# Infiltration Test Clearly Shows Benefits of Good Soil Health Management

By Bryan Painter, Communications Director for Okla. Conservation Commission and Okla. Natural Resources Conservation Service

Just about everyone's heard of or experienced being dirt poor. How would you like to be soil rich?

Western Oklahoma producer Jimmy Emmons, featured this summer in Oklahoma Farm & Ranch magazine, has worked with the Oklahoma Conservation Commission, the Natural Resources Conservation Service and the Oklahoma Association of Conservation Districts to build a bank of sorts in his soil. It's not money he keeps down there, but rather water. However, by using the soil as a reservoir that soil can benefit the land and the producer all the way to the bank.

"I tell everybody that our average rainfall is 20 inches, give or take 20 inches," Emmons said, who lives near the community of Leedey in Dewey County.

"In 2011, we had seven inches, in 2012 we had nine inches. Then soon after in another year, we had 25 in the month of May. We are seeing big extremes in the weather in the last several years. So, where we really want to hit home is with these weather extremes and how we lessen that effect. If I can take in six - seven - eight inches of a 12-inch rainfall within an hour, then I have no runoff and I have no loading of nutrients in the stream. I'm banking that for future use so when we roll into the dry spell, then we have the profile, we have that to work with. It's all about storing it in the bank… in the reservoir."

Before Emmons began applying soil health management, he could only apply a half inch of water before water would start running off the field. The infiltration was so poor he couldn't apply enough water for a crop. Since that time, Emmons has been applying no-till, crop rotation, cover crops, and strategic grazing. The soil has healed dramatically.

So, this year, Emmons and his Soil Health partners of the OCC and NRCS have taken to those fields together to conduct soil infiltration tests. Think of it as an audit.

When they conducted this test, they brought in a four and a half feet diameter by five inch steel ring (wagon wheel) and hammered it into the surface about two inches. Then they turned on the irrigation system to add "rainfall." They put a rain gauge out to measure the water and waited.

Western Oklahoma agriculture producer Jimmy Emmons of Leedey looks at the rain gauge after nearly seven inches of water was applied during a soil infiltration test. (Courtesy photo)

"On our test day we applied six and a half inches of water in about four hours," Greg Scott, OCC Soil Scientist, said. "There was zero runoff from the irrigated strip that was about a fourth mile long and 30 feet wide. The irrigation system stayed in place during our test."

The soil was uniformly wetted throughout the profile to about four feet deep. There was no standing water within a few minutes of turning off the irrigation. When Emmons changed his soil management practices, he unlocked opportunities.

That's why the soil absorbs the water so quickly and so deep. The soil scientists would like to dig down in the soil and see a rate of at least 15 earthworms to a square foot. Here, they found a rate of about 30 earthworms to a square foot. That is critical because those worms create holes, paths and cracks that makes it easier for the water to run or absorb into.

"I've been playing in soil for about 45 years and this is the most fun we've ever had," Scott said. "That's because we've discovered how fast a soil ecosystem can heal and come back to life when we apply the principles of what we call soil health. This soil is gorgeous. This soil is dark, and soft and friable, it's got good structure. Which you may not think there's anything to this, but in 2011 the soil was light colored. Every time the wind blew it got up and left, every time it rained there were gullies in this field, and so we're seeing a remarkable transformation that Jimmy has accomplished."

That accomplishment is not just a matter of applying a few practices. Instead it centers on realizing that this whole ecosystem is made up of these parts that work together - diversifying.

"I know Jimmy's done some grid sampling out here over the last five to six years and if I remember my numbers correctly, about 70 percent of this field was below one percent organic matter during that first round in 2014 or 2015. I haven't seen the latest numbers, but I know the second round he did it, over 80 percent was above 1 percent. So I would guess now, probably every acre out here is above 1 percent and it's because of a few seasons of good crop rotation and the addition of those covers," Steve Alspach, NRCS State Soil

Scientist, said.

So Emmons added about 30,000 pounds per acre of organic matter, about 25,000 pounds of carbon, and somewhere over a ton of nitrogen that's being stored and is active in this soil. It is not only a source of nutrients for the future, but it also feeds and fuels all of that underground ecosystem, it feeds and fuels the bacteria and fungus that are beneficial to our plants, and makes a huge difference in how this soil functions hydrologically.

"We have turned this from a soil that every time it rained we got a gully to now it's a system where we can put on six inches of water in less than four hours with no runoff," Scott said. "Most people would look at that and say, 'That's impossible that can't be done, not even healthy soils are expected to take that much water.' This soil does."

Emmons relies primarily on legumes in this rotation to get nitrogen into the system.

"We can cycle it over and over through the plants," Scott said, once it is in the system. "He gets a huge diversity when he plants a multi-species cover crop. Those cover crops are an important part of this because when he has a cover crop out here, typically he harvests it with cattle. Livestock and grazing animals are an essential part of the ecosystem because they reduce a lot of the carbon real quick."

The improvements have been so dramatic that Scott and Alspach believe the soil classification of this field have changed. So, Emmons turned, looked at Alspach and asked a straightforward question.

"If we could get producers across Oklahoma and across the country to do what we've done here, how would that help us during droughts and floods in the future?"

"Under a conventional system where we're tilling a lot or plowing a lot, depending on the slope and the texture of the soil, we see quite a bit of runoff," Alspach nodded and grinned. "I would say on average, on a fairly good hard rain, we would see that 30 to 40 percent of the rain that falls would run off, go right into the nearest creek, into the river and head for the Gulf of Mexico."

That's just due to infiltration problems. Those bare soils seal over and a field starts having runoff pretty quick after the onset of the storm. However, as this field shows, if producers can get better infiltration, they can put that in the soil profile.

During another test day, the Soil Health team put on eight inches of water, and they will get water well past 40 inches in this soil profile and that's just stored there for the plants to use. That pays numerous dividends.

"Some of it will be partitioned and move on down through gravitational forces into the water table and will eventually flow into the river," Alspach said. "So it will help with base flow on the rivers and it just slows the time it takes that water from underground moving to the river, versus running on the surface to get there."

That helps reduce the number of flood events and things of that nature.

"Again, when I started working with Jimmy he told me he could put on about a half of an inch at a time before he started getting runoff," Alspach said. "Today we're going to put on eight inches on a spot and we're going to have no runoff. So we've seen a huge change in the infiltration rate out here."

Or put another way, a huge return on investment.