

North Central Region Canola Research Program
Application Cover Page
(Must fit on one page)

Project Title: Comparing Straight Harvest with an Antishattering Agent to Swathed Harvest of Canola in the Evaluation of Field Scale Straight Combining Canola compared to Swathed Canola

Lead Principal Investigator and Institution: Burton Johnson

Co-Principal Investigator(s): Kent McKay and Eric Eriksmoen and Greg Endres

Mailing Address of Lead PI: NDSU Plant Sciences, Loftsgard 166 Fargo, ND 58105-5105

Email Address of Lead PI: burton.johnson@ndsu.edu

Phone Number of Lead PI: 701-231-8895

Fax Number of Lead PI: 701-231-8474

Funds Requested for 2007: \$ 33,862

Project Status: New _____ Renewal X

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

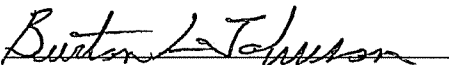
 Yes X No

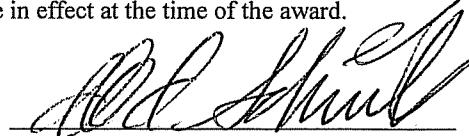
If yes, please complete a CSREES Assurance Statement Form 2008 or a Research & Related Other Project Information Form that is available as part of the new application kit through Grants.gov.

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


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

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

RESEARCH & RELATED Other Project Information

1. * Are Human Subjects Involved? ☐ Yes ☒ No

1.a If YES to Human Subjects

Is the IRB review Pending? ☐ Yes ☐ No

IRB Approval Date:

Exemption Number: ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5 ☐ 6

Human Subject Assurance Number:

2. * Are Vertebrate Animals Used? ☐ Yes ☒ No

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending? ☐ Yes ☒ No

IACUC Approval Date:

Animal Welfare Assurance Number

3. * Is proprietary/privileged information included in the application? ☐ Yes ☒ No

4.a. * Does this project have an actual or potential impact on the environment? ☐ Yes ☒ No

4.b. If yes, please explain:

4.c. If this project has an actual or potential impact on the environment, has an exemption been authorized or an environmental assessment (EA) or environmental impact statement (EIS) been performed? ☐ Yes ☒ No

4.d. If yes, please explain:

5.a. * Does this project involve activities outside the U.S. or partnership with International Collaborators? ☐ Yes ☒ No

5.b. If yes, identify countries:

5.c. Optional Explanation:

6. * Project Summary/Abstract

7. * Project Narrative

8. Bibliography & References Cited

9. Facilities & Other Resources

10. Equipment

11. Other Attachments ☐

Title: Comparing straight harvest with an anti-shattering agent to swathed harvest of canola

1. Objective:

The objective of this research is to:

- i) compare straight combining canola to combining swaths in plots and field scale
- ii) evaluate the effects of delayed harvest on straight harvested canola with and without the use of an anti-shattering agent (Spodnam)
- iii) compare harvest dates for straight and swathed canola
- iv) evaluate treatment effects on yield, green seed, seed moisture, seed and pod shatter, and seed oil content

2. Procedure:

An experiment to evaluate harvest timeliness of canola (*Brassica napus* L.) will be conducted at Carrington, Hettinger, Minot, and Prosper, North Dakota in the 2005 and 2006 growing seasons. The experimental design will be a RCB with 20 treatments and 4 replicates. A common cultivar adapted to all the locations will be selected for evaluation at four harvest dates. Canola will be swathed at physiological maturity. Harvest of swaths will occur at four harvest dates spaced at 10 day intervals. The first harvest date will occur approximately 8 to 14 d after swathing. The first straight harvest date will also occur on swathed harvest date 1. Subsequent straight harvest and swathed dates will occur on 10 d intervals for a total of four straight and four swathed harvest dates. The straight harvest treatments will also include the anti-shattering agent Spodnam applied at a reduced rate of 20 g/acre. This will result in eight straight harvest treatments. Application will be by ground with a pressurized CO₂ sprayer at 40 psi with 60 degree angled nozzles positioned forward and rearward. Spodnam will be applied when the majority of pods are beginning to change from dark to light green in color according to the label. Field studies will have two straight and one swathed treatment with a single harvest date. Fieldplots will be approximately one acre each with four replicates. Harvest will be targeted for 10% seed moisture.

Canola stands will be sown at 600,000 pure live seed per acre with a double-disk opener plot planter with press wheels. Plots will be 6 to 7 feet wide and 25 feet in length with yield and other character determinations measured within a 4 by 20 foot area within the plot interior surrounded by border plants. Characters determined include seed moisture, green seed, seed shatter, seed oil content, plant lodging, and yield. Emergence date, days to canopy closure, days to first flower, duration of flowering, and disease incidence and progression related to harvest yield losses was also be monitored during the growing season.

Standard management practices for planting date, fertility, and pest management will be applied. Canola swathed and straight harvested treatments will be combined with a self-propelled plot combine. Samples will be cleaned, weighed, recorded, and computer file saved for statistical analysis. Location-year (environment) will be considered a random effect and harvest treatment a fixed effect in the analysis. Treatment means separation was performed by *F*-protected LSD comparisons at the $P \leq 0.05$ level of significance.

Problems that could complicate the study include uneven crop maturity, lodged plants, and hot dry weather at time of Spodnam application. These concerns relate to reduced effectiveness of Spodnam for: correct stage of application, application coverage on the canola plants, and rapid changes in maturity resulting in difficulty of precise application timing.

3. Justification:

In the Northern Great Plains, proper harvest management of canola includes swathing. Current North Dakota State University Extension recommendations and guidelines indicate swathing at the optimum stage will reduce green seed problems and seed shatter losses. Swathing presents some challenges in that a grower must swath prior to the crop shattering; however, not too early where green seed will become an issue. Growers do their best to swath at the optimum stage; however, due to adverse weather conditions, they are not always able to get every field swathed in a timely manner. The canola swath should be allowed to cure and ripen for a minimum of 10 to 14 days, during which a strong wind may blow the swaths out of the windrow making combining very difficult and often resulting in yield losses due to shattering. Canola losses have occurred where hail or a heavy rain have shattered a percentage of the seed prior to harvest.

The risk of losing the crop after swathing and the fact that in Europe, canola is straight combined, have canola growers interested in the concept of straight combining canola in North Dakota. Currently, straight combining canola is not a recommended practice due largely to the lack of research information. One risk with straight combining canola is that often the seeds and pods are ripe; however the stem is green resulting in harvest to be delayed. This increases the risk of seed loss due to shatter. Being able to straight combine at the correct moisture with low green content is also a concern.

A product called Spodnam has been developed to reduce the potential pod shattering of canola when straight combined. Spodnam is an organic film-forming polymer that when applied to pod bearing crops' forms a thin flexible layer on the pod. This layer retains moisture held in the plant tissue reducing stress caused by desiccation resulting in a reduction of pod shatter. Spodnam does not translocate into the plant or pod, thus application timing is very important. Research has shown that the product does work in reducing the shattering potential of canola. Current label requirements indicate 50 gallons per acre (gpa) water volume with ground application. This is an economic concern for most if not all pesticides that are ground applied since ground and aerial application rates are typically 5 to 20 gpa. Growers may elect to reduce water volumes to reduce costs and save time from extra reloading of sprayers. There is no information on the effect of reducing water volumes to a rate of 20 gpa on Spodnam performance.

Spodnam is on the market as a canola harvest aid in North Dakota and will be available this coming growing season, 2005. Although Spodnam is not a new product, its use in North Dakota on canola will be a new production strategy. When new agricultural products enter the market, growers often look for university research that indicates product performance in their production region. Growers evaluate university research results and derive their own conclusions on the usefulness of new products.

4. Literature review:

An extensive computer search of agricultural and biological data bases resulted in few publications pertaining to spodnam ([di-1-p-menthene] anti-shattering effectiveness in canola field studies. Rapeseed research conducted in Poland by Tys (1995) reported spodnam effectiveness was partially dependent on cultivar, crop health, and wetting and drying cycles. Other Polish research by Rudko (1995) indicated spodnam increased rapeseed pod strength and should reduce shattering. Rudko (2001) later reported pod strength increased 24 to 65%, depending on cultivar, by application of potato starch and water. Pakkala (2001), in Finland, indicated seed shatter occurred earlier for spring than turnip rapeseed and cultivars differed among years for shattering likely due to climatic dissimilarities among years.

Studies in the United States by Bridges and Raymer (1998)

Bridges and Raymer (1989) evaluated the anti-shattering agent Spodnam on straight harvest of canola in Georgia. They reported no effect of Spodnam in reducing shattering when applied three weeks and one week before harvest when compared to the untreated control. Water volume was 6 gallons/acre which is the amount recommended for aerial application of Spodnam on canola. Shatter losses were similar for Spodnam and the untreated control and increased as harvest was delayed.

Publications on straight harvest of canola and use of anti-shattering agents in North Dakota are not available.

A specialized combine header (Vario) developed in Germany has been shown to be efficient in straight combining canola (Whetter, 2003). Seed companies are already developing canola cultivars (*B. napus*) better suited for straight harvest. *Brassica rapa* cultivars are straight harvested in other regions of the world, but are not commonly grown in North Dakota. Straight harvest of canola will likely require integrating cultivar type, anti-shattering agents, proper application timing and gpa, and harvesting equipment such as the Vario-header.

References

Bridges, D.C, and P.L. Raymer. 1998. Preharvest and combine seed losses in canola: effect of chemical harvest aids and swathing. Univ. of Georgia Ag. Exp. Sta. Res. Bull. 435.

Whetter, J. 2003. Vario header straight-combines canola. Canola. March, p. 36.

5. Current work - Previous research by Johnson and Hanson (2003) indicated substantial yield reductions from seed shattering when straight harvest and harvest of swaths was delayed in North Dakota. They observed yield reductions from 14 to 44 % when straight harvest was delayed 10 d after first harvest and yield reductions from 14 to 62 % when straight harvest was delayed 20 d after first harvest. There was no yield reduction when harvest of swaths was delayed 10 d, but yield reductions were as great as 15 % when harvest of swaths was delayed 20 days from first harvest. First harvest yield for swathed or straight harvest were similar for two of three location-years. Swathed harvest date 1 was 15% greater than straight harvest date 1 in one location-year. Johnson and Hanson's study did not evaluate anti-shattering agents.

Earlier research by Johnson and Hanson in 1999 at Prosper and Langdon, ND, indicated similar yield for straight harvest control and Spodnam treatments when a single harvest date occurred. A later study by Johnson and Hanson, in 2001 with two dates for straight harvest, showed similar yield reductions for both control and Spodnam treatments when comparing early and late harvest.

In 2004, the Northern Canola Growers Association, Kent McKay and Kip Johnson conducted a replicated field scale trial at Rugby, North Dakota to compare straight combining canola with the traditional method of swathing. Straight combining had 235 pounds per acre higher yield than swathing with similar seed and oil quality (K.R. McKay, 2004, personal communication). This trial indicates that straight combining canola can be done successfully.

Reference

Johnson, B.L. and B.K. Hanson. 2003. Harvest date influence on yield and seed quality of straight and swathed canola. Project report submitted to the North Dakota State Board of Agriculture and Education. Fargo, ND.

6. Facilities and equipment - Existing equipment for establishing field experiments will be utilized at the research sites. These items include tractors, tillage equipment for seedbed preparation, planters, sprayers, plot combines as well as transportation vehicles. Laboratory equipment is also available at the research sites and includes grain cleaners, drying ovens, scales, instruments for oil analysis and computers.

Purchase of sprayer nozzles and fabrication of forward and rearward nozzle placement on the sprayer boom will be necessary.

7. Project Timetable

2007 Winter – obtain seed of cultivars for study and disperse to cooperators

Spring – establish field experiments at research sites

Summer – monitor crop development and manage pests, apply Spodnam, harvest

Fall – clean harvested samples, begin laboratory processing of samples

2008 Winter – finish laboratory processing, statistical analysis and final report

8. Personnel support

Dr. Burton Johnson

Eric Eriksmoen

Greg Endres

Kent McKay

Burton L. Johnson, Ph.D.	Education
Associate Professor, Department of Plant Sciences North Dakota State University, Fargo 701-231-7971 e-mail <burton.johnson@ndsu.edu>	Ph.D. in Plant Sciences. 1993. North Dakota State University, Fargo M.S. in Plant Sciences. 1982. North Dakota State University, Fargo B.S. in Biology. 1974. Minnesota State University Moorhead

Professional Experience

Associate Professor, Dept. of Plant Sciences, North Dakota State Univ., Fargo, from July 1, 2004 to present.
Assistant Professor, Dept. of Plant Sciences, North Dakota State Univ., Fargo, from April 1998 to June 30, 2004.
Appointment is 90% research and 10% teaching. Leadership is provided in conducting crop production research in sunflower, alternative, and potential new crops in North Dakota. Teaching responsibilities include instructing an undergraduate course in crop production, and advising undergraduate and graduate students.

Interim Project Leader, Dept. of Plant Sciences, North Dakota State Univ., Fargo, from January 1993 to April 1998.
Appointment was 100% research and associated with crop production research in sunflower, alternative, and potential new crops in North Dakota.

Research Specialist II, Dept. of Plant Sciences, North Dakota State Univ., Fargo, from April 1976 to April 1998.
Appointment was to provide support to the project leader in conducting crop production research in sunflower, alternative, and potential new crops in North Dakota.

Peer-Reviewed Journal Publications 2005 to 2002 (* corresponding author)

- Guyula, T.J.*, R.W. Gesch, C.A. Bradley, L.E. del Rio, and B.L. Johnson. (in press) First report of *Sclerotinia sclerotiorum* infection on *Cuphea*. Plant Disease.
- Berti, M.T.*, B.L. Johnson, and L.K. Manthey. (in press). Seed physiological maturity in *Cuphea*. J. Industrial Crops Products.
- del Rio, L.E.*, C.A. Bradley, and B.L. Johnson. 2005. First report of white mold caused by *Sclerotinia sclerotiorum* on *echium* (*Echium vulgare* L). Plant Disease 89:684.
- Bradley, C.A.*, L.E. del Rio, C.D. Chesrown, and B.L. Johnson. 2005. First report of soft rot, caused by *Sclerotinia sclerotiorum*, on borage in North Dakota. Plant Disease 89:208.
- Lamb, K.E., and B.L. Johnson*. 2004. Seed size and seeding depth influence on canola emergence and performance in the Northern Great Plains. Agron. J. 96:454-461.
- Kandel, H.J., P.M. Porter*, B.L. Johnson, R.A. Henson, B.K. Hanson, S. Weisberg, and D.G. LeGare. 2004. Plant population influences niger seed yield in the northern Great Plains. Crop Sci. 44:190-197.
- Bradley, C.A.*, L.E. del Rio, and B.L. Johnson. 2003. First report of *Sclerotinia sclerotiorum* on niger (*Guizotia abyssinica*). Plant Disease 87:684.
- Johnson, B.L.*, and B.K. Hanson. 2003. Row-spacing interactions on spring canola performance in the Northern Great Plains. Agron. J. 95:703-708.
- Johnson, B.L.* 2003. Dwarf sunflower response to row spacing, stand reduction, and defoliation at different growth stages. Can. J. Plant Sci. 83:319-326.
- Johnson, B.L.*, and T.L. Henderson. 2002. Water-use patterns of grain amaranth in the Northern Great Plains. Agron. J. 94:1437-1443.

Scientific Abstracts 2005 to 2002

- Berti, M., B. Johnson, F. Forcella, and R. Gesch. 2005. *Cuphea* seed yield and oil content response to harvest methods. CD-ROM. In Agronomy Abstracts, ASA Madison, WI.
- Holthusen, R.A., B.L. Johnson, K.A. Howatt, P.J. Petersen, and R.A. Henson. 2005. Oil sunflower desiccation with glyphosate. CD-ROM. In Agronomy Abstracts, ASA, Madison, WI.
- Johnson, B.L., M.T. Berti, B.K. Hanson, and R.A. Henson. 2005. Planting and harvest date influence on borage gamma-linolenic acid content. CD-ROM. In Agronomy Abstracts. ASA, Madison, WI.
- Dash, S., and B.L. Johnson. 2004. Seeding date effect on potential new crops for North Dakota. CD-ROM. In Agronomy Abstracts. Madison, WI.
- Johnson, B.L., and P.J. Petersen. 2004. Plant defoliation influence on soybean yield. CD-ROM. In Agronomy Abstracts. Madison, WI.
- Lubenow, L.A., and B.L. Johnson. 2004. Evaluation of nitrogen fertility in North Dakota spearmint. CD-ROM. In Agronomy Abstracts. Madison, WI.
- Dash, S., B.L. Johnson, B.K. Hanson, M.A. Halvorson, and R.A. Henson. 2003. Screening New Crops for Adaptation in North Dakota. CD-ROM. In Agronomy Abstracts. ASA, Madison, WI.
- Lubenow, L.A., and B.L. Johnson. 2003. Nitrogen fertility determination for North Dakota spearmint production. In Agronomy Abstracts[CD-ROM], ASA, Madison, WI.
- Hanson, B., B. Johnson, R. Henson, N. Riveland, E. Eriksmoen, P. Carr, and M. Zarnstorff. 2003. Seeding rate response to various management factors in canola production. p. 38. In US Canola Assoc. Abstracts, Washington, D.C.
- Henson, R.A., B.K. Hanson, B.L. Johnson, K.R. McKay, N.R. Riveland, E.D. Eriksmoen, and P.M. Carr. 2003. Canola dormant seeding in ND. p. 37. In US Canola Assoc. Abstracts, Washington, D.C.

- Johnson, B.L., R.K. Zollinger, R.A. Henson, B.K. Hanson, E.D. Eriksmoen, and N.R. Riveland. 2003. Herbicide resistant and conventional canola production systems comparison. p. 1. *In* US Canola Assoc. Abstracts, Washington, D.C.
- Johnson, B.L., and B.K. Hanson. 2003. Row spacing interactions on spring canola performance. p. 29. *In* US Canola Assoc. Abstracts, Washington, D.C.
- Porter, P.M., H.J. Kandel, B.L. Johnson, R.A. Henson, B.K. Hanson, and D.G. LeGare. 2002. Niger research in Northwest Minnesota. *In* Agronomy Abstracts [CD ROM C03-porter132026-P], ASA, Madison, WI.
- Henson, R.A., B.K. Hanson, B.L. Johnson, K.R. McKay, N.R. Riveland, E.D. Eriksmoen, and P.M. Carr. 2002. Canola dormant seeding in North Dakota. *In* Agronomy Abstracts [CD ROM C03-henson161827-P], ASA, Madison, WI.
- Michels, B.W., B.M. Jenks, and B. Johnson. 2002. Control of canola volunteers and testing for multiple herbicide resistance. *In* Agronomy Abstracts [CD ROM A00-michels141427-P], ASA, Madison, WI.

Scientific Proceedings / Presentations 2005 to 2002

- Johnson, B.L., and P.J. Petersen. 2005. Winter rapeseed evaluations in North Dakota. *In* Proc. GCIRC Canola/Rapeseed Technical Meeting. 27-28 June. Winnipeg, Manitoba. Intl. Rapeseed Cong. Paris, France.
- Petersen, J.P., R.A. Henson, B.K. Hanson, and B.L. Johnson. 2005. Effect of low initial stand density on canola performance. *In* Proc. GCIRC Canola/Rapeseed Technical Meeting. 27-28 June. Winnipeg, Manitoba. Intl. Rapeseed Cong. Paris, France.
- Holthusen, R.A., B.L. Johnson, K.A. Howatt, P.J. Petersen, and R.A. Henson. 2005. Oil sunflower desiccant evaluations. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. National Sunflower Assoc., Bismarck, ND.
- Johnson, B.L., R.A. Holthusen, K.A. Howatt, P.J. Petersen, and R.A. Henson. 2005. Nonoilseed desiccant evaluations. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. National Sunflower Assoc., Bismarck, ND.
- Berti, M.T., B.L. Johnson, and P.J. Petersen. 2004. Cuphea seeding depth affects plant stands. p. 23. *In* Proc. Industrial crops and uses to diversify agriculture. 19-20 Sept. Minneapolis, MN. Assoc. for the Advancement of Industrial Crops, Phoenix, AZ.
- Dash, S., B.L. Johnson, and B.K. Hanson. 2004. Seeding date effect on potential new crops for North Dakota. p. 44. *In* Proc. Industrial crops and uses to diversify agriculture. 19-20 Sept. Minneapolis, MN. Assoc. for the Advancement of Industrial Crops, Phoenix, AZ.
- Johnson, B.L., K.A. Howatt, P.J. Petersen, and R.F. Roach. 2004. Sunflower desiccant evaluations. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. Bismarck, ND.
- Johnson, B.L., T.D. Larson, and R.A. Henson. 2003. Stay-green and conventional sunflower desiccation response. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. Bismarck, ND.
- Johnson, B.L., M.A. Halvorson, R.A. Henson, K.A. Grady, and E.D. Eriksmoen. 2003. Delayed harvest influence on sunflower. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. Bismarck, ND.
- Johnson, B.J., T.D. Larson, and R.A. Henson. 2002. Sunflower desiccation and plant drydown. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. Bismarck, ND.
- Larson, T.D., B.L. Johnson, and B.A. Vick. 2002. Effect of maturity and achene location on fatty acid composition. [Online] <http://www.sunflowerusa.com/research>. Verified Dec. 2005. Bismarck, ND.

Selected Grants 2005 to 2002

- Johnson, B.L. Harvest management guidelines for cuphea in North Dakota; Nitrogen fertility influence on yield and oil content in cuphea; Seeding depth guidelines for cuphea production in North Dakota. Grants from the North Dakota SBARE for \$2,200, \$1,918, and \$2,200, respectively, for the 2006 season.
- Johnson, B.L. EPSCoR Sunrise award. Grant from NSF EPSCoR for \$44,816 for 2005 season.
- Johnson, B.L. Winter rapeseed evaluations in North Dakota, Grant from ND SBARE and Northern Canola Growers Assoc. for \$6000 for 2005 season.
- Johnson, B.L., and K.R. McKay. North Central region canola research program. USDA-CSREES grant from NCRP for \$33,855 for the 2005 season.
- Johnson, B.L. Harvest management guidelines for cuphea in North Dakota; Nitrogen fertility influence on yield and oil content in cuphea; Seeding depth guidelines for cuphea production in North Dakota. Grants from the ND SBARE for \$2,000, \$1,000, and \$2,000, respectively, for the 2005 season.
- Johnson, B.L., and K.A. Howatt. Sunflower desiccant effectiveness. Grant from ND SBARE for \$13,313 for the 2005 season. Matching funds of \$4,437 from the National Sunflower Assoc.
- Johnson, B.L., and K.A. Howatt. Sunflower desiccant effectiveness. Grant from ND SBARE for \$9,000 for the 2004 season. Matching funds of \$3,000 from the National Sunflower Assoc.
- Johnson, B.L., and K.A. Howatt. Evaluation of potential sunflower desiccants. Grant from the National Sunflower Assoc. for \$3,000 for the 2003 season.
- Johnson, B.L. Industrial hemp production guidelines for North Dakota. Grant from Agricultural Products Utilization Commission for \$55,000 for 2003.
- Johnson, B.L. Nitrogen fertility management for spearmint production in North Dakota. Grant from Alternative Crops Program for \$43,076 for 2003 and 2004 seasons.
- Johnson, B.L. The influence of low initial stand on canola performance. Grant from ND SBARE \$8,400 for the 2003 season. Matching funds of \$2,800 from the Northern Canola Growers Assoc.
- Johnson, B.L., and B.K. Hanson. Harvest date influence on yield and seed quality of straight combined canola. Grant from ND SBARE for \$4,990 for the 2003 season. Matching funds of \$1,663 from the Northern Canola Growers Assoc.

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039
Expires 03/31/2004

BUDGET

ORGANIZATION AND ADDRESS North Dakota State University				USDA AWARD NO.			
PROJECT DIRECTOR(S) Burton Johnson, Kent McKay, Eric Eriksmoen, Greg Endres				DURATION PROPOSED MONTHS: 12	DURATION PROPOSED MONTHS: _____ Funds Approved by CSREES (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages				CSREES-FUNDED WORK MONTHS			
1. No. Of Senior Personnel				Calendar	Academic	Summer	
a. ____ (Co)-PD(s)							
b. ____ Senior Associates.....							
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates.....							
b. ____ Other Professionals.....							
c. ____ Paraprofessionals.....							
d. ____ Graduate Students.....							
e. 3 Prebaccalaureate Students.....							\$16,365
f. ____ Secretarial-Clerical.....							
g. 2 Technical, Shop and Other.....							\$6,240
Total Salaries and Wages →							\$22,605
B. Fringe Benefits (If charged as Direct Costs)							\$3,820
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →							\$26,425
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies							\$5,250
F. Travel							\$2,187
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J) →							\$33,862
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →							\$33,862
N. Other →							
O. Total Amount of This Request →							\$33,862
P. Carryover -- (If Applicable) Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)			DATE
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

Budget Narrative:**Salary:**

There will be three prebaccalaureate students hired for the duration of the grant period at an hourly wage (timeslip). They will be working with the planting, care and research of the project. The pay will be \$9 in an hourly wage depending on experience and they will be working 606 hours approximately.

There will be two field technicians. One technician (Fargo) will be the key technician required for the establishment and continual maintenance of research sites, along with collecting and recording. The second technician will be employed to assist the researcher at the Minot location with conducting field experiments and recording data in the field. Each technician will be working approximately 150 hours.

Total: \$22,605

Fringes:

Fringe Benefits are 35% for technicians, students are 10%.

Total: \$3,820

Total Salary & Fringes: \$26,425

Materials and supplies:

This includes all materials required for routine field and laboratory research such as plot markers, seed, fertilizer, fuel, chemicals, potting soil, pots.

Total: \$5,250

Travel:

Travel costs to conduct the research at Fargo, Carrington, Hettinger, and Minot, ND All research will be conducted in North Dakota. Several trips will be required to conduct the research needed. The current rate of vehicle mileage cost is \$.53 a mile and we are estimating that we will travel over 4,126 miles during the project.

Total Travel: \$2,187

Grand Total: \$33,862

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039
Expires 03/31/2004

BUDGET

ORGANIZATION AND ADDRESS North Dakota State University				USDA AWARD NO.			
PROJECT DIRECTOR(S) Burton Johnson, Kent McKay, Eric Eriksmoen, Greg Endres Burton Johnson				DURATION PROPOSED MONTHS: 12 Funds Requested by Proposer	DURATION PROPOSED MONTHS: _____ Funds Approved by CSREES (If different)	Non-Federal Proposed Cost- Sharing/ Matching Funds (If required)	Non-federal Cost- Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages.....		CSREES-FUNDED WORK MONTHS					
1. No. Of Senior Personnel		Calendar	Academic	Summer			
a. ____ (Co)-PD(s).....							
b. ____ Senior Associates.....							
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates.....							
b. ____ Other Professionals.....							
c. ____ Paraprofessionals.....							
d. ____ Graduate Students.....							
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. __1__ Technical, Shop and Other.....					\$3,000		
Total Salaries and Wages..... →					\$3,000		
B. Fringe Benefits (If charged as Direct Costs)				\$1,050			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				\$4,050			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				\$1,500			
F. Travel				\$1,450			
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J)..... →				\$7,000			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				\$7,000			
N. Other..... →							
O. Total Amount of This Request..... →				\$7,000			
P. Carryover -- (If Applicable)Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)		DATE	
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039
Expires 03/31/2004

BUDGET

ORGANIZATION AND ADDRESS North Dakota State University				USDA AWARD NO.			
PROJECT DIRECTOR(S) Burton Johnson, Kent McKay, Eric Eriksmoen, Greg Endres Eric Eriksmoen				DURATION PROPOSED MONTHS: 12 Funds Requested by Proposer	DURATION PROPOSED MONTHS: _____ Funds Approved by CSREES (If different)	Non-Federal Proposed Cost- Sharing/ Matching Funds (If required)	Non-federal Cost- Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages.....		CSREES-FUNDED WORK MONTHS					
1. No. Of Senior Personnel		Calendar	Academic	Summer			
a. ____ (Co)-PD(s).....							
b. ____ Senior Associates.....							
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates.....							
b. ____ Other Professionals.....							
c. ____ Paraprofessionals.....							
d. ____ Graduate Students.....							
e. 1 Prebaccalaureate Students.....					\$5,455		
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages..... →					\$5,455		
B. Fringe Benefits (If charged as Direct Costs)				\$545			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				\$6,000			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				\$1,000			
F. Travel							
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J)..... →				\$7,000			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				\$7,000			
N. Other..... →							
O. Total Amount of This Request..... →				\$7,000			
P. Carryover -- (If Applicable)Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)		DATE	
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

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BUDGET

ORGANIZATION AND ADDRESS North Dakota State University				USDA AWARD NO.			
PROJECT DIRECTOR(S) Burton Johnson, Kent McKay, Eric Eriksmoen, Greg Endres Greg Endres				DURATION PROPOSED MONTHS: 12 Funds Requested by Proposer	DURATION PROPOSED MONTHS: _____ Funds Approved by CSREES (If different)	Non-Federal Proposed Cost- Sharing/ Matching Funds (If required)	Non-federal Cost- Sharing/Matching Funds Approved by CSREES (If Different)
A. Salaries and Wages.....		CSREES-FUNDED WORK MONTHS					
1. No. Of Senior Personnel		Calendar	Academic	Summer			
a. ____ (Co)-PD(s)							
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty)							
a. ____ Research Associates/Postdoctorates							
b. ____ Other Professionals							
c. ____ Paraprofessionals							
d. ____ Graduate Students							
e. ____1____ Prebaccalaureate Students					\$5,455		
f. ____ Secretarial-Clerical							
g. ____ Technical, Shop and Other							
Total Salaries and Wages..... →					\$5,455		
B. Fringe Benefits (If charged as Direct Costs)				\$545			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				\$6,000			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				\$1,000			
F. Travel							
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J)..... →				\$7,000			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				\$7,000			
N. Other..... →							
O. Total Amount of This Request..... →				\$7,000			
P. Carryover -- (If Applicable)Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)		DATE	
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							

UNITED STATES DEPARTMENT OF AGRICULTURE
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BUDGET

OMB Approved 0524-0039
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ORGANIZATION AND ADDRESS North Dakota State University				USDA AWARD NO.			
PROJECT DIRECTOR(S) Burton Johnson, Kent McKay, Eric Eriksmoen, Greg Endres <div style="text-align: right;">Kent McKay</div>				DURATION PROPOSED MONTHS: 12	DURATION PROPOSED MONTHS:	Non-Federal Proposed Cost-Sharing/Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by CSREES (If Different)
				Funds Requested by Proposer	Funds Approved by CSREES (If different)		
A. Salaries and Wages		CSREES-FUNDED WORK MONTHS					
		Calendar	Academic	Summer			
1. No. Of Senior Personnel							
a. (Co)-PD(s)							
b. Senior Associates							
2. No. of Other Personnel (Non-Faculty)							
a. Research Associates/Postdoctorates							
b. Other Professionals							
c. Paraprofessionals							
d. Graduate Students							
e. 1 Prebaccalaureate Students					\$5,455		
f. Secretarial-Clerical							
g. 2 Technical, Shop and Other					\$3,240		
Total Salaries and Wages →					\$8,695		
B. Fringe Benefits (If charged as Direct Costs)					\$1,680		
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →					\$10,375		
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies					\$1,750		
F. Travel					\$ 737		
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J) →					\$12,862		
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →					\$12,862		
N. Other →							
O. Total Amount of This Request →					\$12,862		
P. Carryover – (If Applicable) Federal Funds: \$				Non-Federal funds: \$		Total \$	
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O)							
Cash (both Applicant and Third Party) →							
- Non Cash Contributions (both Applicant and Third Party)							
AME AND TITLE (Type or print)				SIGNATURE (required for revised budget only)		DATE	
Project Director							
Authorized Organizational Representative							
Signature (for optional use)							