



## Overview

As the first widely available perennial grain crop, intermediate wheatgrass will change agriculture landscapes by providing **valuable ecosystem services**.

Funding for this project will be used to advance our understanding of intermediate wheatgrass production and end-use to commercialize this crop and to provide new economic opportunities for Minnesota farmers, protect the environment, and supply the nation with a new, healthy grain.

By providing **year-round soil coverage** and uniquely large belowground carbon inputs from roots, farmers growing intermediate wheatgrass will **sequester more carbon, reduce greenhouse gas emissions, reduce nitrogen and phosphorus contamination of freshwater and marine ecosystems, and reduce weed competition, minimizing the need for tillage or herbicide applications**. With continuous soil cover, farmers will **greatly reduce soil erosion**, potentially turning agriculture into a soil-forming ecosystem, much like the natural ecosystems it replaced.

Intermediate wheatgrass (*Thinopyrum intermedium*, IWG) is being bred by The Land Institute and the University of Minnesota for increased seed yield so that it can be used as a perennial grain crop. Breeding progress has resulted in increased seed size and seed yields two times larger than those of original populations, which has led to production and sales of this crop under the trade name Kernza® (trade name is property of The Land Institute, a nonprofit organization that has led development of the crop since 2001).

The U of M food science team is working with companies such as **General Mills, Inc.** and **Patagonia Provisions** to determine how intermediate wheatgrass can be incorporated into their food products as a **green and earth-friendly crop**. Specifically, **food companies will gain a valuable marketing advantage** by reducing their greenhouse gas footprint and help attain corporate sustainability goals.



# Forever Green Initiative: INTERMEDIATE WHEATGRASS

A perennial, multifunctional food, feed and energy crop

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## Research Status and Goals

Investments made in faculty, post-doctoral researchers, graduate students, technicians, and undergraduate employees support:

### AGROECOLOGY

Increase intermediate wheatgrass yields and measure the environmental benefits possible from this new crop.

**Activities:** Field experiments are addressing optimum nitrogen fertilizer rates and row spacing for maximized grain yields, incorporating legumes into intermediate wheatgrass stands to reduce nitrogen fertilizer needs, harvesting or grazing forage to complement grain yields, and grain harvest efficiency methods. Projects will address agronomic development, reductions in nitrate leaching to groundwater, reductions in soil erosion, and potential for sequestering carbon in roots and soil.

**Outcomes:** Best management guidelines for intermediate wheatgrass productions, Extension education documents for farmers and producers, and scientific reports describing intermediate wheatgrass merits.

### BREEDING AND GENETICS

Improving intermediate wheatgrass for profitable production in the Midwest.

**Activities:** Projects are focused on domestication traits such as seed shattering, threshability, and seed size. Fortunately, there is plentiful genetic variation for these traits in our breeding germplasm and rapid gains have been made with seed size increasing at a rate of about 5 percent per year. The first five variety candidates of intermediate wheatgrass entered statewide yield tests in 2016. To increase the efficiency of selection and accelerate its improvement, we have optimized and established genomics tools for intermediate wheatgrass based on DNA fingerprinting. These genomics tools can shorten the breeding cycle from three to five years to less than one year and allows us to evaluate more plants than is possible with field-based selection alone.

**Outcomes:** Continuously updated intermediate wheatgrass germplasm, including new variety releases with increased grain yield and grain harvestability.

### FOOD SCIENCE

Quality traits characterization and viable methods to store, process, and utilize intermediate wheatgrass in commercial foods.

**Activities:** Continue to characterize intermediate wheatgrass quality traits (starch composition, gluten protein profiling, dietary fiber content, antioxidants, and problematic enzymes), evaluate its use for various food applications (e.g. flour blends, cereal-based products, baked goods), improve storage and shelf life, and measure the effect of refinement and processing methods on quality characteristics. Expand investigation of health benefits.

**Outcomes:** Guidelines for directing end-use products development using intermediate wheatgrass, evaluation of new varieties for guiding breeding efforts toward achieving grain quality objectives, and scientific papers related to functionality, shelf life and overall quality characteristics of novel perennial grain crops.

## Pilot Studies

Plot-scale intermediate wheatgrass research projects are distributed across the temperature and precipitation gradient of Minnesota. Several current on-farm pilot fields include fields as large as 40 acres near Roseau where growing conditions are well suited for cool-season grass seed production, the farming community grows perennial grass seed for the turf industry, and several processing facilities already operate for dehulling and preparing intermediate wheatgrass for distribution. Pilot studies under development will target fragile landscape features such as wellhead protection areas.

## COMMERCIALIZATION PLAN

Market opportunities exist with General Mills, Patagonia Provisions, and many local restaurants including the Birchwood Café. Markets will grow with grain availability. The specialty crop marketing company Plovgh has been contracted by The Land Institute to assist with marketing, identity preservation, and supply-chain efforts. The non-profit consortium Green Lands Blue Waters is supporting supply-chain development in Minnesota. With the Minnesota Crop Improvement Association, we are developing a certified seed production industry in Minnesota. The Northern Minnesota Turf Seed Council is interested in growing and processing intermediate wheatgrass.

## TIMELINE

### 2017 through 2022 and beyond

- Agroecology research to continuously improve agronomic production practices and track long-term impacts of this new crop on the environment.
- Breeding work to improve grain yields and develop new varieties.
- Food science research to analyze food quality characteristics and benefits.