

## Current Options for Using Auxin Solutions in Cutting Propagation<sup>©</sup>

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### INTRODUCTION

In 1935, Thimann and Koepfli reported the synthetic preparation of the auxin indole-3-acetic acid (IAA), a naturally occurring substance that had recently been found to have root-forming properties, and demonstrated its practical use in stimulating root formation on cuttings. In that same year, Zimmerman and Wilcoxon reported that the synthetic auxins indole-3-butyric acid (IBA; now known to occur naturally in plants) and 1-naphthaleneacetic acid (NAA) were more effective than IAA for rooting cuttings.

Indole-3-butyric acid and NAA are presently the most widely used auxins for promoting root formation on stem cuttings. Auxin treatments are commonly used in commercial plant propagation to increase overall rooting percentages, hasten root initiation, increase the number and quality of roots, and encourage uniformity of rooting. Commercial root-promoting products (“rooting hormones”) are available in various formulations: liquid concentrates, water-soluble salts and tablets, gels, and powders (talc).

### UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGISTRATION

All pesticides sold or used in the United States must be registered by the Environmental Protection Agency (EPA), based on scientific studies showing that they can be used without posing unreasonable risks to people or the environment. The Federal Insecticide Fungicide and Rodenticide Act (FIFRA), as amended, defines a pesticide in part as “(1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pests, (2) any substance or mixture of substances intended or used as a plant regulator, defoliant, desiccant, and (3) any nitrogen stabilizer ...” Individual states may also have additional registration requirements.

Technical grade IBA and the potassium salt of IBA (K-IBA) are not registered for sale and use as commercial plant growth regulators. Only EPA-registered products may be sold and used for promoting rooting on cuttings. Indole-3-butyric acid is classified as a biochemical pesticide, being naturally produced by plants, and is included under the broader range of biopesticides. Biopesticides are generally considered safer than conventional pesticides.

Labels on auxin-containing products specify the personal protective equipment that must be worn by applicators and other handlers. This personal protective equipment includes long-sleeved shirts, long pants, shoes, and socks. Depending upon the product, either water-resistant gloves or chemical-resistant gloves are also required.

### CURRENT PRODUCTS

The following EPA-registered products are currently available packaged for commercial use in preparing and using auxin solutions for plant propagation:

- **Dip’N Grow<sup>®</sup>** (Dip’N Grow Inc., Clackamas, Oregon) is a dilutable concentrate containing 1.0% (10,000 ppm) IBA and 0.5% (5,000 ppm) NAA in an alcohol base. The NAA:IBA ratio of this product is 0.5:1.
- **Wood’s<sup>®</sup> Rooting Compound** (Earth Science Products Corp., Wilsonville, Oregon) is a dilutable concentrate containing 1.03% (10,300 ppm) IBA and 0.66% (6,600 ppm) NAA in an alcohol base. The NAA:IBA ratio of this product is 0.64:1.
- **Hortus IBA Water Soluble Salts** (Phytotronics, Earth City, Missouri) is a dry product which can be dissolved in water. This product contains 20% IBA, a pH buffer, and proprietary ingredients. This product does not contain K-IBA, but forms K-IBA when

the product's ingredients dissolve in water. **Rhizopon AA Water Soluble Tablets** (from the same company) are essentially the same product, pressed into tablet form.

- **Clonex<sup>®</sup> Rooting Compound** (Hydrodynamics International Inc., Lansing, Michigan) is a pre-prepared, viscous solution containing 0.3% (3,000 ppm) IBA, 1.2% 2-hydroxyethylcellulose (gelling agent), and crystal violet dye. This ready-to-use product is only available in one concentration of IBA.

Auxin-containing products are an important tool for the commercial plant propagator, but are not essential for all crops. Cuttings of many plant species may be rooted readily and consistently using hardwood, semi-hardwood, softwood, and herbaceous cuttings without an auxin treatment when cuttings are collected at the proper stage of growth from healthy, well-managed stock plants.

### THE K-IBA QUESTION

The question of whether rooting results obtained using auxin solutions made with Hortus IBA Water Soluble Salts (an EPA-registered product which forms K-IBA when dissolved in water) would be comparable to results obtained using technical K-IBA (available for research use, but not EPA-registered for commercial use) prompted a recent research study at Mississippi State University. Solutions were prepared using these two products at five rates of IBA: 500, 1000, 1500, 2000, and 3000 ppm. Subterminal [3-node, 8.9 cm (3.5 in.)] cuttings of *Ligustrum japonicum* 'Texanum' (Texas privet), single-node [2.5 cm (1 in.)] cuttings of *Rosa* 'Moorcap', Red Cascade<sup>®</sup> miniature climbing rose, and subterminal [2-node, 7 cm (2.8 in.)] cuttings of *Trachelospermum jasminoides* (star jasmine) were prepared in July, received a 1-sec basal quick-dip in one of the ten auxin solutions (30 cuttings per treatment), stuck in Sunshine<sup>®</sup> Redi-earth Professional Growing Mix (Sun Gro Horticulture Canada Ltd., Alberta, Canada), and rooted in a greenhouse under intermittent mist for 6 to 7 weeks.

Upon harvest, cuttings of Texas privet exhibited no significant difference in number of roots or total root length between the two products or among the different rates of IBA. Cuttings of rose exhibited no significant difference in number of roots and a marginally significant increase in total root length using the Hortus product compared with technical K-IBA; number of roots and total root length showed highly significant and marginal increases, respectively, with increasing rate of IBA with both products. Cuttings of star jasmine exhibited no significant differences in number of roots or total root length between the two products, but significant increases with increasing rate of IBA with both products.

### AUXIN OR NO AUXIN?

The availability of unrooted cuttings from intensively managed stock plants from domestic and offshore producers in recent years has made it increasingly possible for growers to propagate a wide assortment of crops without the need to maintain their own stock plants. Softwood cuttings from intensively managed stock plants may or may not benefit from a basal quick-dip in auxin prior to sticking, and may respond differently than cuttings obtained from conventional container-grown or landscape-grown stock plants.

In a study conducted at Mississippi State University, auxin solutions were prepared by diluting Dip'N Grow concentrate to final concentrations of 1000 ppm IBA + 500 ppm NAA and 500 ppm IBA + 250 ppm NAA, and by diluting Dip'N Grow Lite concentrate (experimental formulation with 10,000 ppm IBA only) to final concentrations of 1000 ppm IBA and 500 ppm IBA. Solutions were prepared with isopropyl alcohol and deionized water to contain 50% alcohol (by volume) in the final product. Cuttings were shipped from Columbia and received a 1-sec basal quick-dip in their respective auxin solutions (cuttings in one treatment were not treated with auxin), inserted into 50-cell trays in Fafard 3B substrate, and placed under intermittent mist in a greenhouse. There were 40 cuttings per treatment for a total of 200 cuttings per taxon.

After 1 month, cuttings of all three crops were harvested for evaluation. Terminal, 7.6 cm (3 in.) cuttings of *Agastache* 'Tutti-frutti' rooted best using a quick-dip in 1000 ppm

IBA or 1000 ppm IBA + 500 ppm NAA. Terminal, 13 cm (5 in.) cuttings of *Buddleja davidii* 'Attraction' rooted best using a quick-dip in 500 ppm IBA or 500 ppm IBA + 250 ppm NAA. No auxin treatment was necessary for terminal, 6 cm (2.5 in.) cuttings of *Rosmarinus officinalis* 'Arp'.

### **FOLIAR SPRAY APPLICATIONS**

Early studies conducted at Auburn University between 2001 and 2004 indicated that cuttings of some species receiving a foliar application of IBA + NAA could root as well as cuttings receiving a basal quick-dip, but using a much lower concentration of auxin (approximately 50 ppm IBA + 25 ppm NAA). However, a basal quick-dip provided better rooting with other species. Commercial firms, such as Bailey Nursery and Yoder Brothers, subsequently evaluated foliar spray applications of water-soluble IBA at rates similar to those used for a basal quick-dip, and with time adjusted the rates downward as trialing continued. Some of crops they tested also responded better to a basal quick-dip. Currently published recommendations are generally in the range of 50 ppm to 250 ppm IBA, although higher rates may be found.

If a propagator is considering use of the foliar spray application method as an alternative to the basal quick-dip, here are some general recommendations.

- 1) Conduct trials with crops before switching from a basal-quick dip to a foliar spray application.
- 2) Anticipate that results may be more consistent using highly uniform cuttings from intensively managed stock plants (such as those from off-shore sources) in comparison to cuttings from woody production plants and in-ground stock plants.
- 3) Evaluate cuttings (particularly subterminal cuttings) for adequate shoot development from lateral buds after rooting. Auxin-induced inhibition of lateral budbreak may occur when auxin rates are too high.
- 4) Trial water-soluble IBA alone in initial trials. Once experience is gained, alcohol-based IBA + NAA may be evaluated.

### **GEL FORMULATIONS OF AUXIN**

Propagators interested in testing gel formulations of auxin may want to prepare their own using sodium carboxymethyl cellulose (also known as NaCMC, sodium cellulose glycolate, SCG, and cellulose gum), a thickener and binder used in many foods and consumer products. This material increases the viscosity of auxin solutions and enhances adhesion of the auxin solution to the base of a cutting, thus exposing the tissue to auxin over a longer time compared with use of an aqueous auxin solution alone, potentially allowing lower rates of auxin to be used.

Sodium carboxymethyl cellulose is added slowly to an auxin solution (prepared with any of the alcohol-based concentrates or water-soluble salt products) with stirring. The solution should be left covered overnight to allow the material to dissolve completely. Research at Auburn University showed that adhesion of solutions to bases of stem cuttings is maximized using 13.5 g of NaCMC per liter of solution, but users can determine their own preferred viscosity.

Sodium carboxymethyl cellulose is available from chemical suppliers in food grade and other commercial grades, and as the product Dip-Gel from Dip 'N Grow (Clackamas, Oregon). A few states, such as California and Washington, require agricultural adjuvants to be registered before they can be sold.

