ALBERTA'S APPROACH TO CONTAINERIZED SEEDLING HANDLING

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Abstract.--The Alberta Forest Service has developed a system of handling Spencer-Lemaire containerized seedlings which is both efficient and economical. Details of nursery, transportation, and planting site handling with this modern, palletized system are discussed.

Résumé.--Le Service des forêts de l'Alberta a mis au point un dispositif pour manutentionner de façon efficace et économique les plants en contenants Spencer-Lemaire. Les détails de la manutention en pépinières, sur les lieux de la plantation et en transit avec ce système palettisé moderne font l'objet d'une discussion.

INTRODUCTION

The purpose of this paper is to describe the containerized seedling handling system used by the Alberta Forest Service in its reforestation program. Information is presented on three distinct phases involved in growing and planting containerized seedlings.

1. Production - includes all handling practices at the nursery during seedling growth and storage.

2. Transportation - includes all handling involved in moving containerized seedlings from nursery to planting site.

3. Planting - includes all handling practices at the planting site.

A brief description of the nursery facility and the container system used is essential for an understanding of the containerized seedling handling system.

The Pine Ridge Forest Nursery, located 19 km east of Smoky Lake, Alberta, is one of the largest, most modern forest tree nurseries in North America. The nursery was designed for four major activities:

1) seed extraction, cleaning and storage

2) containerized seedling production

3) bare-root seedling production

4) research and investigations program.

This paper will consider only the container production program, which is currently capable of producing 10 million seedlings per crop.

The nursery employs the Spencer-Lemaire (Ferdinand) Container System manufactured by Spencer-Lemaire Industries Limited, an Edmonton-based company. The basic unit of this container system is the folding book planter. It is a vacuum-formed plastic sheet containing both halves of the container. When folded, the sheet forms rectangular cavities with open bottoms. Each folding book planter forms six cavities. Each 10-cm-deep cavity, measuring 3 cm x 2 cm, is capable of accommodating 41.0 cm^3 of growing medium. Seventeen books, forming 102 cavities, are held in a tray measuring 22 cm x 37 cm. The uniformity and inherent strength of this system facilitate mechanization of seedling production, transportation and distribution in the field.

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PRODUCTION PHASE

Pine Ridge Forest Nursery's container seedling program utilizes both used and new containers. Used containers arrive at the nursery assembled. Before the containers are sent to the filling and seeding line, all broken components are replaced; then the containers are thoroughly washed and disinfected. The container washing machine consists of a chain conveyer carrying the containers through a pressurized water wash followed by a spray of dilute commercial bleach (disinfectant). New containers arrive at the nursery unassembled. Before filling and seeding, the containers are assembled by local residents on a piecework basis.

The filling and seeding line is designed as a continuous flow system. When the nursery was built, machinery that could fill and seed one million cavities per day was not available commercially. Therefore, it was necessary to construct the entire filling and seeding line for this particular container. The design, fabrication, and development of this production line has cost $141,000 to date.

Production starts with mixing of the growing medium which is composed of peat moss and vermiculite in a 2 to 1 ratio. First the peat moss and vermiculite are blended dry in a 4.6 m^3 hopper, then the blend is transferred to a wet mixer where water (approximately 160 L/m^3) and other additives (for wetting purposes or pH adjustment) are incorporated into the mix. When the proper moisture content is reached, the mixture is moved into the two holding hoppers located directly above the conveyor belts which transport the assembled trays through the filling, tamping, seeding and gritting operation in a continuous motion (Fig. 1). Each holding hopper is equipped with a vibrating agitator which prevents the medium from bridging and lodging in the hopper. The growing medium passes through an adjustable gate onto a reciprocating coarse sieve located at the bottom of the holding hoppers (used for removing unwanted debris and breaking up lumps) and then into the tray moving over the vibrating table. Here a worker brushes any surplus growing medium evenly over the tray of containers to ensure even filling of all cavities. As the tray leaves the vibrating table a revolving brush removes any excess medium and returns it to the holding hopper. The tray then moves under a pneumatic packer where the growth medium in the cavities is compressed to a uniform density. Once the growth medium is compressed, the tray proceeds through a drum-type vacuum seeder capable of sowing 2, 3 or 4 seeds per cavity on demand. The tray then moves through the gritter where grit is applied over the cavities to hold the seed in place during germination.The trays are then taken off the filling and seeding line and placed in specially designed plastic pallets, each of which holds 16 trays (1632 trees). Once filled, the pallets are stacked five high and forwarded by forklift or wagon to one of 20 greenhouses where the pallets are unstacked and placed on elevated wheeled dollies, each holding one pallet. The pallets remain on the dollies during the 12- to 17-week greenhouse growing period, after which they are moved to shade frames where the trees are hardened off and/or stored over winter. This completes the production phase of the containerized seedling handling process.

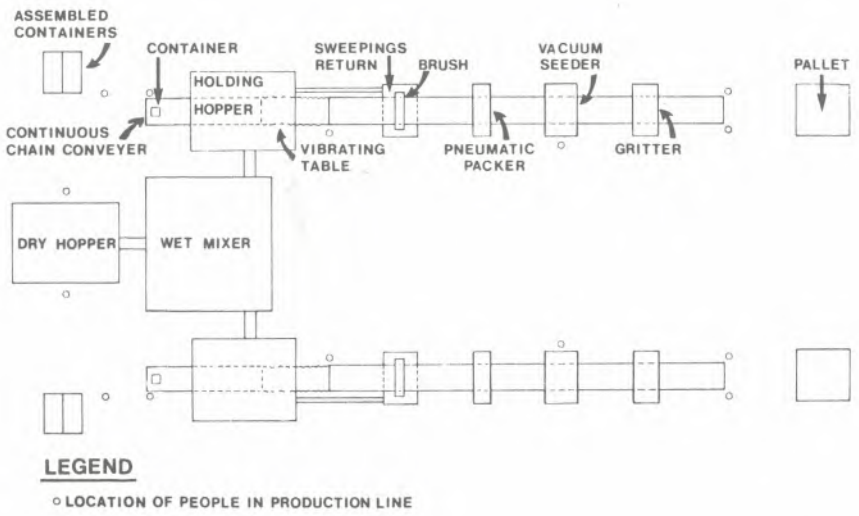

Figure 1. Pine Ridge Forest Nursery Container Production Line

TRANSPORTATION PHASE

Transportation handling involves the movement of palletized trees from nursery to planting site. This is achieved by the use of one of two specially modified cattle liners 15.25 m long, each capable of hauling 250,000 trees per load. The pallets are stacked seven high, loaded onto the trailer deck and moved into position by means of a pallet jack. The last four rows of pallet stacks placed in the trailer are strapped together to prevent movement during the trip to the field.

Upon arrival in the field the pallets are unloaded by one of two systems:

1) the reverse of the loading procedure used at the nursery

2) a swivelling crane on the hydraulic tailgate of the trailer.

If the access permits, pallets are unloaded at a central storage area at or near the planting site. However, in most cases poor access does not permit movement of semi-trailers onto the planting site. In such cases the pallets are unloaded as close to the planting site as possible. Tree planting in Alberta is done primarily on a contract basis. Movement and care of the seedlings after they have been unloaded from the semi-trailers is generally the responsibility of the planting contractor.

As trees are required in the more poorly accessed areas, they are moved to central locations within the planting site by all-terrain vehicles (ATVs) and/or helicopters. In the case of ATVs, the pallets are stacked, tarped, strapped and loaded onto the deck of these vehicles and are forwarded to the planting site. The size and type of the vehicle dictate the number of trees that make up a load. With helicopters, pallet slings designed and built by the Alberta Forest Service are used. These are designed for a helicopter with a 540 kg minimum sling capacity. The sling is assembled around the bottom pallet in a stack of seven pallets. Cables run the height of the pallet stack on all four sides, then through an adjustable top clamp which holds the stack together, and finally to the cargo hook of the helicopter. Each sling kit consists of three complete slings. This is to ensure continuous loading and unloading of pallets, thereby minimizing non-productive flight time. Once the trees have been centrally located within the planting site they are forwarded, usually with ATVs, to seedling cache sites within the blocks scheduled for planting. This completes the transportation phase of the containerized seedling handling process.

PLANTING PHASE

The movement of trees within the planting site is usually by one of two methods. The method most commonly used in Alberta is one in which the trees are removed from the Spencer-Lemaire containers at the seedling cache sites and placed in bare-root planting bags. From this point on, the seedlings are handled as bare-root stock. In the second method individual seedling trays are transported by the planters in wire-framed carriers. With this method the trees remain in the containers right up to the moment of planting.

Once planting has been completed all containers and pallets are returned to the nursery for re-use. This is done in reverse of the handling system used for getting the seedlings to the planting blocks.

Costs incurred during the production and transportation phases up to the unloading of the semi-trailers at the planting site are presented in Table 1. Further costs are borne by the tree planting contractor: the Alberta Forest Service does not have information about these costs.

Table 1. Containerized seedling production and transportation costs

Materials	Total spent ($)	Cost/'000 ($)	
A. Production phase[a]			
Trays	17,486.66	1.543	1/3 of purchase cost (3-yr life)
Filler books	135,954.86	12.000	7.2 /6 cavities
Propane for CO_2	550.10	0.048	
Grit, fertilizer, peat moss, vermiculite, other chem., and materials	25,067.97	2.213	
Misc. small equipment	5,946.23	0.525	
	185,005.82	16.329	
Labor			
Seeding	14,529.77	1.282	
Moving trays	7,337.85	0.648	
Thinning	53,205.08	4.696	
Crop maintenance	21,882.09	1.931	
Crop protection	7,438.33	0.656	
Container handling	6,864.44	0.606	
Tray assembly	11,993.70	1.059	
Misc. labor	36,082.74	3.185	
Benefits - labor	25,239.00	2.228	
	184,573.00	16.291	
Government service charges			
Natural gas (heating)	40,423.78	3.568	
Power, water + maintenance of facilities	107,695.73	9.505	
	148,119.51	13.073	
Depreciation			
Equipment (pallets, dollies, etc.)	57,302.04	5.057	7-yr use, 15% residual
Greenhouses	153,233.53	13.525	$4,597,006 ÷ 30 yr
Seeding line	4,689.24	0.414	30-yr depreciation period
	215,224.81	18.996	
Total cost of production phase before over-wintering	732,923.14	64.69	
B. Transportation phase[b]			
Transportation (average of 800 km round trip)	24,988.00	2.00	
Labor	4,781.43	0.38	
Depreciation	3,873.35	0.31	7-yr use, 15% residual
Total cost of transportation phase	33,642.78	2.69	

[a]Based on 11.33 million trees produced in 1980
[b]Based on 12.495 million trees shipped in 1980