Conservation of Muck Soils in New York

Introduction

Soil scientists use the term "histosol" to categorize muck soils with high (20 to 50% or more) levels of organic matter (Figure 1).

Figure 1: Distribution of muck soils in the United States and New York (Photo credit: USDA).

Muck soils formed in areas where water ponded but was shallow enough to allow significant plant growth and cover to develop. As plants died, the organic material sunk below the surface where decomposition was slow because of lack of oxygen in saturated conditions. Thus, rich black soils, very high in organic matter, developed over time (Figure 2). In 2010, there were 30,000 acres of arable muck land in New York, mainly located in Orleans, Wayne, and Orange counties, with smaller pockets in several other counties.

When drained using ditches or tile, muck soils are very well suited for vegetable production including onions, potatoes, carrots, lettuce and other crops. However, drainage and agricultural production lead to loss of organic matter over time resulting in degradation and loss of muck soils, a situation generally called subsidence. These processes reduce muck soil depth making water management ever more challenging, increasing risk of crop loss, and in some cases, causing a shift to lower value crops. Implementing muck soil conservation practices will help producers slow the rate of loss.

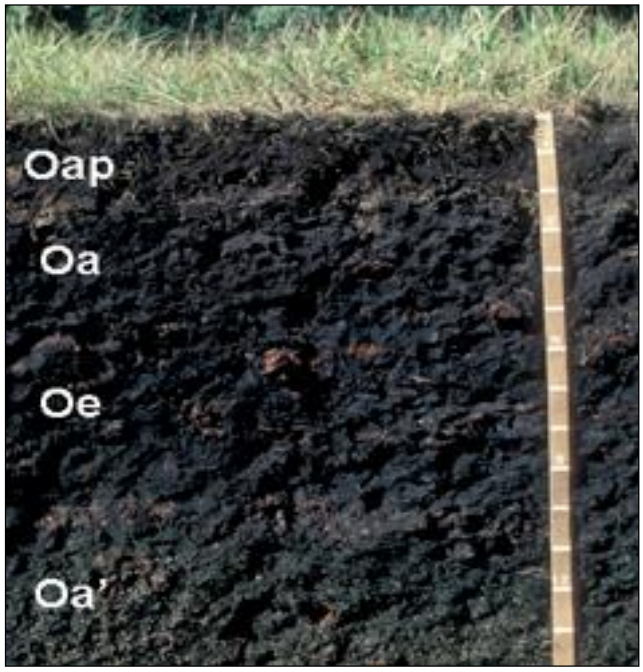

Figure 2: Muck soil profile depicting the multiple horizons of organic soil (Photo credit: University of Idaho).

This factsheet describes challenges associated with the conservation of muck soils and techniques growers can use to manage these challenges.

Challenges with growing crops in muck

- **Water management:** Due to landscape position, flooding can be a common occurrence in muck soils. Additionally, high levels of SOM increase the water holding capacity of these soils prolonging the period the soil can be saturated.
- **Soil organic matter decline:** The ditching and tile drainage necessary to grow crops in muck soils allows oxygen to replace water within the soil. This activates aerobic soil microbes to accelerate decomposition of the SOM at a much more rapid pace. Muck soil's low density and natural porosity further help to increase oxygen penetration of the soil when drained, advancing microbe decomposition rates even more.

- **Tillage:** Many of the cropping systems typical for muck soils (vegetables) use intensive tillage and harvest practices. This serves as another means to add oxygen to the soil and activates microbes and accelerates decomposition of SOM.
- **Wind erosion:** Small, dry muck particles are easily carried by wind. Blowing muck can damage crop seedlings and also move far off site. Soil is especially susceptible to wind erosion in the spring after tilling for seedbed preparation and before there is any soil coverage by the crops themselves, especially when soil is dry.

Strategies for muck conservation

- **Winter flooding:** Although drainage is needed during the growing season, flooding of fields during the winter can help control SOM decomposition. Winter flooding can also provide protection against wind erosion. Flood control devices and installation can be costly, and winter flooding requires careful management to avoid delaying field preparation in the spring and will eliminate the use of overwintering crops.
- **Cover crops:** Cover crops can help to maintain soil cover, reducing the risk of wind erosion. Cover crops also help to build SOM and sequester nutrients. Common cover crops on muck soils include oat, and cereal rye. Fall cover crops must be planted in a timely fashion to be effective. Conflicts can arise with harvest, equipment and labor availability.
- **Companion crops:** Companion crops can help with control of wind erosion during the spring, especially for vegetable crops with small seeds such as onions, carrots and radishes. Barley is a common companion crop. It may be drilled or broadcast and tilled into the soil before planting the main crop. The companion crop emerges first and reduces wind erosion while the main crop starts to develop (Figure 3). After the vegetable crop is established, the companion crop is terminated, typically with herbicides.
- **Conservative tillage:** No-till or minimum tillage can reduce the risk of both water and wind erosion.
- **Crop orientation:** Orienting crops against the direction of prevailing winds will help reduce wind erosion.

Figure 3: Barley wind breaks protecting onion seedlings from damaging wind (Photo credit: Christy Hoepting).

Summary

There are many difficulties associated with agricultural production on muck soils; this factsheet has described some techniques that could be used to manage subsidence. Improved management techniques, including controlled flooding in the winter, use of cover crops, and adjusting vegetable rotations to include no-till crops, can help to prolong the productivity of muck soils. However, it is important to note that these management techniques cannot stop the decomposition of SOM. SOM levels in muck soils will continue to decrease until an equilibrium is reached where SOM is being mineralized as quickly as it is being replenished.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

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2015