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Not too Early to Think About Spring Moisture Conditions, Consideration for Soil Compaction

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Abstract
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Not too Early to Think About Spring Moisture Conditions, Consideration for Soil Compaction

By Mahdi Al-Kaisi, Department of Agronomy; Mark Hanna, Department of Agricultural and Biosystem Engineering; Mark Licht, Extension Field Agronomist

Normally early spring soil moisture is a challenge when the soil profile is fully charged. Depending on the amount of snow we receive and duration of winter, there is a tendency for producers to enter fields at less-than-ideal soil conditions, especially when there is a short window for conducting field operations.

Soil compaction caused by field traffic and machinery increases with high soil moisture. Over the past decade the size of Iowa farms has increased, leading to larger and heavier equipment. However, equipment size is only one factor among many causes of the soil compaction problem. Rushing to the field when the soil is wet, combined with the weight of equipment and traffic pattern in the field, can increase chances for severe soil compaction. Conducting field operations during wet field conditions compounds the amount of compaction occurring.

Maximum soil compaction occurs when soil moisture is at or near field capacity (Figure 1) because soil moisture works as a lubricant between soil particles under heavy pressure from field equipment.

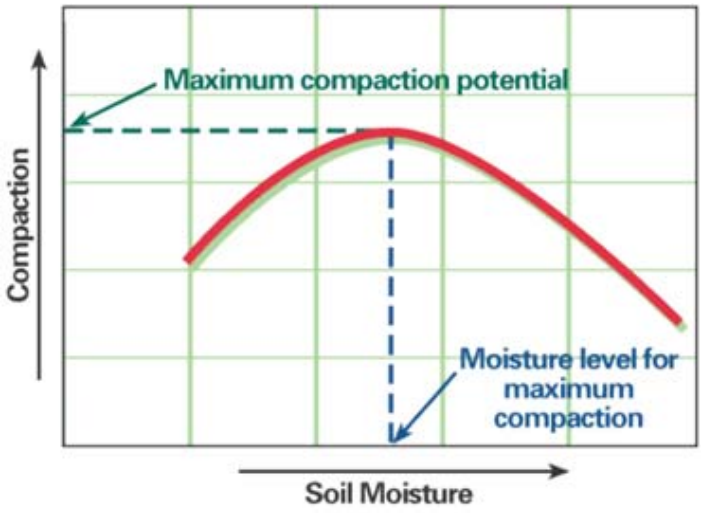

Figure 1. Relationship between soil moisture and potential soil compaction.

Indications of soil compaction during and immediately following a normal rainfall include slow water infiltration, water ponding, high surface runoff, and soil erosion. Additionally, soil compaction can be diagnosed by stunted plant

growth, poor root system development (Photo 1), and potential nutrient deficiencies (i.e., reduced potassium uptake). These soil compaction symptoms are a result of increased bulk densities that affect the ideal proportion of air and water in the soil.

Photo 1. Effect of soil compaction on root growth at three different soil bulk densities: Low, 0.7 g/cm3; Medium, 1.1 g/cm3; High, 1.6 g/cm3.

The most efficient way to verify soil compaction is to use a tile probe, spade, or penetrometer to determine a relative soil density. Soil moisture conditions can have a significant effect on penetration resistance.

For example, in dry soil conditions soil penetration resistance is much higher than wet conditions because soil water acts as a lubricant for soil particles. Therefore, it is wise to determine soil compaction early in the season or compare observations and measurements from suspected areas with adjacent areas that have little chance of soil compaction due to traffic patterns.

Management decisions to minimize soil compaction

The most effective way to minimize soil compaction is to avoid field operations when soil moisture is at or near field capacity. Soil compaction will be less severe when soil tillage, fertilizer application and planting operations occur when the field is dry. Soil moisture can be determined using a hand ball test or observing a soil ribbon test.

Properly adjusted tire size and correct air pressure for the axle load being carried is a second management tool. Larger tires with lower air pressure allow for better flotation and reduce pressure on the soil surface. Additionally, using larger tires that are properly inflated increases the "footprint" on the soil.

A third management decision is to use the same wheel tracks to minimize the amount of land traveled across. Most damage occurs with the first pass of the implement. Using control traffic patterns can be done effectively by using implements that have matched wheel-tread configuration for soil preparation, planting, row cultivation, spraying and harvesting.

Soil compaction can be a serious problem for Iowa farmers, but with proper

farm management, compaction can be minimized. Remember to hold off soil tillage operations until soil conditions are drier than field capacity and look into the benefits of conservation tillage systems.

Top 10 Reasons to Avoid Soil Compaction

1. Causes nutrient deficiencies
2. Reduces crop productivity
3. Restricts root development
4. Reduces soil aeration
5. Decreases soil available water
6. Reduces infiltration rate
7. Increases bulk density
8. Increases sediment and nutrient losses
9. Increases surface runoff
10. Damages soil structure

Source: Iowa State University Extension publication PM 1901b - Understanding and Managing Soil Compaction -- Resource Conservation Practices

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