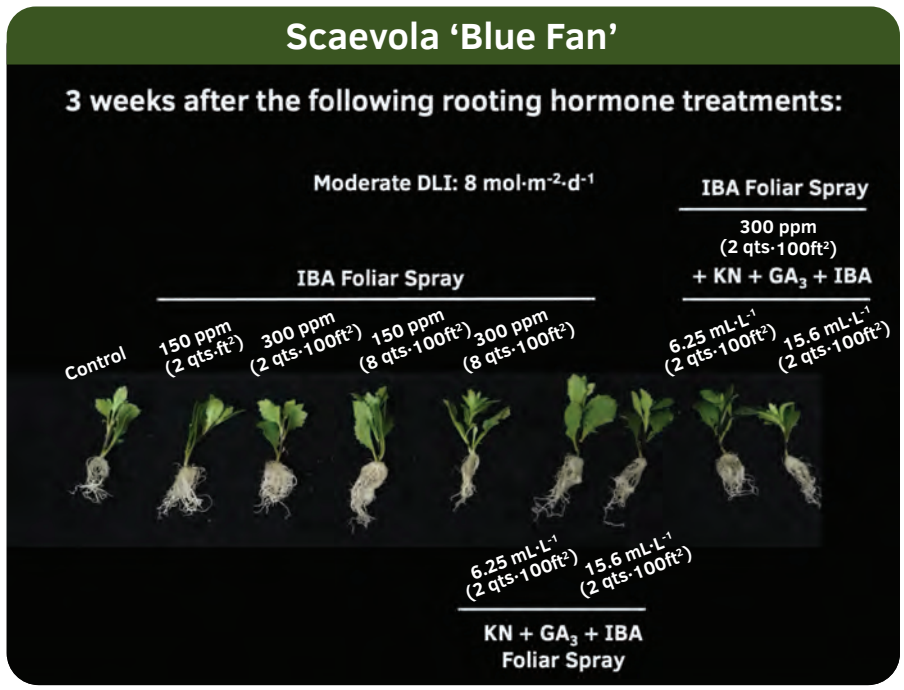

Figure 4. Rooting of Scaevola 'Blue Fan' after three weeks under an average DLI of 8 mol·m^{-2}·d^{-1} and treated with a foliar spray application of 0-, 150- or 300-ppm IBA at 2 or 8 quarts per square foot, or a foliar spray application of 6.25 or 15.6 mL·L^{-1} kinetin + gibberellic acid + IBA (KN + GA_3 + IBA) or 150- or 300-ppm solution of IBA, or a foliar spray of 300-ppm IBA followed by a 6.25 or 15.6 mL·L^{-1} solution of KN + GA_3 + NAA 14 days later.

Acknowledgements: We thank J.R. Peters for fertilizer, East Jordan Plastics for trays, Ball Horticultural Co. for cuttings and Fine Americas Inc. for PGRs. This study was supported by Fine Americas Inc., the Floriculture and Nursery Research Initiative and Michigan State University Project GREEEN.

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