

# Soil Matters

**Conserve resources,  
improve your bottom line**



*Photo: Aaron Putze*



*Your soybean checkoff. Delivering results.*



**Delbert Christensen**  
President  
Iowa Soybean Association

**Conservation tillage makes sense. It improves soil quality and reduces soil erosion while creating resiliency in the production system. It reduces water runoff and improves water quality in watersheds and sustains farmer profitability.**

**According to information from the United Soybean Board, conservation tillage is now used on 65 percent of U.S. soybean acres. Already, it has produced significant benefits, including:**

- **93 percent decrease in soil erosion**
- **31 percent decrease in wind erosion**
- **1 billion tons of top soil preserved**
- **70 percent reduction in herbicide run off**
- **80 percent reduction in phosphorus contamination to surface waters**
- **greater than 50 percent reduction in fuel use**
- **326 million pounds reduction of carbon dioxide emissions**
- **5.9 inches reduction in annual soil moisture evaporation loss**

**As the numbers show, conservation tillage keeps operating expenses down while being good for the environment. Because today's supply of soybean varieties do not require tillage or herbicides subject to runoff and water contamination, they lend themselves well to conservation tillage and make it possible for U.S. farmers to adopt technology and best practices that increase productivity while being stewards of the environment. It is our hope that this publication will reinforce your interest in utilizing conservation tillage in your farming operation.**



Photo: Lynn Betts, NRCS/USDA

*High yielding soybean varieties perform equally well in no-till as they do in conventional tillage.*

## Climate change

By Karen Simon

**M**ost of us have heard enough conflicting information about climate change that we don't know what to believe. Sometimes it's easier to tune it out. Believing in the science behind climate change and its causes are an individual choice, but one scientist says paying attention and adopting the right crop production and conservation practices now could make the difference between producing an average crop or a bin buster in the not-so-distant future.

"Climate has changed, it is changing and will continue to change," says Jerry Hatfield, laboratory director of the National Laboratory for Agriculture and the Environment and one of the contributing authors of a recent study funded by the U.S. Climate Change Science Program. "For agriculture, the bigger issue is that we're entering into a period of greater variability than in the recent past."

Hatfield recommends a whole system approach to dealing with this variability. "As changes occur in other parts of the world, more and more pressure will be put on the upper Midwest to efficiently produce more food," he says. "It behooves us to begin thinking about how we can put together production systems that are more resilient to stress."

How do we build a more resilient production system? "By taking a systems approach – understanding how all the components work together – and with researchers, agronomists and farmers working together we will begin to develop better management systems," Hatfield says.

Roger Wolf, director of the Iowa Soybean Association environmental program, agrees that a proactive agriculture community will be able to adapt to changing climate conditions.

"We need to look at how we can target conservation practices to areas where they will be most effective," he says. "As we adapt to climate



Photo: Lynn Betts, NRCS/USDA

*Switching to no-till can save as much as 50 percent in fuel costs.*



Photo: Iowa Soybean Association

*Conventional tillage destroys soil structure, slowing water infiltration.*

# and production agriculture

changes it's increasingly important to understand the landscape and think strategically about applying conservation practices in places where they make the most sense. This is increasingly important, so we're able to supply food and water that doesn't negatively impact others downstream."

Jim Andrew, who farms near Jefferson, Iowa, is an avid conservationist and believes focusing on conservation is the key to dealing with changes in the Midwest's ecosystem.

"I think the climate change argument is over," says Andrew. "It's an issue; therefore, we need to deal with it. Farmers should want to be seen as part of the solution, not part of the problem."

Andrew no-tills 100 percent of his crops and feels good that he's doing everything he can to produce crops in an environmentally sound way. Despite extremely heavy rains last summer, the conservation

systems he has in place stopped 95 percent of the erosion on his farm.

"I want to be responsible and do the right thing," he says. "We as farmers need to keep an open mind and be willing to rapidly adopt technology if it is science based. As good stewards of the land, we need to get on board, because if we don't pay attention, who will?"

Hatfield adds that, while climate change is often discussed in dramatic, negative terms, the upper Midwest should think of this as an opportunity to improve the efficiencies and resilience of the production system in order to cope with the climate extremes we might be subjected to and produce a profitable crop. "When looking at climate variability as it relates to agriculture, we should look at fully understanding the plant, as well as insect and disease populations, in order to build a more resilient production system."

## Changes in rainfall patterns in recent history

"The Midwest is getting increasingly moist," says Elwynn Taylor, agricultural meteorologist at Iowa State University. "We do not know if this is a trend toward being forever wet or if it will shift back to the dry old days. Logic would say it will go back to the pattern before 1950, but some climate change folks say the trends are set to continue as carbon dioxide continues to increase."

Iowa has now had three springs in a row with high levels of moisture in the subsoil (that is, below the top six inches). "Those levels of moisture put us at risk to be too wet at planting and at risk of spring/summer floods," Taylor says. "However, it does reduce the chance of running out of moisture in the summer."

Taylor notes that October rain is counted as adding to the next year's moisture supply. The period

of last October through February was the second wettest in weather history for Iowa, with nearly 45 inches of precipitation.

The risk of weather on field work is increasing, Taylor adds, noting it appears we are getting more heavy storms per year. From 1950 to 2010, the number of days with 4-plus inches of rainfall at multiple sites across the state has increased from four to more than eight.

"The increase in annual precipitation has been general across the Corn Belt and has contributed to substantial relative yield improvements in the traditionally drier portions of the Midwest," Taylor says. "Increased moisture has both good and bad sides: less crop loss to water stress, greater potential soil loss to water erosion and increased risk of damaging flood conditions."

# Tackling the challenge

## Iowa farmers say no-till pays off

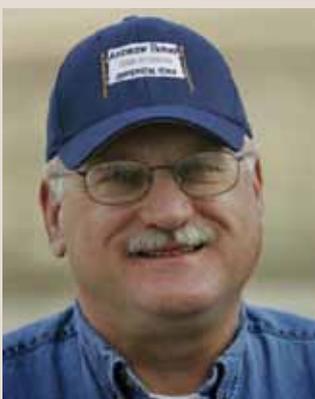
By Steve Werblow

Whether it's to reduce erosion, lower fuel bills, spread labor across more acres or spend less time on the tractor, pioneering Iowa farmers have plenty of reasons to no-till their crops. But although Iowa growers used conservation tillage practices on 81.6 percent of their soybean acres and 43.5 percent of their corn in 2008, according to the Conservation Technology Information Center (CTIC), no-till accounted for 40 percent of soybeans and just 14.5 percent of the corn that year. On the soybean side, that's nearly twice as much no-till as there was a decade before, but no-till proponents say there's plenty of room for the practice to grow – even in the heavy soils of north-central Iowa.

"You hear people say, 'my soil is too cold for no-till,'" says Jim Andrew, who no-tills 1,230 acres of corn and soybeans near Jefferson, Iowa. "But I have friends in Minnesota and Ontario who no-till. It can be done."

Andrew has been experimenting with techniques and residue-managing equipment since he switched to no-till 15 years ago, but he says the effort more than pays off. Erosion has been drastically reduced, and his fuel bill has been cut in half. And without the need for hours of tractor time preparing his fields in the spring, Andrew was able to farm all his acres on his own this year after his long-time hired man left.

It takes a lot to get used to doing just a few passes



***"No-till efforts more than pay off. Erosion is drastically reduced and my fuel bill has been cut in half."***

Jim Andrew  
Jefferson, Iowa

through the field each season to fertilize, plant, and spray weeds, Andrew admits. That's why one of the biggest adjustments in going no-till is mental.

Tom Oswald, who started experimenting with no-till in 1984 with his father Stanley near Cleghorn, Iowa, points out that many growers strongly associate working the soil with farming. "For some guys, there's this void in fieldwork seasons when you feel like you should be out doing tillage," he says. "There's this idea that part of caring for your crop is tilling the soil -- tilling up

the land is part of the idea of being a farmer. So when you quit tilling, do you quit being a farmer?"

Oswald points out that shifting to no-till exposes the tremendous amount of time, effort and stress that goes into tillage. He calls it a treadmill – a cycle of tilling soil, which destroys its natural structure, compacting the soil with field traffic, then tilling it again to address the resulting compaction. Oswald says the cycle is hard on both the soil and the farmer.

"People don't realize how much that treadmill works you to death," he says. "You don't realize it 'till you stop doing it. Once you give it up, you don't regret it."



***"The tillage cycle is expensive and hard on the soil and the farmer. Minimizing these kind of expenses will often add to your bottom line"***

Tom Oswald  
Cleghorn, Iowa

### Soil structure returns

No-till even requires re-thinking the agronomics of good soil, Oswald notes.

"One of the most enlightening experiences for me was when I began to appreciate that fluff isn't good," he says. "I am convinced that good structure is more important than looseness. There's no doubt that the soil is a much more stable medium to work with if you leave it alone as much as possible. It takes a load better. You can abuse it a little more and it'll rebound. We put so much emphasis on looseness because that's what we've known. When you see the soil structure improve over time in continuous no-till on your own farm, the psychological hurdle of 'less is better' is no longer a problem."

Andrew agrees. He adds that years of no-tilling both his beans and his corn have allowed his soil to regain its natural structure, improving drainage and allowing him to get into the field earlier.

"Though it is more porous, it's more solid," Andrew says. "I don't have the wheel slippage you have in tilled ground. I can spray in standing water and not leave a wheel track." He points out that his custom harvester now puts him at the top of the list in rainy falls because the combine operator knows he can get his equipment into the field – and out of it – even in wet conditions.

## One chance for seed placement

No-till is all about field-specific conditions. It's important to remain constantly aware of changing soil conditions throughout planting, which can require adjustments in downpressure, opening and closing wheels, and residue managers, Oswald notes. In fact, he switches between two sets of residue managers – shark-tooth wheels for heavy cornstalks and narrower-fingered sweepers for lighter residue – as conditions require.

Jim Legvold, who started no-tilling six years ago near Vincent, Iowa, uses floating residue managers with treader wheels that prevent them from going too deep.

It's all about setting up conditions for good seed placement, he notes. "Seed placement is everything," says Legvold. "It's make or break. You've only got one chance to start with 100 percent yield potential, and that's at planting."

A big part of good seed placement is downpressure. "If you don't have enough downpressure, you get your disks riding up on the residue and all of a sudden you're seeing seed on the surface of the ground," Legvold warns.

## Starter and sidedress

Maintaining good fertility is another must. Andrew points out that one of the most important things he did in the years leading up to his switch to no-till was to beef up his soil fertility levels while he could still get nutrients below the surface.

"I did a series of soil tests and adjusted to put on everything that was necessary for me to get as good a yield as I could get, because it was the last time I would be able to inject fertilizer under that residue mat," he says. "After that, you've got to wait for the earthworms."

Strip tillers can shank in fertilizer while preparing rows for corn planting. Straight no-till requires banding preplant and starter fertilizer. Many no-tillers also sidedress nitrogen.



*Additional nutrients become available to no-till soybeans as they are recycled from plant residue.*



*Photo: Iowa State University*

## Information is the most important input

**As important as seed, fertilizer and herbicides are for successful no till, the most critical input is information.**

**Cleghorn, Iowa, grower Tom Oswald is a huge fan of online farmer chatrooms, where he's in touch with fellow no tillers from Floyd County to Finland.**

**Jim Andrew of Jefferson, Iowa, spent three years studying no till before making the switch.**

**"Do your homework," Andrew advises prospective no tillers. "Develop your network, relationships with people in the industry who are trying to help you succeed, not necessarily people who have something to sell you. No till conferences are just remarkable – the conversations that take place in the hallways are just as important as the speakers."**

"I want application flexibility to make sure my corn crop seldom or never suffers from nitrogen deficiency," Oswald says. "It seems to be more about availability and position relative to the plant than about high rates." In a slow-release process governed by the microbes and earthworms that flourish in untilled soils, additional nutrients become available as they are recycled from plant residue, he adds.

## Stay ahead of weeds

Eliminating competition from weeds is important. The ability to apply non-selective herbicides over the top of corn and soybeans gave no-till a huge boost by eliminating the need to cultivate, says Dean Coleman, who started no-tilling soybeans in 1993 with his son Mike on their farm near Humboldt, Iowa.

To minimize the chance of building herbicide-resistant weed populations, Coleman rotates between Roundup Ready® beans and Liberty Link® corn. On his corn, he starts with a half-rate of Balance® preemergence for residual activity and a postemergence application of Liberty and Callisto.

"Iowa State University studies show if you get out early in the spring and get those weeds when they're really small, that's key," says Coleman. "A lot of people like to wait to do one application, but we always plan on a two-pass program – one in early June and one around the fourth of July."

## Invest in drainage

Drainage is another key, says Coleman, who bought his own tile plow in 1997 and says he installs tile in the fall instead of working the soil. The Colemans started by draining wet spots, then added tile to drain the moist rings around the drained areas. They are increasingly installing pattern tile.

"The soil is like a sponge," Coleman says. "If you start with a dry sponge, you can absorb more water."

Legvold sees the value of good drainage in no-till daily. Only about one-third of his fields are tilled or well-drained. Another one-third has some tile, and the last one-third has no tile at all. That poorly drained two-thirds can go from wet to mud in a hurry. The agronomists Legvold works with, from the USDA National Laboratory for Soil and the Environment in Ames, Iowa, and private consultants, agree that drainage is a limiting factor for him.

"We feel that as my soils evolve biologically, I can be at or above the yield averages in the area," Legvold says. "But I can't take a poorly tilled farm and beat the wheels off of a guy with good drainage."

## Making the break

After three years of research, Andrew made a clean break from tillage. He sold his big tractor, field cultivators, and other tillage-related equipment. With the proceeds, he bought a 140-hp tractor; a new 12-row, three-point planter; a 15-foot no-till drill and a self-propelled sprayer. It was no-till or bust.

"I burned my bridges to conventional tillage," Andrew says. "I think there's some temptation around year two to go in and stir up the soil, especially when your older relatives say, 'you've got to go in there and loosen it up.' There's a tremendous tendency to want to go out and shake it up and break up that residue.

"I had to be patient, and patience paid off in spades," he adds. "Around year five, the earthworm population got incredible, to the point that the soil is so loose and absorbent." At that stage, the benefits of continuous no-till were paying off.

Andrew says he continues to reap the benefits of no-till. His conservation practices earned him one of the first Conservation Security Program (CSP) contracts

in the country, as well as the prestigious National Conservation Legacy Award. The economics are favorable, too.

"I am not trying to set a yield record," he notes. "I'm looking at the bottom line." And he is happy with the impact of his operation on the environment and his home life.

"If you can make a commitment to a three-to-five-year minimum," he says, "you'll eventually ask yourself, 'why didn't I do this 20 years ago?'"



## Research supports no-till

**Volumes of research document the benefits of no till on soil health, but farmers need to know that the practice doesn't imperil their bankbooks. Research from Iowa State University indicates that no tillers can come out significantly ahead compared to conventional tillage.**

**Mahdi Al Kaisi, associate professor of agronomy conducted a 10 year study in eight locations around the state, each with five tillage systems and three rotations corn/soybeans, two years of corn followed by beans, or continuous corn.**

**"Regardless of the system, soybean yield really did not differ significantly in different tillage systems," Al Kaisi says. "In very wet or very bad conditions, there's maybe a half bushel difference." For corn, Al Kaisi found that no tillers can shake off the trend toward earlier planting and delay seed ing until soils start warming up in late April without suffering a yield penalty.**

**"When we penciled out the economics you look at fuel, the number of hours they spend tilling the field and soil quality and water quality, farmers will come out ahead with no till, and there's really no difference in yield," he says. Depending on the location, savings from no till ranged from \$15 to \$25 per acre.**

# ISA's Environmental Program and conservation tillage

By LeAnn Strother

Gary Hammitt, who farms in Webster County, learned about conservation tillage in 2005 after his father died. Suddenly, he was responsible for the family farm in addition to his full-time job as an agricultural environmental specialist with ISA's Environmental Team.

"Financially and time-wise, I can't afford to do 'recreational' tillage," Hammitt says.

Hammitt found conservation tillage simplified his farming while his yields were as good as before.

"As a result, I am my own guinea pig regarding what I teach the farmers I work with, in addition to gleaning information from others."

After working with numerous farmers through their transition to conservation tillage, Hammitt says the hardest thing for them at first is changing how they look at their farm. "It's natural to wonder if you're doing the best job when you look at your neighbors working their soil. But then, Mother Nature will send a heavy rain, and you realize the benefit when you're able to get back in the field before those neighbors because your soil drains better."

The technical assistance Hammitt and his ISA colleagues provide involves helping farmers with adaptive management. The service is not charged to the farmer but subsidized by grants and checkoff funding.

Todd Sutphin, statewide watershed coordinator with the ISA Environmental Programs team, explains that everyone does adaptive management in their everyday lives, though they may not call it that. "It means you first plan; then you follow your plan. Later, you evaluate the results and modify your management with the feedback you got.



*Adaptive management enables farmers to evaluate the profitability of various management options, including no-till.*



Photo: Carrie Laughlin

*Arliss and Todd Nielsen of Woolstock, Iowa, discuss the advantages of no till and cover crops with ISA Agricultural Environmental Specialist Gary Hammitt, at left. "Being a good environmental steward is going to help your bottom line. You have to be patient, but it will happen," says Arliss Nielsen.*

Through ISA's Certified Environmental Management Systems for Agriculture (CEMSA) program, each farmer and his trained technical service provider design a custom-fit action plan that incorporates the evaluation of data to measure soil, nutrient, pest and energy management. They then use that information to improve the farmer's efficiency and profitability.

The use of the CEMSA ADAPT (Agricultural Data Analysis and Planning Tool) also works well with the transition to conservation tillage. Farmers are able to scientifically measure the difference in their efficiency and their profit when they reduce tillage.

"We're trying to maximize yield while minimizing expense," Hammitt says. "Farmers need to break the cycle of measuring their success solely in bushels. Maximum yield is not the same as maximum profit."

Arlo VanDiest, who farms near Webster City, is an active participant in ISA's Environmental Programs. He has been using strip tillage since 2004 and believes in it so strongly that he hosted a strip tillage field day in June to encourage other farmers to look into it.

"I always say we want to leave this place a little better than what we started with, and I feel comfortable about that with strip till," VanDiest says.

For more information about ISA's Environmental Program, contact Martha Zwonitzer at 515-334-1022 or [mzwonitzer@iasoybeans.com](mailto:mzwonitzer@iasoybeans.com).

# Glossary of Terms

Conservation practices involve a language all their own. The Conservation Technology Information Center (CTIC) has developed definitions for many practices.

## **Conservation tillage**

Any tillage and planting system that covers more than 30 percent of the soil surface with crop residue, after planting, to reduce soil erosion by water. No till, ridge till and mulch till are types of conservation tillage.

## **Continuous no-till**

Maintaining no till practices throughout the crop rotation cycle avoiding the regular or periodic use of tillage is called continuous no till. The benefits of improved soil structure and carbon sequestration result from continuous no till.

## **Conventional tillage**

Conventional tillage leaves less than 15 percent residue cover after planting. It typically involves plowing or intensive tillage. Tillage types that leave 15 to 30 percent residue cover after planting sometimes are referred to as reduced tillage, but they do not qualify as conservation tillage.

## **No-till/Strip-till**

The soil is left undisturbed from harvest to planting except for strips up to one third of the row width (strips may involve only residue disturbance or may include soil disturbance). Planting or drilling is accomplished using disk openers, coulter(s), row cleaners, in row chisels or roto tillers. Weed control is accomplished primarily with crop protection products. Cultivation may be used for emergency weed control. Other common terms used to describe no till include direct seeding, slot planting, zero till or slot till.

## **Reduced-till**

Full width tillage involving one or more tillage trips which disturbs all of the soil surface and is performed prior to and/or during planting. There is 15 to 30 percent residue cover after planting, or 500 to 1,000 pounds per acre of small grain residue equivalent throughout the critical wind erosion period. Weed control is accomplished with crop protection products and/or row cultivation.



1255 S.W. Prairie Trail Parkway  
Ankeny, IA 50023  
[www.iasoybeans.com](http://www.iasoybeans.com)

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