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

Project Title: **2007 Canola Disease and Insect Survey for North Dakota and Minnesota**

**Lead Principal Investigator and Institution:** Janet Knodel, NDSU, Fargo

**Co-Principal Investigator(s):**
Luis Del Rio-Mendoza, Department of Plant Pathology, NDSU, Fargo
Paul Porter, Department of Agronomy & Plant Genetics, Univ. of Minn.
Terry Gregoire, Devils Lake Extension Office, Area Ext. Agronomist
Greg Endres, Carrington REC, Area Ext. Agronomist
Denise Markle, NC REC, Minot, Area Crop Protection Ext. Specialist

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**Funds Requested for 2007:** $14,370

**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.

Janet J. Knodel
PI Signature

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

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

# 2007 Canola Disease and Insect Survey for North Dakota and Minnesota

**PI:** Janet J. Knodel, Extension Entomologist, North Dakota State University

**Co PIs:** Luis del Rio, Plant Pathologist, NDSU, Fargo
Paul Porter, Associate Professor, Dept. of Agronomy, Univ. MN - St. Paul, MN
Terry Gregoire, Devils Lake Extension Office, Area Ext. Agronomist
Greg Endres, Carrington REC, Area Ext. Agronomist
Denise Markle, NC REC, Minot, Area Crop Protection Ext. Specialist

**Cooperators:**
Ron Beneda, Cavalier (ND) County Extension Educator
Derek Crompton, (MN) Local Extension Educator
Nathan Johnson, (MN) Regional Extension Educator
Hans Kandel, (MN) Regional Extension Educator
Scott Knoke, Benson (ND) County Extension Educator
Art Lamey, AgArt LLC.
Terry Lykken, Towner (ND) County Extension Educator
Mark Miller, Rolette (ND) County Extension Educator
Nels Peterson, Nelson (ND) County Extension Educator
Bill Hodous, Ramsey (ND) County Extension Educator

**Objectives.** The objectives of the proposed project are: (1) To provide information on the incidence of blackleg, Sclerotinia stem rot, aster yellows, and severity of blackspot on pods in the major canola growing areas of Minnesota and North Dakota. (2) To provide specific information on fields near NDAWN weather stations to provide end of the season validation of the Sclerotinia Risk Map. (3) To provide information on the incidence, distribution and severity of crucifer flea beetle throughout North Dakota. 4) To monitor for and to provide pest alerts for Bertha armyworm (*Mamastra configurata*) and migratory Diamondback moth (*Plutella xylostella*) using insect pheromone traps.

**Procedures.**

Disease survey methods used will be the same as in previous years, which are based on survey methods adapted from those used by Petrie *et al* in Saskatchewan (16). The crop will examined when it is in the swath. Each field will have 50 stems sampled, 5 per location, with 10 random locations per field. Normally, each random sample should be at least 30 paces from the previous sample location. Each stem will be assessed for blackleg, Sclerotinia stem rot, and aster yellows. Each field will also have 50 pods sampled, 10 per location, with 5 locations per field. Each pod will be rated for severity of blackspot using the published scale of Conn *et al* (1).

Insect survey methods. For crucifer flea beetle, canola stubble will be swept using a 15 inch sweep net, and the number of flea beetles per 4 sweeps will be recorded at 5 locations for a total of 20 sweeps.

Populations of bertha armyworm and diamondback moth will be monitored with insect pheromone traps. Bertha armyworm will be monitored from mid-June to mid-July, and Diamondback moth from late May to early July. Traps should be placed about 6 inches above the crop canopy. The trap designs include the green unitrap (bucket trap) for monitoring the Bertha armyworm and the sticky wing trap for monitoring the Diamondback moth. Sticky wing bottoms of the Diamondback moth traps will be changed weekly. A strip of vapona will be taped to the side of the bucket of the unitrap before it is placed in the field. Pheromone lures will be stored in the freezer to prevent any chemical decomposition due to heat. Disposable rubber gloves will be used for each species to prevent cross contamination of lures. Pheromone lures for bertha armyworm will be changed at the recommended time interval of 4 weeks and for diamondback moth at 3 weeks. Insect counts will be recorded weekly to biweekly.

For the canola diseases and crucifer flea beetle, fields will be examined in all major canola producing counties in North Dakota and Minnesota. Roads will be traveled and canola fields will be examined on a random basis when they are in the swath. The objective is to examine one field for each 5,000 acres planted in each state, based on acreage information from 2006.

For bertha armyworm and diamondback moth, one to five trap sites will be situated in each county based on acreage of canola grown in 2006. A total of 25 trap sites will be maintained in North Dakota in the following counties: Northwest - Burke (1 site), Mountrail (1), Renville (2), Ward (2); North Central - Benson (1), Bottineau (2), McHenry (1); Northeast - Cavalier (5), Ramsey (1), Towner (2); West Central - McLean (2); Central - Foster (1), Wells (1); Southwest - Hettinger (1), Slope (1); and Southeast - Cass (1).In addition, three trap sites will be monitored in Minnesota in the major canola producing counties (Roseau, Marshall).

The data will be summarized to provide incidence (percent infected stems) of blackleg, aster yellows, and Sclerotinia stem rot, and severity (percent pod area infected) of Alternaria black spot. Plants exhibiting blackleg symptoms will be further divided into 2 groups: superficial lesions (less aggressive PG-1 strain) and penetrating lesions (aggressive blackleg strains). Data will be summarized for the two-state area, for each state and for major producing counties. This will provide information on the prevalence and distribution of three diseases. The data will be compared to that from previous surveys, providing information on the prevalence and losses for Minnesota and North Dakota, the Nation's largest canola producer.

For crucifer flea beetle, data will be mapped to illustrate areas with high or low infestations and made available to producers through the Northern Canola Grower Association and Minnesota Canola Council. These data indicate the relative infestation risk for flea beetles in canola the following spring. Real-time trap data of bertha armyworm and diamondback moth will be posted on the IPM / Entomology websites of NDSU, and weekly pest updates in NDSU's Crop & Pest Report.

These data will be summarized and provided to county agents and area agents in the surveyed areas, as well as to plant pathology and agronomy research and extension faculty in North Dakota and Minnesota. A summary of the data will be published as a NDSU Extension Report.

A summary of data from fields near NDAWN stations, along with planting date, crop rotation and fungicide use will be provided to the consultant in Canada that runs the Sclerotinia Risk Map.

**Justification.** Canola acreage has increased very rapidly in North Dakota and Minnesota, with harvested acreage in North Dakota increasing from 15,000 A in 1991 to 960,000 A in 2003 and in Minnesota from 8,000 A in 1992 to 56,000 A in 2003. With these acreages, shorter rotations of canola may be common in some areas and disease and insect pest problems might increase. Careful monitoring of changing problems is essential. Data on the effect of shortened canola rotations on disease and insect pest buildup is needed. Data to support the Sclerotinia Risk Map is also essential to provide maximum accuracy for grower decisions on the use of fungicides.

The crucifer flea beetle survey data will also help support development of a risk forecasting system on canola (Knodel). Forecasting “Pest Alerts” are an important tool of pest management, and producers need to know how many beetles can emerge from their overwintering sites and moving into fields. Trap data on bertha armyworm and diamondback moth levels provide producers, Ag consultants, Ag field researchers, and extension agents/specialists with an “early” warning system of when these insect pests have arrived in the area or are active; and more importantly, when the levels of infestation could be economically damaging in different canola growing regions of North Dakota. It serves as a “Pest Alert” for those occasional insect pest outbreaks, which can be devastating to the unsuspecting canola producer.

**Literature Review:**

**Previous Studies.** Field surveys of canola diseases were conducted previously in North Dakota in 1991 and 1993-2004 (5-14) in Minnesota in 1996-2004 (8, 10, 11, 12, 13, 14) Data from these surveys documented the incidence of blackleg and Sclerotinia stem rot. They documented that blackleg incidence dropped dramatically from 1991 to 1993. Blackleg was discovered in North Dakota in 1991; producers switched from the highly susceptible Argentine cultivar 'Westar' to moderately susceptible or even moderately resistant cultivars by 1993 (5). Surveys in 1994 and 1995 also documented that blackleg incidence was much greater in Polish canola (*Brassica rapa*) than in Argentine canola (*B. napa*) (6,7). This was not surprising since all Polish varieties available were susceptible. A field of Argentine canola with high blackleg counts has occasionally been traced to a susceptible variety such as 'Hyola 401'. Survey data were published in national professional and North Dakota extension publications, as talks and poster sessions at regional and national plant pathology meetings, and have been presented at canola schools as posters (1995) and in slide/lecture or PowerPoint form at canola schools (1996-2004).

In a 1996 disease survey in Minnesota, North Dakota and South Dakota Sclerotinia was the most prevalent disease in Minnesota and North Dakota. Due to wet conditions early in the season, very little canola was planted in South Dakota, and little survey information was obtained from South Dakota (8).

In a 1997 disease survey in Minnesota, North Dakota and South Dakota, Sclerotinia was not important in the more western counties of North Dakota, but was increasingly prevalent farther east, with the highest incidences in Roseau county, MN, followed by Cavalier county, ND (12).

In a 1998 disease survey in Minnesota and North Dakota, Sclerotinia incidence was lower in both states than in 1997, with an incidence of 12.8% in North Dakota and 10.6% in Minnesota. The incidence was lower in 1998 than in 1996 or 1997 because rainfall ceased in much of the canola growing area at early bloom. However, Sclerotinia incidence was high in Rolette and Towner counties, where rainfall was plentiful throughout July: 31% in Rolette County and 20.5% in Towner County (13).

In a 1999 disease survey in Minnesota and North Dakota, Sclerotinia incidence in North Dakota was about the same as in 1998, but was higher in Minnesota, with an incidence of 15% (14).

In 2000, Sclerotinia incidence was 17% in North Dakota, 17,8% in Minnesota and 6.5% in South Dakota. Blackleg incidences were very low in all three states, as was the severity of Alternaria black spot (11).

In 2001, Sclerotinia incidence was lower, at 14.1% in both North Dakota and Minnesota. Blackleg incidences were low in both states, and the severity of black spot was generally low (10).

In 2002, Sclerotinia incidence was low in North Dakota at 4%. Minnesota had 12.5% Sclerotinia incidence; however, the data was based on only 11 fields total. Blackleg was high in North Dakota, with an incidence of 10.6%. The increase in blackleg incidence may have been due in part to the possible introduction of a new pathogroup. Blackleg isolates from 2003 are currently being tested for the new pathogroup that was recently found in Manitoba (2).

Data on yield trials with Sclerotinia indicate that there is a 0.5 to 0.7% yield loss for each 1% of infected plants (15, 18). Since the survey counted only those plants in which the base of the plants was infected, the higher figure of 0.7% was used to calculate yield losses. Thus, an incidence of 17.0% in North Dakota and 17.8% in Minnesota in 2000 was estimated at losses of 12.0% in North Dakota and 12.5% in Minnesota. Based on acres planted, average state yields and the LDP payments, these losses were estimated at nearly $21,000,000.

There are a number of insect pests that reduce yield in U.S. canola. Pest management inputs will probably increase and change with increasing canola acreage. Flea beetles, principally the crucifer flea beetle, *Phyllotreta cruciferae* (Goeze), are the most economically important insect pest of canola in North Dakota and Minnesota (20). Flea beetles emerge from their overwintering sites in early spring (usually May) as the temperature warms up. These beetles are very mobile and can quickly move into a field if environmental conditions are conducive. The beetle feeds on the young cotyledons and leaves causing defoliation and a typical shot-hole appearance (3). Seedlings severely damaged by beetles may die, and less seriously damaged plants may suffer reduction in seed quality and yield. Fields must be closely monitored for populations of flea beetles. When populations are above economic threshold levels (25% leaf area damaged), insecticides must be applied to prevent further damage to the canola crop (3).

Diamondback moth migrates into North Dakota in May or June (4). Insect pheromone traps are good indicators of the subsequent larval populations, which feed on the leaves, buds, flowers, seed pods, the green outer layer of the stems, and occasionally, the developing seeds (4). The amount of injury will depend on the crop stage and the adult moth / larval densities. Extensive feeding on the flowers will delay plant maturity, cause the crop to develop unevenly, and significantly reduce seed yield.

Insect pheromone traps can also be used to detect bertha armyworms in a general area (4). High trap catches generally indicate the level of larval populations to follow. Larvae feed directly on the pod which causes economically important yield losses and premature shattering (4). Fields scouting for larvae is timed to peak and cumulative trap catch. The best time to scout for larvae is usually timed to 2 weeks after peak trap catch. Based on cumulative number of moths, scouting is conducted at a regularly interval or less frequently. For example, a cumulative trap catch of >1,200 moths per season indicates a "high" risk of larval infestations, and fields should be scouted frequently for larvae. In contrast, a cumulative trap catch of <300 moths per season indicates a "low" risk of larval infestation, and fields should be inspected at least once for any signs of insects or injury.

**Current Work.**

In 2006, sclerotinia stem rot was low, and found on 0.7 and 0% of the plants evaluated in North Dakota and Minnesota, respectively. Sclerotinia stem rot was higher in 2005 with 5.5 and 0.3% of the plants evaluated in North Dakota and Minnesota, respectively. Sclerotinia incidence increased to 8.2 and 6.2% for ND and MN, respectively, in 2004. In 2003, Sclerotinia incidence was 4 and 12.5% for ND and MN, respectively. In 2002, Sclerotinia was the lowest in 11 years of North Dakota survey and in 7 years of Minnesota survey, with an incidence of 4.4% in North Dakota and 7.3% in Minnesota.

Penetrating blackleg lesions were found on 2% of the plants evaluated in North Dakota; blackleg was not found in Minnesota in 2006. These figures are similar to the 2005 survey, in which 4 and 0% of the plants evaluated had penetrating blackleg lesions in North Dakota and Minnesota, respectively. Blackleg incidence (penetrating lesions) in 2004 was 4.6 and 0.2% in ND and MN, respectively. Blackleg incidence in 2003 was 10.6 and 0% for ND and MN, respectively. Blackleg incidence in Minnesota was very low, but in North Dakota the blackleg incidence was 6.7%, the highest since 1991. Blackleg incidence was highest in northeastern North Dakota, with an average of 11.0%.

**Insects.** For crucifer flea beetle, research is underway to develop a risk forecasting system for predicting the spring emergence and population size of crucifer flea beetle based on weather data, and populations of summer flea beetles. Results of these data are published in Knodel's doctoral dissertation (2005, Department of Entomology, NDSU, Fargo, ND). The survey information will continue to validate the forecasting tool. Trap data on bertha armyworm and diamondback moth will provide a statewide "Pest Alert" system for producers and others who are interested in managing these insect pests pro-actively. Proper timing of insecticides to manage these furtive insect pests is critical to prevent economic crop loss.

**Facilities and Equipment.** Vehicles will be rented from the North Dakota state fleet. Project vehicles will be used in Minnesota. Many county staff will use their own vehicles and be reimbursed for mileage. Existing office and computer facilities will be used and are adequate.

**Personnel.** A surveyor will be hired at the Devils Lake Area Extension office and at each of the two research extension centers at Minot and Carrington. These surveyors will work on canola part of the summer, and spend much of their time surveying wheat and other crops from separate funding. Surveyors will be paid to survey canola near the end of the season when surveys of other crops are nearing completion.

Extension personnel in both ND and MN will help scout additional fields. In return, they will be reimbursed for mileage.

The time commitment for the PI and Co-PIs will be 5% FTE.

AgArt L.L.C. (Dr. H. Arthur Lamey) will be hired as a consultant to help conduct the field survey in Cavalier and Towner, ND counties, which have very high acreages of canola. Dr. Lamey will also be available to conduct the survey in areas of MN as needed. Dr. Lamey will also collect and summarize the data from all of the surveyors.

**Project Timetable.** The start of the swath survey will depend on local reports from cooperators. An anticipated start of the survey is August 15 in North Dakota, with a completion of the survey along the Canadian border by September 15. The time frame for Minnesota should be similar. Pheromone traps monitoring will start late May and continue through July. Each trap site takes only about 15 minutes to monitor and change lures.

Results will be summarized and sent to cooperators in both states by October 15. The data will be published by January 1, 2008. Training materials will be completed and made available by January 1, 2008.

**Outreach.** These data will be published and made available to research and extension faculty in the four state region. Training materials, consisting of powerpoint presentations will be developed and made available to cooperators in each state of the four-state region. Materials to be developed include a summary of the survey results as well as information on the most common disease problems found in the survey. Real-time GPS maps of canola swath survey and trapping network for bertha armyworm and diamondback moth are posted during the field season on the NDSU IPM website:

http://www.ag.ndsu.nodak.edu/aginfo/ndipm/index.htm

## References

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2. Fernando, W. G. D. and Chen, Y. 2003. First report on the presence of *Leptosphaeria maculans* pathogenicity group-3, the causal agent of blackleg of canola in Manitoba. Plant Dis. 87:1268.

3. Knodel, J.J. and D.L. Olson. 2002. Crucifer Flea Beetle: Biology and Integrated Pest Management in Canola. NDSU Ext. Serv., E-1234.

4. Knodel, J.J. and D.L. Olson. 2005. Insect Management and Control. *In* Canola Production Field Guide, J. Knodel and D. Berglund (editors), NDSU Ext. Serv., A1280, Feb. 2005.

5. Lamey, H. A. 1995. Blackleg and Sclerotinia Disease of Canola in North Dakota in 1991 and 1993. Plant Disease 79:322-324.

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7. Lamey, A. 1996. North Dakota Disease Survey, 1995. NDSU Extension Rpt. 32, 4 p.

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10. Lamey, A., J. Knodel, G. Endres, K. Andol, R. Ashley, D. Barondeau, B. Craig, V. Crary, Z. Fore, N. Johnson, S. Knoke, M. Liane, T. Lykken, R. Melaas, M. Miller, C. Nyegaard, H. Person, N. Peterson and R. Severson. 2001. 2001 Canola Disease Survey in Minnesota and North Dakota. NDSU Ext. Rpt. 71. 8 p.

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12. Lamey, A. and K. McKay. 1998. 1997 Canola Disease Survey in Minnesota, North Dakota and South Dakota. NDSU Extension Rept. 39. 4 p.

13. Lamey, A., K. McKay and J. Knodel. 1998. 1998 Canola Disease Survey in Minnesota and North Dakota. NDSU Extension Rept. 49. 4 p.

14. Lamey, A., K. McKay, J. Knodel, G. Endres, K. Andol, and Z. Fore. 2000. 1999 Minnesota and North Dakota Canola Disease Survey. NDSU Extension Rept. 60. 5 p.

15. Morrall, R. A. A., J. Dueck and P. R. Verma. 1984. Yield Losses Due to Sclerotinia Stem Rot in Western Canadian Rapeseed. Can. J. Plant Pathol. 6:265.

16. Petrie, G. A. 1986. Blackleg and Other Diseases of Canola in Saskatchewan in 1984 and 1985. Can. Plant Dis. Surv. 66(2):51-53.

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18. Stonehouse, D. 2000. Alternaria Black Spot Is Still Out There. Canola Guide May 2000:17.

19. Thompson, J. R., P. M. Thomas and I. R. Evans. 1984. Efficacy of Aerial Application of Benomyl and Iprodione for the Control of Sclerotinia Stem Rot of Canola (Rapeseed) in Central Alberta. Can. J. Plant Pathol. 6:75-77.

20. Weiss, M.J., P. McLeod, B.G. Schatz, and B.K. Hanson. 1991. Potential for insecticidal management of flea beetle (Coleoptera: Chrysomelidae) on canola. J. Econ. Entomol. 84(5): 1597-1603.

**Budget Narrative.**

**North Dakota**

**Salary and Fringe.** A crop scout will be hired at each region (Carrington, Minot, and Devils Lake - total of 3 scouts). Requested amount for labor is $1,000 (100 hours @ $10/hour). Fringe is 10% (10% x $1000 = $100). An hourly pre-baccalaureate student will assist Knodel with coordination of pheromone traps/lures, data compilation, ArcView mapping and NDSU web work in Fargo (50 hours @ $10/hour).

**Materials and Supplies.** Total material and supplies is $1,000. Pheromone traps and lures will cost approximately $920.60 without shipping costs. Supplies will be re-used from last year when they are in good condition; for example, trap stakes, plastic traps. The remaining $79.40 is for miscellaneous supplies.

| Item | Cost/unit | Unit | Quantity | Total Cost |
|---|---|---|---|---|
| **Fargo - Entomology (Knodel)** | | | | |
| **Trap Supplies** | | | | |
| Green unitrap (bertha armyworm trap) | $102.00 | 12 traps | 2 | $204.00 |
| Scentry wing trap top (diamondback moth trap) | $61.85 | 25 tops | 2 | $123.70 |
| Scentry wing trap bottom (diamondback moth trap) | $105.00 | 100 bottoms | 2 | $210.00 |
| Bertha armyworm lure | $61.50 | 25 lures | 5 | $307.50 |
| Diamondback moth lure (need lures) | $18.85 | 12 lures | 4 | $75.40 |
| **TOTAL** | | | | **$920.60** |

**Travel.** Crop surveyors (both hired scouts and extension personnel) will drive a total of approximately 12,500 miles (@ $0.38/mile = $4,750) in ND. . Dr. Del Rio-Mendoza will need some travel funds ($600) for collecting soil samples for sclerotinia risk map in spring.

**Other Direct Costs.** AgArt LLC (Dr. H. Arthur Lamey) will act as consultant and provide additional survey data in Cavalier and Towner counties. Dr. Lamey will survey 8 fields in Towner county and 30 in Cavalier county; additional fields may be scouted by Dr. Lamey in MN as needed. Estimated time for the survey is 48 hours. Survey data will be summarized at the end of the season, with estimated time for summarizing 12 hours. A total of 60 hours will be devoted to the survey. The reimbursement to AgArt LLC would be a flat fee of $50/hour ($3,000 total). All expenses are the responsibility of the consultant.

**Minnesota**

**Travel.** Extension personnel will drive a total of approximately 2,500 miles (@ $0.48/ mile = $1,200) for the field survey.

**Budget:**

| | |
|---|---|
| **Fargo - Entomology (Knodel)** | |
| Labor | $500 |
| Fringe (10%) | $50 |
| Materials and supplies | $1,000 |
| Travel | $100 |
| Other direct costs ($3,000 to AgArt LLC) | $3,000 |
| **Subtotal** | **$4,650** |
| **Fargo - Plant Pathology (Luis Del Rio-Mendoza)** | |
| Travel | $600 |
| **Subtotal** | **$600** |
| **Minot (Markle)** | |
| Labor | $1,000 |
| Fringe (10%) | $100 |
| Travel | $700 |
| **Subtotal** | **$1,800** |
| **Carrington (Endres)** | |
| Labor | $1,000 |
| Fringe (10%) | $100 |
| Travel | $700 |
| **Subtotal** | **$1,800** |
| **Devils Lake (Gregoire)** | |
| Labor | $1,000 |
| Fringe (10%) | $100 |
| Travel | $700 |
| **Subtotal** | **$1,800** |

**Langdon**

Mileage for 6 North Dakota County Extension Educators
7,000 miles x $0.38/mile ..... **$2,520**

**Univ. of Minnesota (Porter)**

Mileage for 2 Minnesota County Extension Educators
2500 miles x $0.48/mile..... **$1,200**

**Total..... $14,370**

**JANET JEAN KNODEL**

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**FAX (701) 231-8557**

**EDUCATION:**

**2005** **PhD,** Entomology, North Dakota State University
**1983** **M.S.**, Entomology, Virginia Polytechnic Institute and State University
**1980** **B.S.**, Zoology, North Dakota State University

**PROFESSIONAL EXPERIENCE:**

•Department of Entomology, NDSU — Nov 2005-present
*Assistant Professor – Extension Entomologist*
•North Central Research Extension Center, NDSU — January 1998-Nov 2005
*Extension Crop Protection Specialist*
*Adjunct faculty status in the Department of Entomology, NDSU, Fargo*
•IPM Support Group, Cornell University, NYSAES — September 1985-January 1998
*Senior Extension Associate, Biological Monitoring Coordinator*
•Finger Lakes Community College, Canandaigua, New York — January-May 1991
*Adjunct Assistant Professor*
•Florist and Nursery Crops Laboratory, USDA-ARS, and Department of Entomology, University of Maryland — January 1984-August 1985
*Faculty Research Assistant*

**FIELD OF SPECIALIZATION:**

•Leadership in extension entomology programming relevant to the Upper Great Plains and in disseminating extension/research results in both professional and lay publications.

•Develop and promote the Integrated Pest Management (IPM) Program of North Dakota with Dr. Marcia McMullen, ND IPM Coordinator.

•Over 20 years experience in conducting applied research in pest management of field and horticultural crops. Research projects include: insecticide-fungicide testing (including seed treatments and foliar sprays), evaluating different monitoring systems, using pheromone trapping systems for forecasting pest populations and infestation risks in the field, and evaluating alternative pest management tactics (cultural, biological control).

**HONORS:**

**2006** "State Early Career" Award from Epsilon Sigma Phi, Cooperative Extension Professionals' Organization.
**2003** Scholarship from Epsilon Sigma Phi, Cooperative Extension Professionals' Organization.
**2003** Mary and Mark Andrews Scholarship, College of Agriculture, Food Systems, and Natural Resources, NDSU, Fargo, ND.
**2003** The Honor Society of Phi Kappa Phi, NDSU, Fargo, ND.
**2002** Scholarship from Epsilon Sigma Phi, Cooperative Extension Professionals' Organization.
**2001** Nominee for the Myron and Muriel Johnsrud Excellence in Extension Award, NDSU, Fargo.

**PROFESSIONAL LICENSES:**

- Pesticide Training Certificate - Commercial, Ag Pest Control
- IR-4 Good Laboratory Practices Field Training Certification

**PROFESSIONAL SOCIETIES:**

- Entomological Society of America, Entomological Society of Canada, Entomological Society of Manitoba, International Organization for Biological Control, North Dakota Pea and Lentil Association, Manitoba-ND Zero Tillage Farmers Association, National Sunflower Association, Epsilon Sigma Phi, Phi Kappa Phi

**SELECTED & RECENT PUBLICATIONS AT NDSU:**

**Web-Related:**

Extension website for Department of Entomology: http://www.ndsu.nodak.edu/entomology/ext.htm

**Computer CDs:**

Developed insect matrix and insect information on **"Crop Sequence Calculator"** in cooperation with the Northern Great Plains Research Laboratory, USDA ARS. It is an interactive program for viewing crop sequencing information and calculating returns.

**Peer-reviewed publications:**

Bradley, C. A., S. Halley, J. Lukach, M. McMullen, **J. Knodel**, G. Endres, and T. Gregoire. 2004. Distribution and severity of pasmo on flax in North Dakota and evaluation of fungicides and cultivars for management. Plant Dis. 88: 1123-1126.

Charlet, L.D. and **J.J. Knodel**. 2003. Impact of planting date on sunflower beetle (Coleoptera: Chrysomelidae) infestation, damage, and parasitism in cultivated sunflower. J. Econ. Entomol. 96(3): 706-13.

**Extension Reports:**

**J. Knodel**, M. Boetel, D. Olson, and D. Markle. 2007. 2007 North Dakota Field Crop Insect Management Guide. NDSU Ext. Serv., E-1143.

Mundal, K.D., G.J. Brewer, L.D. Charlet and **J.J. Knodel.** 2006. Banded Sunflower Moth. NDSU Ext. Serv. E-823 (revised), November 2006.

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Lamey, A. **J. Knodel**, G. Endres, T. Gregoire, and R. Ashley. 2001. 2000 Sunflower Disease and Midge Survey. NDSU Ext. Serv. Rep. 68, 7 pp.

**Knodel, J.J.**, L.D. Charlet, and P.A. Glogoza. 2000. Biology and Pest Management of the Sunflower Beetle. NDSU Ext. Serv., E-824, 8 pp.

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**EDUCATION**

**Ph.D. Plant Pathology.** Iowa State University. 1999.
**M.S., Crop Protection.** University of Puerto Rico. Mayagüez Campus, PR. 1987.
**B.S., Crop Protection** *Magna Cum Laude***.** University of Puerto Rico. Mayagüez Campus, PR. 1985.
**Agrónomo (Associate degree in Tropical Agriculture)**. Zamorano. Honduras. 1979.

**WORK EXPERIENCE**

**Assistant Professor.** Dept. Plant Pathology NDSU. March 2001 to date.
Research: Canola pathology, disease management and biological control.
**Post-doctoral Research Associate.** Dept. Plant Pathology, University of Wisconsin-Madison. Nov. 1999 through Feb. 2001.
**Plant Pathologist.** Zamorano, Honduras Jan. 1994 - Dec. 1994.
Teaching: "Introduction to Plant Pathology", "Management of tropical crop pests"
**Assistant Plant Pathologist,** Zamorano, Honduras. Jan. 1991 – Dec. 1993.

REFEREED PUBLICATIONS

Bradley, C.A., R.A. Henson, P.M. Porter, D.G.LeGare, **L.E. del Río**, and S.D. Khot. 2006. Response of canola cultivars to *Sclerotinia sclerotiorum* in controlled and field environments. Plant Dis. 90:215-219.

Gulya, T. J., R. W. Gesch, C. A. Bradley, L.E. del Río, and B. L. Johnson. 2006. First report of *Sclerotinia sclerotiorum* infection on Cuphea. Plant Dis. 90:1554.

Harikrishnan, R. and **L.E. del Río**. 2006. Influence of temperature, relative humidity, ascospore concentration, and length of drying of colonized dry bean flowers on white mold development. Plant Dis. 90:946-950.

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Bradley, C.A., L.E. del Río, and B.L. Johnson. 2005. First report of *Sclerotinia sclerotiorum* on Borage Niger (*Borago officinalis*). Plant Dis. 89:208.

del Río, L.E., C.A. Bradley, and B.L. Johnson. 2005. First report of White mold caused by *Sclerotinia sclerotiorum* on Echium (*Echium vulgare*). Plant Dis. 89:684.

del Rio, L.E., Venette, J.R. and Lamey, H.A.. 2004. Impact of white mold incidence on dry bean yield under nonirrigated conditions. Plant Dis. 88: 1352-1356.

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Hoffman, D.D., Diers, B.W., Hartman, G.L., Nickel, C.D., Nelson, R.L., Pedersen, W.L., Cober, E.A., Dorrance, A.E., Graef, G.L., Steadman, J.R., Grau, C.R., del Río, L.E., Helms, T., Poysa, V., Rajcan, I., and Stienstra, W.C. 2002. Selected soybean plant introductions with partial resistance to *Sclerotinia sclerotiorum*. Plant Dis. 86:971-980.

**Book chapters and other edited scientific publications**

Harikrishnan, R., F. Zabala, and L.E. del Río. 2005. Evaluation of "Contans", a biological formulation for control of Sclerotinia stem rot (SSR) in canola, 2005. B&C Tests 21:FC043

del Río, L.E., C.A. Bradley, and R.S. Lamppa. 2004. White leaf spot- a new threat for dry bean production in America. Bean Improvement Coop. 47:153-154.

Yang, X.B. and L.E. del Río. 2002. Implementation of biological control of plant diseases in Integrated Pest Management systems. In: Gnanamanickam, E. (ed.) Biological Control of Crop Diseases. Marcel Dekker. New York. pp. 339-354.

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del Rio, L.E.; J. Kurle, T. Maloney, and C.R. Grau. 2001. Management of *Sclerotinia sclerotiorum* with cultural practices and biological control. Proc. 23rd Sunflower Res. Workshop 44-47.

del Río, L.E.; C.A. Martinson, and X.B. Yang. 1998. Control of Sclerotinia stem rot of soybeans with *Sporidesmium sclerotivorum*. In: Nelson, B.D., and T.J. Gulya (eds.).Proc. 1998 International Sclerotinia workshop. pp 64-65.

## ABSTRACTS OF RESEARCH PRESENTED AT SCIENTIFIC MEETINGS (2006 only)

Harikrishnan, R. and L.E. del Río. 2006. Effects of soils texture and sclerotial size on carpogenic germination of *Sclerotinia sclerotiorum*. Phytopathology 96:S46.

Harikrishnan, R. and L.E. del Río. 2006. Influence of soils texture and moisture contents on carpogenic germination of *Sclerotinia sclerotiorum* sclerotia. Proc. 2006 Sclerotinia Initiative Meeting pp. 32.

Henson, B., P. Porter, and L.E. del Río. 2006. Evaluation of canola cultivars for resistance to Sclerotinia. Proc. 2006 Sclerotinia Initiative Meeting pp. 25.

Khot, S.D., C.A. Bradley, and L.E. del Río. 2006. Response of *Brassica napus* germplasm accessions to Sclerotinia stem rot. Proc. 2006 Sclerotinia Initiative Meeting pp. 42.

Qandah, I.S., and L.E. del Río. 2006. *Sclerotinia sclerotiorum* ascospore dispersal gradients in canola fields in North Dakota. Phytopathology 96:S95.

Qandah, I.S., L.E. del Río, and C.A. Bradley. 2006. Dispersal of *Sclerotinia sclerotiorum* ascospores in canola fields from area source of inoculum. Proc. 2006 Sclerotinia Initiative Meeting pp. 19.

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**Professional Specialization:** Cropping systems agronomist.

**Research Interests:**

My research focuses on evaluating cropping system sustainability. Recent efforts include evaluating the influence of a rye cover-crop in a corn-soybean rotation on nitrate-N loss and subsurface tile flow; utilizing rye as a cover crop in both organic and conventional production systems; the influence of cropping sequence on soybean cyst nematode population dynamics; the influence of environment on the magnitude of the rotation effect on corn and soybean; the influence of other crops species on the rotation effect with corn; the influence of row width and plant population on corn production; and interpreting corn and soybean yield variability both temporally and spatially.

**Education:**

1986 Ph.D. Agronomy (soil-plant relations) Univ. of Illinois - Urbana, IL
Effects of simulated acid rain on growth and yield of field-grown corn and soybeans.

1983 M.S. Agronomy (soil chemistry) Univ. of Illinois - Urbana, IL
Identification of phenolic acids and flavonoids in the roots of the soybean.

1978 B.S. Chemistry Moorhead State Univ. - Moorhead, MN

**Work Experience:**

01/00 to present Associate Professor, University of Minnesota - St. Paul, MN.
Cropping systems research involving canola, small grains, and additional crops.

01/95 to 01/00 Associate/Assistant Professor, University of Minnesota - Southwest Research and Outreach Center- Lamberton, MN.
Cropping systems research focused on better understanding the corn-soybean rotation and alternatives to the corn-soybean rotation.

08/89 to 01/95 Assistant Professor, Clemson University – Edisto Research and Education Center - Blackville, SC.
Researched cropping systems and alternative crops (canola and flax). Coordinated statewide extension activities in sustainable agriculture, small grains, and canola.

01/89 to 08/89 Research Associate, University of Illinois - Urbana, IL.
Evaluated plant growth response and fate of pollutants in TNT contaminated soils.

01/86 to 10/88 Assistant Professor, University of Wyoming - Baidoa, Somalia.
Conducted soil fertility trials on sorghum at a dryland agricultural research station.

**Refereed Publications:** 26

**Book Chapters:** 1

**Extension Publications and Reports:** 70

# VITAE
# GREGORY J. ENDRES

**Education**

M.S., Crop and Weed Sciences, 1993, North Dakota State University, Fargo, ND. Thesis: Fall-applied trifluralin and ethalfluralin granules in conservation till.

B.S. with honors, Agronomy, 1983, North Dakota State University, Fargo, ND.

**Work Experience**

1990 - present, Area Extension Specialist/Cropping Systems, NDSU, Carrington, ND.
1985 - 1990, Rolette County Extension Agent, NDSU, Rolla, ND.
1983 - 1985, Assistant Ramsey County Extension Agent, NDSU, Devils Lake, ND.
1983, Crop scout, Centrol, West Fargo, ND.
1977 - 1982, Grain elevator and fertilizer plant production employee, Grain Terminal Association, Tintah, Campbell, and Doran, MN.

**Professional Affiliations/Certification**

American Society of Agronomy.
Weed Science Society of America.
Western Society of Weed Science.
National Association of County Agricultural Agents.
North Dakota Extension Agents Association (Professional Training Committee chair, 1996-98; Director, 1997-1999).
Certified Crop Advisor (1996-present).

**Gifts/Grants Awarded (selected)**

G. Endres, B. Hanson, M. Halvorson, and B. Schatz. 2002. Flax response to nitrogen and seeding rates. ND Oilseed Council. $9500.

R. Henson, G. Endres, and B. Schatz. 2001. Sclerotinia infection and inoculum production as influenced by crop species and management techniques. SBARE and selected commodity organizations. $20,532.

R. Henson, E. Eriksmoen, M. Halvorson, G. Endres, and B. Schatz. 1999-2001. Management systems for profitable soybean production in central and western North Dakota. SBARE and ND Soybean Council. $63,000.

G. J. Endres, et al. 2002. Sclerotinia management with fungicides in Canola. Numerous public and private financial sources. $9150.

**G. Endres - Publications (selected)**

G. Endres and K. McKay. 2002. 2001 North Dakota alternative crop variety performance. North Dakota State Univ. Ext. Serv. circular A-1105.

A. Lamey, K. McKay, J. Knodel, G. Endres, K Andol, Z. Fore, and M. Draper. 2002. 2001 Canola disease survey in Minnesota, North Dakota, and South Dakota. North Dakota State Univ. Ext. Serv. Report 63.

G. Endres, B. Schatz, and V. Anderson. 1999. Crambe production. North Dakota State Univ. Ext. Serv. circular A-1010 revised.

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**EDUCATION**

Master of Science, Plant Science
North Dakota State University, Fargo, ND (1999)

Bachelor of Science, Plant Pathology
North Dakota State University, Fargo, ND (1996)

**EMPLOYMENT**

*Area Extension Specialist – Crop Protection*, North Central Research Extension Center, North Dakota State University, Minot, ND
May 2006 – present.

*Research Specialist,* North Central Research Extension Center, North Dakota State University, Minot, ND
May 2000-April 2006.

*Soil Conservationist/Agronomist*, NRCS, Towner, ND.
February 1999 - April 2000.

*Graduate Research Assistant*, North Dakota State University, Fargo, ND.
January 1997 - January 1999.

*Product Development Intern*, DuPont, Fargo, ND.
January - August 1996.

*Field Disease Surveyor*, North Dakota State University, Fargo, ND.
June - August 1995.

**AWARDS**

2004 IR-4 Technical Service Award, North Central Region

**PUBLICATIONS**

Markle, D. M. 2001. Leafy Spurge (*Euphorbia esula*) control and herbage production with imazapic. Weed Technol. 15:474-480.

Markle, D. M. 1999. Evaluation of AC 263,222 for leafy spurge control. M. S. Thesis. North Dakota State University.

Markle, D. M. and R. G. Lym. 1998. Evaluation of Plateau® for leafy spurge control. North Dakota Crop and Pest Report, No. 15, North Dakota Extension Service, Fargo.

Markle, D. M. and R. G. Lym. 1998. Evaluation of AC 263,222 for leafy spurge control. Proceedings, Western Society of Weed Science. vol. 51.

Markle, D. M. and R. G. Lym. 1997. Evaluation of AC 263,222 for leafy spurge control. Proceedings Great Plains Agricultural Council, Leafy Spurge Task Force, Gillette, Wyoming.

Co-authored several publications for North Central Research Extension Center Annual Report, North Dakota Weed Control Research Report, and Western Society of Weed Science Research Progress Report. 2000-2005.

# VITAE
# Terry D Gregoire

**Education**
M.S. Agronomy. 1972. North Dakota State University, Fargo, ND. Thesis: Protein and CHO in Drought Stressed Barley
B.S. Agronomy, 1970, North Dakota State University, Fargo, ND.

**Work Experience**
1978 - present, Area Extension Specialist/Cropping Systems, NDSU Devils Lake, ND.
1974 - 1976, Research and Development, Ansul co. Fargo, ND.
1973 - 1974, Emmons County Agent, NDSU, Linton, ND.
1972-1973, Barnes County Assistant Agent, Valley City, ND.

**Professional Affiliations/Certification**
American Society of Agronomy.
Weed Science Society of America.
Western Society of Weed Science.
Manitoba-North Dakota Zero Tillage Association
Board of Directors, Zero Tillage Association, 1986-89
Board of Directors NCWCS, 1997-99
Conservation Agriculture board of advisors. Secretary 1999 -2005

**Recent Gifts/Grants Awarded**
J Ransom, T. Gregoire, J.Enz, and B. Hanson. 2005. Corn Growth response to Growing Degree Days. Corn Development Council. $10,500 for 1st year

T.Gregoire. 2005. Silverado herbicide for wild Oat control. Bayer Crop Science. $3,000

T.Gregoire. 2005. Axial herbicide for wild Oat control Syngenta. $2,000

**Terry Gregoire - Publications (selected)**
**T. Gregoire**. 2006. 2006 Survey of Pinto Bean Losses. 2006 Crop Production Guide. NDSU Extension Service

**T. Gregoire**, Terry Albe, Loren Nelson, Becky Clow, Mark Fisher, Kevin Kading and Judy Carlson 2005. Income Alternatives for Farmers and Ranchers. North Dakota State Univ. Ext. Service Circular W-942.(Revised)

Bradley, C. A. S. Halley, J. Lukach, M. McMullen, J. Knodel, G.Endres and **T.Gregoire**.2004. Distribution and severity of pasmo on flax in North Dakota and evaluation of fungicides and cultivars for management. Plant Dis. 88: 1123-1126.

Bradley, C.A., J. Knodel, G. Endres, **T. Gregoire**, and M. McMullen. 2004. 2003 Flax Disease Survey in North Dakota. NDSU Ext. Serv., PP-1261.

**T. Gregoire**. 2001. Canola Flowering and Fungicide Application Timing. North Dakota State Univ. Ext. Serv. Circular A-1208.

Arthur Lamey, Janet Knodal, Gregory Endres, **Terry Gregoire** and Roger Ashley 2001. 2000 Sunflower Disease and Midge Survey. North Dakota State University. Extension Report 68.

**T. Gregoire**, Art Lamey and Vern Hofman 2000. Sclerotinia Head Rot of Sunflower. North Dakota State University Extension Service. Circular PP-1193.