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Technology Innovation for Plant Propagation in New Zealand

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INTRODUCTION

With a high labour cost in New Zealand (NZ) and increasing competition between nursery firms, efficiency in the use of labour and other resources is critical for future growth of this industry. Technologies already being used in North America, Europe, and other overseas locations provide opportunities for increased productivity in NZ, but an "appropriate technology" approach is important because automation is only one aspect of improved efficiency.

GROWING SUBSTRATE

Many NZ growers root plant cuttings in a highly porous mix, often based on pumice or bark, in a community or "hygiene" tray that lacks individual cells. This practice has two main downsides, which include the labour requirement to prick out rooted cuttings to transplant to larger liner containers, and the disturbance and potential damage of root systems as large substrate particles fall from roots during the pricking out process. Pumice substrate has large air spaces between particles, allowing for some air diffusion even when using coarse and frequent sprinkler irrigation. However, the low matric potential in a pumice substrate results in an uneven vertical distribution of air and water meaning that the zone of ideal water/air balance for root initiation and growth is limited in the soil profile.

There are several potential improvements. Trays with individualized cells facilitate grading for quality, and faster transplanting. Several innovations in tray design would benefit NZ growers, such as vent holes in the top of the tray to increase air movement and drying, a more solid tray structure rather than thin plastic to assist handling, and non-circular cell cross-section to reduce root girdling. Substrate in a cell holds together with fibrous components, such as peat or coconut coir, compared with coarse pumice. This means that root systems are less stressed during transplant than if substrate falls off roots during handling.

Crop time can be further reduced, and automatic transplant can be facilitated, by using a stabilized substrate such as foam, peat/polymer, paper-wrapped pots, which do not need a large and mature root ball to hold the cell together. Substrates with higher matric potential, such as peat-based blends, can have a large zone of ideal water/air balance for rooting if irrigation is managed carefully. Roots grown in a substrate (such as peat) that has a similar physical and chemical environment to that of the final container are more likely to grow rapidly after transplant.

WATER AND AIR MANAGEMENT

Time clocks or artificial leaves are commonly used in NZ for controlling mist, with stationary sprinklers that have coarse irrigation droplets to help provide even coverage in semi-open and windy structures. Controlling mist using time clocks means that an experienced (and highly paid) grower is needed to adjust mist depending on weather, crop stage, and cutting type, thereby increasing labour cost and challenges when the lead grower is absent. Artificial leaves are mechanical devices prone to error and inconsistency, and do not function well with fine droplet sizes or fog.

Advanced environmental control computers control mist based on vapor pressure deficit (the combination of temperature and relative humidity), sometimes in combination with wind speed and radiation, and ideally with an in-built crop aging program to reduce mist frequency as cuttings go through callus and root development stages. Simple digital controllers are available with a light meter (sometimes called a calory counter in NZ) that triggers misting during high light times, plus an incorporated time clock to control mist during low light times, and separate day and night settings to avoid over-misting at night.

Most large-scale propagators internationally have moved to boom irrigation to increase mist uniformity, with both a fine mist nozzle for initial hydration and callusing of cuttings and a coarser nozzle for wet-dry substrate cycles during the final root development and hardening off stage. Greenhouse structures that avoid high air flow during the root initiation stage, thereby maintaining high relative humidity, can result in a lower mist frequency and less potential overwatering compared with the open-walled structures often used in NZ. Most NZ propagation structures have fixed shade, however movable shade and automated ventilation allow the environment to adapt to changing weather (which is a feature of NZ climate) and other factors such as crop stage.

The growing substrate must be matched to the irrigation system. Irrigation improvements are essential if NZ growers move to a peat-based substrate with a high matric potential, rather than pumice. Otherwise, the substrate will be over-watered, root diseases and algae growth will increase, and productivity gains from faster rooting and reduced losses will not occur.

LABOUR AND AUTOMATION

Labour costs are high in NZ relative to many countries, however many NZ nurseries are small to middle-scale with high plant diversity. Some NZ growers have moved to automated transplanting, in combination with use of individualized-cell trays and peat-based substrates, but this is primarily for bedding plants rather than natives and other perennials that have widely varying plant forms and sizes. For some larger NZ growers, transplanting robots being used in North America and Europe would have a positive return on investment. However, regardless of size all growers should evaluate simple and low-cost automation of tasks such as dibbling of planting holes in trays.

In addition, hiring lean consultants is standard practice in large international propagators to review the transplant manufacturing process and identify opportunities to reduce labour and other waste even without automation. There are many online articles and training materials available on lean concepts applicable for growers of any scale.

Periodically taking a step back from the day-to-day hard work of running a nursery is essential for business owners in order to identify opportunities to reduce waste and increase efficiency.

In some cases, this may mean automation, however nursery pro-duction will always be labour-intensive and reliant on managing an efficient team of people.

Therefore, focusing on staff training has a rapid return on investment, along with participating in nursery tours with IPPS, and bringing in experienced consultants who can look at processes with a fresh perspective.