Chapter 4

Introduction to Soils and Crops

4.1 Soils

Understanding basic soil science is important because septage is added to soils and soils treat septage. The degree and efficiency of septage treatment by the soil will depend on the nature and properties of the soil and several other factors.

4.1.1 Soil Texture

Soil texture refers to the relative amounts of sand, silt, and clay present in a soil. Soil texture is probably the most important soil property because it determines the amount of surface area exposed by soil particles and largely governs the amount and size of soil pores. These properties will largely determine a soil's fertility (plant nutrient availability), water holding capacity, and water movement (infiltration, percolation, leaching), which in turn influences crop growth, erosion, and septage waste management.

4.1.2 Soil Textural Class

Soils with similar amounts of sand, silt, and clay are grouped into twelve textural classes, as shown in Figure 4-1.

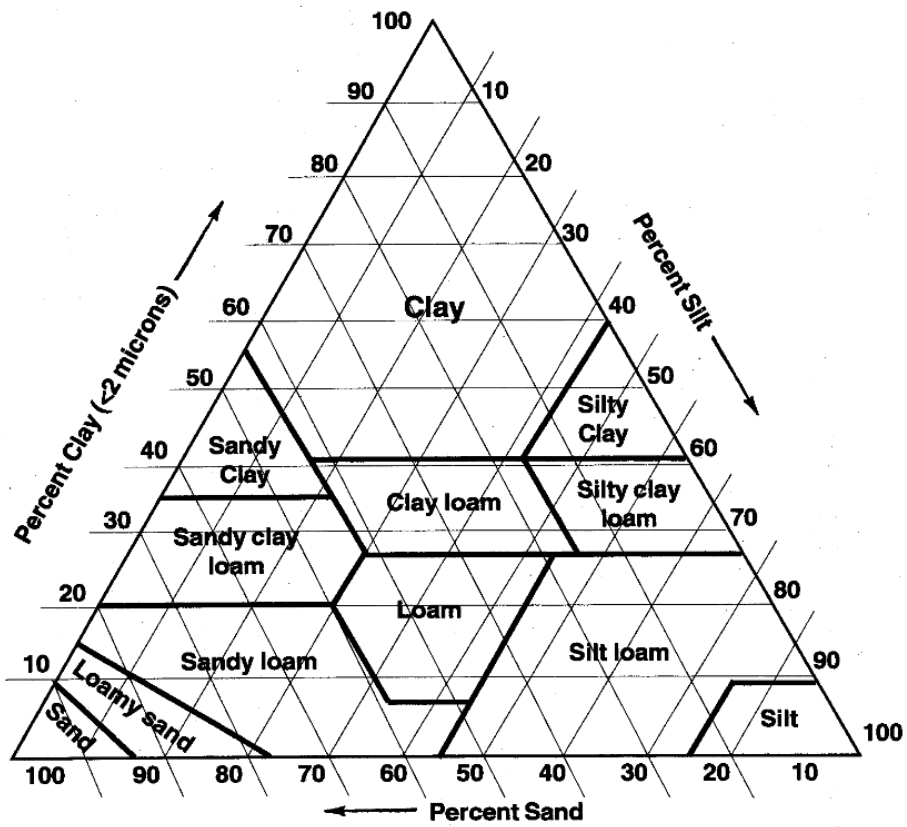

Figure 4-1. Soil Textural Class Diagram.

4.1.3 How to Know the Dominant Soil Textural Class at Your Land Site

Check the soil survey of the county. It contains information about the soil series of your land site. Soil series consists of soils that have similar horizons that are similar in color, texture, consistence, and composition. The soil survey gives information about how to manage the different soils found in a county and is produced by the Natural Resources Conservation Service[2].

Recommended Steps: The three major ways of determining the dominant soil textural class at septage application fields are the following:

- Laboratory Analysis: In this method, the licensee takes soil samples from each major soil horizon of a soil profile. The soil samples are analyzed in the soil testing laboratory to determine the percent of sand, silt, and clay. Using Figure 4-1, the soil textural class can be determined for each horizon, and then the dominant soil textural class of all the horizons can be determined. Where it may be impossible or impractical to determine the soil textural class for deeper soil horizons, the soil textural class of the top horizon (0 to 10 inches) may suffice as the dominant textural class for septage application purposes.

- Soil Survey Map: The soil textural class can be known by consulting the county soil survey map. Soil survey of a county is usually available in national, state, and local government offices or Michigan State University Extension (MSUE) Offices. This document contains information not only about the dominant soil type and soil textural class but also about how to best manage the soils at your septage application land site.

- Feel Method: Soil textural class can also be determined by the feel method. This is a practical determination of the soil in the field by working a little quantity of soil between the fingers with a little moisture. This method is usually described in introductory soil science books like Brady and Weil[1] and takes some practice and experience to make correct soil texture determination.

4.1.4 Soil Groups and Septage Application

There is a broad range of soils in the soil textural classes that are suitable for septage disposal. The following groups of soil textural classes are provided as a guide in the choice and use of land sites for land application of septage.

Table 4-1. Soil Groups.

Soil Group	Soil Textural Class	Comments
1	Sandy clay loam, clay loam, silty clay loam, loam, sandy loam, silt loam, and silt	Soils in this group provide the best choice compared to soils in Groups 2 and 3. There are some soils in this category that will also provide some challenges, such as silt, silty clay loams, and clay loams, similar to Group 3.
2	Loamy sands and sands	Soils in this group are not able to hold or retain enough moisture for good crop growth especially during the summer months. The other challenge is keeping the nitrogen in the septage within the root zone. Due to their permeability, nitrogen in soil solution has a greater tendency to move quickly below the root zone and contaminate groundwater, especially if excessive amounts are applied.
3	Sandy clay, silty clay, and clay	Managing soils in this group will also provide some real challenges especially during the wet and dry periods of the year. During the dry periods, achieving proper incorporation after surface application will be a challenge due to the dense nature of the soil. It is difficult to achieve good incorporation. During the wet period or when septage is applied, the soils are very sticky and tires of trucks frequently get stuck, and it is difficult to achieve good soil turnover. Water and nutrients are held very tight by the soil particles and do not readily release them for crop growth. These soils are generally not recommended for septage application due to the difficulty in tilling (incorporating and injecting) unless a special comprehensive soil management plan is submitted and approved before use.

4.2 Crops

Understanding the differences between crops is important because crops assist in removing the nutrients from the soil where septage is land applied. Moreover, the rate of septage applied depends on a number of factors including the type and yield of the crop and the quantities of nutrients removed from the soil by harvested crops.

4.2.1 Types

A variety of crops can be planted at septage disposal sites. These crops include grain crops, forage crops, and legume crops.

Grain crops include corn, barley, wheat, oats, rye, and sorghum.

Forage crops include alfalfa, birdsfoot trefoil, clover, orchard grass, ryegrass, sorghum and Sudan grass, bromegrass, tall fescue, and timothy.

Legume crops include alfalfa, birdsfoot trefoil, clover, soybeans, and vetch.

These are common crops in Michigan. The list given above is not comprehensive. There are several other crops in each of the categories listed above that can be planted.

4.2.2 Crop Selection Factors

The following factors should be considered in selecting crops for the land site. These include among others:

- Crop use – What the harvested crop will be used for, e.g., feed, food crop, pasture crop, or cover crop.
- Crop adaptability – Whether the crop can survive and grow well in that environment.
- Crop management – Whether licensee or the land manger is willing and able to manage the crop from planting to harvest.
- Phosphorus management – Whether the soil phosphorus level in the field is high and the licensee intends to plant crops that will assist in phosphorus reduction.

4.3 References

1. Brady, Nyle C. and Weil, Ray R. 2002. The Nature and Properties of Soils. 13th Ed. Prentice Hall, Upper Saddle River, New Jersey 07458.

2. United States Department of Agriculture and Natural Resources Conservation Service. Soil Survey. Contact Address: State Conservationist 3001 Coolidge Road, Suite 250, East Lansing, MI 48823-6350. Phone (517) 324-5270, Fax (517) 324-5171.