

**North Central Region Canola Research Program  
Application Cover Page**

Project Title:       Effect of Tillage System, Nitrogen Fertility Strategy, and Soybean as the  
                          Proceeding Crop on Canola Performance and Profitability in Central North  
                          Dakota

Lead Principal Investigator and Institution:   Ezra Aberle, North Dakota State University

Co-Principal Investigator(s):                 Blaine G. Schatz, North Dakota State University

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Funds Requested for 2007: \$6000.00

Project Status: New   X   Renewal           

Does this project involve recombinant DNA, human subjects or vertebrate animals?

       Yes   X   No

If yes, please complete a CSREES Assurance Statement Form 2008 or a Research & Related Other Project Information Form that is available as part of the new application kit through Grants.gov.

Does this project involve the sale of goods or services?        Yes   X   No

If yes, please indicate the nature of the sale in this space:

By signing this proposal, the applicant certifies that the information contained herein is true and complete to the best of their knowledge and accepts as to any award the obligation to comply with the terms and conditions of the Cooperative State Research, Education and Extension Service in effect at the time of the award.

\_\_\_\_\_  
PI Signature

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Dept. Chair/REC Director signature  
(applies only to NDSU applicants)

\_\_\_\_\_  
Authorized Organizational Representative  
(applies only to non-NDSU applicants)

## **Objectives:**

1. To determine the effect of tillage system on canola production.
2. To determine the effect of nitrogen (N) source and fertility on canola production.
3. To determine the effect of soybean as the previous crop on the nitrogen fertility requirements of canola.
4. To determine the effect of the combinations of these factors on canola establishment, yield, seed oil content, disease incidence and severity on profitability and the potential for increased acreage.

## **Procedures:**

The proposed treatments would utilize Roundup Ready soybean as the previous crop. Therefore, we will utilize Liberty Link canola to be competitive across tillage systems and to reduce the potential for building herbicide resistance.

Farm equipment-scale tillage systems, 60 feet wide by 300 feet long, have been established since 1986. The tillage systems are conventional, minimum, and no till. The conventional tillage system is defined by multiple tillage (~3) operations resulting in less than thirty percent residue cover after seeding. The minimum tillage system generally has two tillage operations (non-inversion) resulting in greater than thirty percent residue cover after seeding. The no-till has zero tillage other than disc openers from the drill resulting in greater than eighty percent residue cover after seeding.

Four N fertility treatments will be imposed perpendicularly across the tillage systems. Fertility treatments are ammonium nitrate broadcast applied each spring to plots at 0, 40, and 80 actual pounds of N per acre. An additional N treatment is a composted-manure application designed to make available 40 pounds of N per year for the duration of the four-year rotation. This creates a split-split-plot design with crop as the whole plot (1.25 acres) tillage system as the subplot (.42 acre) and N fertility treatment as the sub-sub-plot (.10 acre). The large size allows for adequate sampling area for data collection of the numerous parameters without confounding data.

Field techniques to be used would be tillage operations to impose the various tillage systems. Fertilizer and manure applications to impose the N fertility treatments. Visual counts will be made of plant stands, plant disease and severity, and weed species and density. Samples will be collected to determine presence of seedling and root diseases, blackleg, as well as sclerotinia. Samples will also be harvested for total above-ground biomass, grain yield, and grain quality. Various machines will be used to determine clean grain yield and seed weight. Nuclear Magnetic Resonance Spectrophotometry (NMR) will be used to determine oil content of the seed samples. All techniques mentioned are feasible.

We expect to be able to determine the effects of tillage system, N source and fertility, and soybean as the proceeding crop, and the interaction between these factors on canola establishment, crop growth and development, yield and quality, sclerotinia and blackleg incidence and severity, and weed species and pressure to determine management strategies to incorporate these practices into canola production. All data will be analyzed using the SAS statistical program and interpreted accordingly. Potential pitfalls could be extrapolation of the

data for growers outside the major canola production regions of North Dakota. There are little, if any, limitations of the proposed procedures.

### **Justification:**

At the recent Canola Biodiesel Forum in Minot, discussion focused on the concern of a canola production shortfall to supply the new biodiesel industry. Therefore, an increase in canola acres and seed oil content is needed to effectively supply this new and growing industry. However, canola production needs to be competitive with other bioenergy crops to satisfy the increased acreage demand. To do this, production methods that decrease production costs and increase the oil content of the canola seed need to be determined.

We will investigate reducing input costs by comparing canola production under conventional and reduced tillage systems, by comparing low-cost livestock manure fertilizer to higher cost conventional fertilizer, and by placing canola after soybean in the rotation to take advantage of potential nitrogen credits and legume benefits.

By placing canola on soybean, we are also looking at the potential to tap into a substantial acreage in the state for increased canola production. Little research data is available comparing the performance and economic viability of canola under different tillage systems, under manure fertilization, and following soybean.

Also, additional work is needed to determine the economic feasibility and competitiveness of growing canola under a lower input system (e.g. reduced rates of N fertilizer and manure as a fertilizer source). The Carrington Center houses a Farm Business Management Program instructor, who is available to assist in analyzing the economics of this study.

The Carrington RE Center has an established long-term trial comparing tillage systems which allows for an immediate comparison of treatments proposed in this project without waiting for years to develop a real (mature) no-till soil environment. This work has been conducted with large plots and farm-scale machinery and little outside funding. With increasing financial demands and the current budget constraints, continuation of the established long-term trial is in jeopardy.

The potential impact of our proposed treatment combinations (tillage systems, N fertility, and soybean) on oil content is unknown. However, the contrast of tillage system and fertility source and level, and taking advantage of the soybean credit, we may be able to enhance the oil content of the seed and reduce production costs, thereby enhancing the competitiveness of the crop. If the proposed research is able to identify some positives of growing canola after soybean, the results could be the basis toward expanding canola acreage due to the significant soybean production in central and east-central North Dakota.

### **Literature Review:**

Numerous studies have looked at the impact of N fertility on canola production. Canola responds positively to increasing amounts of N fertilizer to about 100 pounds of N (Lukach, 2003). However, N fertilizer costs and technology fees associated with growing GMO herbicide resistant canola are increasing. Another potential method of reducing input would be changing the tillage system used. Very little scientific research is available on the comparison of tillage systems on canola production, especially established no-till systems. In addition, little if any scientific research has investigated the deliberate combination of tillage system and N fertility.

Manure has been shown to be a viable and economical fertilizer source for many crops (Funke, 2003). More research needs to be done on ways to lower input costs for producers while remaining economically viable. This study looks at potential ways of lowering input costs and the ramifications associated with the treatments proposed.

Funke, K. 2003. Manure saves fertility costs and adds weed control. Canola Digest. October/November 2003

Lukach, J. 2003. Carrington Research Extension Center. A report of Agricultural Research and Extension in Central North Dakota. Vol. 43 December 2003

### **Current Work:**

The long-term cropping systems project at the Carrington RE Center began in 1986. The work is being conducted with very little outside funding. With increasing financial demands and a limited budget, continuation at the present level is in jeopardy. Every four years a cropping cycle is completed and opportunity exists to make changes or modify the three different four-year crop rotations. Please note that all treatments and sequences are evaluated each year of the study. A new set of crop rotations will be initiated during the spring of 2007 and Carrington researchers are making final determinations of the crops and sequences that will be studied over the next four years.

### **Facilities and Equipment:**

Carrington Research Extension Center and subsequently owned equipment.

### **Project Timetable:**

February – March 2007, 2008	Funding approved
April – May 2007, 2008	Obtain and prepare seed and fertilizer, prepare field, plant trial
June – August 2007, 2008	Impose treatments, collect field data
September – October 2007, 2008	Complete field data collection, harvest, process yield samples
November 2007, 2008 - March 2008, 2009	Analyze data, prepare and deliver reports and presentations

### **Personnel Support:**

Estimate of time commitment involved:

Ezra Aberle 5%

Blaine Schatz 1%

## **Ezra Z. Aberle**

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### **Education**

**Master of Science.** Crop Physiology and Production, Iowa State University,  
December 2002.

Thesis: Determination of Optimum Planting Procedures of Eastern Gamagrass  
in a Northern Climate

**Bachelor of Science.** Animal Science, Iowa State University, May 1998.

### **Work Experience**

#### **Research Specialist / Cropping Systems**

North Dakota State University – Carrington Research and Extension Center, May 2002 - Present

- Design, conduct, and analyze field experiments.
- Implement and assist with the application and evaluation of new and ongoing projects.
- Supervise hourly employees during project establishment, maintenance, and data collection.

#### **Graduate Teaching Assistant**

Department of Agronomy, Iowa State University. Spring 1999 - Fall 2000.

- Organize and prepare materials for an undergraduate laboratory class in Grain and Forage Crop Management.
- Teach specific laboratory sections in the class mentioned above.

#### **Graduate Research Assistant**

Department of Agronomy, Iowa State University. Spring 1999 – present.

- Design, conduct, and analyze field experiments for completion of M.S. degree.
- Assist with application and evaluation of ongoing projects in Crop Physiology and Production.
- Supervise hourly employees during project establishment, maintenance, and data collection.

#### **Undergraduate Research Assistant**

**Department of Animal Science, Iowa State University. Fall 1996 – Spring 1998**

- Assist with the application and collection of data for the Department of Animal Science in the area of Reproductive Physiology under Dr. Stephen P. Ford.

**Other Experiences/Activities/Awards**

- Graduate Agronomy Club member, Spring 1999 – 2002.
- Gamma Sigma Delta, Agricultural Honor Society, Graduate student member, Spring 2001 – present.
- Iowa State University Pre. Vet. Club member, Fall 1996 – Spring 1998.
- North Dakota State University Pre. Vet. Club member, Fall 1994 – Spring 1996.

**Publications**

Aberle, E.Z. L.R. Gibson, A.D. Knapp, P.M. Dixon, and K.J. Moore, E.C. Brummer, and Roger Hintz. Optimum planting procedures for eastern gamagrass. *Agron. J.* 95:1054-1062 (2003).

Gibson, L.R., E.Z. Aberle, A.D. Knapp, K.J. Moore, and R. Hintz. Release of seed dormancy in field plantings of eastern gamagrass. *Crop Sci*, 45:494-502 (2005)

Kirk A. Howatt, Gregory J. Endres, Paul E. Hendrickson, Ezra Z. Aberle, John R. Lukach, Brian M. Jenks, Neil R. riveland, Stephen A. Valenti, and Craig M. Rystedt. Evaluation of Glyphosate-Resistant Hard Red Spring Wheat (*Triticum aestivum*). *Weed Technology*: Vol. 20, No. 3, pp. 706–716 (2006).

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## BLAINE G. SCHATZ

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### Education

**M.S., Agronomy**, 1988, Department of Agronomy, North Dakota State University, Fargo, ND.  
Research topic: Grain sorghum production as influenced by row spacing and plant population.  
**B.S., Agronomy**, 1984, Department of Agronomy, North Dakota State University, Fargo, ND.  
Plant Science option.  
**A.A.S., Soil, Water and Civil Engineering**, 1979, University of Minnesota: Crookston.

### Professional Experience

1996 - Present Director/Agronomist, NDSU: Carrington Research Extension Center.  
1989 - 1996 Associate Agronomist, NDSU: Carrington Research Extension Center.  
1985 - 1989 Assistant Plant Scientist, NDSU: Carrington Research Extension Center.  
1979 - 1984 Agricultural Research Technician II (Agronomy), NDSU: Carrington Irrigation Station.  
1978 - 1979 Agricultural Research Technician I (Seedstocks), NDSU: Carrington Irrigation Station.

### Professional Affiliations

American Society of Agronomy - Member  
Crop Science Society of America - Member  
Soil Science Society of America - Member  
North Dakota Dry Pea and Lentil Association – Director  
North Dakota Oilseed Council - Director  
USDA Cool Season Food Legume Crop Germplasm Advisory Committee – Member

### Research Activities

Evaluation of crop protection products and pest management practices.  
Development of enhanced crop production and management techniques.  
Traditional crop development and evaluation.  
Alternative crop development, evaluation, and adaptation.  
Crop and livestock production systems.  
Crop rotations and systems to improve resource efficiency.

### Publications (selected)

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#### Refereed Journal Articles

- 2007 Ransom, J.K., G.J. Endres, and B.G. Schatz. 2007. Sustainable improvement of wheat yield potential: the role of crop management. *Journal of Agricultural Science* (2007), 145, 1-7.
- 2006 Chen, W., B. Schatz, B. Henson, K.E. McPhee, and F.J. Muehlbauer. 2006. First report of *Sclerotinia* stem rot of chickpea caused by *Sclerotinia sclerotiorum* in North Dakota and Washington. *Plant Disease* 90: 114.

- 2005 Steddom, K., M. McMullen, B. Schatz, and C.M. Rush. 2005. Comparing image format and resolution for assessment of foliar diseases of wheat. Online. Plant Health Progress doi:10.1094/PHP-2005-0516-01-RS.
- 2002 Miller, P. R., B. G. McConkey, G. W. Clayton, S. A. Brandt, J. A. Staricka, A. M. Johnston, G. P. Lafond, B. G. Schatz, D. D. Baltensperger, and K. E. Neill. Pulse crop adaptation in the Northern Great Plains. *Agron. J.* 2002 94: 261-272.
- 1998 Kmec, P., M. J. Weiss, L. R. Milbrath, B. G. Schatz, J. Hanzel, B. K. Hanson, and E. Eriksmoen. Growth analysis of crambe. *Crop Science* 38:108-112.
- 1995 Johnson, B.L., K.R. McKay, A.A. Schneiter, B.K. Hanson, and B.G. Schatz. Influence of planting date on canola and crambe production. *J. Prod. Agric.* 8:594-599.
- 1994 Weiss, M. J., B. G. Schatz, J. C. Gardner, and B. A. Nead. Influence of a intercrop of canola and field peas on population levels of the crucifer flea beetle, *Phyllotreta cruciferae* (Goeze) (Coleoptera: Chrysomelidae). *Environ. Entomol.* 23:654-668.

#### Abstracts

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- 2005 Endres, G.J., and B.G. Schatz. 2005. Weed control in direct-seeded field pea. North American Pulse Improvement Association. Newark, Delaware, 28-29, October. Abstracts (pending ID).
- Henson, B., V. Anderson, G. Endres, and B. Schatz. 2005. Pulse production in the Northern Great Plains of the U.S.A. Market Demand and Production Opportunities for "New" Pulses in Alberta – A North American and European Perspective, Edmonton, Alberta, 23-24 November. Abstracts p. 15-19.
- 2004 Steddom, K., McMullen, M., Schatz, B., and Rush, C.M. 2004. Comparing disease assessment methods for late season foliar diseases of wheat. *Phytopathology* 94:S169.
- 2003 Aberle, E. Z., B. G. Schatz, G. J. Endres, R. A. Henson, S. F. Zwinger, and T. J. Indergaard. Integration of tillage, fertility, and crop rotations in a cropping system. 2003. *Agron. Abstr. American Society of Agronomy.*
- Hendrickson, P. E., D. D. Steele, T. F. Scherer, A. Hla, and B. G. Schatz. Renovation of center pivot systems for enhanced irrigation research. 2003. *Agron. Abstr. American Society of Agronomy.*
- B. G. Schatz, S. F. Zwinger, G. J. Endres and R. A. Henson. Comparison of crop productivity in central North Dakota. 2003. *Agron. Abstr. American Society of Agronomy.*
- 2002 Henson, R. A., K. R. McKay, E. D. Eriksmoen, H. A. Lamey, and B. G. Schatz. Control of Aschochyta blight in Chickpea. 2002. *Agron. Abstr. American Society of Agronomy.*
- 2000 Schatz, B. G., and R. A. Henson. The North Dakota State University network of research and extension centers. 2000 *Agron. Abstr. American Society of Agronomy*, p. 75.

#### Proceedings

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- 2005 Endres, G. J., and B.G. Schatz. 2005. Weed control with soil- and POST-applied herbicides in field pea. 2005 Research Progress Report, Western Society of Weed Science, pp 113-115. March 8-10, Vancouver, British Columbia.
- Endres, G. J., and B.G. Schatz. 2005. Weed control management strategies in imidazolinone-resistant sunflower. 2005 Research Progress Report, Western Society of Weed Science, pp 113-115. March 8-10, Vancouver, British Columbia.
- 2004 McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2004. Wheat uniform fungicide trials, ND 2004. Pages 353-354 in: Proceedings of the 2<sup>nd</sup> International Symposium on Fusarium Head Blight. Dec. 11-15, 2004, Orlando, Florida. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.



#### Outreach Publications

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- 2004 Uniform fungicide trials, wheat, ND, 2004. Pages 477-478 *In*: Crop Production Guide 2005. NDSU Extension Service Crop Production Guide No. 15. Fargo, ND.
- 2003 McKay, K., B. Schatz, and G. Endres. Field Pea Production. NDSU Ext. Circular A-1166 (Revised).
- 2002 Anderson, V.L., R. Harold, D. Landblom, G. Lardy, B. Schatz, and J.W. Schroeder. 2002. A guide to feeding field peas to livestock. NDSU Ext Bulletin EB-76 28 pp.

## **Budget Justification:**

**B. Salaries and Wages:** Salaries for Research Technicians covers expenses for technical support for planting, spraying, data collection, plot maintenance and harvesting and for lab technicians for seed sample analysis. Fringe Benefits are calculated at the rate of 35% for research technicians.

**D.1. Travel:** Funds will be used to visit the experimental area on a regular basis as objectives are implemented and to present data at meetings.

Travel to plots – 450 miles @ \$.48 = \$216.00

Travel to meetings – 300 miles @ \$.28 = \$84.00

**F.1. Materials and Supplies:** Consist of herbicides, fertilizers, fuel for land preparation and harvest, bags, stakes, lab and spraying supplies.

Herbicides and fertilizer - \$550.00

Seed - \$300.00

Fuel - \$200.00

Bags, stakes, lab and spraying supplies - \$350.00

## **F.8. Soil Sampling and Analysis and Oil Analysis**

Soil sampling and analysis – 36 samples @ \$24.50/sample = \$882.00

Oil analysis – 36 samples @ \$.50 = \$18.00