ENGINEERING THE CONTAINER -- Panel Discussion

Second of Nine Papers

THE ONTARIO TUBE[1]

Kenneth H. Reese[2]

Abstract.--The Ontario split plastic tube has evolved from a cost and availability aspect as much as from biological input. The hand loading equipment is quite successful but no automated mechanical equipment is operational to date. This container system appears to work well with jack pine, but at this time is not preferred for spruce. The adoption of an alternative container will require the complete restructuring of the present handling and production system.

DEVELOPMENT OF THE ONTARIO TUBE

Why did Ontario adopt the split plastic tube[3]? The reason is as much evolution and cost as biological.

In 1966, the Ontario Tube System expanded from small trials to large scale production. For over 10 years prior to this, Mac McLean (Forest Research Branch,Maple) had been developing the idea of growing small seedlings in micro-containers. A variety of paper tube materials were tried, the earliest being cigarette paper, then bond paper, then a light cardboard. Even this cardboard lost its strength and fell apart when handled late in the growing phase. Waterproofing with latex paint was not successful and finally each tube was being dipped into a plastic solution. At this point of development, in the fall 1965, it was announced that the container project would be operational in the next season and production would increase from 300,000 to 20 million. There was no easy way to coat such a volume of spiral cardboard tubes wit' plastic. The alternative was an all plastic tube and this could be readily extruded at low cost.

The two most important biological considerations in this tube were the longitudinal split which would allow the tube to fall off as the seedling diameter increased and the overlapping of the split edges to contain the roots inside the tube during growing. Over the few seasons which followed, start-up troubles were not related to the tube and as staff was scarce, no further development on the tube occurred.

In the fall of 1965, handling equipment for the tube such as trays, loading and seeding equipment and planting equipment were only crude wooden prototypes, if indeed such even existed. All

1/Paper presented at North American Containerized Forest Tree Seedling Symposium, Denver,Colorado,August 26-29,1974.
2/Planting Stock Specialist, Forest Management Branch, Ministry of Natural Resources, Toronto, Ontario.
3/Specifications for the 3/4 inch (19mm) Ontario Tube - High impact styrene, white colour, split longitudinally on one side, wall thickness 0.011 inch minimum, inside diameter 3/4 inch(19mm) with 1/8 inch (0.3mm) overlap, length 3 inch (76mm).

the equipment was virtually designed and manufactured during the winter of 1965, so that by May 1966, 15 districts were fully equipped and had germinating seedlings in prefabricated portable greenhouses. Vic Williamson (Forest Research Branch, Maple) was chiefly responsible for designing this equipment and the basic components are still being used with only slight modification. The early phase of this project had two significant reactions. It is difficult to remember a project in which so many people contributed from their area of experience to make something go. The project had a profound effect on our regeneration program by causing great volumes of site preparation equipment to be built and by developing in a great number of staff, an interest in seed quality and growing seedlings.

WHY STILL USE THE PLASTIC TUBE?

We continue to use the plastic tube for most of our production because the alternative containers that have appeared in great profusion do not fit our handlng system, have biological disadvantages or more expensive.

The adoption of a new container has a major effect on the existing handling and production equipment. The basic component in our handling system is the tray. This supports the container from seeding, through growing and transportation, until it is finally planted. If the tray size changes, all of our handling system would have to be rebuilt. if the tube size changes, the seeding equipment and the greenhouse area have changed.

From a biological aspect, many new containers have been rejected. For example, containers of the plug type do not suit our summer planting needs since it appears desirable to plant the container intact with the seedling when the possibility of a droughty soil exists. In general however, our tests of new containers have usually been inconclusive. Each container has its own specific growing schedule. Limited trials with a new container do not give the grower time to modify the standard schedule so that the plants produced do not reflect the full potential. As a result we have not done justice to most manufacturers who have presented new containers.

The cost of a container is usually one of the first questions asked. In our production system, the containers comprise approximately 10% of the total production cost. In recent years the container cost has become more significant as we moved from 9/16 inch(13mm) tubes to the larger 3/4 inch (19mm)tubes. The delivered price this spring increased by 15% to $4.50 per thousand tubes and may increase again next spring. Several containers are now in this price range. If we consider a 1.0 inch (25mm) tube for spruce, the price is $6.50 per thousand tubes. In this range several containers cost less.

We have not yet changed our container. There is however evidence that the 1/2 inch and 3/4 inch tubes for spruce are too small and the cost of plastic for larger tubes is not attractive.

THE TUBE AND PLANTING PERFORMANCE

The planting for the first three seasons following 1966, particularly for jack pine, cannot be considered as representative of the full potential for the plastic tube system. For instance the size of seedlings being planted has changed considerably. The early 50 mg jack pine seedling, 30 days old, is now a 300 mg seedling which is 70 days old or even overwintered. Observations of individual seedlings in these early plantings do however demonstrate the relationship between the container and the seedling.

Plastic tubes and jack pine appear to be compatible. We are able to produce 200-500 mg seedling in a 3/4 inch (19mm) tube which will grow quite rapidly in the second season of outplanting. A good deal of this success is probably due to the coarse root system which exhibits aggressive development. The early development of spiralling roots in the tube has been of no apparent detriment to the performance of the outplanted seedling. In fact tubed seedlings have far less deformation than bare root seedlings and have a distribution of roots radiating in all directions from the root collar.

Plastic tubes and spruce have not produced consistent results. Each season produces a wide range of results. In general, survival has increased but growth does not appear to be satisfactory.

However a few plantations do have spectacular growth. Reasons for the spruce dilemma are not clear. Factors which may be directly attributed to the tube are masked by a wide range of planting sites and planting conditions. Not everyone has discounted the plastic tube for spruce. Certainly in Scotland, exciting results are achieved with plastic tubes on peat soils, although not on mineral soils. A major criticism of the plastic tube is that it forces the roots to egress below this normal rooting zone. Roots of black spruce are quite shallow in mineral soil, preferring the humus layers. The plastic tube also prevents the fibrous spruce roots from establishing quickly outside the tube. One large scale test planting was done with tubes "on" and tubes "off". The tube "off" planting was definitely better rooted at the end of the first growing season, but due to a severe late frost the following spring, subsequent growth could not be assessed.

Our current reasoning is that paper is the preferred container for spruce. Despite our early experiences with paper, one paper container is being successfully used today, the Paper Pot. This type of container provides the required plantable container for an improved water relationship during the initial establishment period and yet allows the roots to egress into their normal zone.

HANDLING THE PLASTIC TUBE

The major disadvantage of this system is in the filling and seeding operation, in particular, placing the loose tubes into a tray in a perfect alignment for batch seeding. In hand loading, this operation is done by slipping the tubes onto lugs attached in the required array to a tray sized base plate. This same tool will hold the tubes until the soil filling has been completed.

No mechanical equipment exists for the plastic tube. Initial attempts at mechanically arranging the empty tubes into a package for simple placement into the tray have not been pursued. The initial mechanical line for filling and seeding tubes had great difficulty in loading the local muck soils to the required compaction. Subsequent mechanical development has been delayed pending a decision on a new container material and system for spruce.

With current hand seeding equipment, Swastika reports that 8000 tubes per man day, 3/4 inch (19 mm) diameter, can be filled and seeded, using a 10 man crew. Approximately one-third of our total production cost is in this loading and seeding operation, including the cost of tubes, trays and peat. Some production centres have recently used large numbers of Spencer-Lemaire containers feeling that these can be loaded at less cost than plastic tubes, but no cost figures are yet available.

The plastic tubes are easily planted, allowing for rough handling without the container breaking apart. This firm package may be important in developing the automated planting machine concept. Although a few roots are required to keep the peat in the tube, the tube does not have to be root bound. This minimum rooting provides considerable flexibility in selecting planting material since seedlings at virtually any stage of development can be planted.

Planting rates of 1500 tubes per man day are reported and even 2000 are not unusual. We have not achieved the high rates of 3000 and 4000 that are reported from other areas and countries. Our work methods or our length of working day may require modification since we are using the basic system that evolved for planting bare root stock.

RESEARCH USE OF CONTAINERS

One of the most significant impacts of the plastic tube has been in tree breeding and research programs where greenhouse propagation or trials are used. Virtually all seed propagation done in our Forest Research greenhouses uses plastic tubes. It provides density control, prevents some of the damping off losses and due to a compact, orderly configuration provides for replicated treatments within a tray.