

Tissue Culture:

The Science of Plant Perfection

Stuck on seed? For better plant uniformity, clean stock and year-round availability, you might want to give tissue culture a try.

By Brandi D. Thomas

Does “tissue culture” sound like some kind of scary governmental experiment that reeks of conspiracy and distrust? For those who don’t quite understand what it’s all about and wonder how it differs from seed, the benefits are many. First, the plants are clonal, making them the same as the parent plant (with selection in the lab when necessary), which means there’s less chance your crop will turn out looking uneven, lopsided or otherwise just plain bad; for many perennials and specialty spring crops where viruses pose a greater threat, the tissue culture process is important to clean up the stock so virus-free liners can

be sent to customers, avoiding unnecessary losses of plant material and profits; plants can be multiplied more quickly than with traditional methods; and most varieties can also be propagated year-round, whereas with other methods, propagation is limited to certain seasons. All of that can only mean one thing. Well, two things. First, you stand to make a higher profit off of tissue culture plants for all of the reasons cited above, and second, you should continue reading to gain a fuller understanding of the intricate process involved in creating these plants.

A LESSON IN TISSUE CULTURE

The best lessons are learned from the experts, and Tigard, Ore.-based Terra Nova has gained prominence in recent years for its tissue culture-produced perennials. Co-owner Ken Brown’s expertise with tissue culture was all self-taught during the days of Terra Nova’s nascence, with the first experiments taking place in an aquarium. Today, the company has two laboratories, one in Tigard, where all the virus-indexed stock plants are maintained, and one in Canby, Ore.,

where the research and development takes place. A new plants manager begins the tissue culture process and conducts experiments to determine the path to successful propagation at the larger lab in Canby. A cytogeneticist, whom Terra Nova brought to the United States from India, also works in this lab practicing embryo rescue. There are six other employees at this location and two employees in Tigard.

Terra Nova tests each plant against 18 of the most nefarious viruses in the industry to ensure clean stock. Walking into the lab, one begins to understand the company’s seriousness about protecting against virus and/or insect scourges; a sealed entry shelters the main lab from the outdoors, and neither the door from the outside into the vestibule nor the door into the lab can be open at the same time. Once inside the entry, shoes must either be removed or protected with hospital-type shoe covers. Only then is entry permitted.

If you’ve never had the opportunity to visit a tissue culture lab, doing so is highly recommended to gain an appreciation for the work that goes into creating one of these plants. The process ▶



Left: Explants, or the sterilized pieces of plant buds, are placed in vials containing plant hormone; Middle: These plants have reached the end of life in a laboratory. After being placed in rooting hormone, they are moved to the greenhouse, where they are planted in cell packs; Right: Each plug is handled twice before leaving the greenhouse for maximum quality control.

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requires great precision and patience. Once a stock plant has been selected, the newest vegetative buds are collected from the plant. They are then washed and trimmed to very small sizes, and sterilized using bleach solutions, which turn the diminutive plants black. Although the black color gives the appearance of some sort of necrosis, life continues at the center of the bud. Once sterilized, the explants, or sterilized pieces of plant buds, are planted onto medium until they begin to grow. Explants and their medium are contained in tubs that come presterilized via gamma radiation. For the next stage, the plants are placed on a medium containing cytokinins, or plant hormones, to help them multiply. Most plants are cut and transferred to new medium about once per month, yielding anywhere from 2:1 to 6:1. When plants are being created for sale, the number of desired cuttings is placed on a media containing auxins to help the plants root. Once rooted, the batch of plants is sent out to Terra Nova's greenhouses, where they are planted and grown out for shipping.

Rooted plants are placed in 72-cell packs on rolling benches that can weigh up to 2,000 pounds. Hot water hoses beneath the benches keep the temperature at 70° F, and everything is hand-watered. They are weaned at this stage for six weeks before being moved to a shade house for hardening off. Every plug is handled twice before shipping, a quality control measure that Terra Nova prides itself on.

Once a new plant moves to the production stage, the protocols and the plants move to one or more of Terra Nova's contract labs located around the world. "We place the plants with the labs we know can produce the best-quality plants and consistently deliver them on time. Over the years, we have worked with many organizations to produce our plants and have made great strides in finding out the ones that give us good-quality plants when we need them," Brown said. Two of these are in New Zealand and Indonesia.

A PERFECT PAIR

It was through a series of serendipitous situations that Terra Nova co-owners Ken Brown and Dan Heims eventually became known to the world as innovators of tissue culture perennials. Brown, a somewhat shy but astute man, studied microbiology with minors in both chemistry and psychology at Oregon State University, becoming interested in plants during the last year of his career there. By the time he graduated, he had 350 houseplants. Heims, the more dramatic and gregarious of the two, attended the University of Oregon, where he graduated with a major in communications and minors in botany and landscape. After college, Brown joined the Indoor Light Gardening Society, where he met Heims, who at that time had his own indoor plant business, Exotic Plants Unlimited. While working at the OSU medical school doing research, Brown met a co-worker who had some

Here are a few of Terra Nova's new varieties for 2002-2003. For more information or to order, go to the wholesale section at www.terranovanurseries.com.



Hakonechloa macra 'All Gold'



Polemonium caeruleum 'Snow and Sapphires' EUPAF EUBR



Dicentra 'King of Hearts'



Geranium yoshinoi 'Confetti'

growing innovator

unusual plants kept in a laboratory window. She turned out to be Heims' girlfriend and later wife, Lynne. Both men married, and though they remained friends, eventually pursued other interests.

A few years later, while Brown was intently focused on finding

daylilies for his garden in a field, he smelled something that would help determine the future paths of both men. It was *Hosta plantaginea*. Pursuing his newfound love, Brown joined the Northwest Hosta Society, which, coincidentally, Heims had founded. By late 1992,

the reunited men had created Terra Nova and began building their tissue culture lab in Brown's backyard. Without having posted any advertising, help appeared: A woman who just happened to have 10 years' experience in tissue culture knocked on their door wanti-



Dan Heims, left, and Ken Brown

ng to know if they needed an employee. "Things like that just started happening — people showing up, situations falling in our lap that would make things happen," Brown explained.

Their first catalog consisted of a color flyer tucked inside the B&B Laboratories catalog; B&B was responsible for Terra Nova's shipping and growing at the time. Their first growing areas were found in the windowless basement of a bookstore, where they could only work late in the evening or very early in the morning to avoid upsetting the grocery store whose parking lot the bookstore shared. Both men also held other jobs at the time, with Brown working as a food technologist at Armour Food Co., and Heims as the owner of a landscaping company.

By 1993-94, Terra Nova was finally housed in true greenhouses, and operations went smoothly for about nine months, until high water salinity began wreaking havoc on their plugs. To solve the problem, Heims and Brown bought a reverse-osmosis unit that had to run all night, rattling the water pipes and making for very unpleasant sleeping conditions for the property owner renting them the greenhouse. After two months of poor rest, the Terra Nova progenitors were asked to leave. "I don't blame him," Brown said. "That's when we bought the place in Canby, and things have been going ever since."

MAKING IT WITH MARKETING

Terra Nova produces approximately 50 new varieties every year — from hostas and heucheras to euphorbias and ferns — which means they are

working on up to 100 plants at any given time. As the “front-man” and company president, Heims travels and channels his charismatic personality into speaking and promoting Terra Nova and its plants. He is also responsible for the catalog and manages the breeders. Complementing Heims’ marketing efforts, Brown, the secretary of the corporation, is the operations manager. As he explains it, “I do the operations, I make things work, I build things, I run the greenhouses, the laboratories and the business, except for the financials, which, if not for our controller, we wouldn’t be here.” Jody Brown is the controller, Ken’s wife and a quarter-owner of the company, as is Lynne, Heims’ wife, who is the contract manager.

For the past seven years, Terra Nova has had a consumer-directed Web site, www.terranovanurseries.com, a pull-through marketing device that gets consumers to ask their garden centers for Terra Nova plants. Terra Nova also supports its wholesale customers through a password-protected area in the site — the username is “wholesale” and the password is “sneaky” — where price lists, plant availability, culture and ordering information can be found. They recently started a tagging program that links the consumer back to the site, their marketing programs and Heims’ speaking engagements. “It’s hard to miss the tags — they stand out in the pot,” said Brown. “The customer will identify us, or that tag, as being a new plant. It’s providing a service to our customers, who would not normally have tags or nice tags for a new plant.” Tags cost \$0.12 and are printed by Norwood, an Australian marketing leader.

Always thinking, creating and innovating, Terra Nova is currently in the process of expanding. They just purchased another piece of property in the heart of their other properties for a new sales office and laboratory. “Terra Nova’s always expanding — if there’s one thing that’s always constant, it’s change. The breeding programs are really starting to blossom now,” Brown said.

Marketing is helping to educate more and more gardeners on the advantages of tissue culture, driving demand and, consequently, the need for expansion. Other tissue culture companies, such as Apopka, Fla.-based

Twyford International Inc., are also in the midst of expansion, amplifying their product lines and constructing new growing and research facilities. Supplier growth is frequently an indicator of market direction — paying

attention to these trends now can ensure your buying decisions are helping your business rather than hindering it. [GPN](#)

Brandi D. Thomas is associate editor of GPN.