forest management note

Note No. 20 Northern Forest Research Centre Edmonton, Alberta

FIELD STORAGE OF CONTAINERIZED CONIFER SEEDLINGS

Fully regulated cold storage is universally accepted as a means of overwintering bare-root stock at tree nurseries. In British Columbia, containerized conifer seedlings are removed from containers, cold-stored alongside bare-root stock, and subsequently handled as bare-root stock. In the prairies, container stock is usually overwintered outside at the nursery site; however, long transportation distances during outplanting and the major climatic differences possible between nursery and planting sites can adversely affect the seedlings. A satellite winter storage facility in the field avoids these problems and can help reduce the risk of heavy losses, particularly from frost damage.

This note provides the structural specifications and operational procedures for an unheated storage facility for containerized conifer seedlings. The structure described was designed at the Northern Forest Research Centre and was tested during 1978-81 with lodgepole pine and white spruce containerized stock. The primary purpose of the facility is for field storage to protect conifer seedlings against frost damage from November to April by maintaining the inside temperature at -2°C to 0°C.

Specifications

1. Wall frames (Fig. 1)

   - Double walls constructed from 5 x 15 cm (2 x 6 in.) construction-grade spruce for bottom and top plates; studs spaced 40 cm (16 in.) apart on center.
   - A gravel pad floor to allow for ground heat conduction and subsequent ground cooling.
   - Inner and outer walls spaced 2.5 cm (1 in.) apart and bolted to a foundation of heavy Douglas fir timber laid slightly lower than the surface of the gravel pad. Entrance door at the loading dock located toward the lee side and the storage vent on the opposite wall.

2. Ceiling (Fig. 1)

   - 5 x 30 cm (2 x 12 in.) spruce beams spaced 40 cm (16 in.) apart along the top plate and toenailed to secure in position.

3. Insulation (Fig. 1)

   - Fiberglass batt material of RS1 3.522 or R20 value installed between studs for a total value of RS1 7.044 or R40.
   - Double thickness used in the ceiling for an RS1 7.044 or R40 value to prevent heat loss or heat gain during the November to April outside temperature range of 8°C to -30°C.
   - Doors and storage wall vent must have RS1 3.522 insulation.

4. Vapor barrier

   - Ceiling and walls facing the storage environment sealed with 6-mm polyfilm to stop air and moisture migration and frost from coating the wood frame.

5. Sheeting (Fig. 1)

   - 1.2 x 2.4 m (4 x 8 ft.) sheets of construction-grade, 5-mm (3/8-in.) thickness spruce plywood nailed to the ceiling and walls for exterior and interior finish with all seams caulked with roofing tar. If more durability and strength is desired, 2-cm (3/4-in.) tongue-and-groove ply-

wood subflooring is recommended as an exterior finish.

6. Roof

- 5 x 10 cm (2 x 4 in.) spruce trusses spaced 40 cm (16 in.) apart on center and covered with 2-cm (3/4 in.) construction-grade tongue-and-groove plywood.
- Attic closed with 2.5 x 15 cm (1 x 6 in.) construction-grade spruce lumber except for a louvered area to prevent snow from drifting in and melting.

Construction

The size of this centrally located storage area should be based on the number of seedlings required to stock cut blocks during the outplanting and replanting operations. The loading dock entrance should have an airtight seal to prevent loss of heat when field and refrigerated storage areas are linked for loading and unloading of seedlings. Such seals are made of thick fiberglass insulation enclosed in durable vinyl. Paint the outside surfaces of the wood with an oil-base white stain to prevent cracking and to reflect radiation heat after winter warming begins. The building standards cited in Ramsey and Sleeper (1970) should be referred to when it is desirable to use other insulation and more durable structural materials. A saving can be realized by use of inexpensive local wood when possible.

Preparation for Storage

- Open the loading dock doors and the wall vent for overnight cooling during ground freeze-up the last week of October or first week of November, when air temperatures stabilize at $0^{o}C$ to $-10^{o}C$.
- Test the stabilization of the temperature using a thermograph.
- Close the door and vent early in the morning when the storage environment stabilizes at $-2^{o}C$ to $0^{o}C$. Repeat the venting and temperature stabilization procedure if necessary.
- Keep wall vent closed at all other times during storage.

Storage Guidelines

- Begin storing seedlings about November 7. Use pallets with legs and stack them four high. Omit center tray of each pallet for better air circulation, wear, and weight distribution.
- When shipments of seedlings come in on different

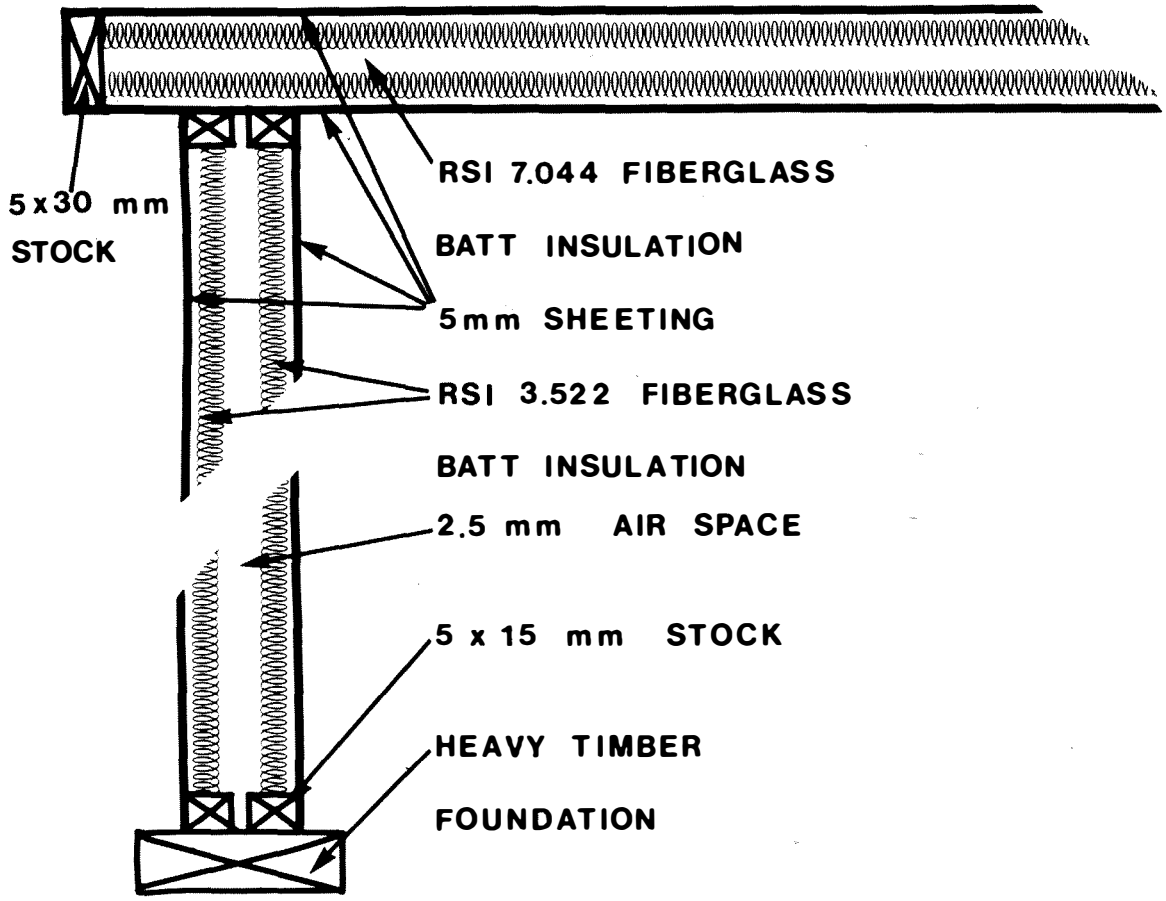

Figure 1. Cross section of the walls and ceiling showing the insulation and structural frame.

dates from November 7 to December 7, the first and second shipments should be stored on pallets to each side of the storage area, preferably leaving 76 cm (2.5 ft.) clearance around the walls and at the ceiling to allow for stabilization of temperature and for air circulation.

- The final shipment should be stored in the center area.

- Crop storage procedures should facilitate monitoring of the seedlings, servicing of thermographs, and checking for molds and rodents.

- Leave a 30-cm (1-ft.) clearance between rows of pallets to allow ground heat and later ground coolness to reach all pallets. This helps maintain stable storage temperatures during winter cooling and winter-to-spring warming.

- Container seedlings do not require light or water during autumn-to-spring storage.

Condition and Care of Seedlings

- Stock maintained outside prior to storage should have no frost damage to tissues or chlorophyll that could encourage mold activity.

- Seedlings that were reared in the greenhouse just before winter storage should not be stored without prior treatment at 8-h day length to initiate dormancy, because they risk damage from prolonged exposure to temperatures of $-2^{o}C$.

- During transit to the field storage facility, the prime condition of the seedling is best maintained in fully enclosed and insulated refrigerated trailers at $-2^{o}C$ to $0^{o}C$.

- The Northern Forest Research Centre's 3 years of experience showed that fully dormant seedlings of lodgepole pine and white spruce overwinter, survive, and grow well after cold storage when planted on frost-prone sites.

- Beware of storing seedlings older than 20 weeks, because mold often develops inside the container medium before it is detected.

- Use a fungicidal dust (such as benlate at rates specified by the manufacturer) and rodent poison as necessary to protect seedlings from pests.

In most years the ground inside the storage unit remains frozen until April or occasionally until early June even though the surface has thawed. This helps prolong the storage and keeps seedlings from flushing in storage during the planting season. Otherwise, storage can be extended by using cooling packs or ice covered with sawdust.

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May 1983

Reference

Ramsey, C.G. and H.R. Sleeper. 1970. Architectural graphic standards. The American Institute of Architects. Sixth Ed. John Wiley and Sons, Inc., New York.

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Cat. No. Fo29-2/20-1983E
ISBN 0-662-12596-7
ISSN 0714-1181

Environment Canada | Environnement Canada
Canadian Forestry Service | Service canadien des forêts