

When is it time to till a no-till field?

November 28, 2016 By Anne Dorrance, Laura Lindsey, Peter Thomison, Andy Michel, Mark Loux, Ohio State University Extension

Tillage is a tool for managing many things that can go wrong on a given field. It breaks compaction (if done at the right soil moisture), improves drainage (again if done at the right soil moisture), and manages inoculum loads from residue borne insects and pathogens that impact corn, soybean, and wheat. Just like pesticides and fertilizers – too much tillage also can bring another set of problems, a compacted plow layer, but more importantly, soil erosion. With any agronomic practice, including tillage, there are benefits and drawbacks.

Below is a list of potential problems associated with no-till fields.

The Pathogens

High levels of disease from pathogens that survive on and in crop residue: This year in 2016, we have had outbreaks of a number of pathogens that cause ear molds and leaf blights on corn, leaf spots and seed rots on soybean. The likes of what we have not seen for some time. All of these pathogens will overwinter during the 2017 cycle – so they will be ready to go and infect next season's crop – the higher the inoculum the more disease that the 2017 season will see.

The Insects

Similar to pathogens, insects can also survive on and in crop residue. Some of the top culprits are true armyworm (which like the grassy weeds and cover like rye), and fall armyworm (which prefer broadleaf weeds). The populations of caterpillars are usually tough to predict since they are migratory and their presence in the spring depends on flight patterns. In addition, higher slug populations are often associated with fields that have a lot of residue. Some of these issues in no-till fields could be controlled by appropriate weed management and good spring scouting.

The Weeds

Most weeds are controlled adequately in no-tillage systems with the currently available herbicide systems. Tillage can be an effective option for management of biennial and perennial weeds – primarily those that have simple root systems (e.g. deep taproots). Tillage can also help with control of perennials with creeping roots or rhizomes, but primarily when integrated with an herbicide application. A combination of fall and spring tillage operations, or even thorough spring tillage alone, can control marestalk for at least the current growing season. Tillage must completely uproot emerged marestalk plants and uniformly mix the upper few inches of soil. The spring tillage should ideally occur as close to planting as possible. Be aware also that in fields where the soil seedbank is

heavily infested with marestalk seed, tillage can turn up seeds to the soil surface where germination and emergence is more likely.

Agronomy

Consider soil drainage. In poorly drained fields, tillage can help reduce yield losses from late planting. Tilled fields will warm up and dry out quicker in the spring. In well-drained fields, no-till is often a better option with many benefits including conservation of soil moisture, reduction in erosion and soil crusting, and reduction in fuel and labor. Corn response to tillage is strongly influenced by soil type and crop rotation. No-till cropping systems are more likely to succeed on poorly drained soils (like those in Northwest Ohio) if corn follows soybean or forage legumes rather than corn or a small grain, such as wheat. On the poorly drained silty clay loam soils, where corn follows soybean or meadow, yield differences between no-till and plowed soils are reduced. Crop rotation with soybeans generally has much less effect on corn response to tillage on the well-drained silt loam. This yield advantage to growing corn following soybean is often much more pronounced when drought occurs during the growing season.

Responses from readers:

1. Bill Haddad [“No-till Bill”]
How about soil loss and nutrient movement into our streams, lakes and Rivers and the millions spent to remedy this. Conservation of moisture during hot dry weather, time, labor, equipment investment, loss of organic matter. These are all advantages farmers gain from eliminating tillage where they can.
Yes it takes a little more management but the rewards are priceless.
 2. [Jim Boak](#) [Salford machinery]
Nutrient loss can come from no till just as easily. In a 50 km trip this fall I counted 136 violations more than 1/2 were from no till fields that were planted and sprayed over the edge of the ditch. We need to stop thinking in terms of till and no till and just focus on doing things right. We need to stop thinking conservation and think regenerative. Never leave soil bare – cover crop or double crop everything
 3. Don McClure [retired from NRCS]
Yes, no-till does provide habitat for insects but it also provides habitat for predators that will attack these insects. That is what Paul Harvey would call the rest of the story.
-

Bret Margraf, no-till farmer and Seneca Conservation District “educator”

That is amazing. I had no idea that plowing resulted in no pathogens, no weeds, no insects and no agronomic issues. So let me get this straight, if I plow there is no need for seed applied insecticides, no need for herbicide applications no need for fungicide application, no agronomic issues (crusting, compaction, ponding) and no need to install subsurface drainage. Someone should tell "the tillage farmer" and their agronomist about

this revelation, because "the tillage farmer" appears to apply more insecticide, herbicide, fungicide and tile than any no-tiller (zero-till).

Where is the bullet points listing all the potential problems to tillage? By excluding "a list of potential problems associated with tillage" these "experts" appear ignorant or biased. Every farmer and every agronomic system has potential problems, as well as benefits. It's the mindset that we approach a seemingly insurmountable challenge with that usually determines success.

The National Center for Water Quality (Heidelberg) can substantiate the reduction of sediment loads and particulate P as a result of conservation tillage (i.e.: no-till) systems dating back to their introduction in the Lake Erie Watershed.

Ryan Stockwell, National Wildlife Federation, Senior Ag Program Leader

Where to begin? The authors have glossed over, ignored, and even incorrectly analyzed the characteristics and consequences of tillage and zero till resulting in misleading readers to incorrect conclusions. The responders have all made accurate points in helping to correct or include facts the authors omitted. Here are a few more:

1. Drainage. The authors conclude tillage can improve drainage. Reality is that any improvement is short lived. Rain, erosion, and field traffic will not only quickly remove any drainage benefit from tillage, but will result in overall reduced drainage through destroyed soil structure. This necessitates another round of tillage, creating a death spiral.
2. Pathogens and Insects. As one of the respondents noted, the authors gathered only half of the story. I'd say they have only half of half. As the respondents noted, there are also good insects than can control pests. Tillage kills them. The other missed half: crop rotation. Let's stop trying to make tillage do what it can't: control pathogen and insect build-up from years of short crop rotations. It doesn't matter if you till or not, if you do years of continuous corn you will have issues. Pests have even figured out the corn-bean rotation. We need to get more complex by adding more crops.
3. Long term consequences. Eventually, every loan comes due, with interest. The authors pointed out short term benefits of tillage (in some cases such as drainage the benefits could be as short as a few weeks), but glossed over the production impacts of soil erosion and declining soil health. When solving any farm cash flow issues, a short term loan can always help. But looking from the perspective of long term farm profitability, paying back loans and interest from the past can destroy the viability of a farm, especially if you don't figure out a way to make the farm profitable on its own. I should know, as a son of an auctioneer I watched farm after farm succumb to built up debt burdens from the past that eventually caught up. It is much better, albeit more challenging mentally, to solve problems without causing bigger problems in the future.

Jim Hoorman

Pure bunk! We have a lot of education to do. Not one of these people is a soil scientist.... The practice of tilling the soil kills most beneficial insects and the good microbes. It also promotes the bad diseases by changing the soil environment so that it has poor soil structure and drains less efficiently.

These are the two options that farmers are faced with today. All the other concerns follow the same logic.

Don Reicosky, Soil Scientist, USDA-ARS (retired)

It's good to see that a few of the early adopters of conservation agriculture are willing to stand up and tell their story and all other associated benefits.

What I find disconcerting is there was no science foundation for the original article. In science, we must have a peer review. Now it looks like in extension, a peer review may be needed to provide balance about the real world.

No-till and Cover Crops: Ecological Solutions to Problems with Conventional Tillage

A common saying in the past was: Plow ahead! Conquer the world and tame nature! A new saying for the 21st century and beyond may be: Keep it Green! Save the World and work with nature! These are the two major agricultural options that face farmers today.

With tillage, farmers get short-term gains solving immediate problems but it create long-term consequences for soil erosion, soil compaction, reduced nutrient efficiency, environmental problems (lower air quality, water and nutrient runoff (N&P)) and a greater reliance on higher inputs for fertilizer (lower soil productivity from soil erosion and lower nutrient efficiencies) and pesticides (weed resistance, higher insect pests due to fewer predators, and increased prevalence of diseases due to poor drainage and soil compaction).

Tillage is a drug and farmers are addicted to tillage and the spiral down is very similar because it solves some problems immediately. However, tillage is a destructive process that burns up carbon, reduces soil organic matter, and upsets many ecological checks and balances. Dr. Rattan Lal estimates that we have lost 60% to 80% of our natural soil organic matter due to tillage. Tilled fields have less water storage capacity and are less resilient to ecological events like droughts, floods etc. If farmers lose the NRCS T-value of 4-5 tons of topsoil every year, in 60 years, 1-inch of topsoil will be lost AND it takes 500 years to rebuild it. Is this a sustainable practice? So when is it acceptable to till? 1) To level fields (One time) and 2) to fill in ruts (not necessary if you stay off wet fields).

Long-term No-till (NOT rotational tillage) and cover crops OR what we now call ***Ecological Farming*** MAY or MAY NOT result in slightly reduced yields for 3-5 years but results in increased soil organic matter, greatly reduces erosion, increased water infiltration, decreases water and nutrient runoff from N&P, increased nutrient efficiency and eventually lowers input costs (less need for fertilizer if nutrient efficiency improves) and less reliance on pesticides and chemicals. Ecologically, weeds thrive in barren and disturbed soil because they are the early colonizers. Less disturbance keeps the weed seed on the surface where predators like ground beetles may consume their weight in weed seed on a daily basis. Plowing in weed seed preserves it until the next tillage pass which replants the weed seed.

For insect control, if you have an estimated 8 billion predators per acre like Dr. Dwayne Beck in South Dakota who is using ***Ecological Farming***, you have to worry less about insect and disease infestations because everyone is hungry and they eat anything! Dr. John Lundgren, Entomologist says there are many natural predators that eat slug eggs, slugs, wire worms, true armyworm, fall armyworm, cutworms and even corn root worms. In a healthy soil, everything is eaten by something else! Ground beetles and lightning bugs eat many soft bodied insects but they need food and habitat to survive (***Ecological Farming***). Create environmental conditions and habitat that allows those predators to thrive and a natural balance will begin to occur. Promoting TRUE Integrated Pest Management (IPM) strategies reduces the reliance on pesticides and they remain viable longer because they are not over-used.

Most diseases (*Phytophthora*, *Rhizoctonia*, *Phythium*, *Fusarium* etc) all thrive in wet soils. The pest triangle includes a vector (the pest), a host (the crops), and the right environmental conditions for that vector to thrive. Tillage may reduce these disease short-term but poor drainage due to reduced water infiltration, poor soil structure and soil compaction allow these diseases to thrive long-term. Changing the soil environment using an IPM and ***Ecological Farming*** improves drainage by improving water infiltration and soil structure and improves soil health (more predators, beneficial insects), resulting long-term in less disease pressure.

Have we set up a system that is meant to fail based on our current agronomic crop practices? A major problem that is being researched today is the long-term detrimental effect of neo-nicotinoid seed treatments (Cruiser, Poncho, Gaucho) on predators, pollinators (bees, beneficial insects), and mycorrhizae fungi. Healthy soils require diverse crop rotations, live plants year round, long-term no-till (undisturbed soils) and the freedom to recover. Over reliance on pesticides and chemicals upsets the natural ecological balance and results in an over-dependence on these products and has caused major ecological and environmental problems.

Farmers have a choice to make. Continue to till your soils, get immediate but short-term gains in pest control, MAYBE good crop populations and slightly better yields initially but expect more problems long-term with pests, more environmental issues and more regulation. The other option is to start adapting ***Ecological Farming*** practices like long-term no-till, cover crops, diverse crop rotations and expect slightly reduced yields (think of it as an investment in your future) but higher yields long-term, less reliance on

inputs over time, and a more resilient and vibrant landscape for human and all wildlife that is ecologically and environmentally balanced. The second path is tougher, requires more education and research, but the rewards are potentially very high. You decide. The future of your children, grandchildren, and all future generations may hang in the balance.