DESIGNING TREES FOR TRANSPLANTING
And
SHREDDING THE ENVELOPE.

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I recently read the proceedings of meetings whose entire focus was transplanting large trees. An assortment of factors were discussed relative to the tops of trees, methods of digging and transport, transplant time of year, water management, etc. And, estimates were presented as to the percent of roots lost at harvest. All this I agreed with. But, all authors of papers referred to roots or the root ball as some assumed generic constant.

An author of one paper described tree establishment as a three stage process – the first year the tree 'sleeps' (in other words, it is so stressed it survives but does not grow), the second year it 'creeps; (it grows a little bit) then the third year it 'leaps' (finally makes something approaching normal growth).

That, I very much disagree with. Further, it was amazing to me that not a word was mentioned about improving the root system in order to increase transplant success. **Remember, Mother Nature did not allow for transplanting.** Root systems can be improved and in particular, benefits from the RootMaker® system are astounding. Trees propagated and specifically developed step by step to create a fibrous root system pay dividends whether trees are planted in the landscape as five gallons or five inch stem diameter specimens or much larger. Trees grown with RootMaker® technology experience less shock, recover and establish more quickly, extend harvest / transplant times, root balls are smaller and lighter, plus other advantages. And, typically, trees make a normal flush of growth the season following transplanting. There is no waiting two or three years for the tree to resume reasonable growth.

How far can these benefits be extended?
To determine just how far the envelope can be stretched or expanded, a series of shumard and bur oak trees were transplanted in 1997 for a long term evaluation. One shumard oak, *Quercus shumardi*, is located just outside my office window and sits as a constant reminder of how far I have pushed the envelope to date. Today the tree is about 10 inch stem diameter and 25 to 30 feet tall. I planted it by hand in 1997 when it was about 12 feet tall with a 4.25 inch diameter stem. At this point, you may be thinking, "Well, so what, most people in the business have transplanted trees with four inch stem diameter and had them live!"

This tree and many others were part of a large transplant study. The trees, bur oak and shumard oak, were grown with the best procedures known at the time for creating a fibrous root system. This began with germination and air-root-pruning four inches below the seed to stimulate maximum root branching at the critical root-stem junction.. The trees were transplanted directly from RootMaker® propagation containers (the original four-packs) to 12 inch knit fabric containers in the field (RootMaker Products LLC, Huntsville, Al) and grown for five years. **The kicker is the fact that the tree outside my office, as well as the others in this study, were harvested and transplanted with a root ball 12 inches in diameter, 12 inches deep.** My office tree was the largest tree of the group. After it was harvested from the field and moved to a nearby road, **I picked up tree and root ball by hand (estimated weight, 90 pounds), carried it about 50 feet across a lawn area and placed it in the planting hole.** No pruning of the top was done. The only site preparation was to dig a hole about three feet in diameter and 12 inches deep. Planting amounted to backfilling with the same soil, staking*, a thorough watering, and then a small amount of mulch and fertilizer. Water was supplied as needed the next two growing seasons. The stakes were removed after one full year. The tree has received no supplemental water since late summer 1999 and fertilization amounts to what is spread over the entire lawn and landscape (Figure 1) Other trees in the study were only slightly smaller. The other 18 were also harvested and transplanted while dormant and watered once following planting. Reasonable spacing of rains during the rest of the first growing season kept drought stress from becoming severe. Only one of the 18 trees was lost. The rest are now large specimens.

Figure 1. Upper left – The shumard oak stem and root ball at time of planting in 1997.
Lower left – Son, Benjamin, standing by the tree in June 1998 after it had grown one year in the landscape and stakes had been removed. Benjamin is about 5' 11". We were at that time, removing fescue sod from around the tree and applying more mulch. Right – The shumard oak as it appeared in Nov. 2008. I am about six feet tall.

[* These trees did require staking because the tops were huge relative to the 12 inch diameter root ball. Further, staking at time of planting is a reasonable option when necessary. On the other hand, staking trees during production is a highly questionable practice, best avoided.]

This tree and the others, mostly bur oaks, stand as evidence that it is not the size of the root ball that matters, but rather what is in the root ball! (Figure 2).

Figure 2. It is not the size of the root ball, but rather what is in the root ball that is important. In this case the knit fabric has been removed and a small amount of soil has been removed. These roots contain large quantities of starch to support new root growth as soon as an opportunity occurs. Nothing to date has suggested that there can be too many roots.

Certainly this is not a practice I recommend, but it serves as a dramatic reminder of what can be done. Water management the first growing season is very important regardless of transplant procedure. The smaller the volume of the root ball, the more critical watering becomes. Once leaves emerge, foliage of the plant extracts moisture rapidly from the root ball and this moisture must be replaced regularly until the plant is established. But, as long as water management is consistent, all is well. In the case of this tree, a small amount of water was applied by a small sprinkler every other day during the first growing season. The objective was to keep the soil both in the root ball as well as the surrounding soil moist but not wet to the point of oxygen exclusion.

As a further study of tree survival using this system, we harvested two Chinese pistache trees in 24 inch knit containers from the field. Both trees had well developed tops and stem diameters of nearly six inches. Once above ground, all soil and small roots were removed from the outer fabric surface. The trees were placed on pallets and vertical sides of tree root balls were then covered with stretch wrap to stop moisture loss (Figure 3). Watering was by two spray stakes per root ball, and watered as needed. After one growing season above ground, stretch wrap and fabric was removed from one tree and it was planted into a 45 gallon RootBuilder® container. When spring arrived, the tree made a normal flush of growth and soon the container was solid with roots. The second tree remained for a second growing season above ground. It leafed out but made only about four inches of growth. Appearance was that it had run out of nutrients and room and was in need of transplanting and more space. Before spring growth of the third year, it too was stripped of stretch wrap and knit fabric and shifted to a 45 gallon container. With new volume of container growth medium including fertilizer, the tree made a normal flush of growth (about 20 inches), indicating a quick recovery and soon the tree looked good and root ball was solid. Holding a large tree two growing seasons above ground in a knit fabric container, then when planted it grows normally, is strong evidence supporting benefits of creating a fibrous root system. Even with a superior root system, careful water management remains a key factor in tree establishment.

Figure 3. This Chinese pistache tree had a stem diameter at the soil surface of six inches. This is a huge tree for a 24 inch diameter knit fabric container. Yet the tree lived above ground for two seasons with no additional root space, only a modest amount of fertilizer, but careful monitoring of water. When the stretch wrap and knit fabric was removed and the tree planted into a 60 gallon container, it quickly produced roots into the new space and made a normal flush of growth. It is all about energy and the root system.

Oxygen plays a key role in root growth. Much is said and written about leaves capturing carbon dioxide and releasing oxygen. Very little is said or written about the fact that roots are consumers of oxygen and release carbon dioxide as they carry on respiration. Without oxygen, roots cannot utilize energy supplied by the leaves and grow. Root growth is not a function of nutrient levels in the soil, but rather of the efficiency of leaves in capturing the suns energy and manufacturing sugars. It is sugars (energy) from the leaves along with an assortment of other physiological processes that promote root growth.