ANNUAL REPORT

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Title: Malt Barley Yield and Grain Metabolite Response to Nitrogen and Sulfur Grown Outside the Snake River Plain

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Accomplishments: Describe accomplishments relative to the proposed objectives.

The objectives of this study

1) Assess the effect of S fertilizer rates and sources on two contrasting malt barley lines grown outside the Snake River plain in terms of grain yield, quality, and grain metabolite species.
2) Evaluate N fertilizer stabilizer/protection products for malt barley yield and grain quality.

Field experiments were conducted at three locations outside the Snake River plain in Eastern Idaho (Soda Springs (dryland), Bellevue (irrigated), and Tetonia (irrigated)). Two malt barley varieties, ABI Voyager and Moravian 179, were planted in the spring and received the fertilizer treatments described in Table 1. In most treatments, nitrogen and phosphorus fertilizer rates were balanced using urea or triple superphosphate. Treatments were replicated 4 times and plots were 5’ by 30’. All other nutrients were managed to be non-limiting according to current UI nutrient management guidelines for malt barley. A pre-plant soil sample was collected at one-foot increments to two-foot depths and analyzed for complete nutrient analysis. Additionally, an irrigation water sample was collected and analyzed for nutrient analysis.

The field was planted using a no-till drill and all fertilizer treatments will be banded midway between the seed rows. Each plot was evaluated for emergence, canopy cover, and greenness at late tillering using the Canopeo phone app and a Greenseeker. Immediately before harvest, plant height, tiller number, and kernels per head were measured. At maturity, yield and yield components (plumps and thins, test weight, grain protein content) were or are currently being measured from each plot. A subsample of grain will be shipped to Drs. Jason Walling and Sarah Whitcomb at the USDA ARS Cereal Crops Research Unit for malt quality and metabolomics analysis.

We held field days in Bellevue, Tetonia, and Soda Springs where we were able to showcase the various treatments. One of the interesting observations of this study was that the lower rate of sulfate sulfur sources emerged approximately 3 days earlier than the higher rates, but the heads

on the higher sulfur rates for the micronized elemental sulfur products emerged earlier than the lower rates.

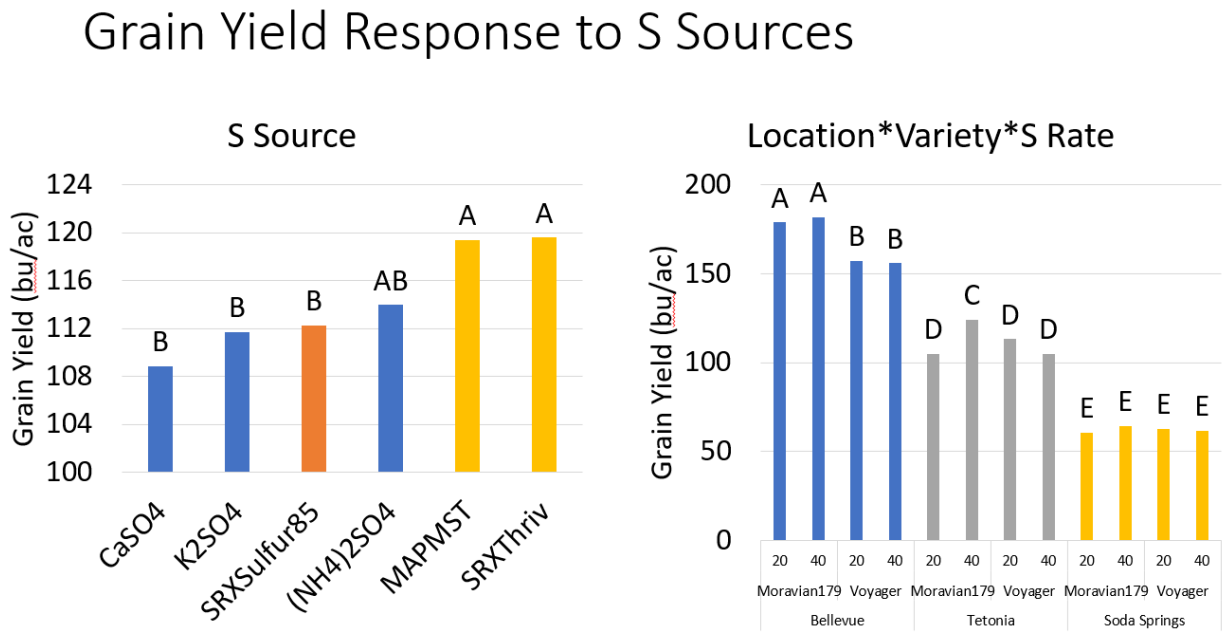
Table1 Fertilizer treatments. GS; Grower standard; N, nitrogen; P2O5, phosphorus; K2O, potassium; S, sulfur; AMS, ammonium sulfate; TSP, triple super phosphate; MAP-MST, monoammonium phosphate with micronized elemental sulfur; SRx Thrive, micronized elemental sulfur embedded in urea; SRx Sulfur 85, 85% elemental S in bentonite clay prills; K2SO4, potassium sulfate; SuperU, urea impregnated with a urease and nitrification inhibitor; Agrotain, a urease inhibitor; ESN, Environmentally Smart Nitrogen- a controlled release N fertilizer;

Treatment	N lb/ac	P2O5 lb/ac	K2O lb/ac	S lb/ac
Unfertilized Check	0	0	0	0
S Check	GS	108	0	0
AMS/Urea/TSP	GS	108	0	10
AMS/Urea/TSP	GS	108	0	20
AMS/Urea/TSP	GS	108	0	30
AMS/Urea/TSP	GS	108	0	40
AMS/Urea/TSP	GS	108	0	50
Gypsum/Urea/TSP	GS	108	0	20
Gypsum/Urea/TSP	GS	108	0	40
MAP-MST/Urea/TSP	GS	108	0	20
MAP-MST/Urea/TSP	GS	108	0	40
SRx Thrive/Urea/TSP	GS	108	0	20
SRx Thrive/Urea/TSP	GS	108	0	40
SRx Sulfur 85/ Urea/TSP	GS	108	0	20
SRx Sulfur 85/ Urea/TSP	GS	108	0	40
K2SO4	GS	108	47	20
K2SO4	GS	108	94	40
AMS/SuperU/TSP	GS	108	0	20
AMS/Urea+Agrotain/TSP	GS	108	0	20
AMS/Urea/50%ESN/TSP	GS	108	0	20
AMS/Urea/TSP	GS+20%	108	0	20
AMS/Urea/TSP	GS-20%	108	0	20

Some other initial observations from this study were: There was no response of grain yield to increasing rates of ammonium sulfate (0-50 lb S/ac at 10 lb increments) across all three locations.

Also, averaged across all three locations, micronized elemental sulfur products like MAP-MST and SRXThrive improved yield by 6-9 bu/ac relative to the other sulfate fertilizer sources.

Projections: Discuss how any latest information and project results can or will be used. Comment on potential design of objectives of possible related future projects.



The data generated from this study will be used to build a database of barley responses to N and S fertilization. This data, in coordination with other researchers' projects, will be used to update the UI's spring barley production guide. We anticipate that this project will generate at least 1 peer-reviewed journal article on the agronomic response of barley to N and S fertilization and 1 or more articles on how N and S fertilization affects malt quality and grain metabolite products. The results from this trial will continue to be shared at professional meetings (such as the Tri-Societies meetings, Western Nutrient Management Conference), Extension events (Cereal Schools, field days), and Extension publications. The raw dataset will be published in a publicly available data repository to ensure the longevity of the dataset and its availability for future research applications.

I have requested additional funds from the Fluid Fertilizer Foundation to add additional liquid N and S sources to the study. These would include urea ammonium nitrate with and without Instinct; and ammonium thiosulfate, potassium thiosulfate, and calcium thiosulfate.

Publications: The first citation is derived directly from this research project. The following two citations were derived from the previous sulfur study funded by the IBC.

Spackman, J.A., J. Bevan, and G. Loomis. 2023. Malt Barley Response to Sulfur Fertilizer Products and Rates. ASA-CSSA-SSSA Annual Meetings. St. Louis, MO. 29 Oct. – 1 Nov. 2023.

R. Findlay, **J.A. Spackman**, Adeyemi, O., J. Sagers, J. Marshall, Z. Hong, and J. Bevan. 2023. Barley Yield and Protein Response to Nitrogen and Sulfur Rates and Application Timing. University of Idaho Annual Extension Conference. Sun Valley, ID. 11 – 12 Apr. 2023.

Adeyemi, O., **J.A. Spackman**, J. Sagers, J. Marshall, Z. Hong, R. Findlay, and J. Bevan. 2023. Barley Yield and Protein Response to Nitrogen and Sulfur Rates and Application Timing. Western Nutrient Management Conference. Reno, NV. 8 – 10 Mar., 2023.