Researchers study ground cover to reduce impact of biomass harvest

July 8 2008

Currently, living mulch negatively impacts yield. The corn on the left is not competing with ground cover. The corn on the right, which has living mulch between the rows, must compete for water and nutrients. Once researchers find the right combination of corn and ground cover, they believe yields will not be impacted, and soil quality will be maintained. Credit: ISU courtesy photo

Ground cover may be one workable method to reduce the effects of erosion that future biomass harvests are predicted to bring. Iowa State University researchers are looking at ways to use ground cover, a living grass planted between the rows of corn, in production farming.

The seemingly limitless national appetite for ethanol has industry and government looking beyond the kernel to the entire corn plant for more fuel.

But corn, the source of most of the United States' ethanol, is not limitless, so turning corn stalks and leaves into ethanol is the target of much research.

The U.S. Department of Agriculture projects that by the year 2030, about 20 percent of ethanol will be made by turning corn stalks and leaves, known as corn stover, into fuel. That projection assumes that 75 percent of this corn stover can be harvested for biofuels. Currently, stover is not used to make ethanol.

Farmers now leave corn stover on their corn fields to slow wind and water erosion and re-supply the soil with organic material to ensure future productivity.

"The issue is this," said Ken Moore, Iowa State University agronomy professor. "How do you harvest corn stover in a way that sustains the productivity of the environment for producing future corn?"

Just as important as the loss of soil through erosion is the loss of organic material that the removal of the stover would bring.

On an average acre of Iowa farmland, there are roughly four tons of stover. Under the expectations laid out by the USDA, three of those tons would be removed and processed into ethanol. That organic matter that won't be returned to the soil to help future crops grow.

"We know that soil organic matter is critical," said Jeremy Singer of the USDA's National Soil Tilth Laboratory in Ames. "And removing that stover over time is going to decrease the amount of organic matter in the soil. That will lower productivity."

To combat the coming problem, researchers are looking into ways to lower soil erosion while retaining vital organic materials.

"This is a real educational moment," said Singer. "If farmers are going to harvest stover, they have to replace the carbon in the soil."

One promising solution is the idea of planting a ground cover grass between the rows of corn that remains year-round. This grass would not be harvested.

This ground cover, or living mulch, will perform all the functions that corn stover currently does.

"Imagine," says Moore, "a large flat golf course where you've gone through with a tillage instrument and you've tilled-up every 15 inches. That's what it would look like in farmers' fields."

"The value you get for the production system is that you could harvest as much of the corn stover as you want without having any problems with conservation," said Moore.

"There is a lot of ecological sense to this."

The challenges that the researchers are studying include finding which types of grass will not compete with the corn, what type of corn will withstand the competition, and what sort of agronomic practices will work best.

"Corn is not a very competitive species particularly early in the season," said Kendall Lamkey, professor and chair of Iowa State University's agronomy department. "Corn doesn't like to be growing with anything else in the field."

But later in the growing season, corn can be a little more hospitable to having neighbors share its space.

By the time the corn plant is five inches tall, the kernel number on the corn plant is already determined. That is a measure of the plant's potential yield, said Lamkey.

Stress early in the growing season can affect yield greatly, he said.

While this research has just begun, Moore says that this idea is not new.

"Nature does this all the time," he said. "You see prairies that have these complementary mixtures of multiple species that grow and share space. In a way we are sort of simulating the grassland systems that were originally here, but in very simple way."

The grass between the rows will also have other advantages in addition to the ecological benefits.

Grasses will help keep weeds down. This will reduce the need for herbicides. Also, grasses, combined with some types of fungi, will help reduce the number of insects that require farmers to spray, said Moore.

These ground cover grasses can also be selected for any number of traits, just like corn can be, said Moore.

"We are trying to identify the right system of herbicide, strip tillage, and species combination that minimizes competition with corn and maximizes benefits," said Singer.

The one obstacle that researchers must overcome is the effect on corn yield.

In the current stages of the research, corn yield suffers because of the competition from the ground cover grasses, said Moore.

"Our goal is produce a ground cover that will not interfere or compete with corn production in any way," he said.

Once that problem is solved, the researchers say that using living mulch as ground cover will be an ecologically sound method of keeping a nutrient-rich soil while harvesting stover in the amounts that the USDA predicts.

"I think by the end of the project in two or three more years, I am optimistic that we'll be able to identify the one or two species of grass that we really need to work with for the living mulch," said Lamkey.

"I am also fairly optimistic that we'll be able to identify inbred corn lines that do well in these systems," he said.

That day may not be too far into the future, according to Moore.

"I can envision a day," said Moore, "when smart seed companies are co-developing these packages where they sell ground cover seed and corn hybrids that work in association."

Source: Iowa State University