Hot Callus Grafting©

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Hot callus grafting is a technique where the graft union is resting on or against hot pipes or heating cables to help increase the take of a union. We started using this technique 2 years ago to help improve the grafting take on certain varieties.

A trough-like structure was made from 1 × 6 inch-boards and 1 × 1 inch-strips, nailed to the edge.

Recycled carpet padding was then used to line the inside and top of the trough.

Three-quarter-inch copper pipe was soldered together and placed inside the trough on top of the carpet padding. Grafted plants were then laid down across the copper pipes and covered with more carpet padding. One inch x six inch-boards were then placed on top to hold the padding in place and to retain heat.

The carpet padding helped to insulate the copper pipes and kept them at a constant temperature. Hot water was provided by a small 1000-watt heating element, inside a 5-gal bucket and a submersible fountain pump, pumps the water through the copper pipe and back into the bucket. A thermostat was used to keep the water between 80 to 85 ºF. The heating element ran on 110 volts.

Thermometers were placed along the length of the structure to monitor the temperature which stayed fairly constant at around 80 ºF.

The plants were left on the callusing tubes for approximately 2 weeks and then moved to a heated greenhouse.

Hand Planting Versus Mechanical Planting©

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After planting seed by hand for 5 weeks at a 5-inch spacing one starts to ponder the statement, "there must be a better way." That was the statement that led to the pursuit of finding a faster and more efficient way to plant seeds in a commercial nursery.

INTRODUCTION

Field-grown commercial nursery stock mainly starts from seed. The Burchell Nursery located in Oakdale, California, is no exception. With an annual production of over 2 million fruit and nut trees for commercial orchards the Burchell Nursery is one of the largest deciduous bare-root tree nurseries in California.

Like many other field-grown nursery crops, trees are started from seeds that are planted in the fall. It takes over 3 million seeds to plant 120 acres of nursery stock. After that seed is planted, it germinates in the spring and is later grafted in June to the desired variety.

With over 3 million seeds to plant each year and the cost of labor increasing all the time, a project was started to look for a more efficient way to plant seed. Several problems were encountered along the way such as the size of the seed was too large for conventional seed machines. The spacing of the seeds was such that just dropping them would be too far apart leaving unnecessary gaps in the field row. These were just some of the problems that faced the Burchell Nursery when the project of developing a mechanical planter began.

MATERIALS AND METHODS

First, a delivery system had to be found that would separate the seeds individually and drop them at a spacing of $2 \times 2^1/_2$ inches. This was really precise and eventually found to be impractical.

What was out there that could accomplish at least some of our objective? A garlic seed planter was found to be very close to fitting the objective. A garlic planter makes use of "spoons" to individually pick up seeds out of a hopper. The seeds are gravity fed into the spoon pick up area where the seeds are scooped up by the individual spoon. The seeds are then dumped into a shoot that leads to the planting site at ground level. While one spoon picking up seeds moved too slow, three spoons picking up seeds out of the same gravity-fed hopper increased the frequency at which the seeds were deposited to the planting site. Once the seeds were picked up by the spoons and dropped down one of three shoots to the ground, a blade at the back of the machine covered the seed. The machine was then expanded to include three hoppers and nine spoons and shoots to plant three rows at a time. The drive wheel for the planting machine was driven by a ground wheel next to the spoon planter so the planter would speed up or slow down according to how fast or slow the tractor pulling the planter moved across the field. The faster the tractor pulled, the faster the seeds were planted.

The mechanical planter still required a person to stand on the machine and make sure the seeds didn't get stuck in the spoons and the seeds were flowing well through the hopper and the delivery tubes. It also required a person to walk along and check the three rows being planted for any skips. A medium-sized tractor pulls the planter so a driver is required.

With the modification to the garlic planter, the spoons could easily pick up one seed at a time. The delivery tubes had to be made larger to accommodate the larger seeds. The soil had to be well worked so that soil clods would not interfere with the planting.

RESULTS

Compared to hand planting, the mechanical planter worked faster and more efficient than hand planting (Table 1). Hand planting used 12 people to plant $2^1/_2$ acres per day at a cost of $116.22 per acre. Hand planting used 3.24 million seeds to plant 120 acres. Mechanical planting used four people to plant almost $4^1/_2$ acres per day at a cost of $35.05 per acre. Mechanical planting used 2.4 million seeds to plant 120 acres. In total for 120 acres of field-planted seed, hand planting costs $13,946.40 and took 48 days. Mechanical planting cost $4,206.00

Table 1. Comparison of hand-planting versus mechanical-planting 120 acres.

	Hand	Machine	Difference
Days	48	27.5	20.5
Cost	$13,946	$4,206	$9,740
Amount of seed	3,240,000	2,400,000	840,000
Return on investment			3.08 years

and took 27.5 days. With a savings of over 20 days of labor to plant the seed per year and a cost savings of $9,740 per year it was estimated that a return on investment could be just over 3 years. That is based on the cost of the machine, which was approximately $30,000.

There was also a substantial savings on the amount of seed that was planted. The seeds cost about $0.02 each to harvest and prepare for planting. By planting 840,000 fewer seeds a year that saved about $16,800 in seed costs.

DISCUSSION

Most of the objectives of this project were met with the development of the mechanical planter. The number of people needed was reduced from twelve to four and the time to plant was reduced from 48 days to 27. With this kind of a savings, the project was paid off in 3 years. Each year as the mechanical planter is used there are small changes and modifications. The soil varies from year to year and it warrants adjustments. In all, the mechanical planter was a successful project and is still being used today at a substantial savings.