

## MOISTURE RELATIONS OF NURSERY STOCK<sup>1</sup>

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Some nursery practices have been carried on for years with little knowledge of their effects on the survival and growth of the stock after it leaves the nursery.

For example, irrigation of nursery beds before lifting is practiced at some nurseries but not at others. In some procedures the stock is loosened by machine, pulled by hand, tied into bundles, and then thrown on the ground or in a pile where the roots may be exposed often as long as half an hour before being taken to the shipping barn. In contrast, other nurseries place the trees in water or moss under shade, even before sorting or tying.

At some nurseries it has been the practice to wash the roots of the trees in water before packaging. This is perhaps intended to restore water to the roots and clean them so that they are brought into closer contact with the damp moss in which they are usually packed. It is contended that this makes a more compact bundle and prevents drying out.

At other nurseries as little disturbance to the plant as possible is favoured. The belief is that the removal of soil particles by washing or dipping is detrimental, because the fine particles serve to prevent the roots from drying out and help the trees to become established on the planting site by retaining the association with a nutrient source. Further, it is believed that the mycorrhizal activity, if such is present, may be inhibited by washing, at least for the critical period immediately after planting.

In planting, only commercial nurserymen seem to have given much consideration to the possibility of ensuring an adequate supply of moisture. Their practice of "watering-in" stock to remove air pockets and to add an initial supply of soil moisture has not been considered practical by government planting supervisors, and it may not be necessary or practical in most instances, although on one dry area watering increased the survival from 20 to 85 percent (Wiedman, 1944).

Further, there has been no clear indication that carrying the trees at the planting site in pails containing damp moss gives greater or less protection against drying than carrying the trees in pails of water. Carrying the trees in water ensures a good supply of moisture, but again there is the washing effect. On the other hand, if moss is used in the pails or containers, there is a constant need to make sure it does not dry out, and sometimes this point is overlooked on a large planting operation.

The purpose of this report then is to assess some of those steps in the present planting routine about which there appears some doubt, and also to examine some of the alternate nursery practices to see if their use in a practical manner would have a significant effect upon survival and development of the trees. In planning the experimental work the following questions were considered:

1. Will trees lifted from wet nursery beds do better than those from dry nursery beds?
2. Should the bundles of trees be dipped in tubs of water before packing?

<sup>1</sup>Condensed from a report issued by the Ontario Department of Lands and Forests as Research Report No. 45, bearing the same title.

3. What difference does carrying in pails of water or moss make?
4. Is irrigation of the planting site beneficial?
5. Does the season of planting affect the above considerations?

### The Experiment

The experiment was a two-stage procedure, involving treatment at the nursery (Kemptville Nursery, 30 miles south of Ottawa) and treatment at the planting site (Larose Forest, 40 miles east of Kemptville). The design of the experiment was a 5 x 2 factorial involving the following: lifted from wet (irrigated) or dry (sheltered with plastic) beds in the nursery; dipped or not dipped in water at the nursery before packing in bales; carried in pails containing water, or moss, at the planting site; planted on watered (irrigated) or nonwatered plots at the planting site; and all the above treatments carried out in fall (1957) and again in the spring (1958).

This procedure, with 5 replications, required 160 plots of 100 trees each in the planting. The stock was white pine (Pinus strobus L.), 2-2 at time of lifting. The plots were 40 feet square with an 8-foot surround, the trees were planted at 4- by 4-foot spacing in the bottom of plowed furrows, using the slit method of planting (Rudolf, 1950).

### The Results

In September of 1958, toward the end of the first growing season after planting, a count of mortality was taken. In July of 1959, following completion of most shoot elongation for the second season after planting, height and diameter measurements were taken for all living trees. A second mortality count was made in the fall of 1959, at the end of the second growing season. The data are not presented here due to lack of space. Analyses of variance revealed significant ratios up to the 0.1 percent level, frequently on second and third order interactions. These emphasize the complexity of the interrelationships of the treatments.

### Application of the Results

Certain findings of the experiment are of value to nurserymen and planting officers.

1. In nursery soils, where an increase in moisture content increases the difficulty of pulling trees, lifting from wet areas or watering before lifting should be avoided. This may also imply regulating routine operations to allow sufficient time for the soil to dry after a rain.
2. The practice of dipping trees in water at the nursery before baling generally had little effect on mortality but tended to cause a depression of growth after planting.
3. The practice of carrying water, rather than wet moss, in the pails appears generally to give better survival. However letting the trees stand in water for a lengthy period, even overnight, was harmful to both survival and growth.

The practice of carrying trees in water appears to cause some depression of growth, more in the spring than in the fall, but this is a minor factor in comparison with survival. This effect may be due to washing soil particles from the roots. Trees planted in the fall have greater opportunity to recover contact before growth.

Some of the effects due to the method of carrying may be due to practical problems. It is easy to see if planters are carrying sufficient water to keep the roots immersed. It is more difficult to supervise the carrying of moss as this tends to pack down to the bottom of the pails.

4. Watering of the planting site generally caused a decrease in survival and no increase in growth. This assessment of watering of the planting site refers only to watering before planting and should not be compared to watering after planting. For example, any benefit of the extra water may have been overthrown by increase in the difficulty of proper planting on a wetter soil.
5. Spring planting, because of resulting higher survival, should be practiced on soils such as those encountered in this experiment where frost heaving may be expected.

On the other hand fall planting, if done early, will give better growth in the first year after planting and should be considered on soils not subject to frost heaving, provided that adequate moisture is available.

In areas subject to drought, planting could be regulated in accord with a "planting index." A daily record correlating weather and soil moisture conditions during the planting season could be kept. The techniques for doing this have been worked out in the various fire hazard indexes used by forest fire protection agencies. The tables prepared by H. W. Beall would serve very well for this purpose (Beall, 1948). These fire hazard tables could be equated to the type of planting site as follows:

<u>Fire hazard</u>	<u>Planting hazard</u>
Fast-drying forest	Underplanting
Slash	Cutover
Heath	Dry site
Grass	Old field

#### Literature Cited

- Beall, H.W. 1948. Forest Fire Danger Tables. Ontario Dept. North. Aff. and Natl. Resources, Forestry Branch, Forest Fire Res. Note 12.
- Rudolf, Paul O. 1950. Forest Plantations in the Lake States. U. S. Dept. Agr. Tech Bul. 1010.
- Wiedman, R.G. 1944. Watering Plantation Trees. Jour. Forestry 42(6): 435-437.