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Wyoming First Grains Project: Effect of Location, Irrigation and Nitrogen on Crop Growth, Yield, and Quality of Ancient Grains of Wheat in Wyoming

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Introduction

Crop diversity in Wyoming is limited by poor soil health, arid conditions, isolation from markets, and high evapotranspiration demands. First grains like einkorn, emmer, and spelt are early predecessors of modern wheat and more adaptable to marginal agricultural land. There has been rapid increase in the market demand of ancient grains due to their desirable characteristics like higher protein (Campbell, 1997), distinct nutrition, and unique taste. First grains are thought to be a viable alternative small grain for Wyoming.

Objectives

Identify agronomic management practices and fertility needs of spelt, emmer and einkorn. Determine how fertility affects agronomic traits and grain quality under multiple Wyoming growing conditions and locations.

Materials and methods

This study was conducted at the Powell Research & Extension Center (PREC) in 2019. The experiment was a randomized design with 3 replications. Spelt, emmer, einkorn, and barley were grown under flood irrigation. They were planted on the 16 April at a seeding of 100 lbs/a. Nitrogen treatments of low, medium, and high (25, 50, 80 lbs nitrogen/a respectively) were applied to each plot before planting. Crops were harvested at maturity with a Zurn small plot combine and hulled and dehulled yield was calculated. Percent yield loss when the hull was removed was calculated as $[1 - (\text{grain yield} / \text{hulled yield})]$.

Results and discussion

Nitrogen treatments had a significant effect on hulled and naked grain yield (lbs/a) of all crops, with the highest yields in the high N treatment (Table 1). Nitrogen treatment had no significant effect on percent yield loss to hull for either spelt or emmer. However, spelt had higher loss than emmer. When comparing yield of the different grains, the grain yield of barley was higher than emmer and spelt and emmer was higher than spelt. However, lower yield of ancient grains might be offset with their high market demand and price premium.

Table 1. Average grain yield (lbs/a) of first grains. Yields are reported for hulled (grain in the hull) and grain (grain only with the hull removed). Percent yield loss [$1 - (\text{grain yield} / \text{hulled yield})$] is reported for spelt and emmer (loss). P-values for yield within each crop are given. NS means not significant, ND means no data, and NA means not applicable.

N(lbs/a)	Barley			Spelt			Emmer			Einkorn		
	Hulled	Grain	Loss	Hulled	Grain	Loss	Hulled	Grain	Loss	Hulled	Grain	Loss
25	NA	4596 ab	NA	1139 b	839 ab	26%	1847 b	1451 ab	21%	2517 b	ND	ND
50	NA	4197b	NA	1071 b	762 b	29%	1885 b	1463 b	22%	2498 b	ND	ND
80	NA	5168 a	NA	1405 a	1011 a	28%	2223 a	1740 a	22%	3325 a	ND	ND
P-value	NA	<0.05		<0.001	<0.05	NS	<0.001	<0.05	NS	<0.001		

The Wyoming first grains project will be continued through 2021. Future work includes dehulling of einkorn, grain quality analysis, and analysis of soil nitrogen and nitrogen use efficiency of each crop. Soil nitrogen and grain quality analysis will be used to determine nitrogen use efficiency of first grains. Studies have been repeated for the 2020 crop season. Future work will include studies on seeding rate to optimize yield of the first grains as well as market analysis for small and large acreage production.

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