



Wheat Fiber 2.0

Super-charging nutrition
through additional fiber and
micronutrient targets

Katherine Frels, Ph.D.
Department of Agronomy and
Horticulture
University of Nebraska-Lincoln

Food Policy

Volume 100, April 2021, 101976

<https://doi.org/10.1016/j.foodpol.2020.101976>

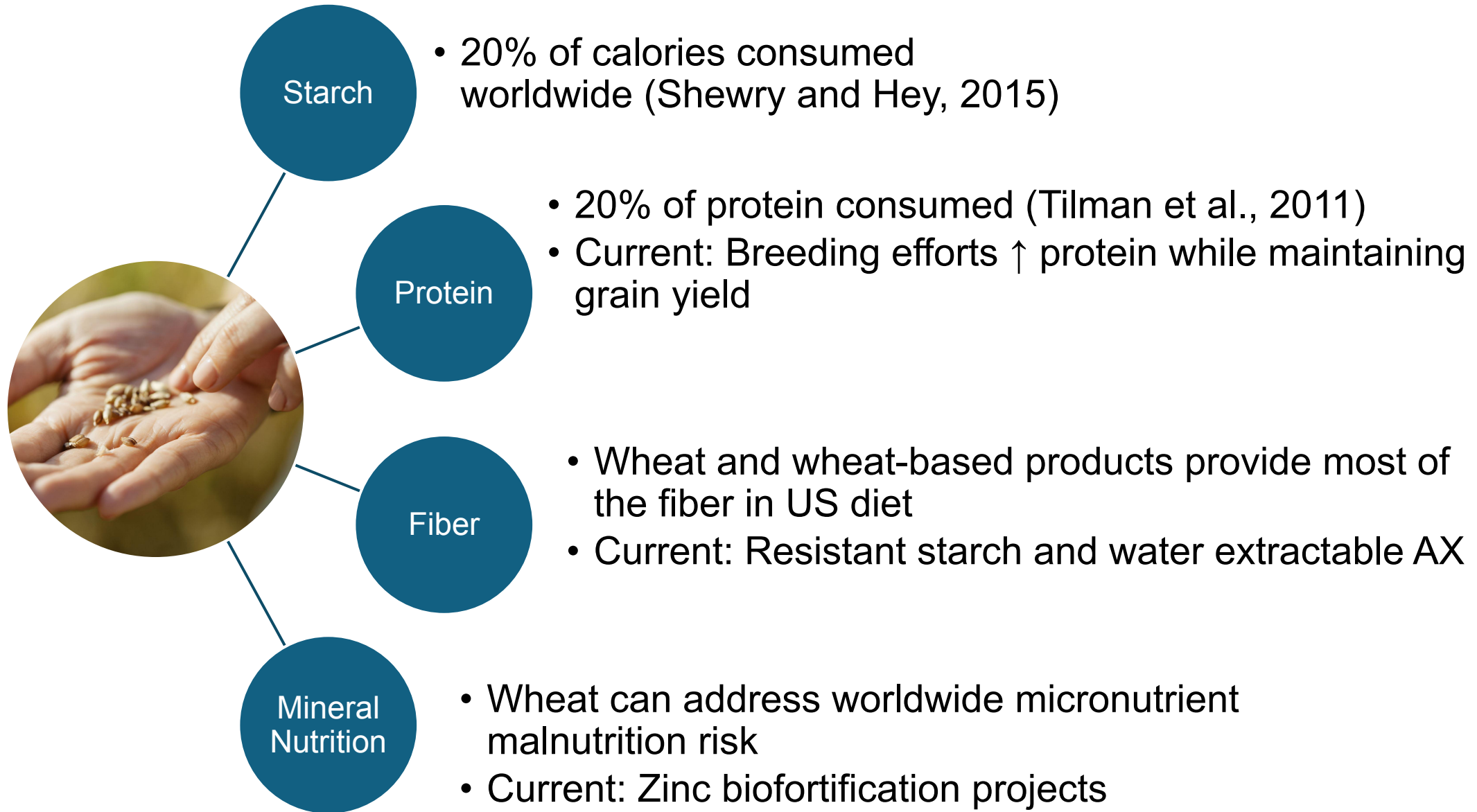
Viewpoint: Agri-nutrition research: Revisiting the contribution of maize and wheat to human nutrition and health

[Nigel Poole](#) ^a  , [Jason Donovan](#) ^b , [Olaf Erenstein](#) ^b 

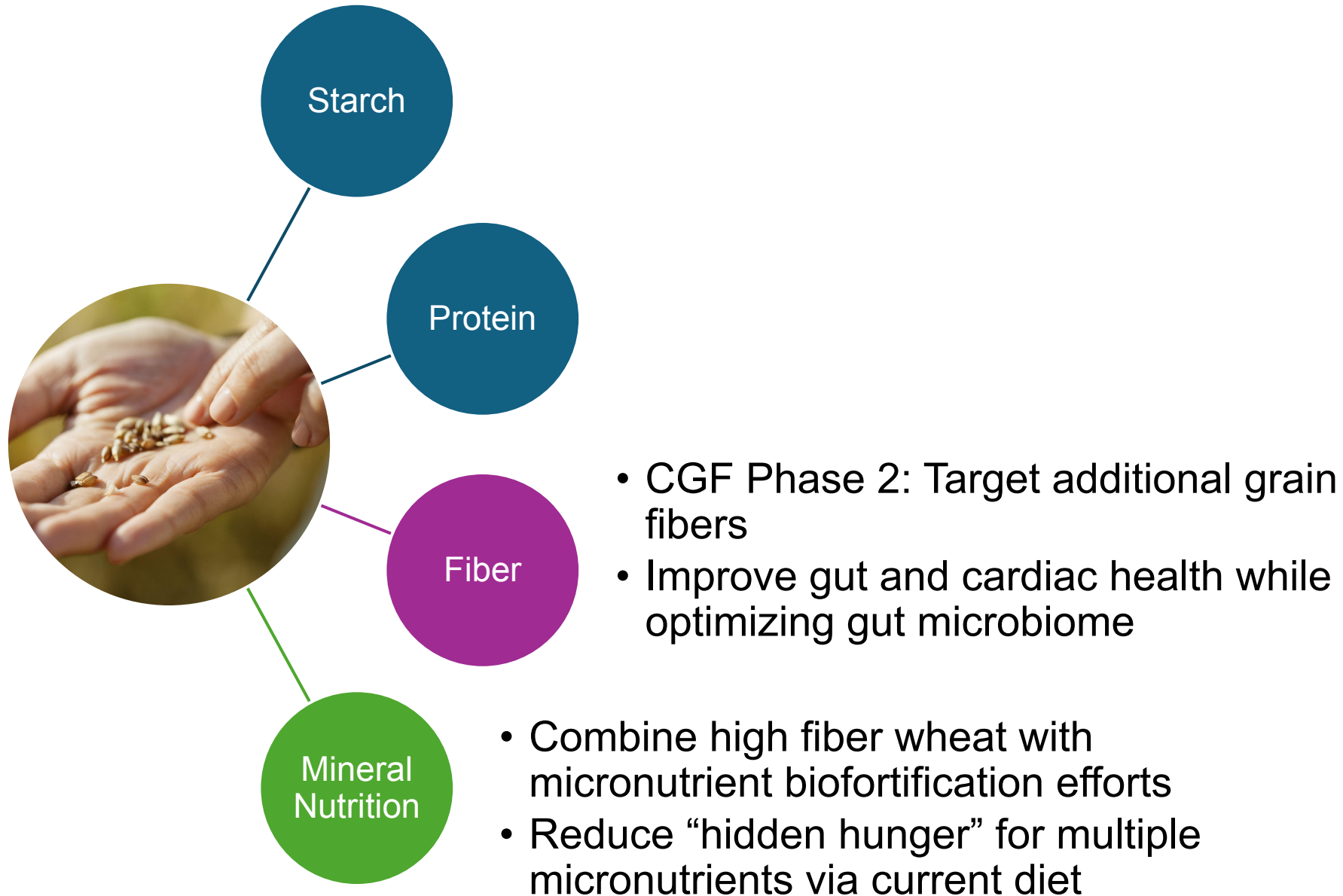
Highlights

- Current agri-nutrition research focuses on micronutrient malnutrition and stunting.
- The dietary contribution of many essential bioactive food components is understated.
- Cereals are rich in bioactives such as dietary fibre that have major health benefits.
- Research should address the full health benefits of cereals like maize and wheat.
- Agri-nutrition studies should be multidisciplinary and whole food systems-oriented.

Feeding the world healthier wheat

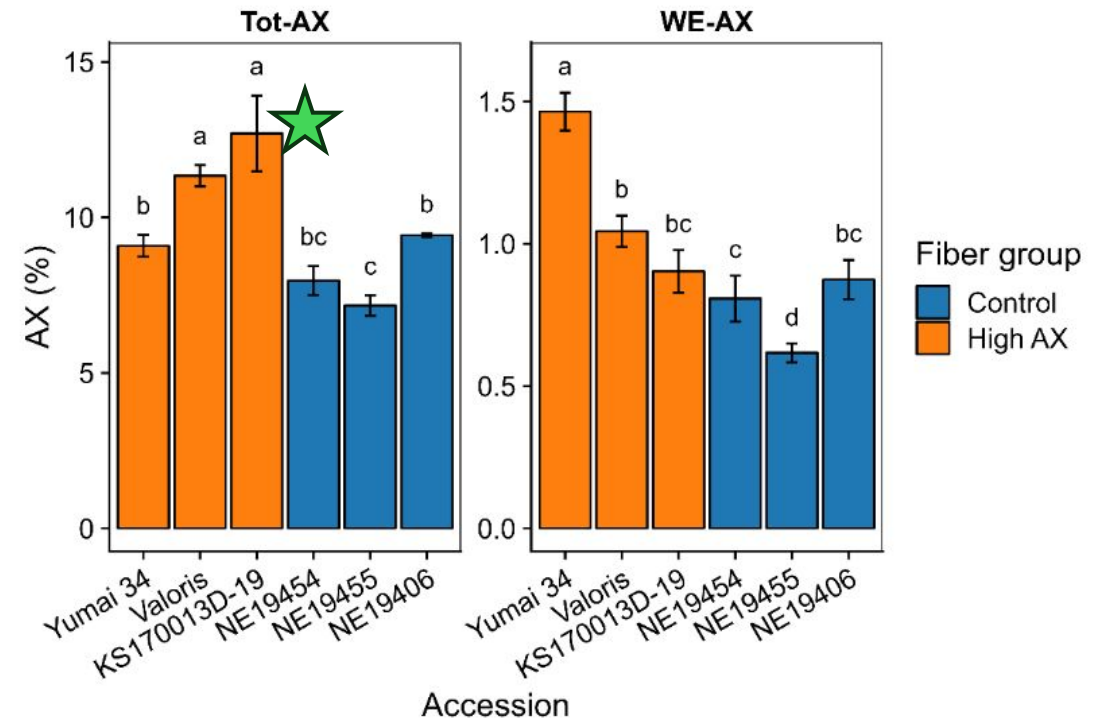


Feeding the world healthier wheat



Wheat Fiber 2.0- additional AX fibers

- $\text{Tot-AX} = \text{WE-AX} + \text{WU-AX}$
- WU-AX is an insoluble dietary fiber
 - Improved gut motility and function
 - Adsorption of undesirable materials
- Increased Tot-AX identified in KS elite breeding line via CGF research
 - High yielding, variety release candidate
 - Complementary DF profile could be stacked with WE-AX profile
 - QTL identification proposed in recent **USDA-NIFA grant submission** to facilitate rapid, marker-assisted breeding



Wheat Fiber 2.0: β -glucan

- β -glucan consumption reduces cholesterol and glycemic index
- Whole grain barley & oat products carry heart healthy labels (FDA 1997, 2005)
- Wheat contains comparatively low levels of β -glucan
 - Only 6% of wheat grain dietary fibers
 - Primarily found in aleurone layer
- QTLs associated with β -glucan level could be stacked with AX QTLs

Genet Resour Crop Evol (2019) 66:897–907
<https://doi.org/10.1007/s10722-019-00753-1>

RESEARCH ARTICLE

β -glucan content in a panel of *Triticum* and *Aegilops* genotypes

Ilaria Marcotuli · Pasqualina Colasuonno · Silvia Cutillo · Rosanna Simeone · Antonio Blanco · Agata Gadaleta

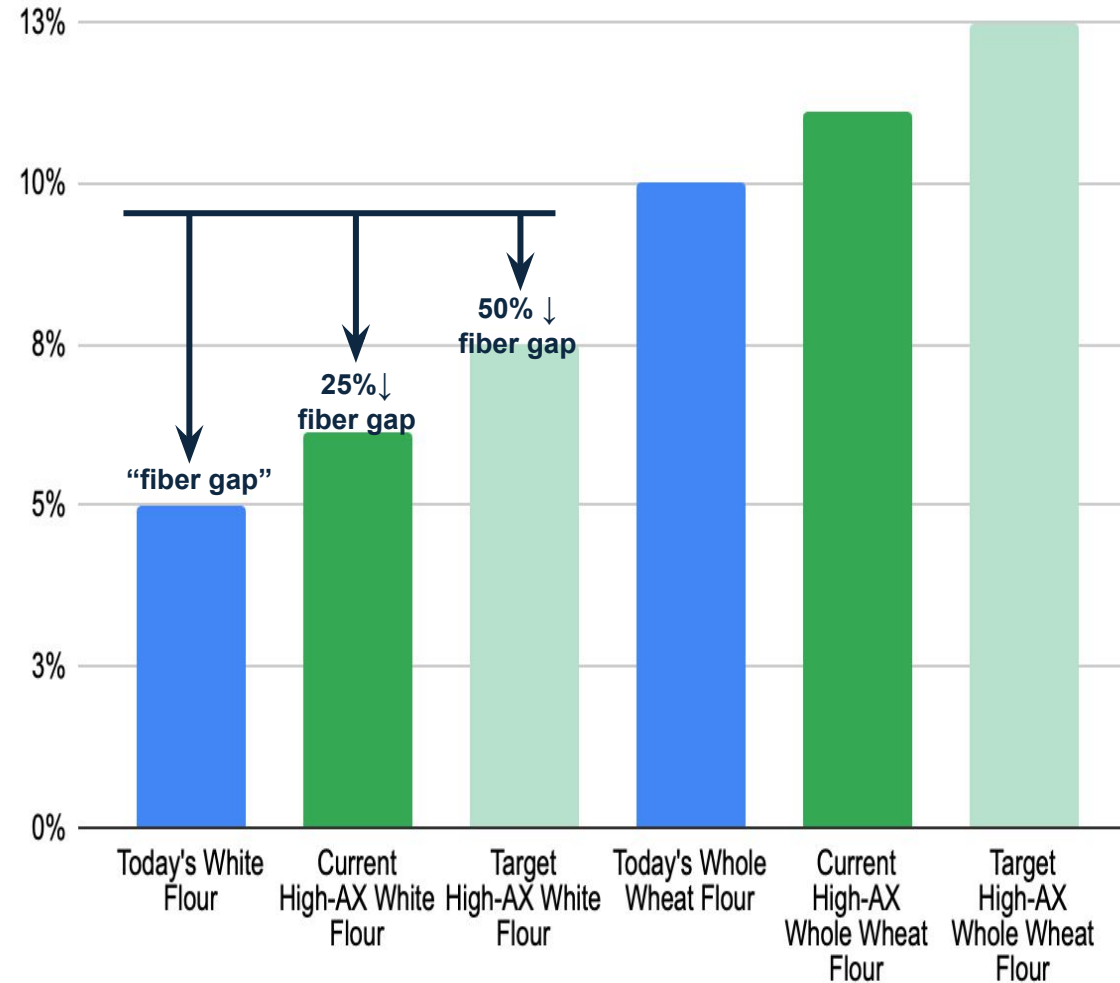
Species	β -glucan content
Bread wheat	0.4-0.9%
Durum wheat	0.39-0.7%
<i>Triticum</i> wild species	0.41-1.33%
<i>Aegilops</i> species	1.04-7.12%

Euphytica (2011) 177:179–190
DOI 10.1007/s10681-010-0217-9

Molecular mapping of quantitative trait loci for domestication traits and β -glucan content in a wheat recombinant inbred line population

Alagu Manickavelu · Kanako Kawaura · Hisako Imamura · Michiko Mori · Yasunari Ogihara

Where can additional fiber improvements take us?



Breeding wheat for more micronutrients

Theoretical and Applied Genetics (2021) 134:1–35
<https://doi.org/10.1007/s00122-020-03709-7>

REVIEW

Biofortification and bioavailability of Zn, Fe and Se in wheat: present status and future prospects

P. K. Gupta¹ · H. S. Balyan¹ · Shailendra Sharma¹ · Rahul Kumar¹

Genome-Wide Association Study Reveals Novel Genomic Regions Associated with 10 Grain Minerals in Synthetic Hexaploid Wheat

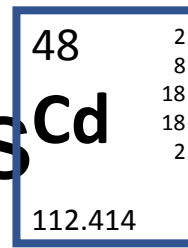
Bhatta et al., 2018 Int. J. Mol. Sci 19(10), 3237

A thorough screening based on QTLs controlling zinc and copper accumulation in the grain of different wheat genotypes

Liu et al., 2021. Env Sci and Pollution Res. 28, 15043

- We can breed high Zn, high Fe wheat varieties.
 - Other minerals such as Se and Cu should be targeted.
 - Wheat wild relatives are key sources for increased mineral nutrition.
- Micronutrient biofortification + increased fiber = wheat as a super food!

Preventing anti-nutritive minerals



- *Itai-itai* disease/ kidney dysfunction
- Cancer
- Absorption increased in women with decreased Fe status
- Pregnancy increases absorption
- Grains contribute > 25% of human Cd consumption
 - Half-life: 15-30 years
- CODEX: 0.2 mg kg⁻¹ in grain
- Regulated in E.U., China, Australia, New Zealand

Crop Breeding & Genetics | [Full Access](#)

Variation for Grain Mineral Concentration in a Diversity Panel of Current and Historical Great Plains Hard Winter Wheat Germplasm

Mary J. Guttieri [✉](#), P. Stephen Baenziger, Katherine Frels, Brett Carver, Brian Arnall, Brian M. Waters

First published: 01 May 2015 | <https://doi.org/10.2135/cropsci2014.07.0506> | Citations: 77

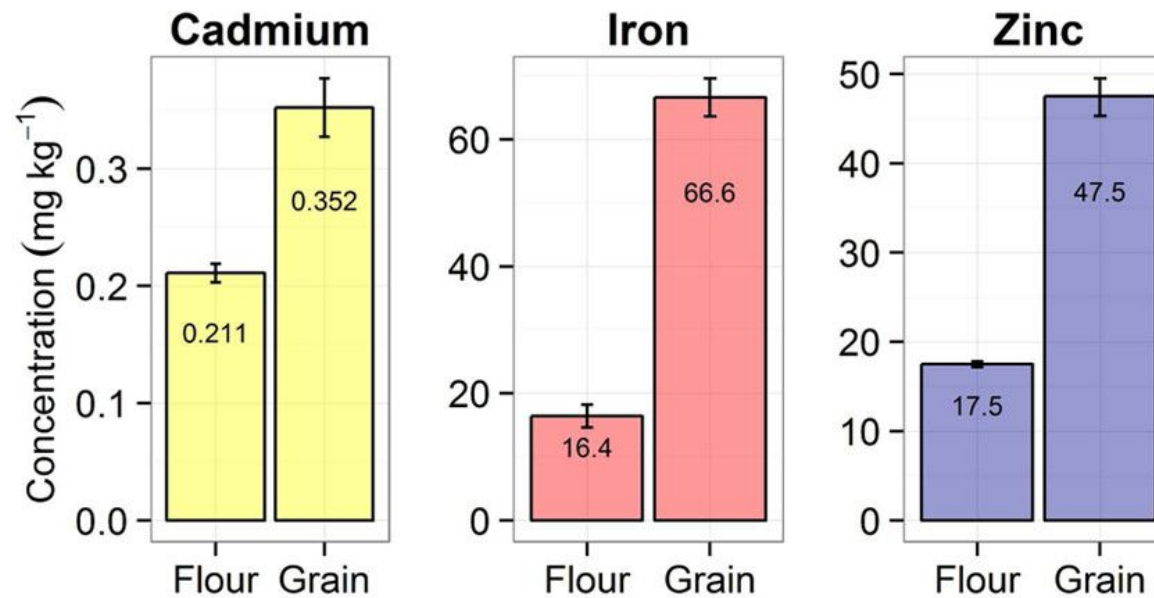


Subscribed

ARTICLE | November 16, 2015

Distribution of Cadmium, Iron, and Zinc in Millstreams of Hard Winter Wheat (*Triticum aestivum* L.)

Mary J. Guttieri^{*†}, Bradford W. Seabourn[‡], Caixia Liu[†], P. Stephen Baenziger[†], and Brian M. Waters[†]



Cadmium is retained at a higher rate in the milling process than iron and zinc.

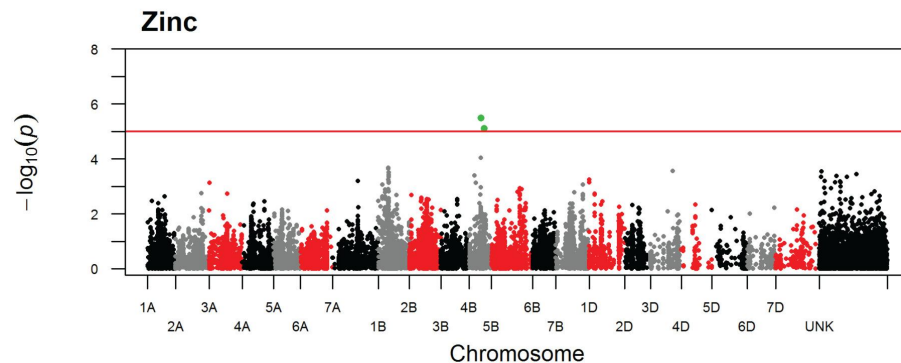
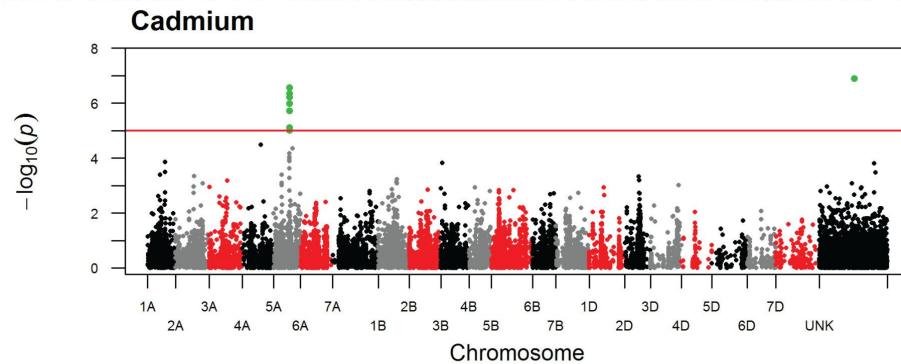
Breeding wheat for better micronutrients

Biomedical, Health Beneficial & Nutritionally Enhanced Plants | [Full Access](#)

Prospects for Selecting Wheat with Increased Zinc and Decreased Cadmium Concentration in Grain

Mary J. Guttieri [✉](#), P. Stephen Baenziger, Katherine Frels, Brett Carver, Brian Arnall, Shichen Wang, Eduard Akhunov, Brian M. Waters

First published: 01 July 2015 | <https://doi.org/10.2135/cropsci2014.08.0559> | Citations: 47

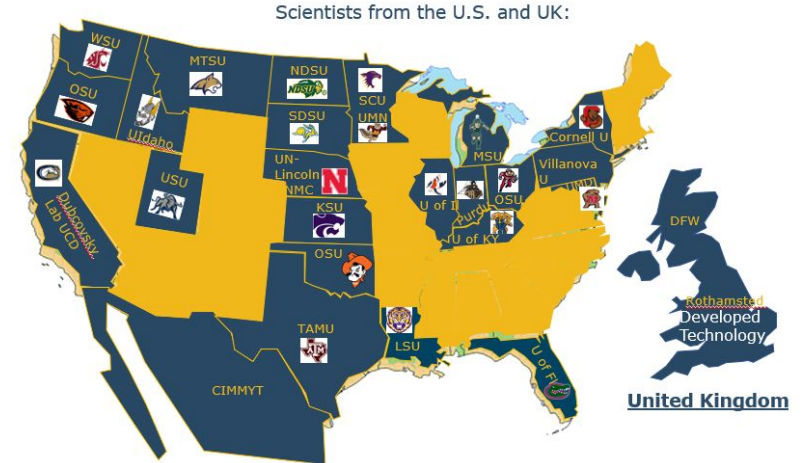


- Genetic control of grain Cd and Zn concentrations are independent.
- We can breed high Zn, low Cd wheat varieties.
- Healthier grain products must also consider reducing anti-nutritive components.

Wheat Nutrition Supporters



ROTHAMSTED RESEARCH



National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

Conference grant: 2024-67013-41578

Grupo Bimbo
Bayer CropSciences