Bickford Winter Wheat

Introduction

- There is a growing demand for sustainably grown food-grade grains.
- Hard-red winter wheat has comparative advantages for organic farm rotations as
  - fall soil cover,
  - high weed competition,
  - high grain yields.

However, limitations of currently available cultivars such as poor disease resistance, winter hardiness, and baking quality, challenges its adoption and use.

Objectives

Develop a participatory hard-red winter wheat breeding program for the U.S. Upper Midwest involving farmers, millers, and bakers.
Specifically, our goals include 1) a thoughtful evaluation in multiple organically cultivated environments, looking for stability for both agronomic and quality traits, and 2) the development of on-farm trials as well as baking and sensory evaluations of genotypes to include farmers, millers, and bakers' perspectives in the breeding process.

The process

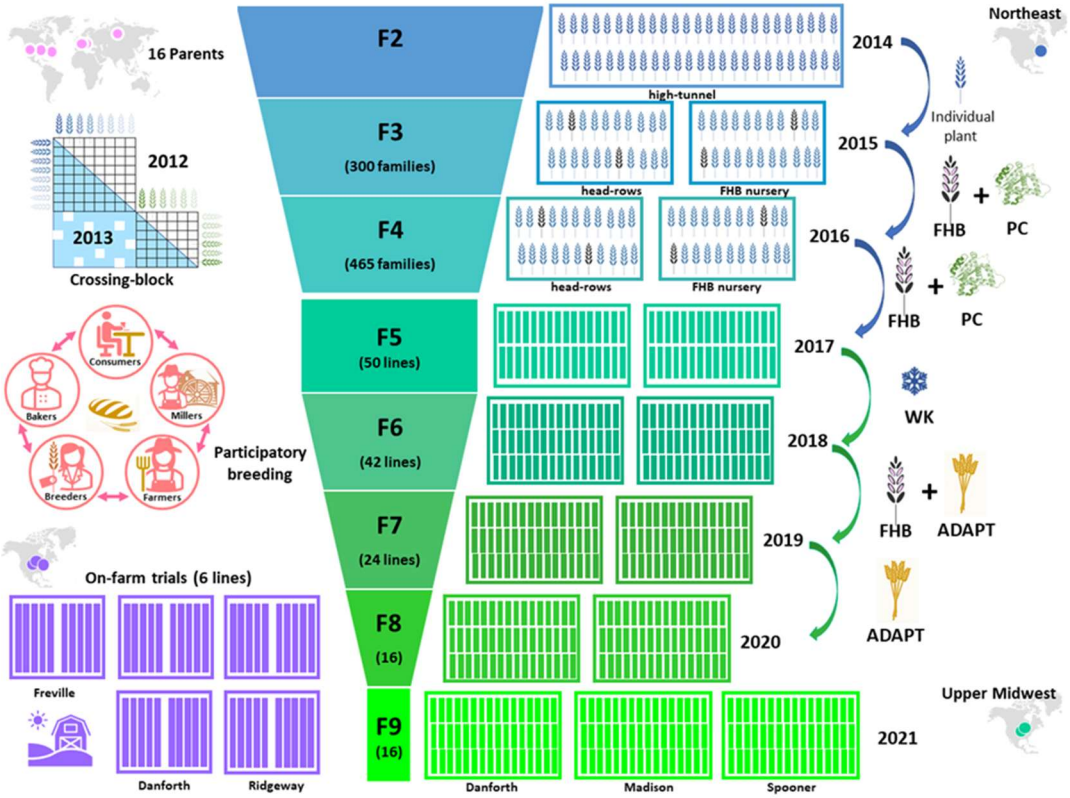

Figure 1. Characterization of the organic hard red winter wheat breeding program. Sixteen parents were used in a crossing block to generate the initial breeding population and families were selected initially based on Fusarium head blight and protein content in the Northeast. At the F5 generation, lines were evaluated in the U.S. Upper Midwest in three on-station locations (Madison, WI; Spooner, WI; and Danforth, IL) in five years (2017-2021). Advanced lines were evaluated in three on-farm locations (Freeville, NY; Danforth, IL; and Ridgeway, WI). Participatory breeding strategies were used to include farmers, millers, bakers, and consumers in the decision to advance and release breeding lines.

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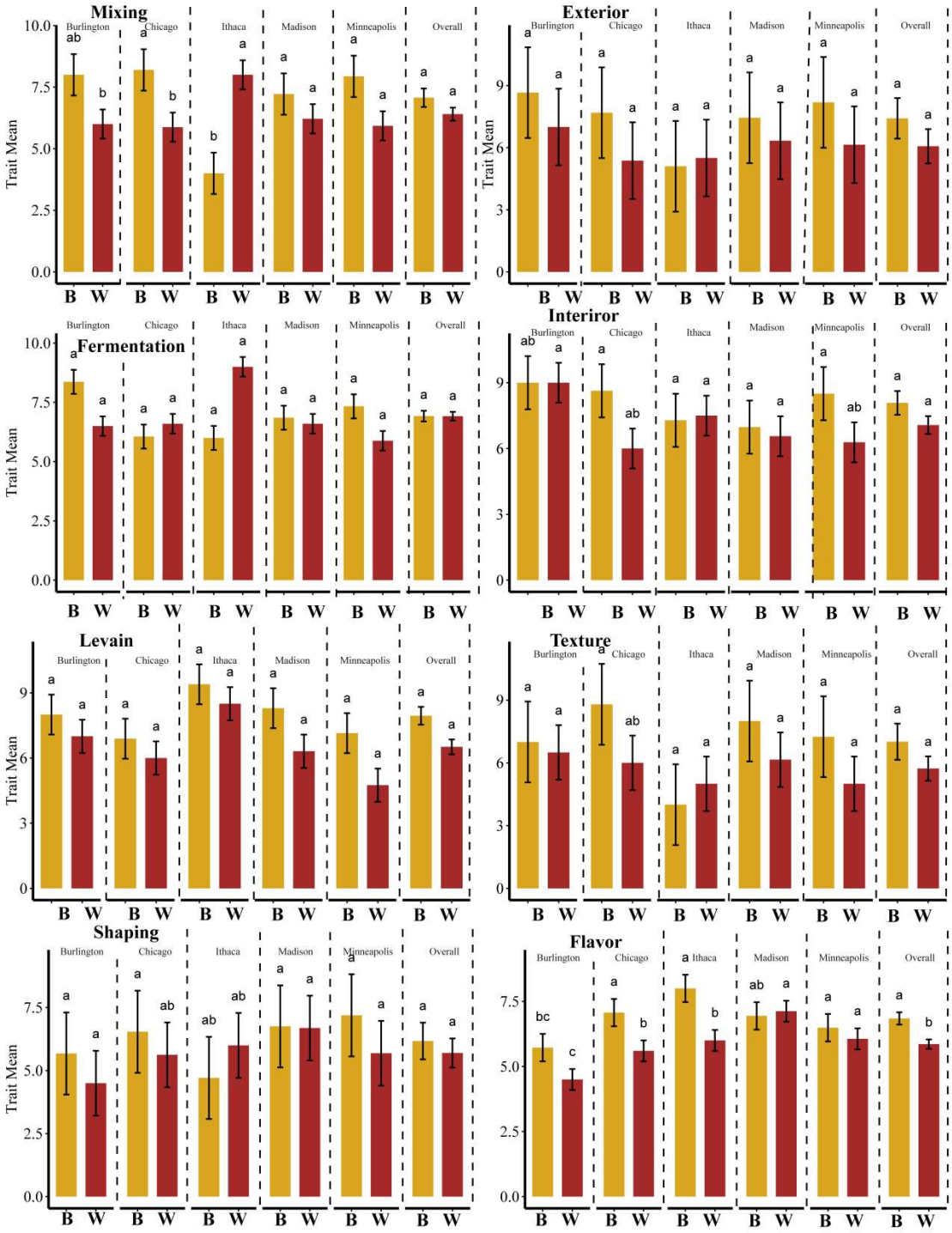
Results



Baking quality traits (Mixing, Fermentation, Levain, Shaping, Exterior, Interior, Texture, and Flavor) were evaluated for Bickford (B) and Warthog (W) by artisanal bakers in Burlington, VT; Chicago, IL; Ithaca, NY; Madison, WI; and Minneapolis, MN. And overall average cross cities .

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Table 1. Grain oat variety description.

Genotype	Origin	Release year	Kernel color	Maturity date [a]	Ht (in)[a]	Lodging (%) [a]	Test Wt (lb/bu)[a]	Protein (%)[b]	Don (%)[b]	Mildew (0-9)[c]	BYDV[c]	Licensed/PVP[h]	Wis. Cert.
Bickford	WI	2025	Red	156	46	17	44	10.1	0.4-0.85	1	2	In process	Yes
Arapahoe	NE	1989	Red	152	43	2	40	10.5	--	1	2	no	no
Warthog	Canada	2001	Red	153	41	2	41	10.1	0.5-1.3	1	1	no	no

a. Measured between 2022 and 2024 in Madison, WI. **b.** Measured between 2019 and 2021 in Madison, WI and Danford, IL. **c.** Measured in 2022 in Madison, WI.

Table 2. Grain yield (bushels per acre) and test weight (pounds per bushel) performance of winter wheat varieties in the 2024 growing season in 2024 and average of three years (2022, 2023, and 2024).

	Grain yield (bu per A)		Test weight (lb/bu)	
Genotype	Madison '24	Madison 3-years	Madison '24	Madison 3-years
Bickford	75*	64*	59*	59*
Arapahoe	67*	65*	61*	61*
Warthog	68*	67*	60*	60*
Mean	73	66	59	60
Trial S.E.	0.6	0.4	0.1	0.1
LSD	13.7	12.3	2.6	2.2

(*) Indicated that there is not significant difference from the top.

Conclusions

- Successful participatory breeding approach
- Bickford winter wheat variety
  - Adapted to organic systems and improved stability
  - Good Agronomic performance
  - High artisanal baking quality
- 16 Elite genotypes to recombine

Bickford in the wild. 2022 Strip on farm trials at Meadowlark organics Ridgeway, WI.