Miscanthus, Switchgrass And Restored Prairie Tested As A Potential Energy Crop

URBANA, ILL.

On the University of Illinois South Farms, 320 acres are devoted to the largest biofuels research farm in the U.S., growing crops that could be used to produce renewable energy. Last year the farm planted miscanthus, switchgrass, corn, and restored prairie as bioenergy crops. The goal is to compare insect and disease challenges, environmental benefits, economic opportunities and potential energy per acre of each.

Tim Mies, who directs the Energy Farm, said that research at Illinois has already shown that the giant miscanthus grass can produce over double the biomass per acre as corn. "It does this apparently without the need for any nitrogen fertilizer, very few other inputs and it adds significant amounts of organic matter to the soil. So, miscanthus might be a third crop for Illinois, and one particularly suited to marginal land," Mies said. "What having 320 acres devoted to energy crops on the energy farm allows us to do is to consider the benefits as well as possible downsides to these new crops and test whether other native plants might do just as well.

"Miscanthus planting is currently a very labor-intensive operation," Mies said. "Because it is a sterile crop and so doesn't produce seed, the question is how do you reproduce it at an agronomic scale?" He said that sterility has the advantage of preventing the plant from becoming invasive. "But, because there's no seed, we have to physically go in and remove the rhizomes underground, break them apart and then replant them into the new fields. Rather like harvesting and then planting potatoes."

U of I researchers are working to develop machinery that can efficiently plant and harvest it, rather than digging it up with a shovel or by hand. For miscanthus to be an effective crop, "we need to scale up the machinery to accommodate planting thousands of acres of it. Potato-handling equipment is something we've been looking at because it can physically go into the dirt and lift out the material," Mies said. "However, are moving away from being able to plant half an acre a day toward 20 acres, with the latest equipment that we are working with."

Restored prairie as an energy crop is a relatively new concept. "Illinois used to be a prairie. If we're going to convert possibly marginal land back to grasses, restored prairie has the potential to be a possible biomass source because it is what was naturally here before modern agriculture," Mies said.

Crop scientist Steve Long said that ecologists have proposed this use of the land from theory and very small scale trials. "Now, for the first time, agronomists and ecologists can work together to asses the viability of this idea."

Restored prairie is a mixture of tall grasses and small nitrogen fixers. Mies said that instead of management through regularly scheduled prairie burns, it would be harvested as a crop in the early winter when nutrients have been cycled back to the roots. "In theory, it makes a lot of sense to convert the land back to what it used to be, but how that might translate on an agronomic scale is yet to be seen."

One of the challenges in growing restored prairie as a biomass crop is that it can be choked out by other more aggressive weeds. "There isn't an herbicide you can use to control the weeds because something that would kill off the weed would also kill the plants that you want. There's no herbicide control you can use for it," Mies said.

The consistency of the resulting fuel may also be an issue with prairie grass. "To process it, you want a consistent material with very little nutrient left in it," Mies said. "A field of switchgrass is all switchgrass, whereas a field of restored prairie is a mixture of plants and grasses – the proportions of which change from acre to acre and bale to bale, a problem you wouldn't have with switchgrass or miscanthus." This inconsistency could make it very difficult to use the harvested biomass as a feedstock for processing to ethanol.

Long term, the Energy Farm will conduct research projects on many more potential biofuel crops. "We want to look at several more grasses, woody crops, some tree species that might be able to be used for biofuels, and even some sorghum varieties – not just one specific crop with a narrow focus. "We want to be a demonstration and testing farm for any possible biofuels crops that could be grown in Illinois or in this region." Δ