

# Straight Talk On Tillage

As the term vertical tillage becomes more mainstream, clarifying what makes a practice fit this system is key **BY MARGY FISCHER**

**F**or more than two decades, Farm Journal Field Agronomist Ken Ferrie has worked to understand how uniform soil density and adopting a vertical system sets the stage for higher yields. Today, vertical tillage is a concept that is well known across farm country, although it's not always well understood.

"Every tool has a specific range of things it's designed to do," Ferrie explains. "But vertical tillage is not a single tool—it's a system."

A comprehensive five-year Farm Journal Test Plot that concluded in 2000 showed that creating and maintaining uniform soil density leads to yield increases of up to 27 bu. per acre. This effort is ongoing as Ferrie continues his soil density studies with new machinery and changing practices.

A vertical tillage system involves understanding the soil profile, tackling compaction issues, ensuring that each pass achieves the goal of the system, respecting residue cover and providing a well-prepared seedbed for the planter pass. Simply put, a vertical system means managing the entire soil profile for uniformity.

"With a well-managed uniform soil profile, farmers achieve better water infiltration and drainage, quicker soil warm-up for spring planting, efficient use of nutrients, more drought tolerance, and uniform growth and pollination," Ferrie explains.

Although the benefits sound like a good fit, Ferrie reminds farmers that adopting a vertical system is not a one-step process.

**From the ground up.** The first step is to understand your soils and the current density profile. This means digging in your fields once during the growing season and again behind tillage tools.

"The roots will tell the story on the



PHOTO: BILL BAUER

**While a field cultivator provides an even seedbed, it leaves a horizontal density change, as shown by the dotted line, where the root turned as it grew. The key to vertical tillage is to provide an even seedbed and a uniform soil profile.**

field, so wait until later in the growing season and you'll have plenty of roots to evaluate," Ferrie says.

Dig plants to evaluate the root structure. Also, dig a soil pit to look at the entire soil profile and evaluate soil moisture and structure and root growth. Sudden changes in those characteristics indicate a soil density change.

You can also use a tile probe to find density changes. With even pressure, push the probe in and feel for resistance as the probe goes down. Be sure to pay close attention as the probe enters the ground, as many density changes created by horizontal tillage occur in the top 4" of soil. If the probe suddenly becomes harder to push, you have found a density shift. Compaction layers must be fixed for a successful transition to a vertical system.

"When farmers change tillage systems, any compaction layer can come back to haunt them," Ferrie says.

Vertical tillage tools for primary tillage, which include in-line rippers, chisel plows, disk chisels and disk

rippers, have deep-digging shanks that fracture compacted layers of soil.

"The key is full-width shatter across the primary tillage tool," Ferrie says. "Many farmers are surprised to learn that they are not achieving the consistency that they assumed."

For a tillage pass to provide full-width shatter, more digging is required.

"When you dig behind your primary tillage tool, you'll want to make sure the soil is fractured from shank to shank," explains Farm Journal Associate Field Agronomist Missy Bauer. "If there are columns of undisturbed soil between the shanks, you did not achieve full shatter. Ideally, you want full shatter 4" to 6" from the surface."

Bauer reports that it's important to get the primary tillage done right as well in sandy soils, where she's done soil density studies.

"Sandier soils are not forgiving to mistakes made with primary tillage," she says. "When the primary tillage is done correctly, the effects of improper spring leveling are less dramatic." ▶

# MACHINERY

Overall, in primary tillage farmers need to consider depth of topsoil, residue issues, crop rotation, timeliness and horsepower. The machine's setting for uniform shatter might need to be checked and adjusted within each field.

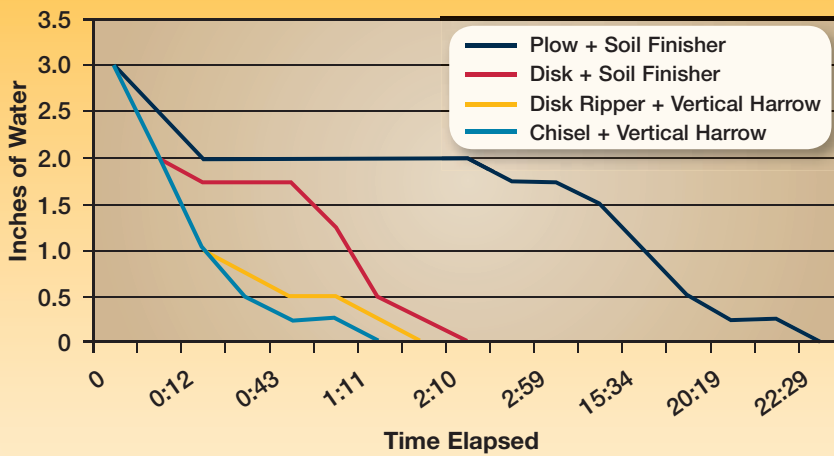
"The end goal of primary tillage is to leave the field as level as possible," Ferrie says. "Staggered shanks, chisel plows, disk chisels and disk rippers leave a pattern of peaks and valleys of untilled soil under the surface."

If the untilled columns extend to the surface, it can create an uneven seedbed. Horizontal secondary tillage tools, such as a field cultivator, can fix this problem because these tools level from the bottom, not from the top like vertical tillage harrows.

"Farmers are seeing that vertical tillage requires a combination of fall and spring tools," says Stan McFarlane of McFarlane Manufacturing. "Some of the mistakes made in the fall can't just

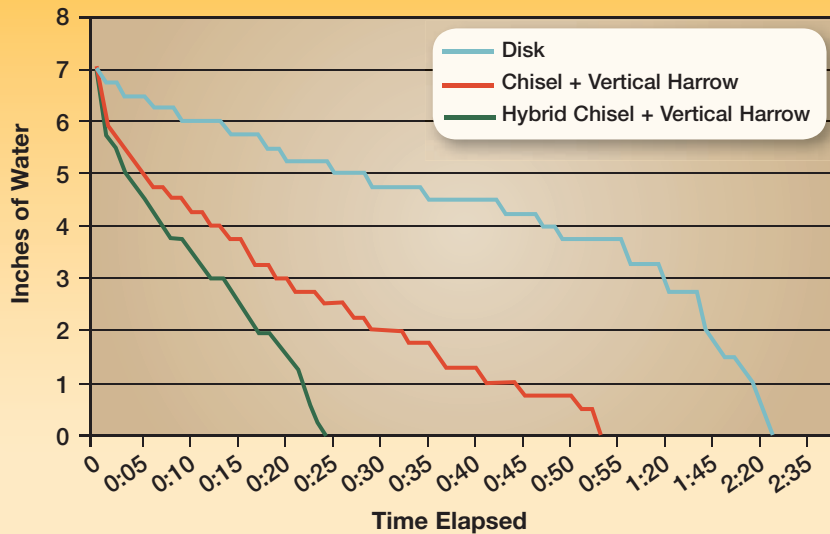
## Water Infiltration Through the Soil Profile

### Illinois Soil Density Study: Loamy Soils



SOURCE: CROP-TECH CONSULTING

### Michigan Soil Density Study: Sandy Soils



SOURCE: B&M CROP CONSULTING

In midsummer, two experiments were done by fitting a barrel cut in half into the ground and then tracking how water was absorbed into the soil profile.

## Residue Left at the Surface in the Spring in Corn-On-Corn Acres

### Horizontal Tillage Systems

Fall Plow  
+  
Soil  
Finisher

Fall Disk  
+  
Spring  
Soil  
Finisher

Fall Disk  
Ripper  
+  
Spring  
Vertical  
Harrow

Fall Chisel  
+  
Spring  
Vertical  
Harrow

Spring  
Chisel  
+  
Vertical  
Harrow

Strip-Till

No-Till

Weight of Visible Surface Residue: Grams per Square Foot

4

68

72

86

156

338

358

Percentage of Ground Cover Provided by Residue

10%

17%

27%

27%

42%

78%

91%

In the spring, the visible surface residue was collected from 1 sq. ft. across these tillage passes. Vertical tillage only moves soil up and down and leaves more residue cover on top, but it sizes the residue for faster breakdown.

SOURCE: CROP-TECH CONSULTING

be fixed with a vertical tool in the spring. I encourage farmers to make sure the field is left level in the fall.”

**From the top down.** Vertical tillage harrows only level the surface from the top, and incorrect primary tillage causes problems for the planter as well as herbicide streaking.

“They don’t bury as much residue as horizontal tillage, so your primary tillage needs to mix residue in the fall,” Ferrie adds. “And you need to consider running row cleaners on your planter.” (See table above.)

One way to distinguish between spring tillage tools and know if they fit a vertical system is to look at how much residue is left on the surface.

“We typically say that 75% residue is left on top of the ground after running a vertical tillage harrow one time,” says Jim Danielsen, national sales manager for Salford Farm Machinery.

Many no-till and strip-till farmers are exercising the vertical system, as they are already managing the soil profile for uniformity.

“We’ve sold machines to no-tillers who want to leave all residue on top of the ground,” says Tom Evans, vice

president of sales for Great Plains Manufacturing. “Vertical tillage harrows don’t mix and bury residue, and they are designed to size residue for it to break down faster and flow through the planter.”

Primary vertical tillage tools, such as an in-line ripper, can be used to help remove wheel track compaction and reset the soil profile.

Another similarity between vertical tillage, no-till and strip-till is the way water moves through the soil profile. (See charts on previous page.)

“We have done studies comparing tillage systems and the amount of time it takes for water to move down the profile,” Ferrie says. “Without a horizontal layer, a vertical system has the advantage of getting rid of water quickly, but it also helps water move back up the profile later in the season.”

Watching how your fields take on water is one way to test your vertical system. From the surface, though, a vertical finishing pass can look the same as a horizontal finishing pass.

“If you dig, you’ll see the difference,” Evans says. “If that field gets a heavy rain, the vertical finish will filter


the water straight down. If it’s a horizontal pass, the water will hesitate at the bottom of where the blades on the horizontal tool ran.”

Another way to tell if a spring tool will provide a vertical finish is to see how it makes contact with the surface.

“You want the blades to be at the smallest concave possible,” McFarlane says. “It’s not just running straight or shallow blades but also the depth at which you run the tool. If it’s on an adjustable gang, evaluate how much of the ground is being worked. You’ll need to watch how the tool runs in different residue environments.”

When a vertical tillage system is executed correctly, the planter pass is smooth-running.

“Setting down pressure, achieving proper depth and getting even emergence are all easier with a well-done vertical system,” Ferrie says.

Not only will your planter help test your performance, but you can let your soils do the talking as you evaluate your vertical tillage system. 

You can e-mail Margy Fischer at [mfischer@farmjournal.com](mailto:mfischer@farmjournal.com).

Watch videos of Ken Ferrie and Missy Bauer defining vertical tillage at [www.FarmJournal.com/soil\\_density](http://www.FarmJournal.com/soil_density)

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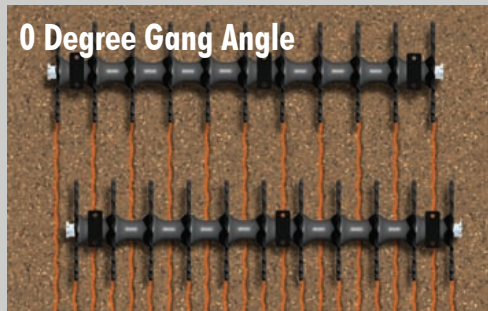
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6 Degree Gang Angle