tivar's suitability as a cut flower crop, a potted crop, or as a garden plant. Those cultivars that are naturally compact and heavily branched should make good potted plants while characteristics such as stem length and flower life are important for cut flower crops. Cultivars which are very free flowering but have a short flower life could be well suited as garden plants.

These evaluations should assist breeders with their work as well as providing rhizome producers with the necessary information to pass on to their customers, all of which will help contribute to the success of *Zantedeschia,* "the flower with a future".

CAPILLARY BEDS—AN EARLY ASSESSMENT

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Capillary beds were installed at Omahanui Native Plants in December, 1985. Although 9 months is a relatively short period of time to offer an assessment, I feel that current interest in capillary beds is high and our experiences to date could be of relevance.

I intend to outline structure, cost, management techniques, and offer an overall assessment of this system 9 months on.

Basically, capillary beds are a watering system where water is made available at the base of the container-grown plant rather than by an overhead sprinkler system. Water availability is an extremely important factor affecting plant growth rates and general plant health. Overhead watering inevitably has variable distribution, resulting in some overly wet and other very dry areas in the nursery. There is also considerable water wastage with fall on standing out areas and pathways. In the capillary system water is available at all times through capillary action from the moist sand of the bed up through the drainage holes of the container into the mix, providing the plant with moisture at all times. The results of constant water supply are to be seen in healthier, faster growing plants.

The decision to build capillary beds at our nursery was made when one standing out area desperately needed resurfacing. After reading an article in Aglink and hearing about capillary beds at a seminar, we thought we would try this system rather than repeat the weed mat and overhead sprinkler layout of the rest of the nursery. We were applying for a Rural Bank development loan at that time and so included the capillary bed costs in the development schedule. The money was approved and work went ahead in November, 1985. We aimed to use the beds primarily for growing larger grade plants.

STRUCTURE

We constructed 682.5 square metres of capillary beds at a cost, including labour, of $9.63 per square metre. This does not include the solenoid valves and the automatic watering system already in existence. A drained-bed concept was used, as outlined in the New Zealand Nursery Research Centre Extension Bulletin No. 4. Briefly, construction was as follows:

1). The beds, each 3.25 metres wide, were constructed of 100 × 25mm timber on levelled ground. The timber framing was level across the bed.

2). Pumice fill was compacted inside this framing to form a slope from one side to the other of 1 in 80. The careful preparation of this layer is vital to the successful functioning of the bed.

3). Over the compacted pumice, black polythene of 125 microns was laid. At the lower end of the slope the polythene ends against the framing, whilst at the higher end it is taken up the frame and fastened to the timber edge.

4). The final layer, termed the capillary substrate, consists of approximately 3cm of graded sand. This is screeded to make a smoothed surfaces.

5). Water supply is through 16mm thin wall alkathene with micro tubes every 50cm. The feeder pipe runs along the higher edge of the bed so the water movement is down the slope and excess drains out the lower edge.

6). Adjoining beds were sloped so that they both drain into the same Novaflo pipe running underneath a metalled walkway.

7). An overhead watering system was also installed as a backup and to flush any salts accumulating on the mix surface. Although in Oropi's high rainfall (200mm a year) we do not envisage this being a problem.

On these beds we can stand approximately 10,000 plants in PB 8's or 8,000 in PB 12's.

ADVANTAGES OF THE CAPILLARY BED SYSTEM

1). **Growth.** Plant growth on capillary beds is said to be both faster and more even. Our observations and simple comparisons substantiate this. Early last January the first plants went onto the beds. Several species were selected for comparisons. The bulk of these plants were stood out on the capillary beds, whilst 10 of each species were put onto weed mat with overhead watering. After 4 and 11 weeks very basic height comparisons were made. *Hoheria populnea, Alectryon excelsus, Pittosporum tenuifolium* and *Sophora microphylla* had all made considerably better growth (up to 30cm more) on the capillary beds. *Entelia arborescens, Corynocarpus laevigatus, Clianthus puniceus* and *Melicope ternata* were larger but not dramatically so. There was not much growth difference in *Beilschmiedia taraire* and *Schefflera digitata*.

Although these comparisons were not done very scientifically, we were and are pleased with the growth performance of most plants on the capillary beds.

Pittosporums put onto the beds at 50 to 60cm in early January were ready for selling at the end of March at 1 metre plus and with bushy growth. Better growth of such species means that more crops can be grown in a given area over a year thereby increasing nursery turnover.

2). **Phytophthora Control.** Latest theories on *Phytophthora* infection indicate that this fungus becomes a problem only when plants are under stress for various reasons. Probably the greatest cause of stress is an inadequate and erratic water supply. Capillary beds with their constant supply of water reduce stress on plants and consequently lessen their susceptibility to *Phytophthora* attack.

Earlier this year we moved older plants which were '*Phytophthora* prone' onto the capillary beds but they continued to die. Species which we have difficulty with are now going straight onto the beds as soon as they are potted and, hopefully, we will see fewer losses this season.

Quintinia acutifolia plants have been on the beds since early April and are still healthy and growing well, whereas we generally have high losses of these plants at an early stage. So we are optimistic that such species will be grown successfully on a capillary system.

MANAGEMENT

Watering. Initially we only partially flooded the beds allowing approximately 40 minutes of watering, but found that the plants on the lower side of the beds were not receiving enough water. We now completely flood the substrate which takes 60 minutes. In summer two 60-minute waterings are allowed—mid-morning and late afternoon. Watering is controlled by a Richdel automatic watering system. Length and number of waterings obviously depends on weather, width of beds, size of plants, and the amount of water being delivered through the feeder tubes.

Plants are watered before being put onto the beds after potting so the dry mix will not spill onto the sand. A second thorough soaking once in place is important to establish water contact with the substrate so capillary action can begin.

Weeds. A constantly moist medium provides a very good environment for weed growth so that an efficient weed management programme is important. *Foresite*® is sprayed on the mix surface to prevent weed growth in the containers; keeping the immediate surroundings weed-free will, of course, cut down the number of weed seeds finding their way onto the beds. For seeds that do germinate, a routine handweeding at regular intervals and a thorough clean up between crops has meant that weeds have not become a problem for us. An experimental spraying of part of one bed with a strong *Foresite*® spray has controlled bittercress growth but not pearlwort or chickweed. We will continue to use such sprays as bittercress is difficult to keep under control with only handweeding.

Sand Replacement. At least 2.5cm of substrate—sand—is necessary to retain sufficient moisture for plant use. We found that we had to "top up" the sand layer significantly before the second crop went onto the beds. It would seem that this was due largely to sand consolidation and perhaps initial uneven distribution of the sand over the beds. However, there will always be some loss on plant roots and, because of scouring, in a few places where the polythene had not been laid close enough to the timber edging. It seems sensible to have a stockpile of sand for such replacement.

Wooden screeds extending across the framing to the correct depth make it easy to achieve the correct sand thickness. This process can be routinely carried out during the clean up between crops.

Shelter. Beds must be well sheltered to prevent or minimise the toppling over of plants by the wind. Plants which fall over dry out since the capillary action is interrupted.

Surface Maintenance. The surface of the beds needs to be smoothed flat (by screeding) before plants are stood onto the sand so that maximum contact is made with the drainage holes in the container base. Hollows in the sand may mean several holes may not have contact with the substrate and so the amount of capillary action is reduced. For the same reasons, planter bags must be seated flat on the sand.

When standing out plants we use strips of plywood laid over the sand to walk on. This stops the surface being disturbed too much before the plants are put down.

Micro-Tube Check. Regular checks need to be made of microtubes to ensure they are clear of sand particles.

CONCLUSIONS

The cost of setting up a capillary watering system is relatively high but, to offset the higher capital investment, there are the advantages of quicker plant growth and consequently higher turnover of stock, plus superior plant health and quality.

However, to obtain a maximum return from the capillary bed, care must be taken:

1) To keep the beds well stocked throughout the year.

2) To establish management routines such as those outlined to ensure the most efficient functioning of the capillary system.

Over 9 months we have established routines necessary in management of capillary beds and our observations of plant growth and health have justified our decision to try this system.

EFFECT OF SOWING TIME ON PEACH ROOTSTOCK ESTABLISHMENT

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Abstract. The effects of four different seed sowing times, plus fungicide treatment, were evaluated for peach rootstocks direct-sown using seed from 'Golden Queen' peach. The two earliest sowings resulted in significantly higher seedling emergence and percentage buddable stocks, than later sowings. The second sowing time of May (late autumn) gave the highest seedling emergence (59.1%) giving 48.9% buddable stocks based on the number sown. Soil temperature and moisture were considered key factors influencing subsequent seed stratification, while prior handling and storage were also thought to influence the results. Fungicide treatment with thiram had no significant influence.

INTRODUCTION

The predominant method of propagating peaches is by T-budding of selected cultivars onto seedling peach stock. The choice of seed source, is not usually governed by any particular cultural value, but rather by ready availability of seed from the canning industry. Thus in New Zealand seedlings of the late maturing canning cultivar, 'Golden Queen', is the principal rootstock used for peach.

As with many temperate zone plants, peach seed requires a stratification period to promote germination. The conditions and length of the stratification period for peach is cultivar-variable (3, 4, 9) though from the literature 80 to 150 days at 4 to 10°C in a moist medium is usual (1, 3, 10, 12, 13).

The problems associated with peach propagation from seed vary according to climatic conditions. In warm temperate and subtropical regions the principal problem is the attaining of sufficient