

Cultural Practices for Producing Dryland Malt Barley: Sulfur Fertilizer Rate

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Introduction

Production of malting barley is expected to increase in non-traditional barley production areas of north central Montana due to the expected increase in contracts from the International Malt facility located at Great Falls, MT and traditional spring wheat producers seeking alternative crops with less nitrogen (N) fertilizer requirements. Generally the requirements and the effects of sulfur (S) on malt barley yield and quality are not well known. Thus field research was initiated at several locations to evaluate planting, N rate, S rate, and possible interactions on the yield and quality of malting barley. This Fertilizer Fact reports only the effect of S fertilizer rate.

Methods

Planting rates of 10, 15, and 20 seeds/ft², N rates of 0, 30, and 60 lb/acre, and S rates of 0, 10, and 20 lb/acre were applied in all possible combinations to Metcalfe (used in 2004 and 2005) or Hockett barley (used in 2006) at the following locations in 2004: Western Triangle Ag. Research Center (WTARC) north of Conrad, Knees community east of Brady, north of Joplin, east of Sunburst, and east of Ethridge. The same locations were established in 2005 and 2006 with an additional location north of Cut Bank. Research plots were established in chemical fallow fields except that the Sunburst site was planted no-till into barley stubble in 2004 and all WTARC sites were planted into conventional fallow. In 2004, plots were seeded with a double disc drill that broadcast N as urea and applied 25 lb/acre of potassium (K) as KCl while planting. In addition, S as potassium thiosulfate or ammonium thiosulfate was dribbled on the soil surface about two inches from the seed row while planting. In 2005 and 2006, N as urea, 25 lb/acre of K as KCl, and S as potassium sulfate was applied while seeding in a band approximately one inch

above and to the side of the seed row using a hoe opener. All plots received 30 lb P₂O₅/acre as 0-45-0 applied with seed. Soils at each location were sampled initially for water, nitrate-N, and sulfate-S in one foot increments to a depth of three feet. Sulfur soil tests averaged 930 lb S/acre and ranged from 82 to 7110. Surface soil samples (0-6 in.) were collected for standard soil analyses of pH, organic matter, phosphorus, etc. Plots were harvested with a small plot combine, and the grain weighed and tested for plump kernels and protein.

Results

Highest average yields were almost 100 bu/acre measured at three locations, but most yields were in the 70 to 80 bu/acre range. Sulfur fertilization did not increase yield at any location, but increasing S rate significantly decreased yields at five locations as indicated in Figure 1. This was probably due to high soil S tests. Protein response to S (Table 1) was mixed; three locations had significant protein reduction with increasing S rate in one of the three years, and two locations had significant protein increases with increasing S rate in one year. In general S did not affect protein content. Kernel plumpness was unaffected by S at all locations in all years (Table 2). Finally, there were no significant interactions between seeding rate, N rates, and S rates (data not shown).

Fertilizer Facts:

- In general, S fertilization of dryland malt barley did not affect grain yield, grain protein content, or kernel plumpness.
- There were no interactions between N and S fertilization and planting rate.
- Generally, S should not be applied to dryland malt barley in the Golden Triangle.

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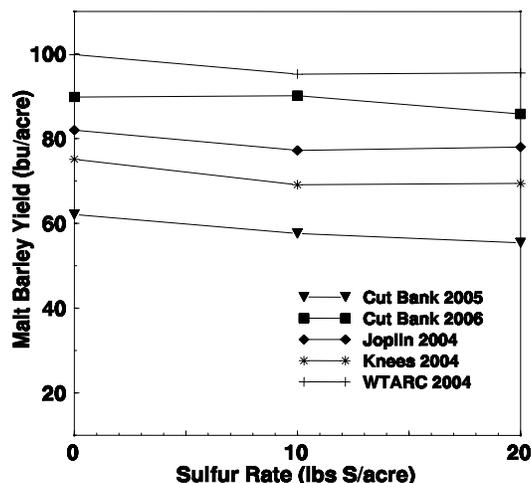


Figure 1. Effects of sulfur (S) on malt barley grain yield (2004-2006). Only site years that had significant yield differences are shown.

Table 1. Effect of sulfur (S) on grain protein content (%) of dryland malt barley. WTARC: Western Triangle Ag. Research Center. 2004-2006.

Treatment S Rate	Location					
	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
2006						
0 lbs/ac	9.8 a	10.8 a	ND	11.1 a	8.4 a	9.5 a
10 lbs/ac	9.9 a	10.5 ab	ND	11.1 a	8.4 a	9.3 a
20 lbs/ac	9.7 a	10.3 b	ND	11.2 a	8.2 a	9.2 a
2005						
0 lbs/ac	10.0 b	9.9 a	12.4 a	11.9 a	12.5 a	13.9 a
10 lbs/ac	9.8 ab	9.8 a	12.3 a	12.2 a	12.1 b	13.6 ab
20 lbs/ac	9.6 a	10.1 a	12.3 a	12.1 a	12.4 a	13.2 b
2004						
0 lbs/ac	ND	12.2 a	12.4 a	14.2 a	13.5 a	11.0 a
10 lbs/ac	ND	12.0 a	12.7 a	14.9 b	14.2 ab	11.2 a
20 lbs/ac	ND	11.7 a	12.8 a	14.8 b	14.4 b	11.4 a

Means with the same letter for a site-year are not significantly different according to the LSD ($p=0.05$).
ND=Not Determined.

Table 2. Effect of sulfur (S) on kernel plumpness (%) of dryland malt barley. WTARC: Western Triangle Ag. Research Center. 2004-2006.

Treatment S Rate	Location					
	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
2006						
0 lbs/ac	94.4 a	84.7 a	13.8 a	89.0 a	94.9 a	95.4 a
10 lbs/ac	94.9 a	87.3 a	16.8 a	89.2 a	94.9 a	95.4 a
20 lbs/ac	94.6 a	87.0 a	16.8 a	89.6 a	95.0 a	94.5 a
2005						
0 lbs/ac	92.7 a	95.3 a	88.9 a	95.0 a	90.8 a	83.0 a
10 lbs/ac	94.8 a	95.6 a	89.0 a	94.9 a	90.9 a	85.5 a
20 lbs/ac	93.8 a	95.7 a	88.3 a	94.3 a	90.3 a	86.8 a
2004						
0 lbs/ac	ND	82.9 a	88.4 a	60.0 a	19.9 a	87.8 a
10 lbs/ac	ND	83.2 a	87.4 a	61.0 a	19.1 a	86.4 a
20 lbs/ac	ND	84.1 a	88.2 a	63.2 a	20.9 a	88.9 a

Means with the same letter for a site-year are not significantly different according to the LSD ($p=0.05$).
ND=Not Determined.

Edited by Clain Jones, Extension Soil Fertility Specialist, and Elizabeth D'Imperio, Research Associate