

Kernza® Perennial Grain in Baking Applications



Agricultural Utilization Research Institute

Introduction

Kernza® perennial grain (Kernza) is a new domesticated grain introduced by The Land Institute that is now being developed for commercial use in Minnesota. It originates from a forage grass called intermediate wheatgrass (*Thinopyrum intermedium*) and is a close relative of wheat. In 2019, the University of Minnesota released its first named Kernza variety: MN-Clearwater. Besides the potential for food applications, Kernza also provides environmental benefits. According to University of Minnesota researchers, its deep roots can protect soil from erosion, improve soil health, and reduce nitrogen leaching, protecting water resources from nitrate contamination.

As a close relative of wheat, Kernza has application opportunities in the food industry. It contains a higher protein and dietary fiber content versus wheat but lacks in some gluten components that limit its functionality in some applications. To overcome the gluten component deficiency, there are several additives or dough conditioners that can be utilized to help improve functional properties. Kernza can also be blended with wheat flour to improve baking (or baked good) quality.

Comparison with Traditional Wheat

*Values in table based on 100g sample

Grain Types		Kernza Refined Flour ^a	All Purpose White Flour ^b
Moisture	%	8.1	11.9
Ash	%	0.6	0.5
Calories	-	368	364
Protein	g	17.5	10.3
Carbohydrates	g	73.2	76.3
Dietary Fiber	g	4.3	2.7
Soluble Fiber	g	1.0	0.9
Sugar	g	N/A	0.3
Total Fat	g	1.2	1.0
Sat Fat	g	0.3	0.2
Mono Fat	g	0.1	0.1
Poly Fat	g	0.7	0.4
Trans Fat	g	0	0
Cholesterol	mg	0	0
Calcium	mg	50	15.0
Iron	mg	3.7	1.17
Potassium	mg	140	107.0
Sodium	mg	0	2.0

^a Source: Results are directional only, data represents analysis of one sample of Clearwater Variety, MVTL, New Ulm, MN

^b ESHA Database USDA Composition Data

Baking Properties

- Whole Grain Flour: Kernza berries have a higher bran-to-endosperm ratio which can lead to reduced loaf volume and increased crumb firmness when using whole grain flour
- Refined Flour: Removal of the bran through refining processes can lead to dough that has increased stickiness

Handling and Special Considerations

- With the proper storage conditions (maintaining low humidity and a temperature-controlled environment) flour from Kernza would be considered shelf stable
- Toasting the grain prior to milling may improve flour particle size consistency and help to highlight

Challenges and Opportunities

- **Glutenin:** Kernza contains significantly less glutenin (a functional component of gluten) which limits the dough's ability to form viscoelastic networks required for certain baking applications
- **Starch Content:** Kernza dough contains less starch, leading to a reduced loaf volume and a weaker crumb structure when compared to conventional wheat dough
- **Dough Conditioners:** the addition of several dough conditioners, such as vital wheat gluten, ascorbic acid, transglutaminase, xylanase, and alpha amylase, can improve the overall quality of the food products made from Kernza dough
- **Blending:** Baked goods made from Kernza would benefit from the addition of wheat flour to make up for the lack of gluten proteins and starches
- **Dietary Fiber:** Kernza flour could be used as a fiber source in flour blends due to its higher dietary fiber content
- **Sourdough fermentation** was found to highlight the earthy notes in Kernza's flavor profile
- Kernza works well in flatbread applications combined with wheat flour, at a Kernza inclusion rate of about 10 to 15%

Baking Applications

- Bread & Sourdough
- Flatbreads such as Focaccia and Pizza Crust
- Pretzels
- Biscuits
- Muffins
- Cupcakes
- Cookies
- Scones
- Pancake/Waffle Mix
- Crackers
- Pasta

"I prefer the flour in non-yeasted applications, particularly products like pound cake, because the flavor of the grain resembles graham and works well with sweet applications. It reflects the flavor of the Earth quite well where conventional flour does not."

—Beth Dooley- Cookbook Author
and Minneapolis Chef

References

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3. *"Evaluation of the Chemical and Functional Stability of Intermediate Wheatgrass (Thinopyrum intermedium) over Storage and in Response to Steam Treatment" Amy Mathiowetz, December 2018, University of Minnesota*
4. *Interviews with Steve Horton from Bakers Field Flour and Bread 2020*
5. *"Effects of Dough Conditioners on Rheology and Bread Quality of Intermediate Wheatgrass" Jaya Dhungana Banjade, July 2018, University of Minnesota*
6. *"Chemical Characterization, Functionality, and Baking Quality of Intermediate Wheatgrass (Thinopyrum intermedium)" Citra Putri Rahardjo, May 2017, University of Minnesota*