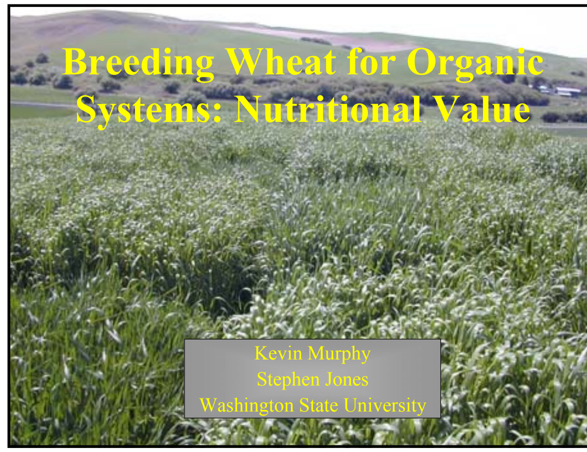


Breeding Wheat for Organic Systems: Nutritional Value

Kevin Murphy
Stephen Jones
Washington State University

Overview of WSU Organic Breeding Program

Initiated in 2000 as a component of the Winter Wheat Breeding Program as a response to farmer requests for varieties adapted to organic systems

- 10 acres certified organic at Spillman Agronomy Farm in Pullman, WA
- 4 acres transitional organic at Dryland Research Station in Lind, WA
- 2 cooperating farmers

Breeding Strategy

Cooperator's farm, St. John, WA

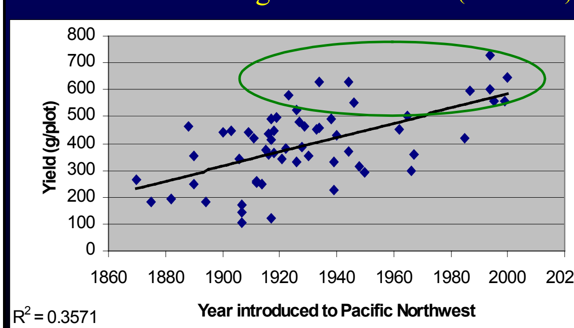
- Evaluate historical varieties adapted to the Pacific Northwest
- Selection occurs in all generations on certified organic research fields and farms
- Utilize farmer knowledge and encourage farmer participation in the selection process

Historical varieties

Breeding Objectives

- High yields in organic farming systems
- Disease resistance (Dwarf bunt)
- Weed competitiveness
- End-use quality / Mineral & micronutrient content
- Nitrogen use efficiency

Grain yield of historical and modern spring wheat varieties in organic conditions (2004-2005)



Yield (bu/a) - Pullman organic vs conventional, 2005

	Organic	Conventional	percentage
Madsen	83	110	75
Eltan	92	91	101
Rod	98	112	88
Stephens	84	112	75
Finch	98	125	78
mean	91	110	83

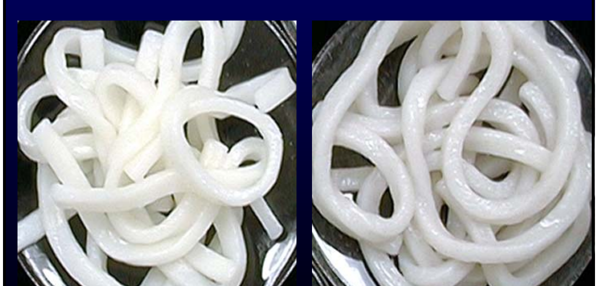
Organic Yield (bu/a), 2005

	St John	St Andrews
WA7916	146.3	38.8
Madsen	127.6	37.0
Eltan	135.2	39.5
Rod	151.6	35.8
Stephens	132.3	37.6
Finch	130.0	30.2

Pan Bread

Sugar-snap Cookie

White Salted Noodles

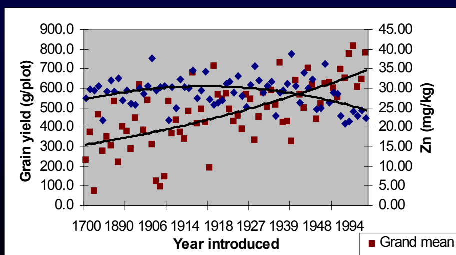


Japanese Sponge Cake

Mineral Content (2004-2005)

Historical (1700-1962) vs Modern (1985-2000) Spring Wheat

- Cu, Zn, P, Mg content = Historical > Modern ($p < 0.05$)
- Fe, Se, Mn, Ca content = no significant difference



Collaboration with Dr. Phillip Reeves, USDA-ARS, North Dakota

Table 2. Mineral content in historical and modern wheat varieties. Mineral content is given in mg/kg dry weight ± standard error for all minerals except Se, which is given in ug/kg. *, **, ***: $P < 0.05$, 0.01 and 0.0001, respectively. Ns = not significant. The 95% confidence interval for the grain yield/mineral content correlation is shown in parentheses.

Mineral	*Mineral Content* Historical (1842-1965)	Modern (2003)	% Change	Grain Yield/Mineral Correlation
Ca	421.58 ± 10.90	398.49 ± 16.12	- 6	-0.43 (-0.49, -0.32) *
Cu	4.76 ± 0.13	4.10 ± 0.23	- 16 ***	-0.46 (-0.51, -0.34) *
Fe	35.73 ± 1.00	32.31 ± 1.75	- 11 **	0.01 (-0.09, +0.11) ns
Mg	1402.62 ± 21.01	1307.6 ± 25.63	- 7 ***	-0.36 (-0.43, -0.25) *
Mn	49.98 ± 1.22	46.75 ± 3.14	- 7 *	-0.38 (-0.45, -0.27) *
P	3797.08 ± 55.65	3492.7 ± 119.25	- 9 ***	-0.25 (-0.34, -0.14) *
Se	16.17 ± 1.74	10.75 ± 2.73	- 50 *	-0.08 (-0.18, +0.03) ns
Zn	33.85 ± 0.92	27.18 ± 1.88	- 25 ***	-0.60 (-0.61 ,-0.45) *

Figure 2. Estimated number of slices of bread required to meet the Recommended Dietary Allowance (RDA) levels for Zn, Cu, Mg, and P, with flour from both modern varieties (denoted 'Top 7 Modern') and historical varieties with high levels of nutrient content (denoted 'Top 7 Historical').

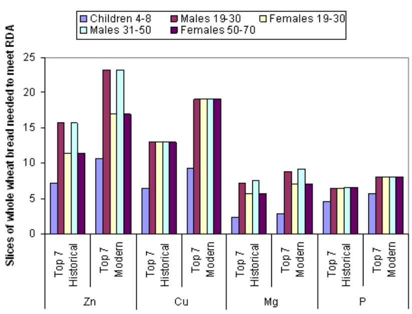


Figure 3. Estimated number of slices of bread required to meet the Recommended Dietary Allowance (RDA) or Adequate Intake (AI) levels with flour from both modern varieties (denoted 'Top 7 Modern') and historical varieties with high levels of nutrient content (denoted 'Top 7 Historical'). RDA was used for Fe, and Se. AI was used for Ca and Mn.