

## Welcome to the webinar!

- The webinar will start at the top of the hour.
- Find a handout of the slides at <http://www.extension.org/pages/72265>
- To type in a question, use the question box on your control panel. We will read the questions aloud after the c. 45 minute presentation.
- The webinar is being recorded and you can find it in our archive in the coming week at <http://www.extension.org/pages/25242>



## Heritage and Ancient Wheat: Varietal Performance and Management

Steve Zwinger, NDSU  
Michael Davis, Cornell University

January 27, 2015





Michael Davis



Steve Zwinger

## **Heritage and Ancient Wheat: Varietal Performance and Management**



Michael Davis and Steve Zwinger



## Outline

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- The Value-Added Grains Project
- Heritage wheat varieties: Performance and characteristics
- Managing heritage wheat varieties
  - Planting rates
  - N fertility management
- Emmer, einkorn, and spelt variety performance
- Managing ancient wheats
  - Seeding rate
  - Planting date



## Value-added grains for local and regional food systems project

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- Funded by USDA Organic Research and Education Initiative (OREI)
- Goal: To increase organic, food-grade, small grain production through
  - adding value through local, organic production
  - adding value through processing, on or off the farm
  - **a focus on crops with high-value**
    - Heritage wheat varieties
    - Ancient grains: emmer, einkorn, spelt, Khorasan wheat

## Value-added grains for local and regional food systems project team

### Universities

Cornell  
North Dakota State  
Penn State  
Oregon State  
Greenmarket/GrowNY  
Organic Growers' Research  
and Information-Sharing  
Network (OGRIN)

### Farmer organizations

Northeast Organic Farming  
Association of NY (NOFA-  
NY)  
Pennsylvania Association for  
Sustainable Agriculture  
(PASA)  
Northern Plains Sustainable  
Agriculture Society  
(NPSAS)



## Advisory committee: Farmers, processors, bakers, chefs

Michael Anthony, Gramercy Tavern,  
New York, NY  
Troy DeSmet, Nature's Organic Grist, St.  
Croix Falls, WI  
Matt Funicello, Rockhill Bakehouse, Glens  
Falls, NY  
Patricia Jackson, chef, New York, NY  
Kit and Cathy Kelley, White Frost Farm,  
Washingtonville, PA  
Klaas Martens, Lakeview Organic Grain,  
Penn Yan, NY  
Thor Oechsner, Oechsner Farms, Newfield,  
NY  
Blaine Schmaltz, Blaine's Best Seeds, Rugby,  
ND

Sam Sherman, Champlain Valley Milling,  
Westport, NY  
Luke Stodola, Small World Bakery, Rochester,  
NY  
Gil Stallknecht, Montana State  
University (emeritus), Lewistown, MT  
Joel, Elaine & Eric Steigman, Small Valley  
Milling, Halifax, PA  
Roberta Strickler, grains marketing,  
Lancaster, PA  
Nigel Tudor, Weatherbury Farm, Avella, PA



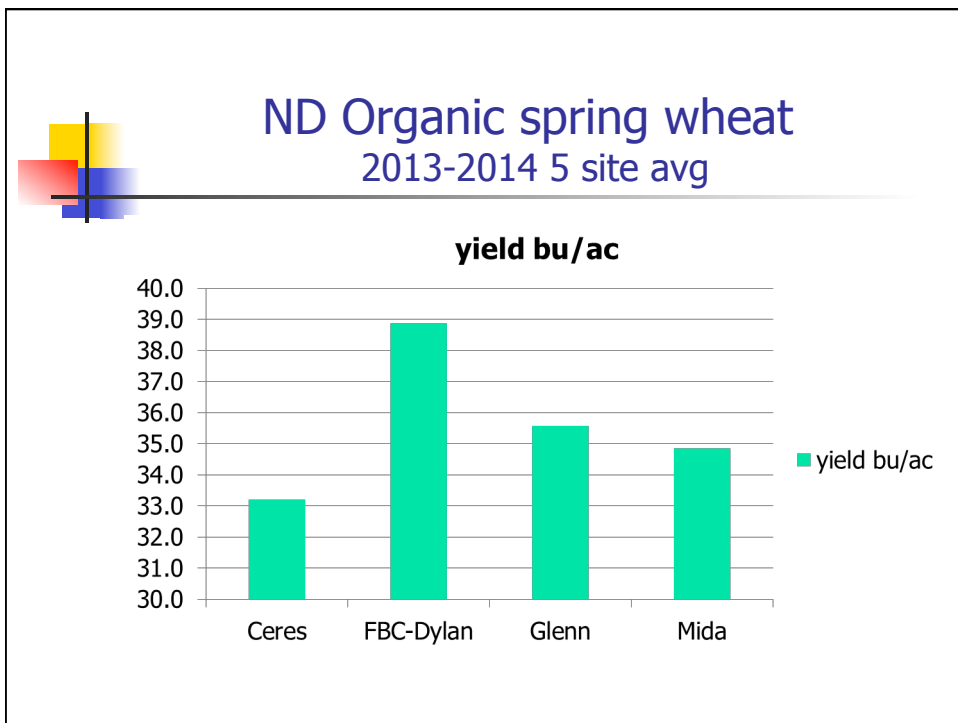


## What are heritage wheat varieties?

- Breeders
  - Varieties that existed or were developed before the use of dwarfing genes by breeders, roughly pre-1950s.
- Consumers
  - Pre WWII varieties (as in heirloom vegetable varieties); the older the variety, often the more “cachet”

### Heritage wheat pre 1950's

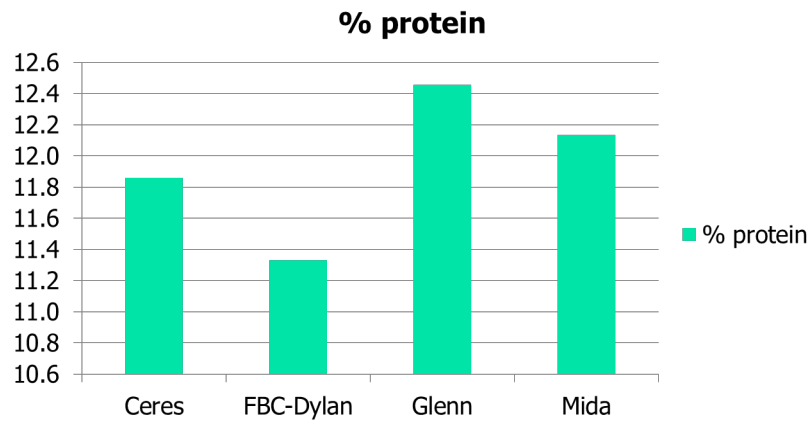






## ND Organic spring wheat % protein

2013-2014 5 site avg.



## Red Fife





## Red Fife

- First grown in North America in the early 1840s
- Reintroduced into production by Canadian growers over the last 20 years
- Famous hard red spring wheat known for good agronomic traits, high protein, good baking quality
- Facultative wheat—in certain areas of the Northeast may be planted in spring or fall



**Hard red winter wheat trial,  
White Frost Farm, PA\* 2010**

Variety	Yield (bu/A)	Tiller height (in)	Protein (%)	Falling Number (seconds)
AC Morley	41a	37a	10.7c	305c
Warthog	43a	32a	11.8b	385a
Red Fife	31a	40a	13.1a	342b



**Testweight and yield of selected hard red winter wheat  
varieties, three sites, 2012-2013**

Variety	Testweight (lb/bu)	Yield (bu/A)
<b>Red Fife</b>	<b>58.6</b>	<b>29.0</b>
<b>Warthog</b>	<b>59.9</b>	<b>48.7</b>
<b>Redeemer</b>	<b>59.4</b>	<b>41.5</b>

Full results at <http://plbrgen.cals.cornell.edu/research-extension/small-grains/cultivar-testing>

<b>Testweight, yield &amp; grain protein of selected hard spring wheat varieties, three sites, 2012-2013</b>			
Variety	Testweight (lb/bu)	Yield (bu/A)	Whole Grain Protein*
<b>Red Fife</b>	<b>55.0</b>	<b>31.9</b>	<b>14.9</b>
Glenn	59.3	41.4	14.7
Tom	58.4	44.6	14.1
*Freeville Site only; 12% moisture Full results at <a href="http://plbrgen.cals.cornell.edu/research-extension/small-grains/cultivar-testing">http://plbrgen.cals.cornell.edu/research-extension/small-grains/cultivar-testing</a>			

<b>Testweight and yield of selected soft winter wheat varieties, three sites, 2012-2013</b>		
Variety	Testweight (lb/bu)	Yield (bu/A)
<b>Fulcaster</b>	<b>58.9</b>	<b>42.3</b>
<b>Gold Coin</b>	<b>57.7</b>	<b>40.8</b>
<b>Pride of Genesee</b>	<b>60.6</b>	<b>40.5</b>
<b>Forward</b>	<b>58.6</b>	<b>46.2</b>
<b>Honor</b>	<b>57.3</b>	<b>42.1</b>
<b>Fredrick</b>	<b>58.3</b>	<b>43.7</b>
Full results at <a href="http://plbrgen.cals.cornell.edu/research-extension/small-grains/cultivar-testing">http://plbrgen.cals.cornell.edu/research-extension/small-grains/cultivar-testing</a>		

Grain protein content of selected winter wheat varieties	
Variety	Protein*
<b>Fulcaster</b>	<b>10.3</b>
<b>Gold Coin</b>	<b>11.2</b>
<b>Pride of Genesee</b>	<b>11.7</b>
<b>Genesee Giant</b>	<b>11.3</b>
<b>Honor</b>	<b>11.0</b>
<b>Fredrick</b>	<b>9.5</b>
<b>Warthog</b>	<b>9.2</b>
*at 12% moisture	

### Heritage variety wheat performance

- May yield less than modern wheat varieties
- Can have as high or higher grain quality than modern varieties
- Database of agronomic , grain quality, and sensory characteristics of selected varieties available by project end



## Management Trials

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- What are the best agronomic practices for heritage wheat varieties?
- How do they compare to the best agronomic practices for modern wheat?



## Seeding Rate Trials

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- Optimal seeding rates for heritage varieties are thought to be much lower than for modern varieties.
- Heritage varieties are generally taller, and thought to be more competitive (with weeds and with each other), via increased tillering and more aggressive foraging for soil resources.
- 2 locations: Willsboro, NY and Rock Springs, PA



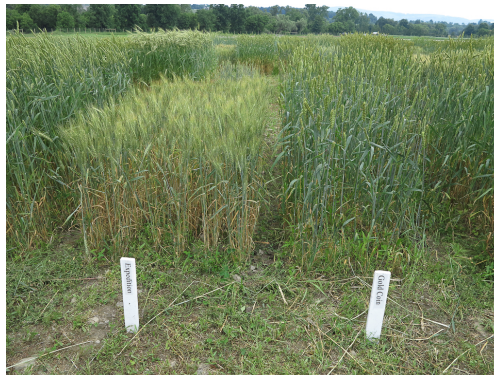
## Seeding Rate Trials - 4 rates

1. 60 lbs/a
2. 90 lbs/a
3. 120 lbs/a
4. 150 lbs/a



## Seeding Rate Trials – 5 varieties

- Fulcaster (SRW)
- Gold Coin (SWW)
- Pride of Genesee (SWW)
- Honor (SWW)
- Warthog (HRW)



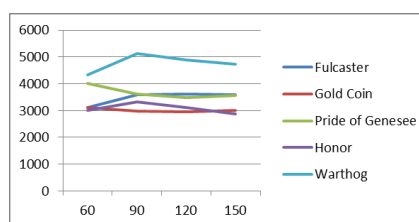
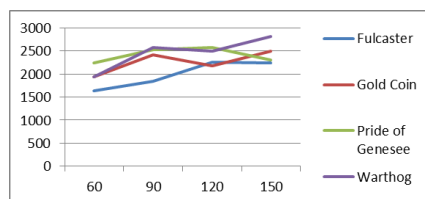
## Plot Evaluations

- Yield
- Test weight
- Lodging
- Plant Height
- Heading Date
- Percent moisture at harvest
- Leaf disease (*Stagonospora*) occurrence
- Head scab incidence and severity
- Tillering and tiller survival
- Weed pressure

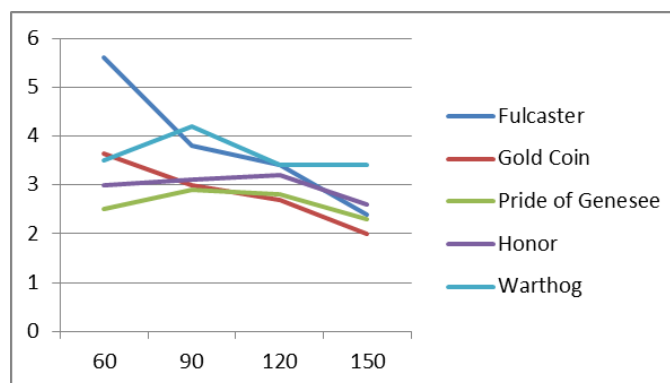
## Seeding Rate Statistics

Site - Year	YIELD	TEST WT	LODGING	HEIGHT
PA 2013	ns	ns	ns	ns
PA 2014	0.003	ns	ns	ns
WB 2013	ns	ns	ns	ns
WB 2014	ns	ns	ns	ns

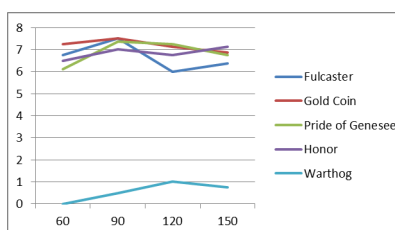
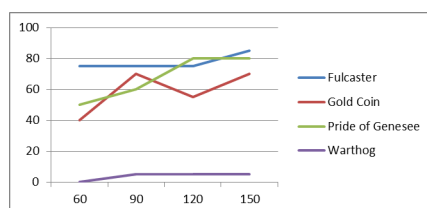
## 2014 Seeding Rate Yields in PA and NY



## 2014 Percent Tiller Increase with Seeding Rate (NY)



## 2014 Seeding Rate Lodging in PA & NY



## Seeding Rate Conclusions

- Heritage and Modern winter wheat varieties have a tremendous capacity to compensate for differences in plant population.
- The standard/traditional planting rate recommendations are solid.
- 65-70 lbs/acre for heritage varieties
- 120 lbs/acre for modern varieties
- Increase the seeding rate if planting late.



## Fertility Management

- What are the optimal fertilization strategies for heritage wheats?
- How do the fertility requirements for heritage varieties compare to modern varieties?
- 2 locations: Willsboro, NY and Rock Springs, PA
- 2 years of data: 2013 and 2014
- Krehers 5-4-3 pelletized chicken manure/compost

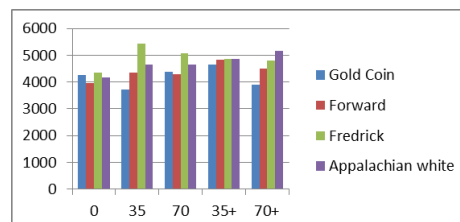
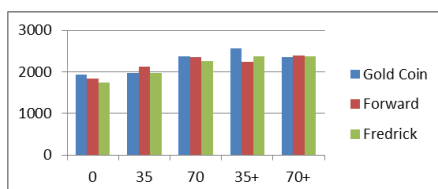
### 5 Fertilizer Treatments

1. 0 = no fertilizer added
2. 35 = 35 lbs N/acre applied prior to planting
3. 70 = 70 lbs N/acre applied prior to planting
4. 35+ = 35 lbs N/acre fall + 35 lbs N/acre spring
5. 70+ = 70 lbs N/acre fall + 35 lbs N/acre spring

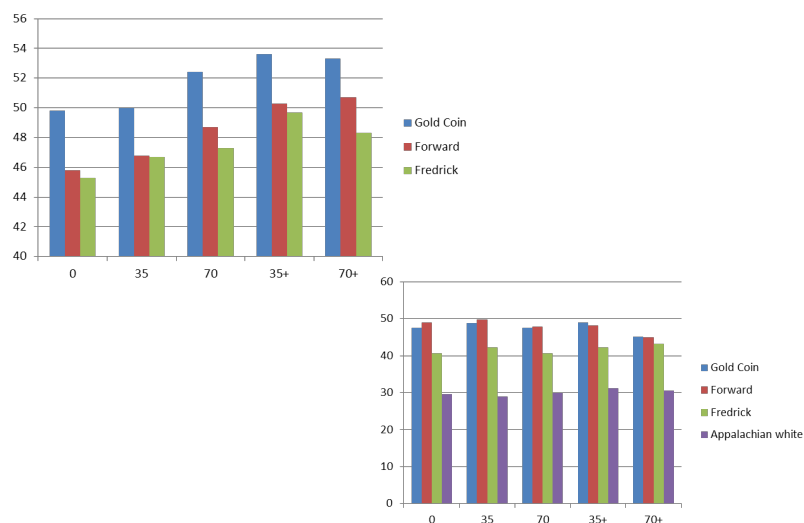
## Fertility Trials – 4 varieties

- Gold Coin – Heritage soft white winter wheat
- Forward – Heritage soft red winter wheat
- Fredrick – Modern soft white winter wheat
- Appalachian White – Modern hard white winter wheat

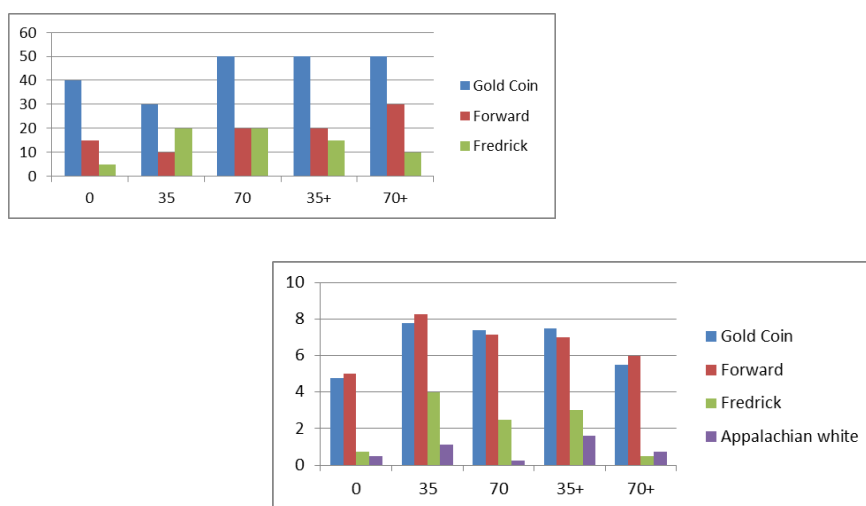
## Fertility Trial 2014 Yields (bu/acre) PA & NY



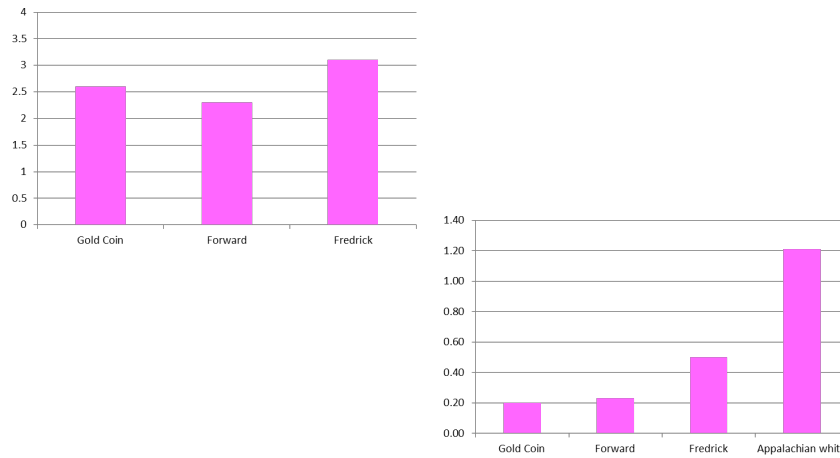
## 2014 Fertility Trial Plant Heights PA & NY



## 2014 Fertility Trial Lodging PA & NY

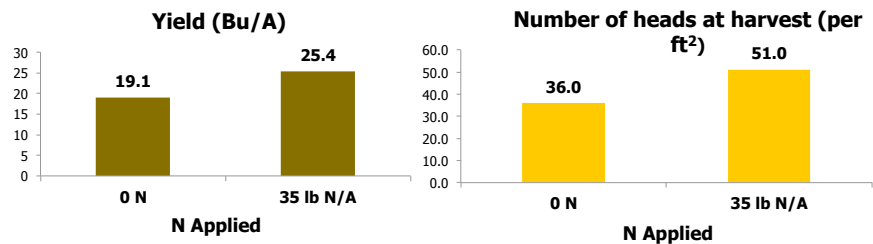


## 2014 Fertility Trial Scab Scores PA & NY



## N Fertility Trial, White Frost Farm, PA 2014

- Fall-planted Red Fife
- N (composted chicken manure) applied at spring green up







## Fertility Trial Conclusions

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- Fertility requirements for heritage and modern wheat varieties will vary depending on the soil type and cropping history/rotation.
- In lower fertility soils, both heritage and modern varieties can benefit from N additions.
- Heritage lines tend to be taller and may be more susceptible to lodging with N applications.
- A plowed down sod on a fertile soil can provide sufficient fertility to optimize winter wheat yields.

## *North Dakota Ancient Grains Variety Performance and Production Update*

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*Steve Zwinger  
NDSU: Carrington Research  
Extension Center*

## 2013 Central North Dakota organic spring grain yield



location	wheat	emmer	einkorn	spelt
	bu (lbs)/ac	lbs/ac	lbs/ac	lbs/ac
Carrington	38 (2280)	3084	3363	3084
Robinson	39 (2340)	2537	2440	2835
Cathay	22 (1320)	1584	1909	1996



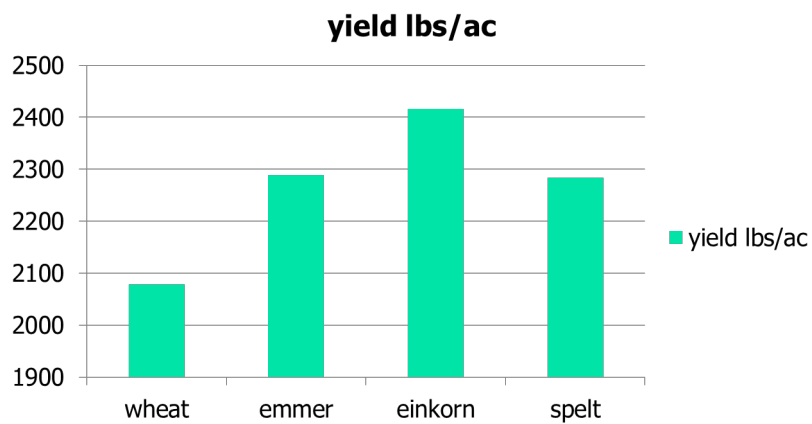
## 2014 Central ND organic spring grain yields

trial means -lbs/ac-

location	wheat	emmer	einkorn	spelt
	bu/ac lbs/ac			
Carrington	56 (3342)	2874	3094	2772
Robinson	23 (1350)	1713	1506	903
Cathay	31 (1836)	1944	2183	2115

## 2013 & 2014 Central ND

organic spring grain yields  
trial means- 6 site average



## Variety Selection

- One of the most important decisions to make in a farming operation.
- Selection & choice of variety will have a large impact on performance & return and is one of the easiest decisions to make based off sound data conducted in the environment of intended use.





## Khorasan wheat

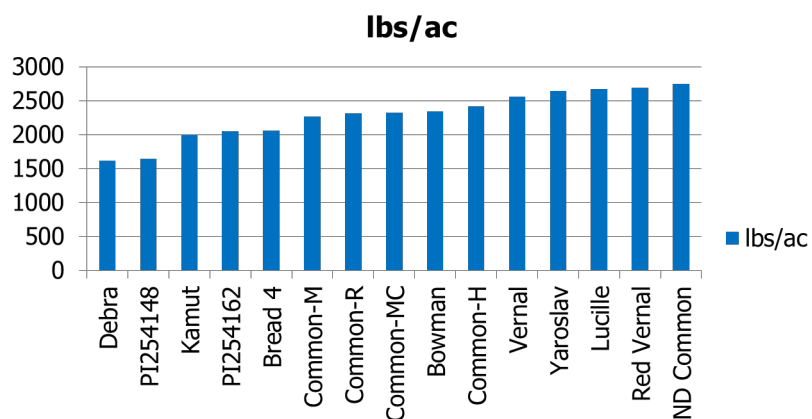
### Kamut = brand name



## ND Emmer variety performance

### 2013-2014 yields

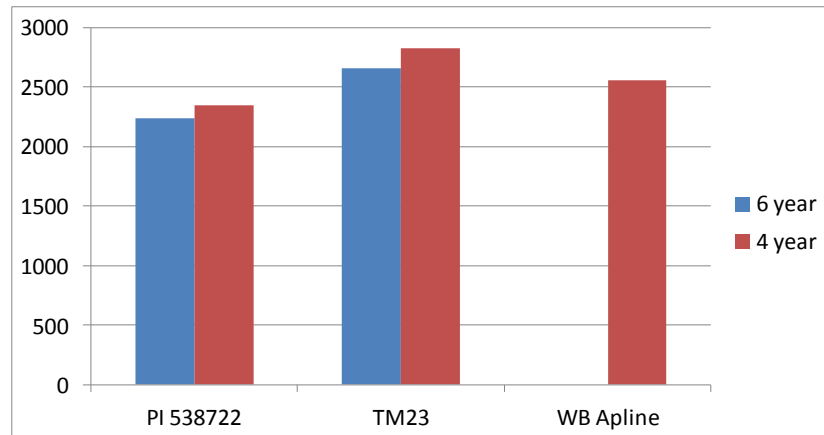
### 6 site average





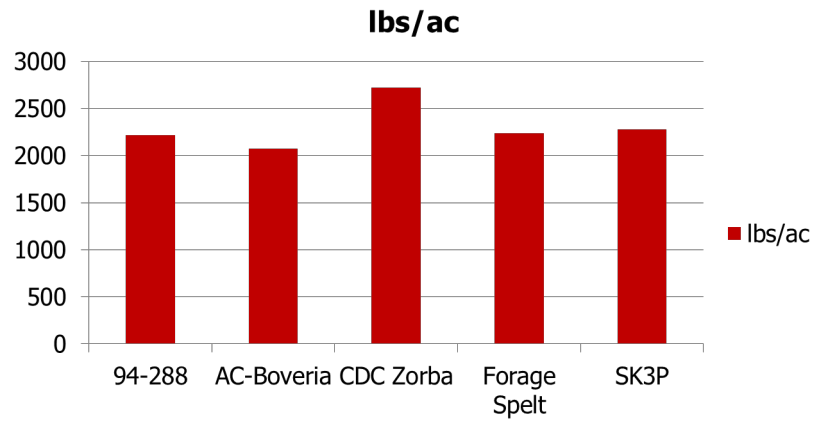


## ND Einkorn variety performance yields lbs/ac 2012-2014



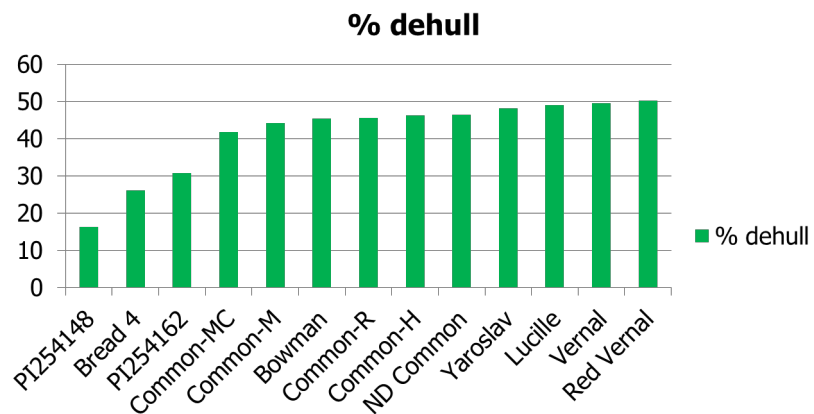
## ND Spelt variety performance

2013-2014 yields  
6 site average

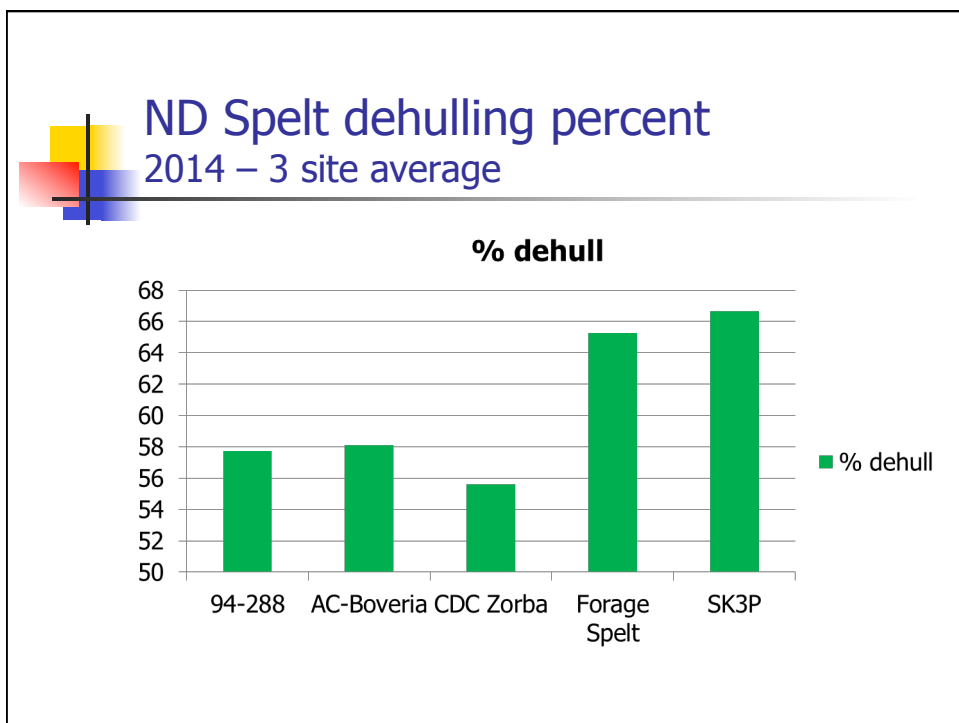
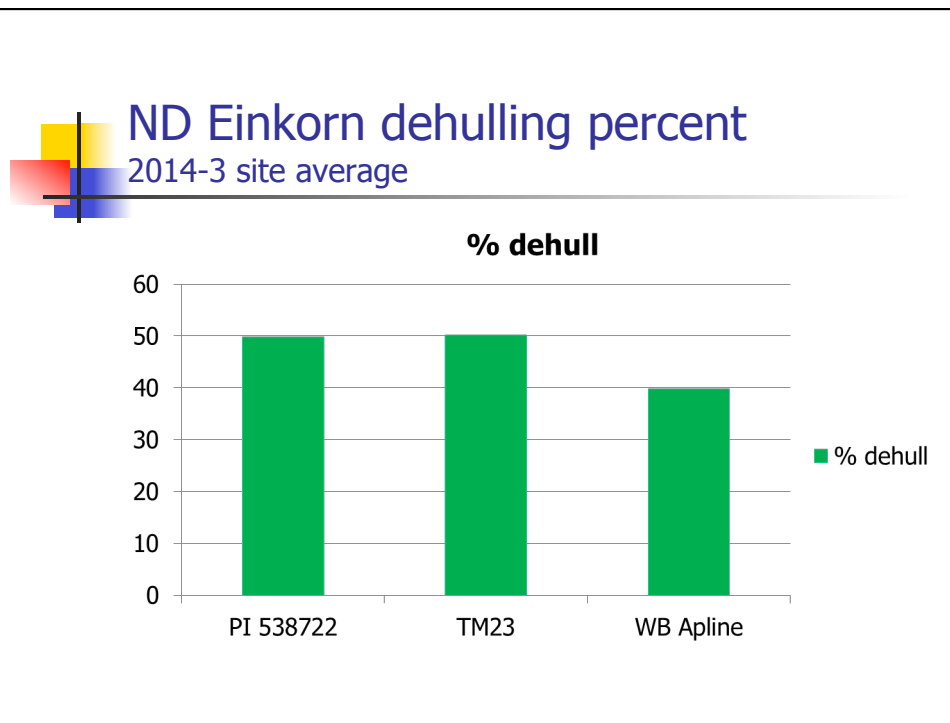


## ND Emmer dehulling percent


2014 – 3 site average





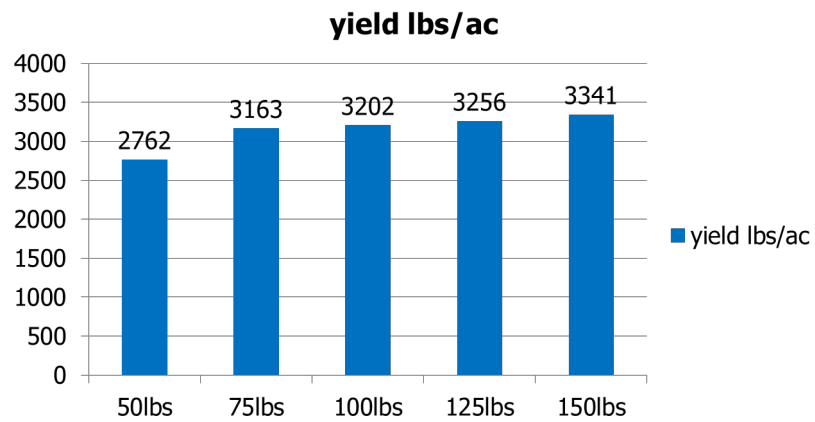




<div>  2014 CREC Organic Emmer Seeding Rate Trial </div>								
Seeding rate	Plant stand	Spike count	Spikes per plant	Days to heading	Plant lodge	Plant height	Test weight	Seed yield
	sqft	sqft			0-9	inches	lbs/bu	lbs/ac
50lbs	14	45	3.1	67	6	44	37	3158
75lbs	22	62	2.8	67	5	43	38	3504
100lbs	25	58	2.4	66	6	41	37	3397
125lbs	31	61	2.0	66	5	40	37	3611
150lbs	34	70	2.1	66	6	40	37	3576
Mean	25	59		66	6	42	37	3449
C.V. %	13	15		1	34	6	3	3
LSD.10	4	11		1	NS	3	NS	137

## ND Organic Emmer seeding rate

2012-2014  
4 site average





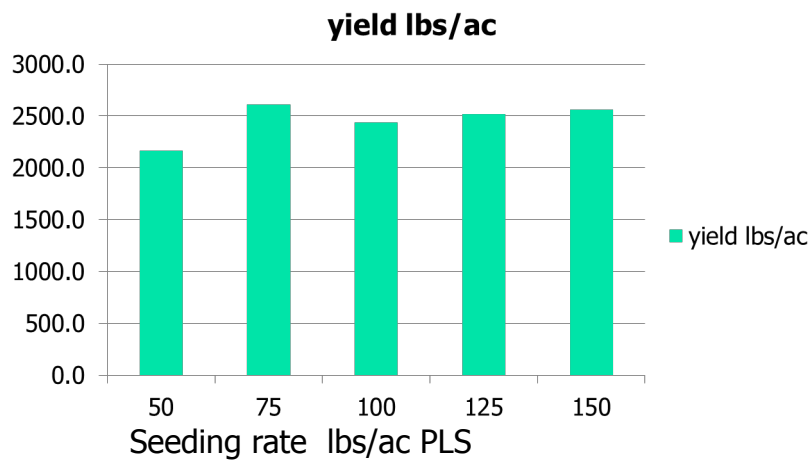
## 2014 CREC Organic Einkorn Seeding Rate Trial

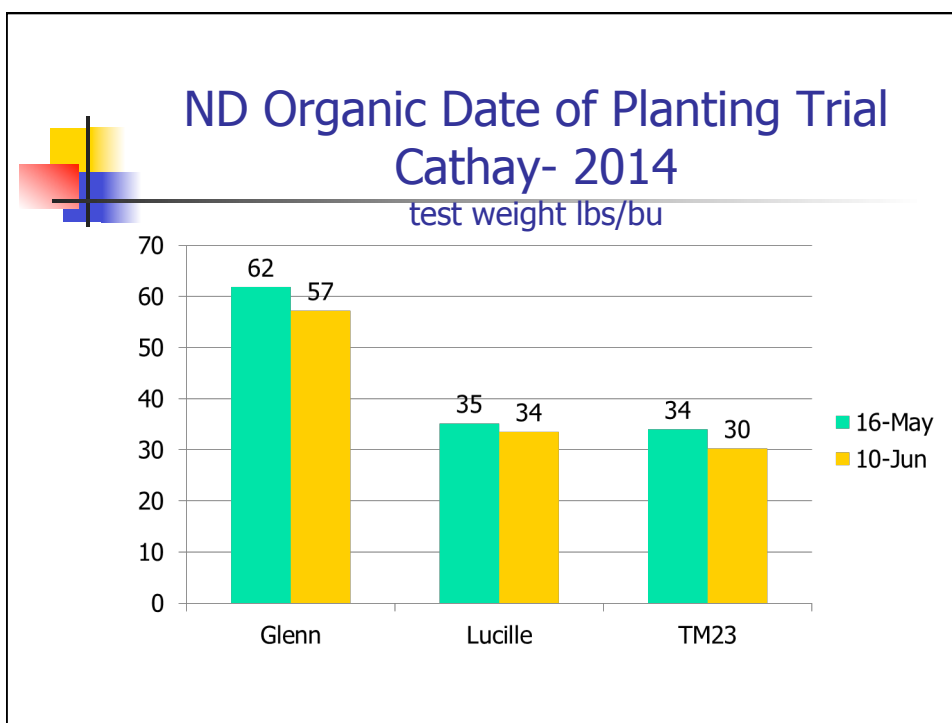
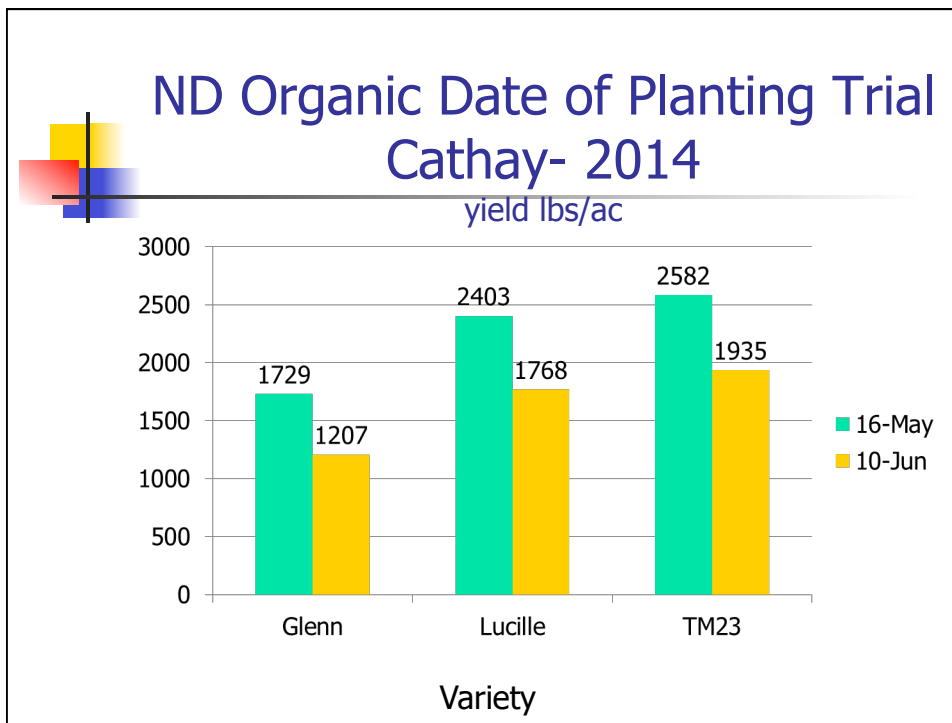
Seeding rate	Plant stand	Spike count	Spikes per plant	Days to heading	Plant lodge	Plant height	1000 KWT	Test weight	Seed yield
	sqft	sqft			0-9	inches	gms	lbs/bu	lbs/ac
50lbs	12	84	7	65	1	43	46	34	3284
75lbs	15	91	6	64	1	42	47	34	3651
100lbs	19	105	5	64	2	41	45	35	3928
125lbs	22	113	5	63	4	40	45	34	3883
150lbs	28	114	4	63	5	40	46	35	4061
Mean	19	101		64	2	41	46	34	3761
C.V.%	18	10		1	83	3	4	2	9
LSD.10	4	13		1	3	2	NS	1	420



## ND Einkorn seeding rate

2013-2014  
4 site average





## Value-added grains for local and regional food systems project

Special thanks for help with this presentation to:

David Benscher  
Elizabeth Dyck  
Kit Kelley  
Lisa Kissing Kucek  
Frank Kutka  
Greg Roth  
June Russell  
Nigel Tudor



More information on ancient grains:

[www.extension.org/pages/66321/the-ancient-grains-einkorn-emmer-and-speltz-what-we-know-and-what-we-need-to-find-out-webinar#.VGOWRofxIAQ](http://www.extension.org/pages/66321/the-ancient-grains-einkorn-emmer-and-speltz-what-we-know-and-what-we-need-to-find-out-webinar#.VGOWRofxIAQ)

[www.extension.org/pages/66869/management-for-high-quality-organic-wheat-and-ancient-grain-production-in-the-northeast#.VGOKzvnF-So](http://www.extension.org/pages/66869/management-for-high-quality-organic-wheat-and-ancient-grain-production-in-the-northeast#.VGOKzvnF-So)

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- We need your feedback! Please respond to an email survey about this webinar.
- Thank you for coming!

