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## Preventing liner stretch

*Controlling plant size can be a challenge, but successful height management begins in propagation. Liner stretch, or unwanted stem elongation of rooted cuttings, contributes to excessive height for finished plants in containers. In this e-GRO Alert we will focus on the causes of liner stretch and what you can do to keep your cuttings compact prior to planting.*

Spring production is ramping up and the time available to dedicate to crops is going to decline. This is going to make controlling crop height for all the different products in the greenhouse a real challenge. Every step taken towards controlling crop growth is going to contribute to better-looking finished plants. Plug growers work to grow fully rooted and compact plugs, as these can result in high-quality finished plants. The same attention and care should be given to controlling the height during production of rooted liners from unrooted cuttings. There are a number of techniques that producers can utilize to minimize unwanted stem elongation, from planning and crop scheduling to plant growth regulators and flowering control.

### Planning and scheduling

Proper planning and scheduling is one of the first opportunities you have to minimize stretch in the liner tray. The longer trays of rooted cuttings sit on the bench, the more stretch occurs. When a tray of



## e-GRO Alert

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cuttings is fully rooted, toned, and ready for planting, shoot growth of liners has resumed. One consequence of a fully close canopy in a tray with a high density of plants is the “shade avoidance response”. Stem elongation is related to the ratio of red to far-red light, with a greater proportion of red light suppressing stem elongation and a greater proportion of far-red light promoting stem elongation. When the canopy of liner shoots fill in a tray, the red light is preferentially absorbed by leaves, while the far-red light is transmitted through the leaves, thus increasing the proportion of red light underneath the upper leaves. This far-red-enriched environment



Figure 1. Rooted New Guinea impatiens cuttings that have been in the tray for too long exhibit excessive stretching. Photo at four weeks after application.

ultimately caused cuttings to elongate more in the liner tray (Fig. 1). With proper planning and scheduling, your trays of rooted cutting can be planted at the appropriate time. This entails: ensuring bench space is open for the finished crop; all containers, substrate, and other materials required for planting are on-hand and ready; and you have the appropriate labor available and/or automation working properly to plant cutting when they are rooted.

## Start with high-quality cuttings

Once you are ready to begin propagation, it is time for the cuttings themselves. If you are harvesting cuttings from your own stock plant, do not harvest cuttings that



Figure 2. These verbena cuttings would benefit from shearing to reduce primary stem length, eliminate flower buds, and promote branching.

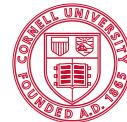
are too large. While there may be a “bigger is better” tendency, large cuttings may not fare as well as smaller shoot-tip cuttings in propagation. While the specifications for cutting dimensions vary widely across different species, shoot tips 1 to 1.5 inches long with a few nodes are generally appropriate for rooting. However, most growers in the United States are no longer producing their own cuttings and are bringing in cuttings from Central America and Israel. At the stock plant facilities where cuttings are harvested, there is a strong effort to harvest and ship uniform, high-quality cuttings for growers. When your cuttings arrive, it is a good idea to inspect them immediately for any damage that may have occurred during shipping, such as cold injury; it is also a great time to inspect the quality of the cuttings. Are they too large? Are the internodes too stretched? If there is a problem, contact the company immediately to see what can be done. Establishing a good relationship with your cutting supplier can pay.

## Managing flowering

Generally speaking, we want to keep cutting vegetative during propagation. The formation of flowers may come at the expense of other growth, such as new roots and leaves.

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Additionally, when the flowers begin to senesce they can increase disease pressure and become unsightly. Yet there is another reason to suppress flowering during propagation. When plants become reproductive and flowers start to form, the upper or apical region of stems may elongate more than compared to normal vegetative growth. This is what we commonly refer to as “bolting”. Though not all genera and species have this tendency to elongate more or bolt when flowering, it can be common for species with a long day photoperiodic flowering response; interestingly this is not really seen on short day or day neutral plants. Many of our annual and perennial spring bedding plants are long day plants and, as such, can exhibit bolting when flowering is induced. Long-day conditions may be provided during propagation with day-extension or night-interruption lighting, though this is generally for seedling plugs that will be transplanted into cell packs and need to flower earlier than if grown in larger containers. Unless early flowering is needed, cuttings can be rooted under non-inductive photoperiods. While natural short days occur for a good portion of the propagation season, later propagation periods may be under long days. If available, black cloth may be used to create short days.

## Mechanical control

Stem elongation can also be controlled mechanically. One method of mechanical height control is brushing crops. This is usually done by gently dragging some sort of cloth or fabric or a broom handle or piece of PVC pipe gently over the top of the canopy. For cuttings in propagation, this may be difficult because cuttings are not fully rooted in the substrate in propagation trays until later in propagation and we do not want to risk pulling cuttings out of substrate. Another method of mechanical control that can be used to reduce the height of cuttings is by shearing or pruning the cuttings (Figs. 2 and 3). There are several benefits that may be achieved with shearing liners. First, it reduces the length of primary stem, especially for stretched liners. Shearing can be performed by hand or, if there is a large enough volume, automation may be employed for labor savings. Sanitation is key during shearing since pathogens can be spread on tools, regardless if it is a few trays with a scissors or hundreds of trays with a machine.



Figure 3. Verbena cuttings that had previously been sheared are ready for transplanting; note the branches that have started to grow.

## Plant growth retardants

Another method of controlling excessive stem elongation is by using chemical plant growth retardants (PGRs). Applying PGRs are a convenient way to suppressive excessive stem elongation; however there are several points to keep in mind when applying them to cuttings. The most convenient way of applying PGRs during propagation is with foliar sprays. Liner dips can be used, but this application is more suited to controlling stem elongation after transplant. Soaking unrooted cuttings in PGR solution prior to planting does control stem elongation, though this method is much less well-understood and predictable and, therefore, not recommended. Since there will be little foliage per unit area compared to larger plants, excess solution not contacting shoots will be absorbed by substrate; this may result in more suppression if using active ingredients that have substrate activity, including ancymidol, flurprimidol, paclobutrazol, and uniconazole. Though ethephon is an effective growth retardant, enhances branching, and aborts flowers, the ethylene that is generated can negatively impact rooting. Extra precaution should be used to not apply ethephon solutions too early to inhibit early root initiation or in excess to inhibit subsequent root development.

## Take-home messages

Cuttings can stretch during propagation, but there are several steps you can take to prevent this. With proper scheduling and preparation, high-quality cuttings, and a few other tools in your toolbox, you can produce well-rooted cuttings that will produce high-quality finished plants.



Figure 4. Recently transplanted, high-quality rooted angelonia cuttings have the potential to be excellent finished, flowering plants.