

## Mechanisation of the Tubing Operation in a Commercial Propagation Nursery

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Commercial tube production is a relatively labour intensive operation when compared to production in general nursery containers. This is due mainly to the fact that a very large number of units need to be produced to be economically viable. Although trays and pallets are used to convey tubes through the nursery *en masse*, there are several stages at which each unit needs to be handled individually—the cutting/dibbling stage, the tubing stage, and possibly grading for sale.

This paper details our efforts as a specialist tube nursery to mechanise the tubing stage, using a potting machine. We were aiming to achieve several objectives:

- 1) To increase the production output per person.
- 2) To decrease the time allocated to potting.
- 3) Achieve these goals with unskilled labour.

There are several potting machines available, each slightly different in its operation. We looked at two machines, the Javo and the Tolley Plantmaster.

The Javo, as is the case with most potting machines, overfills the empty container with mix, brushes it level, then drills the required size hole in which to place the plant.

The Tolley Plantmaster uses a different method of operation. The cutting is planted at the same time that the container is being vibrated and filled with potting mix.

We found the Tolley Plantmaster method better suited to our application of filling small containers, such as 50 mm and 75 mm tubes, and this is the potting machine we acquired. It was also necessary to purchase a bulk feed hopper as the Plantmaster has no mix storage capacity.

### **METHODS**

We operate our machine using two operators and the work table is timed to index every 2.8 seconds. At the first station the operator places an empty tube into one of the four pot holders with his/her right hand. The container then moves on to the second station where the planting operator holds a cutting in the empty tube while it is being filled with mix from the funnel head. The second operator usually removes the cutting plugs from the cell trays with the left hand while the right hand is doing the planting. As the left hand has the quicker of the two operations, it is possible to build up a reserve of cuttings in the left hand and this gives the operator time to grade out any dead or poor cuttings but always having a supply to feed to the right hand doing the planting. Initially most operators attempt the complete operation with one hand. If, however, they select a cutting with no roots, there is insufficient time to select another and place it in the tube before it is filled with mix. The planted tube then moves on to station 1 again where the first operator removes the planted tube with the left hand and places an empty tube in the holder with the right hand.

The planted tubes are packed into a wire tray that holds 100 tubes. We have a bench which holds two of these trays at an angle of 30° to help prevent the tubes from spilling over. Once the trays are full, they are placed on a motorised barrow which is fitted with a pallet designed to hold ten wire baskets. When the pallet is full, the potting machine is switched off and the plants are taken to where they are to be grown-on. Each tray is then individually placed into rows on a gravel growing bed and the empty pallet is returned to the machine to be refilled. The newly potted tubes are watered-in.

## RESULTS

Increased production output per person was not easy to achieve. In the initial stages we were striking cuttings in community pots or trays and much time was spent knocking out these cuttings before planting on the machine could commence. Also, trying to plant at high speed with a bare-rooted cutting can be difficult and a lot of misses result.

After trials using paper pots and various cell tray systems, we found the 198 cell Growing Systems Tray to be the most suitable for our production system. Once the cuttings have rooted, the trays are 'popped' on a peg board and this makes removal of the plugs quick and easy. The compact root plug is very easy to plant at high speed. Production output increased as a result.

We found that an 8 hour potting day was tiring and became monotonous day after day. Good potting rates were achieved early in the day but the rate dropped off as the day progressed. After trying various ways to improve, we finally settled on our current system of operation. We now have a maximum 4-hour shift for any two operators in one day. Approximately 3 1/2 hours in the 4-hour shift is available for potting.

At the start of the shift one operator assembles a supply of tubes and trays and also barrows out the cuttings to be tubed and 'pops' them on the peg board. The other operator makes 1/2 cubic meter of mix in the soil mixer and places it in the bulk feed hopper. For the system to work, it is important that all of the mix is used during the shift, allowing for any following shifts to duplicate the operation. We use various mixes for different plants and the operation is disrupted if a mix needs to be made part way through a shift.

We tube approximately 3,200 tubes per mix in a 4-hour shift. Using this system, it is possible to produce approximately 6,500 tubes in an 8-hour day for two people i.e. 16-man hours. This rate effectively doubled what we were achieving with the average person tubing by hand and improved by 1,500 to 2,000 tubes on what we had been achieving on average on the potting machine previously. This system therefore allows for a large number of units to be potted in peak periods by working additional shifts. It allows us to rotate staff around their various jobs to eliminate the problems associated with employing and training staff for short seasonal peaks.

We have been moderately successful in achieving these results with relatively unskilled labour. A completely unskilled operator can master the first station where the tubes are placed on and off the machine and be up to full speed within a few hours. The planting operation, however, appears much more difficult and we have found only the most proficient staff in the nursery are able to perfect the

technique. The operator needs to develop more skills to plant on the machine than would be needed for hand tubing.

## **CONCLUSIONS**

We found repairs and maintenance costs were negligible when compared to the number of units produced. The major wearing parts are the elevator chain, sprockets, and bearings with a total replacement cost in parts of around \$400.00. All are readily obtainable.

At faster potting speeds it is easy to plant cuttings too deep or too shallow or at an angle. A standard of quality needs to be set and must be monitored closely to ensure the level of quality required is being maintained. At higher speeds the machine tends to whip soil out of the tubes as they index to the next station and this needs to be adjusted for with mix levels in the machine and also moisture content of the mix. The planting operator controls these factors and this is where experience and technique are required to perform the operation satisfactorily, and to maintain quality.

Probably the most important thing to realise is that the potting machine is only one part of the overall potting production system and a continuous work flow can only be achieved if the supply of materials both to and from the machine is adequate.

The machine sets the pace in the potting system and forward planning to ensure that sufficient potting mix, pots, cutting plugs and growing area are available is essential if delays are to be avoided. The process of integrating a potting machine into an individual nursery situation may take months or even years of changing methods before maximum efficiency is obtained.

We have a number of planned modifications to further improve efficiency. It is our intention in the future to palletise the operation by lowering a completed pallet of 10 wire trays onto the growing bed and then pot onto additional pallets. We are also experimenting with various cell trays in an effort to improve or eliminate our existing 'popping' operation; use of conveyors would further assist material supply.

Improved efficiency in the use of potting time and labour can be achieved by mechanising the tubing operation. However, the potting machine is only one part of the overall system. Other nurseries need to examine their individual operations to assess the viability of installing a potting machine.