



BREEDING PROGRAM. Nearly 20 years of breeding and selection of intermediate wheatgrass by Dr. Lee DeHaan of The Land Institute has produced an emerging perennial cool-season dual-purpose crop called Kernza.

Deep-Rooted Kernza Shows Promise as Dual-Purpose Perennial Crop

By [Dan Crummett](#) posted on February 2, 2022 |
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Kernza, a specialty grain crop developed by The Land Institute, is a perennial cool-season, dual-purpose crop that can provide high-quality winter grazing as well as grain in the summer.

The land institute's nearly 20-year-old breeding program with intermediate wheatgrass is on track to perfect a no-tiller's "dream come true" — a cool season perennial that can be managed for both winter grazing and a grain crop the following summer.

Kernza, the Institute's first perennial crop introduced into agriculture and food markets, is the product of plant biologist Lee DeHaan's selections of the intermediate wheatgrass, *Thinopyrum intermedium*, a perennial grass native to Russia, Afghanistan and Turkey. Since 2003, DeHaan has been selecting for increased yield, seed size, disease resistance and other factors that would make the grass an economically viable crop.

The word Kernza — an amalgamation of "kernel" and "Konza," in recognition of the Konza Prairie Biological Station in Kansas — was trademarked by the [Land Institute](#) in 2009 by the Salina, Kansas-based non-profit. The new perennial wheatgrass represents the first fruits of DeHaan's breeding efforts with material originally imported in 1930 by the USDA, and selected and developed by the Rodale Institute between 1983-2001.

About 4,000 acres of Kernza are grown in Montana and the Upper Midwest and as far south as Nebraska and Kansas. More than 50 growers use the crop for forage production and harvest grain for a fledgling market that includes General Mills and Patagonia Provisions, as well as artisan grain outlets, restaurants and craft brewers.

DeHaan estimates it will take years to compete with traditional grain production yields but says Kernza's current benefits include significantly reduced expenses of annual tillage and planting, long-term soil erosion control and soil-building traits, and flexibility of a dual-purpose crop in times of unseasonable weather events.

The benefits he cites fall directly in line with the Institute's stated goal of developing an agricultural system over the next 40 years based on perennials with the ecological stability of native prairies and grain and seed yields comparable to that of annual crops. The group is also committed to developing perennial wheat, rice, sorghum and oilseed crops.

Deep Roots

DeHaan says Kernza's deep fibrous root system has the potential to improve soils over time by sequestering significant amounts of carbon in the roots and providing improved water infiltration, as well as encouraging enhanced soil microbiology in the root zone.

"We've found Kernza roots at least 9 feet deep in tiled fields in southern Minnesota," says Tessa Peters, Institute Director of Crop Stewardship. Peters oversees on-farm field trials of Kernza across the country.



FLEXIBLE HAY CROP. Forage harvest, whether by machine or grazing cattle, is an important asset of The Land Institute's trademarked Kernza cool-season perennial Intermediate wheatgrass. In trials in the northern Great Plains, Kernza has provided winter grazing in droughts that have left it as the only green standing.

"The roots were abundant, and because they weren't balled up around the tiles, we're convinced they were tapped into natural soil moisture and nutrients even at that depth," she says. "The deep roots come in handy in times of drought."

Peters says Montana growers who had grown a Kernza grain crop in 2021 were faced with a serious drought, so they baled the fields or grazed them directly.

"The Kernza was the only green thing available, so in unpredictable weather, it provides some flexibility other crops don't," she adds.

Kernza 101

Compared with traditional winter wheat, Kernza produces a larger seed head but fills with much smaller seed, producing yields roughly one-third that of wheat depending upon weather conditions.

Peters says the highest yields for Kernza reported on farm-size fields have ranged from 1,100 to 1,200 pounds per acre, but elsewhere, where weed control is poor, yield has dropped to 100.

"There are 20-year-old stands of Kernza that are still thick with very little invasive pressure. Managed for forage only, a stand can last decades..."

"That's why Dr. DeHaan's breeding program is so important to improving the performance of our intermediate wheatgrass lines," she says. "Kernza is not a low-water crop, even though it's native to areas of 12-15 inches of precipitation per year. It has to have moisture at planting and again at grain-fill to meet its grain yield potential, just like other grain crops."

As a dual-purpose crop, DeHaan says Kernza provides very high-quality forage in late fall or early spring, and as long as grazing is terminated before elongation, research shows no yield reduction to grain production the following spring.

"While there are many variables, a Kernza stand can be productive for 5-8 years for dual-purpose use, and another 5-8 years for a forage crop," he says. "There are 20-year-old stands of Kernza that are still thick with very little invasive pressure. Managed for forage only, a stand can last decades."

He says grain yields are usually very good for the first few years and then decline.

Flour from Kernza grain can be used alone for baking or mixed with traditional flours, and has a distinctive taste being accepted for specialty recipes by chefs and brewers. Kernza flour contains gluten, but it performs differently than hard red winter wheat in baking.

Developing Market

Today, the niche crop is growing on a small scale on farms in the U.S., Canada and Europe. The Land Institute says as genetics improve and agronomic understanding increases, production can be scaled to provide additional grain for retail groceries and restaurants.

Brandon Schlautman, the Institute's lead scientist on its perennial legume program, says like most emerging crops, intermediate wheatgrass faces the "Chicken or Egg" conundrum of matching production with demand.



MULTIPLE BENEFITS. Kernza intermediate wheatgrass significantly reduces soil erosion and runoff, grows deep fibrous roots to build soil quality and provide drought protection, is a good winter forage, and is enjoying a small but growing market for its grain.

"Specialty crops require specialty markets, and scale of production has to meet potential demand," he explains. "We're currently looking at direct sales to consumers. A brewery may buy 10,000 pounds of grain, which could come from a 40 to 80-acre field, so there's not an obvious demand for widespread planting."

DeHaan agrees, and says it takes a long time for a new crop to reach its potential.

"Until we get yields similar to other crops it will be a more expensive product," he says. "We need to grow the supply chain and develop more local processing and end-use development."

Peters says even with interest from General Mills and Patagonia Provisions, different markets are needed for Kernza.

"We need regional markets for baking, brewing and other baked goods to help us produce and consume locally. We don't want the environmental benefits of the crop to be negated by having to ship it thousands of miles for processing."

Kernza Production Basics

In a new "Kernza Production Basics" manual, Tessa Peters, director of crop stewardship for The Land Institute, outlines recommendations for establishing and harvesting a Kernza crop with the following considerations:

- **Site Selection:** Intermediate wheatgrass prefers a well-drained, non-weedy soil. Weed control for establishing Kernza can be challenging because the crop is not currently labeled for herbicide use. Following a winter annual is not recommended because volunteer plants will contaminate Kernza grain. Choose sites behind legumes or spring annual grain crops.
- **Planting:** Kernza should be planted $\frac{1}{4}$ inch to $\frac{1}{2}$ inch deep in a firm seedbed. Most stands are fall planted, resulting in a grain crop the first summer. Peters recommends planting two-weeks prior to local winter wheat guidelines, preferably just before a rain — usually mid-August to mid-September. Spring planting is also possible, but unless growers can take advantage of grazing or haying, there will be no immediate payback.

- **Population:** Seeding rates for Kernza vary substantially and can range from 3 to 40 pounds per acre, depending upon row spacing and germination rates. University of Minnesota calculations, however, show a 10 pound per acre rate for 80% germination seed on 7.5-inch rows. More information on planting equipment and settings are available at <https://kernza.org/wp-content/uploads/Kernza-planting-guide-1.pdf>.
- **Grain Harvest:** Kernza grain can be harvested with draper and stripper headers, or by swathing plus a pickup header. Cleaning shoe fan speed is critical to manage grain loss through the combine. Rotor speeds must be high enough to thresh all seeds from each spikelet. Grain should be dried as soon as possible after harvest.
- **Forage Harvest:** Spring grazing after April 1 will likely cause a small loss in grain yield. Total loss of grain yield is likely if grazing continues after elongation phase. Summer residue can be swathed and baled immediately after grain harvest, but quality will be only slightly better than oat/wheat straw. Fall/Winter grazing provides medium to high-quality forage from late fall throughout the winter.
- **Identity Preserved:** Kernza grain producers must abide by the Identity Preserved Program guidelines for the approved varieties of MN-Clearwater and TLI C5. More information is available at <https://kernza.org/growers/>.



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