



WYOMING
FIRST GRAINS

www.uwagec.org/neolithicbrand/

#WYFirstGrains

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





Ancient Grain Market – Segmented By Applications (Bakery, Confectionary, Sports Nutrition, Infant Formula, Cereals, Frozen Food And Others), By Crop Type (Gluten Free Ancient Grains And Gluten Containing Ancient Grains) & By Region – Global Forecast – 2023

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Ancient Grain Market Growth and Trends:

Ancient Grain Market was estimated at USD 457.35 million in 2018 and is expected to expand at CAGR 35.50% to USD 6.3 Billion by 2024.

Globally, there is a good demand for ancient grains with half of the shoppers involved and almost 40% claiming the use of ancient grains at least once a week. And of those shoppers who are interested, more than 20% are willing to pay a premium for products that include old grain.



0180	50# Bag	Spelt Berries	\$41.00
0181	45# Pail	Spelt Berries	\$45.00

Item #	Size	Product Description	Price
0001	50# Bag	Bronze Chief® Wheat Berries	\$17.30
0002	45# Pail	Bronze Chief® Wheat Berries	\$22.60



PASTIMES

Following a New Trail of Crumbs to Agriculture's Origins

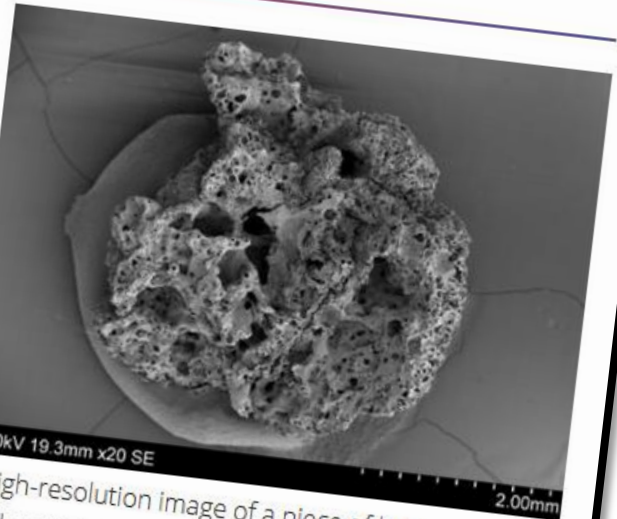
Archaeologists have found tiny pieces of ancient bread from hunter-gatherers that predate agriculture by about 4,000 years.

TOBIAS RICHTER AND AMAIA ARRANZ-OTAEGUI / 16 JUL 2018



The world's oldest bread crumbs found to date were excavated from the stone-lined fireplace in the center of the

Alexis Pantos



A high-resolution image of a piece of bread from Shubayqa 1. The bread remains were analyzed using a scanning electron microscope to reveal the microtexture of the finds, which allowed them to be compared with modern analogues.

Tobias Richter and Amaia Arranz-Otaegui

BOLZANO JOURNAL

Who Killed the Iceman? Clues Emerge in a Very Cold Case



Ötzie the Ice Man
3300 B.C.

“Roughly half an hour before his death he was having a proper meal, even a heavy meal,” Inspector Horn said. The Copper Age menu was well balanced, consisting of ibex meat, smoked or raw; einkorn wheat (an early domesticated variety), possibly in the form of bread; some sort of fat, which might have been from bacon or cheese; and bracken, a common fern.

The Early Wheats

- Nutritional benefits
- Easier to digest than modern wheat
- Not gluten free
- Dough quality (gluten) considered inferior
- Better flavor (mild, nutty)
- Not free threshing
- Thrive in low input systems





Figure 1. (Left to right) Seeds/hulls of Wheat, Spelt, Emmer, and Einkorn

Seed

Hulled

2 seeds /hull

- Spelt
- Emmer

1 seed /hull

- Einkorn

Einkorn

- One of the first cereals domesticated and grown for food in Tigris-Euphrates region (4,000-10,000 BCE)
- Diploid (2 chromosomes)
- Most challenging to grow and bake with
- Replaced by barley and emmer near end of bronze age



Emmer

- Tetraploid (4 chromosomes)
- Ability to thrive in a wider range of conditions
- Easier to bake with than einkorn

THE WORLAND GRIT
WORLAND, WASHAKIE COUNTY, WYOMING, FRIDAY, APRIL 2, 1910

EMMER BREAKFAST FOOD
FIRST ON THE MARKET
Emmer Breakfast Food
15 cts. pkg.
Who will be

GRAND MATRON VISITS STARS
Special Meeting Held in New Home Monday Evening, Followed by a Delicious Banquet

WILL HOLD
Wyoming Stock Will Meet at 10th St

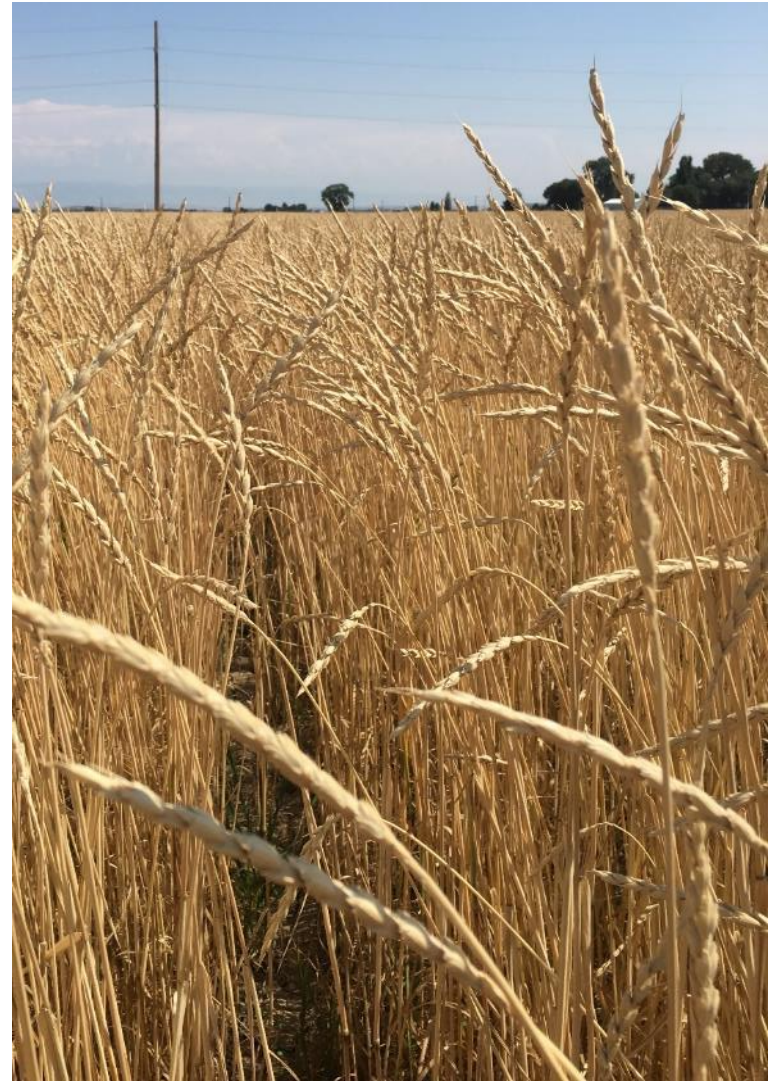
EMMER IS TO BE GROUND SOON
Temporary Building to be Erected and Grinding Started as Soon as the Machinery Arrives

"ELECTRICS" ARE TURNED ON
Worland Again Has Good Light - Our Plant is Now One of the Best in State of Wyoming

EMMER PRODUCTS COMPANY
MAIN EMMER FACTORY AS IT WILL LOOK WHEN BUILT

Spelt

- Hexaploid (6 chromosomes) like modern wheat
- Benefited from crop breeding and cultivar selection
- Used for forage and food
- Peak production of emmer and spelt in US at 600,000 acres in early 1900s
- Most commonly available, and easiest to bake with



Nutrition

Spelt (*Triticum aestivum* ssp. *spelta*) as a Source of
Breadmaking Flours and Bran Naturally Enriched in Oleic Acid
and Minerals but Not Phytic Acid

Saturated fatty acid

Monounsaturated
Omega-9 fatty acid

(i) Spelt has a higher lipid content and also a higher unsaturated fatty acid/palmitic acid ratio than wheat, which results from a nearly double level of oleic acid.

(ii) Compared to wheat, spelt has, on average, 30–60% higher concentrations of Fe, Zn, Cu, Mg, and P, which is most pronounced in fine bran and coarse bran, where cereal minerals are naturally concentrated (28).

(iii) In contrast to minerals, and especially P, the phytic acid content tends to be 40% lower in spelt than in wheat, as indicated by our data obtained in fine brans, where aleurone cells, which naturally contain phytic acid (29, 30), are the most concentrated.

- Impairs absorption of Fe, Zn, Ca
- Reduced by soaking, sprouting, fermentation
- Non-ruminants lack the enzyme phytase

Table 1. Nutritional comparison between 1 serving (38 g) of common whole wheat and spelt flours, where 38 g is equivalent to the amount of flour in 1 slice of bread (from Food Processor Version 7.5, 2000).

Whole Grain Wheat Flour

Calories	140.83
Protein	5.42 g
Carbohydrates	27.08 g
Dietary Fiber	4.33 g
Other Carbohydrates	22.75 g
Fat—Total	0.54 g
Mono Fat	— g
Poly Fat	— g
Saturated Fat	0 g
Water	3.91 g

Vitamins

Thiamin-B1	0.16 mg
Riboflavin-B2	0.07 mg
Niacin-B3	1.73 mg
Niacin Equiv.	1.73 mg

Minerals

Calcium	21.67 mg
Copper	— mg
Iron	1.17 mg
Manganese	— mg
Potassium	140.83 mg
Zinc	— mg

Whole Grain Spelt Flour

Calories	126.00
Protein	5.04 g
Carbohydrates	26.46 g
Dietary Fiber	2.52 g
Other Carbohydrates	23.94 g
Fat—Total	1.26 g
Mono Fat	0.28 g
Poly Fat	0.98 g
Saturated Fat	0 g
Water	4.32 g

Vitamins

Thiamin-B1	0.25 mg
Riboflavin-B2	0.87 mg
Niacin-B3	3.20 mg
Niacin Equiv.	4.33 mg

Minerals

Calcium	0 mg
Copper	0.23 mg
Iron	1.36 mg
Manganese	0.83 mg
Potassium	145.53 mg
Zinc	1.29 mg



khorasan

Per 100 g	Einkorn Wheat	Kamut Wheat	Spelt	Wheat (hard white)	Wheat (soft white)	Wheat (hard red winter)
Proximates						
Water (g)	no data	10.95	11.02	9.57	10.42	13.1
Energy (kJ)	1450	1411	1414	1431	1423	1368
Protein (g)	18.2	14.7	14.57	11.31	10.69	12.61
Fat (g)	2.48	2.2	2.43	1.71	1.99	1.54
Carbohydrate (g)	no data	70.38	70.19	75.9	75.36	71.18
Fiber (g)	8.7	9.1	10.7	12.2	12.7	12.2
Sugars (g)	2.67	8.19	6.82	0.41	0.41	0.41
Starch (g)	65.5	52.41	53.92	no data	no data	no data
Vitamins						
Thiamin (mg)	0.5	0.591	0.364	0.387	0.41	0.383
Riboflavin (mg)	0.45	0.178	0.113	0.108	0.107	0.115
Niacin (mg)	3.1	6.35	6.843	4.381	4.766	5.464
Pantothenic acid (mg)	no data	0.905	1.068	0.954	0.85	0.954
Vitamin B-6 (mg)	0.49	0.255	0.23	0.368	0.378	0.3
Choline (mg)	no data	25.8	no data	no data	no data	31.2
Betaine (mg)	no data	113	no data	no data	no data	no data
Folate (mg)	no data	no data	45	38	41	38
Vitamin E (mg)	no data	0.6	0.79	1.01	1.01	1.01
Carotene, beta (µg)	19	5	5	5	5	5
Carotene, alpha (µg)	53	2	0	0	0	0
Vitamin A (IU)	312	10	10	9	9	9
Lutein +zeaxanthin (µg)	769	301	169	220	220	220
Tocopherol, beta (mg)	no data	0.15	0.25	no data	no data	no data
Tocopherol, gamma (mg)	no data	1.15	1.71	no data	no data	no data
Tocopherol, delta (mg)	no data	0.01	0	no data	no data	no data
Vitamin K (phyloquinone)	no data	1.8	3.6	1.9	1.9	1.9

Sources:

USDA National Nutrient Database for Standard Reference, Release 22. http://www.ars.usda.gov/main/site_main.htm?modecode=12-35-45-00

"Chemical composition and pasting properties of einkorn (Triticum monococcum L. subsp. monococcum) whole meal flour." A. Brandolinia, A. Hidalgo, S. Moscaritolo. Journal of Cereal Science 47 (2008) 599-609

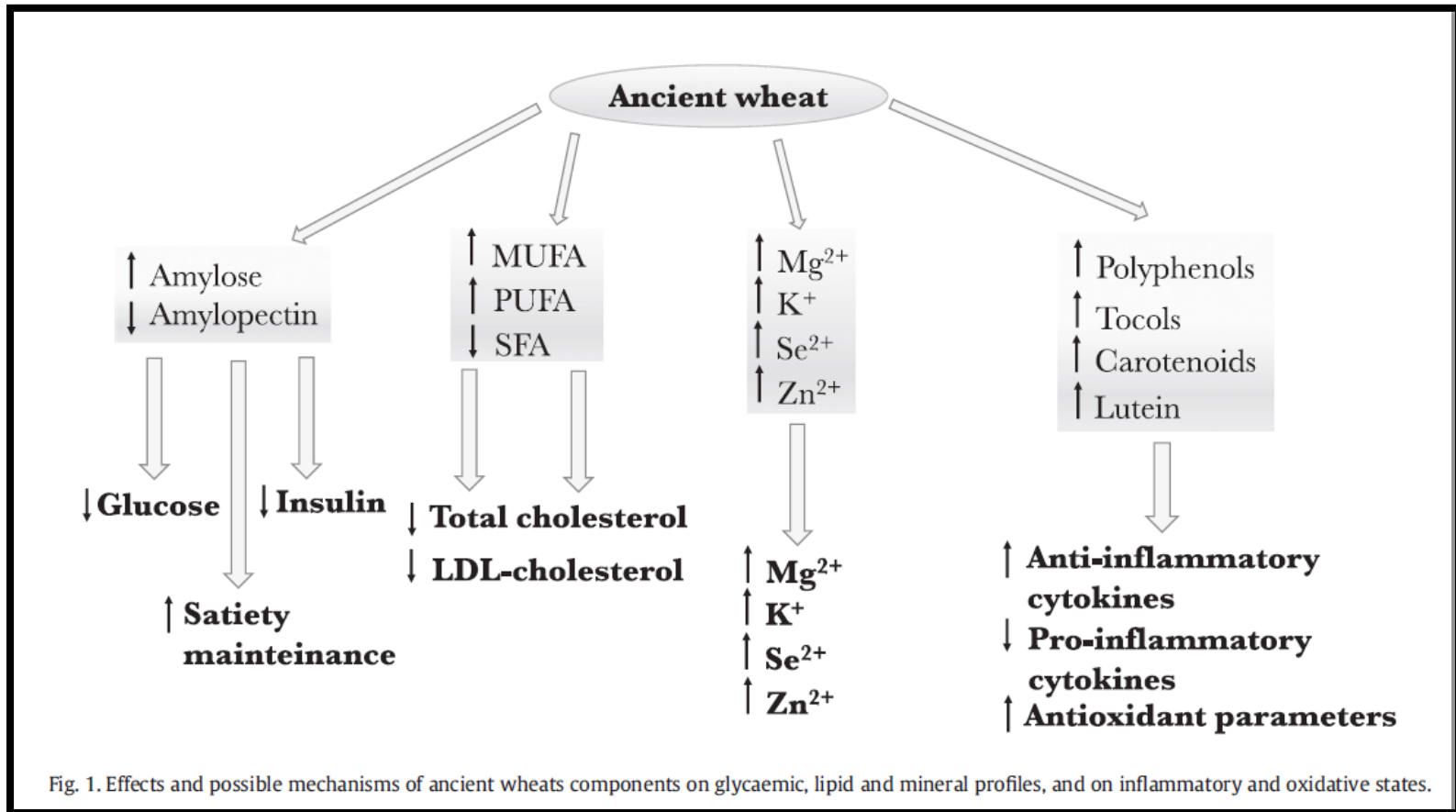
"Variation in mineral micronutrient concentrations in grain of wheat lines of diverse origin." F.J. Zhao, Y.H. Su, S.J. Dunhama, M. Rakszegi, Z. Bedo, S.P. McGrath, P.R. Shewry. Journal of Cereal Science 49 (2009) 290-295

"Compositional and Nutritional Characteristics of Spring Einkorn and Spelt Wheats." E.-S. M. ABDEL-AAL, P. HUCL and F. W. SOSULSKI. Cereal Chem. 72(6):621-624.

REVIEWS: CURRENT TOPICS

Ancient wheat species and human health: Biochemical and clinical implications

Monica Dinu^{a,b}, Anne Whittaker^c, Giuditta Pagliai^{a,b}, Stefano Benedettelli^c, Francesco Sofi^{a,b,d,*}



A recent study evaluating the *in vitro* chemokine response of peripheral blood mononucleated cells from non-celiac gluten sensitivity patients to both modern and ancient wheat genotypes concluded that modern grains can over-activate the production of CXCL10, a chemokine produced predominantly by neutrophils, macrophages and resident cells with an active role in triggering tissue inflammation [41].

Although there is insufficient evidence to suggest that ancient wheat varieties prevent gluten-related disorders, several studies have shown that a diet based on less-immunoreactive wheat products, with fewer amounts and types of reactive prolamins and fructans, may help in the improvement of gastrointestinal and/or systemic symptoms of some auto-immune or chronic diseases (eg, irritable bowel syndrome, *etc.*) [34]. These less-immunoreactive varieties, like einkorn, may be good targets for slowing the development of disease in populations genetically predisposed to celiac disease and other wheat sensitivities [42].

Agronomic Research

- Seed
- Water needs
- Fertility needs
- Harvest
- Post harvest





Figure 1. (Left to right) Seeds/hulls of Wheat, Spelt, Emmer, and Einkorn

Seed

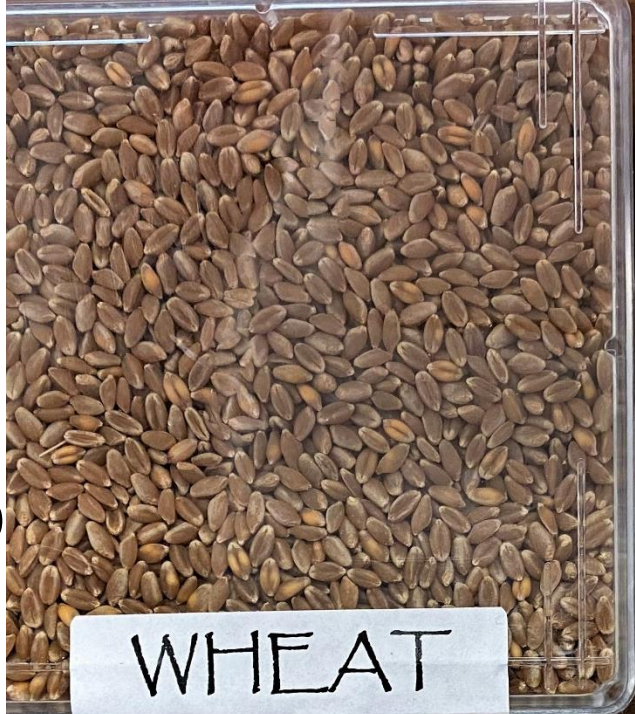
Hulled

2 seeds /hull

- Spelt
- Emmer

1 seed /hull

- Einkorn



10,604
seeds/lb

WHEAT



8,204
seeds/lb

SPELT



11,407
seeds/lb

EMMER



17,356
seeds/lb

EINKORN

1.06 M
seeds/a



WHEAT

0.82 M
seeds/a



SPELT

1.14 M
seeds/a



EMMER

1.73 M
seeds/a



EINKORN

Water Use Efficiency

A photograph of a field of Spring Wheat. The wheat is in a late stage of growth, with some stalks beginning to turn yellow. The field is set against a backdrop of rolling hills under a clear sky.

Spring Wheat

A photograph of a field of Spring Spelt. The wheat is in a late stage of growth, with some stalks beginning to turn yellow. The field is set against a backdrop of rolling hills under a clear sky.

Spring Spelt

A photograph of a field of Spring Emmer. The wheat is in a late stage of growth, with some stalks beginning to turn yellow. The field is set against a backdrop of rolling hills under a clear sky.

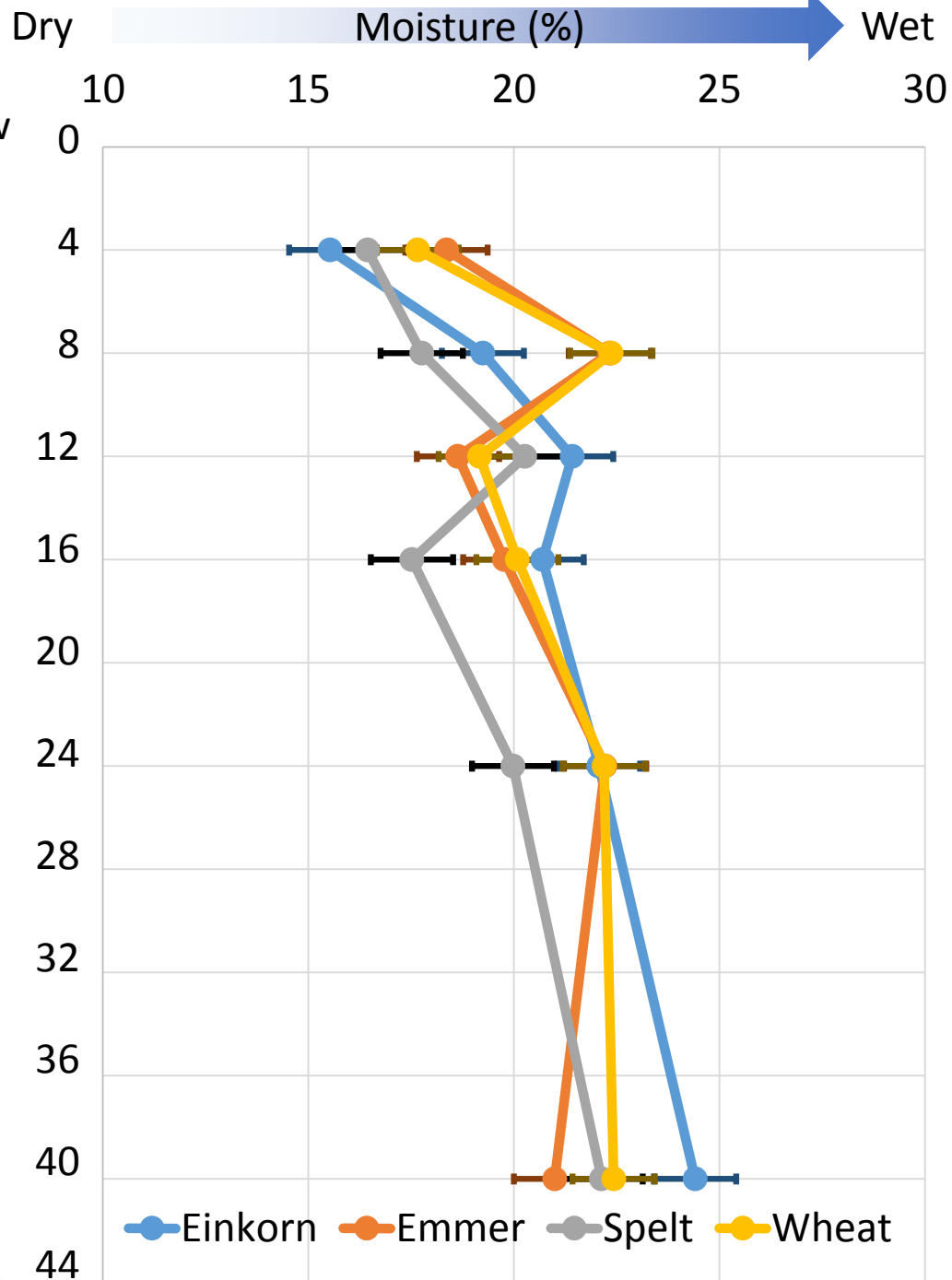
Spring Emmer

A photograph of a field of Spring Einkorn. The wheat is in a late stage of growth, with some stalks beginning to turn yellow. The field is set against a backdrop of rolling hills under a clear sky.

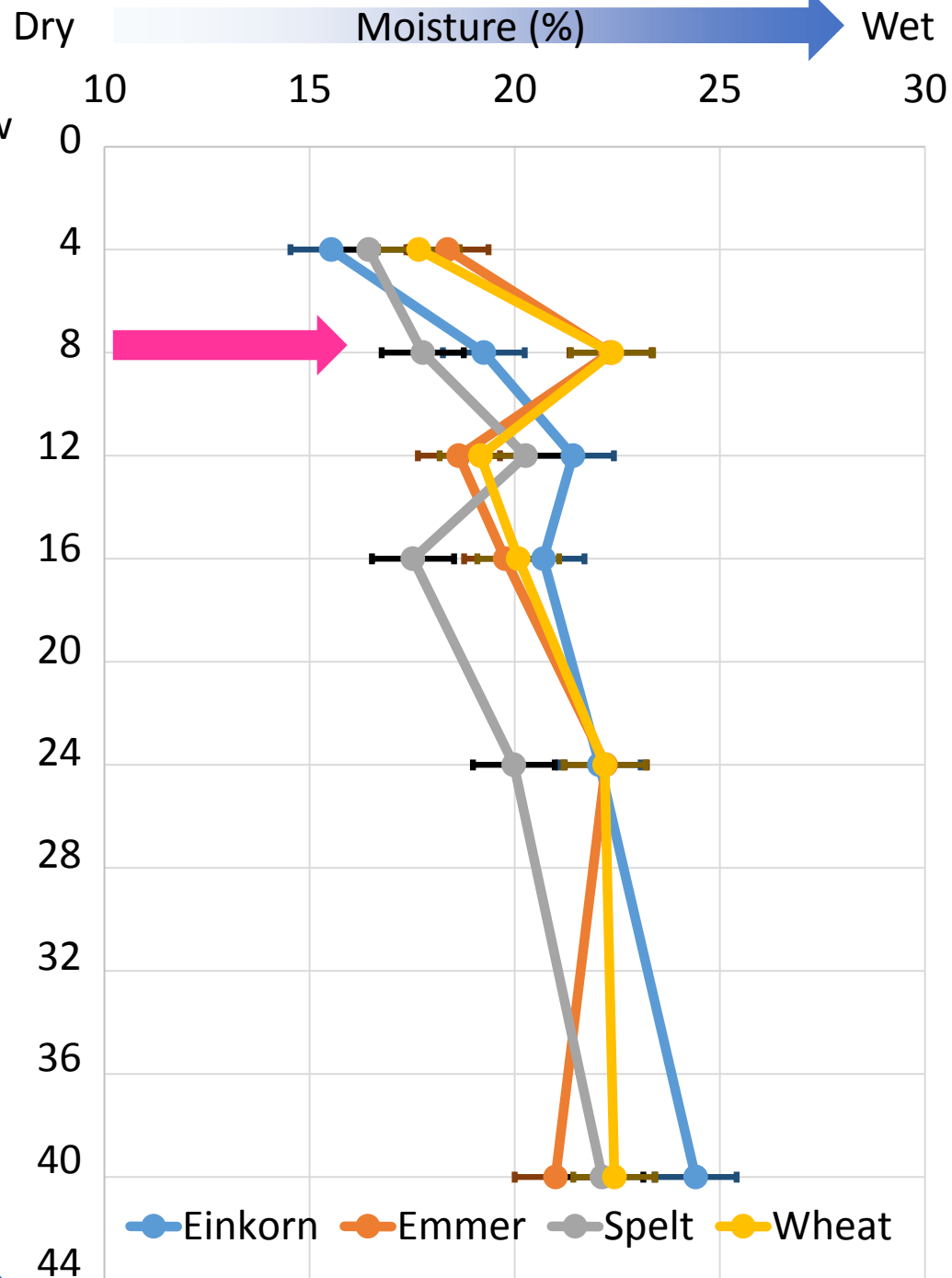
Spring Einkorn

2019 trial on water use

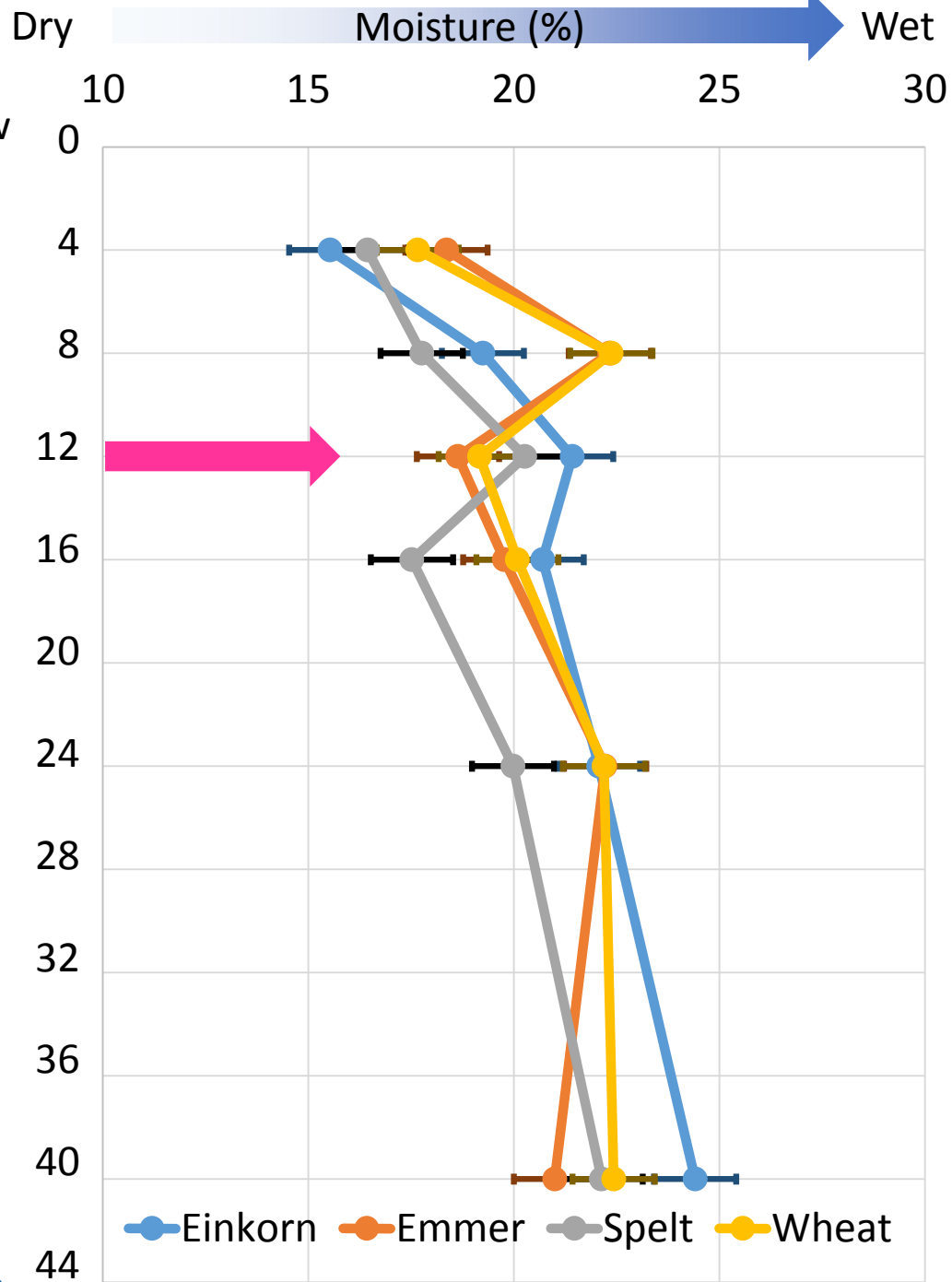
- UW SAREC in Lingle
- Dryland
- Planted at 60 lbs/acre



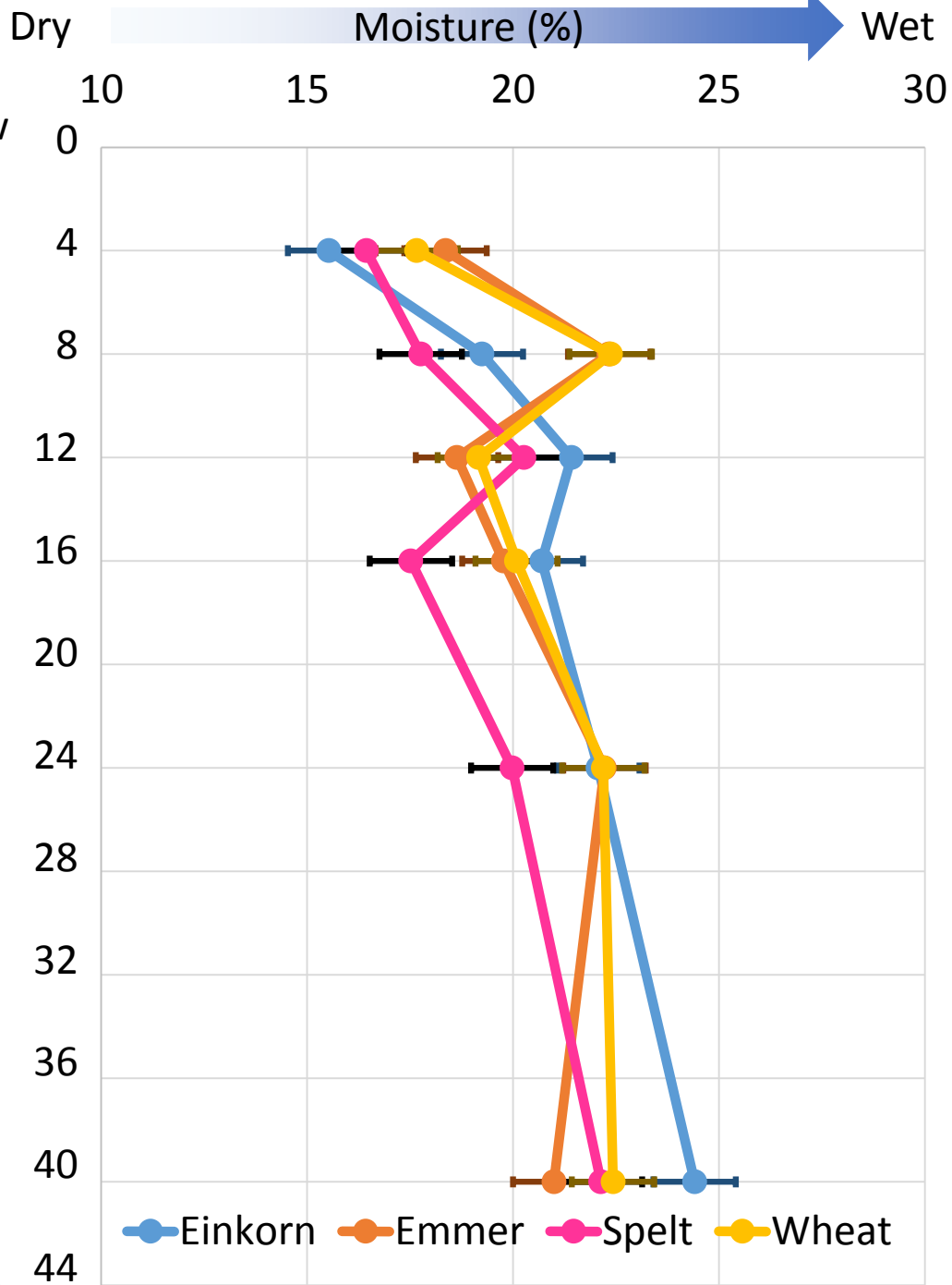
Spelt and Einkorn used more water at 8"



Emmer and Wheat used more water at 12"



Spelt generally used more water



Fertility Trials

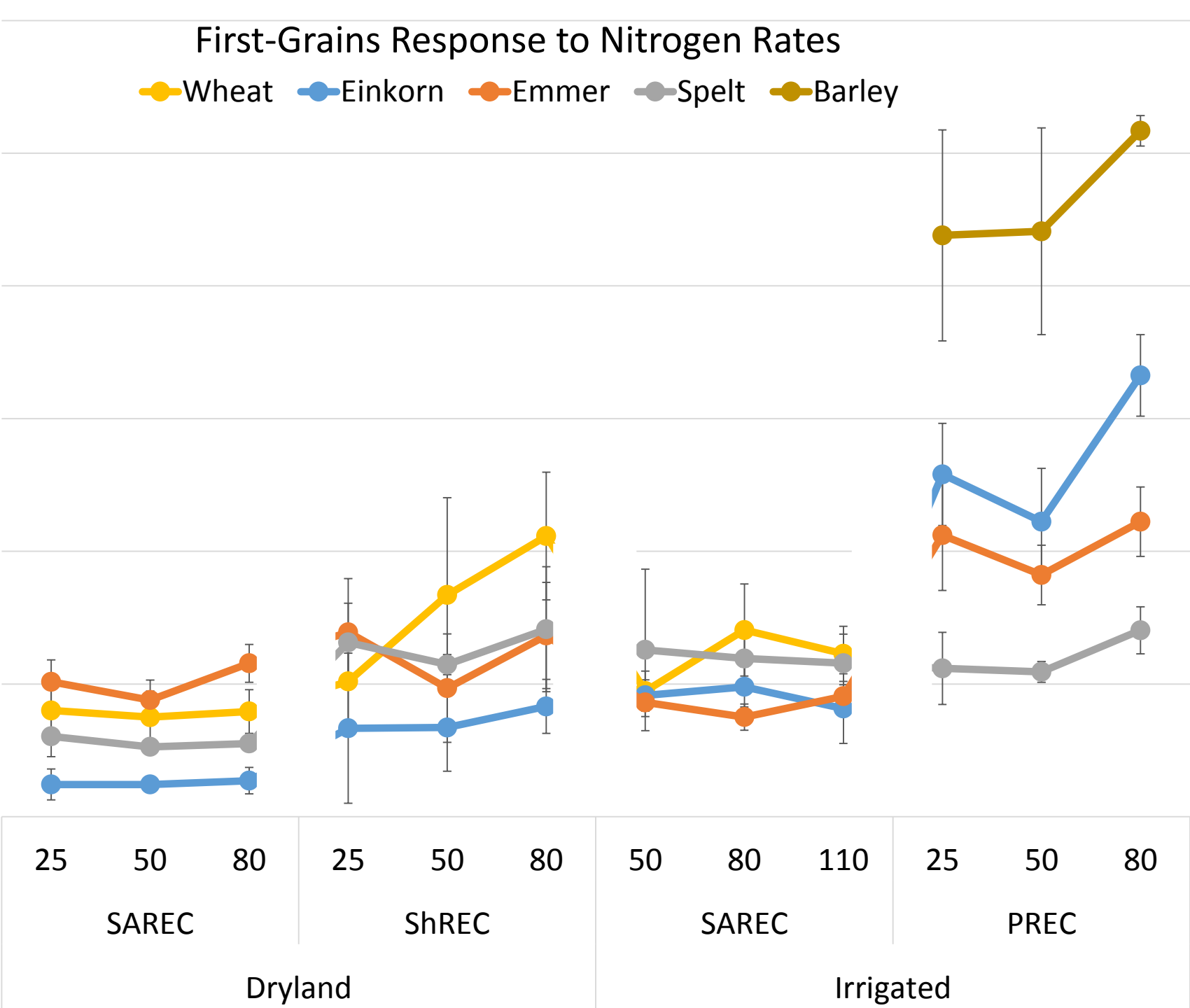


First-Grains Response to Nitrogen Rates

● Wheat
 ● Einkorn
 ● Emmer
 ● Spelt
 ● Barley

Yield (lbs/a)

Total N (lbs/a)
 Growing Location
 Irrigation



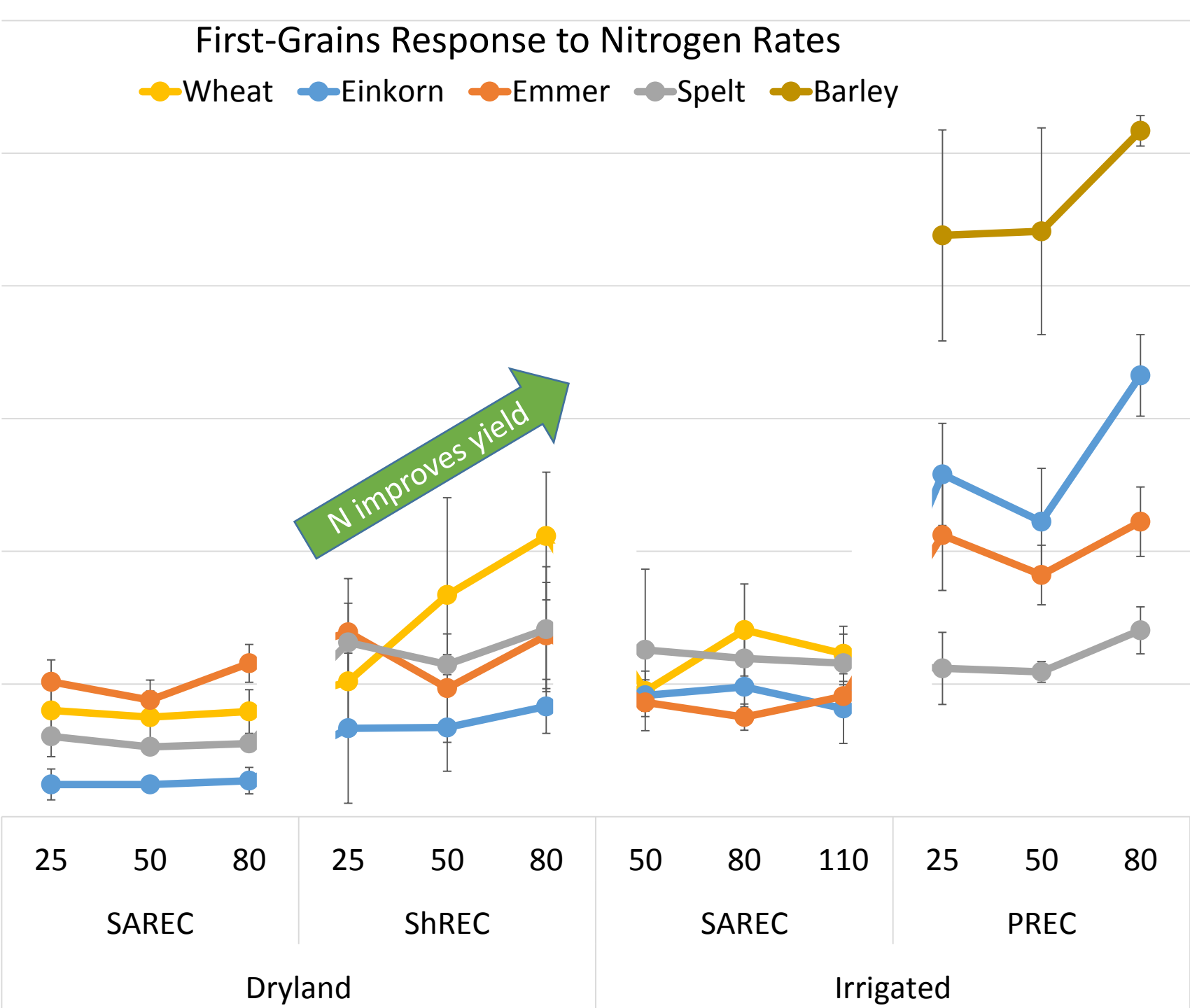
First-Grains Response to Nitrogen Rates

Wheat Einkorn Emmer Spelt Barley

Yield (lbs/a)

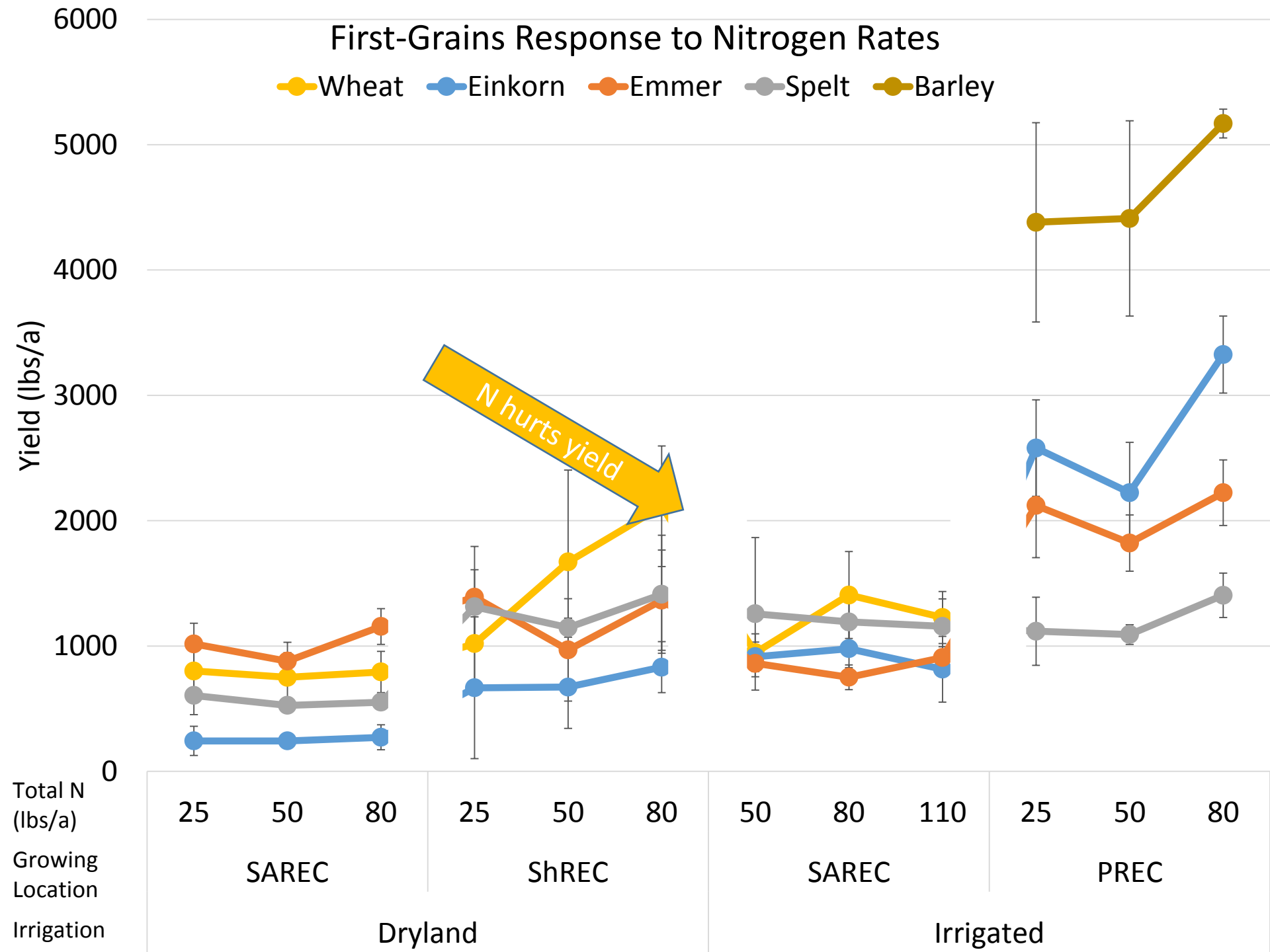
N improves yield

Total N (lbs/a)
Growing Location
Irrigation



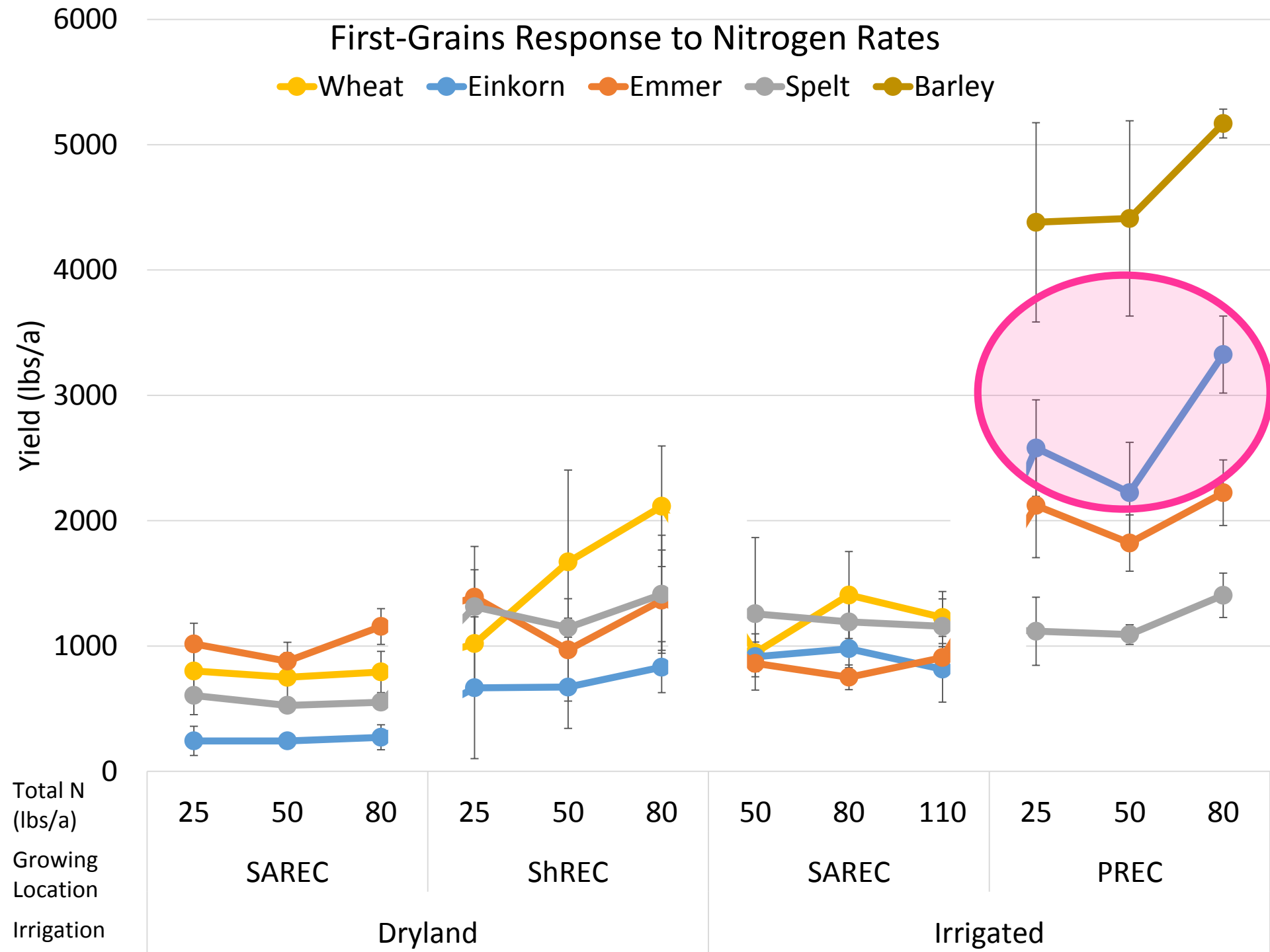
First-Grains Response to Nitrogen Rates

Wheat Einkorn Emmer Spelt Barley



First-Grains Response to Nitrogen Rates

Wheat Einkorn Emmer Spelt Barley





Harvest





Hot Spring County, Irrigated Einkorn and Emmer

- Could not cut Einkorn standing (swathed then threshed)
- Einkorn had very tall, strong straw – cows love it



Speltz



Emmer



Einkorn

Post harvest

- Dehulling
- Hull waste

Now What?

