Shrinkage can destroy profits

B&B producers, avoid this major problem

By Carl E. Whitcomb

When field-grown trees and shrubs are harvested conventionally, a considerable additional investment is added to each plant.

When machinery, labor, loss of productive field soil, wire baskets, burlap, twine and other necessities are added up, the investment at harvest is substantial. Add to this the cost of the liner and planting and maintenance (including fertilizer, pruning, weed control and other factors each year for two, three, four or five years). Such an investment would seem a strong incentive to be sure every harvested plant is well cared for so that it maintains its value and can ultimately be sold. But too often that is not the case.

Typically plants are harvested while dormant and placed in some type of yard or holding area and surrounded with mulch. The shrinkage begins.

Problems abound

On a recent tour of five field nurseries, a survey of the conditions of plants still present in September after spring harvest was made. Counts of nine species, common to all five nurseries, showed a shrinkage (dead) percentage from 6 percent to 62 percent. There was a possible shrinkage (severely stressed and unlikely to be salable) percentage of 17 percent to 100 percent.

To be included in my survey, at least 20 specimens of a species and cultivar had to be present on each site. Only plants with tops that appeared to have been of salable quality when harvested were included.

This survey raises several key questions:

- Why did trees die when held on the nursery site?
- Would trees that died on the nursery site also have died had they been planted into a landscape?
- What can be done to reduce tree stress/loss in the holding area?
- What can be done to improve tree performance in the landscape?

Photos by Carl Whitcomb

These trees were harvested in late winter or early spring and had remained buried in mulch through the growing season. Shrinkage (death or loss of salability) are common with these plants in late season.

Identifying the problem

These nine factors contribute to the problem:

1. Poor root system to begin with. Poor root systems are commonly the result of bare-root stock, root-bound container stock, poor planting procedures or a combination of these.

Bare-root stock loses all fine-fibrous roots during harvest and storage. New roots are produced only with spring bud swell. But these new roots are nearly all produced at the cut ends of old, larger roots that did not dehydrate during harvest, storage and planting.

If a bare-root liner has roots out 10 inches on either side of the stem when planted, and

Roots that extend from the root ball into mulch receive very few nutrients to maintain plant energy.

Plants removed from mulch and spaced as soon as the risk of severe winter weather has passed will develop better root systems and have better survivability.

then is dug with a 24-inch spade, this leaves only 2 inches of new root growth retained on either side of the finished root ball.

If the bare-root liner was planted too deep and the tree spade used at harvest had a sharp taper, even fewer new roots will be in the harvested root ball.

With field-planting machines, a slit opening is made in the soil, the plant roots are inserted, and then packer wheels press soil back in place. This leaves roots of bare-root plants oriented down the row, with compacted soil on either side.

A study with young slash pine trees that had blown over in high wind concluded the blowover was the result of slit planting and restriction of lateral roots on two sides. If soil is moved up and around the stem with cultivation, roots end up buried even farther.

Liners planted in the field from conventional containers are typically root bound and/or have variously deformed roots. Root growth from a conventional container ball continues in the direction root tips were oriented at time of planting. If there were no roots on one side of the container ball due to heat, there will be few, if any, roots on that side at harvest.

2. Root balls too small. Root balls are commonly too small to sustain the top of the plant for more than a brief period. Weight during shipping and handling and loss of productive field soil are the two main reasons for creating root balls of minimum size.

3. Poor nutrition in the field. Plants run on energy (sugars produced by the leaves). When one, two or more nutrients are deficient or in excess, energy production declines.

Frequently little consideration is given to nutrition during fall, winter and early spring when field stock is dug. The old premise that fertilizer, particularly nitrogen, must be low going into fall still haunts. Research has shown this to be false.

In fact, if only one nitrogen fertilizer application is to be made per year, it should be in fall.

4. Poor or no nutrition following harvest. When fertilizer in the soil is low — particularly nitrogen — then plants are harvested, the limited nutrition in the root ball will be exhausted quickly. As noted previously, plants run on energy.

When energy reserves decline, the rate of production of new roots similarly declines.

5. Roots grow into mulch. A harvested balled-and-burlapped tree typically has root buds and energy to make one good flush of new roots. If those roots extend into mulch that contains few or no nutrients, little or nothing can be absorbed to aid recovery and preparation for the next flush of roots.

In most cases, when trees are moved a high portion of roots that extended into mulch are lost due to breakage, dehydration or both. Root production on the landscape site must begin all over, and with the tree in a much weakened condition.

The few roots that are produced following planting must sustain the tree, including terminal bud development. The production of new roots the following spring is very dependent on activity of terminal buds.

6. Poor water management following harvest. Water management of heeled-in B&B trees is especially challenging because of the contrast between fine-textured field soil in the ball and coarse-textured material typically used as mulch.

Most mulch materials allow rapid penetration of water and migration to the ground below. On the other hand, field soils are much slower to absorb water. When leaves are present, water in the soil ball is typically used in a day or less.

Further, unless water is applied slowly and directly to the soil ball by spray stakes or drip emitters, the general area may appear wet, yet little water has penetrated the original soil ball.

7. Poor-quality mulch. Poor-quality mulch materials can be a contributing factor to shrinkage. Fresh hardwood bark or wood chips are very poor mulch.

Rapid decomposition of small particles ties up any nitrogen present. Hardwood bark and wood chips release substantial concentrations of calcium and manganese, which are absorbed.

Leaf chlorosis and browning of leaf margins can be caused by absorption of toxic levels of manganese from hardwood mulch. Any conifer bark is a much better mulch choice. Conifer bark does not accumulate calcium, manganese and other elements like hardwood bark.

8. Poor drainage on the holding site. Many holding yards are, or soon become, poorly drained swamps as a result of soil compaction, spillage of soil, mulch materials and the grinding of mulch particles into very small particles.

With vehicle activity and spilling of organic matter, a well-drained, sandy soil will quickly pond water on the surface. In the rush to get the holding area tended to, water is often applied by large sprinklers. Species vary in their tolerance to poor aeration and poor drainage; redbud, dogwood and most conifers are at the top of the sensitivity list.

9. Plants held too long. The longer plants are held under these conditions, the greater the problem.

The solutions

Here are a few solutions to help to limit waste.

Plant only liners with good root systems. Liners with circling or deformed roots will produce fewer roots out into the surrounding soil and will provide less support to the top compared with liners with

A good finished plant begins with a quality liner. The liner on the left has circling roots that will cause problems later. The liner on the right has a proper, fibrous root system.

fibrous root systems and no circling.

Keep mulch use to a minimum. Trees harvested B&B for short-term sales or use, in either early fall or late spring, should be placed in an area with good surface drainage that's not mulched.

Mulch is a crutch. The only true value of mulch to B&B trees is to protect from cold injury. With fall-dug trees in Northern locations where cold may kill roots, this is a must. But with late-winter- and early-spring-harvested trees, in most areas, mulch is not necessary and is terribly counterproductive.

Protect roots from severe cold. Root injury by cold typically occurs to larger roots when temperatures drop to 15°F-18°F. Root balls not mulched can reach this critical temperature an inch or more from the surface when air temperature is 10°F overnight. However, for lethal temperatures to occur in a major portion of the root ball, long, sustained cold periods must occur. This rarely happens in many areas after mid-February.

Roots are not killed by freezing. Remember it is not simply the freezing process that kills or injures roots, but rather the specific low temperature.

For example, in a study using pyracantha (*Pyracantha coccinia*) in containers, temperature of the top and root ball was lowered to 25°F long enough so that the entire root mass reached 25°F. Then plants were returned to a warm greenhouse and normal spring growth occurred. When plant roots were lowered to 20°F throughout, then moved to a warm greenhouse, normal growth occurred. However, when plant roots were lowered to 15°F throughout, then moved to a warm greenhouse, no spring growth occurred even though the tops remained green for several weeks. Slowly the leaves and stems turned brown and dehydrated since they lacked root support.

To determine if tops had been damaged from the cold as well (before the plants were moved to the warm greenhouse), stem cuttings were taken. All stem cuttings rooted, even with the 15°F temperature treatment. This study demonstrated that roots are more sensitive to cold than tops and also confirmed the validity of other studies that showed the critical root temperature for pyracantha at about 17°F.

Promptly remove mulch before spring growth. As soon as the seasonal point is reached where severe and sustained cold is unlikely, remove all mulch from around B&B plants.

This must be done before spring bud swell to be most helpful. Trees harvested B&B during fall and winter will produce few or no roots into the insulating mulch until spring bud swell.

In a period of no more than seven to 10 days, root balls of most species will go from having no roots out into mulch to having produced large numbers of coarse, white, brittle roots out into mulch. Nearly all of these roots will be lost when the tree is moved. The key stimulus for new root growth on plants harvested B&B is bud swell in the top.

Remove mulch for better root development. When mulch is absent, new root growth also begins at bud swell. However, instead of root growth into mulch, the tips of white roots are air pruned at the surface of the ball.

Even though the new roots are mostly produced at the ends of cut roots, air pruning those roots will cause additional root branching back inside the soil ball on most species. In addition, any roots that originate back inside the ball and reach the soil ball surface will be air pruned.

Tips of these new roots will typically produce secondary branch roots back about 4 inches from the air-pruned tip. With proper moisture management, a tree harvested with a marginal root system can have a much improved root system within a month or two.

Place root balls on barrier material. B&B trees placed in holding yards should be placed on some type of barrier material, preferably RootTrapper fabric or RootBuilder bottom material.

When spring growth begins, a surge of new root production will occur. If the ball is surrounded by mulch, new roots grow into the coarse mulch, and most are lost when the tree is moved. However, if the ball is left exposed, new root production is concentrated inside the ball with a few roots growing downward.

Roots that grow downward and contact RootTrapper fabric branch profusely as the root tip is trapped. Roots that contact the RootBuilder bottom material grow through the fabric and into the soil or gravel below, but root diameter is constricted.

Trees are easier to move later, since roots break at the point of constriction. Constriction of the root also causes accumulation of energy (carbohydrates) at the base of the root ball.

When trees held in this manner are moved, they have a more fibrous

root system compared to when they were first harvested, plus roots with energy are present at or near the bottom as well.

Manage water carefully. Carefully manage water to individual root balls using spray stakes. Water the soil in the ball slowly.

Applying 1 gallon of water over 30 minutes to one hour allows water migration throughout the root ball whereas applying the same volume in 5 minutes will mostly run off.

Add fertilizer. Punch holes 1-1½ inches in diameter and 4-6 inches deep in the root ball at intervals across the upper surface. A 1½-inch spade bit in a cordless drill works well.

Fill the holes with Osmocote 19-6-12 (four- to five-month formulation). Supplying any amount of Osmocote is superior to none. Precise rates are difficult to define because of the volume of soil in the ball and the amount of fertilizer retained in the soil at harvest. However, applying ½-1 pound of Osmocote in a series of holes in a 24-inch root ball would not be excessive.

Apply pre-emergent herbicides. To minimize weeds, treat root balls with Treflan, Pendulum, Ronstar or Goal pre-emergent herbicides.

Spray the surface of the root ball. Granules are effective only on the top, whereas a spray solution is effective around the entire root ball exposed to light. These four herbicides stop root tip growth and contribute to additional root branching.

Place B&B trees in RootBuilder or RootTrapper containers for holding and summer sales. Instead of trees becoming stressed and unattractive, when they're placed in RootBuilder or RootTrapper containers — with bud swell in the spring — trees are on their way to recovery from root loss.

These unique containers stimulate root branching and prevent root circling. Best of all, while the trees are making the adjustment from field to container they are growing in size and value, plus they can be sold and planted all summer and fall. Unlike trees placed in mulch, trees placed in these containers develop a fibrous root system that quickly establishes the tree following planting in the landscape.

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