



United States Department of Agriculture

# *The 2017 South Dakota Cropping Systems Inventory*



Inside...

- ... Slight dip, but No-till still dominant*
- ... Healthy soils better in drought*
- ... Long term trend to less tillage*
- ... Farmers voice thoughts on soil health*

Natural Resources Conservation Service South Dakota



## Measuring Progress

The South Dakota Natural Resources Conservation Service produced this report as part of an ongoing effort to measure the progress South Dakota producers are making in building soils and sustainable cropping systems across the state.

Our employees and partners gathered information from more than 26,000 different fields across the state in the fall of 2016 and spring of 2017 for the latest inventory. This county-level, biennial “snapshot in time” delivers the most up to date information on crop management systems being used in South Dakota.

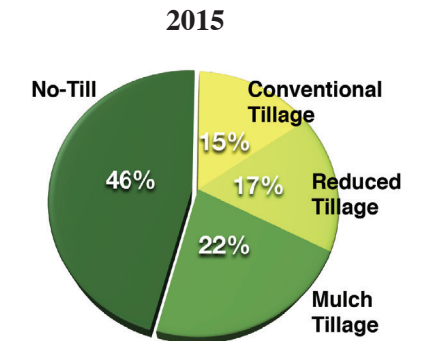
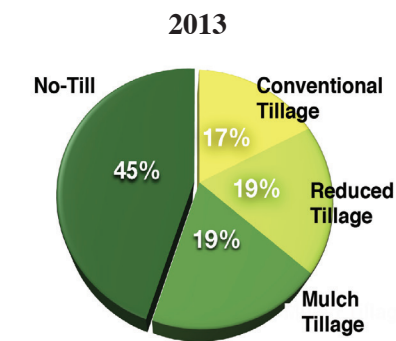
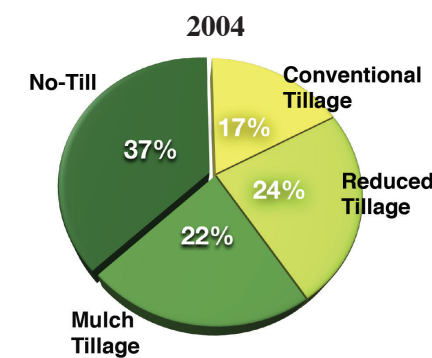
While there has been a steady trend towards more use of no-till farming since this data was first gathered in 2004, and no-till remains the predominant cropping system on South Dakota cropland, the most recent inventory shows a very slight drop in use of no-till. While the drop is only one percent, any drop in no-till is a concern for conservationists like myself, because no-till is a key part of not only protecting, but building healthier soils. It also means cleaner water for all the citizens of South Dakota and beyond.



Jeff Zimprich  
State Conservationist

As you’ll see when you read this report, no-till farmers also tell us no-till results in lower production costs, and their soils had more resiliency in dry conditions this past year. As NRCS strives to assist producers in caring for all their natural resources in times of ever-increasing, wildly-variable weather patterns, I pledge to redouble our efforts to assist producers in improving the health of their soils.

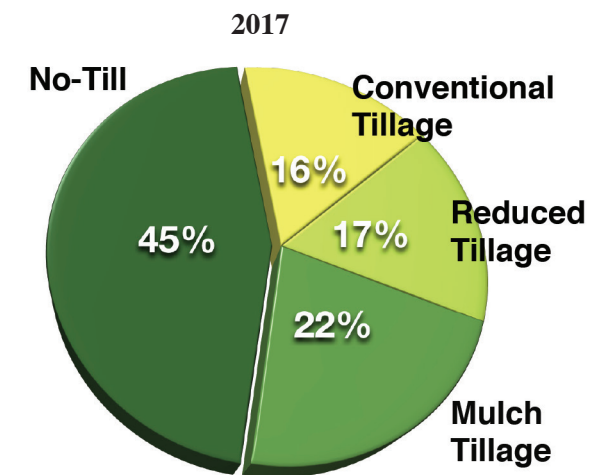
# The 2017 South Dakota Cropping Systems Inventory



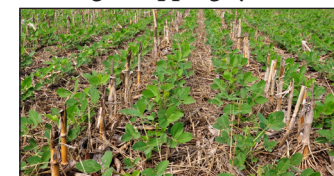
## No-till systems on nearly half of South Dakota cropland in 2017

No-till, a cropping system that protects the soil against erosion and aids in regeneration of topsoil, continued to be the dominant choice of cropping system by South Dakota producers in 2017.

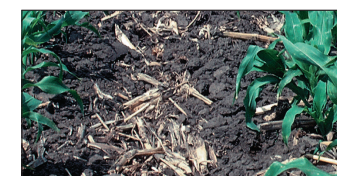
No-till planting acres were down one percent from the 2015 inventory, but at 45% is still the most used cropping system in South Dakota, by more than a 2 to 1 margin.



**Tillage cropping systems.** Corn residues illustrate residue levels, but systems are used on other crops as well.



**No-Till:** Soil is left undisturbed from harvest to planting; typically planting is done with an implement that disturbs less than 33% of the soil surface.



**Mulch Till:** Full-width tillage that involves one or more tillage trips, and disturbs the entire soil surface. There is at least 30% residue cover on the soil surface after planting.



**Reduced Tillage:** Full-width tillage that involves one or more tillage trips, and disturbs the entire soil surface, leaving 15% to 30% residue cover after planting.



**Conventional Tillage:** Full-width tillage that involves one or more tillage trips, and disturbs the entire soil surface, leaving less than 15% residue cover after planting.



### Cropping Systems in South Dakota

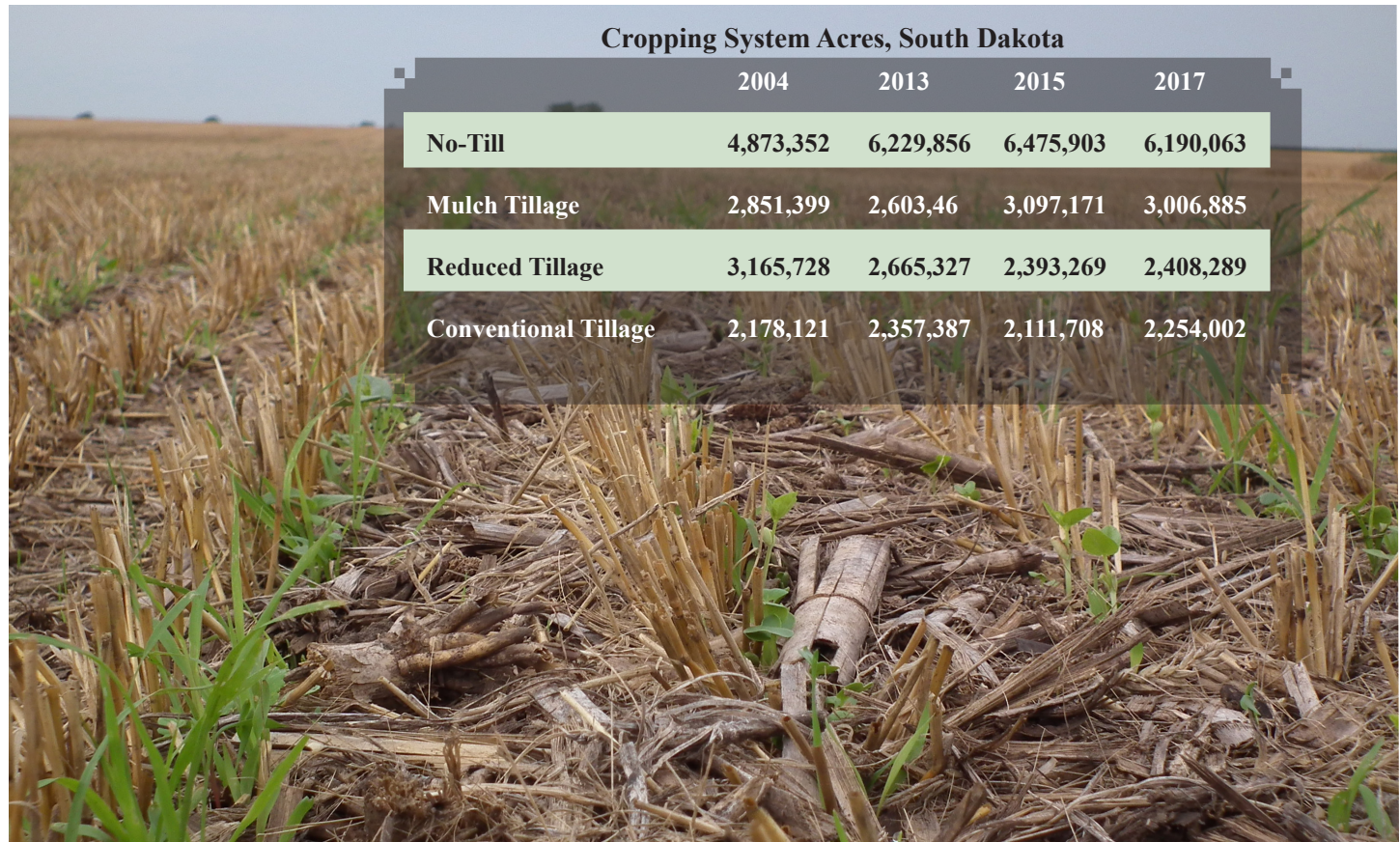


#### No-Till Dominates

No-Till was the dominant cropping system in 2004, and increased even more in the following 10 years. Despite a 1 percent drop in its use from 2015 to 2017, it is by far the most used cropping system in South Dakota.

Cropping System Acres, South Dakota

	2004	2013	2015	2017
No-Till	4,873,352	6,229,856	6,475,903	6,190,063
Mulch Tillage	2,851,399	2,603,46	3,097,171	3,006,885
Reduced Tillage	3,165,728	2,665,327	2,393,269	2,408,289
Conventional Tillage	2,178,121	2,357,387	2,111,708	2,254,002



### 30-Year Trend to No-Till

The NRCS actually began tracking residue management and cropping systems based on the four classes of soil disturbance in South Dakota in the 1980s. For a number of years, conservationists working in each county were asked to provide their best estimates of the breakdown of the four classes. The more formal survey being used today was discontinued after 2004, then revived in 2013. Inventories are conducted every two years.

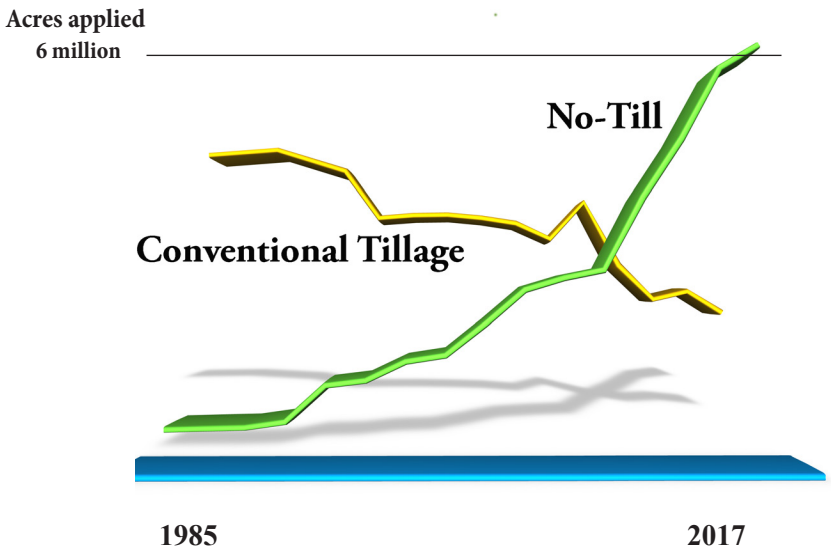
Those early estimates made it possible to track no-till and tillage trends in South Dakota for the past 30 years. As the line graph on this page shows, in more recent years no-till use has spiked while conventional tillage has continued to decline overall.

The greatest use of no-till continues to be in the band of counties through the central part of the state. This is the transition zone between the wetter eastern portion of the state, and the drier western portion. This transition zone represents the area with greatest crop diversity as well.

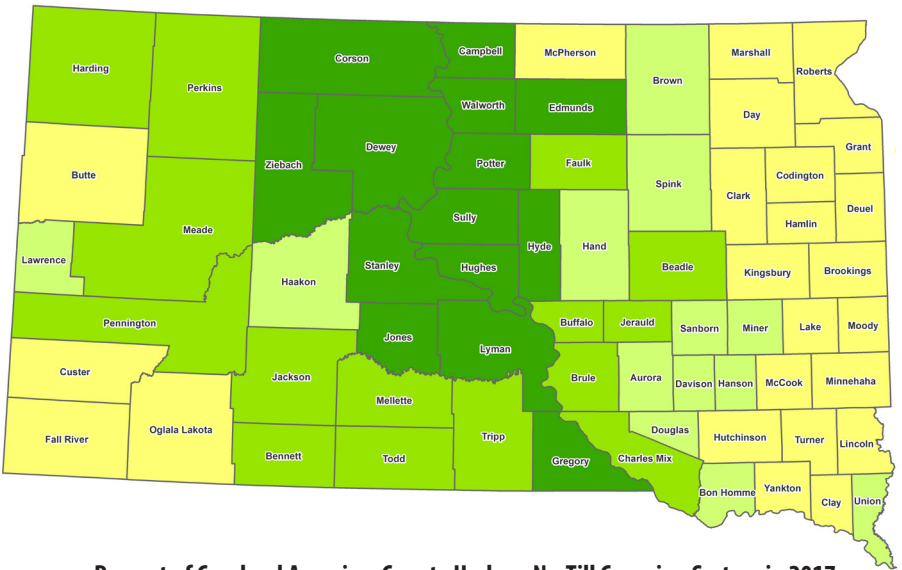
Note that in this part of the state, 14 counties have three-quarters or more of the cropland under no-till cropping systems. That compares to only four counties in 2004.

In an additional 16 counties, between half and three quarters of the cropland is farmed with a no-till cropping system. Overall, 30 counties—nearly half the counties in the state—have more than half of their cropland under no-till cropping systems.

#### No-Till trending up, Conventional Tillage trending down



#### Strong Center for No-Till in 2017



Percent of Cropland Acres in a County Under a No-Till Cropping System in 2017

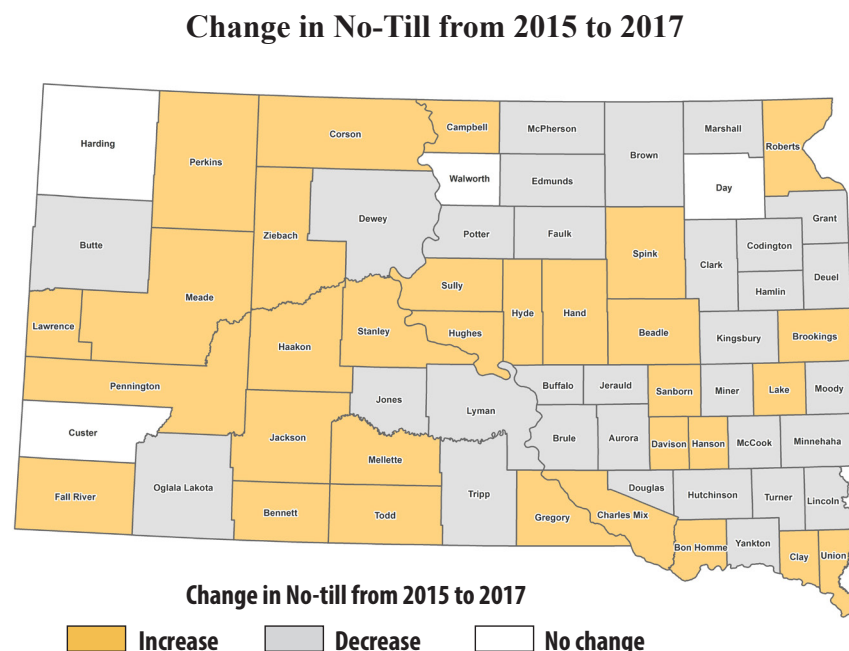
<25 percent    25-49 percent    50-74 percent    > 74 percent



## No-Till Systems Trends by County

The use of no-till systems in 2017 continues to be strong, despite a number of counties showing fewer acres of no-till in 2017 than in 2015. The drop was small overall (1%).

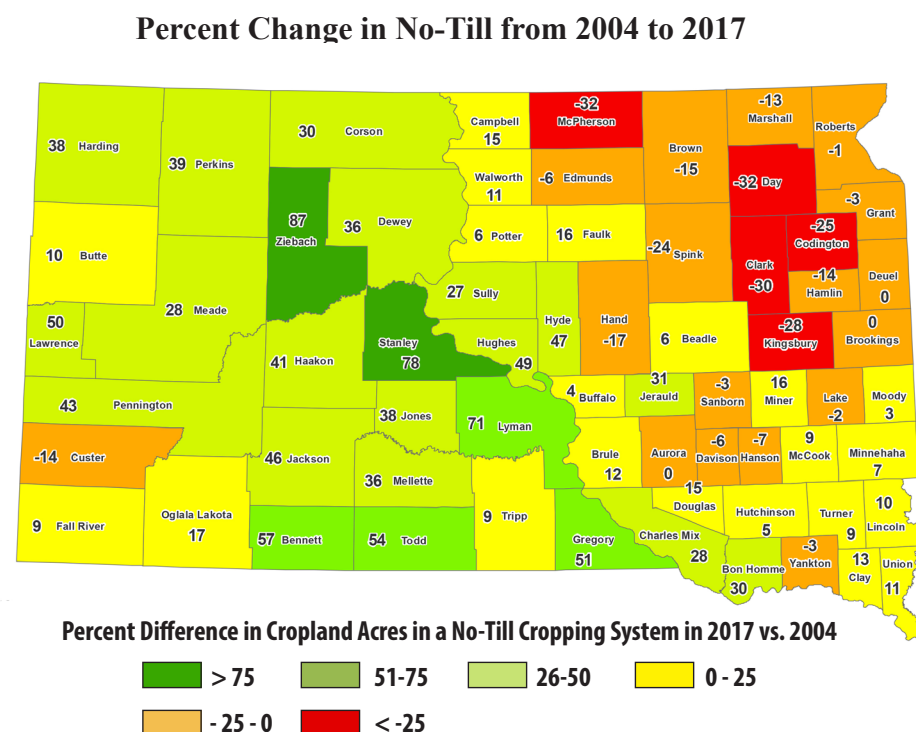
The 32 counties in light brown had an increase in no-till compared to 2015; 30 counties in gray had a decrease, and four counties in white remained the same.



Generally, increases in use of no-till over the past 13 years have occurred statewide, with the exception of northeast South Dakota. Some decreases, noted in red colored counties, are significant. Five counties—Clark, Codington, Day, Kingsbury, and McPherson—had a 25 percent or more drop in no-till acres from 2004 to 2017.

On the other hand, 6 counties—Bennett, Gregory, Lyman, Stanley, Todd and Ziebach—had more than a 50% increase in no-till. Most counties in the western half of the state had increases in no-till.

Overall, 30 counties show a double-digit increase in no-till acres from 2004 to 2017, while 11 counties had double digit percentage drops in use of no-till.



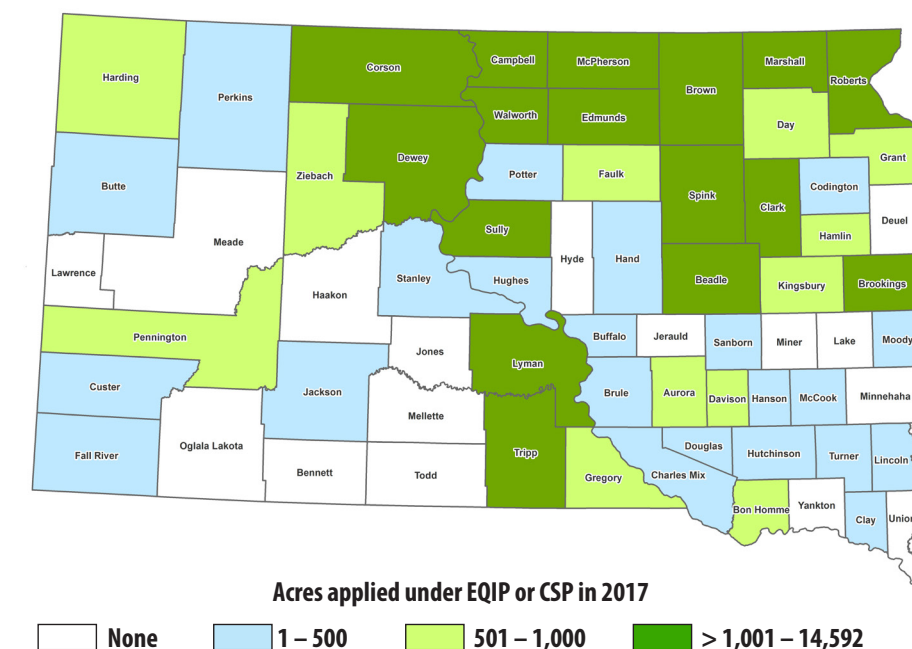
## Cover Crops, Crop Rotation Trends

South Dakota farmers participated in government incentives programs to plant about 63,000 acres of cover crops in 2017 on working agricultural lands. The 2017 figure is 5,000 more acres than seeded though incentives programs in 2015.

As the map to the right shows, the heaviest use of cover crops is in the central and northeast part of the state.

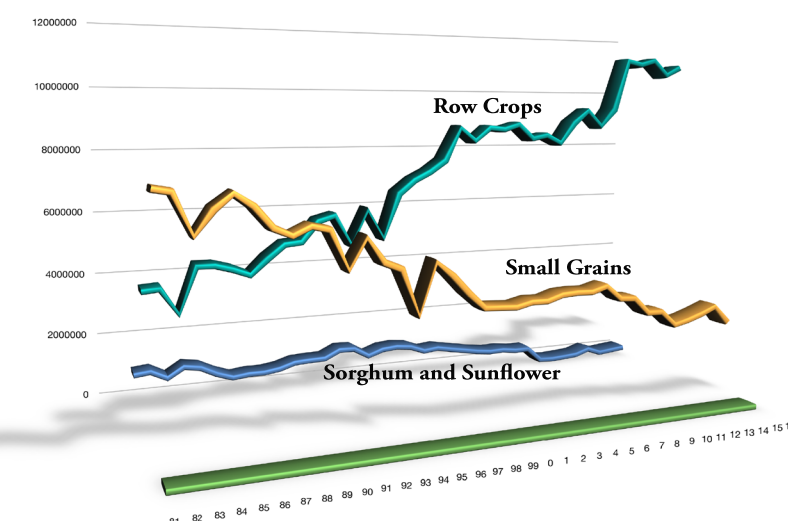
The number of acres of cover crops applied as part of NRCS Conservation Stewardship Program (CSP) or Environmental Quality Incentives Program (EQIP) is an indication of cover crops use statewide, but does not include all acres; there are also many acres of cover crops established by producers outside these programs.

**Cover Crop Acres using NRCS Working Lands Programs in 2017**



The loss of about 4.8 million acres of small grains and about 800,000 acres of sorghum and sunflowers, along with an increase of about 6.5 million acres of corn and soybeans in South Dakota over the past 35 years accounts for a drastic drop in crop diversity. Diversification of crops is a prime component of building healthy, high-performing, productive soils with ever-increasing organic matter that have resilience to harsh weather patterns.

**South Dakota Crop Acreage Trends, 1981 – 2016**



While acres planted to small grains acres decreased from 7,255,000 acres in 1981 to 2,417,800 in 2016, rowcrop acres increased from 4,180,000 acres to 10,716,600 acres. Sorghum and sunflower acres decreased from 1,050,000 acres to 257,000 acres. Total cropland acres increased from 12,485,000 acres in 1981 to 13,392,200 acres in 2016.



# The Truth about Tillage

If it seems like common sense to you that tilling your land like a garden helps more rain water soak into the ground, you might consider trying a few simple infiltration tests to see for yourself whether tillage helps or hurts water infiltration.

That’s what Lynn Boadwine opted to do last spring. In his part of the world, in southeastern South Dakota, he can’t depend on regular rains for a corn crop. “I don’t know a lot about water infiltration, but I know I’ve needed more water for my corn crop these past few years,” Boadwine says. He decided to talk it over with Al Miron, a fellow Minnehaha County farmer.

“Lynn was trying cover crops, but was unsure of their value,” Miron says. He knew I was a long-time no-tiller and that I’ve used cover crops to improve soil health,” Miron says. “We decided to do a series of water infiltration tests on his ground and mine to see what we’d find.”

*Sadly, Al Miron passed away in November 2017.*

**Simple test anyone can do**

They enlisted the help of Extension Soils Field Specialist Anthony Bly of South Dakota State University in Sioux Falls. Bly ran replicated tests on five fields last spring—two on Miron’s farm and three on Boadwine’s farm.

“It’s a pretty simple test anyone can conduct,” Bly says. “We pounded a 6-inch diameter water infiltration ring about three inches into the ground, and poured a small bottle of water (500 ml) onto the soil in the ring. That simulates about an inch of water. Then we used a stop watch to see how long it took for the water to disappear into the soil.”

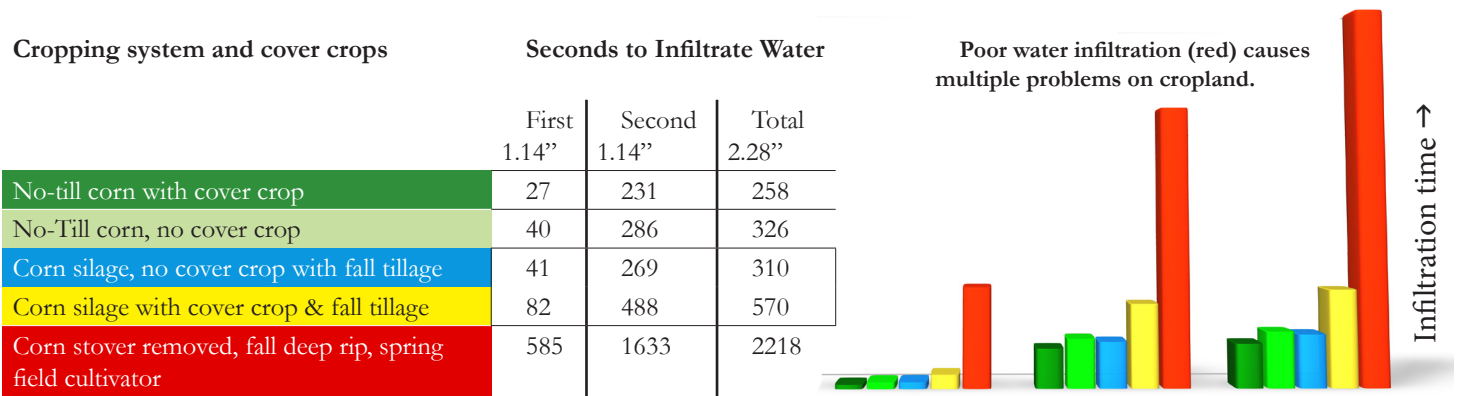
**Off the charts**

As Boadwine and Miron observed, Bly replicated the test four times in each of five fields April 7 and 8. “Infiltration rates vary with soil moisture and type and other factors—we were trying to compare the rates with different types of tillage, ground cover, and cover crops,” Bly says.

*“Once you seal up pores in the soil with tillage, infiltration stops and runoff begins.”*

—Al Miron

Bly put together average absorption times for each field and charted the results. The first field was one of Miron’s no-tilled fields, with a cereal rye cover crop growing in the spring that had been aerial-seeded in growing corn in August of 2016. The average time for the first approximate inch of water to soak into the soil was 27 seconds, and the second, 3 minutes and 51 seconds. In a nearby location with no-till but without a cover crop, the first inch took 40 seconds to soak in and the second inch took 4 minutes and 46 seconds to soak in.



**Water infiltration time skyrockets on tilled land**

Replicated water infiltration tests showed it took longer for water to soak into the ground in fields with fall and spring tillage (red bars)—double, triple and even 9 times that of no-till and cover crop situations (green bars) as more water was applied. Cover crops and no-till reduced infiltration times.

The field with the worst infiltration times was a field harvested for corn that was deep ripped in the fall and then field cultivated and planted to oats just the day before the test. The freshly-tilled field took 9 minutes, 45 seconds to absorb the first inch of water and 27 minutes, 13 seconds for the second inch to infiltrate.

**Heavy tillage is your enemy**

“The infiltration on the field that was manured, deep ripped and field cultivated was terrible,” Boadwine says. “I’m convinced now that heavy tillage is your enemy—tillage harms soil structure more than it helps.”

Bly says that in the dozens of tests he’s conducted, there have been only a few cases where tilled fields infiltrated faster than no-till fields. By far, no-till fields have better infiltration.

“The perception among many farmers is that with no-till, the soil is too firm, like a road that you’ve driven on. They think fluffing up the soil with tillage helps it,” Bly explains. “If the soil is really dry, it can take on some water initially from that fluffing, but it doesn’t last long. The pores are disrupted with tillage. What happens when you throw soil around at the surface is the soil that’s dislodged fills any remaining pores. Then water only slowly soaks into the soil, and the rest runs off.”

Bly says farmers may think soil is too firm with no-till, but it’s actually soil with good, aggregated structure. “No-till helps keep the soil covered and limits soil disturbance—that has a lot to do with better water infiltration,” Bly says.

**Eye opener**

Miron wasn’t surprised by the test results, because he’d watched similar comparisons a few years earlier on his farm. “When the NRCS came to

*“Tilling to make the soil act like a sponge is a fallacy.”*

—Lynn Boadwine

my farm and I watched the infiltration tests, it was an eye-opener for me. It sticks with me now that once you seal up those pores in the soil with tillage, infiltration stops and runoff begins.”

“In 125 years of agriculture we’ve reduced organic matter by 50 percent. That’s not sustainable,” Miron says.



Earthworm channels (above) in no-till fields help water infiltrate faster into the soil. Anthony Bly (right) has conducted many water infiltration tests for producers.

When he bought his farm years ago, organic matter levels were .7 percent on the hills and 3 percent in the valleys. He’s bumped them up to about 5 percent using no-till and cover crops.

**Work in progress**

“We’re trying to find a way to make things work,” Boadwine says. “We need to get roots growing, more alfalfa in our rotation, and stop messing with the top of the soil. Tilling to make the soil act like a sponge is a fallacy.”





# Healthy Soils Key to Resilience in Drought

In 2017, the most severe drought in South Dakota since 2012 tested all cropping systems, as well as grasslands. Despite lower yields, many farmers who have used no-till, cover crops, and diversified cropping systems to build healthier soils believe their soils were more resilient in these times of stress, in both wet and dry weather.

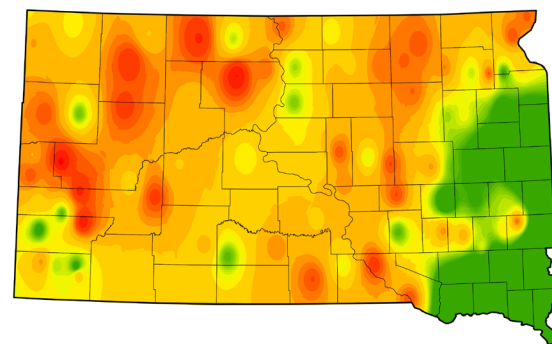
Research shows that organic matter, which plays a big role in soil and water interaction, declines with tillage. The fact that it builds with no-till and cover crops becomes even more important in years when every bit of moisture counts.

Consider this: a one percent increase in organic matter in the top 6 inches of soil holds about 16,500 gallons more water per acre. It not only holds more

water, it allows more water to soak into the ground with each rain— (see infiltration tests on pages 8-9).

Cover on the ground also means cooler temperatures at ground level, reducing evaporation on hot summer days. As farmers who have healthy soils with higher organic matter levels can attest, that all means more plant available water in the root zone in dry times when water is scarce.

The 2017 inventory showed once again that the area of the state with the most crop diversity and higher numbers of crops in rotation was also the part of the state with the least

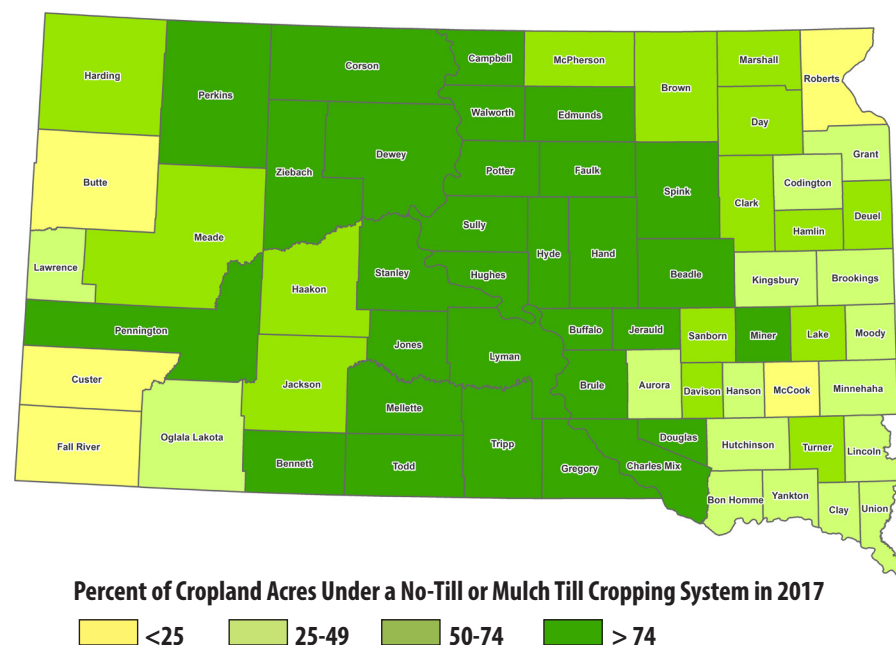


South Dakota experienced drought across most of the state in 2017. As this August 1 drought status map shows, both grasslands and croplands regions were hard hit. (Red is 70% of normal forage production, green is normal). Central South Dakota has the most cropland being managed with cropping systems that feature no-till, cover crops, and diverse crop rotations, a combination that helped provide crop resilience during the drought.

tillage. That combination offered the best chance for crops in a drought year, and a good contrast against conventional tillage.

While there are fewer cropland acres in western South Dakota, farmers and ranchers nevertheless continued a trend to increasing acres of no-till in 2017. In eastern South Dakota, where most counties have 95% of the cropland planted to corn and soybeans, organic matter continues to be lost as that area has the most tillage and the least diversity of crops.

A well-designed no-till cropping system with a diversified crop rotation, including cover crops or perennial crops, builds soil organic matter, uses extra water in the soil efficiently, stores water in the soil when it's in short supply, and reduces compaction, weed, disease, and insect problems.



Most counties in central South Dakota, where drought was severe, have cropping systems featuring high residue cropping systems—no-till or mulch till—that when combined with cover crops offered resilience during the drought last year.



Producer Scott Kolousek and six farmers on the back page who are building healthier soils had this to say about their crops in 2017:

Some farmers lost their crop to the drought in 2017 in tilled fields that looked like this.

## Scott Kolousek

After only 4 to 5 inches of moisture from October 1 until July 25, Jerauld County producer Scott Kolousek thought he'd have a total failure in his corn crop.



“People were baling corn and cutting it for silage—that’s what we had to do on 50 acres we still work,” Scott says. “But on our 800 acres that we’ve no-tilled for 10 to 15 years, with small grains in the rotation, our corn hung in there.

We started to get a little rain in July,

and in the end we did exceptionally well on our corn.

“Our best corn was in a field of wheat stubble that we had a 4-way cover crops mix on the year before. We got 150 bushel corn there. Our worst corn was 100 bushels.”

Scott says on the 50 acres they till that was cut for silage, the projection was 30 to 50 bu/ac.

“People zeroed out in 2012, too, but we grew decent corn then from wheat stubble,” Scott says.

“We don’t have soybeans in the rotation. I think you need to have small grains in your rotation, along with cover crops and no-till. That system leaves residue that keeps the ground covered and catches and holds snow.”

***“We thought we’d have a total failure up until July, but our corn did exceptionally well. I believe you really need small grains in your rotation, with cover crops and no-till.”***

— Scott Kolousek



# Farmers say Crops Saved with No-till, Crop Diversity

## Kevin Deiter

"I doubt we would have had any chance for a decent crop without no-till this year," says Kevin Deiter, who farms in Faulk County. "The carryover effect from a dry 2016 made it really tough—we think a good crop rotation helps in a dry year, along with no-till that doesn't open up your soil. Most people around here no-till." Deiter's spring wheat crop wasn't good, but soybean yields were average and corn yields were average to above average. He has no-tilled for more than 25 years; the cropping system includes a corn-bean-wheat-sunflower rotation.



## Liz Sigdestad

"We see that no-till minimizes your risk," say Day County farmers Liz and Steve Sidgestad. "In a rainy, wet year that turns hot in the summer, it saves bushels out there."

Liz and Steve tried no-till soon after they started farming 7 years ago. "We noticed through the combine monitor that no-till areas were showing yields higher than where we chisel plowed," Liz says. "We're into no-till for the long term."



## Trevor Zantow

McPherson County grazer Trevor Zantow is convinced he's on the right track with no-till and cover crops. He switched from growing corn on corn and now no-tills season-long cover crops that he grazes along with native grasses. "We were fighting nature too much. Now we have flexibility in rotating native grasses, it's a lot less work, and we're beginning to build soil organic matter," he says.



## Dennis Hoyle

"A lot of people in this area had to sell at least some cows after it was so dry the fall before and the first half of the year," says Edmunds County livestock producer Dennis Hoyle. "I think because I give my pastures a lot of rest with rotational grazing, our pastures really showed well in the drought. The grass was in good shape and hung on until it rained in July," he says. "The native grass was pretty well used up by August, but we were able to graze cover crops and corn that was planted for grazing at that point, so our forage quality continued to be high."



## Dan Forgey

"It was so hot here early, we didn't expect much this year," says Potter County producer Dan Forgey, "but we ended up with a touch over average crop yields. We've no-tilled for 24 years, have a diversified rotation, and our soils are healthy." Forgey says integrating livestock and cover crops was part of the success, too. "In a drier environment, we really value the residue for its armor for the soil. We had heavy oat stubble and winter wheat stubble. It takes all of that together to be successful in a dry year."



## John Shubek

"You need to be able to find a way to hold any excess moisture in the spring and carry it into the summer. With no-till, the soil does a lot better job of managing that water—all those soil pores soak up that excess water," says Turner County producer John Shubek.



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