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

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 naphthaleneacetic 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 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

![Image](https://via.placeholder.com/150)

Figure 1. Requirement levels of rooting hormones for a select group of floriculture crops.
should be regulated appropriately, if the propagation medium is too satu-
rated (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-
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
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 $\frac{1}{4}$ to $\frac{3}{4}$ 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
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.

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