Mother-Stock Management and Control©

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INTRODUCTION

Thank you for the opportunity to share with you some of the things that we are doing and some of the thing that we aren't but probably should be doing in respect to the production of vegetative propagation material using a mother-stock system. I also hope to learn from everyone here how we can improve on what we are doing.

WHY MOTHER-STOCK?

At Arnelia we are dealing with a plant that is not that easy to root and that needs special attention to give us the desired results. Growing the vegetative material that is used for cutting production under more controlled circumstances can contribute to improved results. The level of extra effort that you put into your stock plants depends on what outcome is expected. Cutting production from mother-stock does not have to be limited to plants that are difficult to propagate but can also be a tool to get even better rooting percentages, to help schedule cutting production according to your timing requirements, both for an onward production point of view as well as a space point of view (staggered / spread production). Mother-stock, if managed correctly, can give you more uniform cutting material which can lead to a more uniform finished product. A focused mother-stock program can also give you a higher level of plant health in order to avoid or lessen potential losses due to disease outbreaks in the propagation phase. Propagation environments can be conducive to disease development, being warm and humid — if the level of disease or disease propagules that are being introduced into the propagation environment can be limited or reduced, one should have fewer problems going forward.

HOW WE GROW OUR MOTHER-STOCK PLANTS

We have chosen to grow most of our mother-stock plants in pots in tunnels on drip irrigation. The tunnels we use are Haygrove tunnels, where the plastic sheeting runs along the length of the tunnels to facilitate venting. For our purposes the tunnels are essentially a rain covering to avoid the foliage of the mother-stock plants from getting wet. In hot, dry weather, the sides of the plastic can be pushed up by varying degrees to allow for air movement and for hot air to escape. In rainy weather the plastic sheeting is pulled down to the ground and keeps the rain out. Haygrove tunnels are available on raised legs as well, and can accommodate gutters to collect rainwater. Apart from the primary purpose of the plastic covering against rain, we also get the spin-off of earlier spring growth due to the warmer environment inside the tunnels when they are closed during winter and spring.

We pot 1-year-old plants from 16-cm pots up to 20-cm pots for our mother-stock and if we need to keep the mother-stock plants for another year we pot up from 20-cm to 28-cm pots.

Irrigation and fertigation is by drip, every pot has one dripper for 20-cm pots, 2 for 28-cm pots. Drippers are 8 L/h non-leak, pressure compensated, each with a 4-way manifold with tubing going to four arrow drippers. We used angled arrow drippers

as opposed to straight arrow drippers to avoid unnecessary bending of the tubing and to be sure that all the water is delivered to the plant. Ideally we would like each variety to stand on its own irrigation valve, so that water and nutrient can be managed precisely per taxon. This ideal has to be balanced with the practicalities of having too many valves to manage. Having good control over the water and nutrient supply to each and every mother-stock plant ensures that plants never suffer water stress (in theory) and that we can control nutrient supply to give just the right quality of vegetative growth on the plants that is required for optimal rooting (in theory). Supply of nutrients can be used to manage hardening-off of vegetative growth according to a cutting harvesting schedule (in theory). When nitrogen is reduced to slow growth down before cutting harvest, opportunity is given for the shoot to accumulate carbohydrates. Shoots with a higher carbohydrate to nitrogen ratio will root better.

When we have issues with uniformity of plants on one irrigation block, we use pot saucers under the larger plants to collect drainage water for re-absorption thus giving the larger plants access to a higher volume of water per day without the smaller plants pots becoming water logged.

We also use saucers under pots raised by a small frame to collect drainage water under pots as an indication of whether or not we are irrigating too much or too little. Most of the irrigation runs at night, so first thing in the morning, if the saucer under the raised pots are dry, we know we need to irrigate more, if they are full of water, we know we are irrigating too much. Ideally we are looking for 10%–15% or the applied irrigation draining out the bottom of the pot. Remember that for this purpose the pot must be raised above the saucer, the pot must be level on the stand, all the drainage holes of the pot must be above the saucer and one must be able to take the saucer out from under the stand easily to measure the drainage.

We have our pots standing on stone chip and the entire nursery complex is stone chip as a precaution against soil-borne diseases. Ideally the mother-stock pots should be standing on benching for added protection against soil-borne diseases with the extra benefit of increased staff productivity.

HYGIENE, DISEASE, AND PEST CONTROL

We operate from the premise that the better the hygiene during the mother-stock and propagation process, the less risk of diseases — provided that your starting material was disease free. Our mother-stock plants are already grown in a separate production stream during the first year, before they actually become mother-stock. That means that the plants designated to become mother-stock are given extra care and are monitored carefully to keep them disease free during the first year of growth. Using the runts of your production or plants that you couldn't sell as mother-stock plants is counter-productive. Mother-stock is an expensive system and one should put good quality plants into the system to reap the benefits.

Our propagation units with its warm, moist environment can, potentially, be a high risk area for disease development, so if we are introducing disease with you propagation material there is bound to be trouble.

We sanitise all equipment used in the propagation process regularly. Buckets, crates, trolleys, and tables are sanitised daily and secatures between every mother-stock plant when harvesting cuttings and every couple of minutes while processing the cuttings. We have a single access point to our nursery area where everyone passes over a foam mat containing a high concentration of a quaternary ammonium

(QAUT) compound (spore kill or quattro kill). All quad bikes and trailers enter through the same point which ensures that wheel surfaces are sanitized with every entry. We only use a tractor in the nursery for spraying and when that enters the nursery area, the wheels are sprayed with the same high concentration QAUT.

Our insect control is based on monitoring for problems. One of the major insect pests that we have in our Proteaceae cut-flower production, pot-plant production, and mother-stock area is bollworm. We use bollworm pheromone traps to catch male bollworms. The counts for these traps give us a good management tool to know when flights are occurring so that we can target our sprays better.

PROCESS OF CUTTING HARVEST AND PREPARATION

We do our best to avoid any stress on the cutting material during the propagation process. We harvest cuttings only early in the morning, between 7 AM and 9 AM, when it is cool and the plants are fully turgid after the night's irrigation. Cutting material is harvested into buckets and buckets are emptied into shade cloth bags in frames. Another piece of shade cloth is used to cover the cloth bags in the frames on the back to the quad bike trailer to avoid direct sunlight on the cutting material. As the cutting material is harvested into the bags, it is wet with clean water to prevent desiccation. Once six shaded-cloth bags are filled with cutting material, the bags in their frames are taken to the shed and placed in a cold room at 4 °C. From the cold room the bags are taken for dipping, one at a time. After dipping and rinsing, the bags in their frames are returned to the cold room. Processing of the cutting material then takes place in the shed. One bag at a time is taken from the cold room for processing. On hot days it is important not to allow the cuttings to dry out while they are being processed. The prepared cuttings are taken from the shed to the greenhouse in small batches, to minimize the time spent in the shed. One or two people are constantly busy setting the cuttings prepared by the rest of the team (usually 8 others).

REJUVINATION OF MOTHER-STOCK

In difficult-to-root plants, rooting percentages are best when plants are young, so optimizing production off the mother-stock plants for 1 or 2 years is important as we then need new plants again. From some mother-stock plants we harvest cuttings twice in one season, from others once. Some taxa we keep for 2 years, others only for 1 year. After harvesting of cutting material some taxa can be grown out to produce a salable plant, others have to be discarded. Selling ex-mother-stock plants can sometimes be a compromise, either to the productivity of the mother-stock plant (because you have to harvest early to get sufficient re-growth) or to the sales plant (because it has been managed for cutting material). Also the number of mother-stock plants we need for production plan is not necessarily correlated to the market demand for the bigger sized plants.

OTHER OPPORTUNITIES OF MOTHERSTOCK SYSTEM

- Manipulation of photoperiod to keep plants vegetative and avoid dormancy; chrysanthemum is a good example of a short-day flowering plant that can be kept vegetative for better rooting.
- Etiolation, shading, nutritional balancing, and girdling are other techniques that can be applied to mother-stock to increase rooting of cuttings.