

# Brewing with Kernza® Perennial Grain



Agricultural Utilization Research Institute

## Brewing Overview

Kernza® perennial grain (Kernza) is a new type of perennial intermediate wheatgrass that is under development in Minnesota for its environmental benefits. According to University of Minnesota researchers, Kernza has an extensive root system that helps protect soil from erosion, improves soil health, and reduces nitrogen leaching, protecting water resources from nitrate contamination. As a close relative of wheat, Kernza has many potential applications in the food and beverage industry.

## Comparison of Brewing Characteristics

Type of Grain		2-row Barley Base Malt	Kernza Malted Hulled*	Unmalted Hulled Kernza*	Malted White Wheat	Unmalted White Wheat
Moisture	%	5.23	3.53	4.30	5.00	12.0
Total Protein	%	11.5	18.0	17.9	11.5	10.0
Alpha Amylase	D.U.	65.0	15	8	48	-
Germination Energy	%	>95**	NA	65	NA	>95**
Germination Capacity	%	>95**	NA	75	NA	>95**
Extract (FG Dry Basis)	%	81.0	79.9	69.9	83.0	76.0
Color	°SRM	2.2	3.3	1.8	2.5	2
Turbidity	NTU	8.7	N/A	3.0	-	-
pH	-	5.8	6.0	6.3	-	-
Soluble Protein	%	4.7	8.9	4.6	4.7	-
S/T Ratio	-	41.0	49.4	25.7	41.0	-
β-Glucan	mg/L	96	67	176	-	-
Free Amino Nitrogen (FAN)	mg/L	169	174	45	-	-
Diastatic Power	°L	129	104	108	160	-

\*- Source: Data represents initial lab scale testing results at Montana State Malting Labs

\*\* Montana State Lab does not recommend malting grain that does not have Germination Energy and Germination Capacity over 95%.

Malt test results based on one sample of MN Clearwater, numbers may vary slightly, sample to sample

## Comparison of Brewing Characteristics

- Compared to wheat, Kernza yields less extract on a fine ground basis
- S/T Ratio: Soluble Protein to Total Protein Ratio
  - Malted Kernza: Indicates thinner and lighter-bodied beer
  - Unmalted Kernza: indicates fuller-bodied beer with good head retention and foam stability
- FAN level, Free Amino Nitrogen, of malted Kernza suggests higher percentage usage will not negatively impact yeast growth or result in need for added yeast nutrients in the wort
- Low turbidity of unmalted Kernza suggests a clear, bright finished beer appearance
- Both the malted and unmalted Kernza made beers with low SRMs, Standard Reference Methods, suggest that Kernza usage in higher percentages (>50 percent) won't darken the final product

## Challenges

- Grain size: Seed is approximately 80% smaller than conventional wheat, potentially leading to difficulties in milling and malting Kernza traditionally. Genetic modifications are currently under exploration at the University of MN and the Land Institute to increase Kernza grain size
- Processing: The addition of  $\beta$ -glucans in unmalted Kernza and elevated protein levels in malted Kernza may lead to stuck sparges during brewing. Addition of rice hulls during the mash step could mitigate the frequency of these occurrences
- Supply: Low grain supply may impact availability of Kernza for brewing purposes

## Typical Usage

- Suggested beer styles for Kernza use:
  - American Wheat Beer
  - German Hefeweizen
  - German Dunkelweizen
  - German Weizenbock
  - Belgian Witbier
- Typical usage levels- Small batch testing has suggested usage of 15-20% of Kernza to have no perceived negative effects. Specific brewing conditions and finished product sensory preferences may result in usage levels outside of this suggested range.
- For example, a 500-gallon batch of a traditional mild American wheat beer would use around 950 pounds of grain, 20% of which would be wheat. If Kernza were substituted in this recipe, the 500 gallon batch would require around 200lb of Kernza grain.
- Sensory Profile Impacts
  - Addition of Kernza at 15% added a slight sour-like acidity to the beer
  - Beer made with 15% Kernza had less lingering sweetness than a standard, malty beer
  - Inclusion of Kernza at 15% was shown to have a slight dampening effect on the perceived carbonation of the beer
  - Imminent Brewing out of Northfield, MN has used milled Kernza in a German Alt beer at 20% with success, noting a slightly lighter color and a pleasant nuttiness addition
  - Overall, the addition of Kernza at lower levels does not seem to negatively impact the sensory characteristic of beer and may add a unique flavor profile.

### References

The Land Institute, 2020, <https://landinstitute.org/our-work/perennial-crops/kernza/> • Interviews with Dr. George Annor from the University of Minnesota Food Science Department 2020 • Interview with Imminent Brewing 2020