

Einkorn, emmer and spelt are the ancient species of wheat which were replaced by high-yielding, free threshing species. These three grains are hulled and better adapted to marginal low input agriculture systems, making them a potential ideal crop for Wyoming. They often have distinct nutrition, high protein, and unique taste that is driving increasing market demand for the crop.

## Objectives:

1. Identify agronomic management practices and fertility needs of first-grains:
  - spelt, emmer and einkorn
2. Identify agronomic traits of first-grains under multiple Wyoming growing conditions and locations.

## Research Field Sites:

- Lingle, WY: SAREC (Irrigated and Dryland)
- Powell, WY: PREC (Irrigated)
- Sheridan, WY: ShREC (Irrigated and Dryland)

## Production Field Sites:

- Torrington, WY: Randolph
- Chugwater, WY: Jackson
- Thermopolis, WY: Baker
- Sheridan, WY: Koltiska
- Buffalo, WY: Powell-Palm

## Crops:

- Spring emmer var. Lucile
- Spring spelt var. CDC origin
- Einkorn var. Stone Age
- Control small grains for each location
- Wheat: SY605(SAREC), Gunnison (ShREC)
- Barley: Moravian 170 (PREC)

## Nitrogen Treatments:

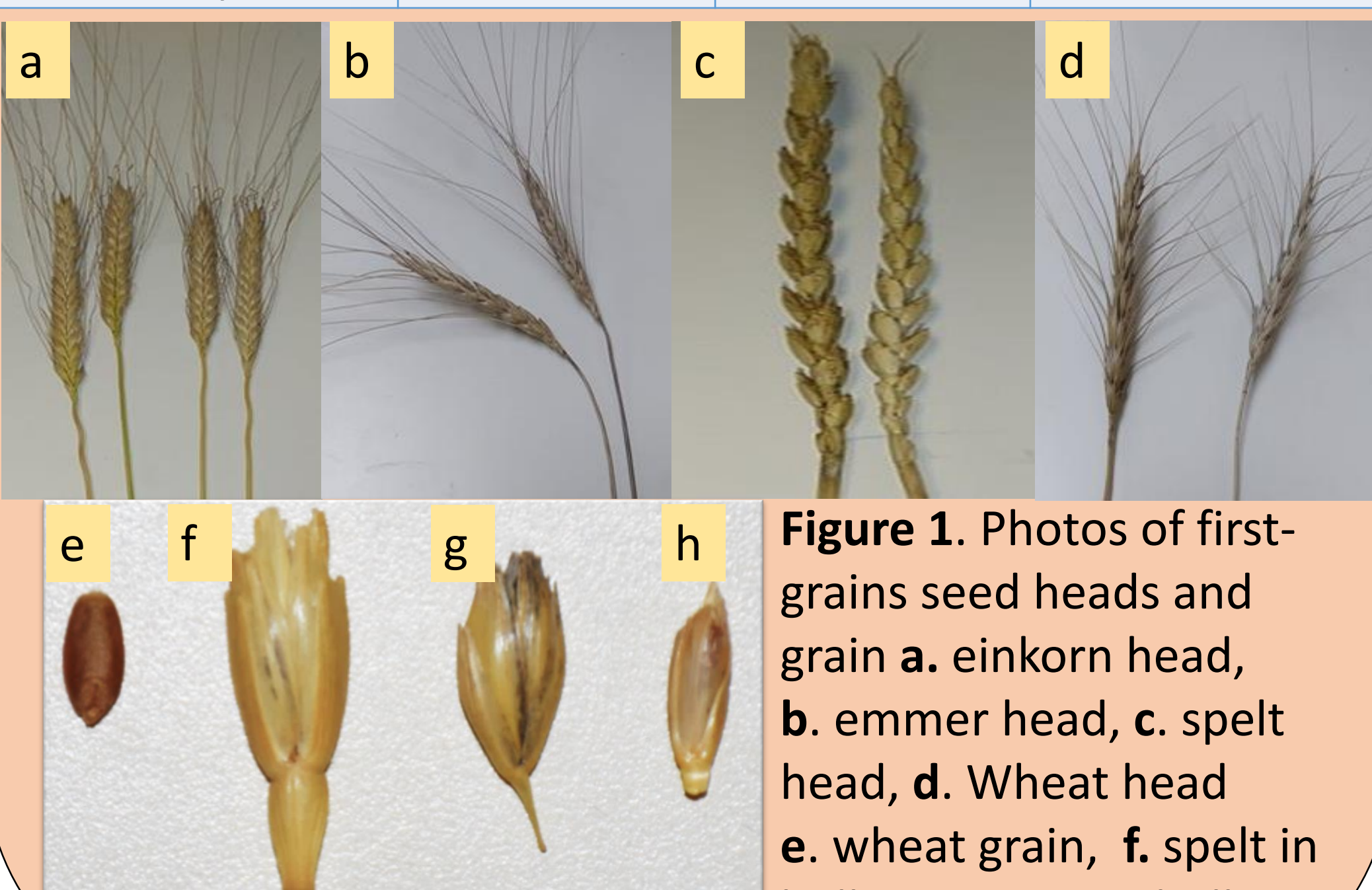
Total N = residual soil nitrate + 32-0-0 fertilizer

**High:** 80 lbs/a N **Medium:** 50 lbs/a N **Low:** 25 lbs/a N

Note: because of high residual nitrogen in the SAREC irrigated field high, medium and low treatments were adjusted to 110, 80, and 50 lbs/a of

**Table 1. Planting date, seeding rate and seeding depth of crops at different locations**

Location	Planting Date	Seeding Rate	Seeding Depth
PREC (Irrigated)	04-16-19	100 lbs/a	1 ½ inch
SAREC (Irrigated)	05-06-19	100 lbs/a	1 ½ inch
SAREC (Dryland)	05-06-19	60 lbs/a	1 ½ inch
ShREC (Irrigated)	05-18-19	100 lbs/a	1 ½ inch
ShREC (Dryland)	05-18-19	60 lbs/a	1 ½ inch



**Figure 1.** Photos of first-grains seed heads and grain a. einkorn head, b. emmer head, c. spelt head, d. Wheat head e. wheat grain, f. spelt in hull, g. emmer in hull, h. einkorn in hull

## Genus Triticum

**Figure 2.** First-grains and wheat in the field on 8/14/2019

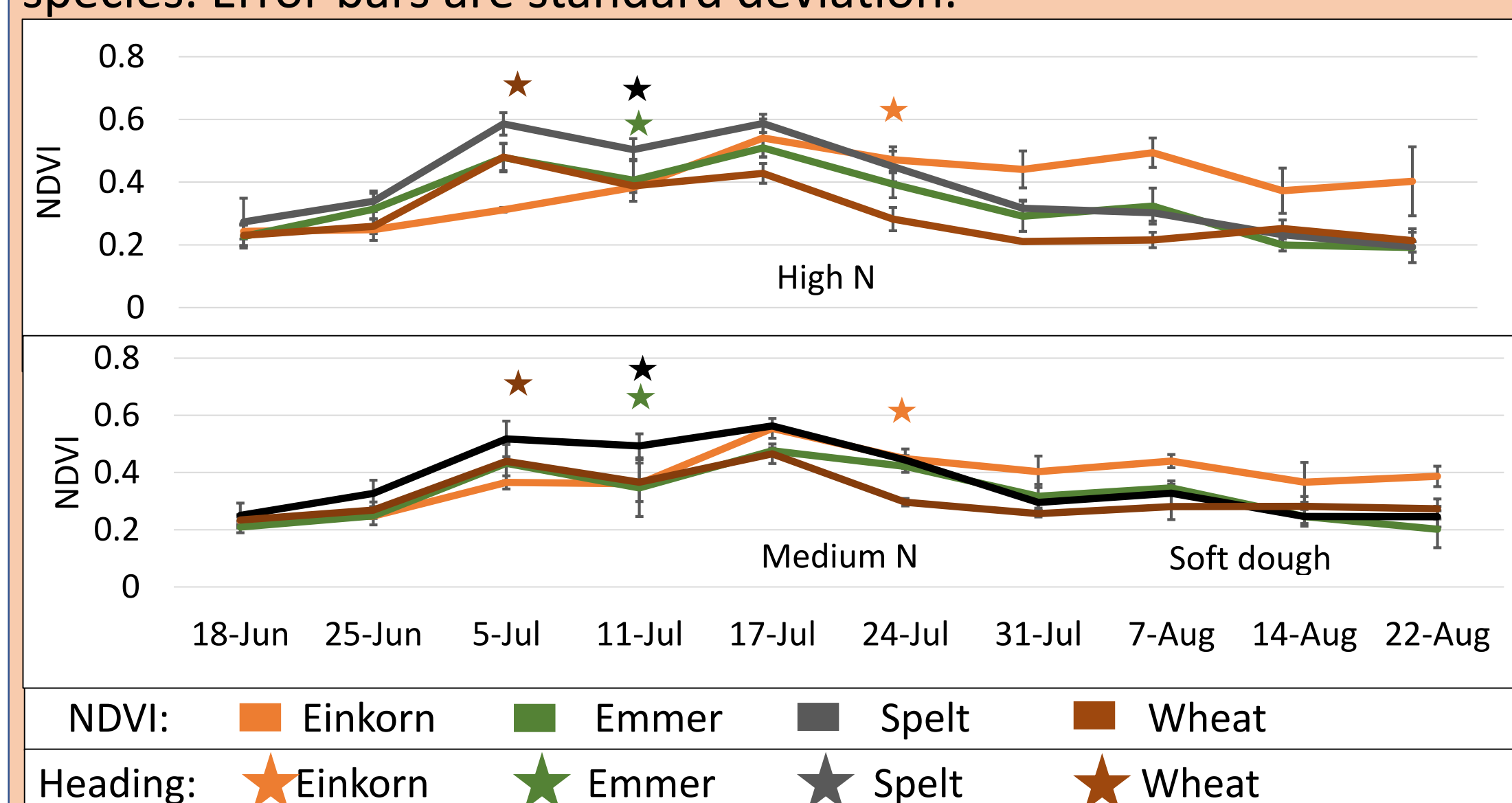


## Spring 2019 Results:

### Growth pattern of first-grains:

First-grains matured more slowly than wheat, with later heading dates. Einkorn matured the slowest, as demonstrated by its NDVI increasing more slowly with time and its late heading date. Growth was not affected by nitrogen treatment.

**Fig 3.** 2019 season NDVI of first-grains and wheat in SAREC dryland under high and medium N. Stars indicate heading date for each species. Error bars are standard deviation.



**Table 2. Crop and fertility effect on yield. Interaction terms were not significant. Values <0.05 are significant.**

Locations	Crop Effect	Fertility Effect
PREC (I)	0.0001	0.0015
SHERC (D)	0.0024	0.1337
SAREC (I)	0.0001	0.2194
SAREC (D)	0.0063	0.7016

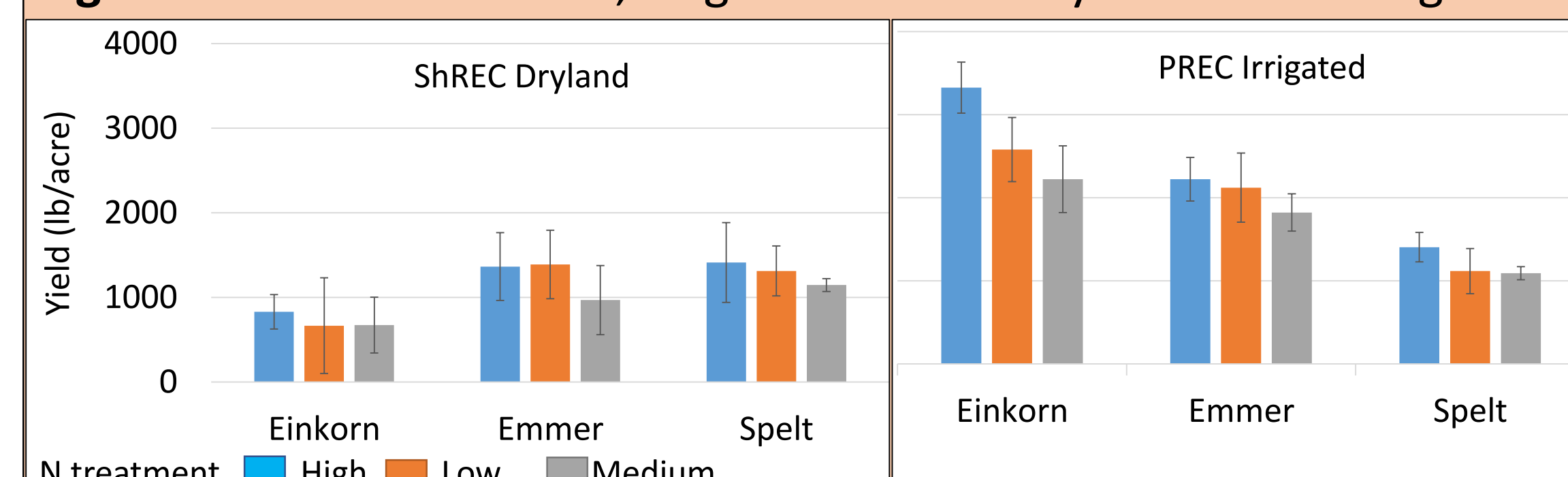
Yield was for hulled first-grains. Within each location, crop had significant effect on yield. Only at PREC did nitrogen treatment significantly effect the yield.

## Results (continued)

### Yield at ShREC (dryland) and PREC (Irrigated):

2019 research plots at SAREC had hail damage and grasshopper predation. So only ShREC and PREC yield estimates are accurate. Einkorn and emmer yielded higher at the PREC irrigated site. At PREC, einkorn also responded to N, with the highest yield in the high N treatment.

**Figure 4.** Effect of location, irrigation and N on yield of ancient grains.



### 2019 Yield of ancient grains in production fields:

Einkorn, spelt and emmer yield was the highest at Baker, PREC, and Baker production fields, respectively. These locations were all irrigated. Interestingly the irrigated spelt at SAREC underperformed relative to the dryland spelt at Koltiska's, perhaps indicating it is better suited to northern growing conditions.

**Table 4:** Yield of ancient grains on production farms in Wyoming

Location	Crop	Irrigation	yield (lb/a)
Powell-Palm	Hullless Blue Emmer	Dryland	1037
Koltiska	Einkorn	Dryland	1783
Baker	Einkorn	Irrigated	1820
Jackson	Emmer	Dryland	1331
Koltiska	Emmer	Dryland	2874
Randolph	Emmer	Dryland	200
Baker	Emmer	Irrigated	3080
Koltiska	Spelt	Dryland	2434
PREC	Spelt	Irrigated	3992
SAREC	Spelt	Irrigated	1459

## Conclusions and Future Work:

1. Einkorn matured later than the other crops
2. Crop type had significant effect on yield.
3. Nitrogen treatment did not effect yield or crop maturity except for einkorn at PREC.
4. Northern production fields had the highest yields.

