ORGANIC MATTER IN THE SOIL

Organic materials (OM) in the soil can be seen as being composed of relatively stable humus and biologically active materials which are constantly recycled through a myriad of micro- and macro-scopic soil organisms. The importance of this material to agricultural soils relates to biological, chemical and physiological qualities developed through interaction of OM and soil organisms with soil minerals. While these interactions may vary, an increase in the level of soil organic material generally includes the following effects (largely after Brady, 1984, and Parr, 1983):

— Soil color is darkened;

— Water infiltration, holding capacity and content are all increased. Concomitantly, drought susceptibility, erosion and resulting sedimentation, and nutrient runoff and leaching resulting in eutrification of water bodies are all decreased. A change in soil OM of 1% changes the erodability factor (K) in the Universal Soil Loss Equation by 10% as well as improving the structural index and the permeability class (Papendick, 1984). Livestock manure applied at a rate of 16 t/a to Iowa corn land with a slope of 9% reduced erosion from 22.1 to 4.7 t/a (Pimentel, 1976);

— Aeration and permeability [pore size] are increased and bulk density is decreased. Summerfeldt (1985) found that bulk density decreased at a rate of .002 Mg/cu m per megagram of manure applied /ha/yr;

— Soil structure is improved through encouragement of granulation and aggregation while crusting, plasticity and cohesion are reduced;

— Plant nutrients are more available [once decomposition is complete]. Cation exchange capacity is increased—OM colloids having 2-30 times the capacity of mineral colloids by weight and accounting for 30-90% of the adsorbing capacity of mineral soils (Brady, 1984). More nutrients are held in organic forms and more mineral elements are released by the action of humic acids;

— The pH buffering capacity of the soil is increased (Arnott, 1982);

— Soil biota increase in both number and variety, thus offering a greater opportunity for biological control of soil-borne pathogens (Lumsden, 1983); and,

— Due largely to increased moisture retention, soil temperatures tend to decrcase. This decrease is somewhat mitigated by increased absorption of solar energy thru darkening color and increased metabolic activity in the soil.

While the inherent capability of soil to produce crops is closely related to the level of OM [and nitrogen] in the soil (Brady, 1984), this level tends to decrease when the land is used for agricultural activity—and the more intensive the cultivation, the faster the rate of OM loss.