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GROWERTALKS

2026 Guide to Perennial Plant Production



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EDITOR'S NOTE



Welcome to our first standalone special supplement on perennial production—a resource designed to guide greenhouse and nursery professionals through the essential methods for starting strong, healthy perennials. If a perennials guide seems familiar that's because we included a special section in *GrowerTalks* last August (check out the 2025 guide using the QR code below) to test the waters with a perennials-focused guide, and the response was



fantastic, so this year we went all-in. This new guide brings together expert perspectives on a critical stage of production—propagation. Of course, perennial inputs come in a range of forms, so we reached out to our contributors asking them to each cover different starter material in a deep dive: seed, vegetative cuttings, tissue culture and bare root. While each operation and production scenario is different, there are best practices shared by each expert based on hands-on experience and years of research—personal, and by the companies and universities they represent.

On page 6, Paul Pilon highlights the importance of choosing the right seed varieties and knowing when plugs are a better option.

Chris Fifo shares strategies for rooting vegetative perennials from cuttings, stressing fast unpacking and rehydration on page 8. According to Chris, success depends on six factors: temperature, light, water, nutrients, media and PGRs.

When starting perennials from tissue culture (TC), acclimation is the name of the game and Nathan Jahnke explains research-based and greenhouse-trialed methods in on page 12. He stresses evaluating plantlet quality and communicating with suppliers from the beginning, as well as careful receiving and handling.

Laura Robles promotes bare root material as a fast, dependable input that establishes quickly and finishes sooner than other methods on page 14.

In this guide, we also reached out to Roberto Lopez and Seth Benjamin at Michigan State University to report on some cutting-edge research into ways that light quality might reduce the need for PGRs in some species. The study included four species—echinacea, heuchera, leucanthemum and nepeta—and findings showed that the broad use of UV-A or UV-B LED lighting is not advisable due to highly variable results and potentially negative effects on some plants. Read about it on page 18.

Finally, Katie Miller from Dümmer Orange shared an article on page 22 about the wonderful diversity of perennials and potential for plants sold in color (in key seasons) to expand perennial consumption in a big way.

Together, these articles offer a comprehensive overview of perennial propagation. By applying their collective wisdom—choosing the right methods, optimizing environments and handling inputs with care—we hope you and your production teams will achieve optimal quality and consistency.

Here's to a season of confident propagation and thriving perennials that sell through and lead to garden and landscape success!

BILL CALKINS

**Senior/Digital Editor—Ball Publishing
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Further Reading:

Snap the QR codes below to read some past biosolutions articles and listen to podcasts. *GrowerTalks*, *Green Profit* and *Inside Grower* understand the importance of sharing bio-based solutions year-round!



2025 GUIDE TO PERENNIAL PRODUCTION: OVERWINTERING & BULKING

Includes articles covering overwintering vs. first-year flowering perennials; vernalizing perennials; overwintering checklist; bulking best practices; a case for early season perennial color; managing weeds in perennial production; understanding how vernalization and dormancy impact perennial plant quality; Trending Now: Perennial Products.



MORE THAN JUST HEIGHT CONTROL

Authors Lauren Kilpatrick and Brian A. Krug share results from trials comparing two common plant growth regulator chemicals at different concentrations on key perennial crops like salvia, gaillardia, coreopsis, helenium and lavender.



2026-27 GROWER GUIDE: GROWTH REGULATORS FOR CONTAINERIZED HERBACEOUS PERENNIAL PLANTS

In partnership with Fine Americas, W. Garrett Owen at The Ohio State University developed the current Perennials PGR Guide and packed it with current research, modern perennials production strategies, crop-specific protocols and much more. The industry-standard charts detailing available chemistries and rate suggestions for most crops have been updated.



TRIALS & TRIBULATIONS OF GROWING PERENNIALS

If you're new to perennials production (or have new members on your perennials team), this article by Susan Martin addresses five common fears and offers comfort and encouragement to follow on the path to success with this group of plants. Susan also details five common pitfalls to avoid, complete with solutions and best practices to follow.



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Reader Service Number 71

Seeds of Success

BY PAUL PILON

I became fascinated with the wonders of seed germination at an early age. I recall collecting tree seeds during recess and planting them in small pots or Styrofoam cups and being really excited as the seedlings emerged and grew. I didn't quite understand the science or biology allowing this magical event to happen, but the process of germination definitely sparked my interest in horticulture.

Millions and millions (perhaps billions) of seeds later, I'm still hooked on germination. Being older and relying on germination successes from a professional/business perspective is very different from the lens I viewed the process of germination as an adolescent.

Perennials from seed can be more challenging than most of the seed annuals being commercially grown. This was especially true when I entered the industry more than three decades ago when perennial hybrids were absent and the seed technologies lagged when it came to perennials. That being said, perennials from seed can still be very challenging. It's impossible to walk you through all the ins and outs of starting perennials from seed in this article, but how about I share a few of the top areas that have helped improve my successes starting perennials from seed?

To germinate or not to germinate?

A large portion of germination successes comes down to the perennial variety you're trying to germinate. Seed quality and seed technology have come a long way over the past couple of decades, but

that doesn't always ensure success. Some perennials are just easier to germinate than others. To improve your success, consider the varieties you're attempting to germinate and try to put yourself in situations where the odds are in your favor.

First rule: If you've been dabbling in perennial germination and have observed consistently poor germination (let's say less than 70%) over multiple occasions, I encourage you to stop trying and leave the germination to other propagators. This also applies after you've had two or more failed attempts with germinating perennials you've tried, but don't have previous experience with. Two strikes then move on. Buying in plugs of these difficult perennials is likely cheaper in the long run and allows you to hit your numbers when transplanting rather than being short all the time.

Second rule: Many perennials are available with various seed treatments to enhance or improve germination. This is usually an indication that germination

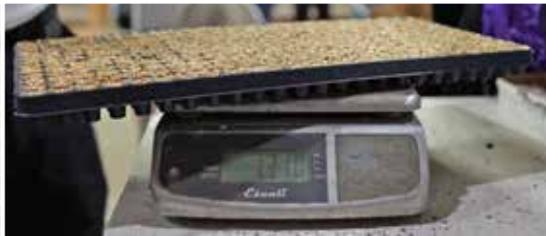
using raw, untreated seed is problematic. When attempting to germinate these varieties, I recommend always using the pre-treated seed and not trying to start them with raw seed, which will likely have significantly lower germination rates.

Third rule: Consider multiple sowing or increasing the number of seeds being sown per cell to help you achieve better germination rates. Although there is some expensive perennial seed, most is reasonably priced. Multiple sowing is a viable, low-cost option for increasing germination successes. If you've been single sowing and have been getting 50% to 70% germination rates, increasing the seed count to two seeds per cell shifts the probabilities of having at least one viable seedling per cell. The increase in seed cost is easily offset by maximizing the yield and reducing the greenhouse space needed to consistently obtain the intended number of viable plugs. In other words, at a 50% germination rate, it would take two trays or twice the growing space to



Germination chambers can be used to obtain more uniform and consistent germination.

Multiple sowing can be used to greatly reduce the number of empty cells as seen in this Lavender Hidcote Blue.



Determining moisture content in an objective way requires weighing trays. Each tray size will have its own optimal weight when watered appropriately.

produce the intended number of viable plants compared to double sowing and reaching 100% yield.

Seed storage

A large percentage of the crops with poor germination rates I've observed over the years was associated with either old seed or seed that's been improperly stored. Most growers don't have the ability to store perennial seeds for extended periods properly. The ideal conditions are 41F (5C) and 25% to 30% relative humidity.

Growers commonly use refrigerators; these can provide proper temperatures, but don't offer any ability to manage humidity. If you plan to store seed for long durations (three to six months), plan on obtaining a unit that can control both temperature and humidity. For short-term seed storage (one to three months), I suggest placing opened and unopened seed packets into airtight containers and placing them into a designated refrigerator set at 41F. The humidity levels inside normal refrigerators will still run higher than optimal for seed storage, which is why this method isn't suitable for long-term seed storage.

Germination chambers

Germinating perennials inside germination chambers increased my germination rates by up to 25% (more in some instances) compared to those previously obtained when germinating inside greenhouses. Germination chambers provide

consistent temperatures and humidity, which are the main requirements for getting consistent and uniform germination. I also recommend chambers are equipped with lighting. Some perennials require light for germination, but the lights are most beneficial for reducing stretched seedlings.

Chambers may not be a possibility for all propagators, but I highly recommend them for growers doing a lot of perennials from seed. Some perennials have different requirements, namely warmer or cooler germination temperatures, but the majority of perennials will germinate well at 68 to 72F (20 to 22C) and >80% RH.

Tray moisture

One of the most significant factors I've learned in recent years is the importance of having the trays at a high enough moisture level after the seeds are sown. This has led to the most significant improvement I've ever made and has resulted in very consistent and uniform germination.

I previously went through the motion of running the trays through a water tunnel after sowing without fully understanding how important this step is. As it turns out, I wasn't adding enough water to the trays during this process, which was leading to faster drying out in the chambers and greenhouses, and reducing the germination rates as a result. Adequate moisture content of the trays after sowing allows the seed to imbibe and start germinating and reduces moisture variability within the trays in the days that follow.

A good rule of thumb for small tray sizes (such as 288-cell trays) is for the trays to weigh approximately 1,000 grams after the trays are run through the water

tunnel. Each tray size will have its own optimal weight; you'll have to determine the targeted weights for each tray size you're using. It's important to avoid high-pressure and high-volume outputs out of any single nozzle in the water tunnel, otherwise small seeds can be washed away and/or buried too deeply.

Even with trays at the proper moisture level going into the chambers or greenhouses, it's still necessary to manage the humidity levels inside the chamber and moisture levels in the greenhouses with booms or mist to keep the moisture levels high enough during the germination process to optimize germination. Germination can be adversely affected when the moisture levels fluctuate largely and the surface where the seeds are located are allowed to dry down.

Carefully manage this stage until germination has occurred and the majority of the cells within the trays have seedlings with the cotyledons (seed leaves) present. Once the majority of the cells have germinated, the moisture content can be reduced to align more with your normal growing practices for plug trays.

Much, much more

There are a lot of other factors for growers to consider and focus on when starting perennials from seed, including using the proper type of substrate, achieving uniform tray filling, managing irrigation properly at the various plug stages—not to mention providing the right fertility, light intensity and fine tuning production using plant growth regulators, to name a few.

There's definitely more to starting perennials from seed than I could possibly cover in this article. The topics I focused on above are truly the areas that have helped me to improve my perennial germination successes the most and hopefully this information will prove valuable to you as well. ■

Paul Pilon is National Sales Manager for Pace 49, Inc. and editor-at-large of the *Perennial Pulse* newsletter. He can be reached at paul@pace49.com.

A Dream Come True

BY CHRIS FIFO



A well-drained media drying slightly in propagation.

Have you dreamed of rooting your own perennials, but only had a foggy memory of that upon waking up? Perhaps your favorite perennial liner supplier isn't supplying anymore. Maybe now is the right time to make these dreams come true.

Advances in perennial breeding have made it much easier to grow perennials alongside annuals with great success. Or you might even grow perennials “as annuals,” which is something we hear a lot these days.

Here are some of my best suggestions to get off to a strong start rooting your own perennials:

Success begins upon arrival. Be aware of what day and time your carrier will deliver the boxes and be prepared so there isn't a delay in unpacking, especially in adverse weather.

Take note of general conditions inside the box. Does it seem excessively warm or cold? This is where a point-and-shoot IR thermometer is very useful. They're available for \$20 at most hardware stores and can be used for checking more than just the temperature of the boxes—for example, your furnaces, hot water pipes and crop temperature.

Also be aware of any visible condensation inside the bags of cuttings. This could be an indication of dehydration of the cuttings and the need for re-hydration before sticking.



Always use rooting hormone on perennial cuttings. Snap the QR code for rates and guidelines for some common crops.

It's best to stick cuttings ASAP upon arrival or after hydration. If all cannot be stuck at once, storage recommendations and priority stick lists can generally be found on supplier websites.

When it comes to rooting perennials, let's review the five factors (plus one) that affect plant growth and relate them to rooting perennials. These are:

- Temperature
- Light
- Water
- Nutrients
- Gasses

And ... a bonus.

- PGRs

Always consider what might be your limiting factor. The better you can optimize each factor the faster you'll get cuttings off mist and the fewer losses there will be.

Gasses

For me, this equals media. You must have a well-drained media. We hear this all the time and maybe don't understand what that actually means. A wise man once said, “Roots grow in air, fish grow in water.” ▶

Which Fall crop would you ship?

When blooms can make or break a crop, you can't afford to guess about timing.



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A good perennial rooting media will have at least 30% plug-grade perlite. If using Elle Plugs, be aware of how compact they are rolled. A tighter roll and large boulders of perlite equals less air.

The bonus factor ... PGRs

This would be the rooting hormone IBA—always use rooting hormone on perennial cuttings.

The traditional method of applying IBA is by dipping the end of the cutting in powder hormone, tapping off the excess and sticking the cutting. There are IBA formulations now available that you can dilute with water and apply overhead. Using this method, you can stick all your cuttings at once and then come in at the end of the day and drench them with IBA. It's much more efficient.

For best success use 4 gal./100 sq. ft. minimum of 250 to 300ppm IBA. Higher rates can cause phytotoxicity. Be aware that there are some liquid IBA formulations that contain alcohol and cannot be applied overhead, as well as some varieties that require higher rates and still need a powder dip.



Watch this video to learn ways to rehydrate cuttings before sticking—from good (misting) to better (dipping) to best (fogging) practices.



Water

Perennials need to be kept dryer under mist than annuals. I've rarely seen too little mist become a limiting factor in propagation. A more porous media is going to be more forgiving of misting practices. Ideal misting practices would be to keep the foliage moist with the finest droplet size possible for the first two days and then reduce the frequency of misting to the point cuttings are on the verge of wilt (variety dependent). Most perennials suppliers include mist requirements on variety culture sheets.

When evaluating misting practices, keep in mind that trays should never gain weight while under mist. This means a very quick duration and as long as possible in between misting. By Day 10, trays should be getting lighter to the point they're maybe turning a bit light brown.

You don't have to have fancy automation to root your own perennials. A very successful method of rooting is using high humidity tents. This involves building a frame with PVC pipe or conduit and covering with white poly. Be sure your tent is sealed all around, including the bottom to maintain humidity. All you need to do is mist by hand several times a day.

Temperature

A soil temperature of 70 to 75F (21 to 23C) is important. Cooler temperatures than this will delay rooting, decrease uniformity and increase chances for losses. Bottom heat is the best and there are several companies that offer small scale root zone heating systems if an in-house boiler system isn't available. If you're only using overhead heaters, be aware that soil temperature can be 10 degrees cooler than the air. (Note: This is another great place to use your IR thermometer.)

Sometimes too cool is not the problem, though. Some perennials require overwintering and are therefore summer propagated, so heat can be a problem. Trying to balance cooling without saturating the media is challenging.

In this case, it's helpful to wet down the entire house except the plants—floor,

empty benches, walls, etc. This can be helpful to passively cool the greenhouse and help keep cuttings turgid. Shading and extra shade over propagation can also be helpful.

Another VERY useful tool for summer propagation is to start with a callused cutting. With this upgraded input, time under mist will be decreased leading to greater uniformity and fewer losses.

Light

If you're shading to reduce temperature in the summer, be sure not to drop your light level too low to where this is your limiting factor. LED lighting can be very useful in the summer.

But lighting is most commonly used in the winter when DLI (daily light integral) can be depressing. While LEDs are the best, HID/sodium lights are perfectly okay. They also add some heat that LEDs do not. Using a long day photoperiod of 16 to 18 hours, supplemental lighting in the winter is extremely helpful.

Nutrients

I generally don't recommend fertilizer in propagation mist. There are too many varieties that can be adversely affected by the salts on the foliage. Instead, be sure the media has a starter nutrient charge to carry you through until rooting and liquid feed.

After five to seven days with the environment optimized you should be checking for rooting. I like to go through twice a week, pulling several cuttings from a tray checking for roots. When rooting begins, it's not necessary to wait until every cutting has roots. And definitely don't wait until plants are rooted to the bottom.

Remove your trays from mist, begin liquid feed and have sweet dreams of success! ■

Chris Fifo is a product representative for Darwin Perennials.

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Reader Service Number 73

Acclimate to Be Great

BY NATHAN JAHNKE



LED lighting is beneficial for tissue culture acclimation.

Perennials are one of the largest classes of products produced from tissue culture. Many of these varieties either don't produce enough cuttings or aren't true-to-type from seed. Tissue culture opens up options for the newest and most interesting genetics.

Inputs from tissue culture, often called stage 3 or plantlets, can look intimidating coming from a lab in glass or plastic flasks, but after a relatively short acclimation period, plants from tissue culture behave like any other plant.

Here are a few best management practices to grow your best crop of perennials from tissue culture.



Understanding the terminology used for tissue culture inputs is important. Here are some of the common terms and definitions.

Quality inputs & grading

It took many years to reach the quality and reliability of the unrooted cutting supply available today. Think about tissue culture in the same way—it'll take a few years and a good relationship with the supplying lab to improve reliability and tissue culture uniformity in the flask. Part of that relationship is good feedback.

Prior to sticking, review the TC quality inside the flasks. Signs of breakdown are a concern, while things like contamination may not be. The goal is to stick TC plants with actively growing roots and meristems. Any plants without either of those are likely to die or be severely delayed.

Some growers wash the agar off the roots prior to sticking and some cut long roots. Washing can be beneficial, but unless there's an excessive amount of agar stuck to the roots, it isn't required for success. Any damage to the plantlet could be an opening for disease, however, plants with

trimmed roots can be successful. Ensure proper sanitation of tools and surfaces. Trimming has been less successful on species with thicker roots. Overly callused TC will also be slow to root. Some growers have been successful trimming the

excess callus, leaving a healthy meristem and sticking it after an IBA powder dip.

Sticking crews should be trained to grade based on size. Tall or stretched TC may need plant growth regulators or a pinch, while "small" could take two or more weeks to finish. It's

recommended to grade at three steps: at stick, halfway through production and prior to shipping if liners are being shipped. Provide detailed feedback consisting of spec photos of large, ideal and smalls to help the lab home in on the right spec.

TC plants can be held, but will likely stretch. Holding time varies depending on the initial quality and crop, but keep containers at room temperature with supplemental light.

Acclimation

Similar to a goldfish brought home from the fair, TC plantlets need to be acclimated to their new environment after deflasking. Acclimation is the process of modifying morphology and physiology to adapt to a new environment. This likely means lower humidity, air movement, fertilizer, higher light intensities, etc. Plants respond best if acclimation is gradual.

Here are a few changes that must happen within the plant to be acclimatized to the greenhouse environment:

- Build a cuticle—The waxy layer that prevents dehydration
- Root growth—TC roots called water roots aren't efficient at water uptake
- Jump start photosynthesis—TC plantlets are technically heterotrophic, using

most of the carbohydrates (“sugars”) and nutrients from the agar or media in the flask

- Air exchange—Stomata don’t function well in the flask, limiting CO₂ for photosynthesis

There are a number of ways to acclimate TC plantlets, but the primary factor to control is humidity, or more specifically, vapor pressure deficit (VPD). While in the flask, most TC plants are growing in 100% RH. Slowly decreasing humidity over time will help the plant build up a cuticle to resist dehydration and grow roots to take up water.

Similar to unrooted cuttings, the goal is to minimize dehydration while roots form. Misting can be successful, however, fog nozzles or a dry fog system provide longer-lasting humidity and more uniformity while minimizing additional substrate moisture. If VPD control is an option, focus on something that follows a schedule similar to crops prone to wilting and slow rooting. This may look like a longer, lower VPD threshold between 0 and 0.5 kPa for the first five days, followed by an increase in VPD every one to two days.

Other methods of managing humidity include Remyay or cheesecloth tents. Increase how much of the tent is vented each day to acclimate plants to ambient humidity levels. Booms can be used to mist over the cloth to reduce water loss or trays could sit above (not in) a flooded bench to create a humidity reservoir. Plastic films have also been used, but be careful during warm seasons, as every additional layer can increase temperature, thereby changing VPD.

Light and temperature are the next factors to consider. TC plantlets can handle high light intensities (>150 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$), however, light from natural sunlight or high-pressure sodium (HPS) lamps could cause dehydration. This is due to the high amount of infrared light or heat, which dehydrates TC plants quickly when the plant cuticle and root function is limited. Aim for 50 to 100 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ with natural sunlight and HPS lamps, and adjust

One method of managing humidity during acclimation is the use of Remyay or cheesecloth tents.



based on the humidity and temperature.

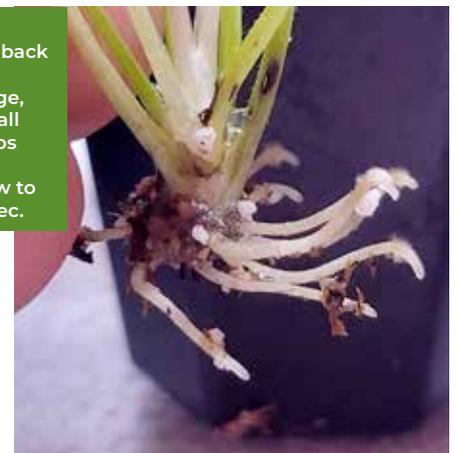
Acclimation chambers are the next step for growers taking advantage of TC varieties. This could be a simple pop-up tent with some humidity control and LED lighting or a full-scale cooler with multilevel LED carts. The goal is the same: uniform humidity, light and temperature control. Acclimation in these chambers has been far more successful, and in some cases, the young plant stage can be completed in this setup. Irrigating the high-density shelves and ease of chemical applications are two challenges to running a full young plant program through this system.

My recommendation is to turn this high-cost, high-density space as quickly as possible with high-value inputs to get a better ROI. This space is also useful during periods of high temperatures or other adverse environments, which can reduce success rate. Signs of acclimation success include root growth and new leaf emergence. Start fertilizing similar to unrooted cuttings once active root growth is observed.

Variety selection

The three top perennial crops from TC include echinacea, hosta and heuchera. All of these provide a plethora of color variations, forms and sizes. Echinacea and heuchera can be more prone to dehydration post-sticking compared to hosta.

Providing detailed feedback consisting of photos of large, ideal and small plantlets helps your TC lab partners grow to your ideal spec.



Stage 3 echinacea commonly have long roots (also called spaghetti roots), but are generally easier to stick than heuchera. Heuchera roots don’t grow into the media or agar well, often resulting in a ball-like plant, which can be challenging to stick. Hosta have the largest roots of the three. It isn’t recommended to trim these roots, while there’s been success with trimming echinacea roots. Other crops available from tissue culture include anemone, rudbeckia, polemonium, brunnera and hardy succulents.

The most important factors are to pick strong varieties with a high degree of uniformity from a reliable lab. ■

Nathan Jahnke is Culture Research Manager for Ball Seed.

Bare Root Best Practices

BY LAURA ROBLES

As more growers look for reliable ways to produce consistent, high-quality perennials, bare root inputs continue to stand out as a proven solution.

There are many advantages to using bare root inputs when growing perennials. Roots purchased from North American companies like Walters Gardens are domestically grown, generously graded and all virus-prone genera are tested, ensuring the plants you receive are healthy and virus-free. Bare roots are available in small quantities of 25 per box for the largest Grade 1 (G1) size, which is beneficial for growers who don't need large quantities of each item. Because bare roots are harvested and stored in coolers or freezers, they're less susceptible to shipping damage than fresh liners. Perhaps, most importantly, bare root perennials are field-grown for one to two years, depending on the genus, making them more mature and pre-vernalized. This results in fast-turn crops that fill out and bloom quickly in your operation, giving you a faster and more reliable return on investment.

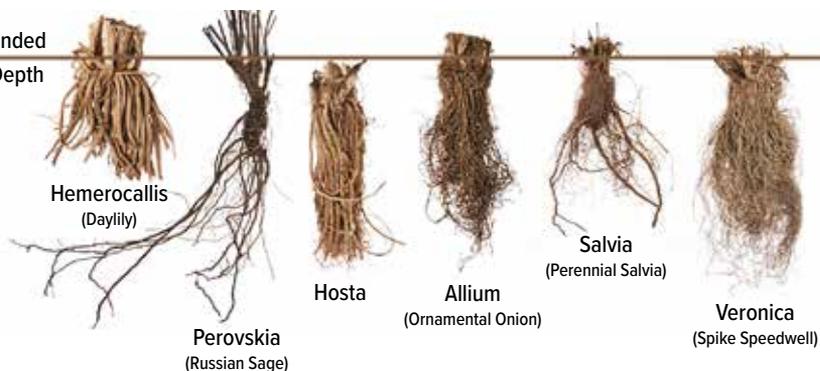
Understanding how to properly handle and plant bare root perennials is key to getting the best performance from your crops. By following a few simple steps upon arrival and during production, you can ensure your plants establish quickly and continue growing strong throughout the season.

When your bare root shipment arrives, begin by opening the boxes and inspecting the roots to ensure they're firm and moderately dry. If the roots appear overly dry, they can be soaked in water for about



Bare root perennials stored in a freezer at Walters Gardens. Be sure to allow them to thaw before planting.

Recommended Planting Depth



Know how deep to plant your bare root material to achieve optimum quality in production.

an hour to help them rehydrate. Light surface mold, often green or bluish in color, is normal, however, if the roots or crowns feel soft or mushy, contact your supplier. Most genera will have been stored in freezers and may still be partially frozen upon arrival. In that case, allow them to thaw at cool temperatures—ideally between 40 to 50F (4 to 10C). If you

cannot plant immediately after thawing, the roots can be stored at 30 to 45F (-1 to 7C) for an additional three to four days.

When you're ready to plant, prioritize evergreen varieties such as *Lavandula*, *iberis*, and *Phlox subulata*, as these should be planted first. The best media options are commercial bark or wood ▶

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PERENNIALS FROM BARE ROOT

fiber-based soilless mixes with a target porosity of 50% to 60% before irrigation. If roots are too long or wide to fit into the container, trim them to size—this is preferable to coiling the roots at the bottom or planting too high in the pot. Take care to eliminate air pockets during planting, especially with genera that have large, fleshy roots such as hibiscus and baptisia. After planting, water the pots thoroughly. Applying a broad-spectrum fungicide drench as a preventative with this first watering can be beneficial, though it's not strictly necessary.

During production, most perennials perform best when grown at cool temperatures of 50 to 60F (10 to 15C) and high light levels. This promotes good quality and minimizes the need for plant growth regulators (PGRs). When growing in a greenhouse during spring, some genera may benefit from PGR applications—particularly if temperatures must be maintained higher than ideal due to mixed crops or if your light levels are reduced due to cloudy conditions or greenhouse structures.

For many perennials, the average finish time in a true 1-gal. container is approximately six to 10 weeks from a Grade 1 (G1) bare root, depending on the genus and time of year. As spring progresses,

finish times typically shorten thanks to higher light levels and warmer ambient temperatures. For some genera, such as amsonia, hosta and baptisia, this fast-turn advantage is especially pronounced—since it can take nearly a full year to produce a finished crop from a 72-cell liner compared to just eight to 10 weeks (or fewer) from a bare root. Larger perennials (especially hibiscus and baptisia) perform best in larger containers. This minimizes the need for root trimming, helps maintain proper planting depth and reduces the risk of excessive dry-down. For *Phlox subulata*, many growers prefer a wider mum pan, which can better accommodate the plant's broader growth habit compared to a narrower gallon container.

Most bare root varieties at leading suppliers are available for shipping from January through June, allowing them to be used for cycle planting. This practice enables growers to bring in new batches of their best-selling items to ensure they have fresh product when needed, while reducing the need for excessive cycle shearing or other labor-intensive maintenance on older plants to keep them saleable.

Another unique feature of bare root is that, for many genera, they tend to grow to fill the container they're in—similar to



Example of a G1 bare root astilbe.

a goldfish in a bowl. This allows growers to select a larger container size if desired, since the roots will fill in a 1- or 2-gal. pot in a similar time frame, while offering the potential for a larger profit margin.

Bare root perennials are a smart, efficient choice for growers looking to produce beautiful, high-quality plants with less time and hassle. Because they arrive mature, healthy and ready to grow, bare roots establish quickly and deliver fast, consistent results. With their ease of handling, flexible shipping windows and ability to adapt to different container sizes, they offer a reliable way to keep fresh product flowing through your greenhouse or retail space all season long. By following best handling and planting practices, growers can maximize the natural advantages of bare root material—ensuring healthy establishment, consistent growth and strong returns all season long. Whether you're looking to streamline production or maximize profit potential, bare root inputs provide an exceptional foundation for success. ■

Laura Robles is Regional Product Manager - Northeast for Walters Gardens.

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Exposure to Ultraviolet Lighting: The Key to Reducing Chemical Growth Regulator Usage?

BY SETH BENJAMIN & ROBERTO LOPEZ

In recent decades, the sale of potted herbaceous perennials has experienced significant growth (Figure 1). Between 2007 and 2022, the domestic wholesale value of perennials increased from \$531 million to \$1.1 billion.

In horticulture, size does matter. Plants that are too tall may not fit on shipping carts, be damaged during shipping or become top-heavy and fall over. Currently, this problem is primarily mediated through the application of chemical plant growth regulators (PGRs). However, using PGRs comes with potential risks, including those to employee health, the environment and phytotoxic damage to the plants themselves if not applied

correctly or if the PGRs drift onto nearby susceptible plants. In addition, the PGR application requires re-entry intervals that can disrupt access to the plants.

While many PGR alternatives exist, such as pinching, brushing, negative DIF (daytime temperature cooler than nighttime temperature) and irrigation/fertigation restrictions, these methods are labor- or energy-intensive, increase disease exposure and/or require precision implementation to prevent plant death or damage.

Light quality has a significant impact on the growth and development of plants, including altering their color, size and

shape. While most focus is placed upon the photosynthetically active (400 to 700 nm) part of the light spectrum, plants also respond to wavebands above and below that range. Ultraviolet (UV) radiation, which ranges from 200 to 400 nm, has mixed effects on plants. This includes increasing the production of secondary metabolites (compounds that defend plants against herbivores, pests and environmental stress) and altering the allocation of sugar by directing more of it to or from different parts of the plant, such as the roots or shoots, which may lead to a reduction in extension growth.

Of the UV radiation that reaches Earth at sea level, about 95% of it is UV-A (315 to 400 nm) while the remaining 5% is UV-B (280 to 315 nm). However, wavelengths below 290 nm are absorbed by the atmosphere and never reach the Earth's surface. In many greenhouse environments, little to no UV reaches the crop as UV-blocking glazing materials are often used to protect workers, prevent plastic degradation and protect the glazing material itself. Because of these benefits, growers may want to find a way to retain their UV-blocking glazing while still utilizing UV as a PGR.

The study

Seventy-two-cell liner trays of *Echinacea* PowWow White, *Heuchera* Timeless Night, *Leucanthemum* Snowcap and *Nepeta* Kitten Around were obtained from a commercial producer and transplanted into square 4.5-in. shuttle containers with a commercial soilless medium. They grew under natural daylengths in East Lansing, Michigan (latitude 43°N). In addition, light-emitting diode (LED) fixtures that extended the daylength to 18 hours were used. A day/night temperature of 73/73F (23/23C) was maintained.

After two weeks of rooting, 20 plants of each species were placed under one of three custom UV LED fixtures: two provided UV-A with peaks at 330 or 365 nm and one UV-B with a peak at 280 nm. The UV LEDs were only turned on from midnight to 5:00 a.m. for the 280- and 330-nm fixtures or from midnight to 2:00 a.m. for the 365-nm fixtures. Each ▶



Figure 1. Potted herbaceous perennials growing in a double-layer polyethylene greenhouse.

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CosMic Plants, a premier Phalaenopsis grower in Ontario, initiated their first HPS to LED replacement in 2022 with the installation of Philips LED toplighting. Due to an almost 40% energy savings coupled with flexibility afforded by the dimmable LEDs, they continue to expand their LED install. "One of the things that drew us to Philips brand and Signify is the fact that it's a large, strong, reputable company. We wanted to partner with a company that we know can stand behind their product."



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night, the plants received 5.6, 8.4 or 11.2 kilojoules of energy per square foot of area per day (60, 90 and 120 kJ·m⁻²·d⁻¹) while under the 280, 330 and 365 nm lights, respectively. For reference, an area of 1 sq. ft. receiving 11.2 kilojoules of energy is equivalent to the amount of energy consumed by a 30-watt LED light bulb in just over six minutes. Of the 20 plants from each cultivar, half (10 plants) were subjected to UV LEDs for one week, while the other half (10 plants) were subjected to UV LEDs for two weeks.

After removing the plants from under the UV LEDs, they continued to grow for an additional three to four weeks, extending the total growth period to seven weeks following transplant. This experiment was replicated three times.

Findings

Out of the four species we investigated, the dark-leaved heuchera was the least impacted by UV radiation (Figure 2). While two weeks of UV-A 330 nm and UV-B 280 nm reduced the extension growth of heuchera, the reduction only ranged from 4% to 12%. We suspect that since Timeless Night is a dark-leaved cultivar, the heightened secondary metabolites that help to produce that dark color protected the plants from the UV radiation. It would be interesting to compare these results to a yellow or green heuchera that has considerably fewer secondary metabolites and that naturally performs better in shadier environments. These lighter-colored heuchera may require significantly less UV and, potentially, the more damaging UV-B may not be necessary to achieve an effective PGR.

For echinacea, only the application of UV-B 280 nm for two weeks was able to reduce extension growth by 24% to 31% (Figure 3). However, it did cause significant bronzing on the leaves. All other treatments were ineffective.

Leucanthemum was a mixed bag in terms of the effectiveness of UV radiation in reducing extension growth (Figure 4). The third replication showed no differences among treatments. Still, the first



Figure 2. Heuchera 'Timeless Night'



Figure 3. Echinacea 'Pow Wow White'



Figure 4. Leucanthemum 'Snow Cap'



Figure 5. Nepeta 'Kitten Around'

No UV	1 wk UV-A (365 nm)	1 wk UV-A (330 nm)	1 wk UV-B (280 nm)	2 wk UV-A (365 nm)	2 wk UV-A (330 nm)	2 wk UV-B (280 nm)
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Figures 2 through 5 show the effects of UV-A 365 nm, UV-A 330 nm and UV-B 280 nm application for one or two weeks compared to the control (no UV).

two replications demonstrated that two weeks of UV-A at 330 nm and one or two weeks of UV-B at 280 nm were effective in reducing final height. This ranged from a 13% reduction for plants under UV-A at 330 nm and a 22% to 27% reduction for plants under UV-B at 280 nm.

Nepeta was the most sensitive to UV-B radiation (Figure 5). After two weeks under the UV-B 280 nm LEDs, approximately 30% of the nepeta died and many others didn't recover well. However, after only one week of exposure, only one plant had died across all three replications. Additionally, no height differences were observed for any of the UV-A treatments on nepeta.

Take-home messages

Currently, we do not recommend the broad use of UV-A or UV-B LEDs to reduce the extension growth of herbaceous perennials. Individual species responses have been shown to exhibit high variability. As seen with the nepeta, high doses can kill the plants you're trying to produce, so each species may require specific treatment plans.

If implemented, UV exposure should be contained in areas of the greenhouse that receive little employee traffic, such as the furthest greenhouse range from the main entrance and clearly marked with UV hazard signs. Additionally, they should only be turned on during non-working hours. If personnel need to access the area while the UV lights are on, all exposed skin should be covered with UV Protection Factor clothing and UV-blocking eye wear must be used. ■

Acknowledgments: We want to thank Nate DuRussel for assistance with the installation of the UV light fixtures, greenhouse maintenance and environmental controls. We would also like to recognize Sean Tarr, Mckenzi Wroe and Megan Kieda for their help in collecting data. This work was supported by the U.S. Department of Agriculture's National Institute of Food and Agriculture, and Walters Gardens provided the plant material.

Seth Benjamin is a research technician and Roberto Lopez is an Associate Professor and Controlled Environment/Floriculture Extension Specialist at Michigan State University.



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Reader Service Number 77

The Case for Perennials as Color

The shifting landscape of perennial production.

BY KATIE MILLER

The story of perennials is one of function and beauty, but also diversity. Diversity of products, production methods, producers and climate regions. As an industry, when we discuss perennials and what they mean, everyone will give you a different perspective based on their own role in the marketplace. For growers, perennials range from being the sole focus of a growing operation to being a value-added line for annual growers or a quick-turn item for nursery stock producers.

The retailers and landscapers being a step closer to the consumer typically look to perennials for their usefulness in the garden, cold or heat hardiness, pollinator friendliness, drought tolerance, etc. The need to fill benches and meet customer demands in spring for certain varieties has at times meant that they had to settle for lovely green plants and a bold colorful tag in order to have the plants and the customer at the same time.

Driven by demand for plants in color that can be grown with more flexibility we've seen a reshaping of the perennial industry in the last decade. Innovations in breeding for first-year flowering varieties has changed production that was once dominated by the biological requirements of the plants to one that allows growers to rethink everything from scheduling to their overall program strategy. The perspective of the retailer has also shifted focus away from variety-specific shopping lists to selecting plants that are in bloom when they hit the retail garden center. In turn, this has increased consumer

discovery of the perennial category and driven demand higher. Every retailer will tell you, "Color sells!"

But what does it mean to be first-year flowering?

First-year flowering perennials are capable of being propagated, finished and flowered within a single growing season without the need for cold exposure. For growers, this typically means producing a finished, flowering plant from an unrooted cutting or liner in the same year it's planted.

This allows for skipping the step of vernalization that's been a historical requirement for many older varieties that have enjoyed decades of popularity. Vernalization is the natural process that perennial plants use to survive winter, but

also prepare for a new growing season. For some genera, it's needed to develop the crown and roots (called bulking); for other varieties it's the biological mechanism that triggers flowering in the spring or summer. While effective, the cold requirement extends production timelines and increases exposure to risk.

First-year flowering selections create more operational flexibility in the perennial category.

- **Geographic adaptability.** Opportunities for growers in warmer regions that may have struggled to properly vernalize a crop.
- **Reduced risk exposure.** Shorter crop cycles minimize losses associated with winter weather, disease pressure and long-term holding.
- **Labor efficiency.** Overwintered crops require repeated spacing, maintenance and cleanup. Single-season production reduces handling.
- **Improved crop quality.** Multiple production runs enable delivery of fresh, peak-color plants aligned with retail demand.
- **Program flexibility.** Growers can respond more quickly to shifts in market demand, weather patterns and sales performance.

The following series are introductions from Dümmen Orange that illustrate how breeding advancements in first-year flowering varieties are redefining perennial production and retail presentation.



Gaillardia SpinTop Yellow Touch

Lavandula angustifolia La Diva

Eternal series: This ground-breaking introduction of the varieties Eternal Elegance and Eternal Grace are redefining lavender production. What's traditionally been a challenging crop that requires being planted in the fall and wintered over has been reduced to a 16-to-18-week schedule for a crop of 6 in. from stick to ship when grown above 50F (10C).

It also makes lavender, which is already the #1 selling perennial, highly program-mable for the grower. Now instead of one or two large crops that are limited by the life of their flowers or that require a cutback to be re-flushed, growers can now produce multiple crops of fresh plants that can be started throughout the year, changing the accessibility of lavender for the consumer.

Leucanthemum Sweet Daisy

Collection: Offering a range of flower styles and sizes (Sweet Daisy Birdy is a standout, recognized as an All-America Selections winner), and unlike other leucanthemum, the Sweet Daisy varieties don't require fall planting for overwinter bulking. It's important when growing them as first-year flowering not to pinch them in propagation or after transplant to preserve the first flush of flowers. Many varieties in the collection reach 24- to 30-in. tall once established in the garden, however, when produced in a 6-in. container for spring sales, height is naturally controlled by skipping vernalization, resulting in a more compact plant and shorter shipping heights for the grower.

Four of the varieties have also been successfully trialed in the Zone 3 True North trials in Canada. Sweet Daisy Birdy, Sweet Daisy Christine, Sweet Daisy Izabel and Sweet Daisy Jane. A crop of 6-in. containers can be produced in 16 to 18 weeks just like the lavender.

Gaillardia SpinTop series: The core series offers five colors with the traditional blanket flower appearance of a double row of flat petals in a range of bold orange, red and yellow colors. Not only have the SpinTop series successfully trialed in the Zone 3 True North trials in Canada, they're known for their



Lavender La Diva Eternal Grace



Gaillardia SpinTop Yellow Touch



Leucanthemum Sweet Daisy Birdy

performance in extreme heat and their humidity tolerance, as well as exceptional drought tolerance. In addition to the core series, there's a subseries called SpinTop Mariachi with selections sporting rows of fluted petals resembling trumpets in the same bold orange, red and yellow color tones. A crop of 6-in. containers can be produced in 12 to 14 weeks, and like the lavender, these are well suited for multiple crop runs during the retail season, providing fresh color from spring through fall.

The above are just a sampling of the varieties that are currently available as first-year flowering offerings. By taking advantage of the new genetics being launched every season, it can have a positive impact on the bottom line by improving margins and increasing the opportunity to reduce shrink. Be sure to review your current program with an eye to replace or supplement overwintered crops with first-year flowering alternatives and look for avenues to streamline or simplify production schedules and improve labor efficiency. Exploring ways to meet the demands of your customers

with new offerings can open fresh market opportunities, recognizing that it may take two or three seasons to develop.

Work with your broker sales representatives to secure trials and explore newer options that might fit into your program mix. We're a slow-moving industry when it comes to change because we only have one spring season. There's always room to make adjustments and try something new for next season.

Perennial production is a dynamic, multi-faceted discipline that offers a world of benefits to consumers who are curious and interested in exploring what our industry has to offer. When we're able to supply reliable, fresh color to an already vibrant and resilient perennial market, the customer cannot resist adding them to their gardens and landscapes. ■



Katie Miller is Regional Product Manager, Perennials for Düm-men Orange.

Growing Against the Rain: Lavandula Tech Tips

STEPHANIE SACCOMANO & SIMON TRASKEY

Lavender, cherished for its aromatic properties and pop of colorful flowers, naturally thrives in the dry, sunlit environments of the Mediterranean—not in the damp and often dark conditions of the Pacific Northwest. Despite these adversities, it is indeed possible to cultivate lavender successfully by thoroughly understanding the plant's needs. We can have up to 100 varieties on site so we can learn a little more every year. Where there's a will (and occasionally a good pair of gumboots) there's a way to make lavender feel at home even in the drizzle. From Qualitree to you, we're sharing some variables you can control to ensure your plants thrive—even if you're growing them in one of the worst places in the world to do so.

Consider your conditions: Here, at home base, we've been working to create as close to an ideal environment as we can. As an example, we all know *Lavandula* are lovers of light. This isn't something we have in spades at Qualitree, especially nestled under a mountain in the dark hours of winter. But quantitatively, what does this mean? It's only by measuring the Daily Light Integral (DLI) within our structures and outdoors that we truly understand what we may be lacking. We can observe that during the spring and summer we have adequate light levels, meaning we'll lean hard on those free photons and focus the majority of production requirements here. In the darker seasons, where active growth may still be necessary, we know that supplemental lighting is a must.

An important facet to the topic of light is temperature. Maintaining a balance of temperature and light ensures strong growth. If light is low and temperatures are cranked to encourage development,

you'll find yourself with soft, pale and stretched foliage that's susceptible to disease. Additionally, you could end up with aborted buds or strictly vegetative growth. Locations with more light have the opportunity to apply more temperature. Playing this balance out practically could mean reducing your temperatures over dark or cloudy weeks, and toning your venting strategy to lock in energy during high light situations. If growing outside, understanding these concepts and watching the weather will help you anticipate the behavior of your crop.

Additionally, if you have the means to protect your plants from moist or frosty conditions, do so. Protective structures that allow for plenty of airflow and ventilation are perfect. This space can also be very helpful in insulating against any frost threats in the shoulders of winter. If this is a luxury you don't have and you're facing a hard frost in the forecast (as is the case with us at times), sprinkling pulses of water for frost protection will be your best bet. Your plant will be safe, but you do add another stressor: more moisture, which is a perfect segue to ...

Mind your roots: Lavender doesn't take kindly to wet feet, therefore careful water management is crucial; overwatering can lead to fungal diseases and weak root systems. An absolute must is a well-draining substrate that alleviates moisture pressures at the roots. Equally important is avoiding over-fertilization, particularly with nitrogen, which can promote soft, weak growth that attracts pests and succumbs easily to diseases. Balanced fertilizers are best to support steady, resilient growth. We incorporate a small quantity of slow-release fertilizer into our substrates and rely on fertigation for the majority of the crop's nutrition.



Biostimulants and resilience boosters: Natural biostimulants or foliar fertilizers such as calcium, silica products and seaweed extracts can strengthen plant cells and enhance overall vitality, preparing lavender to better withstand conditions that may be beyond your control. These products support the plant's natural defenses, promoting growth that's both vigorous and disease resistant. A go-to when we know we're facing humid conditions are calcium foliar applications. In these situations, transpiration (and therefore calcium uptake) is inhibited and can lead to tip discoloration or die-back.

While growing lavender in the Pacific Northwest may initially seem like a horticultural folly, the reality is far more rewarding. By giving this plant every opportunity to thrive, we can indeed create a slice of the Mediterranean in our corner of the world—and you likely can, too. ■

Stephanie Saccomano is Production Technical Lead for Qualitree Propagators and Simon Traskey is Woody Technical Advisor/New Product Development for Star Roses & Plants.



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The new Phlox Candy Cloud series fills the color gap for your early spring programs. It blooms after *P. subulata* and before *S. nemorosa*, keeping your benches filled with options to hit peak retail in the mid-spring market. The series launches for 2026 in four seasonally attractive colors: Pink, Blue, Lavender and Dark Pink. Plants have heavy flower coverage with showstopping color.

Reader Service Number 200



DÜMMEN ORANGE

Iberis White Shadow features extra-large, pure white blooms on a compact, uniform habit. It flowers up to four weeks later than standard varieties, extending the sales window. Stick URCs in summer for fall transplanting and early spring color. Hardy in Zones 4 to 6.

Reader Service Number 201



EMERALD COAST GROWERS

Bouteloua x Little Blondie Zig Zag is a new compact form of Bouteloua Blonde Ambition from the late breeder David Salman. Like its larger counterpart, Little Blondie has a profusion of golden, eyebrow-like flowers that ripen to creamy white with sterile seed heads that hold through winter. It's a tight, tidy grower that needs very little extra irrigation once established and tolerates poor soils. 15- to 18-in. tall in flower. Hardy to USDA Zones 3 to 10.

Reader Service Number 202



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MUST HAVE PERENNIALS

Heliopsis Oriole Variegata shines with bold golden-yellow 3-in. daisies over creamy white, green-veined foliage. Dense, compact and well branched, it flowers all summer and looks great even without blooms. Pollinator friendly and trial proven, it thrives in full sun, USDA Zones 4 to 9, reaching 18-in. tall and 36-in. wide for beds, borders, cottage gardens and containers everywhere easily. Available from Pioneer Gardens.

Reader Service Number 203



THINKPLANTS

The first URC echinacea to market, Panama Red from Danziger delivers first-year flowering with no vernalization or bulking required. This early bloomer finishes in Weeks 22 to 24 and offers everlasting flower power on an open, well-branched plant with flat petal presentation. Naturally compact, it's ideal for quart and gallon production and features great hardiness, making it well-suited for fall programs. Panama Red has vibrant red flowers that transition to a burnt orange as they begin to age.

Reader Service Number 204



WALTERS GARDENS INC.

Growers of this compact catmint will feel like they've struck gold. A tidy plant, Proven Winners Perennials Lemon Purrfection is early to bloom with lavender blue flowers appearing over golden-yellow foliage. The brightly colored foliage for which Lemon Purrfection gets its name doesn't fade through the summer. With increased shade cover the leaf color will be more chartreuse. This selection blooms continuously without being cut back.

Reader Service Number 205

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