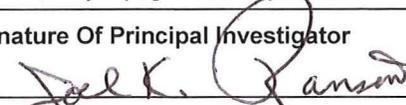
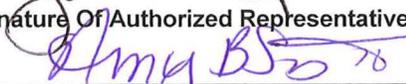


## Minnesota Wheat Research and Promotion Council

### 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> <b>In-Season Nitrogen Applications: Predicting Needs and Verifying Responses for Yield and Protein</b>		
<b>3. PRINCIPAL INVESTIGATOR(S)</b> Joel Ransom  <hr/> PI# 2 Name: Grant Mehring  <hr/> PI# 3 Name:	<b>4. PI #1 BUSINESS ADDRESS</b>  NDSU Plant Sciences PO Box 6050, Dept 7670 Fargo, ND 58108-6050	
<b>5. PROPOSED PROJECT DATES (calendar years)</b> <b>2017</b>  Note: Research Reports are Due November 15th of Each Year	<b>6. TOTAL PROJECT COST</b>  \$30,000	<b>7. PI #1 PHONE NO.</b>  701-231-7405
<b>8. RESEARCH OBJECTIVES:</b> (List objectives to be accomplished by research grant) Determine the impact of N fertilizer timing on the yield and protein of HRSW. Determine if optical sensors can be used to predict the protein level of the crop and therefore could be used by growers to predict the need for additional nitrogen. Test whether the value of using nitrogen rich strips, combined with NDVI or other indexes obtained from a sensor mounted on a UAV (drone), can be used predict the nitrogen requirement of a spring wheat crop.  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).		
<b>Signature Of Principal Investigator</b> 	<b>Date</b> 1/5/17	<b>Phone Number</b> 1-7405
<b>Signature Of Authorized Representative</b> 	<b>Title</b> Amy Scott Assistant Director	<b>Date</b> 1-9-17
<b>Address Of Authorized Representative</b> Amy Scott Sponsored Programs Administration NDSU Dept 4000, PO Box 6050 Fargo, ND 58108-6050	<b>Phone Number</b>  701-231-8045	

# Minnesota Wheat Research and Promotion Council

## RESEARCH PROPOSAL GRANT APPLICATION

### **Project Title:**

In-Season Nitrogen Applications: Predicting Needs and Verifying Responses for Yield and Protein

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

Nitrogen is required for both yield and protein in spring wheat. Nitrogen is mobile and is subject to loss. In-season applications can often be more efficient than applying all of the fertilizer at planting, as it places more of the nitrogen closer to the point when the crop needs it the most. However, in-season applications are relatively more expensive than applying all of the N at planting, and occasionally in-season N can be “stranded” if rainfall does not occur soon after application. Knowing when an in-season application would be profitable and the type of response that can be expected from different application timings is needed in order for any advantages of a split application to be realized. We have two years of research on the effects of various side and topdressing application timings on the yield and protein of spring wheat. We have also tried to determine the best way to predict the need of in-season nitrogen. This has included the use of the Greenseeker™ and similar sensors. The results have been mixed and we feel additional research is needed to better understand how to use these tools. We do not have any experience with the use of drones but they can now be fitted with cameras that can be used to derive NDVI values similar to those produced by the Greenseeker™. NDVI data from drones, coupled with nitrogen rich strips applied prior to planting could be an excellent way for farmers to detect the need for additional N. This system may give better guidance to farmers (and be easier to incorporate into their operation) than fertilizer applicators with mounted sensors, as has been used in other areas of the country. Part of the research we are proposing could be done in conjunction with the on-farm research network in Minnesota and would include whole fields or large portions of a field in the research. We have also carried out crop growth simulation modeling with the intent to predict the yield of a wheat crop based on early season weather. This work needs additional verification and would be funded as part of this project. The results from this project can help improve the profitability of wheat producers by providing them with information to help them better understand when applying in-season nitrogen is likely give a positive response.

### **Procedures:**

We plan to continue the research that is currently being funded that deals with the response of spring wheat to the various timings of urea and UAN. This research will be established at several locations in northwestern MN and eastern ND. Treatments will consist of two base levels of nitrogen augmented with applications of N at the 4 leaf, boot, and post flowering stages, using both UAN and urea. The intent of this research is to answer questions about the impact of in-season applications on yield and protein and the relative cost effectiveness of these applications. Values derived from the Greenseeker™ and Crop Circle sensors will be obtained and used to determine their usefulness in predicting the need for extra nitrogen. Additionally, these same plots will be used to validate the DSSAT model for predicting yield based on weather data. We currently have a student, funded from other sources, that will conduct this modeling work. Finally, we propose to join with the on-farm research group to do the drone related part of this project. Up to 10 growers will be identified that will apply a nitrogen rich strip in a field selected for this activity. This strip will consist of 75 pounds of nitrogen above the normal amount applied by the farmer at planting, will be at least 300 feet in length, and the width of the fertilizer applicator pass. At several times during the growing season, drone flights will be made to measure NDVI values within the N rich strip and adjacent parts of the field. Data from the camera will be stitched to create a base map that will be used for further analysis. Data on yield and protein will be obtained from harvested strips (the N rich strip and an adjacent area of the same dimensions) under the directions of the on-farm research network team. This will be a one-year project. This will allow the current graduate student to finish his program and generate sufficient data to have confidence in the recommendations that are developed.

### **Regional linkages to other research activities:**

The Minnesota wheat on-farm research network. We are open to collaboration with others doing work with drones in Minnesota and benefitting from their expertise.

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

The modeling portion of this project is funded by a grant from the precision ag fund at NDSU. The on-farm research network will be submitting proposals to MDA-AGRI and AFREC-AFREC for their part in this research.

**Research Group:**

Joel Ransom, Grant Mehring, Matthew Rellafor, the MS student working on the project along with the program's research specialists at NDSU.

**Relationship to past projects:**

This research will be a "third" year of research funded by MWRPC dealing with this topic. In addition to increasing our understanding of the role of the environment on the response of in-season N applications and the use of sensor in predicting the need for additional N, we are adding the on-farm work with N rich strips and the use of drones to better meet the needs of growers.

**Estimate the budget requirements:**

We are requesting \$30,000 for 2017, which will be the final year of this project. The justification for this request is as follows:

- 1- Graduate student funding of \$17,000 with associated fringe benefit of \$510 (3% rate for graduate students).
- 2- We are requesting \$750 for consulting and professional services. This will cover the cost of making map after the drone flights that will be used in our further analysis. This will be done by Micasense.
- 3- We are requesting \$2,240 for supplies and services. This will cover the cost of tags, stakes, bags, small research equipment, fertilizers, shipping of seed, tools and fuel for tractors and combines.
- 4- We are requesting \$3,500 for travel, which will cover the motor pool cost of vehicles used to transport people and equipment to the various locations and travel for the PI and or graduate student to a professional meeting to present the findings of the research.
- 5- We have requested \$2,000 for repairs and maintenance. This will cover the cost of repairs to tractors, trailers, combines and other lab and field equipment.
- 6- The request for \$4,000 in the other category is for the purchase of a drone and the camera/sensor to be added to the drone that will be used in the research.

**References:**

Dick, C.D., N.M. Thompson, F. M. Epplin, and D.B. Arnall. 2016. Managing late-season foliar nitrogen fertilization to increase grain protein for winter wheat. *Agronomy Journal* 108:2329-2338.

Woolfolk, C.W., W.R. Raun, G.V. Johnson, W.E. Thomason, R.W. Mullen, K.J. Wynn and K.W. Freeman. 2002. Influence of late-season foliar nitrogen application on yield and grain nitrogen in winter wheat. *Agronomy Journal* 94:429-434.

## Minnesota Wheat Research and Promotion Council RESEARCH PROPOSAL BUDGET

<b>PROJECT TITLE:</b> In-Season Nitrogen Applications: Predicting Needs and Verifying Responses for Yield and Protein			
Principal Investigator(s) / Project Directors(s)  Joel Ransom	Funds Requested For		
	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			
5. Graduate Students	\$17,000		
6. Prebaccalaureate Students			
7. Secretarial - Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits	\$510		
C. Consulting and Professional Services	\$750		
D. Supplies and Services	\$2,240		
E. Travel	\$3,500		
F. Sub-Contracts			
G. Repairs & Maintenance	\$2,000		
H. Rentals & Lease			
I. Other Expenses	\$4,000		
<b>TOTAL AMOUNT OF THIS REQUEST (per year)</b>	<b>\$30,000</b>		