Science Societies

Remember these best practices when It comes to vertical tillage

By Matt Ernst

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Salford vertical tillage unit with individually mounted wavy coulters. Photo by Jodi DeJong-Hughes, University of Minnesota.

The popularity of vertical and hybrid tillage tools continues to grow east of the Mississippi. Pinpointing what producers mean when they say “vertical tillage” can be difficult. Today, it is often used as a more generic term for shallow soil tillage. This article provides some things to keep in mind with vertical tillage, including soil conditions, machine setup, fuel economy, timing, and more.

During a dry spell early in the 2021 soybean growing season, some Ohio agronomists started getting calls about unusually stunted soybeans. Close investigation revealed classic compaction issues and root development problems at 2 to 4 inches.

The agronomists dug deeper, tracing back machine operations and field histories. They found a majority of the soybean fields had been worked with vertical tillage (VT) units before planting—but the producers also fessed up to probably being in the field before the Ohio soils were truly fit to work. The conclusion: the culprit was not the tillage tool, but whether it was being used properly.

With the popularity of vertical and hybrid tillage tools continuing to grow east of the Mississippi—and as producers continue to keep a sharp eye on rising input costs—here are some reminders about using popular VT units.

Remember What Vertical Tillage Is—and Isn’t



The photo shows stunted soybeans from Ohio in 2021. The beans on the right are from ground where it was too wet when vertical tillage was used. Photo from Bill McDonald.

Vertical tillage started in the Plains, especially to manage cornstalks in the fall and help soils dry in the spring. “It started in the states west of us, and vertical tillage has definitely gained lots of traction here in Wisconsin in the past 10 or 12 years,” says Francisco Arriaga, University of Wisconsin–Madison Extension soil specialist.

Pinpointing what producers mean when they say “vertical tillage” can be difficult. The first VT tools in the Plains only worked the soil vertically, reducing compaction and layering but not doing much soil mixing. “That’s still the effect that you get from wavy coulters on today’s vertical till units,” says Jodi DeJong-Hughes, University of Minnesota Extension soils educator. “I call it the ‘Ginsu knife’ effect where it throws the soil up and then right back down again.”

Today, “vertical tillage” is often used as a more generic term for shallow soil tillage: 4 inches deep or shallower, according to a definition of vertical tillage from North Dakota State University. “Hybrid” tillage units, especially those rated for 10 mph or more, are what most producers mean when they say vertical till. The units feature adjustable disk gangs that may reach depths of 6 inches at multiple angles, followed by a variety of soil-conditioning wheels and rollers. Well-known units include the Case IH True Tandem, Horsch’s Joker series, the John Deere 2660VT, Kinze’s Mach Till, Kuhn Krause’s

Excelerator, and Salford's I-4200.



Regardless of the tillage system, it's important to stay off the field when the soil is wet. Photo by Tim Scrivener/Agriphoto.com.

The variety of VT units—and different soil impacts from running at different speeds and different gang angles—mean it is important to find out just what a producer means when they say vertical tillage. "There's a lot of variability, from manufacturer to manufacturer, in what is called vertical tillage. That means you probably need to ask the producer some more information," Arriaga says. "It's a lot like when someone says they are no-till—dig a little deeper, and you'll find out that may mean many things."

Remember Soil Physics 101

One thing does not vary: misuse of a VT unit—like any tillage tool—can create tillage pans. That's basic soil physics. "Wet soil is more susceptible to compaction. Water lubricates the soil particles, and they will pack much quicker than in dry soil," says Humberto Blanco, University of Nebraska soil physicist. "Also, drier soils will have more stable aggregates, helping provide resistance to soil compaction."

Jodi DeJong-Hughes says VT units are effective to help dry out saturated soils—in the right soil types and at the right temperatures. "Vertical tillage really took off in western Minnesota and the Dakotas when we had a couple of wet falls followed by wet springs right in a row. The only thing people could run in the field and not get plugged up was vertical till. As long as the tractor could get through the field, the VT could too," she says.

Those Northern Plains producers found they could run the VT units in their saturated prairie soils without creating adverse compaction. “They’d let it dry (‘gray out’) for a couple days, hit it again with vertical tillage, and they were able to plant,” DeJong-Hughes says.

Minnesota’s DeJong-Hughes thinks her region’s spring temperatures help avoid some of the possible pitfalls when similar VT units are used elsewhere. “We avoided the issue that Ohio experienced in 2021 because the northern states dry out more slowly than areas farther south. If you use vertical tillage when it’s wet, and then get hit with really hot and dry weather—that soil could turn into a brick,” she says.

While saturated prairie soils may be more forgiving than finer, shallower soils, there is always potential compaction from overuse of any tillage tool. Jodi DeJong-Hughes cites one case in her region where vertical tillage was used, “10 years straight, both fall and spring, and it formed a really restrictive tillage pan.”

So while VT tools can minimize adverse impacts, the best bet is to remember the basics about tillage. “Vertical tillage is a low-impact tillage that cuts the soil on a vertical plane. That can have some real benefits,” says Nebraska’s Blanco. “But regardless of the tillage system, we really need to stay off the field when the soil is wet,” he says.

Remember Machine Setup and Fuel Economy

Setting a VT unit at improper gang angles for the field conditions can also backfire. “Remember, it’s still a heavy piece of equipment. You’re basically concentrating that pressure on a small area, which is a coulter,” says Francisco Arriaga. “And at a greater angle, it not only rolls forward, but it is also being dragged.” That means potential soil compaction similar to disking in wetter conditions.

Agricultural engineer Matt Darr, Iowa State University (ISU) Extension, has made a short video (**https://bit.ly/3rCullY**) showing impacts of VT gang angle adjustment.

Vertical tillage gang angles also impact fuel consumption. Researchers at the University of Manitoba completed a detailed study comparing strip till and VT for soybeans following corn. They measured fuel consumption for a Great Plains VT unit, pulled by a John Deere 9510R, on sandy loam soil. The unit set at a zero-degree gang angle used 1.28 gal/ac. At a six-degree gang angle, it used 1.54 gal/ac—a 20% increase. The same Manitoba study found no soybean yield and economic advantages over strip till for the tillage systems evaluated (single VT, double VT, or double disking).

Producers conscious of fuel costs may be thinking hard about how much tillage to do in the coming year. Field history (weed management) and regional differences (soil types) will influence many of those decisions. Especially where there may be compaction concerns, like finer soils in the eastern Corn Belt and Southeast, no-till may be even more attractive.

Machine setup is also vital if a VT unit is being used to incorporate fertilizer or herbicide. In another ISU Extension video (**https://bit.ly/3MbDIrE**), field agronomist Meaghan Anderson explains effective herbicide incorporation with a VT unit set at different gang angles, using blue chalk to represent granular herbicide.

Remember Timing, Field Conditions, and Strengths, Weaknesses

Today's highly adjustable vertical till units provide producers a lot of flexibility. "They're great tools," Jodi DeJong-Hughes says. "Vertical till is very effective in wet conditions and at residue chopping."

In fact, the VT units do such a good job of sizing crop residue that it can set a field up for erosion. "The residue can blow away; it's so finely chopped and everything is so

smooth," DeJong-Hughes says. For that reason, she advises against using VT in the fall. "I'd rather see producers wait until spring and take advantage of being able to get into the field with the vertical till unit."

Wisconsin's Arriaga agrees. "We see cases on land with some slope, after fall vertical tillage, where there's a textbook soil erosion problem the following spring," he says.

Some VT units are not effective in very dry field conditions, depending on machine setup. "A VT unit without shanks or sweeps ends up just bouncing on the soil surface if it's dry. Brush away the soil after the VT was up to speed, and you'll see the wavy patterns from the coulters," DeJong-Hughes says.

Some producers use a VT pass behind broadcast fertilizer. It is important to remember that a VT unit set to work residue into the top inch or two of soil is not going to truly bury broadcast fertilizer. That can set up the field for possible nitrogen loss. But a VT unit with disks, or coulters on gangs set at an aggressive angle, is probably going to bury the fertilizer enough to avoid nutrient loss.

Wisconsin's Francisco Arriaga says he also sees VT benefits for phosphorus management. "Vertical till can also address the incorporation of phosphorus if you're starting to have some layering, some stratification," he says.

Like other tillage tools, VT units may have weaknesses for some applications that are strengths in other applications. Case in point: most VT units are not great at burying weeds as there's usually a 5- or 7-inch spacing in between coulters or disks. But that can be an advantage when a VT unit is used behind cover crop seeding as the cover crops form "rows."

Remember Patience

Like so many other aspects of crop production, the most important practice for VT may be something not so easily quantified: patience. “It’s so easy to want to get into the field and get things done,” Arriaga says. “You’re trying to get through fall, or get everything planted, and you know maybe it’s not quite the right time—but still, you have to get it done.”

There can also be pressure, in producers’ minds, to use the equipment they have. “You’ve made that equipment investment—you don’t want that piece of equipment sitting in the shed,” Arriaga says.

But no matter whether the pressure is coming from harvest or planting, or the itch to run equipment, a little patience will go a long way. “Sometimes by hurrying any kind of tillage, we can create a bigger problem than we had by just waiting,” Arriaga says.

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