

## 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](http://www.extension.org/organic_production)



## Value-Added Grains for Local and Regional Food Systems:

### Project Overview

## 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 Objectives – Add Value

- Evaluate germplasm of wheat varieties with potentially high market value for adaptability to organic systems and for desirable characteristics
- Develop management recommendations for heritage wheat, emmer, and einkorn
- Optimize grain quality through cost-effective and appropriate management
- Document a variety of approaches to dehulling and milling to provide processing options
- Investigate multiple strategies to access local and regional markets

## 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 Funciello: 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*)

Einkorn

## 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  
fkutka@npsas.org

ORGANIC EMMER VARIETY TRIAL

## 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!

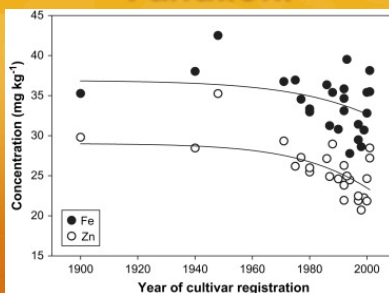



Fig. 1 in Zhao, F.J., et al. 2009. Variation in mineral micronutrient concentrations in grain of wheat lines of diverse origin. *J. Cereal Sci.* 49:290-295.

## Suggested References

- Stalknecht, 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 dicoccon* 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

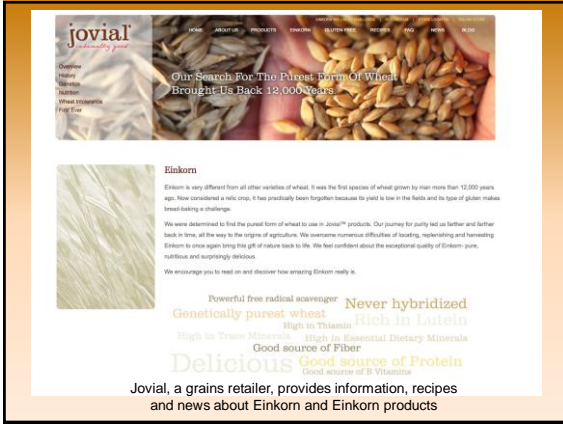
- Einkorn, the "mother wheat".
- There is a lot of interest in einkorn, as many people with celiac disease or who have sensitivity to gluten are finding that they are able to digest einkorn—
- It has excellent flavor!




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



Slow Food Presidia for Einkorn in Provence, France



**jovial**  
Organic Specialty Grains

Our Search For The Purest Form Of Wheat Brought Us Back 12,000 Years

**Einkorn**  
Einkorn is very different from all 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 field and its type of gluten makes bread-making a challenge.

We were determined to find the purest form of wheat to use in Jovial™ products. Our journey for purity led us farther and farther back in time, all the way to the origins of agriculture. We overcame numerous difficulties of locating, reproducing and harvesting Einkorn to once again bring the gift of nature back to life. We feel confident about the exceptional quality of Einkorn's taste, texture and nutritional benefits.

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

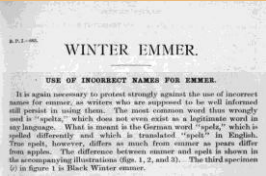
- Powerful free radical scavenger
- Genetically purest wheat!
- High in Trace Minerals
- Delicious

- Never hybridized
- High in Tannin
- High in Lactin
- Good source of Fiber
- 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*



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 Pasta



Sprouted Emmer

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



BUY AMERICAN. EAT ITALIAN.

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

### Greenmarket Recipe Series

#### LUCCAN EMMER (FARRO) SOUP

8 1/2 cups Adapted from Sweet's Harvesting to Cook Emmer


Serves 4

**Ingredients:**

- 2 1/2 cups organic extra virgin olive oil
- 1 large onion, sliced
- 1/2 cup dry milk, soaked and drained
- 1/2 cup onion, peeled and chopped
- Salt and pepper
- 2 cups greenmarket garbanzo beans
- 2 cups dried organic farro, washed for several hours to remove hulls
- 8 cups chopped Italian Chard or any other leafy greens
- 2 cups dried organic mushrooms
- 1 cup chopped fresh parsley
- 1/2 cup chopped fresh basil, optional
- 1/2 cup dried organic farro, optional

**Directions:**

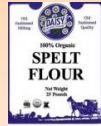
- Heat oil in large deep stock pot on medium heat. Add onion and cook until soft. Add onion, milk, and garlic. Cook until softened and golden and onion is softened. Stir in onion, milk, and garlic. Cook until softened and golden and onion is softened.
- Bring to a boil. Then add farro. Add mushrooms, chard, and milk. Cover and simmer for 45 minutes. Stir in greenmarket farro (if using). Then cook another 15 minutes. Taste and adjust seasoning. Serve immediately.



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



Wide Awake Bakery, Trumansburg, NY

We ♥ spelt breads.

## 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 | Home | News | Politics | Opinions | Local | Sports | National | World | Business | Tech | Lifestyle | Entertainment | Jobs | More

### Health & Science

**The Uncensored True Story: See How Dr. Pimplseur's Discovery Tricks Your Brain to Start Speaking a Language in 10 Days** [Click to Watch Video Now](#)

Home » Collections

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

By Cholesterol Chicks of United States Inc, August 13, 2012

**Quin.** What are amaranth, emmer and 100% No. They're not celebrity baby names. Along with millet, quinoa and rice, they're part of a class of food commonly referred to as ancient grains. Although they represent some of the oldest diets consumed by humans, for many Americans they're a new way to eat.

While many are true cereal grains, several, such as amaranth, buckwheat and quinoa, actually originate from broadleaf plants, but they offer the same health benefits, such as helping to prevent cancer, heart disease and high blood pressure. And when eaten as a whole grain, most are high in fiber.

According to the U.S. Department of Agriculture's dietary guidelines, at least half of all grains eaten each day should be whole. That is, from ground, cracked or flaked. Most of us limit our grains to barley, corn, oats, rice and wheat, but you can add variety to your diet by including some ancient grains. And doing so could make it easier to eat the recommended three ounces of whole grains daily. Additionally, several varieties are sources of high-quality protein.

Here are eight of the more widely

**4 Signs of a Heart Attack**  
Right Before a Heart Attack Your Body Will Give You These 4 Signs  
[www.heart.com](#)

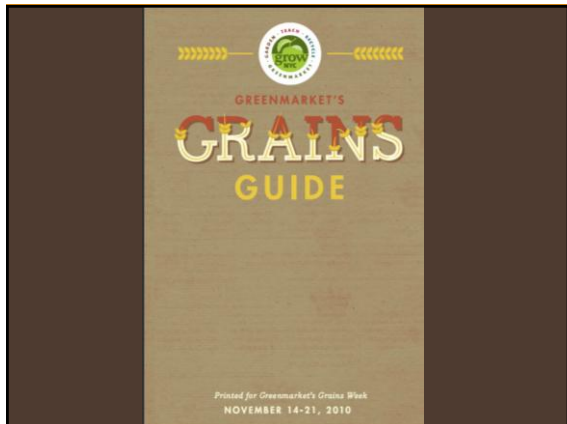
**Organic Essentials**  
Working With Wheat Grains  
\$179.99  
[SHOP NOW](#)

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 heavy cover crop, which can also be harvested for its grain. Buckwheat contains high-quality proteins, which include all the amino acids. The seeds are a good source of iron, B vitamins, magnesium and other vitamins. The whole grains are often toasted and sold as Kasha. Also called a buckwheat seed, a groat is the 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 groat when grinding it for flour. Buckwheat flour can be used to make pancakes, crepes, blinis, and soba noodles. It is also gluten-free.

== EASY! ==

Pancakes, Blinis, Soba Noodles, Cook it whole (Kasha)

**EMMER (FARRO)**

Emmer, termed "farro" in Italy, is an ancient wheat that has been cultivated for over 20,000 years. It is also a very nutritious grain—it grows well without chemical inputs and can better tolerate stressful growing conditions than modern wheat. The emmer grown in New York State comes from Europe, by way of North Dakota, where diverse types brought by German immigrants have been grown since 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.

== EASY! ==

Pasta, Flat Bread, Cook it whole

**CORN**

Flint or dent corn is typically used for grinding. (Considered an ancient grain, most people are familiar with flint corn as decorative Indian corn, which you can find at many Greenmarkets and grind yourself!). Both flint and dent corn are rock hard meals, more so, contain high amounts of protein, and, while widely used for industrial purposes and animal feed, can also be ground into a variety of products for cooking. Both can be ground very coarse to create polenta, ground flour for grits, even flour for cornmeal, and the finest for corn flour. Freshly ground corn will oxidize and turn rancid and is best used fresh or stored in the freezer. Flint corn is also used to make bourbon.

== CORN ==

Polenta, Grits, Bourbon, Cornbread

**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 any other wheat. The grain may be cooked whole or ground into flour for baking. Einkorn is also safe for some gluten restrictions.

== LINKEN ==

Baking, Pancakes, Oatmeal

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 18<sup>th</sup> - 6am - 5pm  
Saturday - January 19<sup>th</sup> - 8am - 5pm

at **WIDE AWAKE BAKERY • TRUMANSBURG, NY**

Overcome your bread-baking fears and discover the countless flavors and textures of locally made breads from wheat, rye, and spelt. This course is a hands-on, intensive, and fun way to learn the art of breadmaking. You will learn the secrets of breadmaking from the farm to the bakery, including the science of breadmaking, the art of fermentation, and the art of baking. You will also learn about the history and culture of breadmaking, and how to choose the best grains for your bread. This course is a great way to learn about the local food system and to support local farmers. The course is limited to 12 participants per session. Cost for the course is \$100, which includes bread and lunch, a handbook on bread-making, and samples of flour made from locally grown wheat and ancient grains. A limited number of scholarships are available to students and for farmers who are interested in developing on-farm bakeries.

For more information, contact Elizabeth Deak at OGRIN (oak@ogrin.org, 607-897-6071). To register for a shortcourse, please fill out the registration card attached to this flyer and email it to: oagr@ogrin.org or OGRIN, 1114 County St., Northburgh, NY.

Wide Awake Bakery is located at 3101 South 10th Street, Trumansburg, NY 14886, about 40 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

Einkorn at Cornell Field Trials 2012



## Greenmarket, GrowNYC 2013

[www.grownyc.org](http://www.grownyc.org)

For more information, contact  
June Russell  
[russell@greenmarket.grownyc.org](mailto:russell@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 Benschler, 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
  - Threshes 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



Emmer Variety Trial-Cathay

Emmer Variety Trial-Robison

## 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

### Emmer seeding rate



### 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)

2008 ND Common emmer field  
Louis Seibold, Cathay



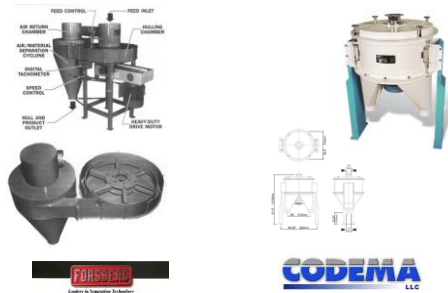
Thank You!



### HORN Dehuller -- friction



### Impact Dehullers



### 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.ogrin.org](http://www.ogrin.org)
  - [www.grownc.org/greenmarket/topics/regionalgrain](http://www.grownc.org/greenmarket/topics/regionalgrain)
  - [www.ag.ndsu.edu/CarringtonREC/agronomy-1/copy\\_of\\_crop-index](http://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!

