

## Growth and Development of Ancient Wheat in Wyoming

### Under Different Irrigation and Nitrogen Treatments

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**Introduction:** First-grains are early predecessors of modern grain varieties and include spelt, emmer and einkorn. These three grains are considered ancient relatives to wheat. They are hulled grains offering potential benefits to the farmers including higher nitrogen use efficiency, higher water use efficiency, and unique market opportunities. Consumers are showing interest in the unique flavor and nutritional value of first-grains.

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

### Materials and Methods

Research Field Sites:

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

Crops:

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







Treatments:

- Total Nitrogen (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 N, respectively

Field Establishment:

- Design: Randomized Complete Block Design (RCBD)

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

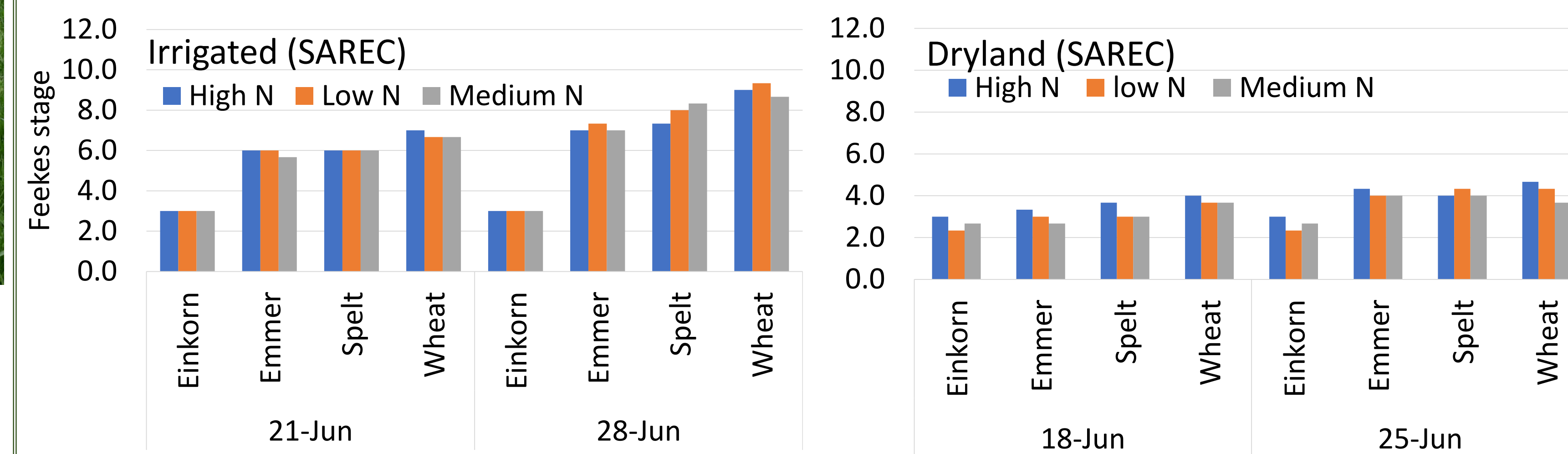
SPELT	EMMER	EINKORN
		
		
Spelt in the field at heading stage and spelt grain in the hull. Each hull has two grains of seed in it. Spelt is the closest relative to wheat.	Emmer in the field at heading stage and Emmer grain in the hull. Each hull has two grains of seed in it.	Einkorn in the field at jointing stage and einkorn grain in the hull. Each hull has one grain of seed in it. Einkorn is the oldest relative to wheat.



**Results:** Development of ancient grains under irrigated conditions is slower than spring wheat (Figure 1), however spelt and emmer canopies are denser than wheat under both dryland and irrigated conditions at low and medium nitrogen (Figure 2).

**Figure 1. Growth stage was effected by irrigation and crop type but not nitrogen.** The Feekes growth stage scale was used to evaluate the growth stage of crops at different dates on both irrigated and dryland fields at SAREC. Plants in the irrigated field were at higher Feekes growth stage compared to those grown in the dryland. However, there was no difference noticed in the growth stage among crops grown under different nitrogen treatments.

(Feekes stage of 2 = tillering, 6 = jointing, 10 = heading)



**Figure 2. NDVI of first-grains does not respond to nitrogen treatment but modern wheat does.** NDVI of the crops was recorded over time under different fertilization and irrigation treatments at SAREC. Spelt had the highest NDVI both in irrigated and dryland conditions. NDVI of wheat increased with fertilization whereas NDVI of first-grains was unaffected by nitrogen treatment.

