UC MASTER GARDENERS NAPA COUNTY

# Healthy Garden Tips

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## AMENDMENTS FOR LANDSCAPE SOILS

**Will Soil Amendments Improve your Soil?**
Yes, in some cases, but not always. Their use should be based on evidence of need, not hope. If needed, select best one for the job.

**What is a Soil Amendment?**
A material which improves a soil, not by adding plant nutrients as a fertilizer does, but by changing the physical or chemical properties of a soil.

**What is the Main Purpose of a Soil Amendment?**
To change either the physical or chemical properties of the soil to indirectly improve plant growth.

**Why Change Physical Properties of a Soil?**
1. To make the soil surface more permeable to water, especially with silty soils.
2. To enlarge pore spaces so that water and air move more freely; important in clay soils.
3. Prevent soil cracking so that distribution of roots, water and air will be more uniform.
4. To make soil easier to work; important in managing annual plants.
5. In a new planting, to encourage roots to more easily and quickly extend from the root ball soil into a heavier native soil of the site.

**How is the Soil Pore Space Enlarged?**
1. Binding the small particles of soil into aggregates. Organic matter decomposes, produces gums and these bind soil particles into aggregates. Micro-organisms decompose gums. Therefore, organic matter must be replenished regularly.

2. Separating soil particles further and thereby increasing the soil volume. For long term effect, amendments must be resistant to decomposition. Large amounts are usually needed (peat moss, redwood shavings, rice hulls, vermiculite, etc.). Mineral materials, like sand, generally will not be used in large enough amounts to amend. If not, they can cause more of a problem so mineral additives are not recommended for this purpose.

**What Organic Amendments Last the Longest?**
Coarse textured materials last longer than fine. Lignified materials last longer than soft vegetative materials, and coarser textured materials withstand decomposition better than fine textured ones.

| | | % Decomposition | |
|---|---|---|---|
| Examples | | 3 months | 6 months |
| Canadian peat moss | Fine | 8 | 15 |
| | Medium | 4 | 5 |
| Redwood sawdust | Fine | 12 | 46 |
| | Medium | 2 | 17 |

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| Examples | | % Decomposition 3 months | 6 months |
|---|---|---|---|
| Redwood shavings | --- | 4 | 17 |
| Douglas-fir bark | Fine | 6 | 14 |
| | Medium | 6 | 9 |
| Douglas-fir sawdust | Fine | 15 | 33 |
| | Medium | 8 | 31 |
| Rice hulls | --- | 24 | 27 |

**Do Different Soil Amendments Affect Plant Growth Differently?**

Yes. Sphagnum peat moss promotes good top growth and a dense root system when properly irrigated to avoid poor aeration. It cannot withstand compaction when wet, and can become excessively wet if irrigation management is neglected. It is hydrophobic when dry. It does have an ion exchange similar to a sandy loam and a pH range from 3.5-4.5; acid.

Tule peat, from the delta region of California, is different. It has a pH range of 5 to 7, may contain salts, some soil and will most likely behave much like a soil. That is, it will release available water to plants over a much wider range of tension than sphagnum peat moss.

The impact of shavings depends much on the particle size; the smaller, the more nutrient exchange. Due to high C/N ratio, shavings, sawdust, etc. can be toxic and provide a nitrogen drag for plants in the soil mix.

As seen, from the previous chart, bark materials tend to have a slower decomposition rate than shavings. Also, redwood shavings and sawdust tends to decompose slower than pine shavings.

To avoid some of the problems with shavings and bark, fresh materials are composted and toxins leached. Also, these materials may be ammoniated and moistened. The purpose of ammoniation is to provide a nutrient source for micro-organisms which would otherwise prevent plant roots from getting it during the decomposition process.

There is not much reliable information regarding toxicity of various woody materials, but generally few, if any, of the commonly available materials have been a proven problem.

**How Much Organic Matter Would be Needed to Alter Physical Conditions of the Soil; the Whole Root Volume?**

An average practical figure is 30% by volume to begin to alter soil tilth. This amounts to eleven (11) cubic yards of material for each 1,000 square feet, one foot deep. This is expensive and less nitrogen would be available to plants due to use by micro-organisms in decomposing the organic matter (nitrogen drag). Four and one half to six cubic yards of quickly decomposed materials (manure, mushroom compost, etc.) or six to nine yards per 1,000 square feet, one foot deep of slowly decomposed materials (coarse sawdust, bark or shavings, etc.) will probably avoid nitrogen drag if not compensated, but this volume is too low to significantly affect soil physical conditions. As for depth of incorporation, it is practically impossible to uniformly mix deeper than one foot.

**How Much Organic Matter is Suggested to Get a Loose Friable Soil Suitable for Quick Growing, Short Lived Plants?**

About one-half (0.5) the above amount mixed into six inches of soil would be practical.

There is a danger, however, of creating an interface and resulting poor drainage. So careful irrigation is essential.

**How Much Organic Matter Would be Needed to Separate Clay Particles in Surface Soil of Clay to Prevent Soil Cracking?**

Fifteen to 30% by volume thoroughly mixed into the surface two inches is practical without creating a soil interface or having the material "float off" after irrigating. Very little material. This amounts to one-half inch to one inch of material mixed into the surface two inches of soil.

**How Much Nitrogen Should be Added to Prevent a "Nitrogen Drag" on Plants in the Organic-Amended Soil?**

Where sawdust, grainstraw, and other similar low-nitrogen materials are used, chemical nitrogen should be added in the amount of approximately 24 pounds of actual nitrogen per ton of dry mulching materials. When the dry weight of the bulky organic amendment is unknown, one to three pounds per cubic yard can be added; one pound for slowly decomposed materials; three pounds for quickly decomposing woods such as white fir and pines.

**How Much Sand Would Have to be Added to a Clay Soil (30% silt, 5% sand, 65% clay) to Make it a Sandy Clay Loam?**

It would be a sandy clay loam if sand and clay were mixed 50:50. Two parts sand to one part clay would make it close to a sandy loam requiring 60,000 pounds sand per one acre foot depth, if it were pulverized and mixed uniformly.

**Where is There More Information on Various Bulky Soil Amendments?**

A good account of several sands and organic materials regarding total and unavailable water, rate of infiltration, and air filled porosity has been published by UC Cooperative Extension in 1970. *A Guide to Evaluating Sands and Amendments Used for High Trafficked Turfgrass*, by William B. Davis, Extension Environmental Horticulture Specialist. Also, see *Organic Soil Amendments and Fertilizers*, ANR Pub 21505.

**Why Change the Chemical Properties of a Soil?**

Chemical amendments are useful to correct two specific soil chemical problems. Not panaceas for all soil problems.

1. Correct very acid conditions. Gypsum, for example, has little direct effect on soil pH and cannot be used to correct as low soil pH. Dolomite, burned lime, calcium silicate, Hydrated lime. (Hazard involved if planted immediately; enough choice without it. If left in, specify two weeks waiting period before planting).

Here is a table to estimate quantity of lime needed, if necessary (for California soils). Most garden soils do not need lime.

**Lime Requirements:**

Different methods have been developed to determine the amount of lime needed to bring the pH of an acid sol to a desirable range. All of those presently used take into consideration the soil texture and organic matter content and use a specialized procedure. It can be seen in the following table what the effect of finely ground limestone is on different soils.

**APPROXIMATE AMOUNT OF FINELY GROUND LIMESTONE NEEDED TO RAISE THE pH OF A 7-INCH LAYER OF SOIL***

| Lime Requirements (Tons per Acre) | | | | |
|---|---|---|---|---|
| **Soil Texture** | **From pH 4.5-5.5** | **Lbs/1000 sq. ft.** | **pH 5.5-6.5** | **Lbs/1000 sq. ft.** |
| Sandy and loamy sand | 0.5 | 23 | 0.6 | 28 |
| Sandy loam | 0.8 | 37 | 1.3 | 60 |
| Loam | 1.2 | 56 | 1.7 | 79 |
| Silt loam | 1.5 | 70 | 2.0 | 93 |
| Clay loam | 1.9 | 88 | 2.3 | 107 |
| Muck | 3.8 | 177 | 4.3 | 200 |

*Adapted from USDA Agricultural Handbook No. 18

2. Leach excess sodium in the soil. Sodium excesses occur where there has been a high water table and where the sodium content of ground water has been high in proportion to calcium and magnesium. The symptom is extreme impermeability; confirm with soil analysis. Correct the problem by adding suitable amendment to replace excess sodium, then leach to wash out replaced sodium. Adequate drainage is essential. Repeat applications usually required a decade apart.

**Which are Suitable Amendments for Replacing Excess Sodium in Alkali Soils?**

Gypsum (calcium sulfate). Most commonly used inorganic soil amendment. Gypsum will improve structure of most clay alkali soils of this area when added at a rate of about two tons per acre. (One pound per 10 square feet). Work into top few inches of soil before planting. Add every year if using softened water to improve water infiltration.

Sulfur or sulfuric acid is used where soil contains calcium carbonate (lime). Both render calcium in the e soil more soluble. Soil micro-organisms convert sulfur to sulfuric acid and the acid converts the lime to calcium sulfate (gypsum). The residual sodium sulfate is removed by leaching.

Iron sulfate and aluminum sulfate react in the soil to furnish sulfuric acid. They react quickly but are less efficient, however, than sulfuric acid or sulfur on a pound-per-pound basis.

Chemical soil amendments are not likely to improve your soil unless it is either too acid or it has an excess of sodium.

**What are Some Problems of Soil Amendments in Landscape Horticulture?**

1. Some manures, including sewage sludge, contains excess salts which can prevent plant growth.
2. Some materials (peat moss) will compact and can become excessively wet.
3. Most of the available water in a soil that is highly amended with bulky organic materials is held at low tensions. It tends to be very wet when irrigated and it can dry out very quickly. Management of such soils in the landscape becomes tricky.
4. Soils highly amended with bulky organics can present an interface problem at the place where the amended soil and the “native” soils meet. Due to increased porosity of amended soils, an excess amount of irrigation water may accumulate at the interface, leading to a saturated soil and a deficiency of oxygen.
5. Some bulky organic amendments are difficult to mix uniformly into the soil. They may become layered. Dry air pockets and dead plant roots may result.
6. Water drainage from amended plant basins in ‘tight soils is usually not increased, hence an accumulation of soluble salts and a reduced air supply.
7. With inadequate leaching, adding chemical amendments may just increase a salt load.
8. Short-lasting bulky organics (animal and green-plant manures) can result in chlorotic and stunted growth from a quick depletion of nitrogen by soil micro-organisms (nitrogen drag). A rapid decomposition or organic material can also result in anaerobic conditions. (A loss of oxygen).
9. The addition of more than 30% (vol) of bulky organic materials can result in an unstable soil surface for human activity.
10. Changing a silty loam soil to a loam texture requires the addition of large volumes of sand, well mixed with the clay; expensive and often impractical. It would take about 60 pounds per square foot and the soil would still be sticky. Also the sand should be fine textured. It would take repeated tilling over several years to thoroughly mix in the sand.

**Conclusion**:

In conclusion, there are some definite advantages to incorporating soil amendments in a soil intended for landscape plants: changing acidity, reducing sodium (alkali) problems, preventing surface-soil cracking, binding fine particles into aggregates and further separating soil particles. If properly done and managed, desired improvements in plant growth should result. However, before investing in soil amendments it would be well to learn about soil mulches, as sometimes the same results can be achieved by putting the additive on the soil rather than in it.

**Sources of Information:**


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October 1976
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