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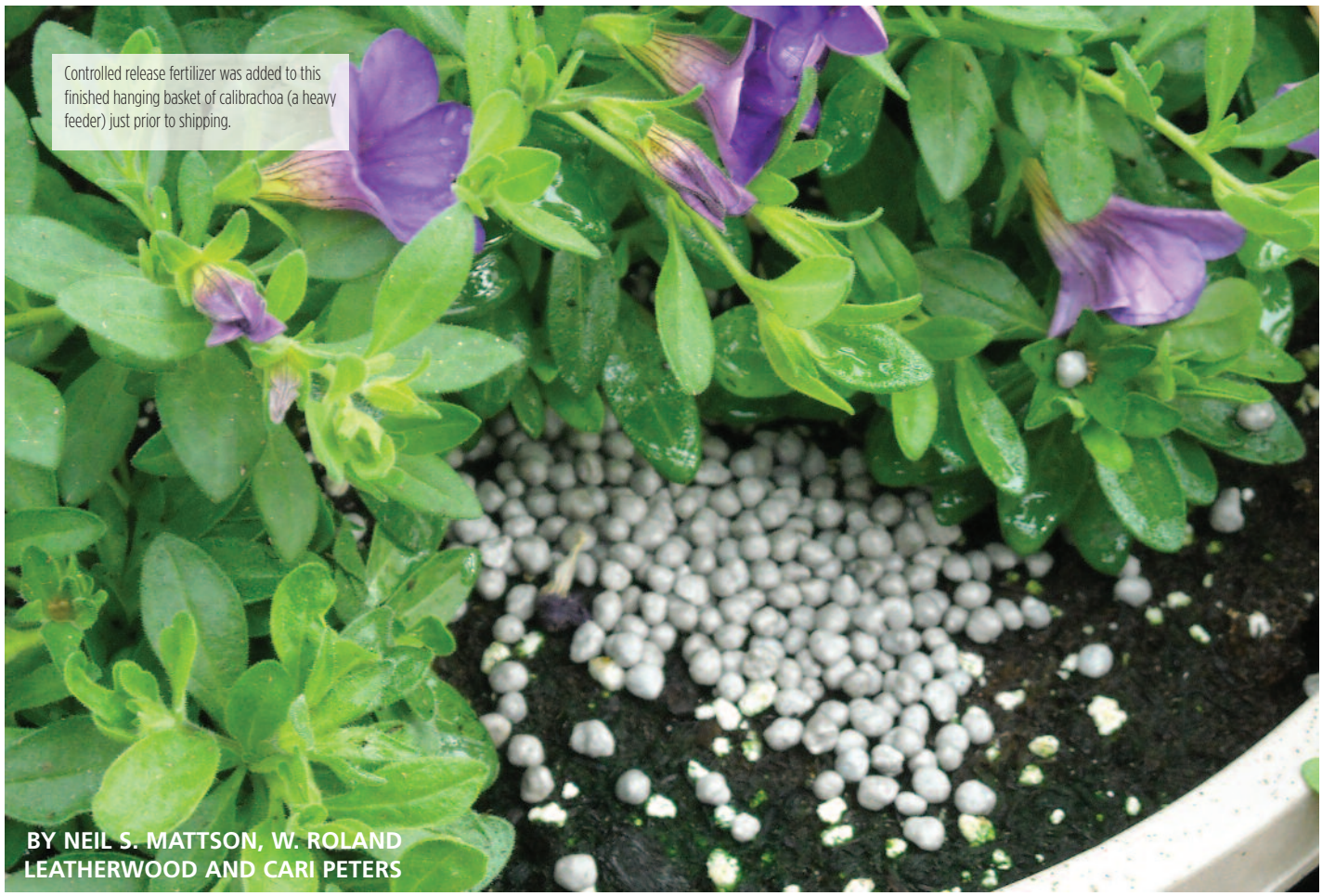


Controlled release fertilizer was added to this finished hanging basket of calibrachoa (a heavy feeder) just prior to shipping.

BY NEIL S. MATTSON, W. ROLAND LEATHERWOOD AND CARI PETERS

Planting the Seeds

For Consumer Success

The products we produce in the greenhouse industry are often grown in an environment that offers nearly optimal growing conditions such as high light and plenty of water and nutrients. Yet the end use of our products is in a consumer landscape where plants are often exposed to less-than-ideal conditions.

There are two stressful steps a bedding plant must go through as it transitions from a production greenhouse to the consumer's garden:

1) **Shipping to and display in the retail environment.**
2) **Establishment in the outdoor landscape.**

In the retail environment, a plant may be exposed to low light levels, low humidity and under-watering. These conditions can promote rapid water loss and a reduction in carbohydrate reserves that could have been used to foster future plant growth. As a plant is installed in the outdoor landscape it is likely to be exposed to more extremes than it previously encountered: high light, lower fertility and water stress due to a lack of watering or an initially small root volume that has not yet expanded into the neighboring soil.

Considering that we all rely on consumer success for repeat sales, the

Are your irrigation and fertility practices backfiring on the end consumer and causing garden failure?

Impatiens Super Elfin Mix two weeks after planted into a flowerbed without added fertilizer. Plants on the left were produced using 50 ppm CLF, while plants on the right received 350 ppm CLF.

fertilizer and irrigation program that you use to produce your plants should not focus only on producing the largest plant in the shortest time period; it should take into account how these practices will affect plant performance in the consumer's landscape. By paying attention to the details you can ensure consumer success and cultivate repeat sales.

Don't under-fertilize during the production phase

Certainly it makes sense to use fertilizers efficiently to keep production costs down and to limit nutrient runoff to the environment. However, using too little fertilizer during greenhouse production can reduce plant performance once it's installed in a consumer's landscape.

Research was conducted at Cornell University to investigate how fertilizer rates during greenhouse production affected plant finish size and landscape performance. Snapdragon, torenia and impatiens were grown in a greenhouse for eight weeks using overhead watering. Plants received 50, 100, 200, 350 or 500 ppm nitrogen (N) daily in the irrigation water from a commercially available fertilizer (Jack's LX 21-5-20 Water-Soluble Fertilizer). For all three species, fertilizer concentrations of 50 or 100 ppm N significantly reduced plant growth; with optimal growth occurring at 200 ppm N. A significant impairment of plant growth occurred for impatiens at 500 ppm N and for torenia at 350 and 500 ppm N due to salt injury.

Following the eight-week production period, plants were installed in a flowerbed, where growth was monitored for an additional eight weeks. We choose an unfertilized flowerbed for the landscape experiment as we felt this would be most representative of a typical consumer's growing conditions. Sprinklers were used to deliver 1 in. of water to the bed every three days. The surprising result was that fertilizer rate during greenhouse production dramatically affected landscape performance (Figures 1-3).

At the end of eight weeks in the landscape, plants that received the lowest fertilizer rate in the greenhouse (50 ppm N) were half as big as plants that had received 200 ppm N in the greenhouse. Our experiment also found that excessive amounts of fertilizer during greenhouse production could carry through and reduce landscape performance of salt-sensitive species. Torenia plants grown at 350 or 500 ppm N were less than half the size of plants grown at 200 ppm N. Our research illustrates that starting your plants off with the proper amount of available nutrients will lay the foundation for a strong plant later on. In contrast, a plant that's nutrient deficient during the early phase of growth can end up being quite delayed at each stage, culminating in a late finish date or a sparse plant unable to fill its container.

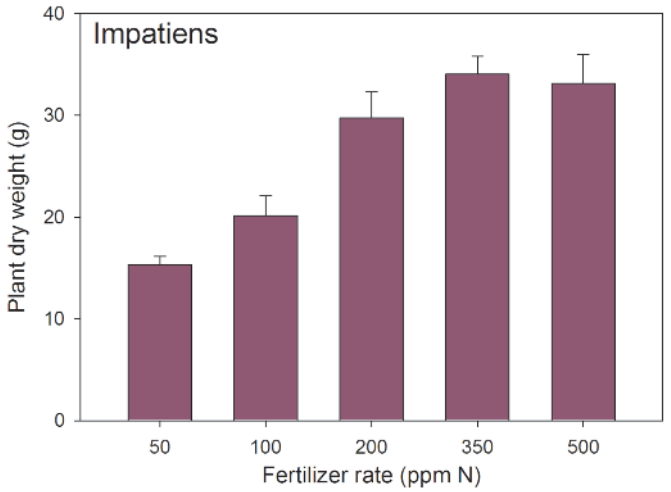
Research at the University of Florida found that landscape performance of geranium, impatiens, salvia and vinca was impaired when greenhouse fertilization was terminated more than two weeks before crop finish.

FIGURE 1. Performance of impatiens Super Elfin Mix after eight weeks in the landscape following greenhouse production under fertilizer rates of 50 to 500 ppm N with 21-5-20 fertilizer.

FIGURE 2. Performance of snapdragon Rocket Light Pink after eight weeks in the landscape following greenhouse production under fertilizer rates of 50 to 500 ppm N with 21-5-20 fertilizer.

FIGURE 3. Performance of torenia Clown Mix after eight weeks in the landscape following greenhouse production under fertilizer rates of 50 to 500 ppm N with 21-5-20 fertilizer.

FIGURE 1.



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Toning it down?

While our research focused on landscape establishment directly following greenhouse production, in many cases, greenhouse-grown plants must undergo a substantial shipping and retail display stage before they're installed into landscapes. "Toning" plants or acclimatizing them to post-greenhouse stresses can take the form of exposing plants to lower night temperatures and not applying luxuriant amounts of water or fertilizer. It's often suggested to use "clear water" for the last few weeks before ship. This practice is a common misnomer that can often flush out much of the nutrition you have fought to build up over the last several weeks. Research at the University of Florida found that landscape performance of geranium, impatiens, salvia and vinca was impaired when greenhouse fertilization was terminated more than two weeks before crop finish.

During the last week or two of production, reducing the fertilizer rate or applying clear water if soluble salt levels test high can help reduce salt buildup before shipping to retail. Switching your fertilizer formula to a classic finishing blend that's higher in nitrate nitrogen and potassium can harden growth and help regulate water loss. Once in the retail environment, excessively high salt levels should be avoid-

Impatiens Super Elfin Mix two weeks after it was planted into a flowerbed without added fertilizer. Plants on the left were produced using 50 ppm CLF, while plants on the right received 200 ppm CLF.

FIGURE 2.

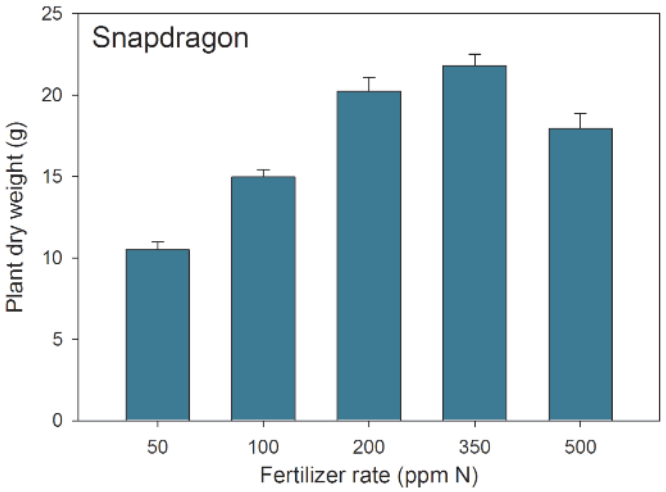
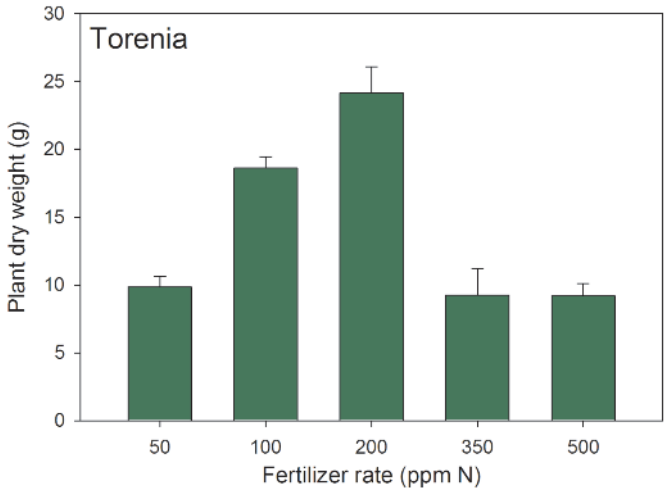


FIGURE 3.



ed because of the interaction with water stress. In a well-watered substrate salts are fairly dilute; however as the substrate dries down, salts become more concentrated, which makes it increasingly difficult for roots to extract enough water from the substrate. Most finishing fertilizers, such as K-trate 14-5-38, are potassium nitrate-based, low in phosphorous and have a balanced micronutrient package. Raw materials such as calcium nitrate 15.5-0-0 or potassium nitrate 13-0-44 can be used for short periods; however, since they have no micronutrient package they can deplete trace element levels in the root media rather quickly.

No doubt, some practices meant to provide great plant tone are at odds with delivering a plant with higher fertility. Fertility sources such as composts, well-seasoned manure and organically based compounds (blood meal, bone meal, and etc.) are slow-release fertility sources that may help contribute to long-term plant performance. An incorporated slow-release fertilizer may be a way of providing late sustained nutrition during retailing and post-planting. Be sure to conduct your own trials when adding new materials to your substrate. Today, plants are shipped great distances and are required to be held in a retail environment for a long period of time. As a grower, it's essential to finish your plant in a way that ensures lasting enjoyment for the consumer.

New techniques: regulated deficit irrigation and abscisic acid applications

Two additional techniques that have the potential to reduce retail shrink and improve post-harvest performance involve manipulating abscisic acid (ABA) concentrations in the plant.

ABA, a naturally occurring plant hormone, helps regulate plant response to water stress such as closing stomates to reduce leaf water loss. Applications of a commercially available ABA source (Stasis, Natural Industries, Inc.) as a soil drench appears to improve postharvest stress tolerance and extend marketable life of ornamental plants. Research with ABA at the University of Georgia found that drenches could delay wilting of salvia by two to three days.

Another method of increasing plant ABA content is by applying slightly less irrigation water than is optimal. Known as regulated deficit irrigation (RDI), the technique has been proven useful for improving stress tolerance of nursery plants and of improving their subsequent establishment in the landscape. Research trials conducted at Cornell University demonstrated that the technique is useful for improving poinsettia postharvest life. Although ABA can improve water stress tolerance, levels that are too high can reduce growth and cause excessive drop of lower leaves. Therefore, both these techniques must be used with great care.

Educate and add value

The simple truth is that consumers typically don't take the time to fertilize consistently once they take their plants home. Before plants leave your door, consider top dressing with a controlled release fertilizer for plants destined for containers and hanging baskets: 1 tablespoon per 10-in. basket works well for many species. Also, educate your consumer about the benefits of periodic additions of water-soluble fertilizer. Using a 1:1:1 ratio fertilizer such as 20-20-20 every seven to 10 days at the rate of 1 tablespoon per gal. will deliver 750 ppm N and will help promote vigorous growth throughout the summer.

Irrigation and fertilization efforts that prepare your plants for the post-greenhouse environment ultimately add value to the product the consumer takes home. The consumer ends up with a quality product they can be proud of all summer long, which hopefully nets you more repeat sales. **GT**

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