# Non-Chemical Height Control

Figure 1. Here are two different cultivars of calibrachoa planted on the same day and grown in the same bench showing the impact of cultivar selection.

Integrating height control strategies with traditional chemical control is an approach for growers embracing sustainability.

by **CHRISTOPHER J. CURREY** and **ROBERTO G. LOPEZ**

AS part of the movement toward sustainable production of greenhouse crops, many growers are looking for non-chemical alternatives to control plant height and size. Fortunately, there are numerous options available. These options include genetic selection, planning and graphical tracking, environmental manipulation of light quality and air temperature, cultural manipulation of irrigation and mineral nutrition and mechanical control.

## Genetic Selection

When trying to control plant size, the first step is to select naturally compact or dwarf cultivars. Many breeding companies are constantly introducing new cultivars of popular genera and species with a more compact growth habit (Figure 1). This benefits growers by providing them with plant material that can be finished at a smaller size than their standard-sized counterparts.

## Planning & Graphical Tracking

After selecting the proper genetics for production, the next step in controlling crop height is to put your pen to the paper (or finger to the keyboard!) and put together production schedules. Putting together an accurate schedule will get your plants out the door when they are the right size and minimize any chance of holding your crop too long.

Successful scheduling includes providing the proper conditions to get a crop flowering by the target sales date, such as proper temperature set points or photoperiods. For example, if you are growing bedding plants that flower in response to long days (LD) under short days (SD), you will delay flowering and have to take extra steps to control the size of these plants (Figure 2). In a similar scenario with temperature, if you are trying to get your New Guinea impatiens in flower but have your greenhouse running cooler than 65°F, you'll be delaying flower development.

Once your production schedule is put together, keep an eye on how crop height is progressing through the use of graphical tracking. Graphical tracking is popular for potted crops such as poinsettias and lilies, though this technique can be used with virtually any crop. After growing a crop for a few years you'll have an idea of the pattern and timing of growth and can use this knowledge, along with a computer spreadsheet and a final target height, to produce the right-sized crop.

## Environmental Control

Stem elongation is strongly influenced by light quality. Specifically, it is the ratio of red (R) to far-red (FR) light (R:FR) that influences elongation. When plants are grown under a low R:FR light ratio, elongation is greater compared to plants grown under a high R:FR light ratio.

So what would create an environment with increased far-red light? The first is tightly spaced plants. Because leaves preferentially absorb red light, light under the canopy has a lower R:FR light ratio

**Figure 2.** An improperly scheduled petunia crop grown under short-day conditions is vegetative and not marketable.

**Figure 3.** Garden mums grown on close spacing are stretched and have an unmarketable appearance.

due to the absorption of red light by the canopy. For example, the R:FR ratio of direct sunlight is approximately 1.1, whereas the R:FR light ratio under a leaf is around 0.15. This is why floriculture crops on close spacing stretch more (Figure 3). Increasing container spacing will allow more red light to penetrate the canopy, increase the R:FR light ratio and reduce stem elongation.

In addition to light quality, you can control plant height by manipulating greenhouse air temperature. Stem elongation is strongly influenced by the difference (DIF) between the day air temperature (DT) and night air temperature (NT). This is represented as: DIF = DT – NT. For instance when the DT is higher than the NT, DIF is positive. If the DT and NT are the same, DIF is zero. If the NT is warmer than the DT, DIF is negative.

As DIF is more positive (a larger difference between DT and NT), stem elongation increases (Figure 4). As DIF decreases toward zero or becomes negative, stem elongation is suppressed. Running a higher NT than DT can be a very effective means of suppressing elongation. Increased heating at night to achieve a negative DIF can also be expensive.

There is an alternative, yet effective, strategy using the difference between DT and NT. This method is called DIP, DROP or Cold Shock. You can DROP or DIP your air temperature by running a constant DT and NT for most of the day. Then, about 30 to 60 minutes before sunrise, DROP your air temperature by 5 to 10°F for up to four hours. This will create a negative DIF without drastically increasing your nighttime heating and allow you to take advantage of the naturally warmer afternoons. Because the majority of stem elongation occurs during the morning, dropping your air

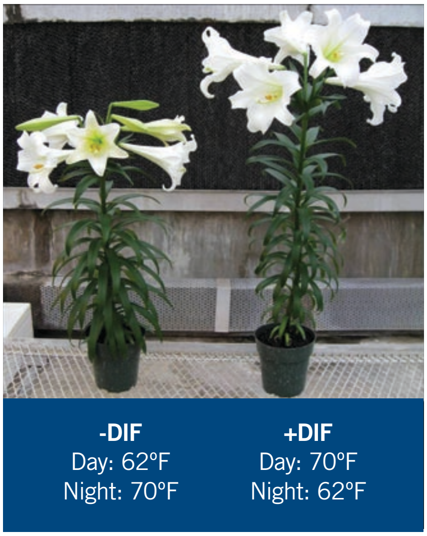


**Figure 4.** Here are two Easter lily plants grown under the same average daily temperature (66°F), but the plant on the left was grown with a negative DIF (-8°F) while the one on the right was grown with a positive DIF (+8°F).

temperature early can be very effective in reducing elongation.

## Cultural Techniques

One cultural strategy to keep plant size in check is to decrease overall fertilization. By not applying maximum concentrations of fertilizer, you can avoid excessive growth and stem elongation. However, you can take a more targeted approach by reducing nitrogen (N) or phosphorous (P).

While reducing N fertilization will suppress overall growth, this must be done cautiously because N deficiency appears as yellowing leaves. This can produce crops that are visually "unhealthy" and less appealing to consumers. Fertilizing with low P is a viable alternative. Two of the main symptoms of early phosphorous deficiency include reduced height and deep-colored foliage. One drawback of using P deficiency is bedding plants finished from plugs where P starvation was used may flower a few days later.

Another method of height control for many plants is to impose a very mild water stress or grow crops on the drier side throughout the production cycle. These methods are not easy and are best employed by an experienced grower, as allowing too much water stress can ultimately result in unmarketable crops. With certain crops, such as celosia, water stress can cause premature flowering, resulting in plants with color but not up to size.

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## Mechanical

In addition to environmental and cultural height control options, there are also a few mechanical methods to reduce stem elongation. Pinching or shearing is a fairly common practice in many greenhouses, depending on the crop (Figure 5). Pinching does reduce plant height, although it is primarily used to promote branching and produce a more "full" plant. While the shorter height may be a benefit of pinching, it can be a labor-intensive process and not produce the best height control compared to other options.

**Figure 5. Shearing is commonly used to reduce plant height while encouraging branching.**

When plants experience movement from coming into physical contact with something, stem elongation can be suppressed. Brushing is a technique in which a bar, rope or cloth is gently run across the canopy of a crop. Recently, one Danish pot rose producer found it was able to completely replace paclobutrazol sprays with daily brushing to achieve the height control needed for its 4-inch crop. Brushing should be used carefully, as certain crops may be more susceptible to mechanical damage as a result of brushing.

## Integrated Height Management

Hopefully, some of the options presented here will prove to be useful alternatives to chemical height control. Remember to test these techniques on a limited basis before implementing them in your entire production facility or on every crop you produce. The methods described here are additional tools for your height control toolbox, along with chemical PGRs.

We feel that in addition to chemical PGRs, the use of proper plant selection, scheduling and graphical tracking, and managing your greenhouse environment and cultural inputs, you can approach plant height with an integrated height management (IHM) approach. This idea is similar to integrated pest management (IPM), which encourages using several methods for pest prevention and control strategies to manage pest problems. By integrating some of the height control strategies we've reviewed here with traditional chemical control, you can approach height control in a more sustainable manner. **GG**

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