Exhibit I

FOR ADMINISTRATIVE USE
Program Area Code   Proposal Code

Minnesota Wheat Research and Promotion Council

RESEARCH PROPOSAL GRANT APPLICATION

1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Name: NDSU Sponsored Programs
Address: 1735 NDSU Research Park Drive
PO Box 6050, Dept. 4000
Fargo, ND 58108-6050

2. TITLE OF PROPOSAL
Improving N-use efficiency in spring wheat.

3. PRINCIPAL INVESTIGATOR(S)	**4. PI #1 BUSINESS ADDRESS**	
Joel Ransom	NDSU Department of Plant Sciences NDSU Dept. 7670, 166 Loftsgard Hall PO Box 6050 Fargo, ND 58108-6050	
PI# 2 Name: Amitava Chatterjee		
PI# 3 Name: Hans Kandel		
5. PROPOSED PROJECT DATES (calendar years) 2012 & 2013 Note: Research Reports are Due November 15th of Each Year	**6. TOTAL PROJECT COST** $39,010 year 1, $27,610 year 2, *$66,620 total for 2 years*	**7. PI #1 PHONE NO.** 701-231-7405

8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)

1) To determine if N-fertilizer additives can improve N-fertilizer use, with and without tile drainage.

2) To quantify sources of N losses as affected by tile drainage and fertilizer additive.

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).

Signature Of Principal Investigator	**Date**	**Phone Number**
Joel K. Ransom	2/22/12	701-231-7405
Signature Of Authorized Representative	**Title**	**Date**
Valrey V. Kettner	Assoc. V.P. ~~Assistant Director,~~ Sponsored Programs Administration	02/27/12
Address Of Authorized Representative		**Phone Number**
NDSU Dept. 4000 P.O. Box 6050 Fargo, ND 58108-6050		701-231-8045

Minnesota Wheat Research and Promotion Council
RESEARCH PROJECT PROPOSAL
(2-pages maximum)

Project Title: Improving N-use efficiency in spring wheat

Importance: Nitrogen fertilizer is the single most expensive input used in wheat production. Moreover, the price of nitrogen relative to the market value of wheat has generally been increasing. During the recent wet cycle in northwestern MN and eastern ND, the efficiency of applied fertilizer N has been low due to losses from leaching and denitrification. Not only do these losses impact the profitability of farming, but they cause environmental concerns as nitrates have adverse effects in surface and ground water, and nitrous oxide is a potent greenhouse gas. Improving N use efficiency has the potential of increasing farmers' profits and reducing environmental concerns.

Background: Adequate levels of nitrogen have been key to maintaining high productivity and grain quality in spring wheat in MN and ND. In the past, when N fertilizer was considered cheap relative to the market value of a bushel of grain, nitrogen fertilizer recommendations were largely based on the expected yield of a given environment. Current recommendations take into account the price of fertilizer and the price of grain and rates are generally lower than previously recommended (Franzen, 2009). Fertilizer use efficiency is low in spring wheat production; on average only about 30% of the applied nitrogen is recovered by the crop even at low rates of application (Kaiser et al., 2010). Nitrogen is biologically active in the soil. Urea and anhydrous ammonia, the most commonly fertilizer sources of N, are readily converted to ammonium. Ammonium can be converted to nitrate relatively rapidly. Nitrate is the most common form of N taken up by the plant, but it is much more easily lost from the soil than is ammonium. Nitrate can be lost through leaching, particularly in coarse textured soils and through denitrification, particularly in heavy soils and in environments prone to waterlogging. Denitrification inhibitors such as nitrapyrin can slow the rate conversion of ammonium to nitrate and thereby may be able to reduce field losses where waterlogging may occur. In the heavy soils of the RRV we postulate that most of the nitrogen that is lost from the system is lost through denitrification in years when rainfall is excessive. Others have observed these types of losses in heavy soils after large rainfall events (Parkin and Hatfield, 2010). Tile drainage, by reducing the amount of time that a soil is saturated, also has the potential for decreasing denitrification, but may increase losses through leaching. We currently do not have good data that quantified these losses, nor the role that tile drainage and/or a nitrification or slow release fertilizer may have on these losses. Last year, we observed significant yield increases with the use of nitrification inhibitors in corn in both drained and un-drained environments.

Procedures: Experiments will be established at NW22 near Fargo where we are able to compare tile versus non-tiled production systems and at a second location in the RRV and near Prosper. The nitrogen treatment list consists of the following at Prosper and other sites to be conducted by other researchers:

1- 90 lbs N as urea, incorporated prior to planting
2- 130 lbs N as urea, incorporated prior to planting
3- 170 lbs N as urea, incorporated prior to planting
4- 90 lbs N as urea plus Agrotain, incorporated prior to planting (check the value of urea stabilization)
5- 130 lbs N as urea plus Agrotain, incorporated prior to planting (check the value of urea stabilization)
6- 170 lbs N as urea plus Agrotain, incorporated prior to planting (check the value of urea stabilization)
7- 90 lbs N as urea plus Instinct (surface sprayed), incorporated prior to planting (check the value of nitrification inhibition)
8- 130 lbs N as urea plus Instinct (surface sprayed), incorporated prior to planting (check the value of nitrification inhibition)
9- 170 lbs N as urea plus Instinct (surface sprayed), incorporated prior to planting (check the value of nitrification inhibition)
10- 90 lbs N as SuperU, broadcast and incorporated
11- 130 lbs N as SuperU, broadcast and incorporated
12- 170 lbs N as SuperU, broadcast and incorporated

13- 45 lbs N as urea, incorporated prior to planting, plus 45 lb N as UAN at 4/5 lf stage
14- 65 lbs N as urea, incorporated prior to planting, plus 65 lb N as UAN at the 4/5 lf stage
15- 85 lbs N as urea, incorporated prior to planting, plus 85 lb N as UAN at the 4/5 lf stage
16- 45 lbs N as urea, incorporated prior to planting, plus 45 lb N as UAN plus Agrotain plus at 4/5 lf stage
17- 65 lbs N as urea, incorporated prior to planting, plus 65 lb N as UAN plus Agrotain plus at the 4/5 lf stage
18- 85 lbs N as urea, incorporated prior to planting, plus 85 lb N as UAN plus Agrotain plus at the 4/5 lf stage
19- 90 lbs N as ESN urea, incorporated prior to planting
20- 130 lbs N as ESN urea, incorporated prior to planting
21- 170 lbs N as ESN urea, incorporated prior to planting
22- 63 lbs N as urea, incorporated prior to planting and 27 lb ESN applied with the seed at planting
23- 91 lbs N as urea, incorporated prior to planting and 39 lb ESN applied with the seed at planting
24- 113 lbs N as urea, incorporated prior to planting and 57 lb ESN applied with the seed at planting
25- 63 lbs N as urea, incorporated prior to planting and 27 lb urea with the seed at planting
26- 0 N Instinct applied and incorporated prior to planting
27- 0 N – for research purposes only and when making GreenSeeker measurements, it is nice to have a
28- 210 lbs N as urea, incorporated at planting

At NW22, this experiment will be conducted with and with tile drainage. The number of N treatments will be reduced to 20, with the highest N rate being deleted for all factors (i.e. treatments 3, 6, 9, 12, 15, 18, 21, and 24 will be deleted)

A single cultivar will be used with good yield potential and disease resistance (Prosper). Plots will be taken to harvest to determine if N additives improve yield and NUE and to quantify N uptake into the grain. Soil nitrogen form and availability will be measured by intensive weekly soil sampling during the first two months of the growing season of the higher rate of N of each of the additive treatments. These samples will be analyzed for ammonium and nitrate concentration (about 400 samples in total at NW22 only). In years two and three, gaseous loss of nitrogen in the form of nitrous oxide (one of the greenhouse gases) will be measured by gas sampling static chambers biweekly. Gas samples will be analyzed for soil carbon dioxide, nitrous oxide and methane emissions. Funds are requested in year one of the project to help in the purchase of the gas chromatograph and to fund a more limited amount of gas sampling using borrowed equipment. In year two, more extensive sampling will begin and funds are requested for the actual cost of running these samples. Previous research in plots established near Crookston (by Dr. K. Smith) showed significant differences in the amount of nitrous oxide emitted from the soil with different types N sources/additives. Based on data presented in her project report, losses were least in the ESN treatments. Her data showed that the total seasonal N losses as nitrous oxide were about 10 lbs/acre greater in the urea alone treatment than in the ESN treatment. Though this amount seems small in relation to the added cost of the ESN, it may have been on the lower end of what occurs in a year like 2011 when there were significant periods of water logging in some of the heavier soils of the RRV. We believe monitoring nitrous oxide emissions from additional environments is needed, particularly following an extremely wet season when yields were probably halved, in part, by nitrogen deficiencies arising from in-season N losses. We are also interested in determining if tile drainage has a role in improving NUE in years like 2011 by reducing nitrous oxide losses..

Research Group: Joel Ransom (extension agronomist), Amitava Chatterjee (soil scientist-NDSU) with expertise in measuring N losses from the soil, and Hans Kandel (extension agronomist).

Regional Linkages to Other Research Activities: This project will be linked with some of the on-going on-farm research and with a project on soil fertility project lead by Dave Grafstrom.

Additional Sources of Funding: none

References:

Franzen, D.W. 2007. Nitrogen (N) Recommendations for Spring Wheat and Durum. NDSU Extension Service.

Kaiser, D. A. Sims, and J. Wiersma. 2010. Efficient N fertilization of wheat grown in Minnesota – final report. AFREC Project, 2008-2010. Can be viewed at http://www.mda.state.mn.us/en/chemicals/fertilizers/afrec/researchprojects/~/media/Files/chemicals/afrec/reports/wheatnitrogenfert.ashx.

Parkin, T.B. and J.L. Hatfield. 2010. Influence of nitrapyrin on N_2O losses from soil receiving fall-applied anhydrous ammonia. Agriculture, Ecosystems and Environment 136:81-86.

Budget Justification:

All bolded items in the budget table will be assigned to Dr. Chatterjee. The other funds will be assigned to Drs. Ransom and Kandel.

A. *Salaries and Wages Other Professional* – We request funding to cover three months of salary of a research specialist. He/she will provide much of the leadership and labor in the implementation of the proposed work. He/she will supervise students, collect data, harvest plots and summarize data. These funds will be used by JKR/HK.
Salaries and Wages Prebaccalaureate Students – Funds are requested to cover the cost of 400 hours of student labor (@$10 per hour). These students will help with the soil sampling and in lab work that is conducted.

B. *Fringe Benefits* – Fringe rate will be 35% for the Research Specialist and 10% for the student workers.

C. *Nonexpendable Equipment* – Funds are requested to help purchase a gas chromatograph to be used in the work of this project. The amount requested will allow the PI to add the accessories that will facilitate the large number of samples proposed.

D. *Materials and Supplies* – In year one $2,000 is requested to be used in field supplies (tags, bags, fuel for equipment, etc.), soil sampling supplies, and basic lab supplies. In year two $8,000 is requested to cover the added cost of running the gas samples in the lab. These costs include reference gas samples, reagents, etc. It is estimated that each sample will cost about $5 to analyze once the system is fully functional.

E. *Travel* – Funds are requested to cover the cost of travel to and from the field and the university.

H. *All Other Direct Costs - Purchase of Service* – Funds are requested to cover the cost of soil analysis at a commercial lab. We estimate that we will analyze 400 samples in year one and 200 samples in years two and three. The current rate is $12 per sample.

Exhibit II

Minnesota Wheat Research and Promotion Council

RESEARCH PROPOSAL BUDGET

ORGANIZATION AND ADDRESS

Name: North Dakota State University
Address: Office of Sponsored Programs Administration
Dept #4050 PO Box 6050
Fargo, ND 58108-6050

THIS BUDGET IS FOR THE REQUEST FROM MWRPC ONLY

Principal Investigator(s) / Project Directors(s) **Joel Ransom**	Funds Requested For Year 1 (2012)	 Year 2 (2013)	 Year 3 (2014)
A. Salaries and Wages	$	$	$
1. Co-principal Investigator(s)			
2. Senior Associates			
3. Research Associates - Post Doctorate			
4. Other Professionals (Research Specialist)	8,748	8,748	
5. Graduate Students			
6. Prebaccalaureate Students	**4,000**	**4,000**	
7. Secretarial – Clerical			
8. Technical, Shop and Other			
B. Fringe Benefits @ 35% for grads and 10% undergrad	3,462	3,462	
C. Nonexpendable Equipment (Planting and harvesting equipment use)	**15,000**		
D. Materials and Supplies	2,000	**8,000**	
E. Travel	1,000	1,000	
F. Publication Costs			
G. Computer Costs			
H. All Other Direct Costs (Attach supporting data) - Purchase of Service -	**4,800**	**2,400**	
I. TOTAL AMOUNT OF THIS REQUEST (per year)	**$39,010**	**$27,610**	