Soil Is Not Dirt! Building Healthy Soil

It is said that if you take care of the soil, plants will take care of themselves.

Good soil, together with choosing the right plants adapted for your climate and local growing conditions (sorry about the blueberries!) and proper irrigation, will help greatly with insect and disease control. Healthy plants are able to survive attacks and still produce the flowers and vegetables you want. Healthy soil is able, with the aid of its organisms, to process organic matter and return the right amount of nutrients to your plants without supplemental fertilizers.

Composition Soil is a dynamic system, ideally composed of:

45% mineral: sand, silt, clay particles from underlying rock, from wind and water sources

25% air, including oxygen and nitrogen and other free or dissolved gases – pore spaces are important!

25% water; best soil consistency is damp like a wrung-out sponge.

5% (minimum) organic matter; roots and living animals, and decaying animal and vegetable matter on its way to becoming humus.

Idaho Falls area soils range from good loess or loam, clayey, to slightly sandy (with rocks!), alkaline, and low in organic matter due to our cold dry climate.

Good soil contains a world of life, including microorganisms such bacteria, fungi, and other single-celled plants and animals, plant roots, worms, insects, and other burrowing animals- billions and billions! – most of which are important to the process of decay, returning nutrients to the soil, and improving soil texture and structure.

One cup of undisturbed good soil may contain the following: Bacteria (some bad, most good in healthy soil), 200 billion; Protozoa (single celled organisms), 20 billion; Fungi (some bad, most good and are symbiotic with plant species, e.g. mycorrhizae) 100,000 meters of hyphae; Nematodes (many good, some pathogenic), 100,000; Arthropods (insects and spiders), 50,000; Earthworms, many, many in good soils, where they aerate and contribute nutrients to soil.

Good soil provides nutrients in solution, available to plants. Application of abundant organic matter is encouraged to supply or release important nutrients - nitrogen (N), phosphorus (P), potassium (K), iron (Fe) and other trace minerals - as well as improving the texture and porosity of soil.

pH is a measure of the acidity (low pH) and alkalinity (high pH) of soil; a pH of 7 is neutral. pH strongly influences the health of soil microorganisms and the ability of plants to take up many nutrients; neutral to slightly alkaline is optimal for most growing. Our soils are alkaline (pH 7+),

sometimes severely, due to their origin, volcanic ash content, and the alkaline nature of our irrigation water. But the consistent incorporation of organic material, along with elemental sulfur or iron sulfate to prevent nitrogen loss, will gradually lower the pH. Work on your soil, but for success it is best to choose woody plant, flower, and vegetable varieties that will adapt to our soil and climate.

"When the soil is right, you're a green thumb genius. When it's not, forget it." Warren Schultz

Test your soil:

For composition (particle sizes): dig down about a foot, take small samples at intervals, mix in jar, add water, shake, and let sit for a while; soil components will precipitate out, forming layers in the jar, from heaviest (sand), silt, clay, to lightest (organics) to give you an idea of the relative amounts of each.

To test for moisture and structure: wet a handful of soil sampled from depth intervals (above), and squeeze. The soil ball should clump and be sticky, but also crumble easily; too much clay will result in a ball or rolled "snake".

To monitor for adequate watering or percolation rate: use the same shallow hole and observe or time the rate at which water drains. A tuna can under your sprinkling system, running for long enough to yield about 1 inch of water, will allow you to adjust your watering rate to reach this minimum.

To test for soil nutrients (N, P, K, S, Fe, etc.) and pH, the best tests are run by commercial or state agricultural extension labs. They are more expensive, but worth it if you are dealing with poor, unproductive soil. Mail-in service for soil samples can be purchased at several of the local nurseries or check with your county extension office. The small do-it-yourself kits are OK, but not very informative.

Creating or Maintaining Healthy Soil:

Work for Tilth! Tilth is a descriptive term which combines the best qualities of good soil: texture, structure, and composition. Soil with good tilth is dark in color, crumbles and tills easily, holds water but drains well, has a healthy organism population, maintains and provides nutrients, and smells sweet!

Enhancing soil structure and texture is very important! You can augment or maintain the relative amounts of mineral and organic fractions, pore spaces (for oxygen and water), and avoid compaction (to allow better root penetration, evaporation and drainage) with proper mulching, amendments, tilling, and watering.

Organic Amendments: Pile It On!

Both heavy clay and light sandy soils can be improved with the addition of humus or components to help create humus. Use liberal applications of fine organic material such as aged compost; aged manures, rotted hay or leaves to, improve soil structure and composition. Use organic amendments as top dressing or mulch annually. Incorporate by digging or tilling when necessary – but avoid excessive cultivation! Initial loss of nitrogen during the decay process can be overcome with the addition of pellet sulfur – which also offers the bonus of lowering the pH (temporarily) of our soils.

Some good organic amendments (except as mulch, the finer the better) include: aged manures, grass clippings (no 'weed & feed' lawns!), rotted hay and straw, leaves (chopped or shredded is good), aged compost, crushed corn cobs, sawdust, coffee grounds, "Soil Pep", mushroom, cotton, brewery

and malting waste – whatever is available and cheap in your area. Just be sure the material isn't carrying toxic minerals and chemicals or disease organisms. It is best to add heavier mulches (leaves, manures) in the fall, let them break down over winter – then incorporate in the spring.

Cover cropping is also a handy and inexpensive way to add organic materials to your soil, with weed suppression benefits while the crop is growing. There are several nitrogen-fixing legumes (clovers, peas, vetch) and grasses that work well in southeastern Idaho. Some are planted in the fall, over-winter, and are tilled under in the spring; others can be planted throughout the warm season, e g. buckwheat, in fallow areas or to replace early vegetables when they are harvested.

Amending the soil, proper watering, encouraging organisms, reducing weeds, pests and disease will allow you to use low till (spade, fork) or no-till methods to reduce impacts on soil structure and tilth. Double-digging is work, but is a great way to begin building good soil.

If you have time and patience, new garden spaces can be created from lawns or weedy spots by heavy mulching over thick layers of newspaper or solarizing with clear plastic. After one year or one summer, the beds can be turned.

It may be necessary to create raised beds for some soil conditions or to prepare for plants which require lower pH or better drainage. Raised beds are easier to tend and great if you have limited garden space.

Resources: There are many good books on soils, soil life, and gardening out there!

Building Healthy Soil:

One of the best basic online descriptions of soil and soil improvement:
http://www.gardeners.com/Building+Healthy+Soil/5060,default,pg.html

For Idaho-specific gardening guidance, go to (watch for organic solutions):

http://www.cals.uidaho.edu/edComm/catalog.asp?category1=Gardening

(And for Idaho cold climate and short season resources, click on short season/high altitude gardening.)

Soil, pH, cold climates, and managing alkaline soil: (with links to other good information on gardening in cold and dry climates)
http://www.ext.colostate.edu/pubs/garden/07220.html
http://www.ext.colostate.edu/menu_garden.html

http://casfs.ucsc.edu/publications/for-the-gardener (California - but still useful!)

http://soils.usda.gov/sqi/concepts/soil_biology/soil_food_web.html (Excellent for life in the soil)

http://forces.si.edu/soils/