Grower 101:

Rooting Hormones

Rooting hormones are essential for some crops; find out which ones, which hormones to use and how to use them.

By Christopher Cerveny and James Gibson

The quick dip is a popular technique used to apply rooting hormones. (Photo courtesy of Christopher Cerveny)

Vegetatively propagated floriculture crops continue to increase in popularity because of tremendous production, marketing and garden success. Growers are able to propagate a wide variety of herbaceous plants on-site through the help of improved stock plant management techniques and propagation protocols set by industry standards and university research programs. However, moderate and difficult-to-root plant species can prevent producers from realizing their full potential as propagators. Application of auxin-based, commercially available rooting hormones may be the key to overcoming this challenge, which ultimately leads to an increase in product diversity. See Figure 1, right, for a list of species that may benefit from a rooting hormone application.

In general, the application of rooting hormones is not required for most herbaceous species. The added labor cost of application is not necessary with easy-to-root cuttings; however, propagation of moderate and difficult-to-root species with rooting hormones may enhance rooting percentages. Exogenously applied hormones also facilitate rooting where cultural practices or environmental conditions are not ideal. Examples include uneven misting, suboptimal propagation temperatures and, in some cases, reduced light levels during winter.

Perhaps the situation in which rooting hormones are best utilized is in propagation of the "new and unusual." In today's marketplace customers are oftentimes demanding new products faster than they can be developed; the green industry is no stranger to this phenomenon. Rooting hormones can improve the visibility of temperate and tropical annual and perennial species by increasing propagation success. Common or prized woody ornamental groups such as vines, groundcovers and flowering shrubs add a multitude of new possibilities to a grower's plant inventory.

AUXIN

Auxin is a plant hormone that aids in the initiation of adventitious roots. Indole acetic acid (IAA) is the naturally occurring auxin found in plants. IAA is involved in nearly every aspect of plant growth and development. Some of the processes regulated by IAA include formation of embryo in development, induction of cell division, stem and cleoptile elongation, apical dominance, induction of rooting, vascular tissue differentiation, fruit development, and tropic movements such as bending toward light. Synthetic forms of auxin are available commercially in the form of Indolebutyric acid (IBA) and napthaleneacetic acid (NAA). Commercial preference given to these synthetic compounds and less to IAA is illustrated by the large number of rooting products available containing one or both of them (see Figure 2, page 38).

CULTURAL PRACTICES

Plant response to rooting hormones varies with each species, but before rooting hormones are introduced, growers should implement a few simple cultural practices to reduce the number of propagation challenges. Cuttings, whether they are grown from on-site or off-shore stock plants, should be thoroughly inspected before planting. Softwood cuttings that have an actively growing shoot tip should be selected. Tissues that are too young or too old will root more slowly than cuttings that are at the proper stage of maturity. Cuttings that are too old also tend not to branch as well as younger, softer tissue. Therefore, it is important to visually inspect the lower portion of the cutting to check for woody tissue that is brown or grayish-brown in color. Cuttings that exhibit this hardwood tissue may need to be trimmed closer to the shoot tip. Fully developed flowers on cuttings are sometimes another sign that tissue may be too old to root optimally. Mist and light levels ➧

***Top:** Crops such as argyranthemum may benefit from an application of rooting hormone. **Bottom:** Rooting hormones may improve uniformity of cuttings in propagation trays. (Photos courtesy of James Gibson)*

Figure 1. Requirement levels of rooting hormones for a select group of floriculture crops.

None	Optional	Essential
Angelonia	Argyranthemum	Bougainvillea
Bacopa/sutera	Calibrachoa	Brachyscome
Coleus	Diascia	Dahlia
Cuphea	Nemesia	Heliotrope
Impatiens	Salvia (certain species)	Hibiscus, tropical
New Guinea impatiens	Scaevola	Lobelia
Petunia	Snapdragon	Mandevilla
Perilla	Fuschia	Mimulus
Plectranthus	Strobilanthes	Osteospermum
Portulaca	Verbena	Thunbergia

should be regulated appropriately, if the propagation medium is too saturated (low oxygen) or light levels are too intense, rooting is inhibited.

HORMONE CONCENTRATIONS

Generally speaking, auxin-based rooting products are applied at concentrations of 500-1,500 ppm for herbaceous and softwood cuttings. In addition, rates between 1,000 and 3,000 ppm may be used for woodier tissue, but the maximum recommended concentrations are not more than 5,000 and 10,000 ppm for semi-hardwood and hardwood cuttings, respectively. When optimal treatments are applied, cuttings will tend to have the following characteristics: Basal portion of cutting shows some swelling, callus tissue forms and root initials emerge just above the cutting base.

Care should be taken with rooting hormones because over-➧

Figure 2. Commercially available rooting hormones for herbaceous plant propagation.

Trade name	Source	Formulation	Ingredient
Chryzopon	ACF Chemiefarma	Powder (talc)	0.1-8 percent IBA
C-mone	Coor Farm Supply Services, Inc.	Liquid (isopropyl alcohol)	1 and 2 percent IBA
C-mone K	Coor Farm Supply Services, Inc.	Liquid (isopropyl alcohol)	1 percent KIBA
C-mone K+	Coor Farm Supply Services, Inc.	Liquid (isopropyl alcohol)	1 percent KIBA + 0.5 percent NAA
Dip 'n' Grow	Astoria-Pacifica Inc.	Liquid (alcohol)	1 percent IBA + 0.5 percent NAA + boron
Hormex	Brooker Chemical Corp.	Powder (talc)	Rooting Powder — 0.1-4 percent IBA
Hormex	Brooker Chemical Corp.	Liquid	Hormex Concentrate — 0.013 percent IBA + 0.24 percent NAA + vitamin B-1
Hormodin	E.C. Geiger, Inc.	Powder (talc)	0.1, 0.3 and 0.8 percent IBA
Hormo-Root	Rockland Chemical Co.	Powder (talc)	0.1-4.5 percent IBA
IBA Water Soluble Salts	Hortus USA Corp. Inc.	Liquid	20 percent IBA
Rhizopon	Hortus USA Corp. Inc.	Powder and water-soluble tablet form	0.1, 0.3 and 0.8 percent IBA
Stim-Root	Plant Products Co. Ltd.	Powder (talc)	0.1 and 0.4 percent IBA
Woods Rooting Compund	Earth Science Products Corp.	Liquid (ethanol)	1.03 percent IBA + 0.56 percent NAA

Top: *Cutting bases can be sprayed with rooting hormones; efficiency is increased when they are treated in bundles.* ***Bottom:*** *K-IBA is a water-soluble rooting hormone that has enormous potential with floriculture crops. (Photos courtesy of James Gibson)*

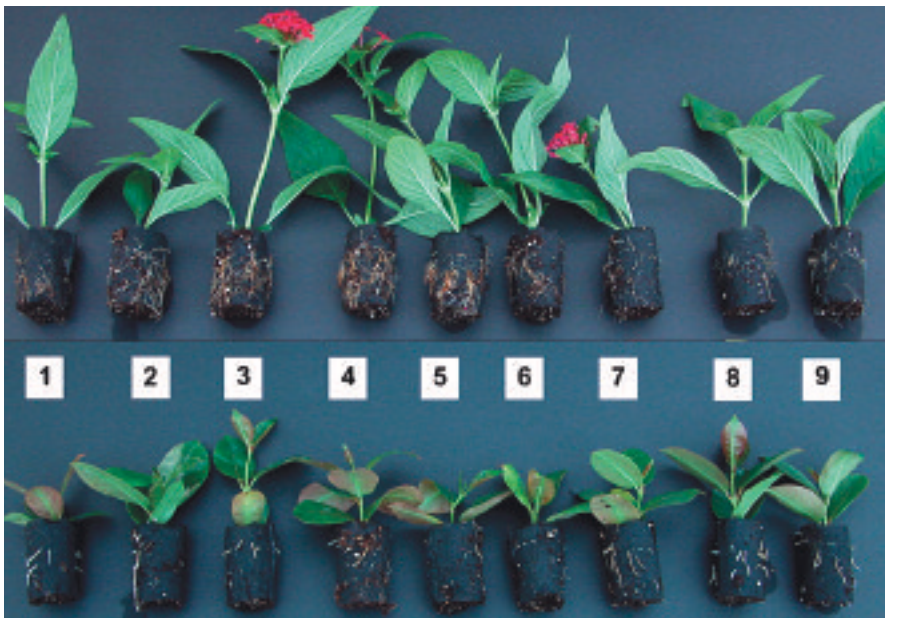
application of some formulations can cause damage to the cutting base. Formulations dissolved in alcohol are more prone to cause burn or dehydrate plant tissue. Auxin in excessive concentrations may result in inhibition of bud development, yellowing of leaves, leaf abscission, blackening of stems and even death of cuttings. It has also been reported that misapplication to leaves may result in curling or other distortion of plant growth.

APPLICATION

There are several accepted methods of application for growers wishing to utilize rooting hormones in their propagation practices. When dipping cutting bases into a rooting hormone, better efficiency is maintained with dipping several cuttings at once, rather than dipping them individually. It is also better to use a small portion of the hormone mixture in a separate container, away from the stock batch with frequent changes. This will minimize the potential for disease spread and cross contamination.

Powders. Auxin-based rooting hormones may be mixed with talc and applied to the base of cuttings. The cuttings are dipped in the powder, then lightly tapped to remove excess chemical. To increase adhesion of powder to cutting bases, stem tissue can be re-cut or dipped in water or alcohol before application. However, this will lead to a more rapid deterioration of the rooting hormone batch and may increase the potential for disease spread.

Powdered forms of rooting hormones are generally less effective than liquid formulations applied at the same concentration. Auxin uptake by the cutting base is often ➧



Influence of rooting hormones on propagation of pentas (top) and mandevilla (bottom) left to right: untreated, K-IBA at 1,000 ppm, K-IBA at 5,000 ppm, K-IBA at 10,000 ppm, Dip 'n' Grow – semihardwood concentration, Dip 'n' Grow – softwood concentration, Hormodin #1, Hormodin #2 and Hormodin #3. (Photo courtesy of James Gibson)

inhibited by the texture of the stem (smooth vs. rough) or immediate removal of talc from the cutting tissue when inserted into the propagation medium. However, talc-based products have the advantage of being less toxic, more sanitary than the liquid formulations and quicker and easier to apply. These factors may ultimately make powders more cost effective.

Quick-dip Solutions. Quick-dip solutions follow the same general principle of application as powders, in that they are auxin-based products mixed with a carrier (usually alcohol or water) and are applied to the base of the cutting. Cuttings are dipped for 1-5 seconds at a depth of ¼ to ¾ inches. Dipping the cuttings deeper in solution can be used to compensate for lower auxin concentrations.

Quick-dip solutions have the advantage of being highly uniform, consistent and easy to use. However, the risk of disease contamination is higher with liquid formulations. These formulations also tend to increase in auxin concentration as the solution evaporates. It is important to change out solutions periodically throughout the day, especially in hot, dry environments, and to keep containers tightly sealed when not in use. It is also a good idea to throw out any unused solution at the end of the planting period rather than putting it back into the stock container.

Other formulations. Water soluble formulations of rooting hormones such as K+ or potassium salt formulations of IBA and NAA have traditionally been used by propagators of woody ornamentals and show promise for herbaceous plant propagation. These compounds are readily dissolved in water rather than alcohol, which tends to make their use by growers safer and easier.

Post-planting sprays. As an alternative to dipping cuttings in talc or liquid, rooting hormones can be applied to cutting bases or the foliage as a spray. Pre-plant foliar sprays directed toward the stem base can be applied with a spray bottle; this is most practical when applied to bundles of cuttings before planting. This form of application eliminates the need of a common container, ultimately reducing the incidence of disease spread. With post-planting applications of rooting hormones (spray to the point of run-off), much lower concentrations (50-100 ppm) of auxin are required when compared to conventional methods. Advantages to this treatment are that fewer workers handle the chemicals, and applications can be made up to 24 hours after planting. One challenge to this alternative method of application is that limited information on rates and concentrations for specific crops is available.

From a practical standpoint, most of the plant species used by the ➧



Left: *Propagators of perennial plants utilize rooting hormones with semi-hardwood tissue.* ***Center:*** *Rooting hormone research at the University of Florida-Milton.* ***Right:*** *Difficult-to-root species such as mandevilla benefit from a rooting hormone application. (Photos courtesy of James Gibson)*

greenhouse industry root relatively easy. The propagation process can often be hastened by treating cuttings with commercially available rooting hormones. Improved cutting performance and greater finished plant quality can be achieved with these tools; growers have to debate the added expense of hormone application and cost versus increased product diversity and the potential for increased revenue. GPN

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