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Precise Portions

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Precision farming assists farmers in meeting government mandates for increased corn-ethanol production.

BY CASSIE FLEMING

A century ago, a farmer, with his wife and children in tow, spent long autumn days husking corn with a metal hook strapped to his hand.

Half a century later, the farmer sat in a self-propelled, diesel combine to harvest and husk his corn.

Today, the farmer can sit in a cushioned chair, enjoying air-conditioning and the local oldies station while the combine picks and husks the corn.

But a comfortable seat, cool air and choice tunes are not the only technologies a farmer can employ while in the field. New tools offer both convenience and precision to modern farmers raising crops not just for food and fiber, but for fuel.

A contemporary farmer can align with satellites orbiting the Earth by placing a box on top of the combine's cab. As part of a Global Positioning System (GPS), these satellites follow the box and produce imagery data of the field. Combines today can also be equipped with machines called yield monitors that use electrical currents to identify soil patterns and to measure the amount of grain coming into the combine at different points in the field.

The farmer can then print out detailed maps of a field with different colors representing hills, valleys, soil types and quality, water, nutrient levels and yield.

At a computer, a farmer or company can connect to the Internet and download crop-simulation models, which contain weather data for each county, and then grow crops virtually in the computer.

When merged, these technologies provide a mosaic of information that allows growers to uniquely supervise each portion of land, a process called site-specific management or precision agriculture.

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>
> **John Shanahan**
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> UNL agronomy professor

From what kind of crops to plant, to when and where to plant them, to how much fertilizer and water to apply to each area, the technology used to manage this process emerged in the early 1990s. It can help farmers manage crops in a way that increases crop yields and profits while decreasing labor and the cost of inputs like chemical fertilizer and pesticides. Used properly, this technology can also help farmers use only the irrigation and fertilizer they need.

"It's been really exciting," said Ken Cassman, an agronomy professor and director of the Nebraska Center for Energy Science Research at the University of Nebraska–Lincoln. "We have been able to produce corn with much less water and with much larger yields."

Today, farmers and agribusinesses aren't producing crops just to provide food and fiber; to cash in on the market for corn-based ethanol, they may have to alter their production philosophy to encompass energy farming while still protecting soil quality.

"We are at a paradox," said John Shanahan, a UNL agronomy professor and research agronomist. "We are supposed to feed people first, and then clothe them, all while holding the soil together. But now we are supposed to provide cheap feed stocks for biofuels."

Agronomists agree that the use of precision ag will help farmers meet the government's mandates for increased corn-ethanol production. But precision ag has a place beyond its use in growing corn. Grain-based corn ethanol is seen as a bridge to producing cellulosic ethanol, biofuel made from the stems and leaves of plants rather than the grain.

"Precision ag use in producing cellulosic ethanol is definitely out there in the future," said Jim Schepers, a UNL agronomy professor and USDA Ag Research Service soil scientist.

Cellulosic ethanol can be made from corn stover or crop residue — the material, such as stocks, husks and leaves that farmers typically leave on the field after harvest. But crop residue that may be used for cellulosic ethanol also serves a purpose on the field: It adds organic matter to the soil, improving the soil's fertility.

"Taking the crop residue off the soil is like having a bank account and taking the interest out," Schepers said. "Take the residue out, and you take the nutrients out."

But if technology is developed to produce cellulosic ethanol on a large scale, farms across the Midwest will be like bank accounts without interest.

Removing crop residue, Shanahan said, is like pillaging and plundering the land.

But agronomists, farmers and agribusiness companies nationwide have established that energy farming is in their future, so they must find a way to use crop residue as both a source for cellulosic ethanol and as a way to protect their soil. Precision ag provides one key.

"We have figured out that you can remove some residue for ethanol," Shanahan said. "This is the trick."

Precision ag may allow farmers or companies to treat each portion of land like an individual, Shanahan said, ensuring each portion receives the exact care it needs.

"And, as the country is increasingly relying on the Midwest's crop land as future fuel sources, cultivating each piece of land individually is crucial," he said.

CHOICES

A look at the present and future of crops used to manufacture American ethanol. However, all alternatives retain the same common negative: Ethanol is more corrosive than gasoline, making it incompatible with existing pipelines. Ethanol must be transported by truck or train.

	CORN	SWEET SORGHUM	WOODY, FIBROUS BIOMASS SUCH AS SWITCHGRASS, CORN STALKS, WOOD CHIPS
SOURCES			
ETHANOL YIELD	350-400 gallons/acre	400-800 gallons/acre	320 gallons/acre (est.)
PROS	· Displaces some oil · Easier, less expensive than cellulosic ethanol · Here and now: vast majority of ethanol plants use corn · Useful byproducts	· Grows with less water than corn · Easier, less expensive than cellulosic ethanol · Uses the same fermentaion and distillation process as corn	· Net energy gain of about 540 percent, according to UNL study · Can convert waste crop products to energy
CONS	· Needs prime ag land · Raises corn prices · High water, fertilizer needs	· Grain sorghum (milo) is used with corn at some plants, but sweet sorghum ethanol hasn't been tried on a large scale	· Some pilot plants but not tried on a large scale · Need expensive enzymes to break it down into sugars

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