Pine Ridge Forest Nursery Container Filling and Seeding System[1]

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Abstract.--Describes four major programs at Pine Ridge Forest Nursery in Alberta, Canada, including: seed program, container seedling production, bare-root seedlings operation, and research and investigation program.

INTRODUCTION

Pine Ridge Forest Nursery is one of the new developments of the Alberta Forest Service (Department of Energy and Natural Resources) and located about 90 miles northeast of Edmonton (provincial capital of Alberta). Nursery operation started in the fall of 1977 for bare-root seeding and spring 1978 for container program. The construction of 20 greenhouses *(42 by* 180 feet) started in the summer of 1977 and was completed in 6 months.

In order to meet the increasing demand for seedlings and seed for reforestation, this nursery facility was designed to grow 10 million conventional seedlings (bare-root) and 10 million container seedlings annually, and also to process 50,000 bushels of spruce and pine cones annually. We grow the 10 million container seedlings with 20 greenhouses in a 1-crop system other than with fewer greenhouses in a 2- or 3-crop system, as it is more economical in the overhead cost and also allows us adequate time for the hardening off in our northern weather.

There are four major functions designed for Pine Ridge Forest Nursery. They are:

1. Seed program.--Seed extraction, seed cleaning, seed testing, and seed storage.

2. Container seedling production.-Filling and seeding operation and shadeframe operation (first crop 1978).

3. Bare-root seedlings operation.-Seeding operation, tending operation, and harvest operation (first crop 1981).

4. Research and investigation program.--Seedling quality monitoring, fertilization study, soil study, pesticide study, and cover or rotation crop study, etc.

In the production of 10 million container stock in a one-crop-per-year system and in order to allow the crop to be outplanted in the fall of the same year with equivalent period of acclimatization under the shadeframes, it is imperative to establish an efficient filling and seeding system in order to have all greenhouses operational in a short period of time without a sacrifice of quality for quantity. The time that can be saved from efficient filling and seeding can also allow us to make better use of manpower for the thinning operation. The designed growing capacity of each greenhouse is 500,000 seedlings with the maximum being 600,000 seedlings.

The operation and equipment required for our filling and seeding is in a continuous flow system. Up to now there was no equipment and system available in the market for the continuous filling and seeding of 1,000,000 cavities per day of Spencer-Lemaire 2.5 cubic inch containers. Therefore it was necessary to develop our own equipment and procedures. As a matter of fact, the equipment and procedures we used were in many circumstances a direct result from staff innovation and modification during actual operation.

We would like to share with you the way we handle this filling and seeding operation and the experience we gained from this interesting procedure.

PRODUCTION METHOD

Materials used in the filling and seeding line are:

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Trays.--Spencer-Lemaire rootrainers with a capacity of 2.5 cubic inches, consisting of a holding tray and 17 folding fillers. Each filler has 6 civities giving 102 cells per tray.

Growing medium.--Sphagnum peat moss and vermiculite (#2 agricultural) mixed at a ratio of 2 to I in terms of peat moss to vermiculite.

CONTINUOUS FLOW SYSTEM

Step 1.--Pre-Mix

The process starts with a 6 cubic yard dry mix hopper. The growing medium is premixed dry. This is held until the main mixer is empty. Two people required.

Step 2.--Main Mixer

The dry mix is transferred by an elevator from the premixer hopper to the main mixing hopper. At this point the desired amount of water and other additives are added. Water is added to make the peat moist, but there can be no free moisture if squeezed. pH is adjusted at this time and a surfacant may be added. We don't add any surfacant if the peat being used is already a little moist.

Step 3.--Holding Hoppers

It is at this point in the filling and seeding line that the process is split into two separate lines. The growing medium is transferred by a 2-way lateral conveyor to two 5-cubic-year holding bins. In these bins there is an agitator which consists of a single shaft with arms mounted every 18 to 24 inches. This prevents the medium from cavitating and locking up in the bins. On the front of the bin is an adjustable door which regulates the amount of peat moss being dropped on top of the trays. Just prior to dropping onto the trays, the peat moss is put through a coarse brush which breaks up any large lumps and allows the peat to be shaken into the cells easier.

Step 4.--Tray Placement

The trays are fed onto a continuous chain feed which travels from the back of the holding bin all the way through to the second conveyor which carries the trays to where they are palletized. Every tray is checked to ensure that they are properly put together and then placed on the feeder chain.

It is important that as they are placed on the chain that the lip of the tray behind is put under the lip of the one in front. The reason for this is that the weight of the one in front holds the following one down. Four people required.

Step 5.--Vibration Table

We are using high-frequency vibrators to shake down into the cells. Two people are required to brush the growing medium around to ensure that every cell is filled. Trays remain on this table for approximately 30 seconds. This depends on the speed of the line which can be adjusted from 0 to 28 trays a minute. We have found that 18 trays a minute gives the best results on the vibrator table. If you slow down from that point, the medium tends to start spilling out of the cell and if you speed it up beyond that point the trays do not remain on the vibrator table long enough to get the growing medium to a reasonable density in the cells. Four people required.

Step 6.--Sweeper

Just as the trays leave the vibrator table, a sweeper brush removes the excess medium. This excess growing medium is gathered and returned by a return elevator to the holding bin.

Step 7.--Rotary Packer

To create a desirable compression and a slight depression for the seeds to sit in, the use of a packing machine was developed. This packer is timed to the feeder chain and creates a depression in each cell about one-half inch deep. Four people required.

Step 8.--Seeder

Vancouver's Bio Machines vacuum seeders are used in our seeding line. They have inter-changeable heads and we use 2, 3, or 4 seeds per cavity heads depending on seed quality and purity. When our new seed-cleaning plant comes on stream we hope we will be mainly using the 2 seeds per cavity head. The seeding machine rotates and is activated by a photocell. Vacuum picks up the seed and holds it in place until the seed is directly over the cell, valve shuts off to drop the seeds into the cavity, and then a small amount of compressed air cleans or purges the tiny holes. Two people required.

The speed of the whole filling and seeding line is controlled from this point.

Step 9.--Gritter

This is also activated by a photocell. This was done in order to save on the amount

being wasted when there was a break in the line. We are using granite grit, grade #1 to hold the seed in place during the germination period.

Gritter was developed from a lawn fertilizer. We had to put augers on the ends of the distribution shaft to move grit away from the bearings. Then a quantity breakdown had to be developed so that only a small amount of grit flowed over the distribution shaft.

Step 10.--Palletize

As the trays come off the filling-seeding line, they are placed in pallets. Each pallet holds 16 trays. The pallets are stacked six high and then carried by forklift or wagon to the greenhouse. Four people required.

Each side of the production line is processing 18 trays a minute. This means that each side can produce 7,120 trays each day if there are no breakdowns or other holdups such as seedlot changes. This gives a total line capacity of 1,424,000 cavities per day. The maximum we have achieved is 1.2 million in I day. Our goal was to maintain a production of 1 million cells per day

for 10 days. This year we filled and seeded 12 million in 13-1/2 days.

Summary of Manpower Requirements

Premix	- 2 people
Shakertable	- 4 people
Packer	- 4 people
Seeder	- 2 people
Palletizing	- 4 people
Forklifts	- 2 people
Greenhouses	- 7 people
Trays	- 4 people
Supplies	- 2 people
Cleanup	- 2 people
TOTAL	33 people

When this is worked out to number of cells per manday, it is 27,385 or better than one tray per minute per person.

In conclusion, we feel we have reached our desired goal in production. There are a few minor changes we will be making to this line to improve quality instead of increasing quantity. This goal has been reached through the cooperation and information given by other nurseries from all across North America.