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Wet conditions: Challenges and opportunities

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Abstract
Spring rains can come hard and fast as we have experienced during the last few weeks, causing substantial soil erosion when soils are most vulnerable because of extensive tillage that has led to degraded crop residues cover and lack of a crop canopy. The soil profiles in most of Iowa are now filled to capacity with water. Therefore, the intensity and amount of rain received has exceeded the soil's capacity to filter water and minimize surface runoff even in fields with the most adequate conservation practices.

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Wet conditions: Challenges and opportunities

by Mahdi Al-Kaisi and Palle Pedersen, Department of Agronomy

Spring rains can come hard and fast as we have experienced during the last few weeks, causing substantial soil erosion when soils are most vulnerable because of extensive tillage that has led to degraded crop residues cover and lack of a crop canopy. The soil profiles in most of Iowa are now filled to capacity with water. Therefore, the intensity and amount of rain received has exceeded the soil's capacity to filter water and minimize surface runoff even in fields with the most adequate conservation practices.

Ponding water on a conventionally tilled field vs. a no-tillage field in the background.

The lack of residue on such fields with conventional tillage can cause significant crusting problems and eventually will create significant germination and emerging issues. Crusting is usually most noticeable in fields with high silt content, low organic matter, and little surface residue, especially where excessive tillage occurred. Soil crusting can prevent emergence, reduce oxygen flow to the roots, and set up a barrier to efficient water infiltration. In addition, the sealing effects created by surface crusting can enhance soil erosion significantly due to the destruction of soil surface structure. The role of surface residue is to minimize the intensity of the rain drops in destroying soil structure and reducing surface runoff. Also, residue will reduce water evaporation and dry the soil surface much slower than a bare soil surface where high air temperatures and wind can speed up soil evaporation causing crusting.

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Soil crust on conventionally tilled field after heavy rain. (Mark Licht)

Soil crusting in general is a very thin layer about one inch thick that acts as a barrier to plant germination and water movement. Emergence can be problematic with a dense surface crust because the seedling may not only be completely depleted of carbohydrate reserves before emergence, but also the hypocotyl is easily broken when pushing against a solid crust. It is therefore recommended to monitor high-risk fields (for soil crusting) where corn or soybean emergence has not yet occurred.

Combating soil crust quickly is a real challenge for producers but one way to prevent a poor stand. The cooler the weather, the longer the seedling can survive, unless a seedling disease infects it. The warmer the weather, the faster the seedling grows and the sooner it runs out of energy. It is therefore important to deal with crust soon after it forms. Using a rotary hoe is one of the best ways to break the soil crust and enhance seed emergence. If done properly (drive as fast as you can to minimize the damage of the cotyledons), rotary hoeing causes very little damage to the young plant and little disturbance of crop residue, thereby enhancing infiltration and preventing erosion. If cotyledons are damaged or ripped off, the plant will die because during the cotyledon stage. it can't use photosynthesis and gets all its energy from the cotyledon.

The lesson to learn from such events is to look at the degree of damage caused to fields with better residue cover by such uncontrollable rains versus the intensely tilled fields. How does damage happen? In a normal rainfall, raindrops 6 millimeters in diameter hit the ground at 20 miles per hour. The cumulative impact of millions of raindrops hitting the ground in a hard--hitting spring storm rainfall can be incredible, dislodging soil particles and "splashing" them up to 3-5 feet away.

The splashed particles clog soil pores, effectively sealing off the soil surface and leading to poor water infiltration. Instead of soaking into the soil, rainwater collects and moves down

slope in sheet or rill erosion, forming gullies and carrying soil particles. An effective soil conservation plan that limits exposed soil and rain splash erosion also depends on observation and maintenance. Spring is as good a time as any to develop a new and different strategy for addressing conservation planning.

What are the lessons of the rainfall events over the last weeks?

Heavy rain in such an intensity that causes significant property and soil damage provides an opportunity to examine what can be done differently in the field to minimize, if not control, soil erosion. Some recommendations are:

- Look at the pattern of surface runoff and the placement of buffer strips on the field when directing surface runoff and minimizing sediment transport.
- Examine your choice of tillage and compare it to other fields in the area to evaluate the degree of damage caused by soil erosion in each conservation system.
- Evaluate the residue cover, the uniformity of residue distribution, and residue effectiveness in minimizing soil erosion.
- Document your field conditions with photos, if possible, and assess the water ponding on the surface under each tillage system.
- Evaluate your field fertility conditions, especially if nitrogen was applied in the fall. There can be substantial nitrogen, phosphorus, and potassium loss due to leaching and surface water runoff.
- Evaluate your plant populations, the damage your field experienced, and the alternatives for replanting.

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