Controlling Cold Hardiness and Seedling Size in Southern Interior Container Nurseries - Project No(s). 3.14, 3.17 and 3.18

Ensuring the availability of high quality planting stock is an important part of the Southern Interior backlog reforestation research effort. Three FRDA projects related to seedling physiology and nursery cultural practices are currently underway at the Kalamalka Research Station in Vernon. Tree physiologist Dave Simpson is directing this research, focusing on two major problems encountered at B.C. forest nurseries:

1. assessing root cold hardness and preventing over-winter damage, and
2. improving methods of controlling seedling dimensions in order to meet size standards set by nursery customers.

Unseasonably low fall temperatures have severely damaged container seedlings over-wintering or awaiting lifting outdoors. Most of the mortality has been attributed to root damage. Very little is known about cold hardiness in conifer roots and Simpson has been experimenting with different methods of assessing root damage and hardiness, including visual assessment of browning, aeroponic and potted root growth capacity tests, and physiological tissue viability tests (FRDA Project 3.14). The potted root growth capacity test is now a standard practice in many nurseries, but preliminary results suggest that measurement of root tissue respiration could be another practical method of collecting quantitative data on root condition, though further work is required to refine the procedures. Information gained from this part of the project is being used to monitor seasonal development and environmental control of root cold hardiness for several lodgepole pine, interior spruce and interior Douglas-fir families, under a range of daylength and temperature conditions. Seedlings exposed to artificial freezing stresses will also be placed in cold storage for varying periods of time. The damage assessment technique found to be most useful in measuring non-lethal root damage will then be used to determine if root damage is aggravated by cold storage.

Most of British Columbia’s interior spruce planting stock (Picea glauca, Picea engelmannii, and their hybrids) is raised in containers, using a variety of cultural practices and facilities. Simpson is experimenting with different container designs, with the aim of producing seedlings with physical characteristics acceptable for outplanting (FRDA Project 3.17). Varying seedling espacement (the number of plants per m² of growing space) is one way of changing plant size without greatly affecting physiology. Early results have shown that, for container interior spruce, closer spacing produces taller seedlings, smaller root collar diameters, and smaller root weights, and that 600-700 seedlings per m² is the optimum espacement for producing sturdy seedlings (20 cm height; 4 mm root collar diameter). Another aspect of container design is root plug shape, which may substantially affect growth of spruce after outplanting. Keeping root volume relatively constant (80-100 ml), a number of container systems having diameter-to-depth ratios of 1:1 to 1:5 are being used to grow 1+0 interior spruce seedlings at various espacements. Further evaluation in 1988 will be followed by field testing of promising alternative container systems.

Simpson is also experimenting with shoot growth control through manipulation of daylength and moisture near the end of the growing season (FRDA Project 3.18). The traditional method of imposing late-summer drought on container seedlings is thought to adversely affect root growth. Imposing long night treatments may be an alternative method of inducing bud set without halting root growth. In 1986, test lots were grown under natural daylengths with no drought, cyclic drought and continuous drought, and long nights (16 hours) with no drought. The seedlings were then examined for shoot, root and resting bud development, bud dormancy, tissue nutrient content, cold hardiness and root growth capacity (the results have yet to be analyzed). A second experiment conducted in 1987 is addressing technical problems encountered in applying these drought and daylength conditions, and additional experiments will begin in spring 1988.

Dave has presented his findings at the last two annual meetings of the Forest Nursery Association of B.C. in September 1986 and 1987.

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