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Identifying & Managing Soil Compaction…

The need to conduct field operations in a timely and efficient manner has renewed concerns regarding the "productivity robbing" effects of soil compaction. Today's producer manages more acres with the pressure to complete operations in a timely manner. Operations are often conducted when soils are wet. These factors have become problematic on dairy farms and other livestock operations, where frequent and extensive manure application is necessary.

Typically soils are 50% solid and 50% pore space, with about half of the pore space filled with water. Soils are most easily compacted when the water content soil is at, or just above, its field capacity. Pressure from wheel traffic and tillage consolidate the soil, first reducing the number and size of larger pores by re-arranging soil aggregates. Heavy loads can destroy the soil structure itself. The resulting soil has a greater density and lower porosity. Pores, especially the larger ones, are important for water and air movement. The potential for compaction increases as the soil clay content increases, however sandy soils can become compacted, especially if sand particles are of different sizes.

The signs and symptoms of compaction can be found by examining the response of the soil and crops to wheel traffic. Compacted soils have imperfect drainage, resulting in ponding and increased runoff. Where the structure is destroyed the soil will be massive and cloddy. A horizontal or plate-like structure can also develop in the upper soil layer. The loss of structure disrupts natural pores and channels important for water and air movement, and the resulting increase in soil strength impedes root proliferation.

Compaction effects are also exhibited in the growth of the plant. Uneven height is common where one plant appears normal and the adjacent plant is stunted. The root system will be malformed such that horizontal development occurs at the restrictive layer. Nutrient deficiencies, especially K, can develop in response to poorer aeration in the soil. Compaction almost always causes a loss in yield. The magnitude of the yield loss is often related to the incidence of water stress conditions during the growing season.

A common assessment device is the penetrometer, a cone-tipped rod attached to a gauge that is pushed into the soil at a constant rate. It measures the resistance to penetration and somewhat simulates the environment that a growing root would experience. Simple penetrometers are pushed by hand and have a dial that translates the force into green, yellow, and red zones. Advanced units are mechanically driven and have sensors that can be calibrated to measure and record the resistance in units of pressure. The soil water content will have a significant impact on the penetration resistance. Soil bulk density is a useful measurement of compaction and its measurement provides for the calculation of porosity.

There is no critical level of any soil measurement that universally identifies the degree of soil compaction that will result in a crop yield reduction. Penetration resistance, as previously indicated, is greatly affected by the soil water content and will obviously be very high if readings are taken in dry conditions. Bulk density is not affected by moisture, but is a function of soil texture. It is recommended that any measurement should be made to develop a relative comparison between areas where compaction is suspected and where it is unlikely. For example, compare a headland with an area in the main part of the field or a wheel-tracked area with a non-tracked area. It is often useful to excavate the soil to examine the soil structure and evaluate plant root distribution. Be sure to note the depth at which compaction occurs to determine the depth of the restrictive layer. Knowledge of the location and size of this layer will determine if deep tillage can remove the compaction.

The effect of compaction has been studied by this author at several locations. Because compaction has such a profound effect on the soil tilth its effects vary from year-to-year depending on weather conditions. Clearly, yields are reduced in a dry year and yields are similar in more normal years, if the soil isn't compacted. However, yields are drastically reduced in compacted plots.

Whenever possible soil compaction should be avoided! Practices such as limiting operations on wet soils, reducing load weight when possible, and controlling traffic will go a long way toward limiting compaction and maintaining soil productivity.

Often deep tillage or subsoiling is considered when compaction problems are severe. Some producers routinely subsoil as a form of primary tillage. Subsoiling can be conducted with a variety of tillage tools that will have a variable effect depending on soil conditions, the depth of tillage, and the tool used. Before deciding to subsoil it is important to diagnose the existence of compaction and to record the depth of the restrictive layer. If subsoiling is done it should be conducted 1-2 in. below the layer.

Soil compaction problems will continue to be an issue in modern agriculture. Use common sense to avoid the occurrence of compaction. Reduce loads, stay off wet soils, and control traffic. Maintain soil fertility, especially with respect to K. Use a complete starter fertilizer for corn and be sure to re-supply crop K. Look for compaction symptoms and physically identify the existence of a restrictive layer before conducting subsoiling operations. Do not abuse the soil in the fall, expecting that over-winter condition will correct compaction.

(edited from an article by *Richard Wolkowski ~ UW Extension)*

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RENAISSANCE… *for* RESULTS!

MAKING A DIFFERENCE ALL YEAR

Fall seeding grasses… when is the best time?

Late-summer/fall establishment of grass is often desired in many locations. Many producers do not realize how much fall seeding affects the yield of the grasses the next year. In research trials, we seeded six forage grasses at several late summer dates over three years. Seeding dates were spaced approximately every 2 to 3 weeks from August 1 to November 1. Species included orchardgrass, smooth bromegrass, timothy, reed canarygrass, perennial ryegrass, and tall fescue. All of the grasses seeded by mid-to-late September produced stands with visible plants by killing frost most years, usually surviving the winter. Later seedings did not produce visible plants until spring, if at all. Slow establishing species like reed canarygrass produced better stands when seeded by early September. Timothy tended to be the most variable with regard to seeding date and next-year yield. The most important finding is that earlier seeding dates (early- through mid-August) usually had more tillers per square foot, more tillers per plant, and higher dry matter yield the following season. Delaying late summer seeding from mid-August to mid-September generally resulted in 1 ton/acre less yield the next year. These studies clearly show that delaying grass seeding in the late summer or early fall not only increases the risk of establishment failure but reduces yield of the stand the next year. Therefore, we recommend seeding grasses as early as possible during the month of August.

(edited from an article by Dr. Dan Undersander, Agronomist – UW Extension)

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