

We can detach the Tree Boss and put a forklift, loader bucket, spade, or any other tool on the front of the same tractor. The Tree Boss has little support legs that stabilize it when it's parked. Hooking it up and unhooking it takes 3 or 4 min, which helps us minimize the number of tractors we require.

From the time our trees are planned for production (as part of our closed-loop marketing strategy) to the time they are delivered to a landscape site, we use planting, cultural, and harvesting systems to make our nursery operation profitable. Growing is one area of the green industry that is still heavily dependent on manual labor. We have discovered that the creative use of production systems — “a philosophy that transcends mere equipment” — can turn plant growing into a truly efficient enterprise.

Efficiencies from Rolling Bench Propagation®

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INTRODUCTION

I feel honored to be able to share this presentation with you this morning here at the Eastern Region. I have been a member of the Western Region for many years so I have always been taking. It is now a pleasure to give in return. There are a number of basics, which influence our decisions. People are very important to us. We believe that people should be loved and things used. The problems arise when things are loved and people are used. People comfort is very important to us. The rolling bench equipment is available “off the shelf” in the Netherlands where a number of liner producers are using it. To the best of my knowledge we are the only nursery propagators in North America using it. The goal is to bring the work to the people, rather than having employees spread all over the nursery. This eliminates what I call “walking time” — to lunchrooms, washrooms, or telephones. With the rolling benches most of the work can be done in an ergonomically correct fashion. Supervision is also easier as most of the tasks are done in a central area. Another realization was that we are not in the nursery business but are in the materials handling business. Many of the tasks lend themselves to mechanization. The simple question we are presented with is how do we take 3000 yards of soil mix, add unrooted cuttings, some plastic and fertilizer, ship 3,000,000 liners, and get paid for them? Presently most of the tasks in propagation are done under an incentive system, with all tasks having basic numbers, which must be achieved. Anything over these numbers, the employee and employer share the savings.

COMPANY BACKGROUND

Van Belle Nursery operates 60 acres on two locations in Abbotsford, British Columbia. We specialize in hardy woody ornamental shrubs and vines from 4-inch liners to 3-gal container stock. Our nursery is located in U.S.D.A. Zone 7–8, which is the same as Southern Georgia. Although only 2 miles away, our liner location does not suffer the cold outflow winds coming down from the United States as our other location does. We grow 4-inch liner stock for the northern half of North America or U.S.D.A. Zones 3–6, including shrubs, vines, and some conifers. Shipping is

year-round with a heavier emphasis in the spring and early summer. Demand has increased greatly in the past few years, with many of our liners grown under license from 14 growers and breeders. We pay our royalties on time, which in turn means North America's best nurseries approach us to grow their protected product lines. This allows for "one-stop shopping" by our liner customers. We employ 50 people year-round, while during summer softwood propagation employment increases to 80 people. Liner facilities consist of 3 acres of Cravo retractable-roof structures plus an assortment of freestanding polyhouses. We do not believe in working long hours. The busiest day this past spring we worked 10 h while most of the spring we were at 9 h. Being north of the 49th gives us more daylight hours and sunshine during the summer softwood propagating season.

PAST PROPAGATION METHODS

The polyhouse (Fig. 1) is 27 × 200 ft with a double poly covering. It has: (1) a natural gas heater for minimal heat protection, (2) manual roll-up sides for ventilation, and (3) an irrigator. The procedure was to pre-fill the 4-inch pots in flats and put them on typical small nursery tracking trailers. After pulling the trailer into the polyhouse the flats would be watered as each layer was dibbled and the cuttings stuck. After sticking each layer the flats would be put on the ground and the irrigator would go back and forth as directed by the time clock. When the cuttings were rooted, usually in 3 weeks, the water was decreased until conditioned. The flats would then be picked up and put onto wagons to be placed outside and make room for the next crop. We would usually get three crops per season or 25 plants per square foot annually. It was backbreaking work. In the mornings the staff would place the flats on the ground carefully. By afternoon there could be a 12-inch drop as the flats were "aimed" into location. Another problem was that if all cuttings were not rooted at the same time you would need to skip a plant selection, which meant you could not drive your tractor inside, making for a lot of extra plant moving. It would take us a whole day to empty the polyhouse so that a precious summer day for propagation was lost. We prefilled 1400 4-inch pots per wagon. This became a challenge, as each



Figure 1. The polyhouse with a double poly covering.

house would hold 37,000 liners so we would need 26 trailers per house. At the time we just didn't have that many wagons. After rooting the tops were pruned either by hand with hand shears or we used a hedge trimmer over the top. This sometimes resulted in uneven pruning. The growth in demand for our product meant we had to expedite the whole procedure, make the product more uniform and be ergonomically friendly. We started looking at the greenhouse industry and came to the conclusion that rolling benches were a possible solution.

WHY ROLLING BENCHES?

Rolling benches in and of themselves are interesting but expensive. Really they are part of a system to which different machines can be added when justified by cost. Working with the benches is similar to working with a set of children's building blocks. Today we propagate, by the direct stick method, 2,000,000 4-inch liners in 4 months (April-August). Doing the math this means 500,000 per month or 125,000 per week or 3,000 per hour or 60/min or 1/sec all summer long. I would add that our company does no grafting or seeding, as this is a different production philosophy. Today we fill the pots in shuttle trays using a flat filler. When filled the shuttle trays are placed on cheesecloth on the bench by hand. As each bench is filled it is rolled away and the next one is filled. Benches being filled with flats are shown in Fig. 2. Each bench holds 640 pots. This past spring we had a night shift crew just filling pots. If we ran out of space in the greenhouse we just rolled them outside. Pots used in our own growing operations are sent to a lab and sterilized by radiation. These pots are then filled by hand on a piece rate system.

At the same time, cutting crews are taking cuttings from production plants, not stock beds. Being in a U.S.D.A. Zone 7–8 allows us to do our own potting into larger containers, mostly 2 gal, in December and January, which are usually sold the following spring. So we have these plants for a whole growing season to take cuttings from. There are two reasons for this: (1) the high cost of farmland in our area — \$25,000 U.S.D. per acre and (2) after some time we have built a juvenility factor into our plants. Traditional problem plants such as *Lonicera × bownii* 'Dropmore Scarlet' and *Viburnum cassinoides* are now direct stuck with acceptable results. We try to stick as soon as possible after cutting but we can also store cuttings for 2 to 3 days in our fridges. In the greenhouse the benches are rolled into the desired bay and watered down by the irrigator. This irrigator rides on a twin set of rails and is activated by a number of timers. Holes are then dibbled by finger and the cuttings stuck eight pots from each side. When the bench is finished it is pushed back to the one behind it and the process is repeated on the next bench.

Figure 3 shows the young lady sticking *Potentilla fruticosa* cv., Pink Beauty™ shrubby cinquefoil. After sticking the irrigators make a number of passes per day over the crop until rooting. We are using a computer to control the roof but have not hooked it up to the irrigators. We will probably do this next year. Also we bought irrigators with triple "flip of the wrist nozzles" but this was a waste of money as we use only the large size nozzles. Another issue during sticking is the use of rooting hormones. In B.C. and Washington state masks must be worn when applying rooting hormones for Worker's Compensation regulations. In Oregon this is a non-issue. When the plants are rooted sufficiently to go outside the benches are rolled outside. Figure 4 shows how one person can roll out 100,000 4-inch liners in a couple of hours. If there are some taxa in the line of benches that are not suf-



Figure 2: Benches being filled with flats.



Figure 3. Shows a staffperson sticking potentilla cuttings.

ficiently rooted they can be separated, rolled back in and put outside at a later date. After the plants have been rolled out and sufficiently hardened off the benches are run through a mowing machine to make them a pre-determined height. Two people can easily push enough benches through the mower to do 100,000 4-inch plants in an 8-h day. This machine, made in Denmark, is the Cadillac of mowers. It has a drive wheel to push the benches through, paddles to make the cuttings upright and belt to remove the tops. Some taxa, like *Cornus*, we are still pruning by hand

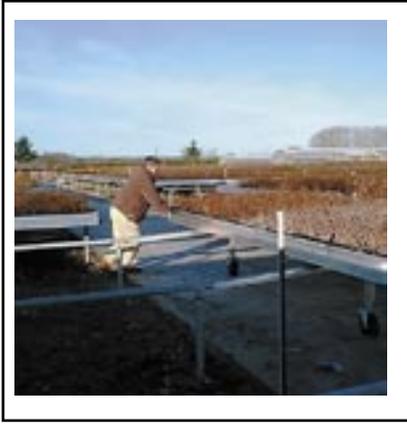


Figure 4. Showing one person rolling out 100,000 4-inch liners.



Figure 5. Benches are rolled to the shipping bay and packaged for shipping.

to prevent disease entry. We used to put herbicides and fertilizers on with a belly spreader. Unless you have a 7-ft giant to do this, the coverage is uneven at best. We have just finished installing a fertilizer and herbicide spreader (Sept. 2004). This was improvised from a number of field applicators. So far this is working very well. For winter protection the plants are put on the ground, or moved inside according to the plant needs and our space availability inside. We have found that leaving plants on the benches with an early fall or late spring frost can be tricky as the air circulation chills the whole plant, not just the top layer.

We have kept track of the hours of a number of tasks in propagation. A somewhat startling result was that more time was needed for shipping than for propagation. Most nurseries tend to dwell on potting up or other beginning activities. As with other activities the ideal is to have all functions done in one area. In our case the benches are rolled to the shipping bay. The boxes are assembled here. The plants are then graded, prepped, and packed here (Fig. 5). Various height boxes are used but each box always holds 25 plants. The boxes are then stacked on pallets and labels attached to each box. Each pallet will hold 800–1200 plants depending on

height. Corner bead and strapping are added to each pallet. After this shipping sheets are attached to each pallet. The pallet is fork lifted onto the semi-trailer with 26 pallets per semi. This way all-empty shuttle trays can be stacked here; all debris is in one area; labels are kept here as well as the boxes and shipping supplies.

The Cost. The cost is fairly expensive but when worked out over a number of liner crops annually it is viable. Also the cost per unit goes down with each step that is mechanized. We are currently working on a detailed cost analysis which I'm sure will be the subject of future discussions.

The Benefits.

- The first benefit is that it is built to human scale and ergonomically correct. This is a very important consideration for keeping long-term employees.

- We can work ahead. We can prefill several hundred thousand pots and utilize them in a matter of hours. We did a crop of 250,000 4-inch vegetables for a regional chain store promo. When the seedlings came we were able to plant them manually in 2 days. We were also able to ship them out in 2 days.
- We have better use of greenhouse space — we roll out half a bay if only half is rooted, before we used to wait until the whole bay was rooted.
- It forces us to standardize everything and makes us plan better to utilize the facilities.
- If financial disaster or a pest like sudden oak death syndrome were to overcome us we could switch the whole system to another crop.
- It has allowed us to increase our numbers greatly with efficiency. We do not have a migrant labor force so we cannot increase production by simply adding bodies.
- At times we may go outside in the rain to load up some benches of a specific variety but most of the time the crew is under cover. A dry camper is happy camper.

ISSUES

Liverwort has become a real problem with such a high density of plants. We are using hydrogen peroxide in the lines inside the greenhouses to good effect. Outside it is still a problem, but our herbicide applicator may help with exactly measured chemicals. We also learned that a number of crops do not propagate well under single poly. We have had to install shade curtains for crops such as *Hydrangea*. We have learned not to propagate 2-inch plugs and 4-inch pots under the same water regime. Because the benches are moved and not all the taxa are besides each other inventory tracking has become a nightmare. We are looking at bedding plant tracking mechanisms.

THE FUTURE

We hope to increase our number to 10 million liners in 5 years. Already available are robotic pot fillers. A step we plan to take fairly soon as part of the system will be a self-unloading soil bunker to feed the soil hopper. This will eliminate one skid steer loader and one part-time position. Energizing the transport lines and using bar codes and scanners will speed movement of the rolling benches. Next will probably be a box stacker. This tends to be a hard job, stacking 25-pound boxes all day. Also on the list is dibbler to punch the holes. This would make sure that the cuttings are stuck at just the right depth and in the center of the pot. It is possible that the dibbler could also squirt a small amount of rooting hormone in the hole. Robotic pot fillers to fill the 4-inch pots will be next. Robotic photo graders to grade the plants for size, quality, and other attributes are also available. These machines are all currently available. I would strongly suggest a visit to the NTV, the world's premiere show on greenhouses and automation equipment, held annually in November in Amsterdam for horticultural mechanization if interested.

CONCLUSION

Without rolling benches we could not have achieved the production numbers we did in the summer softwood time-frame window. This system will allow us to add

automation features as needed. It also allows us to build up a high investment in facilities over time. He who has the most invested per employee will probably win.

Please visit us in person or at our website at <www.vanbelle.com>. I would be happy to answer any emails or telephone calls.

New Ideas from J.C. Bakker & Sons Nursery®

John Bakker III

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Before I start, I would like to bring greetings from Gerry Dehaan who was supposed to be bringing this presentation. Gerry this year is celebrating his 20th anniversary and promised to take his wife Joyce somewhere special. Gerry had I.P.P.S. in mind but it didn't fly with Joyce. Some guys have got to get their priorities straight.

At any rate it is good to be here. In this talk I would like to briefly share with you just a few of the things that are happening at Bakker Nurseries these days. Many of the new ideas I will touch on, are not really new, but are simply improvements on old ideas. The first topic, a portable water source, is something we have had around for many years. It is a piece of equipment that gets used a lot and we felt there was room for some improvements. Our old water wagon worked well but was getting tired. So it was time to build new. I would like to go over some of the features on this new system. The most outstanding feature on this unit is the mechanical watering boom (Fig. 1). This boom, along with all other controls, is operated by one person as opposed to two on the earlier model. The watering boom is retractable and can be raised and lowered for different applications. We use the system to spot water small areas instead of running irrigation, or in areas where no irrigation is set up, such as in the fields and on the loading docks. Other interesting features of this piece of equipment include carry-on hoses for coupling to irrigation, an internal venturatype agitation for mixing additives to the water, various hand-held nozzles, and a lockable storage compartment. This unit is powered by a Kubota diesel engine and is also completely self draining for frost protection in cold weather.

Speaking of cold weather, my next topic is on snow load protection for conifers. In our field production of evergreens we are often faced with heavy snow and ice loads



Figure 1. Mechanical watering boom.