

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

Project Title: Effect of Phosphorus Placement on Canola

Lead Principal Investigator and Institution: Paul Hendrickson, North Dakota State University

Co-Principal Investigator(s): John Lukach, North Dakota State University

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Funds Requested for 2007: \$15,700.00

Project Status: New Renewal

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

Objectives

The objective of this project is to evaluate the effectiveness of mid-row banding phosphorus fertilizer.

Procedures

The project will be conducted at Carrington and Langdon. At each location, the study will be established at 2 sites comparing the canola response to phosphorus placement on soils with low and medium phosphorus soil levels. A third site at Carrington will include a high-yield, irrigated environment with a low phosphorus level. Phosphorus will be applied at the recommended rate at each site to compare five phosphorus application strategies: 1) in-row, 2) mid-row band, 3) broadcast incorporated 4) mid-row band + Jumpstart, and 5) Jumpstart. An untreated check will also be included. An Invigor canola hybrid will be seeded at a rate of 14 pure lives seeds/ft² in 14 inch rows. Two plots for each treatment will be planted. One plot will be used to evaluate stand establishment, days to beginning and end bloom and physiological maturity, plant height, plant vigor, and yield parameters. The second plot will be used for destructive plant tissue samples to determine when and how efficiently the plants utilize the phosphorus. Tissue samples will be collected weekly for 4 weeks starting 10 to 14 days after emergence. The tissue samples will be sent to Agvise Laboratories in Northwood and analyzed for phosphorus concentrations.

The individual treatments will be arranged in a randomized complete block design with four replicates. All treatments will receive identical cultural care throughout the growing season. If present, observations will be recorded on other factors affected by the treatments under study.

Justification

The adoption of direct seeding and the desire to apply seed and fertilizer in a one-pass operation has led to the development of new fertilizer application techniques, such as mid-row banding. Mid-row banding usually involves adding an independent opener between every seed row or every second seed row. Some no-till drills with 7.5 or 10 inch row spacing have the capability to direct the seed to every other row, while placing the fertilizer in the openers between the seed rows. The large distance between the seed and fertilizer allows higher rates of fertilizer to be applied with no risk of seed damage. Since phosphorus is relatively immobile, the distance from the seedling root could be a problem. The use of a phosphorus inoculant (Jumpstart) may provide sufficient phosphorus until the roots reach the banded fertilizer.

Current fertilizer recommendations for canola are based upon years of research across Canada. Phosphorus is a relatively immobile nutrient and, in cold soil, phosphorus availability and movement is reduced even further. Phosphorus during the early vegetative stages of the plant is critical for maximum yields. Therefore, applying a starter fertilizer in the seed row is recommended, in addition to any broadcast or banded fertilizer. Differences in application methods tend to be greatest on fields with low phosphorus levels. In research trials on soils that received phosphorus applications for many years, yield responses between seed placed and banded fertilizers tended to be minimal. In these studies, the banded fertilizer was usually placed 2-inches to the side and 2-inches below the seed.

Previous research in this area at Carrington has indicated that canola yields were similar regardless of the phosphorus placement. This research was conducted in 2005 and 2006 under hot and dry conditions. Canola yields were low, possibly masking any phosphorous placement effect that may have occurred. This project will be evaluated at more locations and will also

include plant tissue samples to help identify when and how efficiently the phosphorus is being used in each fertilizer placement method.

Since we are using tissue samples to identify phosphorus uptake, we want to evaluate the response under optimum soil moisture conditions. The high-yield, irrigated site at Carrington will ensure that we have adequate soil moisture in the spring for optimum root development and phosphorus availability. This will also help address some of the questions we have received on the potential for irrigated canola.

Literature Review

In 2003, Desbiolles conducted a trial to evaluate canola responses to various direct seeding system technologies. In his study, canola seed yields were reduced 5-6% when deep banding all of the fertilizer was deep banded when compared to topdressing with urea prior to planting and applying a starter fertilizer with the seed. The trial was conducted under ideal sowing conditions with good follow up rain after planting to incorporate the urea.

Desbiolles, J. 2003. Canola response to seeding systems.

http://www.alkalinesoils.com.au/Trial_Results/Trial%20Book%20pdfs/2003%20pdfs/Soils%20&%20Seeding%20systems%202003/Canola%20&%20seeding%20systems%202003.pdf

Current Work

Studies were conducted in 2005 and 2006 at the Carrington Research Extension Center to evaluate 1) the effect of phosphorus rate and placement on canola performance and 2) the effect of row spacing on canola yield.

Phosphorus Rate and Placement

Studies were established using conventional tillage practices at two locations (Q3 and Landon E) to compare the agronomic performance of different phosphorus rates and application methods. The application methods were: 1) in-row, 2) mid-row band, 3) in-row + mid-row band, and 4) broadcast. The phosphorus rates were: 1) 0 lb, 2) 11.25 lb, 3) 22.5 lb, and 4) 45 lb in 2005 and 1) 0 lb, 2) 22.5 lb, 3) 45 lb, and 4) 90 lb in 2006 phosphate /acre. Soil tests indicated 10-11 ppm (Olsen) phosphate at Q3 (medium) and 3-4 ppm (very low) at Landon E. Canola 'Invigor 4870' was seeded at a rate of 8 pure lives seeds/ft² in 14 inch rows. The in-row and mid-row band applications were applied at seeding. The broadcast application was incorporated prior to seeding.

The phosphorus rate, independent of placement, had the most impact on crop performance. At both locations and in each year, yields increased up to the recommended fertilizer rate and then leveled off (data not shown).

Under the conditions of these trials, phosphate fertilizer placement had minimal effect on yield.

Row Spacing

Trials were also initiated to study the effect of row spacing and seeding rate in two canola hybrids with contrasting plant types. 'Invigor 4870' and 'Hyola 357 Magnum' were seeded in 2005 and 2006 in 7 and 14 inch rows at a rate of 7 or 14 live seeds/ft².

Bloom duration, days to physiological maturity, plant lodging, seed weight, and test weight were similar. A variety by row spacing interaction was observed for seed yield. Yields were similar in each year for Invigor 4870 planted in 7 or 14 inch rows and Hyola 357 planted in 7 inch rows. Seed yield was reduced by about 365 lb/acre when the Hyola 357 was planted in 14 inch rows

While results from the 2005 and 2006 studies are promising, further research is needed to help refine the canola production recommendations for applying seed and fertilizer in a one-pass operation when using the new single disk opener air-drills.

Facilities and Equipment

Carrington and Langdon Research Extension Center and subsequently owned equipment.

Project Timetable

March-May	Obtain and package seed and fertilizer; Prepare field area and apply treatments; Start tissue sampling
June-July	Manage pests; Collect data on crop development
August-October	Collect data on crop development; Harvest; Process samples
November-December	Analyze data, prepare reports and presentations

Personnel Support

<u>Principal Investigators</u>	<u>Estimate of the time commitment involved</u>
Paul Hendrickson	3%
John Lukach	3%

Paul Hendrickson
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(701) 652-2951

Education:

University of Minnesota - Crookston
Major: Agriculture Industries Sales and Management
Bachelor of Science

Oregon State University
Major: Weed Science
Master of Science in Crop and Soil Science
Thesis: Response of Downy Brome (*Bromus tectorum*) and Kentucky Bluegrass (*Poa pratensis*) to Applications of Primisulfuron

Experience:

03/00-present **North Dakota State University Carrington Research Extension Center,**
Carrington, ND
Research specialist

08/99-02/00 **Oregon State University,** Corvallis, OR
Contract research assistant

09/97-08/99 **Oregon State University,** Corvallis, OR
Research assistant

09/95-09/97 **Oregon State University,** Corvallis, OR
Graduate research assistant

06/95-09/95 **American Cyanamid,** Fargo, ND
Technical representative intern

Publications:

Broadleaf weed control in onion. Hendrickson, P. and H. Hatterman-Valenti. 2005. 2004 North Dakota Weed Control Research. Yellow Section, P. 36-40.

Onion Hybrid Performance. Hendrickson, P. and H. Hatterman-Valenti. 2005. Midwestern Vegetable Variety Trial Report for 2004. p.35.

Sunflower head rot screening nursery. Henson, B., M. Swanson, P. Hendrickson, and M. Dahmer. 2005. 2005 Sclerotinia Initiative Annual Meeting, Bloomington, Minnesota, 18-20 January. Abstracts p. 41.

Broadleaf weed control in onion. Hendrickson, P. and M. Swanson. 2004. 2003 North Dakota Weed Control Research. Yellow section, p. 43-45.

Broadleaf weed control in onion sets. Hendrickson, P. and M. Swanson. 2004. 2003 North Dakota Weed Control Research. Yellow section, p. 46.

Imidazolinone-resistant sunflower and subsequent crop evaluations. Hendrickson, P. and B. Henson. 2004. 2003 North Dakota Weed Control Research. Yellow section, p. 61.

Imidazolinone-resistant spring wheat and subsequent crop evaluations. Hendrickson, P. and B. Henson. 2004. 2003 North Dakota Weed Control Research. Green section, p. 40.

Onion Hybrid Performance. Hendrickson, P. and H. Hatterman-Valenti. 2004. A Report of Agricultural Research and Extension in Central North Dakota, Vol. 45:86.

John R. Lukach

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Education:

M.S. 1982, North Dakota State University, Thesis topic: Gluten Strength Evaluation in Durum Wheat, Plant Breeding
B.S. 1974, North Dakota State University, Agronomy

Employment:

July 2000. Superintendent/Plant Scientist, NDSU Langdon Research Extension Center, Langdon, ND.
The superintendent responsibilities are 30% administrative as supervisor over the day to day operations of the center. He also coordinates labor, equipment and resources used by two other centers scientists and for about 20 projects from the Main ND Experiment Station at Fargo who do research at Langdon. The Langdon Center employs eight full time staff. The superintendent's research program is plant protection research in plant pathology, weed control and soil fertility.

June 1982 - July 2000 Director/Plant Scientist, NDSU Langdon Research Extension Center, Langdon.
March 1976 - June 1982. Assistant Agronomist, NDSU North Central Research and Extension Center, Minot, ND.

Annual Producer Oriented Publications:

Performance of Small Grains and Flax in Northeastern North Dakota, 1990-2006.
Performance of Row, Oil and Specialty Crops in Northeastern North Dakota, 1990-2006.
Small Grains Disease Report for Northeast North Dakota, 1993-1994 and 1997-2005

Publications:

McMullen M., and Lukach J. 2005. Results of the uniform fungicide trial on barley, North Dakota, 2005 Page 217 in: Proceedings of the 2005 National Fusarium head blight Forum. Dec. 11-13, Milwaukee, WI. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing.

MI McMullen, M, Lukach, J, McKay, K, and Schatz, B. 2005. Wheat uniform fungicide trials, ND, 2005 Pages 218-220: Proceedings of the 2005 National Fusarium head blight Forum. Dec. 11-13 Milwaukee, WI. U.S. Wheat and Barley Scab Initiative, Michigan State Univ.

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

Lukach, J. 2004. Post applied Nitrogen for Wheat and Canola Production. 2004 Manitoba-North Dakota Zero-Till Proceedings. Vol. 26:126-128.

Lukach, J. 2004. Yield Response to Nitrogen Fertilizer by Application timing in Hybrid and Open Pollinated Canola Varieties. 2004 Manitoba-North Dakota Zero-Till Proceedings.

Halley, S. and Lukach, J. 2004. Calcium supplement alone or in combination with Ronilan fungicide for control of white mold in canola, 2003. Fungicide and Nematicide Tests.

Howatt K, Endres G, Lukach J, Jenks G, Valenti S, and Rystedt C. 2004. Glyphosate-Resistant Wheat Research in North Dakota. Poster. 57th Western Society of Weed Science

Halley, S. and J. Lukach. 2003. Effect of additives in combination with fungicides for control of Sclerotinia in canola Langdon, 2002. Fungicide and Nematicide Tests. Report 58:FC034.

Halley, S and J. Lukach. 2003. Flax cultivar response to fungicide application for the control of pasmo disease, 2002. Fungicide and Nematicide Tests Report 58:FC051.

Lukach, J. R. and E. J. Deibert. 2003. Timing sulfur fertilizer application for canola production in Northeast North Dakota. Poster. U.S. Canola Research Conference Washington, DC from Feb 23-25, 2003.

Lukach, J. 2001. Effects of Dew, Spray Volume and Adjuvant on Fungicide Control of Fusarium Head Blight in Durum wheat, HRSW and Barley. 2001 National Fusarium Head Blight Forum Proceedings.

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 – 658 miles @ \$.48 = \$315.00 x 2 locations = \$632.00

Travel to meetings – 600 miles @ \$.28 = \$84.00 x 2 locations = \$168.00

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

Fungicides, herbicides and fertilizer - \$1000.00 x 2 locations = \$2000.00

Seed - \$300.00 x 2 locations = \$600.00

Fuel - \$300.00 x 2 locations = \$600.00

Bags, stakes, lab and spraying supplies - \$500.00 x 2 locations = \$1000.00

F.8. Tissue and Soil Analysis

Four sampling dates x 16 plots x \$10/sample x 5 sites = \$3200.00