produced in summer. Weak plant growth and small, soft fruit with reduced shelf life may result from insufficient winter chilling. Excessive chilling causes poor fruit production and excessive plant growth and runnering.

Table 1 gives an example of the chilling response testing that is carried out.

## SUMMARY

The success of our programme is our ability to propagate high quality plants for grower testing. Along with the breeding programme we also run a nuclear and elite plant certification scheme and distribute and sell about 60% of all strawberry plants sold in New Zealand.

# DUNCAN AND DAVIES NEW ZEALAND *PSEUDOPANAX* SELECTIONS

PHILIP J. CARSON

*Duncan and Davies Nurseries Ltd*
*Waitara Road*
*Brixton, Waitara*

Family—ARALIACEAE—mainly a tropical family with some genera in temperate regions, e.g. *Pseudopanax*
Genus—*Pseudopanax*

## OUTLINE OF THE PSEUDOPANAX SPECIES

There are approximately 20 species of this genus of which about 14 are endemic to New Zealand. Species that were previously classified in the genus *Neopanax* are now included in the genus *Pseudopanax,* which are glabrous shrubs or small trees with very variable leaves which may be simple, digitately compound or palmately lobed. The juvenile leaves of young plants often differ greatly from those of the adult.

Some of the species, particularly *Pseudopanax crassifolius* are excellent plants from a landscape point of view with a great variety of foliage type and plant form not found in any other hardy exotic trees. In other species, particularly *Pseudopanax laetus* and *P. lessonii,* the plant form is not so characteristic but they are excellent foliage plants and are very suitable for growing in pots and tubs for interior decoration or on patios and terraces.

Not all of the species are completely hardy. *P. lessonii, P. discolor,* and their cultivars can be somewhat tender where heavy frosts are experienced.

All species will grow in a wide range of soil types but do best in a soil that is well drained. They grow well in an open position with plenty of air movement and in exposed coastal situations. All species will grow in various situations from full sun to partial shade.

## PROPAGATION

The two methods of propagation are by seed and by cuttings.

**Seed Propagation.** All *Pseudopanax* species can be successfully raised from seed. At Duncan and Davies we propagate *Pseudopanax crassifolius* and *P. lessonii* from seed. These species hybridise quite freely in the wild so we get a large variation in leaf types from the seedling raised plants. This gives us the opportunity to continue selecting different forms for either their foliage type or growth habit.

After the seed is collected it is best sown when fresh. In September [spring] we pre-germinate the seed in sphagnum moss at room temperature prior to sowing which gives us a much better result than direct sowing the seed.

The seed is then sown in a seed mix containing 50% peat and 50% pumice-sand plus various elements [Table 1]. The seed trays are placed on bottom heat set at 22°C in a propagation house with the air temperature held at around 25°C. After 3 to 4 weeks from sowing the seedlings appear. Then after 6 weeks from sowing the seedlings are pricked out into 5.5 cm Maclons into a G.O.L. mix containing two-thirds composted bark and one-third bark fibremix plus various elements [Table 1]. The newly-potted seedlings are then placed in a heated house for about 1 month to re-establish with air temperature held at 25/15°C (max./min.). After they have re-established they are then placed in a shade house [50%] for the balance of the growing season.

**Table 1.** Components in the seed mix and growing-on-line mix [G.O.L.] per ½ cubic metre

| SEED MIX | | G.O.L. MIX | |
|---|---|---|---|
| 50% | Peat | 66.6% | Composted bark |
| 50% | Pumice-sand | 33.3% | Bark fibremix |
| 230 gms | Nitroform | 1135 gms | 9 month Osmocote |
| 455 gms | Superphosphate | 230 gms | 3 month Osmocote |
| 114 gms | Potash | 455 gms | Superphosphate |
| 455 gms | Dolomite lime | 680 gms | Dolomite lime |
| 230 gms | Whiting | 455 gms | Whiting |
| 30 gms | Terrazole | 30 gms | Fritted Trace Elements |
| 40 gms | Lindane prills | 300 gms | Cal Nitro |
| | | 40 gms | Lindane prills |
| | | 30 gms | Terrazole |

The following spring they are planted out and grown for two growing seasons to attain a saleable grade. The saleable grade varies greatly with seedling raised plants.

**Cutting Propagation.** Duncan and Davies selected cultivars are all propagated by cuttings. Cuttings are taken in May from new season's growth that is firm. We usually make top cuttings about 8 cm long with 3 to 4 leaves left on the cutting. They are made as nodal cuttings and are wounded on one side. The cuttings are dipped in 0.8% IBA powder which also contains a fungicide (Thiram).

The cuttings are set into Plixie 54's into a propagation mix containing 3 parts sawdust, 2 parts peat, and 1 part pumice-sand to which is added 30 gms Terrazole and 500 gms 9-month Osmocote per ½ cubic metre.

The cuttings are placed on bottom heat set at 22°C and the air temperature is held at around 25°C. Root initiation usually begins after 5 to 6 weeks and they are usually well-rooted after 8 to 12 weeks. *Pseudopanax* cuttings do best in an airy environment and it is important for the high humidity conditions to be maintained for the shortest possible time. The air temperature is usually reduced to about 20°C after 6 to 8 weeks.

After 8 to 12 weeks, when well-rooted, cuttings are potted into 7 cm Maclons into the G.O.L. mix shown in Table 1. They are then placed into a heated house for 4 weeks to re-establish with the air temperature around 20°C. After re-establishment they are placed in a shade house (50%) for the balance of the growing season. The liner plants are trimmed in December/January to produce a three-bunched plant. During propagation the cuttings are sprayed every two weeks with Ailette/Captan/Lorsban and alternated with Benlate/Captan/Orthene. In the liner and field stages the plants are sprayed at three weekly intervals with a general spray programme.

The following spring the plants are planted out for two growing seasons to attain a saleable grade.

**Pests and diseases.** *Pseudopanax* plants are susceptible to the black leaf spot fungus, *Alternaria tenuissima,* which is controlled with the use of Dithane M45, Euparen, and Sportak.

The main insect pest of *Pseudopanax* is the oyster-shell scale which is controlled with Lorsban or Orthene and, with heavy infestations, they are best incorporated with an all-seasons oil.

**Stock plant material.** The juvenility factor plays a major part in the successful propagation of *Pseudopanax* by cuttings. With permanent stock plants they should be hard-pruned to 30 to 40 cm high every other year and lightly pruned in the alternate year. At Duncan and Davies we produce temporary stock crops in the field which we take cuttings from for 2 to 3 years and then sell the plants. In this way we are able to maintain plants in a more juvenile state which gives a higher propagation percentage.

## DUNCAN AND DAVIES CULTIVARS

Duncan and Davies produce several cultivars, all of which originated at the nursery, and all are propagated by cuttings. They are as follows:

*Pseudopanax* 'Adiantifolius'—This is a hybrid whose parentage is probably *P. lessonii* and *P. crassifolius.* It is a strong growing cultivar with erect branches and, with its green foliage which is suggestive of *Adiantum,* it is very distinct. The true *P.* 'Adiantifolius' occurred in the wild and is now rare in cultivation. What Duncan and Davies produce as this plant is a seedling which differs by the leaves not being so thick and narrower at the base and also more deeply lobed. It is an erect shrub or small tree growing to 4m or more.

*Pseudopanax* 'Cyril Watson'—This cultivar belongs to the same hybrid group as *P.* 'Adiantifolius'. Its distinguishing features are a very compact growth habit and thick leathery deep-green leaves which are 3 to 5 lobed with short broad lobes. It makes an excellent tub plant for patios and indoor use. This cultivar was named in honour of a long-serving member of Duncan and Davies staff. It is a compact shrub growing to approximately 2 to 3 m.

*Pseudopanax* 'Linearifolius'—This is another hybrid between *P. lessonii* and *P. crassifolius.* However in Duncan and Davies earlier catalogues it is indicated that it is a form of *P. lessonii* from Mercury Bay. This is a fastigiate growing shrub to 3m or more. Leaves are of a dark green, mainly 5 foliolate, and individual leaflets are up to 20 cm long. It is excellent for tub culture and very tolerant of dark conditions.

*Pseudopanax* 'Purpureum'—This is another hybrid probably between *P. lessonii* and *P. discolor.* This is a much-branched shrub of 3 to 4m or more. The leaves are 3 to 5 foliolate on stout petioles with the leaflets 5 to 10 cm long. The foliage colour is a rich bronze purple, particularly during the colder months of the year. This cultivar is also excellent for tub culture.

*Pseudopanax crassifolius* 'Sabre'—This cultivar is a seedling selection of *P. crassifolius* which is faster growing and branches from a lower level. The leaves of young plants are up to 30 cm long and deflexed as in *P. crassifolius.* The foliage colour is a very dark green with an orange coloured mid rib which is very distinctive. It is an excellent plant for landscape work with a very fastigiate erect habit when young and forms a more rounded head as it matures, growing to 4 to 6m.

*Pseudopanax* 'Trident'—This cultivar is in the same hybrid group as *P.* 'Adiantifolius'. The leaves are of two kinds on the same plant. Those from which its cultivar name is derived are 3-lobed with the lobes all pointing forwards. It also has simple lanceolate leaves which have no lobes. As it matures the lobed leaves become fewer. Foliage color is a deep green with some bronzing in colder conditions. It is a very erect growing shrub or small tree to 3 to 4m or more in height. It is very wind hardy and tolerant of shady conditions.

*Pseudopanax lessonii* 'Gold Splash'—This cultivar is the most recent introduction by Duncan and Davies and was first released for sale in 1978. It appeared as a mutation which sprouted from the stump of a plant of *P. lessonii* which had been cut off at ground level in the garden of Mr. Trevor Davies, New Plymouth. Its foliage type and growth habit are the same as for the typical form of the species, leaves being 3 to 5 foliolate on stout petioles 5 to 15 cm long. It grows as a much branched shrub 3 to 4m in height. Its leaves are so heavily variegated with yellow that they appear to be all yellow with flecks and splashes of light and dark green. On older leaves the yellow tends to become more creamy. This is an excellent landscape plant and is quite suitable for tub culture.

Duncan and Davies are continually selecting for different foliage types and plant habits and these are put through a trial programme to select for ease of propagation, growth performance, pest

and disease resistance, and hardiness. This programme can take several years before a plant is given a cultivar name and commercially produced.

## SIGNIFICANCE OF GELLING AGENTS IN A PRODUCTION TISSUE CULTURE LABORATORY

BEVERLEY J. NAIRN

*Tasman Forestry Micropropagation Laboratory*
*P.O. Box 149, Te Teko, Bay of Plenty*

This paper gives a brief account of some experiences with gelling agents and their effect on the survival, multiplication rates, and vitrification in a production crop of micropropagated *Pinus radiata*. No attempt has been made to obtain quantitative data. Vitrification was also influenced by benzylaminoprine (BAP) concentration and other factors (1). The additives to the medium studied were Merck 2186 activated charcoal, Difco Bacto agar, Davis Bacto agar, Coast Biologicals agar (batch 950), Agarose type V, and Gelrite.

The study was undertaken to find the best combination of agar, Gelrite, and BAP to give the greatest multiplication of shoots without vitrification.

### MATERIALS AND METHODS

The basic proliferation medium was modified Quoirin Le Poivre (2) with 3% commercial sugar. Gelrite is the trade name for a polysaccharide gellan gum compound produced by the bacterium *Pseudomonas*. The gum produces a mineral dependent, water clear, brittle gel at much lower concentrations than agar, making it very desirable for routine use. Gelrite is supplied by Kelco Division of Merck & Co., Kelco, San Diego, California, U.S.A. Difco Bacto agar is supplied by Difco Laboratories, Detroit, Michigan, U.S.A. Davis Bacto agar is supplied by Davis Gelatine Co., Auckland, N.Z. Coast agar is supplied by Coast Biologicals Ltd, Auckland, N.Z.

Embyros were initiated in plastic petri dishes for the first 12 weeks and were later transferred into clear polystyrene culture pots for subsequent elongation stages. Incubation conditions were 25°C by day, 19°C night temperature with a 16-hour photoperiod of 40$\mu$ Einsteins/$m^2$/sec using cool white fluorescent tubes as the light source.

The seedlot in use was an open pollinated 850 selection from Tasman Forestry's Te Teko seed orchard.