FIELD HANDLING 1

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ABSTRACT

A field handling system for care of seedlings from the nursery to the planting hole has been implemented in the Intermountain Region of the Forest Service. This system has improved both survival and growth of the seedlings.

INTRODUCTION

Dick Thatcher asked Al Dahlgreen and me to explain how we handle seedlings from the nursery cooler to the planting site and our planting procedure. I will cover the field handling procedure and quality control in the Intermountain Region of the U. S. Forest Service and the Payette National Forest. Al will then cover planting the seedlings, inspection for quality, and results of our reforestation efforts.

Tree seedlings that are properly cared for during lifting, packing, storage, and field handling demonstrate a great desire to survive and grow when outplanted. Seedlings are living organisms subject to environmental factors. They can cope with these factors in a suitable environment, but are extremely vulnerable to physiological as well as mechanical injury when out of the ground. Seedlings are exposed to many causes of injury from the time of lifting until outplanted. Survival and growth responses are influenced by the number, degree, and duration of such injuries, in addition to the site and other factors. These damaging effects are cumulative and are often interacting.

A field handling system for care of seedlings from the nursery to the planting hole has been implemented in the Intermountain Region of the Forest Service. Reforestation personnel on the Payette National Forest have been following this system since the early 1970[1]s.

Our main objective in artificial reforestation is good survival and growth of seedlings to obtain a satisfactorily stocked, rapidly growing stand. To achieve this objective, proper handling of stock from the nursery to the planting site is necessary. Our goals for handling stock are:

1. Minimize disturbance of seedlings.

2. Minimize variation from optimum temperature and relative humidity levels.

3. Minimize moisture stress, exposure, and mechanical injury.

1/ Paper presented at joint meeting of Western Forestry Nursery Council and Intermountain Nurseryman's Association, Boise, Idaho, August 14, 1980.

2/ Forest Silviculturist, Payette National Forest, McCall, Idaho.

4. Provide for gradual transition of seedlings from storage to field conditions

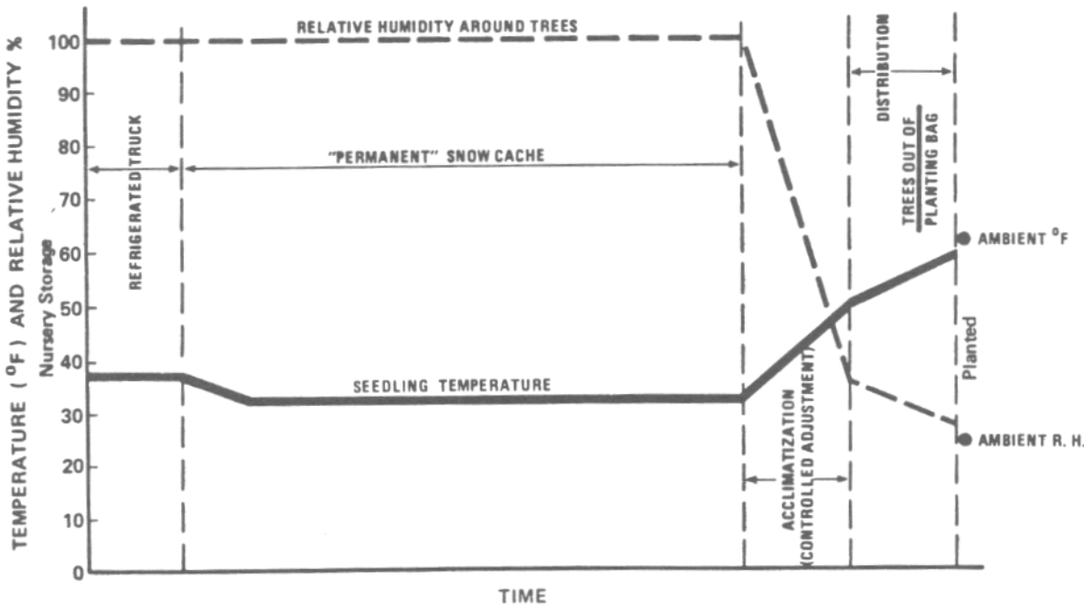

Diagram of temperature - relative humidity regimen considered ideal for seedlings during the nursery to planting hole journey in the Intermountain Region. The objective is to reduce the frequency and rate of environmental change which could injur the seedlings. (Time frame not to scale).

We obtain nursery stock from both Lucky Peak and Coeur d'Alene nurseries. Seedlings are generally lifted, sorted, and packed the end of February or the first part)f March. During this time the District people are plowing snow to open roads to their snow cache locations for seedling storage.

LOADING

Bare root stock stored in nursery coolers is loaded on refrigerated trucks for delivery to the Forests. Racks are built in each truck to allow stacking of the crates without crushing, yet still leave adequate air space between crates to allow air circulation and prevent temperature increases. Seedlings are loaded by seed lot for each snow cache location. Trees are generally loaded the evening before delivery with the refrigeration units left in operation. The objective is to maintain a root mass temperature of no higher than 36^0 - 38^0 F. This is about the temperature we can currently expect seedlings to come out of the nursery coolers.

DELIVERY

Delivery occurs during the second or third week of March on the Payette National Forest. When possible, delivery is coordinated between Lucky Peak and Coeur d'Alene nurseries for the same day. Lucky leak trucks generally arrive at the delivery points

at 0800. The trucks are driven directly to three of the four snow cache locations on the Forest. Due to a muddy, steep road on the Weiser Ranger District, seedlings are unloaded into a stake rack truck in a shaded location, covered with a tarp, and delivered to the snow cache. Thermometers are placed inside the refrigerated trucks to record root mass temperature upon delivery. The temperature readings are recorded on the delivery ticket for a permanent record. We document these conditions for evaluations of our plantations.

STORAGE

A day or two prior to tree delivery, each District prepares a packed snow floor for their snow cache. Minimum depth of the snow floor is two feet. This is necessary to prevent seedlings touching the ground if the snow melts.

We are faced with a storage period of two weeks to four months depending on elevations and aspects of planting sites. Sites are located at elevations of 4,000 to 6,500 feet above sea level. Planting begins at the lower elevations about the third week in April and may last until the third week of July at the high elevation spruce sites. The bulk of our planting is done in May.

Due to the length of storage, up to 120 days, we use a snow cache. Snow cach8s provide an environment of uniform high humidities and a constant temperature of 33 F. This appears to be ideal for seedling storage. As with any job, there are proper procedures to be followed to prepare a snow cache.

When a refrigerated truck delivers seedlings to a snow cache, extreme care is taken when unloading seedlings to prevent damage to the buds, especially ponderosa and lodgepole pine. Seedlings are packed in lettuce crates specifically for snow cache storage as trees arc least susceptible to damage in a crate. Boxes or bags may be crushed when snow is piled on them.

Crates are stacked in an orderly manner with boards between the third and fourth crates. This helps in removal of crates. Root mass temperatures and ambient humidities have been monitored inside the cache. A properly constructed snow cache will maintain a temperature of 33^{0} F. and a relative humidity of 100%. Stacks of crates have air spaces between them and rows are spaced one to two feet apart. Snow is shoveled between the stacks and the rows until there is enough snow covering the crates to utilize a tractor to pile four feet or more of snow over the trees. A sawdust layer of up to one foot deep is then placed over the snow for insulation, plus a canvas on top of the sawdust. Canvas helps reduce snow melt. A map showing seed lot location is prepared to assist with proper removal of the trees. It is generally less than two hours from the time of unloading the trees until they are covered by snow.

The cache is generally not opened until two days before tree planting begins. Extreme care is taken to remove only the minimum amount of snow needed to create an opening to the row of trees which will be planted first. The opening is then closed with insulating material when not is use in order to retard snow melt and maintain existing temperature and humidity inside the cache.

ACCLIMATIZATION

Trees are prepared for acclimatization and field distribution by dipping their roots in a vermiculite and water slurry and rolling them in wet burlap. Water held by the vermiculite is readily available to replace any the trees may have lost in storage,

as well as that which will be transpired prior to planting. The wet vermiculite particles help reduce root stripping by acting as a lubricant; they maintain a film of moisture on the roots during the brief journey from planting bag to planting hole, and they aid planting inspections by "marking" seedling roots.

The burlap protects the tree roots from mechanical injury or exposure, assures good root contact with moist material, and binds the seedlings in a safe and convenient package for field transportation and distribution. The entire procedure has a beneficial psychological value, reminding all concerned of the need for extreme care in handling trees.

A shaded tent is used for packaging trees. It is large enough to accommodate a two-day supply of trees, a work table, two large garbage cans, and one or two tree handlers. It may be located near the snow cache, or at the planting area. Trees are transported from the cache to the dipping and wrapping area in an insulated pickup box or a tree trailer on an "as needed" basis. Trees are removed from snow cache in early morning or late evening and moved to the acclimatization facility in a tree trailer. A one- or two-day supply is removed at each entry if the usual 24-hour acclimatization period is used. Number 4 horticultural vermiculite is mixed into a large garbage can of water to make a thick slurry and allowed to soak until well saturated. A second garbage can is used to soak 20-inch by 30-inch pieces of burlap which have been impregnated with mud to improve water retention.

A piece of the wet burlap is spread on the table and a handful of seedlings is removed from the shipping container. Roots of trees remaining in the container are kept covered. The trees are grasped with both hands so their roots tend to spread. The roots are then dipped into the slurry and gently agitated until thoroughly coated with wet vermiculite when removed. The slurry is kept stirred, since wet vermiculite sinks. The seedlings are gently separated and arranged in an orderly manner on the burlap with roots parallel to the short axis, and root collars about one inch below the upper edge of the burlap. Additional seedlings are similarly treated until the desired number (usually 50 to 100, depending on tree size and weather conditions) are in place. Roots may be trimmed so they are within specifications--(12 inches).

The exposed flap of burlap is folded over the roots, care being taken not to bind any roots in the fold. The burlap, with trees in it, is firmly rolled from one end to j the other, jellyroll fashion. The outer end of the burlap is pinned or tied in place. The resulting package must be firm so trees have good root contact with the wet material and will not fall out. Proper placement of trees on the burlap and correct rolling facilitates removal of the trees with minimum root stripping.

Acclimatization is completed in the packaging tent, or in a snow-free tree trailer. Trees can he more gradually brought into equilibrium with an environment near that which prevails on the planting site, if temperatures and humidities surrounding the trees are monitored occasionally at different points in the handling process. Procedures can then be changed to soften any stressful conditions noted.

The packages of trees are stacked in single rows on low platforms of lumber or poles. The burlap-covered roots are aligned vertically and horizontally within the stack, with tops alternating from side to side to permit free air circulation around them. Stacks are no more than five or six packages high, and tops of trees in adjacent rows are at least one foot apart.

Newly packaged seedlings should be covered with light canvas or other material which is removed as the trees approach equilibrium with the surrounding environment. Doors of tree trailers are adjusted to achieve similar control.

Trees should be protected from freezing by covering with insulating blankets or holding them at the desired temperature in insulated trailers. Protective coverings are removed, or tree trailer doors reopened, when freezing conditions no longer prevail.

Longer acclimatization periods (up to 48 hours) are required during warm, dry weather than on cool, humid days. Seedling temperatures should be near the soil temperature at a depth of 8-10 inches, or air temperature, whichever is lower, at the time of planting. Humidities around their tops should approximate that found in the shade near the ground on the planting site.

DISTRIBUTION

Trees are brought from equilibrium with the environment at the acclimatization site to equilibrium with that of the planting site during the distribution process. They should suffer little stress if differences in temperature and humidity between the two sites are not great and the transition is not rapid.

Trees are issued for planting in the same order they were packaged. They are not placed in or on snow or ice, nor are their tops covered by wet burlap or other material (except as protection from freezing) after acclimatization has started. Such "protection" nullifies the benefits of acclimatization.

Trees are kept in the shade and protected from the wind while being transported or held at the planting site. A pickup truck with a cover may be closed while moving and opened when stopped to provide ventilation when parked. Wet burlap placed over the root zone (not on the foliage) of stacked trees will slow drying of the top layer of tree packages.

Trees are placed in clean planting bags. The nail or string holding the tree packages together is removed after the trees are in the bag or tray, but before trees are removed. We use planting bags 18 inches deep, generally of white canvas with a shield of waterproof material on one side to protect the planter from water seepage.

In addition, inspections and documentation of care of the planting stock are done on a daily basis.

EVALUATION

Thermometers are standard equipment for reforestation personnel. They are used frequently during the storage and handling of seedlings to monitor temperatures. We also request assistance from Russ Ryker, silviculture researcher from Intermountain Forest and Range Experiment Station, to use an oscilloscope or other techniques to monitor seedling condition if something looks strange to us.

PUBLICATIONS CITED

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