Managing surplus or holdover nursery stock

By Thomas D. Landis

So, you've survived another hectic lift-and-pack season but you are left with some surplus or "holdover" plants. Maybe your sowing factors were a little too generous or you overestimated the market for a particular species. Sometimes, poor outplanting site conditions or operational problems means that some stock must be held over for another season. Surplus plants can also show up during grading. Sowing problems, poor weather or cultural shortcomings can result in perfectly good plants that don't meet grading specifications. Overly dense seedbeds produce stunted plants that lack the desired stern diameter, or excessive fertilization produces excessive height growth. What about the large plants that exceed both height and stem diameter specifications? These are often the genetically superior plants that you just hate to throw away. Even if you were aware of the surplus and didn't harvest the stock, you can't leave them in the seedbed or in the containers for too long.

One of the most difficult concepts for novice nursery managers and their customers is that, unlike many products, plants have a shelf-life. Nursery stock is at its peak quality when the plants are harvested and graded and, ideally, they can be shipped and outplanted soon afterwards. Of course, that often isn't possible so the plants must be placed in some sort of storage that maintains that quality. In the days before refrigerated storage, bareroot nurseries "heeled-in" their stock but this mainly protected the roots from desiccation and eventually plants would break bud. Early container nurseries tried to maintain plant quality by placing their stock in lathhouses or other shaded storage, but again, this was a short-term solution. Eventually, the plants would begin to grow and quality would suffer. Refrigerated storage will maintain plant quality for months but eventually, if you can't sell or ship them, something must be done.

Figure 1 – The best option for surplus or holdover bareroot stock is to root prune and transplant them (A); transplanting increases in-row growing space, which produces greater stem diameter (B).

One of the greatest challenges in nursery management is what to do with plants that have reached target size but haven't been sold or shipped for outplanting. Surplus or holdover stock happens in both bareroot and container nurseries but, as we will see, is a much greater problem in containers.

Bareroot stock — If the surplus plants are still in the ground, you need to evaluate the seedbed density. Seedbeds that are not too dense and still have lateral room to grow can be root pruned and/or wrenched to slow shoot growth, develop a more fibrous root system, and increase stern diameter. In most cases, however, plants are already too dense and would become stunted if left in place for another season. Overly dense crops are also an ideal breeding ground for fungal pathogens such as *Botrytis cinerea.* So, the best option is to harvest the plants, grade, and transplant them (Figure 1A). These plants and stock that is already in storage will have to be root pruned because the target root length for outplanting is much too long for transplanting. Transplanting increases growing space with the row, which produces plants with greater stem diameter (Figure 1B). The greatest challenge will be to keep the shoot-to-root ratio in balance, so these transplants will have to be root pruned or wrenched, which will also increase root fibrosity.

Container stock - Container nursery culture has lead to increased growth rates because of the greater control over most potentially limiting environmental factors. The challenge comes when we want to stop that growth, especially in roots because they don't go dormant. Shoots can be coaxed into dormancy by cultural manipulations of daylength (blackout), mineral nutrition, and water supply, but how do you stop roots from growing? The only way to do this is with cold temperatures, which is why refrigerated storage has become so popular (Landis and others 2010). Nurseries in milder climates that use open or sheltered storage can have a serious problem because roots continue to grow even after shoot growth has stopped. Tropical nurseries suffer the greatest risk of plants becoming "rootbound" because their stock never goes dormant.

Rootbound nursery stock can be defined as plants that have grown too large for their containers, resulting in severe matting and tangling of the root system (Figure 2A).

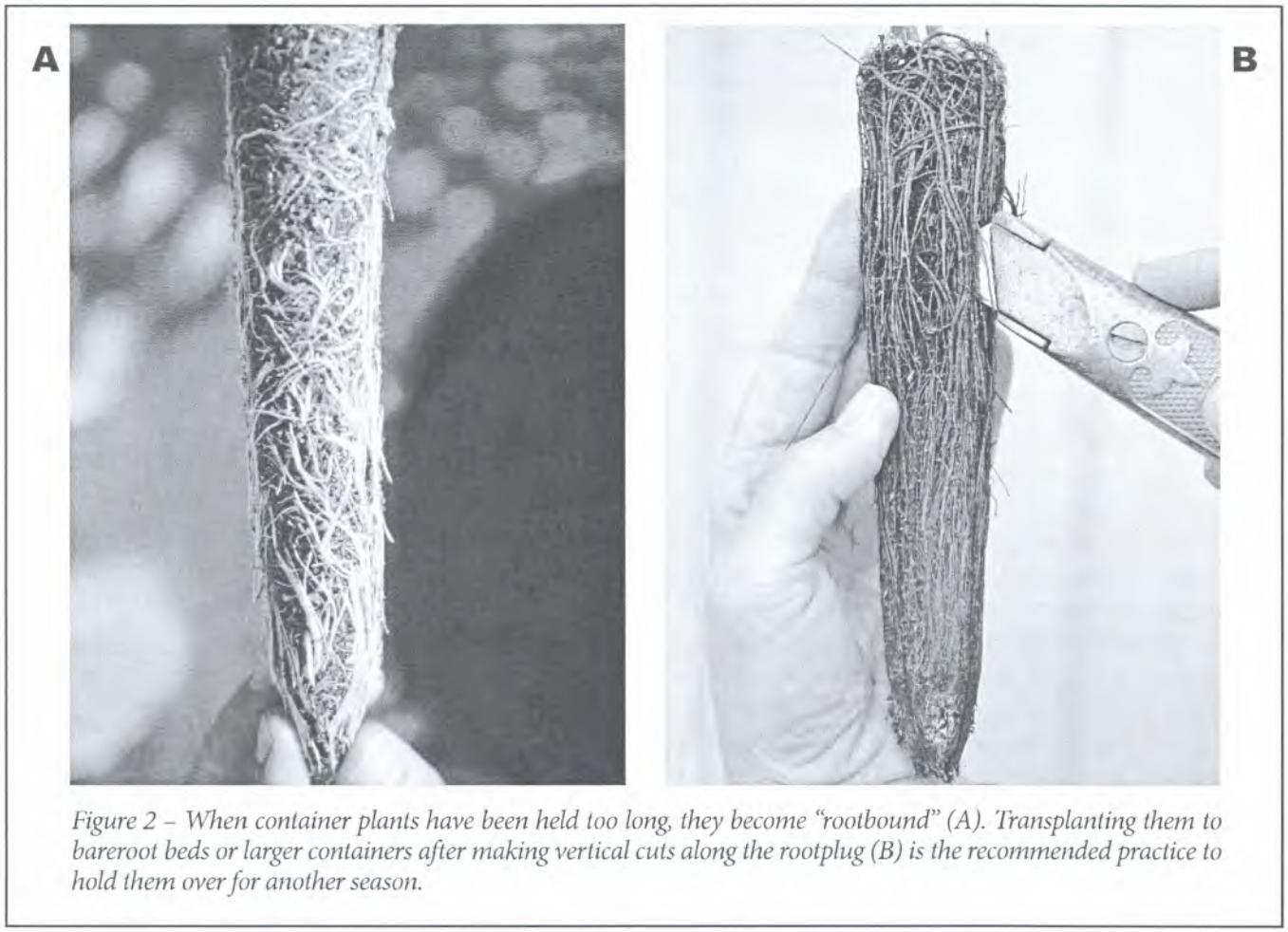

Figure 2 – When container plants have been held too long, they become "rootbound" (A). Transplanting them to bareroot beds or larger containers after making vertical cuts along the rootplug (B) is the recommended practice to hold them over for another season.

Observations have related rootbinding to the length of time that the plant has been in the container (Balisky and others 1995). Logically, the larger the container, the longer it takes for the plant to become rootbound. But time alone is not the only controlling factor, because root growth is also affected by cultural conditions at the nursery. A species growing rapidly in one nursery will become rootbound faster than the same species growing more slowly in another nursery. Similarly, a species in a large container given large amounts of fertilizer may become rootbound as fast as the same species in a smaller container given smaller amounts.

The fact that excessive root growth can be a quality issue in container plants has been known for decades. During the early 1980s there was considerable concern about "toppling" of lodgepole pine *(Pinus contorta)* container stock which was proven to be caused by poor root egress after outplanting (Burdett and others 1986). This lead to the development of copper-coated containers and then to sideslit containers which encourage roots to egress all along the length of the plug instead of just at the bottom. Trials into extending the growing period to produce larger stocktypes also resulted in plants with excessive root biomass for their respective container volumes. Whatever the cause, container plants that have plugs with high root densities suffered poor survival and growth for several years after outplanting (Salonius and others 2002).

How to characterize rootbound plants has been a challenge. South and Mitchell (2006) propose a "root-bound index" based on root-collar diameter divided by container diameter or volume, but this index must be calculated for each container type. From an operational standpoint, establishing a maximum stem diameter along with a visual assessment of root binding might be the most practical system (Landis and others 2010).

Okay, what do you do if your container plants have become rootbound? The best option is to transplant into larger volume containers or into bareroot beds. In fact, the relatively new plug+one stocktype was originally developed as a way to hold over container seedlings (Hahn 1984). If you want to keep your plants as container stock, then you can just transplant into another container that is large enough to support new root growth. It's a good idea to cut the root plug from top to bottom at a couple of places as well as trim the roots at the drainage hole (Figure 2B). This process is time consuming but encourages new root growth all along the length of the original root plug.

Summary

Surplus or holdover stock is sometimes inevitable hut careful planning and good communication with customers can reduce the instances. Bareroot stock should have their roots trimmed and then be transplanted; the plants may need to be pruned or wrenched to maintain a good shoot-to-root ratio. Holdover container stock is more of a challenge because the plugs can become severely rootbound. Make vertical cuts along the root plug before transplanting them to bareroot beds or containers large enough to promote new root growth while retarding excessive shoot growth.

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