



Why Soil Moisture Can Impact Tillage Decisions

Many areas of the Midwest have experienced wet conditions all season long. Many growers are wondering if they should attempt tillage on soils that are covered with crop residue when soils are wet. Getting harvest completed then dealing with tillage will be a consideration for many.

Soil compaction is always a consideration when pulling implements through or driving on the field with wet soils. Residue management is another concern. The strategy of limiting soil damage and helping fields quickly warm up and dry out in the spring for fast planting is a top concern.

When to Till and When Not to Till Based on Soil Moisture

There are a couple of factors growers should consider when contemplating fall tillage and wet soils. Two main questions: Is tillage necessary to help with heavy residue? Is tillage necessary to help relieve soil compaction?

- When heavy residue is a potential problem for planting next spring, and soils are wet in the fall, the use of light tillage to mix the residue into the soil and start the decomposition process should be considered. The disk or vertical tillage tools are usually enough to accomplish this task. The current levels of corn residue being generated by today's hybrids will easily tie up 50 -60 lb/a of nitrogen. The use of row cleaners on planters can be used to move the residue off the row at planting - helping warm the soil. Chopping stalks after harvest can also assist in residue decomposition and will result in less soil structural damage than tillage under wet conditions.
- Soil moisture is considered to be the single most important factor contributing to soil compaction. Heavy clay content soils are particularly vulnerable to severe compaction under wet conditions. Soil density also influences the level of compaction. Soil density is dependent on soil organic matter, soil texture, the density of soil mineral (sand, silt, and clay) and their packing arrangement. Generally, coarser textured soil has a higher density as they have fewer pore spaces.
- An in-the-field method to determine soil condition involves working a small ball of soil (half the size of a golf ball) in the hand, and then rolling it into a thread between two hands.
 - » If a long, thin thread is rolled easily, the soil is too wet, and compaction will result from traffic by many, perhaps most, vehicles.
 - » If the soil cannot be rolled but smears easily, then it is much too wet. Compaction will result from traffic by virtually all vehicles.
 - » If the soil cannot be rolled into a thread, but crumbles or breaks into hard crumbs, compaction is unlikely to occur and is unlikely to be severe.
 - » If soil can be rolled without crumbling but is "on the edge" of crumbling, some vehicles will compact the soil, and some lower ground pressure vehicles will not.
- The important thing to remember on wet soils is not to do anything that will further increase the compaction situation. It is best to wait for better soil moisture levels rather than increasing the compaction problem by running heavy equipment on wet soils that are already compacted.

Recommendations and Watch Outs

Fill in tire ruts from fall harvest with aggressive tillage is one of the grower's main concerns. Soil structure is the soil's number one defense against future soil compaction and tillage destroys soil structure. Fill in ruts with light tillage by running equipment at an angle. You may need two to three passes to accomplish this. These areas most likely will not yield as well as the non-rutted areas, but there is not much you can do at this moment. When soils are dry in the future, the use of a deep tillage tool will help relieve these compacted areas.

Keep tillage shallow, disking, and vertical tillage. A light tillage pass, like disking, is useful for incorporating residue and allow air into the soil. If the soil is wet, try to operate this shallow tillage equipment no deeper than 3 inches. Another option for wet soil is a vertical tillage system. Vertical tillage (figure 1) runs 1 to 3 inches deep and uses straight or wavy coulters, a harrow, and a rolling basket. Vertical tillage will fluff the remaining residue with shallow penetration and minimal inversion of the soil.



Figure 1. Vertical tillage on heavy corn residue. Picture courtesy of David Kanicki, Ag Equipment Intelligence.

Avoid clods. Lifting wet soil can create clods. If using a chisel plow or disk ripper, shallow the shanks and use narrow points. The wings have a higher potential for smearing the soil. Twisted or parabolic shanks create the most soil movement and can create soil clods. Clods themselves are not bad going into winter. The next spring, they might leave more surface area for water infiltration. However, a field with clods will likely need an extra tillage pass in the spring to create an adequate seedbed for good soil-to-seed contact.

Frost tillage. “Frost tillage” is a phrase from Harold van Es and Robert Schindelbeck in 1993 when researching tillage on a slightly frozen soil in New York. The premise was, as the soil surface freezes, it pulls or wicks moisture from the lower layers of the soil, making it drier.

When compared to no frost, the study found that when the frost layer was 0.5 to 1 inch:

- The soil better supported the equipment weight when chisel-plowing to a depth of 8 inches.
- The soil below the frost layer was drier and tilled much easier.
- Corn yields were not affected.
- Water infiltrated quicker in the tilled soil versus a soil without tillage. This is most likely due to the frozen plates of soil created with frost tillage. As these plates thawed, they quickly diminished.

Many areas of the Midwest rarely have the shallow frost cycles throughout the winter like New York but may have at least one or two freeze-thaw cycles in the fall.

Reduce weight and maintain tire air pressure. Wet soils have a high potential for soil compaction. To help limit soil compaction, keep axle loads under 10 tons and properly maintain air pressure in the tires. This will help the soil, plus it will help your tractor run more efficiently and with less slippage. On wet soils, use the lightest tractor that can still have the horsepower and traction to get the job completed. There is very little you can do to reduce the weight of combines. When possible, unload before the grain hopper is full to limit axle loads. Large grain carts have very high axle loads (up to 43 tons per axle).

Control wheel traffic. Wheel traffic should be controlled from grain carts by running in the previous combine tracks and don't cross the field at a diagonal. 80% of the compaction happens on the first pass. Use it to your advantage.

Source

Fall Tillage in Wet Soils, University of Minnesota Extension. <https://extension.umn.edu/soil-management-and-health/fall-tillage-wet-soil-conditions>

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