

Perennial OPTIMIST



Kernza farmer Carmen Fernholz says deep roots are the “wisdom” of perennial crops, as their long life spans help build large root systems. PHOTO: SUSAN WINSOR

They’re also the cornerstone of plant geneticist Wes Jackson’s vision of sustainable agriculture. A MacArthur fellow, Jackson founded The Land Institute in Salina, Kansas, 42 years ago to advance this vision and identify crops suited to be grown or adapted as perennials.

He promotes perennial grain crops’ erosion control and their little to no need for inputs. “Most food crops are annuals, requiring far more water, fertilizer and energy than perennial crops. Unlike oil, soil has no technological substitute,” MacArthur says.

It took more than a decade of research by The Land Institute and seven years of plant-breeding and food-science research by the University of Minnesota Forever Green Initiative before Kernza intermediate wheatgrass was trademarked and began its early commercialization.

Market demand from sustainability-minded food companies is key to its early success. Food and brew companies including General Mills, Patagonia Provisions, Bang Brewing, Crank Case IPA and others use Kernza grain in their food and drink products.

Kernza also provides two grazing seasons as a forage crop and abundant biomass as an energy crop.

Grower incorporates Kernza in his rotation to improve soil health and productivity.

BY SUSAN WINSOR

Carmen Fernholz is proving perennial crops in his rotation improve soil health and productivity. This spring is the western-Minnesota farmer’s seventh year of growing Kernza, a perennial intermediate wheatgrass that’s a forage, grain and energy crop.

The crop’s deep roots build soil tilth from the bottom up and use nutrients and water more efficiently than annual crops. His other perennial crop is alfalfa, which also improves soil structure and helps to manage weeds.

Perennials are Mother Nature’s original erosion-control tool and nutrient recyclers. The huge roots often found on these plants trap nutrients before they escape into groundwater.

FROM THE ROOTS UP. Fernholz focuses on what’s belowground. “Soil’s built from the roots up, rather than from aboveground,” he says, explaining why he has perennial Kernza and alfalfa in his small-grains rotation. Perennials’ long life spans build large root systems, accessing soil nutrients and water not available to annuals’ smaller and more temporary roots.

Annuals lack the efficiency of perennials, but they represent 85% of agricultural crops globally, says Fred Iutzi, The Land Institute president. “Global data for corn, rice and wheat indicate that they take up only 20 to 50% of nitrogen fertilizer; the rest is lost to surrounding environments.”

Since agriculture’s transition from native perennial plants to annuals, “soil carbon and nitrogen levels have decreased by 40 to 50% or more,” says former Land Institute researcher Jerry Glover.

Tillage and related soil erosion are a couple of the main raps against annual crops. Tillage releases soil ▶

PHOTO: THE LAND INSTITUTE



Pasta is one of several food products, including crackers, tortillas and beer, that can be commercialized from Kernza.

carbon into the air as carbon dioxide and accelerates soil organic matter decomposition, says Rattan Lal, the Ohio State University distinguished

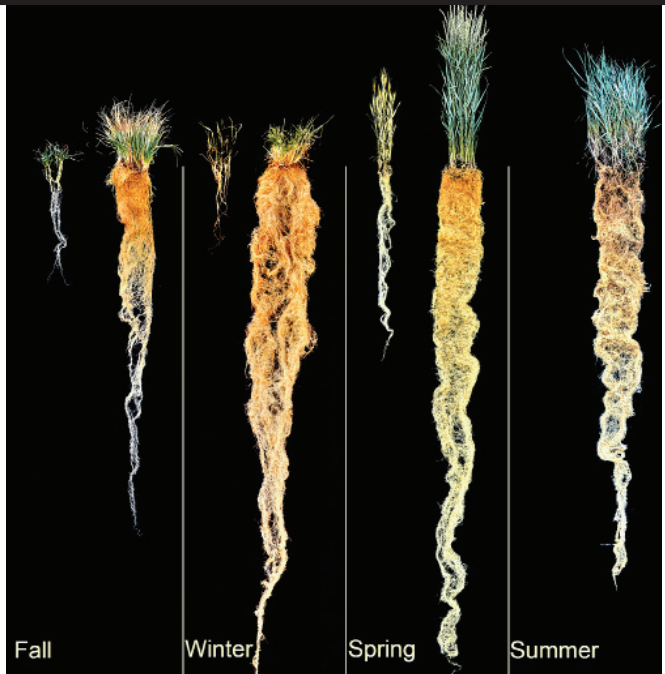
soil science professor and president of International Union of Soil Sciences. Bare ground during much of the year leaves soil vulnerable to soil erosion, nutrient loss and weed establishment.

NO NEW EQUIPMENT. Farming clay loam prairie soils near Madison, Minnesota, Fernholz has grown Kernza in collaboration with University of Minnesota and Land Institute scientists. Inspired by its nitrate-trapping root system and much lower input needs, he's testing practical recommendations for adding it to Corn Belt corn/soybean rotations.

Kernza requires no new equipment, uses 50 to 60% less nitrogen (N) fertilizer than corn and uses it more efficiently. Its growth habit crowds out weeds, which is almost too much of a good thing after two years since stem growth saps energy from the Kernza's seed head

production.

As a cool-season grass, Kernza offers a high-protein livestock ration in early spring, says University of Minnesota Kernza researcher Jacob Jungers. "Spring Relative Feed Value is 130 to 150. Grazed again after harvesting Kernza's grain (October through



Perennial growth accumulates massive root systems in Kernza intermediate wheatgrass compared to annual wheat. Its "continuous coverage" prevents soil erosion, retains and uses nutrients and water more efficiently, traps atmospheric carbon underground, and increases soil health. PHOTO: THE LAND INSTITUTE

snowfall) yielded 6 tons per acre biomass of usable but not spectacular grade fall forage," he says. Grazing is a vital profitability tool, thinning out surplus stems to potentially help maintain grain yields.

After two years, Kernza can become "sodbound" and less productive, Fernholz says. Grazing effectively thins it out. "If we can devise some acceptable stand-restoration practices, I'd see the non-land costs paralleling alfalfa production costs," he explains. "First-year establishment costs, harvest, storage and transportation are the only non-land expenses."

He applied manure the first year amounting to the equivalent of about 60 pounds per acre of N. Fernholz experiments with interseeding legumes among Kernza to provide renewable N.

Fernholz broadcast the seed in September the first year at 10 to 15 pounds per acre, paying attention to seed-to-soil contact and shallow (0.5-inch) planting depth. The crop requires cold-winter temperatures to head the following spring. He then windrowed and baled it in mid-summer. Forage yields were more than 7 tons per acre biomass.

Kernza ripens from the seed head top to bottom, with the largest seeds at the bottom of the head. Because its seed heads shatter easily, adjusting the combine for straight grain combining is still a work in progress.

Jacob Jungers



Jacob Jungers, University of Minnesota Kernza researcher, says it offers a high-protein spring forage, a fall-grazing option, grain and energy crops.

PHOTO: SUSAN WINSOR

“We only capture 40% of the grain with today’s genetics,” Fernholz says.

Antishattering genetic progress has improved by 25% annually, Jungers says, making straight combining a viable future option.

VIABILITY IN PLAY. “Kernza has room to improve, just as soybeans did in the 1940s when people dismissed them as impractical,” Fernholz says.

Plant breeders at the University of Minnesota and The Land Institute have already increased Kernza’s seed size by 100% since the early 2000s. They’re also focusing on reduced lodging, seed head shattering and declining grain yields after two years.

Sequencing the genome of the intermediate wheatgrass accelerates trait improvement. “Other new genetic technologies such as marker-assisted breeding make perennial grain crop development more practical in the next 10 to 20 years,” Glover says.

“Kernza’s the first grain crop designed for its ecological functioning,” says Lee DeHaan, a Land Institute researcher. The idea is to mitigate N leaching with continuous living cover. It’s a much less expensive approach than idling farmland, says Aaron Reser, watershed initiative coordinator at the Green Lands Blue Waters Initiative, based at the University of Minnesota.

Its early-spring growth captures soil nitrate when it’s most likely to be lost with spring rains, Jungers says.

In one study, second-year Kernza reduced total nitrate leaching by 86%—more than annual wheat—reflecting how well perennial roots captured applied N, says DeHaan, one of the study’s researchers.

“We need 10 years yet to develop reliable production volume, processor acceptance and, most importantly, farmer and consumer acceptance,” Fernholz says. “If Kernza does become a staple in my rotation, I’d incorporate it much like I now do with alfalfa. It would be a cash crop for three growing seasons, then be terminated and followed by corn, soybeans and another spring annual small grain.” ●

“Soil is built from the roots up, rather than from aboveground. Deep roots are the wisdom of perennial crops.”

—CARMEN FERNHOLZ,
MADISON, MINN., KERNZA FARMER



It's not a popularity contest, but if it were...

WESTFIELD

MKX SERIES MKX 100 | MKX 130 | MKX 160

99% WESTFIELD OWNERS ARE SATISFIED WITH THEIR AUGER

82% BELIEVE WESTFIELD IS A BRAND YOU CAN TRUST

82% WOULD RECOMMEND WESTFIELD

*Based on independent market research conducted by Ipsos Reid.

888.467.7207 | grainaugers.com

AGI