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

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
- 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
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. dicoccon)
- 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)

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
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, Russian 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
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.

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
• 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.
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.

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

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

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

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

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

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

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
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 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
  - 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 thrashing
  - 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
  - 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

- Cathay
- 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

<table>
<thead>
<tr>
<th>Year</th>
<th>Seed Rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-2004</td>
<td>.0025 ac</td>
<td>1 farm, small plot increase (3.5 lbs)</td>
</tr>
<tr>
<td>2005</td>
<td>.1 ac</td>
<td>2 farms, strip increase (140 lbs)</td>
</tr>
<tr>
<td>2006</td>
<td>2 ac</td>
<td>1 grower (1400 lbs)</td>
</tr>
<tr>
<td>2007</td>
<td>18 ac</td>
<td>1 grower (16,000 lbs)</td>
</tr>
<tr>
<td>2008</td>
<td>144 ac</td>
<td>2 growers (1975 lbs/ac avg)</td>
</tr>
</tbody>
</table>

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
  - 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!