Sunland Analytical
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# Advantages of Organic Matter

Organic matter is chemically defined as any material containing carbon. Typically, organic matter is found in a range of 1 to 6 percent top one foot of most non-amended soils. However, as seen in Fig.1 the amount of organic matter diminishes as a function of distance below the soil surface. In this case, the samples were taken from fields in Yolo County (California) that had been farmed for at least 2 decades. Samples taken from a depth of 6 feet had very little organic matter. This soil profile reflects addition of organic matter from decomposing plant material as well as increased oxygen near the surface and this environment allows microorganisms to grow more effectively. Soil organic matter is composed of approximately 10% living microorganisms. This includes, in the top six inches of an acre of soil, approximately 3000 pounds of both bacteria and fungi and another 1200 pounds of microorganisms like Protozoa and Algae. These average values increase in warmer, moist, well aerated, high nutrient soils and decrease in cold, water saturated soils.

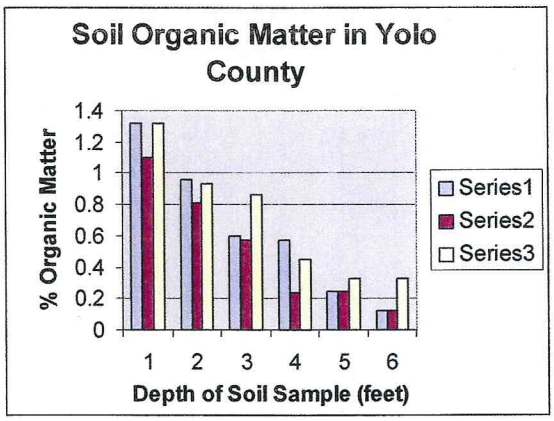


Figure 1. Soil Organic Matter Content at Varying Depths

One of the functions of soil microorganisms is to breakdown the non-living organic matter and release nutrients for plant growth. As can be seen in Fig.2, the rate of decomposition of grass clippings is very rapid. Most of the material is decomposed in less than a year. This is typical for most organic materials added to soil. Thus, contribution to soil by tilling in "green manures" like grass clippings, clover, alfalfa etc. is mostly short term, i.e. one season. However, after longer decomposition a much more stable organic matter is produced from the original material applied. This material is very similar whether it represents the decomposition of manure, corn

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stalks, bark, leaves, grass, garbage, municipal sewage sludge, etc. This material is generally defined as humus. While the chemical composition of humus has been defined, the way these chemicals are bound together to form humus has not been determined. The important aspect is that humus slowly degrades (Fig.2) and provides the advantages of organic matter over a much longer range of time.

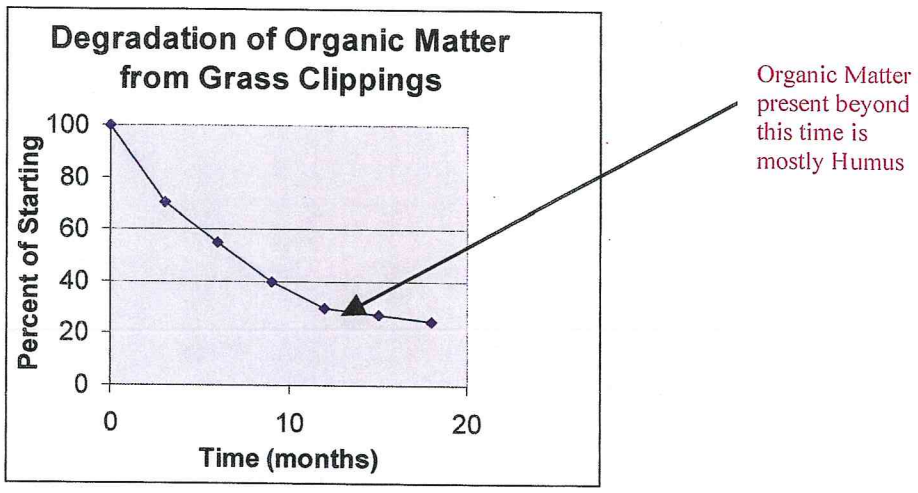


Figure 2. Degradation of Grass Clippings

The advantages of organic matter are that it improves the water penetration and water holding capacities of soils. This means that organic matter can improve the extreme sandy soil or clay soil. Sandy soil are improved by increasing the water holding capacity, while clay soils acquire better aeration and water penetration. All soils gain in nutrient holding ability because the organic matter binds most plant nutrients including the micro-nutrients like copper, iron, manganese and zinc. In addition, the organic matter limits the amount of pH change due to other additions to the soil. Finally, but very importantly, stable organic matter (humus) provides plant nutrients by their own decomposition. Since humus is slow to degrade, resulting an effective time release of nutrients constantly available to plants.

Incorporation of excessive organic matter can result in extensive settling of the amended soil. This occurs because the organic matter is degraded and much of the organic matter carbon is given off as carbon dioxide gas. The resulting loss of mass causes the settling. Typically, 10 percent organic matter is the goal for landscaping sites, while soil used for fill for construction purposes are often rejected if the organic matter exceeds 5 percent. An additional disadvantage of soil organic matter is that organic matter addition can result in a loss of available nitrogen in the soil. This

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condition arises if the composition of the organic matter being applied has a carbon to nitrogen ratio is too high. This lack of availability of nitrogen for the plants can occur because the microorganisms aggressively consume the organic matter, utilizing the major component of organic material carbon. Thus, an abundant amount of nutrients for the results in large increases in the populations of the of these organisms. However, it is not just carbon that is utilized, as carbon is ingested so also is nitrogen. To the point that all the nitrogen in the organic material applied is consumed and then any nitrogen that is in the soil around them. The effect is to eliminate the available nitrogen to the plants. Experimentally, it has been demonstrated that if the ratio of Carbon to Nitrogen (C:N) is greater than 32, then nitrogen will not be available to the plants. From a practical stand point, if 6000 pounds of cornstalks which are 40% carbon and 0.7% nitrogen were incorporated back into a field the C:N = 58:1. To overcome this problem and make nitrogen available to plants immediately, at least 40 pounds of nitrogen must be applied at the time of incorporation. A similar situation occurs with munches or sawdust used in landscaping. Depending on the carbon content, a suitable amount of nitrogen must be present at tilling to allow nitrogen to be available for plant nutrition. If planting is not immediate effective breakdown of the organic material can be accomplished with sufficient time (varying with conditions) so that there is release of nitrogen. However, when planting immediately after incorporation of organic matter lack of nitrogen may be critical to establishing new plants or a field crop. Thus, while organic matter provides very significant benefits to the soil, like most other things knowing how to use it provides the most benefit. Information and recommendations are available with analysis at Sunland Analytical.