MECHANISATION OF OPERATIONS IN OPEN-GROUND GROWING

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It has been obvious in recent years that the trend towards indoor-growing of plants is progressing at an ever increasing pace. With well over 90% of the population in city areas this is the obvious market, and to avoid transport costs, and with increasing prices for land in these areas, intensive cultural arrangements are an obvious move. There still exists however, a considerable need and, in fact, a demand for the production of open-ground nursery stock, particularly for fruit-growers.

I would like to address my remarks particularly towards the production of trees for commercial growers. Some of the problems faced by all nurserymen are spiralling costs of labour, lack of suitable labour, and control of this essential element in production in open-ground situations. Our nursery reached a cross-roads a few years ago in making decisions for determining our future directions of operation. One of the first steps we took was to analyse the use to which we put our labour and facilities and to assess the results of this input on an annual basis. This involved the breaking down of almost every component in the production of a tree. I might take as an example the production of citrus trees and the time taken to produce them for commercial sale.

We analysed the various steps required to produce seedlings during the first year. We did the same for the second year in preparing lining-out stock for budding, and finally broke down the work necessary to get the budding done and have the trees ready for delivery to the grower. In this way it was possible to find where the major costs of each operation were.

This analysis not only highlighted the necessity for replacing labour units with mechanical alternatives, but determined the degree that such action might be taken to yield the best return. It is often easy to mechanise 5 cents of a $1 operation, but the capitalisation in this case may well exceed the labour saving.

Seed Extraction Mechanisation. The most tedious and time-consuming process of seed extraction from the fruit has been mechanised by the development of a twin-headed version of the well-known Mixmaster. Power comes from a small electric motor through a steering gearbox and the pulp and seed reamed out from the halved fruits is retained on a screen and ultimately separated on a specific gravity basis, using large amounts of water. All residue is handled in bulk hoppers by forklift, and it is possible to process quite large quantities of seed quickly and cleanly.

It is difficult to put a time-saving on the operation since it is some years since we made the change, but suffice to say that the change was made because of the appreciation that much larger volumes of fruit would need to be handled, and a better way had to be evolved.

Seed Planting Mechanisation. One example where we found considerable saving was in the placement of seed in seed beds. Costing indicated that this was the most expensive area during the first year's operation, and this precipitated the development of a semi-automated 3-part unit, which made provision for seed in a shallow flexible tray, use of a portable vacuum tube to suck up seed over the width of a 3' bed, and the automatic provision and levelling of white sand to follow this operation and complete the job. This cut 75% off the cost of the job in time, the outlay in capital was purely nominal, since the equipment made was from scrap parts and involved no great time in construction.

Seedling Digging Mechanisation. Another aspect of seedling production was the high cost of seedling removal from the beds. A special blade was made to cut each bed at a 7'' depth, loosening the soil in the process, and facilitating fast removal of the seedlings for grading. A winch was used to pull the blade; I shall describe that in a later section. We estimated a 60% saving in time for this particular operation. Basically we found it was not possible to speed up any of the other component parts in seedling production and gain a significant saving sufficient to justify the expense involved.

Seedling Planting Mechanisation. All our operations are handled on a 2-row basis for planting, cultivating and spraying — rows being 3' apart. One of the biggest problems we had to contend with was the accuracy of root placement to avoid bench-roots, and to maintain an even spacing. Even today current model tractors are normally not slow enough in their lowest gear to allow a single operator the time to plant seedlings on an 8-10'' spacing without being pushed. We have achieved 2-row planting using one operator on each row, by using the winch I referred to earlier as the power-source; this has proved an exceptionally easy job to match the speed of planting with the persons operating the unit and adds to the versatility of one of our most expensive capital items in the nursery.

The planter consists of 2 V-sections or flaps, 30'' long, 12'' deep, and about 1½'' apart. They look very much like a very narrow bow on a ship; 2 pneumatic wheelbarrow tyres, which are adjustable, follow behind the delving unit, and the operators' seats are mounted directly over these wheels. Using adjustable footrests the operator can comfortably place the seedling into the beginning of the V, and he will feel the pressure as the tyres grip the seedling, before he places the next seedling into the slot.

Water is carried on the unit, and the slot is continually flooded so that at no stage do the roots get a chance to dry out. We have found this is probably the most important aspect of planting since no amount of watering after the planting is done seems to have the same result. Simple semi-circular troughs are provided in front of the operators where they can continue to replenish their seedling supply without interruption to their rhythmic planting pattern.

Seedling Root-Wrenching. One of the most significant and important jobs we now do, as a matter of course, is root-wrenching. Prior to the development of the winch and specialised cutters it was not possible to adequately or precisely root-wrench and, consequently, it was never done satisfactorily. Also some stocks were always considered difficult in developing a suitable fibre during the time of growing.

Prior to spring, and a year after planting out, we root-wrench at 12'' depth by running a U-shaped blade in a very flat position under every row. Since the seedlings were cut in the seedbed at 7'', forcing fibre-roots close to the surface, this cutting at 12'' further discourages the development of long stringy roots, and the forcing of high-density fibre-root is already well under way. This will ultimately be useful during the planting-out stage a year later.

Open-ground growers in this audience will appreciate that the highest labour input from now on in preparing seedlings for budding, and growing them to maturity, becomes the critical factor in profitability.

Mechanical Nursery Machine. We have recently developed a self-propelled 4-wheel machine approximately 10' long, designed to straddle a pair of rows which are 3' apart. Sufficient clearance is available to straddle fully-grown trees up to 6' high. Provision is made for 4 operators (2 to each side) to sit, squat, bend or lay on platforms, an inch to two off the ground, which are supported on each side between the wheels. Speed of the machine is infinitely variable from 6'-20' per minute to cope with the many operations required in trimming, budding, tying, staking etc.

A canopy is provided to make conditions pleasant during the hot summer months when activity is at a peak and transistor radios and water bottles travel with the workers. The canopy also helps in the winter to protect from wind and rain. Employees are very happy with the arrangement, since it almost eliminates the normal fatigue experienced in getting up and down, up and down, hour after hour, along rows.

Cost to date of the machine has been a little under $1000 but this is spread over the production of between 40,000 to 60,000 trees per year.

I should point out that there have been dramatic savings in times for individual operations. It is possible to halve the time rubbing off shoots, and halve the time fitting aluminum seedling guards, and it certainly halves the time for budding.

Tree-sales digging mechanisation. Prior to the development of the winch it was considered that two men could dig trees at a regular rate of somewhere between 400-800 per day, and it was certainly the hardest job in the nursery. Probably this provided the greatest incentive to look for a better way. The winch is tractor-powered, and therefore quite mobile. It consists of twin drums driven through a 5-ton truck differential; 1'' cables are turned around pulleys beneath the tractor on an 18'' spacing, and are rolled out by various means, on each side of the row to be dug. The cables are connected to a simple framework which supports a solid duraflex steel U-blade, capable of cutting to a depth of 22''. It is 18'' wide.

The angle of the cut is infinitely variable, as is the depth, depending on the size of trees for use, as I mentioned earlier, in the shallower process of root-wrenching. Speed of cutting is adjusted by the incorporation of a 4-speed gear box and by varying the tractor engine revolutions. It is quite common to prepare trees at the rate of 4000-5000 per hour, using a 3-man team, and with no hard physical work whatsoever.

Row lengths that can be handled currently are up to 450'. It is standard practise to leave a gap in nursery rows, and make them 900' long, and cut from both ends. Other than drum size there is no real limit to length of rows that could be cut. A brake is attached to each cable drum, and the direction of the cutting unit is controlled quite precisely by the tractor operator at the direction of one of the 3-man team, who follow the cutter along the rows. The use of fork-lifts, bulk bins and hoppers, as an integral part of materials handling is now commonplace; there is no need for me to elaborate on the versatility of such systems.

I hope some of the comments I have made stimulate you to continue the need to evaluate better ways of doing familiar jobs. I am never impressed by nurserymen who stick to their own fields on the basis that they will learn more this way, than looking in an entirely different field. This in itself shows a tendency towards a closed mind and, perhaps, this may well spell the differences in a nurseryman's future, by his attitude towards new ideas, or the interpretation of an idea which can be converted to his direct use. No person or one area contains all the right ideas; it is the very essence of change, and the acceptance of this which separates the successful nurseryman from the static one.