Frequently Asked Questions about *Roots Demystified*

By Robert Kourik, Metamorphic Press
http://www.robertkourik.com/

1) **Why did you write about roots?** Roots don't get the respect they deserve because they are out-of-sight, out-of-mind. Yet, roots shape plant growth in ways most gardeners don't imagine. A healthy root system makes for a healthy plant. All too often diseases and troubles above ground are due to problems with the roots below ground. Plus, it's a lot of fun to see how amazing root growth can be. For example, the roots of a single carrot can grow four feet wide and seven feet deep.

2) **What are some of your favorite tidbits about roots?** The common alfalfa, while not a very tall or imposing plant aboveground, can vary its root depth from slightly over one foot to 128 feet, depending on the soil. A measly turnip can produce roots that explore 100 cubic feet of soil [enough "dirt" to fill 20–25 wheelbarrows], and the roots of the lowly lima-bean bush as much as 200 to 225 cubic feet. The roots of a single rye grass plant can extend for a total of 372 miles and have 6,123 miles of root hairs.

3) **Aren't the roots a reflection of the foliage above ground?** Not true. Most plants have very different root systems than their tops would indicate. A drought-resistant grass called Buffalo grass grows only eight inches or less above ground, yet it has roots down to nine feet in a deep, loose soil. A low-growing rhubarb plant has roots as deep as nine feet . . . and nearly as wide.

3) **How big do roots get?** Plenty big and extensive. Some think that the mass of roots at least equals the total weight of the plant or tree above ground. This is easy to see with a root "map" of a cauliflower plant; its roots grow four feet deep and five feet wide. Others say the roots of trees explore a mass of soil equal to six to sixteen times the weight of the tree's bulk above ground.

4) **Doesn't it take a long time for roots to grow?** Nope. At the end of its first year's growth, an apple tree can produce as many as 17,000,000 root hairs with a total length of well over a mile! A sprouting cucumber seed, in a good, loose topsoil, can grow a taproot down to about three feet, at the rate of one inch per day.

5) **How do roots absorb food?** Soluble nutrients are absorbed by each root hair. The root hairs are very short-lived. The productive life of most root hairs is about one day, which is why new ones are always forming. So, a gardener needs to provide a healthy soil and extensive root system to encourage the rapid growth of new root hairs each day. Besides typical absorption, roots can exude chemicals that dissolve minerals in the soil into a soluble form that makes it easy for the plant to gather more nutrients.

6) **Aren't all trees deep rooted?** Most trees, regardless of the depth of a few roots, have 90% or more of their feeding roots in the top 18–24 inches of the soil. Many trees have deep roots for survival during periods of drought. Some trees in arid climates do get carried away with growing deep to find water. As an example, some juniper trees in New Mexico were found with roots 200 feet deep.

7) **Doesn't the taproot hold the tree up?** Very few trees have taproots—a single root that grows straight down from the base of the tree—their entire life. [Some nut trees, like pecan trees, are an exception . . . *if* the soil is deep and fertile.] Trees actually have roots that extend one-half to five or more times the width of the tree's foliage [the dripline]. Some trees have roots that explore soil eight times the width of the dripline. A wide root system helps the tree stand up to harsh winds and find plenty of moisture and nutrients.

8) **How often should I water?** In *Arboriculture* (by Richard W. Harris, James R. Clark, and Nelca P. Matheny), the preeminent text on growing and caring for trees, the authors recommend frequent irrigation: "In contrast to other systems, drip irrigation must be frequent; watering should occur daily or every two days during the main growing season . . . the amount of water applied should equal water lost through evapotranspiration." [The evapotranspiration rate—ET—is just a five-dollar word for how much water a plant loses due to evaporation from the soil around it and transpiration from its foliage; thus, evapo- + transpiration, or ET.] If you wait to water once each week, then apply seven times the daily requirements to keep the plant happy. [The book explains in detail how to determine the ET rate and convert that to gallons of water per square foot.]

9) **How do I know when to water my lawn?** It's time to water the lawn when it begins to show signs of wilt. Walk across its surface; if your footprint remains depressed for several minutes [known to lawnmeisters as the "footprinting" effect], it's time to irrigate. Also, if your grass develops a blue-gray or blue-green color, it's very important to begin irrigation to avoid permanent wilting of the grass leaves.

10) **Where do you water something like, say, corn?** Water plants out at the edges of the root system to encourage new feeding roots; that's where most of the root hairs that absorb moisture already are. With a corn plant that means nearly five feet wide. That's also where compost should be applied—not only near or at the base of the plant. Like a form of horticultural bondage, watering and fertilizing at the base of a plant restricts its growth. Such plants become more dependent on the gardener for food and water. And, in the case of trees, they are less able to stand up to strong winds.

11) **Why do you favor drip irrigation so much?** In a six-year test of various types of irrigation systems for fruit trees, including drip irrigation, and a review of their performance for both home and commercial applications, it was demonstrated that drip-irrigated trees showed more impressive results compared to no irrigation at all. The test showed that some peach trees were yielding 14 tons per acre by the third year, while local growers were only harvesting seven tons. Likewise, three-year-old apple trees were producing 20 tons per acre, while established, unirrigated, and mature apple orchards were only reaping 13 tons per acre. [These impressive increases in yields translate to an increase in abundant foliage and plentiful bloom produced on ornamental trees when appropriate irrigation is used.]

12) **What is your favorite mulch?** With small plantings of ornamentals or vegetables, I like cocoa bean hulls—the Porsche/Lamborghini of mulches in cost but heavenly when sprinkled from above, filling the garden air with the aroma of chocolate. This is *not* a good mulch to use with drip irrigation; since the drip system is under the mulch, the surface stays dry, and you'll miss out on the water-activated hedonism of the chocolate aroma. [If you have a dog, be sure they don't eat any of the cocoa bean hull mulch, as chocolate is known to make dogs sick.]

13) **You mention cardboard as a mulch. Why in the world would a gardener use cardboard?** Cardboard is especially useful for killing off large areas of lawn or weeds before planting. A friend of mine inherited a lawn composed of some grasses and weeds like dandelions. She covered the entire 15' by 30' area with cardboard for two years [using a decent-looking mulch to cover the ugly-looking cardboard] and completely eradicated all the growth.

14) **You talk about the soil's pore space. What is it, and why is it so important?** The terms "pore space" and/or "pore structure" refer to the maze of minute continuous channels found throughout the upper layers of most soils. Soil breathes 24/7 at a lumbering, beneficial rate we cannot hear. A soil with a healthy pore space allows for easy and deep root growth and will produce the best-looking lawn, garden, and tree growth. An ideal pore structure results in a crumbly soil that allows water to percolate down, harmful gases to vent, and refreshing air to permeate the soil. Now another vital ingredient comes into play: the biological action of certain organisms in the humus [a beneficial soil ingredient generated by the decomposition of organic matter and/or compost] coats the surfaces of the soil's minute particles to form a colloidal matrix—a kind of gooey, slimy chain of molecules called polysaccharides. This coating helps to maintain a thin film of beneficial moisture from rain or irrigation and assists in keeping the pore spaces open, thus creating an ideal medium for plants to flourish. Organic matter and compost improves pore space by helping make an aggregate of mineral particles and humus form more continuous channels.

15) **Your book mentions "good fungus". What is that?** According to experts on the subject, the intriguing lifeforms known as fungi comprise about 52% to 55% of a forest's biomass. Since a whopping 95% of all green plants depend on at least one fungal relationship in order to survive, it's appropriate here to discuss the magical relationship of beneficial fungi with the roots of trees as well as with a range of annual, herbaceous, and woody plants. This relationship is known as mycorrhiza, or fungus root, from the Greek: *mykes* [mushroom] and *rhiza* [root]. These fungi have minute filaments that actually live between and inside of the cells of the feeding roots. This is not a parasitic relationship. For example, all trees need phosphorus but are not always able to absorb soluble phosphorus efficiently; they are thus dependent upon the mycorrhizal relationship. In general, mycorrhizal plants are well-fitted to endure environmental stress. Nutrient-poor or moisture-deficient soils show improved capacity for supporting plant growth and reproduction when mycorrhizal fungi are present. As if to return the favor, the plant allows the mycorrhizal fungi to extract sugars, starches, proteins, and lipids from its roots. Mycorrhizal fungi may also improve water absorption, increase drought resistance, and exude substances that reduce infections caused by some soil pathogens. It's a win-win situation.