ADVANCED AG SYSTEMS'

Crop Soil News

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July 2024

"It is the crops that feed the cows that make the milk which creates the money."

Note: tar spot is breaking out in a number of regions. BMR male sterile sorghum supports the same milk as corn silage but does not get corn tar spot.

Now is the Time to Dig Your Crops

No, we are not talking about root crops nor is this some 1960s hippie newsletter (a term from before most of you were born). It is something I have uncovered over 50 years of studying forage crops and why they grow or don't grow. Going out in July (picking a hot, oppressive day makes it more interesting), digging in corn fields, and then continuing digs in alfalfa or grass fields.

Compaction is caused by tillage operations: wheel traffic with high (greater than 5 ton) axle loads and high tire pressure; raindrop impact on tilled soils (surface compaction; and crops grown with no winter cover and no rotation

This came about as I was doing considerable work researching no-till. The <u>number one factor limiting no-till success</u> and growth was that the roots were not going below 6-8 inches. That ground was like a roadbed underneath. The layer is at the base of **moldboard plow**, or the **offset disk** commonly used in the south or even a **chisel plow**. All leave the surface nice and fluffy (structure destroyed) and an impenetrable roadbed underneath. It looks great from the tractor seat. Most farmers do not get off to look at what is happening underneath. I convinced a farmer one morning to take 5 minutes and check his field next to the house. He reluctantly agreed, thinking it was a waste of time. At 5 in the afternoon, I said I had to go home – he kept saying "one more field". He then said he learned more about his fields and cropping in that one day of digging holes than at all our seminars.

Conventional chisel/disk on left, compaction removed with no-till following on the right. Your choice.

I have seen these root-limiting layers in all soils; sand, gravel, silt, and clay. Beginning research here in Tennessee, we requested deep tillage before planting our plots. We were assured there was no compaction in the silty clay soils worked by an offset disk. That view changed quickly once they dropped the deep

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tillage unit into the field. Both moldboard and disks really compact this soil. Multiple shallow **vertical tillage trips** can do the same thing as I found in one of my New York research trials. When farmers switch to no-tilling into these conditions without removing the compaction , the result is a crop that has little or no roots. They blamed no-till when actually the problem was previous tillage. With todays tractors that can go when they shouldn't, farmers often push the envelope with wet soils. Wet spots continually get bigger (see graph at right). **It only takes seconds to compact and decades to remove the damage.**

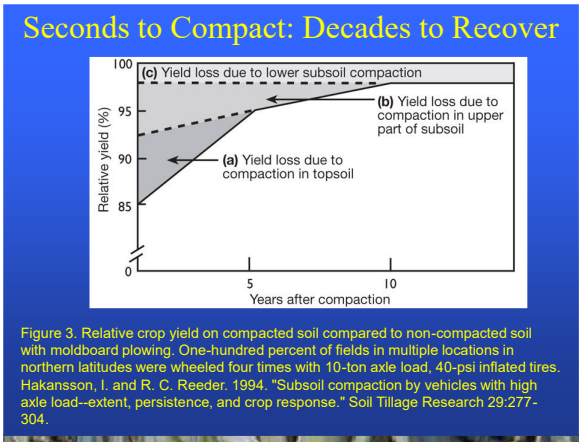


Figure 3. Relative crop yield on compacted soil compared to non-compacted soil with moldboard plowing. One-hundred percent of fields in multiple locations in northern latitudes were wheeled four times with 10-ton axle load, 40-psi inflated tires. Hakansson, I. and R. C. Reeder. 1994. "Subsoil compaction by vehicles with high axle load--extent, persistence, and crop response." Soil Tillage Research 29:277-304.

Despite old farmer tales in the north, **frost does NOT remove compaction**. In an area with heavy freezes, we had a 15-year alfalfa timothy hay field that clearly showed compaction from the moldboard when it was originally plowed for seeding. The individual plow share marks could still be seen. NO roots went below 7 inches. This was plowed with a smaller tractor when the soil was still plastic at the plow shear layer. Massive equipment today puts compaction even deeper. At a compaction seminar in Canada, equipment with 100 psi tires and more than 10 tons/axle load broke the compaction sensor down 20 inches. Multiple trips in all kind of conditions leaves your soil the consistency of a large block of concrete. The worst was in soils the farmers thought would not compact.

The key point of this newsletter is that you must go out and LOOK. It takes effort and time to dig the holes and carefully excavate the roots. Teasing the soil away from the roots with the point of a jackknife reveals the history of what they were dealing with from the moment they emerged from the seed. Majority of roots going horizontal on one plane indicate a compacted layer. We even saw this on sand soil that was deep-tilled and then moldboard plowed the next spring. No roots went below the 7-inch plow pan even though the soil underneath the pan I could put my arm in up to my elbow. Roots should be round and have many small feeder roots coming off. Rectangle and flattened roots with few feeders emerging is indicative of compacted soil. As you can see in the photo at the right, the opposite extreme is of a corn root growing over a narrow shank, deep tilled pass which was then planted no-till. The corn was only a foot tall but the root went a foot directly downward into the ground with so many feeder rootlets emerging that it looked like a fox's tail. This raises the question is the two-inches-over and two-inches-down fertilizer placement a result of normal root growth or a result of plowed and disked field compacted layers causing the corn to grow that way?

Corn planted directly over a narrow shank loosened row grew straight down with tremendous number of feeder roots. This is very different from what we thought we know about how corn grows.

Narrow, vertical deep till shanks remove compaction in a 12 to 15 inch V slot yet leave firm soil between to drive on without compacting the loosen soil. Another year you remove in between the rows.

Giant monster ripping machines with disks and choppers are impressive (and expensive) but not the best way to remove compaction. They pulverize the soil structure which then consolidates into a giant lump. The deep wings they have leave a severely compacted layer at the bottom. Roots will never penetrate it nor will water and oxygen. Curved shanks will assure any rocks and lumps are

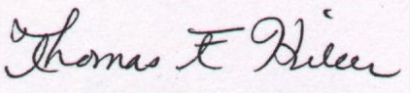
brought to the surface. **Finally, deep tillage without changing the rest of the cropping system is a waste of time.** Adding insult to injury it makes sure the deeper layers along with the surface are also severely compacted.

Shattering the compacted layers followed immediately by a deep fibrous rooted crop like winter triticale forage, produces a mass of roots 16 inches deep that stabilized the soil yet kept it loose.

A holistic approach is to remove the deep compaction with a narrow (3/4 inch) vertical shank with a small foot at the bottom (no wings). Narrow vertical shanks with a pointed lead edge slip around the rocks and leave them in the soil as long as tractor speed is kept reasonable (<3 mph for stoney ground). It may take a couple of passes over several years to completely remove the deeper compaction. Ironically **removing compaction and then utilizing year-round cropping systems based on no-till has a tremendous beneficial effect on the soil**. Shattering the compaction in a pass and then **growing winter forage followed** next season by summer energy crops has the farmers reported that the **soil is getting noticeably softer and easier to plant.** They also report a tremendous increase in earthworm populations. This is an underestimated factor in the switch to no-till after compaction is removed. The benefit is from both the small worms and the large "nightcrawlers". The latter will bore holes 4 feet into the soil profile (I know I looked). Each leaves a macro hole in the soil that is stabilized by organic matter and worm casting. When it pours, the rain is captured and moved deep in the profile to be recovered to feed the crop later. When it pours these macropores enable critical oxygen to move in the soil to keep the roots growing and healthy. Multiple farmers have commented on the visible increase in worms in their now healthy, uncompacted soil. Tillage destroys worms either directly or by destroying soil structure so there is no oxygen, critical to their survival.

All this is useless unless you go out and look in your fields by digging holes. You need to accurately determine at what layers the compaction occurs. In the above 15 year alfalfa field we ran the deep till at 14 inches. All it did was cut a groove in the compacted soil. Digging a hole revealed this. We lowered the shank two inches; the tractor shifted down two gears to pull it; and we shattered the entire plow pan. Compaction is caused by tillage operations; wheel traffic with axle loads and high tire pressure; raindrop impact on tilled soils (surface compaction); and same old—same old crop growing in the field without rotation. You need to correct this by doing something different.

Sincerely,



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