

## The Q-Plug: A One Year Transplant

By David Steinfeld

For years, nursery managers have looked for ways to produce a transplant seedling in one season. Not only would this drastically reduce costs, it would also make planning and ordering seedlings easier for clients. One approach that has been investigated is to 1) sow into small containers in early winter, 2) grow for three to four months under greenhouse conditions, 3) extract and transplant in spring, 4) grow in bareroot beds for nine months and 5) lift the following winter. At Stone Nursery we have tried this method over several years using Styroblock<sup>®</sup>2, [2.9 in<sup>3</sup> (39 cm<sup>3</sup>)] and Styroblock<sup>®</sup>4, [3.7 in<sup>3</sup> (70 cm<sup>3</sup>)] containers. We learned that seedlings sown in mid winter did not have a firm root plug that would tolerate transplanting until late May to mid June. Unfortunately seedlings planted at this late date are not only subjected to hot, dry environmental conditions but, they also don't have enough time to develop the target size requested by our clients.

We realized that the key to producing a one-year transplant is to work with a plug that would hold together without the support of a developed root system. This would allow us the flexibility to extract and transplant at any time during seedling development, opening the transplant window to as early as mid March at our nursery. Concurrently, we were also looking for a stabilized plug that would work well in a carousel type



Figure 1. 10 week old Doulgas-fir seedling in Q-plug ready for transplanting.



Figure 2. Carousel transplanter – Q-plug is placed in chamber (A) which rotates the plug 180 degrees and drops it into tube (B) which delivers it to the soil.

transplanter - a transplanter that we believed would give us higher transplant production, better density control and better planting quality. When it really came down to it, we were looking at modifying our entire transplanting system if we could find the right plug. That plug is called the “Q-plug”.

### The Container Seedling

A Q-Plug is like a fine textured sponge that when thrown against a wall will bounce. A bag of them could very well be wrapped and placed under a Christmas tree to a young child's delight. Q-Plugs are produced by International Horticulture Technologies ([www.ihort.com](http://www.ihort.com)) who describes their product as a “stabilized rooting media<sup>™</sup>”. The technology is proprietary but basically the media is composed of composted bark and peat, held together with a binding agent. The media can be molded into any shape and size and the company has molds for a variety of growing containers. For our needs, we chose a Hortiblock<sup>®</sup>200 container which is a styrofoam block container with 200 cells, tapered for easier extraction. Plug volume is 1.2 in<sup>3</sup> (20cc) and length is 2.4 in (5.8 cm) (Figure 1).

### The Transplanter

Having found the right plug, we turned our attention to selecting a transplanter. Up until this point, our production transplanting had been done with a clip/wheel

transplanter. Since clips cannot hold the stem of a very small Q-Plug seedling, we became interested in the carousel type transplanter. With this technology, a seedling is simply placed into a rotating chamber (Figure 2) which drops the seedling through a tube that delivers it to a furrow in the soil where it is packed into place (Figure 3).

We settled on the Mechanical Transplanter 5000<sup>®</sup>, a carousel transplanter produced by the Mechanical Transplanter Company. We purchased nine carousel units and fabricated a transplanter that could plant nine rows in a bareroot bed at a density of 11 seedlings per square foot (118/m<sup>2</sup>).



Figure 3. As transplanter moves to the left, a Q-plug drops into the soil (A) and is placed into an upright position with a moving paddle (B). The soil furrow is immediately closed.

### Container Culture

Last fall, we contracted with the IFA Nursery in Klamath Falls, Oregon to grow several million ponderosa pine, Douglas-fir and incense cedar seedlings in Q-Plugs. The nursery was within an hour and a half drive from us, which was close enough to give us flexibility in ordering seedling shipments on short notice. Their nursery management saw this as a great opportunity to fill greenhouses that were typically empty in the winter months. They could have a Q-Plug crop grown and shipped to us by the time they needed to fill their greenhouses with the normal spring production crop. So, in late January we sent them stratified seed, which they sowed over the next several weeks. Since the volume of the Hortiblock<sup>®</sup>200 plugs are very small, attention to the moisture status of the plug was critical and irrigation schedules were adjusted accordingly. In addition to frequent irrigation, seedling culturing involved light fertilization and several applications of mycorrhizal spores. By late March, the crop was ready to ship back to our nursery for transplanting.

### Transplanting

As luck would have it, the weather last spring was the worst we had experienced in decades. We were uncertain from day to day if we were going to be able to transplant so flexibility in seedling shipments was important. When a shipment of seedlings arrived, we would store them outside for several days until we were ready to transplant them. Because of the small size of the seedlings and lack of many roots, plugs could not easily be extracted from the containers without a little help. We had to fabricate a pin-type block extractor to loosen the Q-Plugs from the styrofoam blocks. As soon as they were loosened, the styrofoam blocks were placed on the transplanter (Figure 4). We designed the transplanter to store enough containers to transplant an 800 foot (244 m) bed. At the beginning of each bed, our crews would position several styrofoam blocks in vertical frames in front of each carousel. Crew members would then gently pull Q-Plugs from their containers and place them in the carousel chambers. Once our crews got the hang of it, we were planting between 130 to 170 thousand seedlings a day per transplanter.

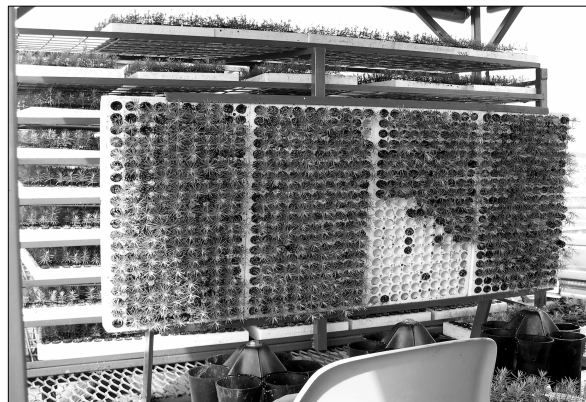


Figure 4. Several styroblocks (Hortiblock 200) are placed vertically in front of each carousel for easy extraction and placement in chambers.

### Bareroot Culture

Culturing a seedling crop started in Q-Plugs presented us with some initial challenges. We learned that transplanting into less than ideal soil conditions becomes even more critical with the small Q-Plug. Since the soil conditions last spring were often very moist during transplanting, the soil around the Q-Plugs was often compacted, resulting in poor aeration and drainage immediately around the plug. To increase soil friability, we wrenched the seedling beds in late June. The Douglas-fir and incense cedar seedlings were not affected by the stress of this operation and they kept growing through the summer but the ponderosa pine set

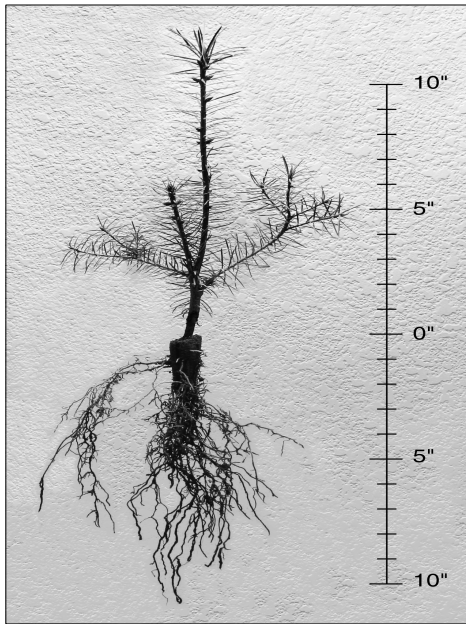


Figure 5. Douglas-fir seedling started in Q-plug in February 2003 and lifted in January 2004.

a bud and stopped height growth. All seedlings however continued to put on root and caliper growth into the late fall (Figure 5). Transplanting with drier and more friable soils will improve future crops.

### Summary

We see many advantages to this new one-year transplant stocktype. Most of our clients are located in areas where summer precipitation is extremely low. Their target seedling has a small top, high root volume and large stem diameter. While our 2+0 or 1+1 seedlings have large stems and good root volumes, they also typically have corresponding large shoots since they have been grown for two years in a nursery that has an extremely favorable growing environment. While the Q-Plug transplant has a smaller root volume and stem caliper than a 2+0 or 1+1, it has a much higher root to shoot ratio, giving it an advantage on droughty sites. Our departure from standard bareroot transplanting methods has resulted in many benefits including:

- ?? Eliminating the 1+0 year in a bareroot bed
- ?? Eliminating seedling extraction and cold storage
- ?? Increasing worker productivity on the transplanter
- ?? Increasing seedling bed density
- ?? Reducing poorly planted seedlings (reducing culls)

- ?? Decreasing the time in a greenhouse (10 weeks vs. up to 9 months)
- ?? Reducing seedling costs, while producing a stocktype that meets the needs of many of our clients.

We are receiving good orders for one-year transplants for this coming year. Of course, the final test for any new stock type is survival and growth on the outplanting site. Several land management agencies (including Medford BLM and the Umpqua, Winema and Wenatchee National Forests) will be outplanting our transplant stock this coming spring and we will monitor seedling performance for several years.