Tillage Reincarnated

by Matt Hagny

Matt Hagny is a consulting agronomist for no-till systems, based in Salina, KS

Tillage has been reinvented. No longer the clumsy scratching and churning of the soil with crude instruments like plows, tandem discs, and the sweeps of yore, tillage has been redefined into some sexy nouveau alteration of the soil to enhance crop root growth and water infiltration. Just look at the ads—machines featuring cutting discs, chisel points, covering discs, and treaders all gathered into some perfect constellation to place fertilizer or "break up" compaction or create "rooting zones" or some other hoopla. At least in the old days tillage tools were simple, cheap, and effective. The new stuff is at least twice as complicated, and twice the price. At least you get to tear around in a big tractor and blow smoke.

Strip-till. Zone-till. Para-plow. Mole-knife. Vertical till. "No-till" rippers. Coulter machines. The list goes on. It is amazing how resilient the idea of tillage is. Let's take a minute to confront ourselves with the facts:

First, tillage does not eliminate or alleviate compaction. It applies pressure to the soil (if you don't believe it, have someone lower that ripper point onto your foot), which pushes the clay platelets together. Any and all tillage implements do this, it is just physics. Lifting and fluffing the soil creates equal pressure downward, not to mention the compressing action as the soil is inverted and/or lifted. All soils will be *more* compacted after the implement has passed than what they were before, even if the result is a fluffier soil. The temporary fluffing will go away with a few precip. events, leaving a true picture of what you have: soil with no structure. Tillage will not make compaction go away. Only natural processes can do that. The absolute best a tillage implement can hope to do is to rearrange your compaction (while adding a little more in doing so).

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Secondly, tillage may temporarily reduce 'nutrient stratification,' as if that were some sort of problem. The prairies were stratified. Forests are stratified. Plants evolved to deal with this: they tend to have the greatest root mass near the surface—near the nutrients. No-till crops generally have more roots in the top two inches due to improved moisture conditions there, as well as greater root mass at depth (following old channels). While having some nutrients at depth is desirable, getting them there quickly requires big horsepower, and great destruction if you are already no-till. However, many natural processes will redistribute nutrients to depth quite effectively, including leaching, earthworms (particularly nightcrawlers), deep rooting crops, and the self-mulching (shrink/swell) of some clayey soils.

Photo by Matt Hagny.

High-yielding no-till corn. Would it have been better with strip-till or zone-till? Depends on the details of the comparison.

Third, tillage does not create the optimum environment for seedlings. This misconception apparently is perpetuated by various factors, including seedlings sometimes growing slightly faster in tilled soils (due to warmth and a flush of nutrients being released from oxidizing OM—but fast seedling growth does not a crop make). Or seedlings being more visible against the blackened soil. Or simply because most of the rural community grew up looking at crops planted into black tilled soils and think of it as 'natural.' This is a faulty paradigm. Nature does not grow plants in tilled soils. Look at a pasture, a prairie, a forest. The plants are growing fine without tillage. As for the seeding equipment, yes, much of what is out there has been engineered to work in a tilled fluffy seedbed. This is an engineering problem, not an agronomic one.

Why Did That Result Occur?

So what to make of all the research showing yield improvements with strip-till, zone-till, ripping, or whatever? Well, look at the details. Since most scientists strive to minimize all variables except the one or two under scrutiny, something has to give. Often it is the case that the