Reduce SHRINK in Propagation

From top: Cutting quality comparison; loss of leaves in propagation; well-rooted liner (Photos: Roger Styer)

Here are a few tips for growers in navigating the many potential pitfalls during the propagation process.

By Roger C. Styer

With the wide range of vegetative cutting varieties and off-shore suppliers currently available, more and more growers are buying unrooted cuttings and rooting them out themselves. In the past, growers would grow their own stock plants of geraniums, New Guinea impatiens and even poinsettias. But with serious disease problems such as Xanthomonas, Ralstonia and impatiens necrotic spot virus (INSV), as well as hard-to-control insects such as thrips and whiteflies, it is easier just to buy unrooted cuttings. Growing your own stock plants requires heating greenhouses earlier, more labor and more costs. Unrooted cuttings of many crops can be purchased cheaper nowadays. And with the enormous number of annual and perennial varieties available, no grower can handle all the stock plants for their seasonal needs.

However, buying unrooted cuttings requires trust in your suppliers to provide consistent quality cuttings in every shipment. And when shipping in cuttings from offshore to your greenhouse, weather conditions during transit can pose major challenges. Some cuttings do not tolerate too-cool or too-hot climate conditions, and none will survive freezing! Also, ethylene production by the cuttings themselves can occur during transit, resulting in loss of leaves and poor rooting. Cuttings from different suppliers and offshore production farms can vary in their quality as well.

With fuel costs uncertain and costs of production going up every year, there is increasing pressure to conserve heat, start up greenhouses later, reduce costs any way possible, and reduce losses or shrink in propagation. Losing cuttings anytime after receiving and sticking results in an expensive reduction in profit. And a delay in availability of finished product due to reordering and shipping cuttings at a later date is another costly consequence. Here are the areas of propagation where I see the most serious problems showing up throughout my visits to growers around the country.

Quality of Cuttings

Success in propagation starts with a quality cutting. The old saying, "Garbage in, garbage out!" really applies here. Whether you are taking your own cuttings or buying them, you need to have cuttings that are consistently healthy and of uniform size. If one time you receive geranium cuttings that are 3-4 inches tall and the next time they are hardly big enough to stick, then you will have problems rooting them. Caliper of the stems is just as important as the size of the cutting. Smaller and thinner poinsettia cuttings will take longer to root, and may be more susceptible to diseases and damage to stems when sticking. The number, color and size of the leaves on the cuttings determine how cuttings were grown on stock plants, and how much energy they will have to survive the rooting-out process.

Cuttings could be of great quality when they are harvested and shipped off the production farms, but may go down quickly during transit. Shipping temperatures within the boxes should be 45-50° F for most crops. If subjected to freezing temperatures by FedEx, you will see the cold damage quickly on sensitive crops such as New Guinea impatiens, lantana, begonia and coleus. However, shipping temperatures higher than 60° F starts the production of ethylene gas by the cuttings themselves. Ethylene production increases with increasing temperature. Damage from ethylene shows up as lower yellow leaves within the first three days of sticking, slower rooting, defoliation and even tip abortion. Measure the temperature of boxes when received, and report any problems quickly to your suppliers. Any delays in transit will cause problems with ethylene.

Diseases can be a major hassle with some cuttings, regardless of time of year. Remember, cuttings have a wound and maybe some bruised leaves and stems as well. These wounds are great openings for bacteria such as Erwinia and fungi such as Botrytis. If there is too much moisture or humidity in the bags, disease problems can increase. High moisture with high temperatures guarantee diseased cuttings. If cuttings look like they are melting or smell rotten, do not bother to stick them.

Handling After Receiving

Upon receipt of boxes of unrooted cuttings, measure the temperature inside the box. If warmer than 70° F, report immediately to your supplier. Take a look at the ice packs within the boxes. Are they melted and warm, or still very cool? Check the bags to make sure you received the correct varieties and number of cuttings. Follow directions included with every shipment about how to handle the bags, storing them over-

night in a cooler at 50° F if needed, and keeping the cuttings moist, not dry. Ethylene-sensitive crops should have first priority for sticking (Table 1). If at all possible, stick them the same day you receive them. Make sure it is someone's responsibility for checking in all cutting shipments promptly!

If you are taking cuttings from your own stock plants, try to handle them quickly. Make sure you cover the collection containers with moist paper towels. Keep out of high light and get them cooled down to 50° F as soon as possible if weather conditions are hot. If you take cuttings in the morning, you can easily stick them the same day. However, poinsettia cuttings will do better if cooled overnight, and will have fewer problems with Erwinia soft rot. Plus, your sticking crew will thank you!

Sticking

When physically handling cuttings, sanitation is the rule. Hands should be clean, and suitable disinfectant used to clean hands or gloves, as well as any tools and surfaces the cuttings might touch. Make sure to clean frequently, not just once a day. And don't stick a cutting that does not look good. It will only get worse once under mist, causing more problems with disease that you'll have to spend more time and money cleaning up.

There are many different rooting media to use, and no best one for every grower. I have found that the best rooting media for a particular growing operation is the one that works well with the misting system. If you are having trouble with the rooting media staying too wet, you can either adjust your misting system or use a rooting media that has more air porosity. Some media, such as Oasis wedges, need to be on the wetter side, whereas compressed media such as Ellepots do better when not so wet. Rooting times will be faster with stabilized or wrapped media (Preforma, Ellepots) than with loose-filled trays. Make sure that the rooting trays are dibbled before sticking cuttings, so as not to bruise the cut ends and to allow a better fit with the moist media.

The use of rooting hormones will speed up rooting on a number of crops, but other crops do not benefit (Table 2). Whether you use a powder (Hormodin #1) or liquid (Dip 'N Gro) rooting hormone, follow basic sanitation procedures. Work with a little bit of rooting hormone in a disposable container so you can frequently start anew without spreading diseases from cutting to cutting. Follow directions for mixing and using the rooting hormone closely.

If cuttings are not of uniform size, you will need to size them while sticking them. Train your sticking crew to handle this task, and it will save you time later on. Get some mist on the cuttings as soon as possible after sticking. The rooting media should already have some moisture in it before sticking, but it is of utmost importance to get mist onto the stressed leaves quickly. If sticking directly on the greenhouse bench, either have the mist system come on as needed and your crew wear ponchos, or have someone go over the cuttings with a mist nozzle frequently.

Temperature and Light Levels

Best rooting for most herbaceous cuttings occurs with soil temperature between 70 and 75° F. When too cool, rooting slows down greatly, and may not even occur with crops that like it warm. Also, disease problems may be more prevalent as rooting takes longer. Soil temperature is different than air temperature. If you have under-bench heating, then soil temperature will be pretty close to air temperature. But if you have overhead heating, then soil temperature could be 5° F lower or more. Check your soil temperature with a soil probe frequently. And make sure any water or mist that goes on the cuttings is heated to 70° F. You don't want them catching a chill during the cold weather.

Light levels should be 800-1,200 foot-candles during Stage 1, the time from sticking to callus formation. Check light levels with the shade you have available, and add more shade if needed. Too much light during this stage makes it extremely hard to keep enough moisture on the leaves to keep them from stressing out, which shows up as curled up leaves and delayed rooting. Too little light will allow cuttings to callus, but may not be enough to get roots. And too low of light will demand less mist, so be aware of problems with diseases such as Botrytis and Rhizoctonia. Once callus has formed, light levels should be increased to 2,500-3,000 foot-candles for best root and shoot growth.

Misting and Watering

Once cuttings are stuck, the mist schedule becomes the most important area to focus attention. Cuttings are just that — a stem cut off the mother plant. And as such, they are highly susceptible to stress, particularly during the first seven days or so after sticking. A small amount of moisture is needed on the leaves to prevent desiccation or wilting. Until callus forms, cuttings of many crops need an almost continuous film of water on their leaves. This means you can still see some beads of water or a very light film, but not soaking wet. The best way to provide this moisture is through mist or fog nozzles. Small water droplets from fog or mist will give better distribution of moisture on all leaves, and will not soak the growing media.

Where I see the most problems with mist schedules is either too much mist or not enough. You need to adjust the mist frequency by the light levels and temperature within the propagation greenhouse at least daily. Cloudy, cool or rainy days do not require as much mist as do sunny, warm days. Under-bench heating will probably require more mist, especially during cool nights. Not enough mist will show up as curled-up leaves in the morning or end of day. You will naturally see some leaf curling during the middle of sunny days even with proper shading. But extended periods of time without enough mist cause permanent damage to leaves and delayed rooting. I also see problems with nonuniform misting, sometimes because of air flow or clogged mist nozzles.

Too much mist results in more diseased cuttings. Botrytis, Rhizoctonia, Erwinia, and a few other fungal and bacterial pathogens will show up on cuttings fairly quickly if the mist is excessive. And with the density of cuttings on the propagation bench, it is easy to lose a lot of cuttings in a short time to diseases. Also, certain crops do not like as much mist as most other crops. Generally, crops from Mediterranean or dry climates should be on a lower mist schedule. These include most herbs, rosemary, ➧

Leaf burn from improper misting

Cuttings That Should Be Stuck First

- Geraniums, ivy
- Geraniums, zonal
- Heliotrope
- Lantana
- Thunbergia

Table 1.

Crops that Need Rooting Hormone

- Achillea
- Brachycome
- Dahlia
- Evolvulus (optional)
- Geraniums (optional)
- Helichrysum (optional)
- Heliotrope (optional)
- Heuchera
- Lantana (optional)
- Lavender (optional)
- Lobelia (optional)
- Mums
- Osteospermum
- Phlox (optional)
- Plumbago (optional)
- Poinsettias
- Rosemary (optional)
- Scaevola (optional)
- Vinca major and minor (optional)

Table 2.

helichrysum (licorice), lavender, succulents, and hairy- or fuzzy-leaf crops. Geraniums do not like as much mist as poinsettias, and ivy types need less mist than zonal types.

Once cuttings approach or achieve callus formation, you need to cut back the mist or get off all together and water by hand or boom. Night misting should be the first to be reduced or eliminated, provided you are not pumping so much under-bench heating at night. Otherwise, you may need to keep some night misting going until you can water more thoroughly by hand. For most crops that normally root within four to five weeks, the first three to five days are the most critical for misting. After that, you need to start weaning them off mist. I have seen some batches of cuttings that root very unevenly, which makes the decision about weaning off mist more difficult. Leaving them under mist longer does not help. More disease or poor rooting will be the results.

Fertilizing and Media pH

It is best to constantly feed cuttings with low rates (50- to 75-ppm nitrogen) on a constant basis right from the time you stick them. Once they are rooted and off mist, you can increase feed levels to 100- to 150-ppm nitrogen and feed with every thorough watering. I see too many growers waiting too long to start feeding, or not feeding enough with sunnier weather. The result is slower growth for both leaves and roots, smaller leaves and paler color. Using a fertilizer with moderate or low phosphorus (P) but with some calcium (Ca) and magnesium (Mg) will suffice for most all cuttings under most all conditions. Best choices would be 15-5-15, 17-5-17 or something similar. Under very low light and short days, you could use fertilizers lower in ammoniacal nitrogen (NH4), such as 13-2-13.

There are a number of crops that are very sensitive to high media pH (greater than 6.5). These include calibrachoa, petunia, vinca, bacopa, nemesia and dianthus. Symptoms typically show up as upper yellow leaves, stunting and poor rooting. Make sure to keep pH less than 6.5 and add some extra iron (Fe) with the feed program for these crops. On the other side, there are some crops that do not like low media pH. These include New Guinea impatiens and geraniums. Symptoms typically show up on lower leaves because of micronutrient toxicities, and may include necrotic spots and marginal burn, as well as twisted leaves. Using neutral or basic fertilizers will help keep media pH up for these crops.

From top: *High pH yellowing on calibrachoa; overwatering and disease on helichrysum*

As you can see, there are many steps in the process of propagation where you can lose cuttings. Success starts with quality cuttings received in good shape; stuck under sanitary conditions, with correct mist, temperature, light and feed; and with no disease or insect problems. Failure to pay attention to any of these steps results in significant monetary losses, as well as delays in getting replacement cuttings. Can you afford these losses? GPN

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