

# NDSU NORTH DAKOTA STATE UNIVERSITY

## GRANT APPLICATION TRANSMITTAL

**This page indicates university endorsement of the referenced proposal and is intended to be submitted to the sponsor organization.**

**Sponsor Organization:** MN Wheat Research and Promotion Council

**Project Title:** *Impact of Sulfur, Nitrogen, and Their Interaction on Grain Yield, Quality, and Net Farmer's Return*

**Project Director:** Jasper Teboh

**Department:** Carrington Research Extension Center

**Project Budget:**

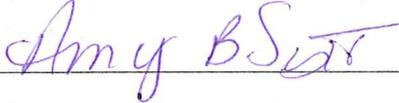
Total Direct Costs	\$ 31,809
F&A/In-direct Costs	\$
F&A/IDC Rate	%
Total Requested	\$ <u>31,809</u>

**Authorized University Representative:** Amy Scott

**Title:** Assistant Director for Sponsored Programs Administration

**Address:** North Dakota State University  
NDSU Dept. 4000, PO Box 6050  
Fargo ND 58108-6050

**Phone:** (701) 231-8045

**Signature:** 

**Date:** 12-28-16

**Any future notifications regarding this proposal, including award notices, should be directed to the authorized university representative at the address listed above.**

**Thank you.**

## Minnesota Wheat Research and Promotion Council

### RESEARCH PROPOSAL GRANT APPLICATION

<b>1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE</b>  <b>Name:</b> North Dakota State University <b>Address:</b> Office of Sponsored Programs Administration Dept #4000 PO Box 6050, Fargo, ND 58108-6050		
<b>2. TITLE OF PROPOSAL</b> Impact of sulfur, nitrogen, and their interaction on grain yield, quality, and net farmer's return		
<b>3. PRINCIPAL INVESTIGATOR(S)</b>  Jasper M. Teboh  <hr/> PI# 2 Name: Joel Ransom  <hr/> PI# 3 Name: Szilvia Yuja	<b>4. PI #1 BUSINESS ADDRESS</b>  NDSU Carrington Research Ext. Center 663 Hwy 281 N Carrington, ND 58421	
<b>5. PROPOSED PROJECT DATES (calendar years)</b> 2017  <small>Note: Research Reports are Due November 15<sup>th</sup> of Each Year</small>	<b>6. TOTAL PROJECT COST</b>  \$31,809	<b>7. PI #1 PHONE NO.</b> 701-652-2951
<b>8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)</b>  1. To determine the extent of S impact on wheat yield and protein 2. To determine if S improves N use efficiency of wheat 3. To determine and show how S application impacts farmers' net return on investment across soil types   <small>Attach a 2-page detailed discussion of importance of the proposal to wheat profitability; how study complements previous research in area; procedures to be used; and competency of the research group in achieving research objectives. (Please keep the proposal concise, only 2 pages will be provided reviewers).</small>		
<b>Signature Of Principal Investigator</b> 	<b>Date</b> 12/22/2016	<b>Phone Number</b> 701-652-2951
<b>Signature Of Authorized Representative</b> 	<b>Title</b> Assistant Director	<b>Date</b> 12-28-16
<b>Address Of Authorized Representative</b> Office of Sponsored Programs Administration Dept #4000, PO Box 6050, Fargo, ND 58108-6050		<b>Phone Number</b> 701-231-8976

# Minnesota Wheat Research and Promotion Council

## RESEARCH PROPOSAL GRANT APPLICATION

### (2-pages maximum)

**Project Title:** Impact of sulfur, nitrogen, and their interaction on grain yield, quality, and net farmer's return

**Importance of this project to the profitability of wheat producers:**

One serious challenge to sulfur (S) fertility management in the Northern Great Plains is the prediction of wheat response to S application based on soil test recommendations. Even though some studies have shown that S fertilization may increase nitrogen use efficiency (NUE) and ultimately yield, and net positive revenue, this has not often been consistent across other locations. In 2016, we examined wheat response to S and N and found yields were numerically lower when S was applied in a soil high in clay and organic matter (3.6%) at Red Lake Falls. Soil organic matter (SOM), which contains at least 90% of plant available S in the soil and is the most important source of S, could have accounted for lack of response. It is therefore important to verify a notion that yield response to S is unlikely when SOM content is greater than commonly communicated value of 3%. Management of S is often a challenge because crop response is dependent on mineralization of S from SOM, soil moisture, soil temperature, and soil texture, and landscape position. To provide farmers with a better understanding of how S may be impacting profitability, and for better management of S fertilization, this project will conclude a three-year study that assesses S impact on yield components, protein, NUE, and most importantly, net revenue across N rates. Preliminary results from the first two years of this study suggest that less N may be required to increase yields when S is applied or available in adequate amount for wheat growth. Though inconclusive from the first two years (2015 and 16), there are indications that in environments where SOM >3.5%, and the soil is loam or heavier, application of S fertilizer may not increase yield and protein by any significant amount, and therefore may be uneconomical. Conducting multi-year studies across environments is a positive and reliable way of identifying environmental limitation of a "one fit-all" approach to applying S fertilizer to wheat on diverse soil types. It also will permit us to assess the consistency of results, and enable us to provide producers with a clearer picture of what to expect with S and N fertilization.

**Procedures:**

The trial will be conducted at three locations in the Red River Valley area. Two field locations have already been identified at Ada and Thief River Falls (TRF), where nutrient leaching is more likely, SOM content is usually less than 3%, and clay content is below 30% (sandy loam). A third site will be located in or near Red Lake falls, MN, where SOM (>3%) and/or clay content is relatively high (loam to clay loam). Five N rates in 60 lbs/ac increments including a control (0 lb/ac), will constitute the main treatment plots, and three S rates (0, 10, 20 lbs/ac) as sub-plot treatments to be imposed within every N main plot treatment. The treatments will be applied following a split-plot arrangement within a randomized complete block design, using four replicates. There will be a total of 15 treatments at each site. Recommended Minnesota state agronomic practices will be followed, such as for herbicide and pesticide application, and deficient soil nutrient application. Data will be collected mid-season to assess tissue N and S levels of flag leaves before anthesis, to determine if S content is limiting, and if N:S ratio is related to final yield or protein in response to S. This is important because some recommendations for mid-season S rely on the N:S ratio, rather than S content, as the best predictor of yield response to S. Grain yield and biomass yield would be recorded at harvest. Grain samples would be analyzed for S and protein content. The

protein content will be used as a proxy to estimate N content in the grain.

**Regional linkages to other research activities:**

None at the time the proposal was prepared.

**List current or potential other funding sources for this project:**

Minnesota Wheat Research and Promotion Council

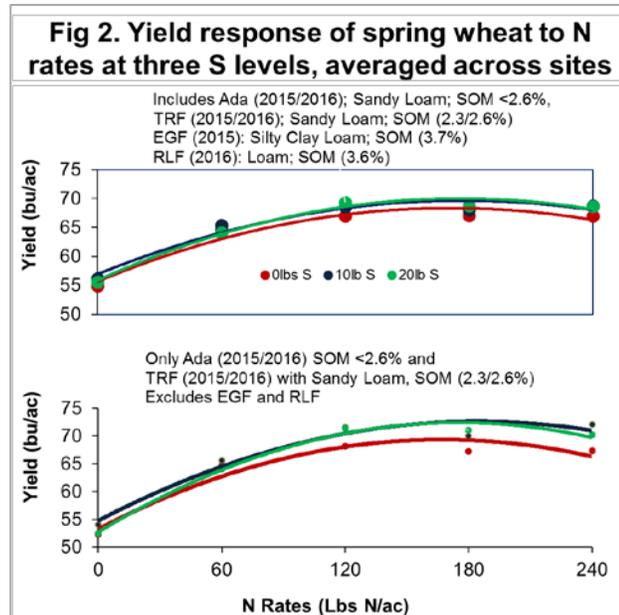
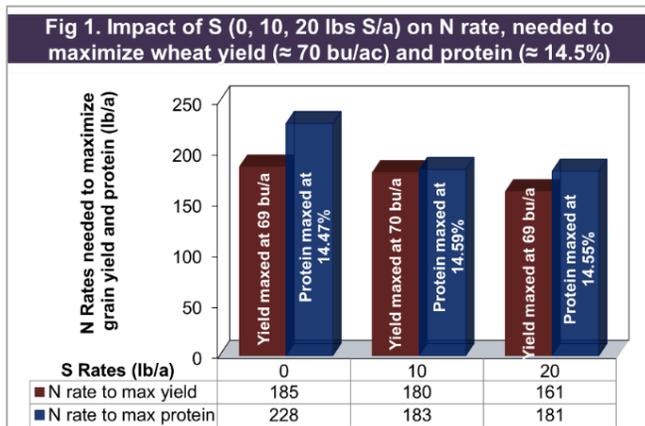
**Research Group:**

Dr. Joel Ransom: Agronomist, Department of Plant Sciences, North Dakota State University (NDSU)

Ms. Szilvia Yuja: Soil Research Specialist, Carrington Research Extension Center - NDSU

**Relationship to past projects:**

This research will conclude three years of studies that started in 2015. Research result highlights from the first two years were presented at the 2015 and 2016 Prairie Grains Conferences, and the 2015 results published in the 2016 Prairie Grains Magazine. Combining results from all sites in 2015 and 2016, yield was maximized at 69 bu and protein at 14.5% (Fig 1); but the quantity of N fertilizer needed to produce maximum yield and protein was always higher without S than with S. Figure 2 shows that S effect on yield was less evident when all sites were combined (EGF +RLF + Ada + TRF for the first graph) than without EGF and RLF (second graph), where SOM was > 3.5%, and the soil had higher clay content. Net return from application of S was inconsistent. In 2015, net return was higher for Ada and negative for TRF and EGF. In 2016, S had a positive effect on net revenue at TRF, but negative in 2016. This final year research will provide us with some answers regarding overall S effect on yield and protein, on NUE, and revenue.



**Estimate the budget requirements:**

\$31,809

**References:**

- Mr. Blaine Schatz – Carrington REC-NDSU Director
- Dr. David Franzen – Extension Soil Fertility Specialist, NDSU
- Dr. Dan Kaiser – Extension Soil Fertility Specialist, University of Minnesota

## Minnesota Wheat Research and Promotion Council RESEARCH PROPOSAL BUDGET

<b>PROJECT TITLE:</b>			
Impact of sulfur, nitrogen, and their interaction on grain yield, quality, and net farmer's return			
<b>Principal Investigator(s) / Project Directors(s)</b>  Jasper Teboh	<b>Funds Requested For</b>		
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)
A. Salaries and Wages	\$	\$	\$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals	2000		
5. Graduate Students			
6. Prebaccalaureate Students	1400		
7. Secretarial - Clerical			
8. Technical, Shop and Other	5700		
B. Fringe Benefits	4004		
C. Consulting and Professional Services			
D. Supplies and Services	6396		
E. Travel	7425		
F. Sub-Contracts			
G. Repairs & Maintenance			
H. Rentals & Lease	4884		
I. Other Expenses	<b>31,809</b>		
<b>TOTAL AMOUNT OF THIS REQUEST (per year)</b>	31,809		

### H. All Other Direct Costs

Flag leaf N and S analyses (0, 10 lbs S at 5 N levels) – 120 samples x \$21.90/sample = \$2,628

Grain S analyses (excludes 20 lbs S) – 120 samples x \$16.55/sample = \$1,986

Soil sampling – 3 samples x \$30 = \$90

Grain protein analysis (All treatments)– 180 samples x \$1/sample = \$180

TOTAL for soil and plant analysis: \$4,884