Automation appeals to an inner nerd

We highlight the incredible work being done at Scion Nursery, led by Matt Dunn and his talented team, offering a glimpse into the future of forestry and plant propagation in New Zealand.

Matt's journey with Scion began in June 2022, following his years of experience gained in garden centres and nurseries since 1991. He even recalls when PrimeHort started in 2002, he was at Palmers Garden Centre in Rotorua at the time. While his introduction to forestry and research may be more recent, it perfectly suits his love of problem-solving. Today, Matt leads a seven-member team, working on fascinating projects that range from plant propagation to cutting-edge forestry trials.

About Scion Nursery

As a Crown Research Institute (CRI), Scion's focus is on supporting scientific research. The nursery's role is to provide optimal growing conditions and oversight for numerous science and commercial pilot projects. In 2022, Scion recalibrated its operations, stepping back from large-scale commercial plant production to make room for more research projects.

"You can't grow commercial quantities at research prices," Matt explains. "The more you handle a plant, the more expensive it becomes."

This shift allows Matt's team to dedicate their efforts to assisting scientists with intricate proof-of-concept trials and partnering with commercial nurseries if studies require evidence at a larger scale.

Current projects

The work at Scion is as varied as it is innovative. From field trials for commercial foresters to tissue culture propagation, here are some of the exciting projects underway:

1) **Field trials for commercial foresters**
   The nursery germinates thousands of seeds for trials, often from specific tree origins, where genetic markers determine the strongest candidates for growth. They are planted in indoor sand beds and grown into mini hedges . Cuttings are taken from these mother plants and grown to a suitable size for field trials around New Zealand. These trials, which take up to 2.5 years, involve multiple team members at various stages.

2) **Tissue culture propagation**
   Scion's team works with somatic embryogenesis (SE) and organogenesis (OG) shoots, receiving these delicate specimens in petri dishes filled with gel-based growing media. The team carefully deflasks and nurtures them using paper pots and high-humidity environments. Tissue culture is a manual, temperamental and precise process, involving tweezers and misting systems to ensure the plants stay healthy .

   "Imagine them as plants coming off life support and we're now tasked with developing them in a gentle manner," Matt says, "The automated misting is very dense small droplets; when it goes off you can't see a metre into the greenhouse. It's not the most pleasant environment to work in. Scion currently has about

50,000 plants in this phase, divided into multiple trials, including research for forest genetics and commercial propagation."

The nursery work sits with the 'forest genetics' team, which is spread around Scion's campus and includes two propagation scientists. These two scientists spend a lot of time in the nursery; one of them has a background in tissue culture, so is doing plenty of hands-on work between the genetics team and the nursery. Matt's providing the right 'facility' and it's very collaborative, he says, "We've only talked about Pine in the article, but we're doing Redwoods, Cypress, and hopefully going into the indigenous space – there are Puriri in the sand beds right now."

3) **Fertiliser and herbicide trials**

The nursery is also testing a new fertiliser and herbicide, derived from by-products of other industries. The goal is to determine which combinations work best for different species, such as Pine or Eucalyptus. Results can emerge in as little as three months for simpler trials, or up to a year for more complex tests, like examining soil microbiomes. Typically the testing for the reports is done by the Plant Protection Chemistry and Physics team.

4) **Chatham Island revegetation help**

Scion is also involved in a long-term project to help restore indigenous plant life on the Chatham Islands. The nursery team helped set up a couple of nurseries but have also been growing and shipping plants back to the island.

Scion is helping repair ecosystems that have been largely converted to farmland. "It's not easy getting plants back to the Chatham's, with just one flight a week carrying freight, passengers and tourists," Matt explains. "The biological controls in despatch are intense, with the added pressure of limited shelf life of plants in boxes."

But Matt finds the work particularly rewarding, he grins, "So I've been working with plants for a very long time. You learn the common name and botanical names, then the Māori name, and now I'm learning the Moriori too."

5) **Biodegradable pot trials**

With a focus on sustainability, Scion is currently trialling three types of biodegradable pots, with plastic pots as the control. The plants were grown in these pots in a split pot trial, with no favouritism to how they were laid out. They were kept in their individual pots and grown and hardened-off under normal nursery conditions. Once ready to be planted out, they were measured at six months old for height and root collar diameter, and their planting locations recorded.

The plants in the biodegradable pots do not require transplanting, as they are made from materials designed to break down (and even provide fertiliser for the plants). The plants are effectively eating the pots! The results of these trials, focusing on native species such as Mānuka and Kanuka, will be reviewed as this article goes to print.

The role of automation

Automation has transformed the way Scion operates, allowing the team to focus on multiple projects. However, Matt reminds staff not to take the automation for granted. "Just because something is automated, it still needs to have human oversight. That might be replaced one day by a camera or AI, but not yet."

From automated misting systems in the greenhouses to intelligent irrigation, Scion's nursery is becoming more efficient, allowing the team to focus on what really matters – growing plants.

"I'd rather spend five minutes pushing buttons than moving 60,000 plants from one zone to another," Matt says. Automation allows Scion to recreate the right environment around the plants, rather than moving the plants to different conditions, resulting in significant cost and time savings.

The nursery also employs a reverse osmosis system to recapture and clean water, which is reused in the greenhouse. This water-saving technique ensures minimal waste while maintaining optimal growing conditions. Even the sand beds used for micro-hedging are designed to maximise efficiency, recapturing excess water for reuse.

Another favourite feature are the wet walls, with the latest installed in February 2023. During the set-up it was about 40 degrees in the greenhouse. The electrician switched it on and the wet wall and two fans dropped the temperature to 25 degrees within five minutes. If the nursery is growing plants that need heat to form roots, but don't like warm humidity, having this cooling effect is a game-changer. "You can zone off areas, because it's fully automated. It also means the roof vents won't need to open, "which is great because that's as efficient as running the air-conditioning with your car windows down," Matt says. "Last summer they only opened twice because the shade screen and wet walls kept the temperature below 28 degrees, even with heated tables going. It is fantastic climate control."

Artificial lighting allows Scion to extend photo periods to suit studies such as Poplar Rust, which started in April 2024. "To study Poplar Rust you need leaves with the rust on it, so going into autumn wouldn't normally be the ideal time to study a deciduous tree, but by replicating spring/summer we're able to keep deciduous trees evergreen through winter. Even some of them that had gone into dormancy thought it was spring and came back out of dormancy."

Automation is creating a dynamic environment at Scion. There are even flight crew working on drone testing, where they're teaching the drones to measure trees e.g. height and volume of wood.

Future innovations

Matt sees automation as the future of nurseries. If he had a magic wand, he would like to see an intelligent spray boom/spider cam that could pass over crops, identifying issues such as moisture content, any pests or fungus, and applying remedies precisely where needed. This would allow for significant reductions in water and chemical usage while ensuring each plant gets exactly what it needs.

Matt believes the industry will continue moving toward containerised growing, where climate control is more manageable. "Bare-root growing is back-breaking work, but with containerised systems, you can make the work more ergonomic and efficient," he says.

Scion's stool and sand beds are all at hip height. The team has done both styles of work and is far happier taking the cuttings off the inside beds. "I wonder if in future, robots might be used for tasks such as cutting propagation – in which case it could be multi-storied stool beds".

Team dynamics

Scion's team is a tight-knit group. Many are locals, and several bring over a decade of experience. Matt credits the team's success to its collaborative spirit. Whether it's a complex scientific project or a day spent weeding, the team comes together to get the job done, fostering a positive work culture. "There's always science happening, but the gut feel, and experience of a nurseryman will always be invaluable."

"There is a great second-tier of leadership, and the wider industry is very helpful," Matt says.

Scion Nursery's blend of automation, innovation, and a skilled team ensures it is well-equipped to meet the challenges of modern forestry and plant science, all while pushing the boundaries of what's possible in the field.

Quick-fire Q&A:

What are the top four things Matt would recommend to forestry growers right now?

1. Water recapture, cleaning and reuse
2. Paper pots, so there isn't the need for single-use plastic
3. Get more efficient with your facilities. Greenhouses can be adapted as plants grow, instead of shifting plants from place to place around a nursery. Greater environmental control indoors means less cost and effort spraying for pests and diseases.
4. Try to move away from soil-based growing media. If you can, use waste product (from the industry) and turn it into growing media, instead of peat which isn't sustainable.

SIDE NOTE: In September 2024, Matt received the Scion Industry/Stakeholder/External Customer Engagement Award for his exemplary work with external customers.