



FOREST RESEARCH REPORT

**NOVA SCOTIA DEPARTMENT
OF LANDS AND FORESTS**
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THE EFFECT OF VARIOUS FIELD-STORAGE CONDITIONS ON THE SURVIVAL AND GROWTH OF OUTPLANTED BARE-ROOT STOCK

INTRODUCTION

In Nova Scotia, approximately 5 million, or 17% of the trees grown in provincial nurseries each year are bare-root stock. To ensure that plantations of this stock type are successfully established, certain conditions governing the care and handling of the trees on-site must be followed. For instance, proper handling and storage of trees prior to planting can greatly reduce seedling mortality and subsequent plantation failure (Murray, 1979). More specifically, techniques that moderate extreme temperatures and minimize excessive drying of the

seedlings on-site before they are planted increases their chances of survival. One of these techniques involves covering seedling bags with Silvi-cool® blankets¹ (Duryea and Landis, 1984).

In this study, various field-storage conditions, including Silvi-cool® blankets, were tested to determine their effect on the growth and survival of outplanted red pine (*Pinus resinosa* Ait.) and white spruce (*Picea glauca* (Moench) Voss) bare-root seedlings originally packed in polykraft planting bags.

SITE DESCRIPTION

The trial was established at Antrim, Halifax County (45° 00'N; 63° 21'W) on a moderately well-drained site with south-east exposure. The soil is classified as sandy clay loam derived from shale and sandstone. Prior to harvest, the site supported a cover of mature softwood (predominantly red spruce (*Picea rubens* Sarg.)). Silvicultural treatments before planting were limited to site preparation using a Rome

disc. The weather during planting (May, 1986) was clear and sunny with temperatures averaging 20°C for daytime highs and 0°C for over night lows.

¹ Registered Trademark of Forest World Supplies.

² A tarpaulin, commonly referred to as the shade tarp, with a reflecting side which when placed over seedlings is designed to reflect solar radiation outwards, thus reducing the temperature of the seedling package below.

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METHODS

A split-plot design with 3 replications was utilized in this experiment. Factorial combinations of species (white spruce (wS) and red pine (rP)), planting sessions (9 AM and 2 PM) and planting dates (May 13, 14 and 15) were systematically assigned to 12m by 19 m plots within each replicate. Within each plot, 6 tree shading methods (Table 1) were assigned systematically to a separate row of 10 trees.

Equal amounts of rP 2/1 and wS 2/1 bare-root seedlings were shipped from the Lawrencetown nursery, Annapolis County in sealed polykraft bags on May 12, 1986. Upon arrival at the site, 2 bags of trees were assigned to each treatment. One bag was reserved for temperature measurements while the other was used for planting.

The treatments consisted of various combinations of opening the bags, placing tarps over them and placing them in the shade of surrounding mature trees (Table 1). Temperature readings for treatments 1-4 (See Table 1) were taken with a thermograph¹ inserted into the bags reserved for this purpose. These bags were then resealed. For the bags assigned to treatments #5 and #6, min/max thermometers were placed in their open ends and temperature measurements taken at regular time intervals.

Planting was carried out twice daily (9 AM and 2 PM) for 3 consecutive days (May 13-15). All trees were planted at 1.8 m x 1.8 m spacing using a Wifsta Hoe.

Table 1. Treatments and number of trees planted—Antrim Shade Trial.

Treatment #	Bag ¹	Treatments		Trees Planted	
		Tarp ²	Shade ³ (%)	rP	wS
1	Closed	On	0	180	180
2	Closed	Off	0	180	180
3	Closed	On	50	180	180
4	Closed	Off	50	180	180
5	Open	Off	0	180	180
6	Open	Off	50	180	180
TOTAL				<u>1080</u>	<u>1080</u>

1 Seedlings were shipped from the nursery in sealed polykraft bags

2 Silvi-cool[®] shade tarp

3 0% shade = bags placed in the center of the clearcut

50% shade = bags placed in shade of trees adjacent to cutover

¹ A device used to graphically record temperature over time.

An assessment of survival and growth was carried out in the fall of 1987, the year following planting. Survival was determined from a 100% tally. Average leader growth and total tree height were determined by measuring 5 randomly sampled trees per treatment, per plot. An estimate of the severity of competing vegetation

was also recorded.

Survival was expressed as follows:

$$\text{Survival (\%)} = \frac{\text{Live trees}}{\text{Live} + \text{dead} + \text{missing trees}} \times 100.$$

RESULTS AND DISCUSSION

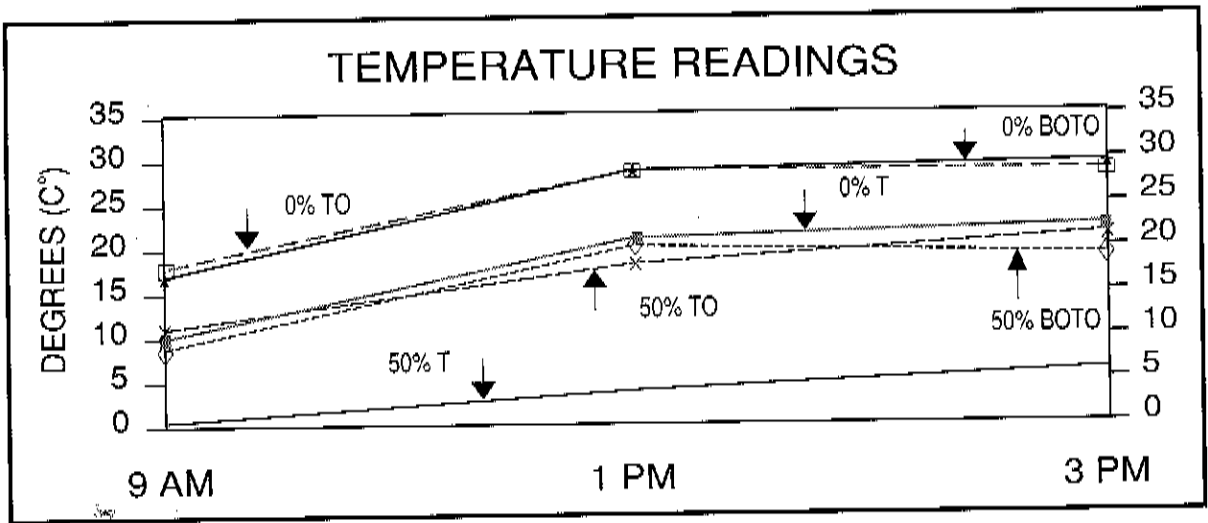
TEMPERATURE READINGS

Figure 1 illustrates the variation in temperature for the different treatments, recorded over the 3 day planting period. Sealed bags stored in 50% shade with a Silvi-cool® blanket over the seedlings provided the coolest environment during the day. In contrast, bags stored in similar shade conditions, without any cover were on average 13°C warmer by mid-afternoon (3 PM).

Bags stored in the clearing with no protective covering experienced the fastest rate of temperature increase, as well as the highest temperatures by mid-afternoon (3 PM). Unsealing the bags had little effect on temperature at either the shaded or unshaded site.

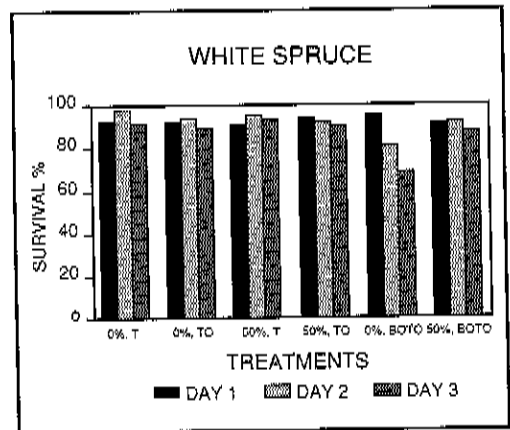
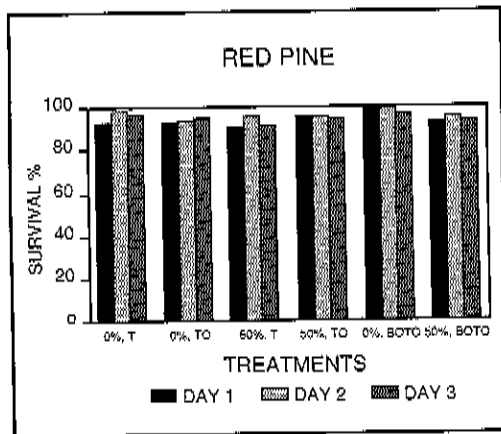
SURVIVAL

Figure 2 shows the average levels of survival (%) for rP and wS. With one exception, survival of either species was not affected by shading. Survival over all treatments was 95% for rP and 91% for wS. The only treatment which resulted in a substantial decline in survival was the '0% shade, bag open, tarp off'. For this treatment, wS survival declined from 97% for blocks planted on Day 1, to 70% for those planted on Day 3.



0%, T	: 0% Shading,	Bag closed,	Tarp on
0%, TO	: 0% Shading,	Bag closed,	Tarp off
50%, T	: 50% Shading,	Bag closed,	Tarp on
50%, TO	: 50% Shading,	Bag closed,	Tarp off
0%, BOTO	: 0% Shading,	Bag open,	Tarp off
50%, BOTO	: 50% Shading,	Bag open,	Tarp off

Figure 1. Average temperature (°C) within polykraft-planting bags by treatment, recorded at 3 times per day over the 3 day planting period.



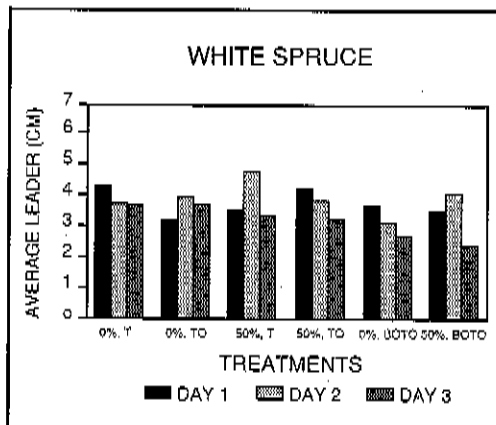
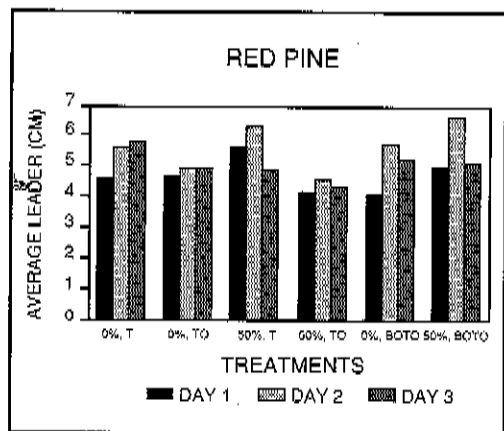
0%, T	: 0% Shading,	Bag closed,	Tarp on
0%, TO	: 0% Shading,	Bag closed,	Tarp off
50%, T	: 50% Shading,	Bag closed,	Tarp on
50%, TO	: 50% Shading,	Bag closed,	Tarp off
0%, BOTO	: 0% Shading,	Bag open,	Tarp off
50%, BOTO	: 50% Shading,	Bag open,	Tarp off

Figure 2. Survival (%) of rP and wS by treatment and planting day measured the year following planting.

AVERAGE LEADER LENGTH

Average leader growth by treatment, in the second growing season following planting, is shown in Figure 3. No apparent trend was observed between treatments.

The experiment will be remeasured again in 1990 (5 years after establishment) to provide more comprehensive data concerning the effect of the treatments on both survival and leader growth.



0%, T	: 0% Shading,	Bag closed,	Tarp on
0%, TO	: 0% Shading,	Bag closed,	Tarp off
50%, T	: 50% Shading,	Bag closed,	Tarp on
50%, TO	: 50% Shading,	Bag closed,	Tarp off
0%, BOTO	: 0% Shading,	Bag open,	Tarp off
50%, BOTO	: 50% Shading,	Bag open,	Tarp off

Figure 3. Average leader growth (cm) for rP and wS by treatment and time of planting; measured the year following planting.

SUMMARY

1. Temperatures inside sealed polykraft bags, filled with 2/1 bare-root stock, were lowest when placed in 50% shade and covered with the Silvi-cool® blanket. In contrast, sealed bags placed in similar shade conditions without the blanket, were on average 13°C warmer by mid-afternoon (3 PM).
2. For red pine and white spruce, none of the treatments appeared to have any measurable

- effect on second year leader growth.
3. Method of storage, except in one instance, had little effect on survival of either species (95% rP; 91% wS). For white spruce stored in open, unshaded bags for 3 days, survival decreased from 97% for trees planted on the first day, to 70% for trees planted after the third day.

MANAGEMENT RECOMMENDATION

Although the results of this trial indicate that survival and growth of transplants packed in polykraft planting bags are not greatly affected by short-term storage in unshaded conditions, it is recommended that planting bags remain sealed while stored on site and that they be kept at all times in cool shaded areas, out of direct sunlight and exposure to wind. The trees should be planted as soon as possible following arrival at the site.

LITERATURE CITED

Duryea, M.L. and T.D. Landis (eds.). 1984. Forest Nursery Manual: Production of bareroot seedlings. The Hague/Boston Lancaster, Forest Research Lab., Oregon State Univ., 386 pp.

Murray, T.S. 1979. Storing bareroot and container nursery stock on the planting site. Mar. For. Res. Cen., Fredericton, New Brunswick., Technical Note No. 6., 6 pp.

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