MULTIPOTS FOR PRODUCTION OF FOREST TREE SEEDLINGS

by /
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In 1981, 51 million containerized forest tree seedlings were produced in the Maritime Provinces - 42% in multipots (MP), and 45% in paperpots (PP). Recently, greenhouse facilities have expanded in Nova Scotia and both government and industrial nurseries now use the MP system.

The Swedish MP was first used in Nova Scotia for planting trials in the late 1960's (Levy 1972; Routledge 1974). Large-scale use of MPs began in 1976 when the Nova Scotia firm, Can Am Containers Ltd.2, started manufacturing an improved version (57 cm^3) of the MP for a New Brunswick company, Frasers Inc. This new MP #1 was followed in 1979 by the MP #2 (65 cm3), designed initially for Nova Scotia Department of Lands and Forests. The MP #3 (105 cm^3) and MP #4 (135 cr^3) were introduced in 1982. New Brunswick Department of Natural Resources is using the MP #3 for production of 2-y "growing season" crops. Recently, a competing firm[a] began marketing the "original" MP.

In this paper, I attempt to point out design features of the MP system, its advantages and disadvantages. My intent is not to argue which system is best, because with each of the four major systems in use in Canada - multipot, paperpot, styroblock, and bookplanter - excellent seedlings are growth and successfully established in plantations. Could anyone contest the statement that major problems were encountered with the Ontario "tubeling", the "solid wall" containers without ribs, and for that matter, with these four systems when inappropriately handled?

Multipot Features and Potential Benefits

1. Trays are made of durable, high density polyethylene with UV inhibitor for long life, which is easily cleaned between uses.

2. Empty trays stack or nest for storage or transport and have tabs to prevent jamming.

3. Several sizes (cavity volume) are available - the MP #1 and #2 have the same length and width to facilitate use of one type of equipment, and the MP #3 and #4 have dimensions similar to the styroblock (SB) system so the two containers can be used with the same equipment.

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2 Can Am Containers Ltd., P.O. Box 340, Springhill, N.S. BOM 1X0

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4. They produce a "containerless" plug for outplanting, which facilitates rapid root establishment in surrounding soil.

5. This extractable plug can be pulled for cold storage, shipping, or planting and can be repacked for 100% tray stocking.

6. The cavity is tapered and has a rounded bottom, which facilitates removal and planting into a "dibbled" planting hole.

7. The tray size is convenient for direct handling by the field planter.

8. Roots are directed downwards by vertical ribs on the cavity wall, thus preventing spiralling.

9. Roots at the drainage hole are air pruned.

10. Roots cannot penetrate between cavities, so the container, if sufficiently large, can be used to hold seedlings more than one season.

Multipot Features and Potential Drawbacks

1. Color of the flats can lead to heating (black) or shorter life (white or yellow).

2. In the nursery, extra handling of the small MPs can be extensive, and with the new MP #3 and #4, the large size and weight may require special adaptations for field handling.

3. Root development must be adequate for pulling the plug.

4. Individual cell drying, particularly in summer, can cause seedling mortality and reduce stocking.

5. An inactive root mass may develop at the drainage hole.

Color Black trays are reputed to cause heating problems but such has not been the case in climate-controlled greenhouses. For germination in unheated greenhouses in spring, extra heat absorbed by the black trays could be an advantage.

Ribs There are several papers in the Proceedings[4] of the symposium "Root Form of Planted Trees" (Victoria, B.C. May 1978) about root development problems with the original smooth-wall MP system. Hagnar (1978) recognized that the deformation of pine root systems could be combatted by ribs on the cavity wall, but did not think a great danger existed for spruce because spruces produce adventitious roots after outplanting. Stefansson (1978), the originator of the

4 B.C. Ministry of Forests/Canadian Forestry Service Joint Report #8.

Swedish MP, concluded that root grafting led to occlusion of curled roots; danger of toppling existed when there wasn't adequate directional distribution of major roots to stabilize the tree, but the addition of ribs effectively reduced these root deformations. Lindgren and Orlander (1978) noted that trees with root deformation are often larger than those without deformation (see also Bergman and Haggstrom 1975).

Dimensions, volume and shape An advertisement for MP referred to a "wider, more shallow root system better able to take advantage of ground surface heat, giving seedlings a higher survival rate" (Can. For. Equip. Ltd., For. Chron. June 1982). However, opinions differ about the benefits of this heat, because there are considerable differences between Scandinavian and Canadian conditions. Apparently, the shallower MP #1 appears suited for the rooting of juvenile black spruce cuttings (personal communication Brian White, Superintendent, Strathlorne Forest Nursery).

Shade is not beneficial after establishment (Scarratt 1974).

Air root pruning Solid wall containers are designed for air root pruning and this is an important feature (Scarratt 1972; van Eerden 1974; Tinus and McDonald, 1979). Two types of problems may be encountered.

Crops raised on the ground enabling the roots to grow into the material beneath the container can lose root regeneration potential. If such crops are left in place until major rooting occurs beneath the container, then coarse, woody roots develop within the container. After lifting of the crop and drastic root pruning (either by ripping up and letting the dangling roots go by chance, or by cutting them off) the initiation of new roots takes valuable time and energy.

When crops are grown on raised benches or pallets for air root pruning, a similar problem may be found: a mass of inactive, air-pruned roots may extend from the drainage hole.

I should note that all crops to be overwintered in containers outdoors under freezing conditions must be stored in contact with the ground.

Density Every container has limits to the growth that it can support - limitations are imposed on both roots and shoots. However the right combination of cultural practices can produce shorter, stockier seedlings with good rooting. We see evidence of this when comparing winter vs summer crops (Hallett 1980), or in crop specifications for British Columbia (Matthews and van Eerden 1982), which they call "growing seaons" production.

Major Cultural Problems and Monitoring

Soil Water Managing soil moisture in the MP system probably is the most important factor not just because of the need for water, but

because of the influence of soil moisture content on aeration, nutrient uptake, and soil salts concentration. It is important to know how much irrigation water should be applied. Too much water drowns roots and washes out fertilizer; too little, desiccates roots, because of increased concentration of the soil solution.

Since no water can transfer between cells in the MP trays, and dried peat medium does not rewet readily, individual cells can dry excessively (evidenced by wilting seedlings here and there in the trays). Water should be added periodically to run-off to ensure that all cells are wet, and when fertilizer solution is applied, it also should be applied until it begins to leach out.

Soil fertility In the Maritimes, irrigation and fertilization practices were developed using the Paperpot which, like a sponge, can hold moisture beyond the limit of adequate aeration. Now, with the solid wall MP we must adapt to the system proposed by Carlson (1979). A large volume of nutrient solution at a specific concentration (replacement fertilization) is applied, which promotes the leaching of excessive salts, maintains a more uniform nutrient concentration (Fig. 1), and helps prevent individual cell drying.

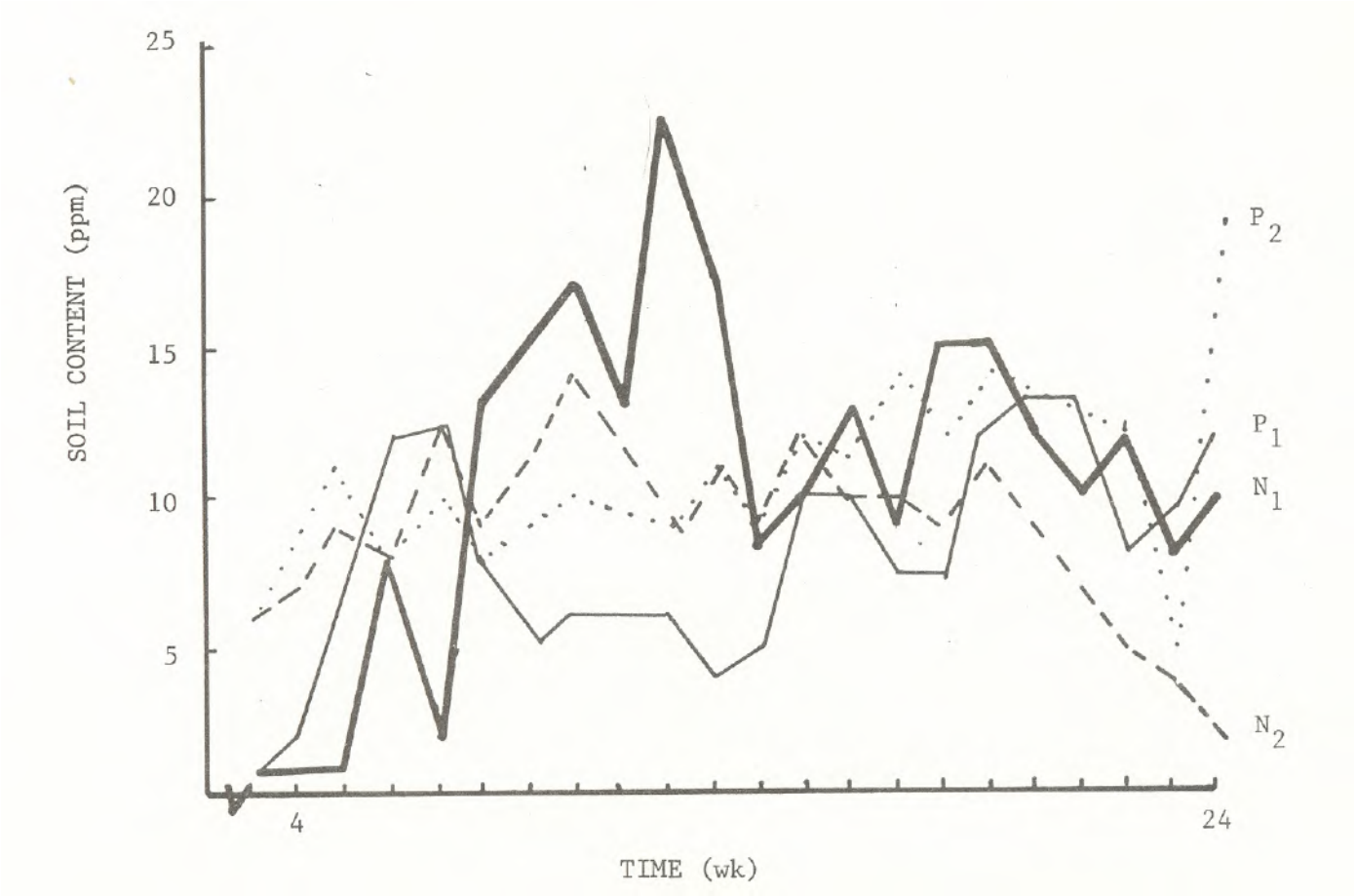

Fig.1. Trends in soil content of nitrate nitrogen and phosphorus as determined by lab analysis of greenhouse soil (peat-vermiculite): P_1N_1 - weekly addition of fertilizer by weight; P_2N_2 - weekly fertilization by "replacement" method.

Monitoring Seedling growth, soil moisture, and nutrient content should be carefully monitored as done by most Maritime growers. The control of soil moisture content may be the biggest problem because the water content of the medium can vary greatly in a greenhouse. These effects are discussed in a paper on monitoring (Hallett 1982). The influence of moisture can be readily documented by use of irrigation booms to create strips wich different moisture (and fertilizer) contents within a greenhouse.

Roots Most growers talk about problems in achieving the required root growth for extracting the plug in time for scheduled planting. Carlson (1979) stated that the dry weight of roots should be at least 40 mg/cm3 of rooting volume. It appears that may of our programs "get by" with much less. For example, some typical production crops of black spruce (Picea mariana (Mill.) B.S.P.) have lagged in root development when outplanting was expected by 18 to 22 weeks (Fig. 2). Some nursery-men say if the top shows good growth, root growth can be achieved before planting. How many complaints come in about poor rooting? Larson (1974) stated "nurserymen attempting either to maximize growth or to mass produce nursery stock must consider the ontogenetic relation between these two major plant systems, for an unbalanced seedling will not only limit growth potential, but will also be ill-suited for future out-planting".

Future Development Considerations

1. Slow-release fertilizers require refinements.

2. Mycorrhizal fungi, although known to be beneficial, are not available for economic inoculation of crops.

3. Maritime greenhouses have been operating in winter; will energy conservation measures allow the continuation of winter crops?

4. Can pregermination seed be effectively used for container production?

5. Overwintering crops is now widely practiced, who has not experienced problems?

6. Quality - what is required and what kinds of measurements can be made to ensure not just size, but also the quality needed for field conditons?

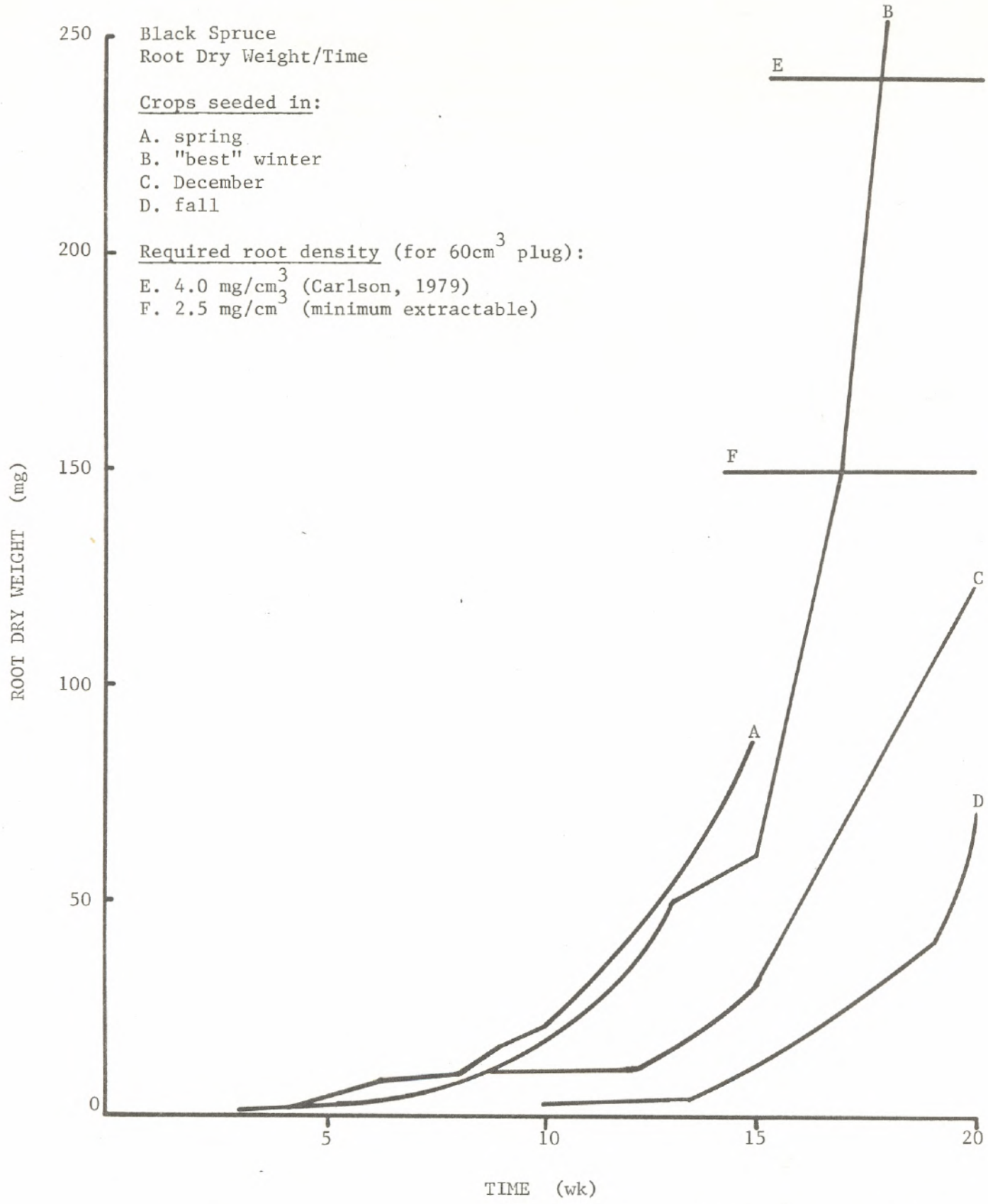

Fig.2. Progression of root growth in dry weight with age of several black spruce crops raised in greenhouses.

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