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EFFECT OF LIFTING DATE ON ELECTRICAL IMPEDANCE, SURVIVAL AND ROOT-REGENERATION OF LODGEPOLE PINE (*Pinus contorta* Dougl.) SEEDLINGS.*

by

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Abstract

Electrical impedance, survival and root-regeneration of lodgepole pine seedlings was determined in relation to lifting date and provenance. There was no significant difference in impedance and survival among provenances. Electrical impedance, survival, and root-regeneration ability increased continuously from August 10 to November, 1972. An electrical impedance value of 43.0 K Ohms at lifting time and 21.0 K Ohms after cold storage was associated with a 98 percent survival rate for the November 2 lifting date. The lifting date even in late Fall has a marked effect on survival.

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Introduction

Planting of lodgepole pine seedlings in Central British Columbia has occasionally resulted in poor survival. These planting failures may possibly be attributed to the physiological condition of the seedlings and not to environmental factors which might limit survival. Lifting date and cold storage undoubtedly have an effect on the physiological condition of the seedling which is critical to the success of transplanted nursery stock. Krueger and Trappe (1967) found significant differences in seasonal growth and food reserves of Douglas fir which would have important implications on lifting date and cold storage. Brown (1969) working with Scotch pine found significant differences between provenances in seasonal patterns of growth, survival and the ability of seedlings to regenerate new root systems. A marked periodicity in root regenerating potential has been found in ponderosa pine (Stone and Schubert, 1959) and Douglas fir (Stone, Jenkinson and Krugman, 1962) seedlings in relation to lifting time. It is apparent that nursery seedlings must complete a critical cycle of physiological processes which confer a level of conditioning that allows cold

stored seedlings to regenerate a root system and survive.

The objectives of this study were to determine the electrical impedance, survival and root-regeneration of lodgepole pine seedlings in relation to lifting date, cold storage and provenance.

Methods and Procedures

This study was conducted at Red Rock Nursery, Prince George, B.C. lodgepole pine seedlings from three provenances were studied (Table 1).

Table 1 Lodgepole pine provenances used in the study

Provenance no. /thousands of feet	Provenance Name	Location	Latitude °N	Longitude °W
1783/2.7	Hutda Lake	Prince George	53°40'N	122°53'W
1793/2.6	Valemount	Rocky Mt. trench	52°50'	119°15'
1800/3.0	Telkwa	Telkwa	54°40'	127°05'

A sample of 2-0 seedlings was lifted by hand out of the production beds at two week intervals according to the following schedule: August 10, 24, September 7, 21, October 5, 19, November 2 and 16, 1972. Upon lifting and after cold storage a sample of 20 seedlings were measured for electrical impedance. The electrical impedance of the stems was measured at 4.5 KHz according to the method of van den Driessche et al (1968). A sample of 60 seedlings from each lifting date was placed in cold stoarage at ca. 2°C. The seedlings were stored in a sealed

paper bag. On May 15, 1973 the seedlings roots were pruned to a length of 6 inches. The seedlings were planted in the nursery and allowed to grow for two months at which time survival and root-regeneration ability were determined

Results and Discussion

There were no significant differences in electrical impedance and survival among provenances. Figure 1 shows the electrical impedance and survival percentage of the seedlings in relation to lifting date. Seedling survival increased over the time period of this study until it reached 98 percent on the November 2 lifting date. Electrical impedance of stored seedlings increased with lifting date and was lower than impedance at lifting for all dates. Electrical impedance values of 43.0 K Ohms at lifting time and 21.0 K Ohms after cold storage were associated with the 98 percent survival rate. The lifting date even in late Fall has a marked effect on survival.

While electrical impedance does not explain the physiological condition of the seedling it may be a useful index of seedling hardiness. Glerum (1973) found that the annual trend in electrical impedance was similar to that in frost hardiness for seven coniferous species. If impedance trends can be related to hardiness, this would alleviate the problem of trying to assess tree physiological condition based on

an interpretation of environmental factors. To better understand the relationship between growth and survival and electrical impedance the physiological and biochemical condition of the stored tree must be studied. The difference in electrical impedance values at lifting and after cold storage (Figure 1) may represent a difference in total stored food reserves between storage periods (Ronco, 1973) or a change in the type of food reserve (Krueger and Trappe, 1967).

Root-regeneration (Table 2), when using the number of meristematic root tips and root length as criteria, increased with lifting date.

Table 2 Root-regeneration of lodgepole pine seedlings in relation to lifting date

	Root-regeneration	
Lifting Date	No. of meristematic [2] primary roots	Total length of roots greater than 6 inches
Aug. 10	0	0
Aug. 24	0.1	0.3
Sept. 7	1.0	1.1
Sept. 21	1.7	4.2
Oct. 5	4.7	5.8
Oct. 19	8.3	6.4
Nov. 2	12.8	8.5
Nov. 16	19.2	8.6

1. 10 seedlings per lifting date

2. white "absorbing" roots.

Survival was probably closely related to the ability of the seedlings to produce new roots after transplanting. Stone et al (1959, 1962) found that root regenerating potential and survival of transplanted seedlings were closely related. This is similar to the trend found in this study where the seedlings lifted in late Fall show an increased potential to regenerate a new root system with a concomitant increase in survival.

The relationship between lifting date, electrical impedance, root-regeneration and survival is expected to be different at other locations depending on the environmental factors which determine the physiological condition of a given provenance.

Therefore the annual trend in electrical impedance and hardiness development for a particular species and provenance should probably be measured over a number of years to better describe the relationship.

References

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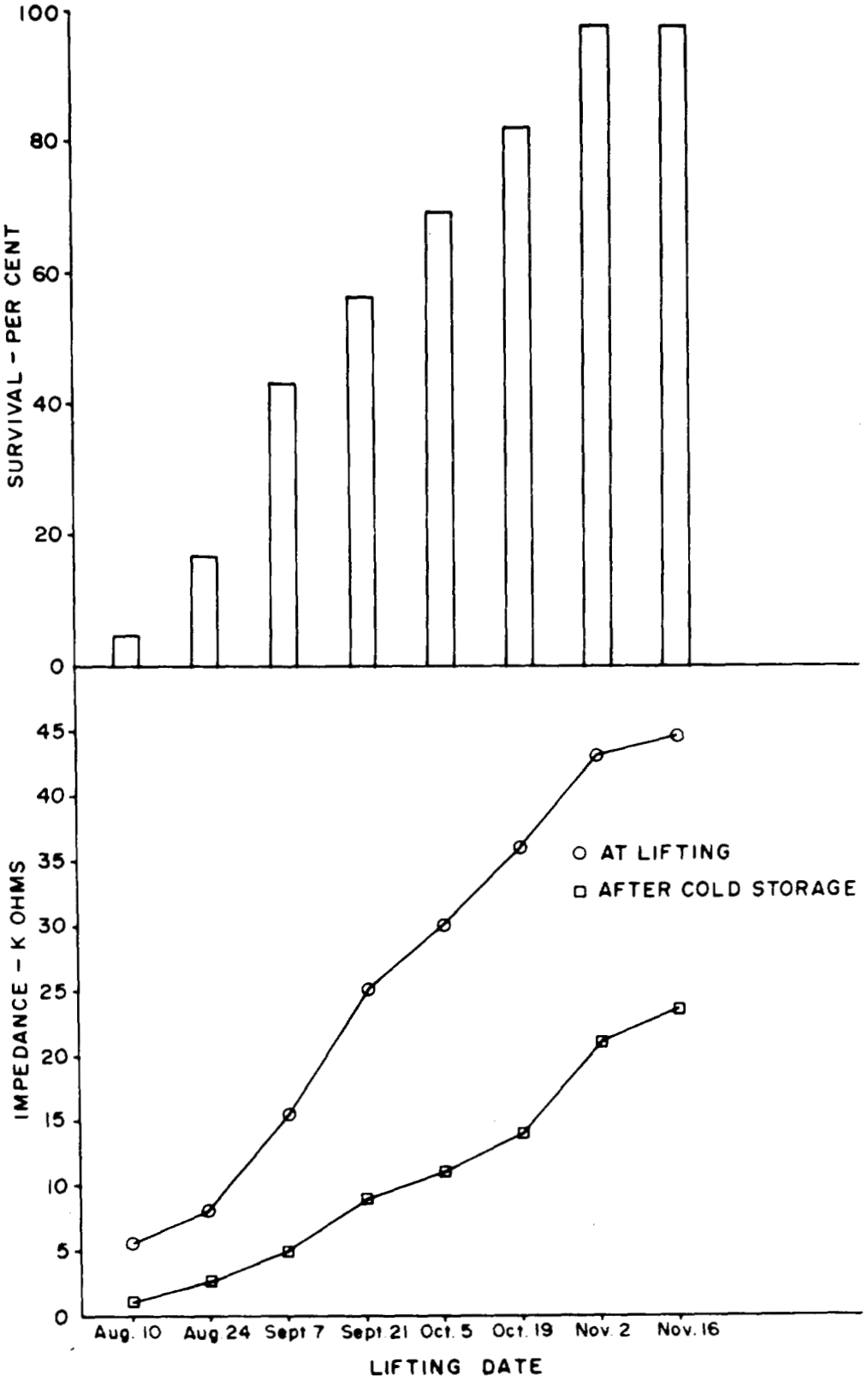

Figure 1. Survival and electrical impedance of lodgepole pine seedlings in relation to lifting date.