Soil Amendments

Gardening in Arizona is a challenge. Arizona soils can have abundant rocks, too much clay, too much sand, high alkalinity, excessive salinity, and little or no organic matter. Additionally, vegetables and annual flowers are not adapted to the desert environment and since we expect them to produce something within a growing season, we must provide them with abundant resources before planting.

Many products are purported to enhance Arizona soils. It is important to understand the differences between and benefits of soil amendments, and non-traditional soil additives.

Soil amendments are materials added to soil to improve its physical and chemical properties. Physical properties include: water retention, permeability, water infiltration, drainage, aeration, and structure. These improve the soil environment for plant roots. Fertilizers provide essential plant nutrients that improve growth and production of the crop plant. Other amendments, such as soil sulfur, alter soil pH and improve availability of many plant nutrients. The correct combination of amendments and fertilizers can make the difference between success and failure in your garden.

There are two broad categories of soils amendments: organic and inorganic. Organic amendments come from something that is or was alive and include sphagnum peat, wood chips, grass clippings, straw, compost, manure, biosolids, sawdust, and wood ash. Inorganic amendments are either mined or man-made and include things like vermiculite, perlite, and soil sulfur.

Fertilizers are also soil amendments. It is best to have some knowledge of local soil conditions before adding any amendments. A soil test can provide information about nutrient availability and which fertilizers should be added. In most areas of Arizona, seasonal additions of organic amendments are always necessary.

Most organic amendments also contain plant nutrients and act as organic fertilizers. Organic matter also is an important energy source for bacteria, fungi and earthworms that live in the soil. By feeding these organisms, you will increase bioactivity, which will, in turn, release more nutrients to the plant roots during the growing season.

Uncomposted wood chips or sawdust should not be incorporated into the soil. These materials are high in carbon, but lack the nitrogen necessary for decomposition to occur in a reasonable time frame. When nitrogen is in limited supply in the presence of uncomposted wood fiber, microbes tie up this nitrogen leaving little or none available to plants. Under these circumstances, adding some nitrogen fertilizer will provide nutrition for the microbes to do their decomposition while also making some available for plant growth.

Fresh manure can harm plants due to elevated ammonia levels. To avoid this problem, use only aged manure (at least six months old). Since issues related to food safety have increased, so have concerns about manure. Remember that human pathogens (such as E. coli) are another potential problem with fresh manure, especially on vegetable gardens. Compost manure for at least two heating cycles at 130 to 140 degrees F to kill any pathogens before applying the manure to vegetable gardens. Most home composting systems do not sustain temperatures at this level. To minimize pathogens in edible garden crops, fresh manure should be incorporated into soil 120 days prior to their harvest.

During composting, ammonia gas is lost from the manure. Therefore, nitrogen levels may be lower in composted manure than in raw manure. On the other hand, the phosphorus and potassium concentrations will be higher in composted manure. Modify fertilizer practices accordingly. Salt levels also will be higher in composted manure than in raw manure. Symptoms of excess salts include burning of leaf edges and poor growth. Excess salt can be leached by applications of water which will carry it below the root zone over time.

Soil texture, or the way a soil feels, reflects the size of the soil mineral particles. Sandy soils have large soil particles and feel gritty. Clay soils have small soil particles and feel sticky. Both sandy soils and clay soils pose challenges for gardeners. Loam soils have the ideal mixture of different size soil particles. When amending sandy soils, the goal is to increase the soil's ability to hold moisture and store nutrients. To achieve this, use organic amendments that are well decomposed, like composts or aged manures. Compost and/or aged manures help clay soils by improving soil aggregation, increasing porosity and permeability, and improving aeration and drainage.

Soil activators are a non-traditional soil additives and are marketed on the basis that they stimulate existing soil microbes or inoculate the soil with new beneficial organisms. Some manufacturers suggest that such products may improve soil physical properties (improve structure, reduce compaction), increase fertilizer and soil nutrient uptake, improve crop yields and/or quality, correct soil “toxicities” (such as salinity), and provide disease and insect resistance.

Most soil microbiologists agree that to significantly increase the activity of soil microbes for more than a few hours, a minimum of several hundred pounds of organic material must be added to the soil. However, these products often are applied at rates of only a few pounds per acre, which may add as little as 1 pound of microbes to soil that already contains 2,000 to 4,000 pounds of microbes per acre. Numerous studies have been conducted across the United States to evaluate various soil activators. In general, these studies have shown no significant beneficial effects of these products on crop yields or quality. One exception is where legume seeds are inoculated with an appropriate Rhizobium bacteria strain. Rhizobium inoculation improves legume nodulation and nitrogen fixation, a phenomenon which has been thoroughly investigated and well documented.

When evaluating non-traditional soil enhancers, you may ask the manufacturer for independent research results. Where results are available, scrutinize them for bias – who conducted the research, was the study replicated, were yield increases noted? Where no information is available, you may choose to conduct a small trial making sure to compare the effect of a soil additive/conditioner using the same crop varieties on the same soil. Keep all factors equal except for the addition of the soil additive/conditioner. Always compare the results to an untreated control plot.

Additional Resource:

Fertilizing Home Gardens in Arizona
University of Arizona Cooperative Extension

Ten Steps to a Successful Vegetable Garden
University of Arizona Cooperative Extension

Guidelines for Using Non-Traditional Soil Additives, University of Arizona Cooperative Extension Publication AZ 1582, 2012

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