THE PAINFUL PROBLEMS OF PIONEER PROPAGATION PLANS AND OTHER ADVENTURES

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I would like to add my personal welcome to delegates here from out of the province. You'll notice a few unusual characters and peculiarities both in the people and in the place. First, trees take forever to mature, and everything can be conveniently blamed on the weather. The people are a colorful lot. We have blackhearted rednecks, who have managed to garner a few greenbacks in the pursuit of oil and politics; a strong group of Conservative blue bloods born to the purple; and some immigrants from the East--the older population regards them as white-faced, brown-nosed, yellow-bellied Orangemen! Seriously, however, we have a really cosmopolitan population and a reasonable amount of tolerance. Our Heritage Days attract tens of thousands of people to see native and ethnic displays, taste their food, watch their dances.

Looking around at what we have now, it's hard to visualize how we got to where we are in the business of reforestation and reclamation. What did we do, before tubes were in and bullets were out, when a million was a big number, and we did not know words like air pruning, outplanting, tubeling, bench spacing, and Rootrainers?

In the beginning was bare-root transplanting, along with which certain nurseries had problems with clay soil, blown weeds, and inefficient herbicides. Budgets were miniscule, and responsibility for the job of forestry research largely depended on the Canadian Forestry Service.

Those boys in green had long been trying to apply new ideas to tree growing. *In 1952 a research forester from the Alberta district office, noting that scientists had* discussed root growth as being independent of top growth, proposed transplanting white *spruce at the Kananaskis Station over a period of 24 weeks, right up into October. Tests were replicated for 3 years, and in 1956 when this research forester, Des Crossley,* became Chief Forester for St. Regis, he took along his innovative ideas.

In 1960, when John Walters first introduced the Bullet, Des, along with Larry Kennedy from the Alberta Forest Service, John Chedzoy from the Department of Agriculture, and Bob Ackerman of the Canadian Forestry Service, tried to adapt the bullet technique to Alberta conditions. They found that roots got stuck inside and would not grow into Alberta's cold soils. This was the start of most of our work, and looking back you could say our work was to suffer similarly from blind gropings into the darkness of the unknown. But note the beginning cooperation between industry, two departments of the provincial government, and our federal friends. We can applaud the fact that it is still going on today.

By 1963, new ideas were beginning to be put forward. Larry Kennedy designed a half-shell bullet that was to be held together by friction or an elastic band, and then he shopped around Edmonton for a plastics manufacturing company that could do it. John Chedzoy found, about the same time as the Ontario Forestry Service, that paper tubes impregnated with latex could be used to grow seedlings. Peat blocks such as the Jiffy 7 were tried, and then began a search for a container that would really work.

The thing that I remember most clearly from those days was the incomplete knowledge base. We would think of a solution and would have to try that solution without fully knowing its side effects. Often there would be 10 or more designs, all being tried at once. Problems would get compounded such as, for example, when unsterile cardboard tubes were tried with scorched peat that was short-fibered and everything died, or when waxed cartons were tried instead of plastic trays, and Rocky Mountain House Nursery grew a beautiful bunch of mushrooms.

Uppermost in our minds at first was the experience of the bullets, that the roots of a small seedling could not get out of the drainage hole provided and that the bullet should allow for expansion by being made in pieces. (Walter's latest design follows this idea!) Trials made by Joe Soos and company several years later showed that split bullets worked after a fashion, but the first results were not so great. As I mentioned, Larry Kennedy's design was to have the bullet open easily to let the roots out, and he thought of a two-shell unit bound with an elastic band. The idea was that the band would rot in the soil, there would be easy egress for the roots from the join all around the two halves, and it seemed like a terrific idea. We calculated that we might persuade people to plant up to 100 000 trees this way. We did not reckon with the elemental forces of nature, however. (And we grossly underestimated the eventual market.)

First, we chose a rubber band of enduring and superior quality that six years after being buried in Alberta's cold and relatively inactive soil was still there, holding the two halves of the shell together. Second, we put some lateral grooves around the sides of the shells to act as anchors for the elastic band. These indentations would turn the lateral roots as they reached the side walls, and spiralling within the container was deadly. Third, the containers were very hard to handle, with their sharp points, their tabs sticking out on each side, and their awkward shape. And fourth, the unknown factor, many of the transplants were lost because they were a bright blue. A lot of the seedlings were pulled out and broken to pieces because of the curiosity of magpies. There was one side feature that was somewhat beneficial to the effort, and that was that frost did not heave these containers out, since there was a certain amount of friction plus a locking effect caused by the lateral grooves and the rubber band.

Subsequently, in Alberta we had some doubts about tubes, thinking it would be difficult to keep the medium inside, that it would fall out when taken to the field, and so on. About 25 different ideas were tried, from square cross-sectioned bullets that were folded over to little blocks made of a foamed cement. We were not very successful. But along the way, a number of ideas showed real promise. One of our problems was bad peat, which had not been sterilized. It was thought that we should use containers and media that were sterile.

An early experimental container was the Oasis block, a foamed open-celled phenol-formaldehyde material used by florists for holding cut flowers. We took a block, cut through with a saw in both directions to form a grid of containers 3/4" x 3/4" x 3" deep. A small depression was carved with a sharp point in the tops, and a seed was placed in each and covered with a little soil. There was a little difficulty with roots moving from one block to the next, but this was thought unimportant, since a minor amount of pruning prior to transplanting might stimulate root growth even if the seedlings were shocked.

The second idea was a container made from cigarette filter material. These were 3/4" in diameter by 3-1/4" long and were prepared by being placed in a tray and watered; then the seeds were forced into the filter material.

A side note on this: the seeds could not turn over or decide which way was up. When they germinated the root would sometimes head off up into the air. The problem was solved by forming a small pocket in the top of the filter material and again covering the seed with soil.

Both ideas failed in the field. With the slightest projection of the porous or filter material to the atmosphere, the container would act as a wick, drawing all the moisture out and evaporating it, and drying out the soil for some distance around. The cigarette filter material was also particularly attractive to field mice, who used it to line their nests.

Another step forward was unconsciously taken when the roots were grown in the longitudinally directed media. It was observed that the roots would follow straight lines in the general direction of the parallel spaces between both filter fibers and long cavities in the Oasis material and did not form the usual branched pattern.

Meanwhile, urgency had been mounting for implementation of one or other of the dozens of systems tried at that time. By this I mean we were told we had to get the lead out! Public relations was one of the forces that led us into the next error. At the time, the split styrene tube was the best available plantable container. It was assumed that roots would grow out the bottom and that the roots would hold the growing medium together. The split side was to allow root pressure to force the container apart and prevent girdling.

The process was adopted and used for 5 years by both government and industry. We standardized the size of trays, and the Alberta Forest Service and North Western Pulp and Power refined the systems of filling, growing in the greenhouse, hardening-off, transporting to the planting site, and out-planting.

But, during that 5 years several of us had some concerns. Our experience with root spiralling, and the fact that in some sites the best nutrition the plants could get was in the top 3" of soil (where it was prevented from reaching the plant by the impervious styrene tube), drove us to examine ways of removing the tube before the plant went into the ground. We experimented with razor slitting, with fingers that would unfold the tube and allow the plug to drop free, or with building in a weak spot that would break. None of these ideas really worked. Styrene has a shear strength of 2000 psi, and anything we designed seemed to require several hands to operate. Bob Carman, silviculturist with St. Regis, suggested a styrofoam block with tube-size holes in it that could eliminate the trays. We decided against this partly because of tooling costs and partly because we could see extraction problems. During this time we discovered the hard way that tubes held together in a plastic tray would allow roots to mat all over the bottom, making transplanting very difficult. The solution was to paint the bottom of the tray with a copper salt chemical. While trying to make the trays less expensive, it was decided to purchase a number of foam styrene ones. Unfortunately, the solvent for the copper dissolved the tray bottoms!

In September 1970, Bob Fish, who took over from John Chedzoy, hosted a meeting of the Inland Empire forest group in Edmonton. We were all introduced to the B.C. Styroblock and the Alberta Research Council's "sausage" container. I showed the group an experimental hexagonal grid container block I had made up for the U.S. Forest Service at Bottineau, North Dakota. Following the discussions, Jim Kinghorn of the Canadian Forestry Service described the action of roots being air-pruned and the necessity for the blocks to be held up off the ground to prevent roots from jumping the distance to the ground and finding a hold. He told us that in working with bullets the Canadian Forestry Service had decided to remove seedlings from the shells and had discovered or rediscovered the principle of air pruning and its effects on root branching.

Listening to him talk, I thought that a book design, by which the seedlings could be extracted very easily, and grooves, which would direct the roots to grow quickly to the drainage holes, would be beneficial features.

We could see the potential for the idea. After discussions with people who would be the main purchasers of the new design, North Western Pulp and Power and the Alberta Forest Service, we began work for production of the original Rootrainers. We had samples under test by December and results by January. The roots really went straight and followed the grooves instead of spiralling. Patents were applied for.

We designed production tools to provide two sizes at once, for North Western Pulp and Power and for the Provincial Tree Nursery. Tooling was barely completed in time for the growing season, but tests were successful, and we were off and running.

Rootrainers went through at least 25 design changes to arrive at the present style. We at first wanted round containers, to fit dibble holes exactly. Then we found out that the planters used mattocks or spades, so we would not need to have a round container and could get better greenhouse utilization using square or rectangular ones.

The first boxes to hold the Rootrainers had no ventilation holes in the base, and we tried to depend on little knobs on the bottom of each book to hold the box up and prevent roots from growing any more. That did not work. We tried special designs to keep the books from getting out of line and finally developed corrugations that fit back to back and held the books solidly. We redesigned the shiplap seal to be one-sided instead of having to fit in pairs. We modified the lock-over ears to come up higher and thus prevent root wandering. We made a folding box so it could be shipped some distance and redesigned that several times to improve its practicality. The latest design has just been finished, and we now have developed five Rootrainer sizes, which are still not enough for the demand. Tests are being performed continually, on new materials, on new additives, on different shapes, various growing media, and so on, in available laboratories such as the Provincial Tree Nursery, the Northern Forest Research Centre, and the USDA Forest Service labs at North Dakota. Through the cooperation of these organizations we are able to solve field problems.

One problem we have been concerned with from the beginning is the filling of these small, deep containers with peat and peat and vermiculite mixes. Recently, the Provincial Tree Nursery built a shaker table that has some special characteristics. The main one is that it works very well. Vibrating horizontally with an amplitude of half an inch, the shaker table is able to settle a sticky wet mass of peat into the cavities. Operators place five trays in a holding rack and start the vibrator, and a conveyor belt brings peat to be dumped on the Rootrainers. By hand brushing, the material is spread evenly over the trays. Individual trays are then taken out and manually drop-compacted on bars in front of the shaker table, then placed back in the table for another vibratory filling. Our newest design, a modification of this has been tried out at various amplitudes and speeds and is capable of faster and more uniform filling. The prototype, sold to Simpson Timber, does a very acceptable job.

We look forward to many changes, both in design and fabrication methods. For now, however, we have a working system that pleases most people. We have turned our attention to streamlining the Rootrainer manufacturing process. Our new development is a folder-upper that will fill trays with folded Rootrainers. Many other machinery designs are on the drafting board, and we continue to see new applications for the Rootrainers system. At Spencer-Lemaire, we all enjoy the challenges.

Of course, the business that has been developed has made for a lot of traveling. One of our province's great travelers, the Honorable Horst A. Schmid, Minister of International Trade, loves to sell Rootrainers. Recently he was made an honorary chief of the Samson Band in Alberta, and because he travels so much they call him Chief Flying Eagle. Perhaps a quotation from Konrad Lorenz will be to the point:

> "How thankful I should be to Fate, if I could find but one path, which, generations after me might be trodden by fellow members of my species; and how infinitely grateful I should be, if in my life's work, I could find one small "up-current", which might lift some other scientist to a point from which he could see a little further than I do."