Guidelines for Soil Compaction Management During a Wet Harvest Season

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Fast Facts:

- Waiting for better soil moisture conditions is best, but not always possible.
- Reduce axles loads and maintain low equipment tire pressure.
- Managing equipment traffic pattern can help contain and reduce soil damage.
- Don't assume subsoiling is needed.
- Surface tillage might be needed to address ruts.
- Cover crops can help.

Background:
Crop yields are decreased in compacted soils. This reduction in yield is caused by a reduction in root growth, water infiltration and plant water availability. Therefore, it is important to reduce the risk of soil compaction. Wet soil conditions in the fall increase the risk for causing soil compaction during harvest operations. Below are some guidelines to help prevent forming, diagnose, and manage soil compaction during wet harvest conditions. Preventing soil compaction from happening is usually the best management approach when possible.

Guidelines:
One of the main issues during wet harvest is the creation of ruts from equipment traveling in a field. Rutting creates an uneven soil surface which affects seed to soil contact during planting the following season's crop. Also, ruts are a sign of surface soil compaction and clay smearing which increase the likelihood of soil crust to form. An effective strategy to reduce the risk of ruts is to manage traffic patterns in a field.

Most discussions of traffic pattern management within agricultural fields involves uniform machinery sizing and Global Positioning System (GPS) guidance of machines. However, it can also be achieved with some awareness and discipline on the part of the operators. This is even easier in wet conditions where rutting has occurred. Maintaining repeated travel patterns between transport equipment and the harvester (i.e. driving in the ruts) can reduce the damage of operating on wet soils and will confine any damage to specific and well known locations in the field. Figure 1 shows GPS data, collected once per second, on every piece of equipment involved in an operation harvesting alfalfa for ensiling. The left image shows the paths of two mergers, the forage harvester, and six transport trucks. The right image only shows the path of the forage harvester, simulating managed traffic, where every other piece of machinery is staying within the forage harvester tracks. Although the entire field is impacted by the operation of the machinery future corrective measures could be taken on the locations of the ruts rather than applying the correction to the entire field.

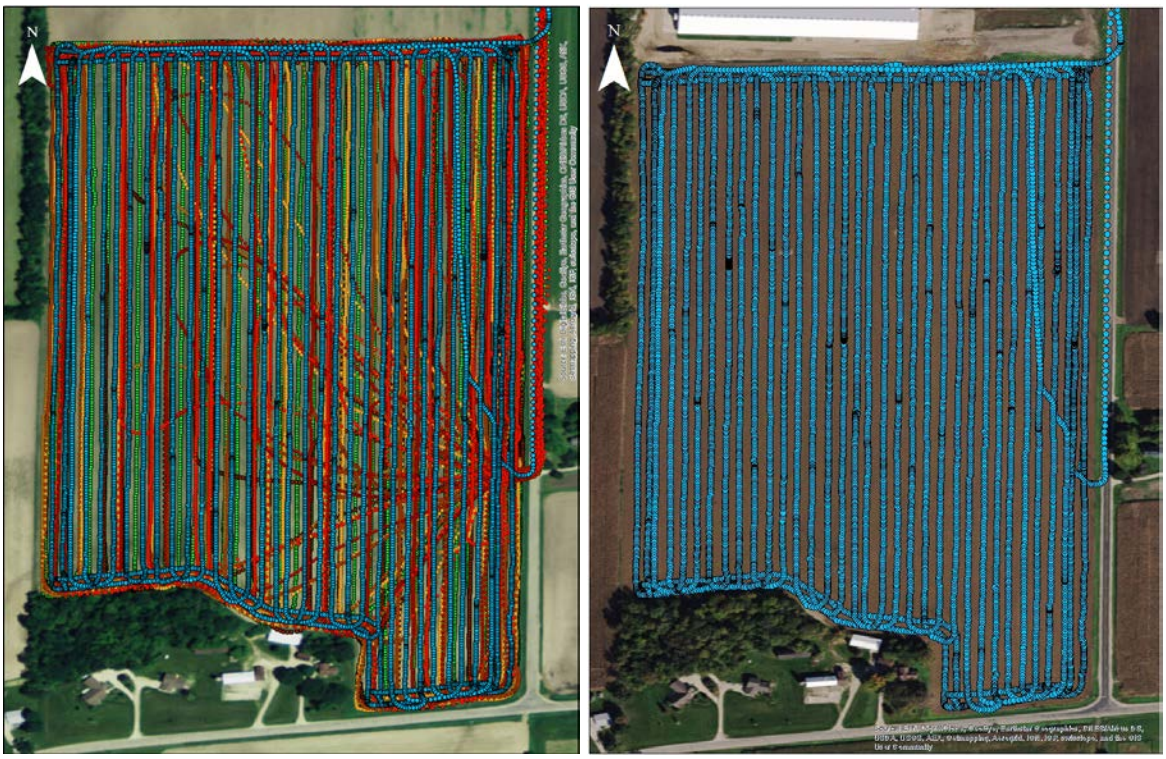

Figure 1. Global positioning system data of an alfalfa forage harvest operation with all equipment involved; merger path, chopper path, and six transport trucks (Left). Global positioning system data of forage harvester path only simulating controlled traffic within a harvest operation (Right).

Some other machinery specific considerations for operating in wet conditions are to: 1) utilize machines equipped with tracks if possible, 2) maintain tire pressures as low as practical, 3) attach dual wheels wherever possible, 4) consider only carrying half (or reduced) loads out of the field, and 5) utilize tractor based transport equipment within the field while loading transport trucks at the edge of the field. Using equipment equipped with tracks spreads the mass of the machine over a greater area which reduces the overall pressure exerted on the soil. This effect is also achieved by running tire pressures as low as practical and implementing dual wheels wherever possible. Reduction of the total machine weight by only carrying half loads out of the field will reduce the total pressure exerted on the soil as well. There is a harvest efficiency consideration with this, in that it will take longer to harvest, so a judgement call on whether this is a good approach will need to be made based on crop quality and weather conditions. Finally, utilizing grain carts or dump carts to carry the product out of the field will reduce compaction with that equipment having larger tires and spreading the load over a larger area as opposed to utilizing trucks.

If there is a considerable amount of tire ruts, doing some light tillage to smooth the soil surface will help with planting operations. If ruts are present, surface tillage might be needed to improve the seedbed. Surface tillage can be done localized to those areas with ruts only if needed. Then plant a cover crop if possible, probably a grass such as cereal rye that has a fibrous root system that will help that soil surface.

If shallow compaction (<6" deep) is detected, plant a cover crop (again cereal rye would be a good option for this, maybe mixed with a legume but not necessary for this) and track compaction with a penetrometer in the fall and spring. Freeze/thaw conditions this winter can also help alleviate shallow compaction but might not always work.

Don’t assume that the presence of ruts indicates subsoil compaction. Soils are most susceptible to compaction at water contents near field capacity because the proportion of soil pores filled with air and water is just right for compaction (soil consolidation) to occur. It seems counterintuitive, but soils with most of the pores filled with water are less susceptible to subsoil compaction. Recall that liquids are not compressible, unlike air, thus can bear an equipment load whereas air would allow for a pore space to collapse. However, soils near saturation are very prone to rutting and smearing near the surface.

If deep/subsoil compaction (deeper that 6") is detected, a sub-soiling or deep strip-tillage operation might be helpful. A cover crop would help here as well, but it will depend more on the growing season required for that cover crop and its root system’s ability to penetrate the compacted layer. Freeze/thaw will not help for deep compaction (need the freeze/thaw cycles, similar to wetting/drying, to loosen the soil). There is a chance that a cover crop will help here, so it might pay off to monitor compaction this fall and again in the spring to determine if a deep tillage operation (e.g. sub-soiling or deep strip-till) is needed.

It is recommended for long-term no-tillage fields with ruts or other soil damage in localized spots in the field, to just target those areas with tillage if needed and leave the rest of the long-term no-tillage field alone. Soils in long-term no-tillage fields have a greater ability to "bounce" back than of conventional tillage managed soils.

In general, soils should be allowed to dry before any other operations are implemented, if weather cooperates. The diagram below can be used as an aid to assess the risk of soil compaction after harvest in wet field conditions (Figure 2). A You Tube video “Using a penetrometer to detect soil compaction” can be accessed at: https://youtu.be/Zq_785JqRq8?list=PLF17555C62D9A378B

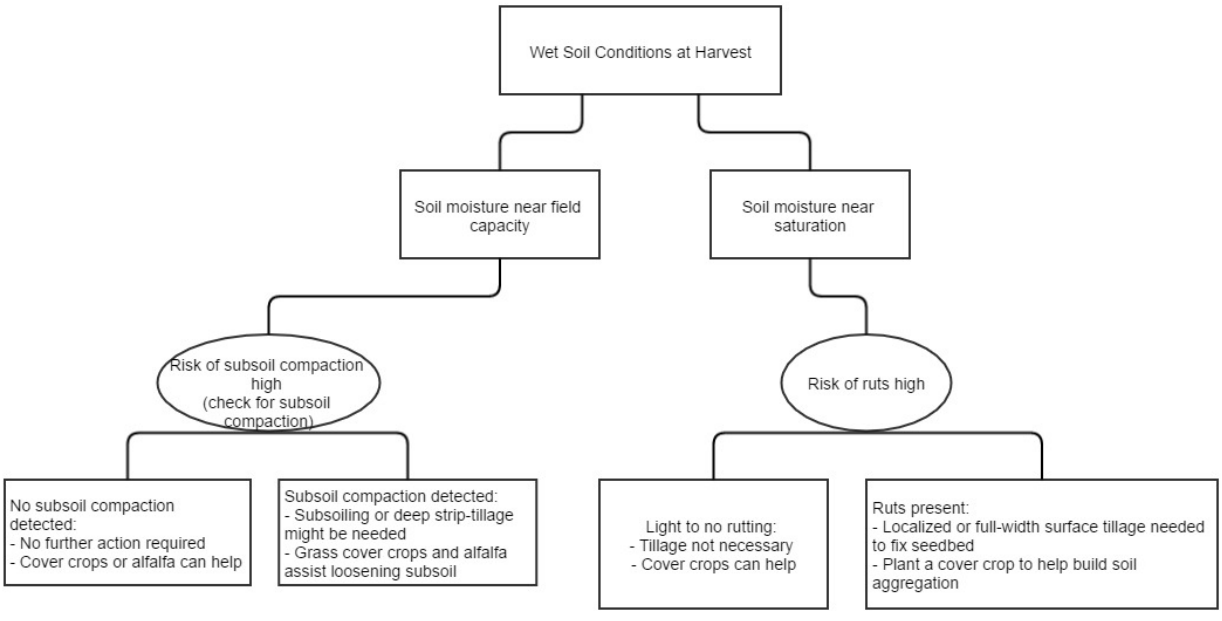

Figure 2. Decision diagram to assist in determining soil compaction presence after harvest during wet field conditions.