The Hidden World of Roots

By Kathy Wolfe
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An unseen web of life

Just under our feet lies an unseen web of life essential to the world as we know it. A vast system of roots works its wonders to create our familiar landscape, keeps it stable and vibrant, and benefits us in many ways we don't normally consider. Applying our knowledge of root systems and functions will help us maximize our plants' potential.

Roots have three primary functions: 1) to anchor plants to the ground so they can endure strong winds and flooding rains; 2) to absorb water and dissolved minerals from the soil to feed plant leaves and fruit; and 3) to store reserves for the plant, an especially important asset for winter survival in perennials.

Root structure and growth habits have a large impact on the size of the plant and its adaptation to certain soil types. In compact and clay soils, roots will stay on the surface where oxygen is available. In droughty soil, root systems spread farther in search of water and minerals. Loamy soil allows roots to spread easily and maximize their nutrient uptake.

Our own irrigation practices influence the formation on the root system as well. Applying water and mulch in a wide band extending on or beyond the plant dripline will encourage fine roots to absorb the most nutrients. Watering thoroughly and deeply when needed will encourage plants to form a deep system better able to anchor the plant. Shallow, frequent watering only encourages roots to stay at the surface, where they are vulnerable to drought, compaction and pests.

To perform their job, roots must have adequate levels of soil oxygen. Soil compaction and waterlogged conditions reduce soil oxygen levels, leading to shallow root systems and possibly to plant death. Raising or lowering soil grade in established plantings can disrupt existing root systems and adversely affect plant growth.

Healthy roots are generally light in color, firm and smooth. Check roots of plants before purchasing to ensure the best starts for your garden.

There are two basic types of root systems: fibrous and taproots. Fibrous root systems have a mass of similarly-sized roots which tend to concentrate in the top foot or so of soil. A significant number of lateral or sinker roots may grow downward from these roots to provide an effective absorption system and act like a tripod to secure the stem/trunk and foliage.

Taproots consist of one or more main roots with smaller side roots. Taproots grow straight down, rather than spreading along the surface. Some tree roots reach down 30 feet or more. These roots

can become woody, providing strong anchors for the plants and trees that have them. Taproots are also an important adaptation for searching for water.

Contrary to popular belief, most trees do not have taproots. When the water table is close to the surface or when soil is compacted, most trees develop fibrous roots. Hickory, conifer, oak, pine, pecan and walnut trees do have taproots, but most fruit and shade trees do not. Many desert plants have long taproots to mine water in very dry conditions.

Taproots also serve to store food reserves, making them even more self-sufficient and resilient. It is difficult to give a definite list of plants with taproots since many, like most trees, may start with a taproot then develop a fibrous root system. Tomato plants grown from seed tend to have a taproot while those grown from cuttings do not. Some common garden flowers with taproots include balloon flower, bugbane, butterfly weed, dill and sea holly. Transplanting and dividing plants with taproots can be challenging. Check with your local master gardener or other reliable sources for how best to proceed.

Root structure and growth habits have a large impact on the size of the plant and its adaptation to certain soil types. *Photo by Nancy Crowell / WSU Skagit County Master Gardeners.*

There are other specialized root systems, including adventitious roots which arise in unexpected places like the brace roots of corn plants; aerial roots that grow from stem tissue above the ground(e.g. on English ivy, orchids and Christmas cactus); and strangling roots, among others.

Both fibrous and taproot systems have long root hairs which occur in great numbers just behind the tip of the growing roots. These root hairs vastly increase the surface area available for absorption of water and nutrients. They are extremely delicate and easily damaged. When transplanting, be careful not to disturb them so they can continue to function properly.

Root systems benefit the earth by holding soil in place during strong weather. As roots die, their waste breaks down into organic particles that fertilize the soil. Roots help absorb and cleanse water through transpiration, the process of water absorption through roots, transferred into the plant and released by evaporation through the leaf pores. Rain gardens are a fine example of utilizing this technique.

Roots improve soil structure by breaking up packed earth with their growth and creating space to store food and water. Farmers and gardeners can use cover crops of tap-rooted plants to take up nutrients while growing, distribute them throughout the plant, and return them back into the soil once the mature plants are tilled under.

This mass is actually the bottom of a fallen tree that shows the fibrous mass of its root system – now covered with moss and ferns as it is being recycled into the forest. *Photo by Kathy Wolfe / WSU Skagit County Master Gardeners.*

Humans have discovered and developed many products from roots. Familiar root vegetables include carrots, beets, onions, parsnips, turnips, potatoes and jicama. Sugar beets are one source of the sugar we use in our food. Spices from roots include ginger, horseradish and turmeric. Roots from beets, carrot and madder can render fabric dyes, and roots have been used since

ancient times to attempt cures for diseases and to relieve physical pain. Aconite, ipecac, ginseng, bitterroot, licorice and valerian are examples.

Roots, while mostly out of sight, are always hard at work maintaining our plants, improving our soils and our lives. Let's treat them well!

RESOURCES:

- "Botany: Plant Parts and Functions." Arizona Master Gardening Manual: Roots, produced by the Cooperative Extension, College of Agriculture. The University of Arizona. 1998.
- "Plant Roots." L. Thompson. Furman University. http://facweb.furman.edu/~lthompson/bgy34/plantanatomy/plant_root.htm.
- "Roots as Anchors." NGA's Learning Garden at www.garden.org. National Gardening Association. Copyright 1999.
- "Plant Structures: Roots." David Whiting, retired. Colorado State University Extension.Colorado Master Gardener program. Copyright 2003-2014.
- "Medicinal Plants." Kevin Curran. University of California, Riverside.
- "Dispelling Misconceptions about Trees." Edward G. Gilman, Assistant Professor, Institute of Food and Agricultural Science. EDIS Publication #SSORH3. Florida Cooperative Extension Service,. University of Florida. Original published date June 1991, revised October 1998, reviewed August 2011, copyrighted 2015.

Note: some hyperlinks in this article have been updated since its initial publication.