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4915 West Monte Cristo Road
Edinburg, Texas 78541
Telephone: 956-383-0739
Facsimile: 956-383-0730
www.TPSLab.com
www.AskThePlant.com

# ORGANIC MATTER vs. HUMUS

## *What's the difference?*

The terms "Organic Matter" and "Humus" are often used interchangeably, but *they are not the same!*

**ORGANIC MATTER (OM)** exists as the remains of plants, animals, and microorganisms that are in different stages of decomposition. Their decomposition is carried out by microorganisms in the environment as a natural and essential process of ecosystems. Visually, organic matter includes fresh plant materials, still recognized as being "plant", and various brown or black non-descript substances whose origins are not so easily recognized.

OM has a few obvious qualities:

- ♦ It is a bulky material that takes up space. When added to soil, it "fluffs" it up.
- ♦ It has the ability to hold a lot of water and nutrients – Nitrogen, Phosphorus, Sulfur, and trace elements such as Iron, Zinc, and Boron.
- ♦ It is a raw material (food and energy) for microbes to convert organic nutrients into plant available forms as the organic matter continues to decompose.

### DEFINITIONS:

| | |
|---|---|
| **Humus** | Humus is the part of compost that is highly decayed and is dark brown or black in color. It is extremely complex, containing much lignin and an amorphous physical structure. It consists of well decayed plant and animal matter that provides nutrients to plants and, when added to soil, imparts many benefits. |
| **Humic Substances** | Partly decomposed organic compounds that are extracted from compost (or soil) with a strong alkaline solution. They are amber to brown in color, and have very complex chemical structures. **They contain the following three classes of compounds:** |
| **1. Fulvic Acid** | Fulvic acid is that fraction of humic substances that is soluble under all pH conditions. Fulvic acid dissolves in water or alkaline solution to give a clear orange solution. It is also very chemically complex, but generally has more oxygen atoms than found in the humic substances. It is generally considered to be of lesser age than humic acid. The functions of fulvic acids in nature are not well understood. |
| **2. Humic Acid** | Humic acid is another intermediate decomposition product produced during the decomposition of organic matter. It is defined by the chemical operations used to isolate it from humic substances and separate it from fulvic acid. As with fulvic acid, very little is known with certainty about the ecological role of humic acids. |
| **3. Humin** | Humin is the final chemical fraction of extracted humic substances. It is the mass of chemical debris left over after humic and fulvic acids have been removed from humic substances. Virtually nothing is known about the role of humin in ecosystems. |
| **Humates** | Humates are *mined* materials taken from the earth in a manner similar to coal mining. They are probably "under-developed coal", originating as plant materials that were buried beneath the surface in ancient times. They are popular soil amendments because they mimic the benefits of humic substances. |

***Humic Substances have positive effects on plant growth by stimulating growth such as plant hormones, assisting in nutrient uptake, and protecting against disease.***

**A high level of OM in the soil matters only if it is being broken down into Humus – but OM has been largely depleted in most of today's soils!**

The bulk of fresh organic matter contains easily decomposed carbohydrates and proteins. Smaller amounts of lignin and waxes are present initially, but contribute much of the character of humus that accumulates over a longer time. The more slowly decomposed substances become linked to newly produced organic molecules that come from microbial decomposition of the organic matter.

The combination of these newly produced molecules and the residual compounds left over from the decomposition of bulk organic matter results in **humus**. This is the brown-black granular organic material we see most readily in compost or as the rich organic **Duff Layer** in forests. Humus imparts several benefits to soil and plant health and plays an essential rôle in maintaining soil as a **living habitat**.

These benefits include:

1. **Providing a stable environment** for microbes to live, feed, and grow beneficially with plant roots;
2. **"Biological buffering"** is enhanced. This allows the soil to endure stressful changes (i.e. drought, fire, flood, chemical toxins) and then recover again to carry out the important agricultural processes.
3. **Water holding capacity**; humus has an enormous capacity to hold water—much greater than that of clay. Just by its presence, humus helps reduce soil drying and promotes efficient water use;
4. **Soil structure**; humus is "sticky". It helps stick clay particles together into a 3-dimensional aggregate with the consistency of coarse corn meal. When a clay soil has good structure, water passes easily from the surface to the lower soil layers; erosion is reduced and water use is greatly increased. Structural development is greatly enhanced by polysaccharide compounds produced by microbes growing on organic matter and humus. Good soil structure also improves æration in the soil and creates many different microhabitats to support a wide variety of microbes, increasing the diversity of microbial activity in the soil;
5. **Adding CEC.** CEC is important to retaining certain nutrients within reach of plant roots. Calcium, Magnesium, Potassium, ammonium, and trace metals can be held in place until they are needed by plants. Humus also helps keep them in an acceptable form for plant uptake thereby increasing nutrient uptake efficiency.

This ability to hold and release water and nutrients is called **Cat-ion Exchange Capacity** or **CEC.** Total soil CEC is heavily influenced by the base soil texture. Generally speaking, the finer the texture, the higher the CEC. Sandy soils with a low Humus Fraction have little CEC and soil nutrients are highly susceptible to leaching. A Texture 1 is coarse (sand), graduating down to Texture 6 - very fine (heavy clays):

| SOIL TEXTURE | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| SOIL CEC RANGE | 3 – 8 | 6 – 12 | 10 – 20 | 15 – 25 | 20 – 35 | 30 – 50+ |
| IDEAL HUMUS % | 2.8 | 3.1 | 3.6 | 4.1 | 4.5 | 4.8 |

Why a lower Ideal Humus % with decreasing Soil Texture/CEC Range? Because a low Humus % has a proportionately larger impact on total soil CEC with a soil that has lower intrinsic CEC. A higher Humus % is required in high-intrinsic soil CEC to be relevant.