Making the Ancient Modern and the Costly Profitable.

- Dr. Carrie Eberle
- Cropping Systems Agronomist
- Sustainable Agriculture Research and Extension Center (SAREC)
- Lingle, WY

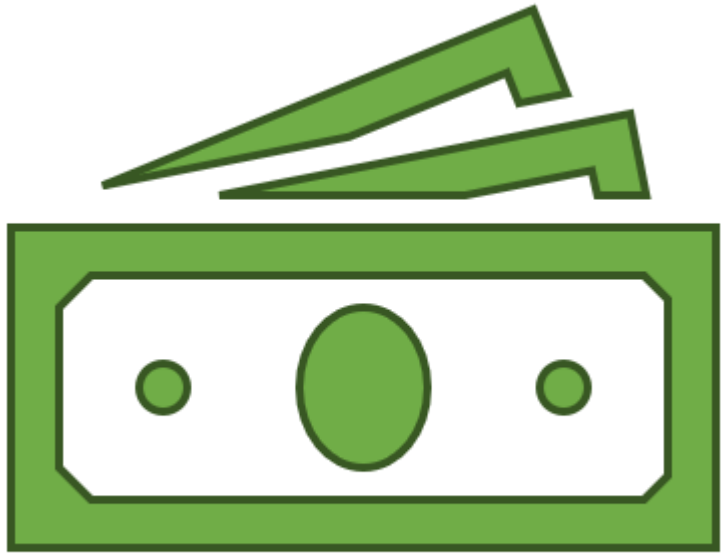
Ancient to Modern

Wyoming First Grains Project

Neolithic Brand
Wyoming grown first-grains ™

Costly to Profitable

Agricultural Pollution and Profitable Cover Crops for Minnesota



Wyoming First-Grains

(aka Ancient Grains)

Dr. Caitlyn Youngquist
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WESTERN SARE
Sustainable Agriculture Research & Education

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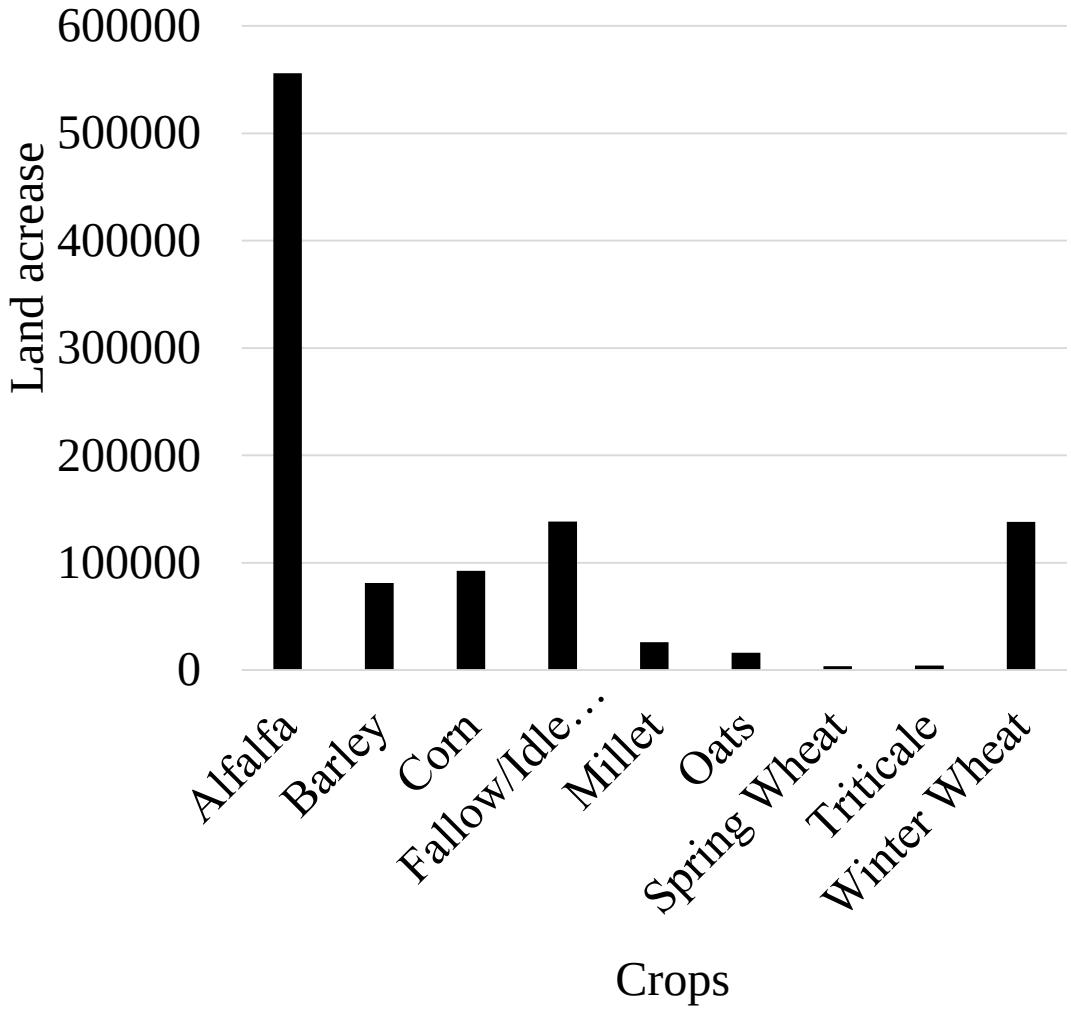
Background

- Wyoming state, a challenging place to farm
  - Low soil fertility and quality
  - Saline and alkaline soils
  - Arid conditions
  - High evapotranspiration demands
  - Isolation from markets
- Soil, climate, geographical conditions lead to limited crop diversity
- Wyoming grows about 250,000 acres of wheat, oats and barley

Fig1: land acres for different crops in WY



Source: USDA

The Ancient Wheats

- Higher in protein and minerals
- Distinct flavors
- NOT gluten free
- Easier to digest than modern wheat?
- Thrive in low input systems
- Not free threshing
- Lower Yield
- Dough quality (gluten) considered inferior

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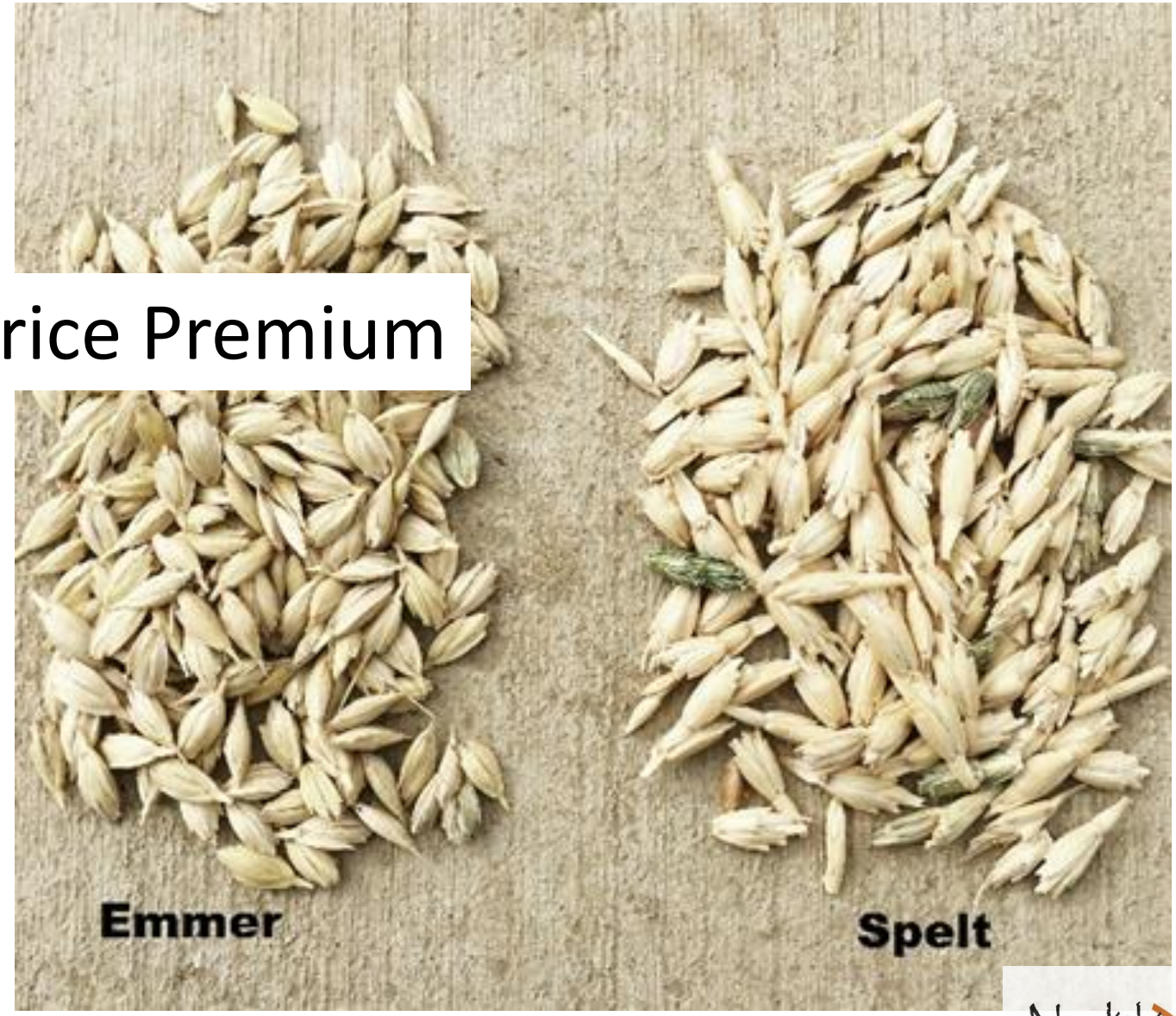
Price Premium



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Einkorn

- Domesticated 4,000 – 10,000 BCE in the Tigris-Euphrates region
- Diploid (2 chomosomes)
- Challenging to grow and bake with
- Replaced by barley and emmer near end of bronze age

Emmer

- Einkorn outcrossed with another grass
- Tetraploid

  (4 chromsomes)
- Can thrive in a wider range of conditions
- Easier to bake with

Spelt

- More crop development and cultivar selection efforts
- Hexaploid

  (6 chromosomes) like modern wheat
- Most common and easiest to bake with

Higher in protein and lipids More Zn, Fe, Cu, Mg, P More Vitamin B

Lower in phytic acid and inflammatory cytokines

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The Wyoming First-Grains Project

- Research and economic development effort of the University of Wyoming
- Field trials on five farms and three research stations across the state
- Working with maltsters, brewers, and commercial and home bakers to develop markets

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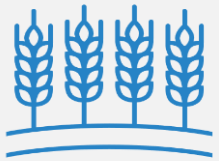
Relevance to sustainable agriculture

- Combines sustainable crop production and market development
- Suited for harsh environmental conditions
- Maintains environmental sustainability
  - low nitrogen demand
  - low water demand
  - certain disease resistance

Objective:

Identify agronomic management practices and fertility needs of spelt, emmer and einkorn and how fertility affects agronomic traits of these first-grains under multiple Wyoming growing conditions and locations.

RESEARCH QUESTIONS



How does the growth pattern of ancient grains compare to modern wheat?

Which ancient grain is best suited to different growing regions in Wyoming?

Is the NUE and WUE of ancient grains better than modern grains?

Do ancient grains maintain grain quality with low nitrogen inputs?

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MATERIALS AND METHODS

- Experimental sites:
  - SAREC: Lingle, WY
    - Irrigated and Dryland
  - PREC: Powell, WY
    - Irrigated
  - ShREC: Sheridan, WY
    - Irrigated and Dryland

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- Spring Planting Treatments:
  - 4 grain crops
  - 3 N treatments
- Winter Planting Treatments:
  - 3 grain crops
  - 3 N treatments

Season	Crop	Variety
Spring	Spelt	CDC origin
Spring	Emmer	'Lucile'
Spring	Einkorn	'Stoneage'
Spring	Wheat	SY605(SAREC) Gunnison (ShREC)
Spring	Barley	Moravian 170
Winter	Spelt	'Frank'
Winter	Einkorn	'Stoneage'
Winter	Wheat	Warhorse
Winter	Barley	

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3 Nitrogen rates
(residual soil nitrate + 32-0-0 fertilizer)

- High: 80 lbs N $acre^{-1}$
- Medium: 50 lbs N $acre^{-1}$
- Low: 25 lbs N $acre^{-1}$
  - SAREC irrigated site:
    110, 80, and 50 lbs N $acre^{-1}$

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Yield Results

- Irrigated Research Plots
- PREC and SAREC

Hulled

Grain

% Loss = (Hulled Yield – Grain Yield) / Hulled Yield

Yield (PREC vs SAREC)

	Hulled Yield		
	Einkorn	Emmer	Spelt
PREC	3325 A	3397A	2610A
SAREC	1063 B	2007B	2004B

Nitrogen Rate Had No Effect

Yield (PREC vs SAREC)

	Hulled Yield			Grain Yield		
	Einkorn	Emmer	Spelt	Einkorn	Emmer	Spelt
PREC	3325 A	3397A	2610A	2401A	2660A	1882 A
SAREC	1063 B	2007B	2004B	357 B	1369B	1066 B

Yield (PREC vs SAREC)

	Hulled Yield			Grain Yield			% Loss	
	Einkorn	Emmer	Spelt	Einkorn	Emmer	Spelt	Emmer	Spelt
PREC	3325 A	3397A	2610A	2401A	2660A	1882 A	20.9 B	27.8 B
SAREC	1063 B	2007B	2004B	357 B	1369B	1066 B	31.3 A	48.7 A

Yield (PREC vs SAREC)

	Hulled Yield			Grain Yield			% Loss		% Protein		
	Einkorn	Emmer	Spelt	Einkorn	Emmer	Spelt	Emmer	Spelt	Einkorn	Emmer	Spelt
PREC	3325 A	3397A	2610A	2401A	2660A	1882 A	20.9 B	27.8 B	10.5 B	9.82 B	12.1 B
SAREC	1063 B	2007B	2004B	357 B	1369B	1066 B	31.3 A	48.7 A	17.9 A	16.99 A	18.2 A

Yield (einkorn vs emmer vs spelt)

	PREC				SAREC			
	Hulled	Grain	% Loss	% Protein	Hulled	Grain	% Loss	% Protein
Einkorn	3277 A	2337 B	35.9 A	10.58 B	1139 B	450 B	39.2 B	18 A
Emmer	3274 A	2596 A	21 C	9.81 B	2123 A	1448 A	31.4 C	17.1 B
Spelt	2585 B	1844 B	28.7 B	12.18 A	2078 A	1123 A	48.3 A	18.3 A

Irrigated Spring Yield Results

- Powel had higher yield
- SAREC had higher protein
- At PREC emmer had the highest grain yield and spelt had the highest protein.
- At SAREC spelt had the highest grain yield and protein.

What’s it worth?

- Wheat pays between **9 and 12 cents/lb**
- With emmer and spelt, we believe we can offer **13 to 17 cents/pound**.

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- Emmer and spelt are hulled grains…the hull needs to be removed with a separate operation. This costs between **2 and 5 cents/pound**.
- And then there is cleaning. This costs another **2 to 5 cents/pound**
- Wyoming, being a rural state, means that we have long distances to transport these grains to market. We estimate **6 to 10 cents/pound** for transportation to Colorado for malting and/or distribution to bakers.

Estimated cash production costs:

What it costs the farmer to grow.

	$/pound
Growing	0.18
Transporting	0.02
Cleaning	0.02
De-hulling	0.03
Transportation	0.02
Malting	0.08
Distribution	0.02
	0.37

Total cost of production

Product Price Variables

Product type

- malt
- grain

Packaging Size

- sack
- bulk

Currently

- 50-pound sacks of cleaned grain for baking
  - $1.20/pound
- Tons for malting
  - $1.60/lb