breakthroughs with regards to innovation have really been ideas that we have borrowed from other industries. Propagators often become more effective by studying what others are doing in dissimilar businesses/industries. Conveyors, robotics, soil mixers, flat fillers, and the like are technological advances that came into our arena by way of industries such as the grocery, egg, automotive, and food processing companies.

CONCLUSION

In summary, striving for excellence in key areas provides a good basis for becoming a more effective propagator. While our focus should not be limited to just the seven focus areas we have discussed, these areas must be of top priority in any successful propagation operation.

Camellia Production from Cuttings©

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INTRODUCTION

At Bennett's Creek Nursery we grow a full line of camellia cultivars to supply customer demand. All cultivars are propagated from cuttings and container grown. Spring bloomers consist of *Camellia japonica* cultivars and related hybrids. Fall bloomers are either *C. sasanqua* or *C. hiemalis* cultivars and related hybrids. To date over 200 cultivars have been evaluated for commercial production. We continue to trial promising new cultivars in order to supply the best possible marketing mix to our customers.

PRODUCTION

Variety Selection. Cold hardiness, flower bud set, flower characteristics, and production ease are the primary criteria upon which all potential cultivars are evaluated. Cold hardiness is essential because most of out clients are selling to customers near the northern edge of the camellia range. Good flower bud set makes a plant much more marketable as it begins to show color. In regards to flower characteristics, red blooms are currently in greatest demand. Consumers seem to prefer double blooms. And larger blooms are usually better. To be more specific about production — rootability, vigor, and disease resistance are our primary focus. Cultivars scoring high in all categories are good candidates for our marketing mix. Examples of *C. japonica* cultivars that score well are 'Les Marbury', 'Otome' (syn. 'Pink Perfection'), and 'Lady Vansittart'. *Camellia sasanqua* examples are 'Yuletide' (see *C.* 'Yuletide'), 'Cleopatra', and 'Autumn Moon'.

Propagation Timing. Timing is based upon stage of growth. Cuttings are collected from current season wood on young containerized plants. *Camellia sasanqua*, *C. hiemalis*, and related hybrids are normally ready first. Stems should be semi-hard and tan in color. An average cutting is 10 to 13 cm (4 to 5 inches) in length with 4 to 5 leaves. *Camellia japonica* and related hybrids should have tan or green and tan

mottled stems. These will also be in the 10 to 13 cm (4 to 5 inch) range and have 3 to 4 leaves on average. This type of wood is typically available between late July and the end of October.

Pre-stick Dip Treatment. For disease prevention all *C. japonica* cultivars and related hybrids are dipped into a Zerotol solution before preparation. Of the *C. sasanqua* cultivars and hybrids, only three require a pre-stick treatment: 'Bonanza', 'Mine-no-yuki', and 'Snowflurry'. Labeled rates and directions are followed.

Cutting Preparation. Terminal as well as internodal cuttings are collected and prepared. The lower leaf is removed, leaving a node near the bottom of the stem. Any obvious flower buds present are removed at this point. No wounding is performed other than the scar left as a result of removing the lower leaf.

Medium. Propagation media is prepared from raw materials in a paddle mixer as follows: aged pine bark, coarse perlite, and sphagnum peat moss (20 : 8 : 1, by volume). During mixing the medium is amended with the following per yd^3: 2.2 $kg \cdot m^{-3}$ (4 lb per yd^3) Osmocote 18N-6P-12K (8 to 9 month formulation), 0.8 $kg \cdot m^{-3}$ (1.5 lb per yd^3) Micromax (micronutrient package), and 2.2 $kg \cdot m^{-3}$ (4 lb per yd^3) dolomite.

Sticking Technique. Cuttings are direct stuck into 8.3 cm (3.3 inch) × 8.3 cm (3.3 inch) × 8.9-cm (3.5-inch) liner pots. Each tray holds 36 liner pots. Spin Out treated pots promote well-branched root systems. Each tray is tagged for variety identification.

Environment. Cuttings are kept moist and placed into a cooler until sticking. Once stuck, trays are placed in the greenhouse with an intermittent misting system. The greenhouse is shaded at 50%. Frequency of misting is adjusted based upon time of day, weather conditions, and degree of rooting. Proper water management is a key to success. If cuttings are stuck earlier in the season, no supplemental heating is necessary for root initiation. If cuttings have not rooted by late September, a hot water bottom heating system is turned on to maintain soil temperature at 21°C (70°F).

Rooting Time. Rooting time averages 8 to 12 weeks. The *C. sasanqua* cultivars are fully rooted by 8 weeks, while *C. japonica* cultivars are slower and finish rooting at about 12 weeks. Rooting success averages 90%.

Propagation Spray Program. Cuttings are sprayed with a fungicide/algaecide every 7 days while under mist to prevent diseases and maintain sanitation. Applications are made just after the final misting for the day in order to allow for maximum contact time before misting resumes the following morning.

Disbudding. As the flower buds form in the fall on newly rooted cuttings, they are removed by hand. This helps prevent diseases and conserve energy for future vegetative growth.

Overwintering Rooted Cuttings. In early November greenhouses are covered with 50% white poly and thermostats are set at 1°C (33°F) to prevent the roots of the cuttings from freezing during very cold nights.

Weed Control. Rooted cuttings are scouted for weeds and other pests on a regular basis. Hand weeding is minimized through the use of preemergent herbicides. We are using Ronstar G at 9.7 to 14.6 kg per 1000 m^2 (2 to 3 lb per 1000 ft^2) under good ventilation and irrigating immediately.

Fertilization. In early spring liners are top dressed (using a rotary spreader) with StaGreen 12N-6P-6K (3 to 4 month release) at a rate of 146.7 kg per 100 m^2 (3 lb per 100 ft^2).

Soluble salts are monitored and additional fertilizer is applied as necessary through the irrigation system. We are altering with 15N-5P-15K Cal. Mag. and 20N-8P-20K plus minors. Satisfactory E.C. readings would be between 0.5 and 1.0.

Pruning. Liners (fully rooted cuttings) are power sheared over the top after the first flush of growth in May of the following year. The shears are sanitized with 70% isopropyl alcohol between varieties sheared. Liners are finished and ready for potting into 1-gal containers by late June.

Production of 3.8-liter (1-gal) Containerized Plants. Liners are removed from the propagation houses and potted on our Gleason Potting Carrousel. They are transported to the camellia area greenhouses via tractor and tracking farm trailers.

Spacing. Containers are placed can to can for the first season. In May of the following year they are spaced on 30.5 cm (1 ft) centers. During the spring, summer and fall, the camellia houses are only covered with 50% shade cloth. Plastic is put on the houses for winter protection in early December and removed by mid April.

Growing Media for 3.8- to 56.8-liter (1- to 15-gal) Containers.

- 92% aged pine bark
- 8% coarse sand
- One 5.5-ft^3 bale of sphagnum peat moss per 5 yd^3
- Osmocote 18-6-12 at 5.4 kg m^{-3} (9 lb per yd^3)
- Micromax micronutrient package at 0.8 kg·m^{-3} (1.5 lb per yd^3).
- Dolomite at 2.8 kg·m^{-3} (5 lb per yd^3)

Weed Control. A combination of weed control practices are necessary for best results. Hand weeding on a timely basis, spot spraying walkways and perimeters, and use of preemergent herbicides are essential for good results. We rotate with Rout, Scott's OH2, and Pendilum.

Tagging. Each plant is tagged with a strap tag as a 1 gal after arriving in the camellia houses to prevent mislabeling.

Pruning. Liners are pruned as they come off the potting carrousel and again in the late fall. The fall pruning is only a light pruning to remove the longest shoots.

Pest and Disease Management. Scouting is performed regularly. Spider mites and aphids are pests to watch for. Chemical applications are made as needed for insect and disease control. To prevent root rot, we practice sound water management techniques and treat irrigation water with 2 ppm chlorine to kill waterborne pathogens. We try to irrigate early and only as needed. Fungicides are also periodically applied for root rot prevention. Strict sanitation practices are implemented during bloom season for petal blight prevention. All camellia houses have woven nylon ground cloth on top of the gravel on the ground for easy clean up of fallen blooms.

Fertilization. After the plants are spaced in May they are pruned again to promote fullness and top dressed with 13 g of Osmocote 17N-6P-10K plus minors in the 8-9 month formulation.

Finish Time. The 3.8-liter (1-gal) containerized plants are saleable or ready for shifting up to larger containers at 15 months from potting.

Production of 11.3-liter (3-gal) Containerized Plants. Each year a portion of the finished 1-gal crop is set aside for 11.3-liter (3-gal) production. We have found October to be an ideal time of year for canning-up one into 3 gal. Once again, plants are potted-up using a carrousel, and then transported to greenhouses for growing on. The same overwintering and production techniques used to produce healthy 1-gal camellias are followed for 3-gal production. However, fertilizer rates during top dressing are obviously different (45 g). When spaced, the 3 gal are placed on 48-cm (18-inch) centers. We consider mid-May to be the cut off date without adversely affecting flower bud set. A very light final pruning is performed in the fall only the longest shoots in order to maintain flower bud set. At 39 months from sticking, 11.3-liter (3-gal) *C. sasanqua* begin their show of autumn blooms and are saleable. The *C. japonica* cultivars are also saleable at this time but usually don't sell until the following spring.

Propagating Under Different Plastics and Shading Materials©

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The color of the shade material applied to greenhouse plastic influences rates of rooting as well as disease incidence. This reaction is governed by plant species as well as shade color. Some of the greatest potential for enhanced plant response may be in the area of pathogen control.

INTRODUCTION

A great variety of shading methods have been used in the nursery trade, from tall pines or lathe houses to spray on shade compounds and shade cloths. Available now are poly films with shading compounds incorporated during manufacturing. We have used two types of shaded poly film, one a white film rated at 55% shade and the other a gray aluminized (reflective) film rated at 40% shade. Whereas plant growth under the gray film was what would be expected for light shade, plant response under the white film raised many questions. The possibility of a shift in light quality under this film was raised when it was noticed that the sun viewed at midday was orange in color. Cuttings of Azaleas or *Rhaphiolepsis* did poorly, while cuttings of *Ilex decidua*, *Rosa banksiae*, and *Hydrangea macrophylla* did better than under conventional shade.

Since light used by plants for photosynthesis is in the 400 to 700 nm portion of the light spectrum, by shading to reduce light intensity portions of the desirable (and undesirable) light quality could be altered with the colored poly films or shading compounds utilized. As the proportions of light change with selective shading one would expect to see altered plant responses. From the perspective of the commercial