

The “Ancient” Grains Emmer, Einkorn and Spelt: What We Know and What We Need to Find Out

Julie Dawson, Frank Kutka, June Russell, Steve Zwinger

January 8, 2013

http://www.extension.org/organic_production



Value-Added Grains for Local and Regional Food Systems: Project Overview

Project Objectives – Add Value

- Adding grains to crop rotations adds value
- Organic production adds value
- Grain for specialty ethnic markets adds value
- Direct marketing adds value
- Higher nutrient density adds value
- Processing into flour, pasta or bread adds value

What do we mean by “value-added”?

- Adding grains to crop rotations adds value
- Organic production adds value
- Grain for specialty ethnic markets adds value
- Direct marketing adds value
- Higher nutrient density adds value
- Processing into flour, pasta or bread adds value

Project Partners

- Cornell University
- Organic Growers Research Information-Sharing Network
- North Dakota State University
- Northern Plains Sustainable Agriculture Society
- Northeast Organic Farming Association - NY
- Pennsylvania Association for Sustainable Agriculture
- Pennsylvania State University
- Greenmarket/Grow NYC
- Oregon State University

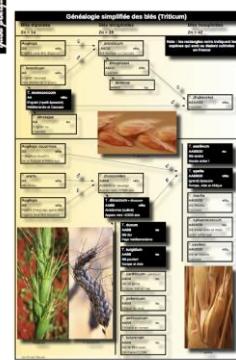
Project Advisors-1

- Sam Sherman: Champlain Valley Milling, Westport NY
- Luke Stodola: Small World Bakery, Rochester NY
- Roberta Strickler: Daisy Flour, Lancaster PA
- Joel and Eric Steigman: Small Valley Milling, Halifax PA
- Thor Oechsner: Oechsner Farm, Newfield NY
- Nigel Tudor: Weatherbury Farm, Avella PA
- Kit and Cathy Kelley: White Frost Farm, Washingtonville PA

Project Advisors-2

- Blaine Schmaltz: Blaine's Best Seeds, Rugby ND
- Troy DeSmet: Nature's Organic Grist, St. Croix Falls WI
- Michael Anthony: Gramercy Tavern, New York NY
- Matt Funiciello: Rockhill Bakehouse, Glens Falls NY
- Klaas Martens: Lakeview Organic Grain, Penn Yan NY
- Gil Stallknecht: Retired from Montana State University, Lewistown MT
- Patricia Jackson: I Trulli Ristorante, Enoteca NY

"Simplified" genealogy of wheat



Florent Mercier

Cultivated species in the wheat family

Diploid:

Einkorn: free threshing and hulled, hulled most common (*T. monococcum*)



Tetraploid:

Rivet and durum: free threshing (*T. turgidum* ssp. *durum*)



Emmer: hulled (*T. turgidum* ssp. *dicoccum*)



Khorasan: free threshing (*T. turgidum* ssp. *turanicum*)



Hexaploid:

Bread or soft wheat: free threshing (*Triticum aestivum* ssp. *aestivum*)



Club wheat: free threshing (*Triticum aestivum* ssp. *compactum*)



Spelt: hulled (*T. aestivum* ssp. *spelta*)



Spelt



Bread Wheat



Emmer



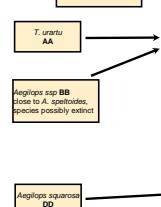
Durum



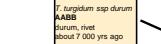
Rivet

Genealogy of cultivated wheat species

Diploids



Tetraploids



Hexaploids



Qualities of Einkorn, Emmer, and Spelt

Frank J. Kutka
Farm Breeding Club Co-Coordinator
Northern Plains Sustainable Agriculture Society
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Einkorn

- Favored for adding excellent flavor to foods.
- Suitable for baked products, some good for bread.
- Higher lipid content than bread wheat (4.2 vs. 2.8 g/100g).
- Usually high in minerals although low in Cadmium.
- Usually higher in protein, lutein, and Vitamin E; Lower in total phenols.
- Has same allergenic proteins as other wheats but may be lower in some of the gliadins that cause responses in those with celiac disease: more research is needed.

Emmer

- Favored for adding excellent flavor to foods.
- Recommended for children and new mothers in Ethiopia and for diabetics in India.
- Gluten varies from very low to higher than bread wheat: bread making properties vary but are usually lower than bread wheat. Missing some gliadin proteins.
- Usually has higher minerals, higher fiber and lower glycemic index.
- Often has higher antioxidants (total phenolics and flavonoids) and protein. Not high in carotenoids.
- Often has higher phytic acid concentration.

Emmer

- The species is a known source of disease and pest resistance traits (common bunt, stem rust, leaf rust, powdery mildew, *Septoria Leaf Blotch*, Loose smut, Tan Spot, Russian wheat aphid, Hessian Fly)
- Asian and African types appear to be more drought tolerant
- Some varieties have shown tolerance to higher soil salinity
- Alternate source of dwarfing trait

Spelt

- Spelt has gluten and similar protein composition to bread wheat but reduced bread making quality.
- Higher lipid and unsaturated fatty acid content.
- Some minerals tend to be higher in spelt: Fe, Zn, Mg, P. This is especially true of the bran.
- Spelt has less phytic acid than bread wheat.
- Protein may be higher and fiber appears to be lower in spelt than in bread wheat.

Variation!

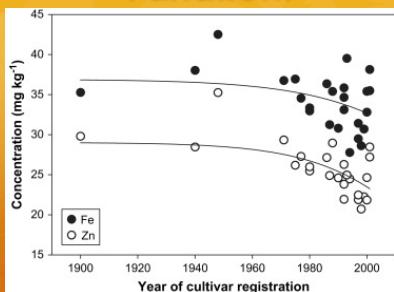


Fig. 1 in Zhao, F.J. et al. 2009. Variation in mineral micronutrient concentrations in grain of wheat lines of diverse origin. *J. Cereal Sci.* 49:290-295.

Suggested References

- Stallknecht, G.F., et al. 1996. Alternative wheat cereals as food grains: einkorn, emmer, spelt, kamut, and triticale. In J. Janick (ed.), *Progress in new crops*. ASHS Press, Alexandria VA.
- Zaharieva, M. et al. 2010. Cultivated emmer wheat (*Triticum dicoccum Schrank*), an old crop with a promising future: a review. *Genetic Resources and Crop Evolution* 57:937-962.
- Hussain, A., et al. 2010. Mineral composition of organically grown wheat genotypes: contribution to daily minerals intake. *Int. J. Environ. Res. Public Health* 7(9):3442-3456.
- Preedy, V.R., et al. (eds.). 2011. *Flour and breads and their fortification for health and disease prevention*. Academic Press. Burlington, MA.

Value-added grains for local and regional food systems

Marketing the “Ancient Grains” Einkorn, Emmer and Spelt



Greenmarket's mission is to support regional agriculture

- As researchers & farmers in the Northeast work to grow these grains and develop the grain processing infrastructure needed to deliver these grains to our local markets,
- We are working to build the market and educate consumers about these products and their potential uses.



Field Day, at Cornell research station, 2012

Einkorn, Emmer and Spelt

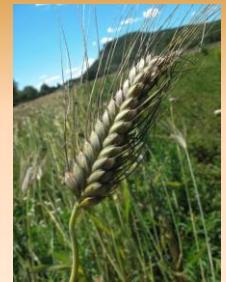
- Einkorn, emmer and spelt have a relatively low profile in the US, with spelt being the best known.
- These grains are more well known and utilized in Europe.
- Regions in Switzerland, France, Italy and the UK are growing emmer and einkorn.
- Spelt has been grown in Eastern Europe & the Mediterranean continuously, for millennia.



Einkorn bread, Zurich, Switzerland

Einkorn

- Einkorn, the “mother wheat”.
- There is a lot of interest in einkorn, as many people with celiac disease or who have sensitivity to gluten are finding that they are able to digest einkorn—
- It has excellent flavor!



the healthy HOME ECONOMIST

The 4 Reasons Why I'm Switching to Einkorn Wheat



I've been purchasing organic white wheat and spelt in bulk for many years to grind into fresh flour. My family fortunately does not have any wheat allergies or problems digesting grains provided they are traditionally prepared.

For those of you who do have wheat issues, you're encouraged to know that my husband used to have allergy and digestive issues with wheat when we first got married, but no longer does thanks to re-balancing the gut environment with traditional cooking, raw diets and a few months on the SADP.

The online community, including bloggers, social media users and the press talk about the benefits of ancient grains.

Slow Food Foundation for Biodiversity

Slow Food Presidia

Haute-Provence Einkorn

Consumed as a grain or used to make flour, pasta and even beer, the appreciation for this ancient cereal outside of France. The dark qualities of einkorn, its resistance to winter and drought, and the unique taste due to its higher yield and the fact it needed no processing. An einkorn has a very specific way of growing and a specific technique to that used for rice. For a dinner in no years now, einkorn is a grain that can be harvested in a single stalk, a sturdy plant that adapts to either dry climates and poor soils, it has a high protein content (12%) and a high fiber content (and magnesium). Haute-Provence Einkorn (in French)致力保护并传承Einkorn的历史和质量，这可以追溯到它的祖先。

Slow Food Presidia for Einkorn in Provence, France

Einkorn
Einkorn is very different from other varieties of wheat. It was the first species of wheat grown by man more than 12,000 years ago. Now considered a relic crop, it has practically been forgotten because its yield is low in the fields and its type of gluten makes bread baking a challenge.

We were determined to find the purest form of wheat to use in Jovial™ products. Our journey for purity led us further and farther back in time, at the way to the origins of agriculture. We overcome numerous difficulties of testing, retesting and harvesting Einkorn to once again bring this gift of nature back to life. We feel confident about the exceptional quality of Einkorn—pure, nutitious and surprisingly delicious.

We encourage you to read on and discover how amazing Einkorn really is.

Powerful free radical scavenger. Never hybridized. Genetically purest wheat. High in Thiamin. Rich in Lutein. High in Trace Minerals. High in Essential Dietary Minerals. Good source of Fiber.

Delicious Good source of Protein. Good source of B Vitamins.

Jovial, a grains retailer, provides information, recipes and news about Einkorn and Einkorn products

Emmer

- Emmer is often mislabeled as farro, Italian farro or spelt.
- Among others who caution against the impostors is Faith Willinger, an American who lives in Italy and researched farro while writing her book "Red, White and Greens" (HarperCollins, 1996). She discovered that the proper English definition of true farro is not spelt, but emmer, a word that is rarely used but is nonetheless correct. "Even Italians are confused," Ms. Willinger said in a recent telephone conversation from Florence. *From New York Times 1997 Farro, Italy's Rustic Staple: The Little Grain That Could*

WINTER EMMER.

USE OF INCORRECT NAMES FOR EMMER.

It is again necessary to protest strongly against the use of incorrect names for emmer, as writers are supposed to be well informed and responsible in writing their books. The name of the word thus wrongly used is "spelt," which does not even exist as a legitimate word in English. Spelt is a word that is derived from the German word "Spelt" which is spelled differently and which is translated "spelt" in English. Spelt, however, differs as much from emmer as pease differ from beans. This is clearly shown in the accompanying illustrations (figs. 1, 2, and 3). The third specimen (3) in figure 1 is Black Winter emmer.

USDA Brochure, 1911

Farro is Emmer

- We are trying to make a concerted effort to market emmer as emmer, or at the least as emmer(farro).
- For all intents and purposes emmer/farro are the same thing so any recipe calling for farro should use emmer(farro).
- Farro is a well known and beloved grain in Italian cuisine.
- It has been described as "Hearty and Robust", with a flavor once described as "more elegant than earnest".
- Emmer is great as a whole grain and when ground into flour, can be made into pasta and bread.
- There is a big potential market for emmer pasta.

Emmer bread is delicious, it tends to be more dense, as it has a lower gluten content than wheat.

BUY AMERICAN. EAT ITALIAN.

WE ARE PLEASED TO REPORT THAT CAYUGA PURE ORGANIC'S EINKORN AND SPLETTA® FLOURS ARE NOW AVAILABLE IN SELECT GROCERY STORES ACROSS THE COUNTRY.

Cayuga Pure Organic's Emmer, in Bon Appétite magazine.

LUCCAN EMMER (FARRO) SOUP

Recipe adapted from *Greenmarket Journal* by Mark Miller

Ingredients:

- 2 tablespoons extra virgin olive oil
- 1 large onion, finely chopped
- 2 cloves garlic, finely chopped
- 1/2 cup dried farro
- Salt and pepper
- 1/2 cup fresh basil leaves
- 1/2 cup crumbled feta cheese (or several handfuls of shredded Parmesan)
- 1/2 cup chopped flat-leaf parsley
- 1/2 cup chopped fresh mint, optional
- Freshly grated Parmesan

*Imports farro is available in a number of grocery stores. Greenmarket

Instructions:

- Pull out a large piece of parchment paper and spread it out. Add a small bowl of water and some olive oil, a large pinch of salt and some pepper. Cook until vegetables are plump and onions are softened. Add farro and cook for another 10 minutes.
- Bring to a boil then adjust heat so water continues to boil. Cook and remove from heat. Add basil, feta, mint, and parsley. Let stand for 5 minutes. Add mint and parsley. Stir in the farro. Taste and adjust seasoning. Then serve with lots of Parmesan!

Greenmarket Recipe Series, adapted from *Greenmarket Journal* by Mark Miller. © 2007 Greenmarket, Inc. All rights reserved. Reprinted with permission. No part of this publication may be reproduced without written consent from the publisher.

Zuppa di farro, a Classic Tuscan soup, should be renamed Zuppa di Emmer!

Spelt

- Spelt has had a long presence in New York and Pennsylvania.
- Available in health food stores & coops for many years.
- Sought out as a healthy alternative to white bread.
- Some people with gluten sensitivity find they can digest spelt.
- Spelt bread is very common.
- Spelt crackers and snacks are available.
- Artisan bakers are now working with spelt.



Romans, Brooklyn, NY

Bread Alone Bakery, Boiceville, NY

We ❤️ spelt breads.

Wide Awake Bakery, Trumansburg, NY

A note about “Ancient Grains” as a marketing term

- A survey of products shows that the ancient grains can include

Quinoa
Buckwheat
Amaranth



Also Teff, Millet, Sorghum and Kamut

The Washington Post | Politics | Opinion | Local | Sports | National | World | Business | Tech | Lifestyle | Entertainment | Auto | More

Health & Science

Ancient grains can help prevent cancer, heart disease and high blood pressure

By Consumer Unity of United States Inc., August 13, 2012

4 Signs of a Heart Attack

Right Before a Heart Attack Your Body Will Give You These 4 Signs

www.newsmax.com

Click to Watch Video Now

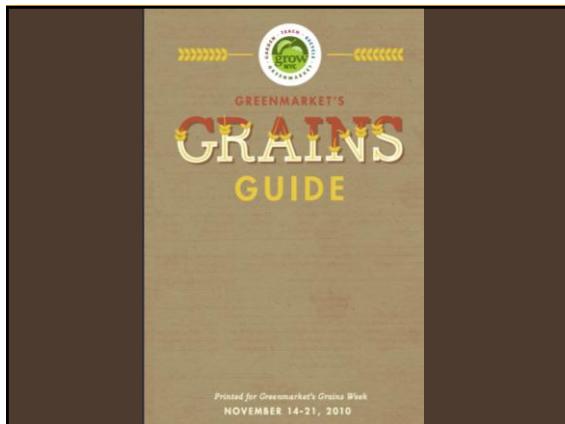
Working With Wheat
\$179.99
SHOP NOW

Several reasons consumers are seeking out these “Ancient Grains”

- Consumers are interested in:
 - nutritional value
 - impact on digestion & health
 - flavor
 - dollar value
- Consumers will pay more for items they believe have higher value.
- I.E. the market for gluten free, organic & nutrient dense foods is growing rapidly!

Einkorn, Emmer and Spelt

- Are NOT gluten free
- They DO have lower gluten than wheat
- Many people with gluten sensitivity ARE able to eat these grains, without digestive difficulties
- They DO have high protein content and many other nutritional benefits
- They are versatile as whole grains, and as flour
- They have great flavor!



BUCKWHEAT

Buckwheat is used as a hearty cover crop, which also provides grain for its grain. Buckwheat contains high quality protein, which is good for health. The seeds are a good source of lysine, B vitamins, magnesium and other vitamins. The whole grains are often toasted and sold as flour or whole grain flour. Buckwheat is also a whole grain (the buckwheat equivalent to a wheat berry). Buckwheat groats need to be boiled before being cooked whole, although one does not need to boil the grain when grinding it for flour. Buckwheat flour is used for pancakes, crepes, biscuits, and soba noodles. It is also gluten-free.

use BUCKWHEAT IN: Pancakes, Blinis, Soba Noodles, Cook it whole (Kasha)

CORN

Plint or dent corn is typically used for grinding. (Considered an ancient grain, most people are familiar with first corn on the cob.) Flint corn is also known as 'Indian' corn. Greenmarkets and grind yourself! Both flint and dent corn are rock hard inside, store well, contain high amounts of protein, and, when ground, used for industrial purposes and animal feed, can also be ground for a variety of products for cooking. Both can be ground very coarse to create polenta, ground fine for grits, even finer for cornmeal, and the flour can be used for breads, muffins, and more. Flint corn is used whole or ground into flour for baking. Flint corn is also safe for some gluten sensitive.

use CORN IN: Polenta, Grits, Biscuits, Cornbread

EMMER (FARRO)

Emmer, termed "farro" in Italy, is an ancient wheat that has been cultivated for over 10,000 years. It is also a very nutritious grain. It grows well without chemical inputs and can help reduce soil erosion. It is higher in protein than modern wheat. The emmer grown in New York State comes from Europe by way of North Dakota, where diverse types have been selected and grown since the late 19th century. In the late 19th century, Emmer is known for its distinctive, delicious flavor as a cooked grain. This flavor carries through when it is used to make pasta and flat breads as well.

use EMMER IN: Pasta, Flat breads, Cook it whole

EINKORN

Domesticated in ancient Mesopotamia in the Fertile Crescent, Einkorn is considered to be one of the "ancient" grains. Einkorn is higher in protein, trace minerals and essential amino acids than modern wheat. The grain may be cooked whole or ground into flour for baking. Einkorn is also safe for some gluten sensitive.

use EINKORN IN: Baking, Pancakes, Crackers

Greenmarket, OGRIN & NOFA-NY conduct consumer tastings to get the word out to bakers, chefs, processors & consumers

PASA Conference, 2012

NOFA-NY Conference, 2012

Through exposure, education and our own marketing and promotional efforts, we have seen tremendous growth in the usage of "local" grain and flour over the past three years in the press, in bakeries throughout NYC and the country

2011-New York Magazine touts bakeries using local flour

**A Shortcourse on Breadmaking
with Locally Grown Grains ***

Two sessions available:
Friday • January 18th • 8am - 5pm
Saturday • January 19th • 8am - 5pm

at WIDE AWAKE BAKERY • TRUMANSBURG, NY

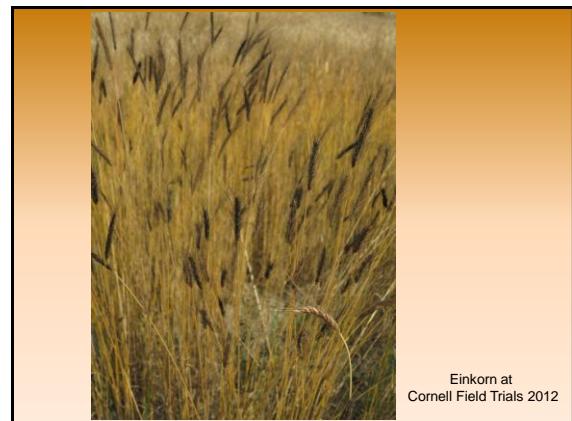
Comments from those invited to the first session have said that bread made from whole grains and milled in the Northeast, because flour made from locally grown grain is not the same as commercial flour. That there can be a learning curve in working with this unique product. Any bakers looking for a challenge will find it here. The course will include a brief history of breadmaking and the use of whole grains and milled wheat. Stellar and David will share insights and techniques that stem from their work with the Greenmarket and the NOFA-NY. The course will include a tour of the mill, a demonstration of the stone mill, a discussion of the use of whole grain flours, and a hands-on session baking with the six local grain varieties, emmer, and spelt (led by Jane Russell of Greenmarket) to create four loaves of bread. Participants will receive a copy of the book "Bread: A Baker's Book of Techniques and Recipes" by Peter Reinhart, and a signed copy of "The Bread Baker's Apprentice" by Peter Reinhart will be awarded. Plus, Stellar and David will share their experiences with their community-supported grain mill.

This course is for urban bakers, home bakers, students, farmers... all those interested in experimenting with locally grown grain. Space is limited. We have room for 12 participants per session. Cost for the course is \$150 per person. Payment is due at time of registration. The course will be taught in a classroom made from locally grown wheat and ancient grain. Limited number of scholarships are available for students and individuals who are members of the Greenmarket and the NOFA-NY.

To apply for a scholarship, which will pay half the tuition cost, students and farmers should write a paragraph explaining why they would like to attend the course and how it would benefit them with future goals and send to scholarship@grün.org. OGRIN, 112 Cooper St, Brooklyn, NY.

Wide Awake Bakery is located at 4801 Black Hill Road South, Trumansburg, NY 14886, about 10 miles west of Ithaca, NY. You can learn more about the bakery at wideawakebakery.com.

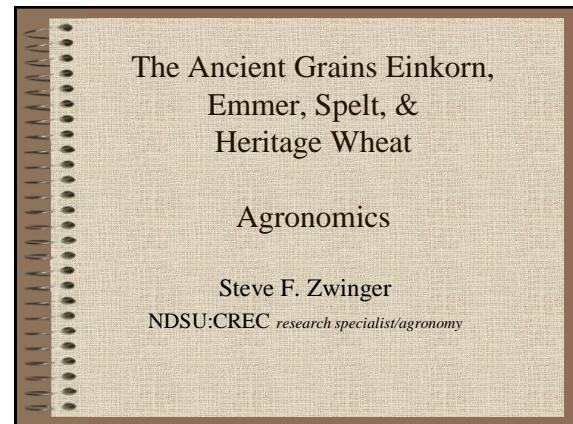
Shortcourse offered by
Greenmarket
and OGRIN, including
emmer, einkorn and spelt





Greenmarket, GrowNYC 2013
www.grownyc.org

For more information, contact
 June Russell
jrussell@greenmarket.grownyc.org
 212.341.2320



The Ancient Grains Einkorn,
 Emmer, Spelt, &
 Heritage Wheat

Agronomics

Steve F. Zwinger
 NDSU:CREC *research specialist/agronomy*



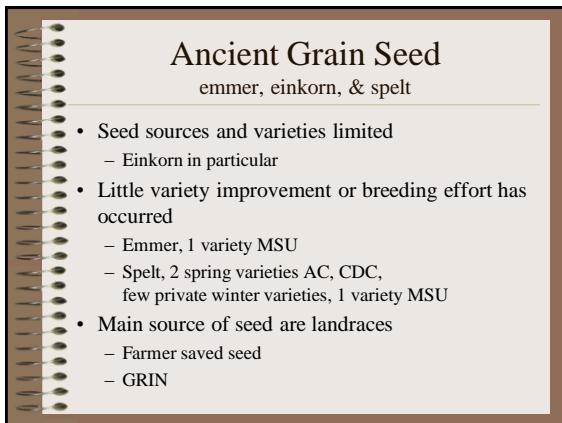
Agronomic Research Team
 P.I.- Mark Sorrells -Cornell University

- David Benschoter, Julie Dawson
 - Cornell University
- Mike Davis
 - Cornell Baker Research Farm
- Greg Roth
 - Penn State University
- Elizabeth Dyck
 - Organic Growers Research and Information-Sharing Network
- Steve Zwinger
 - North Dakota State University:Carrington



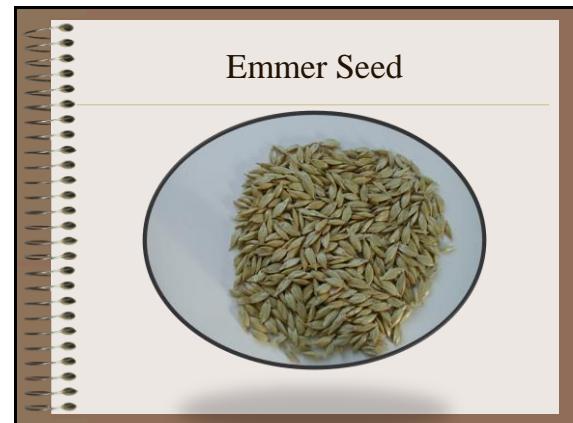
Ancient &
 Heritage wheat

- Ancient wheat
 - Thrashes with hull intact
 - Einkorn, emmer, and spelt = order of appearance
 - Winter or spring types, mainly spring
 - 5000-12,000 years old
- Heritage wheat
 - Free threshing
 - Winter or spring types
 - Modern varieties, can be from 30-150 years old
 - Pre 1950's may be most common definition
- Limited supply of seed for all types



Ancient Grain Seed
 emmer, einkorn, & spelt

- Seed sources and varieties limited
 - Einkorn in particular
- Little variety improvement or breeding effort has occurred
 - Emmer, 1 variety MSU
 - Spelt, 2 spring varieties AC, CDC, few private winter varieties, 1 variety MSU
- Main source of seed are landraces
 - Farmer saved seed
 - GRIN



Emmer Seed



Ancient Grain Agronomics

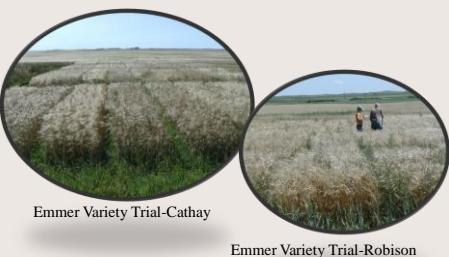
What we know

- Production practices & management recommendations similar to wheat
 - Yields (in hull) similar to wheat
 - Plant lodging can be an issue
 - Pest problems
 - Weed, disease, & insect
 - Management
 - Seeding date
 - Planting rate
 - Fertility

Objective 1: Germplasm

- Evaluate germplasm of ancient, heritage, and modern wheat
 - All research sites and multiple on-farm sites
 - Variety trials, observation screening, seed increase
 - Multiple sources of seed
 - Initially started with 224 vt's and landraces
 - National Small Grains Collection (GRIN), organic seedsman and farming groups, universities, state seed foundations, farmers
 - Additional lines being accessed throughout project
 - Over 500 lines to date

Emmer Variety Trials



Objective 1: Germplasm

- Adaptability to organic systems
 - Yield, maturity, pest resistance, vigor, height, lodging
- Desirable grain and baking characteristics
 - Hulling, protein, test weight, quality
- Select and increase lines that fit criteria
 - Research trials
 - Field scale production

Einkorn & Emmer Seed Increases

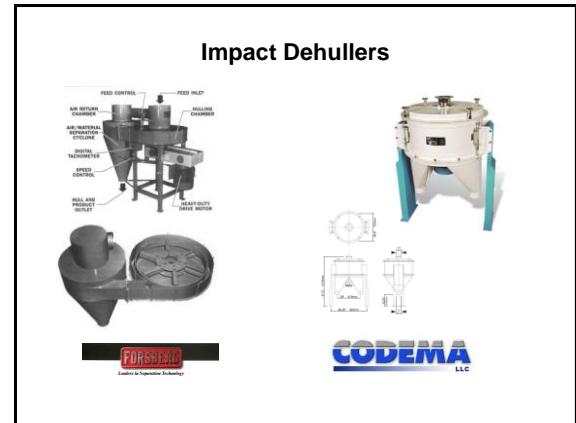
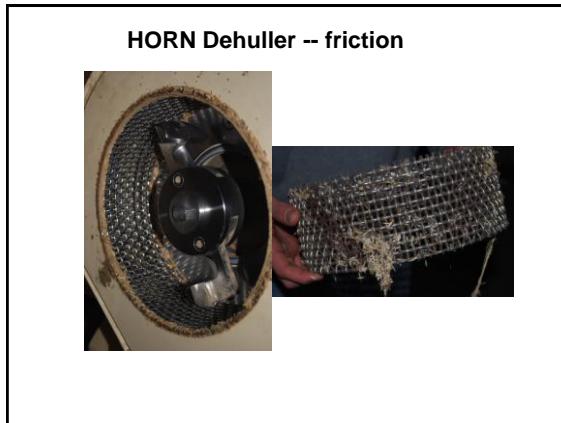
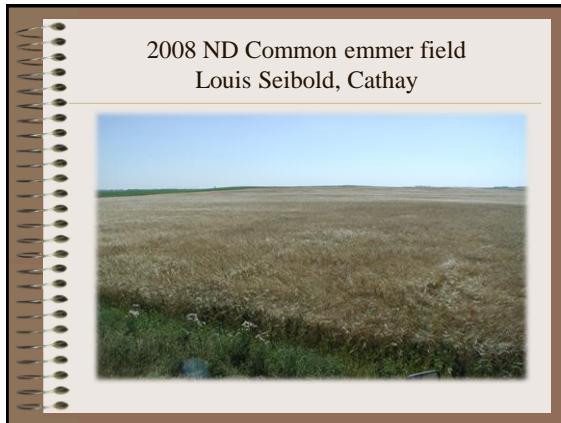


Objective 2: Management

- Develop management recommendations for heritage wheat, emmer and einkorn
 - N fertility management
 - Heritage winter wheat and emmer
 - Planting date
 - Heritage winter wheat, emmer, & einkorn
 - Planting rate
 - Heritage winter wheat, emmer & einkorn
- Trials conducted at research sites and on-farm



ND Common-Emmer Farmer-Led Development/Increase		
2002,2003,2004	.0025 ac each year (1/4 lb)	1 farm, small plot increase (3.5 lbs)
2005	.1 ac (10lbs)	2 farms, strip increase (140lbs)
2006	2 ac (140 lbs)	1 grower (1400 lbs)
2007	18 ac (1400 lbs)	1 grower (16,000 lbs)
2008	144 ac	2 growers (1975 lbs/ac avg)



Dehuller design project



- De-hull emmer and einkorn
- Process at least 120 kg/hr
- Operate with minimal supervision
- Minimal maintenance and adjustment during operation
- Adjustable for variability in grain size (dependent on growing conditions)
- Cost less than \$10K.

Take home points

- The ancient wheats represent different species and subspecies which have great genetic diversity for important traits.
- While there are overall differences among species in nutrition and baking quality, the qualities of any one variety from among these species cannot be determined without testing
- Seed evaluation & increase of adapted lines along with cultivar development needed for future crop expansion.
- Management practices need to be refined.
- Affordable small scale dehulling capacity remains an issue in producing ancient grains and new options are still in the R&D stages.

For more information on ancient grains and the Value-Added Grain Project

- Websites
 - www.orgrin.org
 - www.grownyc.org/greenmarket/topics/regionalgrain
 - www.ag.ndsu.edu/CarringtonREC/agronomy-1/copy_of_crop-index

Find all upcoming webinars and archived eOrganic webinars at <http://www.extension.org/pages/25242>

Find the slides as a pdf handout and the recording at <http://www.extension.org/pages/66321>

Additional questions about organic farming?
<https://ask.extension.org/groups/1668>

We need your feedback! Please fill out our follow-up email survey!

