Study: Cover crops use water, but benefit soil health

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Dr. Paul DeLaune, Texas A&M AgriLife Research soil scientist at Vernon, looks at wheat. In the background, a neutron probe is being used to measure soil moisture. Credit: Kay Ledbetter

A continuing study of cover crops in the Rolling Plains has determined that yes, they do use water, but that doesn't necessarily translate into reduced cash crop performance, according to a Texas A&M AgriLife Research scientist at Vernon.

Dr. Paul DeLaune, an AgriLife Research environmental soil scientist, said there has been a lot of interest nationwide about cover crops and the effects they have on soil health. Those beneficial effects are exactly what he is seeing in multiple studies, although none are immediate.

"The No. 1 question farmers have is, 'If I plant a cover crop, how much soil moisture is it using?'" DeLaune said. "And what are the benefits of having a cover crop compared to standard no-till without a cover crop?"

He said he has worked on two studies using cover crops in the Rolling Plains: warm-season cover crops in dual-use wheat – for cattle grazing and grain production – systems and cool-season cover crops in cotton cropping systems.

In both studies funded by the U.S. Department of Agriculture-Natural Resources Conservation Service, DeLaune is examining conventional tillage without cover crops; no-till without cover crops and no-till with various mixtures of cover crops.

Cool-season cover crops being evaluated in cotton include Austrian winter field pea, hairy vetch, crimson clover, wheat and a multi-species mix consisting of each of the aforementioned cover crops, along with rye and turnips. A multi-species mix is currently recommended by USDA-NRCS, he said.

Initial findings indicate the water use differs among cover crop species, with the multi-species mix consuming significantly more water than both legume cover crops and treatments without cover crops, DeLaune said. However, the multi-species cover crop also produced the greatest biomass.

Entering the cotton growing season, both conventional till and no-till treatments without cover crops had higher stored soil moisture than any

treatments consisting of cover crops, he said. However, a sharper increase in stored soil moisture was seen in cover crop treatments compared to standard no-till and conventional till treatments after the first major rainfall event after planting.

Additionally, DeLaune said, stored soil moisture was actually greater in some cover crop treatments compared to treatments without cover crops after this initial rainfall event.

"This indicates that cover crops could be encouraging infiltration."

For both dryland and irrigated cotton systems, 2013 yields were not statistically different between treatments with cover crops versus without cover crops, he said. Cover crops and/or conservation tillage has only been implemented for one year within the irrigated system and two years in the dryland system.

"We've also evaluated wheat as a cover crop in cotton cropping systems for about six years, and we have shown no impact of tillage on economic returns for cover crops versus no cover crops in no-till systems," DeLaune said.

Examining the impact of cover crop implementation in long-term no-till wheat systems was initiated in June 2013 near Vernon, he said. The demonstration site has been on no-till for 12 years.

Treatments include standard no-till and conventional till treatments, no-till with a multi-species cover crop and no-till wheat intercropped with turnips and radishes, he said. These treatments were further split with grazing as an additional treatment: standing cover crops were grazed by 15 cow/calf pairs on one acre for 24 hours before it was terminated in late August.

The multi-species cover crop consisted of sorghum sudan, millets, peas, forage soybeans, sesame, lablab and buckwheat, DeLaune said. This mix was seeded in early June at 30 pounds per acre, at a total seed cost of nearly $33 per acre. Radishes and turnips, planted at a half-pound per acre each, were mixed with wheat at planting in early October for intercropped treatments.

"With the financial investment associated with cover crops, there is an interest in knowing what the return investment is," he said. "This is one reason we are evaluating grazing opportunities provided by cover crops. Cover crops could provide supplemental grazing opportunities as well as stimulate soil biology by incorporating residue into the soil through trampling and addition of organic matter through defecation during the grazing period."

As seen with cool-season cover crops in cotton systems, stored soil moisture was significantly lower at the time of wheat planting in treatments consisting of cover crops compared to standard no-till and conventional till treatments without the multi-species cover crop.

"It will be interesting to see how stored soil moisture responds after a major precipitation event and subsequently wheat yields," DeLaune said.

"Initially we found that cover crops can use significant amounts of soil moisture compared to treatments that have no cover crops."

Terminated cover crop in wheat, with no grazing. Credit: Kay Ledbetter

The question, he said, is can that soil moisture be replenished?

"Are we increasing or improving soil health enough to encourage soil moisture infiltration after the termination of the cover crops?"

In addition, DeLaune said he has found that water use varies between cover crop species. Even when soil moisture was lower throughout the growing season with some cover crops, this was not translated to crop yields, indicating that other factors, such as nutrient cycling, may be playing an important role.

The results won't be immediate, he warned.

Standard no-till wheat. Credit: Kay Ledbetter

"This is a long-term process. It takes several years to build up soil carbon, which is one of the main factors in increasing infiltration in changing soil properties, so we can't expect to see changes that will tell us where we are going in two or three or maybe even five years.

"Initially we might not see the changes," DeLaune said. "It is something

the farmer is going to have to be dedicated to, committed to and understand that it is a long-term process before possibly seeing the benefits of this system."

The study used a neutron probe to measure soil moisture. A tube reaches 59 inches deep in the ground, and the probe is inserted to a depth of 55 inches and measurements taken every 8 inches to get a full soil-moisture profile reading. Measurements are taken every two weeks.

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