INSIGHTS
IPNI
International Plant Nutrition Institute

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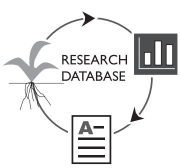
Northern Great Plains Research Report

It is extremely valuable to have local, regional research results when evaluating new fertilizer technologies, whether these are newly developed forms of fertilizers, new additives, or new methods of placing fertilizers. Most research projects are conducted for at least 3 years. This is extremely important due to the natural variability of



weather from one year to another. In parts of the Northern Great Plains in 2009, there were some areas that experienced dry and cool conditions. This made it hard to draw any conclusions as to the effectiveness of the new technologies as drought conditions rarely show any differences between experimental treatments. Fortunately these research projects will be conducted for more than one year. Areas that were droughty in 2009 are presently receiving ample rain in 2010.

This issue of *INSIGHTS* contains brief Interpretive Summaries of research projects supported or arranged by IPNI in the Northern Great Plains Region in 2009. More detail on these and projects from other IPNI regions can be found at the research database at our website: >**www.ipni.net/research**<.

Alberta

Evaluation of Phosphate and Nitrogen Fertilizers Treated with Polymer Additives to Increase Fertilizer Efficiency

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Project Cooperators: Claire Langlois, Guy Lafond, Brian Hellegards

Spring wheat was grown for the N experiment at Ellerslie, Alberta, but cool and dry conditions experienced from April to July affected yield potential in the region. This could not be compensated by more favorable moisture and temperatures that appeared later in the growing season. No significant differences in grain yield were observed between the selected N fertilizer forms [urea, urea treated with Nutrisphere-N® (a polymer coating), Super Urea (including both urease and nitrification inhibitors), and Environmentally Smart Nitrogen or ESN® (designed as a semi-permeable, polymer-coated urea source)]. Differences between fertilizer placement methods (banded at planting versus surface broadcast) or N rates (60 and 120 kg/ha) were also not observed.

In the P experiments, significantly higher yields were observed for dry granular monoammonium phosphate (MAP) compared to liquid ammonium polyphosphate (APP) at Ellerslie. In most years that are warmer and more moist, advantages for MAP over APP are not observed. Yields at Ellerslie responded to P rate as they increased from 3,659 to 4,839 kg/ha as P rate increased from 7.5 to 30 kg P_2O_5/ha. However, no significant difference was observed between regular P fertilizer compared to forms treated with the Avail® polymer additive. The Breton site was less responsive to P with no significant difference observed between the rates of P averaged for both form and with and without Avail®. However, a yield advantage was detected at the 30 kg/ha rate for MAP (3,350 kg/ha) compared to APP (2,728 kg/ha) and both forms resulted in greater yields with Avail® (3,664 kg/ha) than without Avail® (2,413 kg/ha). It is planned to repeat the experiments one more year at these two sites. *AB-26F*

Use of Large Urea Granules for Broadcast Application in No-till Cropping

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Research in Alberta and North Dakota has supported the use of urea granules larger than regular, ag-grade urea as a means of increasing crop yield and reducing the potential for denitrification losses. Thus, larger urea granules (up to 10 mm in diameter) commonly used in helicopter applications in replanted forest stands, and in agro-forestry plantations, could be used in broadcast applications for no-till cropping systems in the Northern Great Plains

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(NGP). The research noted above was largely done by hand application in small field research plots because existing spin-broadcast applicators could not achieve an even spread with larger urea granules. More recent pneumatic spreaders do have the capability to handle these larger granules. Past research has also investigated the addition of a nitrification inhibitor (dicyandiamide, DCD) with different-sized urea granules...although such treated granules were not commercially available at the time. Recent developments now allow the treatment of different-sized urea granules with both a urease and a nitrification inhibitor (i.e., Agrotain® and DCD).

This study investigates: two application timings (fall versus spring); two urea granule sizes (regular 3 mm and large 10 mm); four Inhibitors (regular untreated urea, urea+Agrotain®, and urea+Agrotain®+DCD, and Agrotain® plus N-Serve® (nitrapyrin); three incorporations (no incorporation, harrowing, and sweep chisel-plow tillage). The potential benefits to the agriculture industry are a low cost, low energy input method of applying N to no-till cropped fields in the NGP with reduced potential for ammonia volatilization losses. The fall 2009 treatments were applied as planned, and the spring applications were done in late April 2010. Barley were planted in early May 2010 and will be harvested in late August. *AB-27*

British Columbia

Evaluation of Phosphate and Nitrogen Fertilizers Treated with Polymer Additives to Increase Fertilizer Efficiency

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Project Cooperators: Dick Puurveen, Guy Lafond, and Brian Hellegards

Unfortunately, this site experienced severe early growing season drought and no yield data were available for the phosphate experiment involving the Avail® polymer coating, and only a minimum amount of samples were available for the N experiment involving urea treated with Nutrisphere-N® (a polymer coating) and Super Urea (including both urease and nitrification inhibitors). However, Nutrisphere-N® did perform better than regular urea, while Super Urea generated intermediate results. Yields of canola were 2,866, 2,689, and 2,397 kg/ha for Nutrisphere-N®, Super Urea, and regular urea, respectively. This was the second year of a 3-year study plan. *BC-17F*

Manitoba

Impact of Traditional and Enhanced Efficiency Phosphorus Fertilizers on Canola Emergence, Yield, Maturity, and Quality

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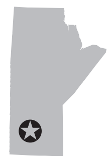
Project Cooperators: Gerhard Rakow and Jo-Anne Relf-Eckstein



An adequate supply of P is needed in the first 2 to 6 weeks of growth to optimize canola yield. Due to recent experiences with relatively high prices for P fertilizer products, many producers reduced their rates of application for seed-placed monoammonium phosphate (MAP), which may reduce crop yield potential. If regular rates are maintained, farmers also run the risk of some seedling damage. A number of enhanced efficiency P products have been developed that may improve the effectiveness of seed-placed P fertilizer, by reducing the risk of seedling damage and/or maintaining P in an available form for a longer period to enhance crop uptake. These products include a polymer-coated MAP that releases the phosphate slowly into the soil, Polyon® (a polymer-coated product), and Avail® (stabilized phosphate). Ammonium polyphosphate liquid fertilizer may also show improved performance compared to MAP, particularly on calcareous soils. While these enhanced efficiency fertilizers may have an advantage over traditional MAP, they have a higher cost. Therefore, it is important to determine if any increases in crop yield, quality, fertilizer use efficiency, or simplification of field operations are large enough to justify their use.

Results in 2009 indicated that the enhanced efficiency P products had little effect on any of the growth parameters assessed. Differences that did occur were mainly due to poor performance of the Polyon® product, although the reasons for the poor performance were not apparent. The second part of the research assessed whether a new yellow-seeded cultivar of canola has a similar tolerance to seed-row P fertilizer compared to a conventional dark-seeded canola cultivar. Results found the yellow-seeded canola cultivar to have very poor emergence compared to a conventional dark-seeded canola, leading to lower yields and limited competitive ability with weeds and volunteer barley. *MB-22*

Comparison of Phosphorus-Based Starter Fertilizer Products, Forms, and Rates Affecting Crop Yields

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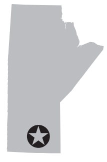

High P fertilizer prices during the spring of 2009 resulted in numerous questions regarding the utility and practicality of applying low rates of fertilizer with the seed. This lesson/demonstration was designed for the 2009 Crop Diagnostic School in Carman, Manitoba. It was presented to 358 extension and retail agronomists over a 2-week period in July. Three sources of P were compared, including granular orthophosphate (mono-ammonium phosphate 11-52-0 or MAP), liquid orthophosphate (6-22-2), and liquid ammonium polyphosphate (10-34-0). A research planter was equipped with a liquid fertilizer kit so that both dry granular and liquid starter products could be seed-row applied. The plots were used as a back-drop for discussion about the short-term and long-term efficacy of various starter P-based formulations and management strategies used in small grain and oilseed crops in Manitoba. In addition, a demonstration showed the distribution of starter liquid seed-row blend droplets compared to the distribution of MAP granules as the planter openers passed slightly above a plastic sheet.

It was interesting that the actual spread pattern comparing the dry granular and liquid formulations were not that much different. Some marketing information describes liquid starter blends as going down in a continuous stream along the bottom of the seed-row trench. However, it was shown that the liquid fertilizer actually falls down in droplets not that much closer than dry granules. The final yield samples from the four-replicate demonstration research project will be available in future project reporting. *MB-23*

Saskatchewan

Effects of Potassium and Chloride Nutrition on Seed Yield of Canaryseed

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Project Cooperators: Yantai Gan and Sukhdev Malhi

The objectives of this study are to determine the responsiveness of canaryseed seed yield to K and Cl- and provide better recommendations to producers on the use of potassium chloride (KCl) in canaryseed production. In 2007, five locations were established in Saskatchewan at Melfort, Stewart Valley, Regina, and two locations near Indian Head on Vale Farms. In 2008, another location on the Indian Head Research Farm was added. Only the Vale farm sites showed strong yield responses in 2007 to Cl^-, but a moderate yield response to Cl^- occurred at Regina. The yield components most affected were seeds per square meter and seeds per head, which indicates that the addition of Cl^- may prevent seed abortion from occurring. Grain yield was not affected by Cl^- or K applications at Melfort or Stewart Valley in 2007. In 2008, only the Vale Farm sites had a Cl^- response. One important difference was that the yield response at the Vale farm site occurred when yield conditions were quite good (40 to 50 bu/A). These preliminary results indicate that canaryseed growers need to measure Cl^- when doing soil tests. The response to Cl^- occurred when the crop was either under stress or under high yielding conditions.

The work was repeated in 2009 with strong Cl^- response at the farm site near Indian Head, and varied response at Stewart Valley and Regina. This research confirms that canaryseed responds to Cl^- and that the positive effect is observed through improved seed fill and seed yield. There can be sites that respond to Cl^-, but not to K, and other sites can respond to both Cl^- and K. Both responses can be predicted quite well by testing soils for plant available Cl^- and K. The final project report will be completed in early 2010 after grain sample quality tests are complete. *SK-38F*

Evaluation of Urea Nitrogen Fertilizer Treated with Nutrisphere® Polymer Additive to Increase Fertilizer Efficiency

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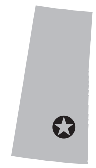
Project Cooperators: Clair Langlois, Dick Puurveen, and Brian Hellegards



This project consists of three experiments comparing regular granular urea, urea treated with Nutrisphere-N® (a polymer coating) and Super Urea (including both urease and nitrification inhibitors) at 45, 90, and 135 kg N/ha. The experiments were conducted on spring wheat, barley, and canola. This study was initiated in April 2008, repeated in 2009, and will be conducted for a third year in 2010.

In 2009, growing conditions were excellent at the Indian Head Research Farm. A significant response to N was observed for all three crops. All three forms of N did equally well as no differences in yield were observed between N forms for all three respective crops. *SK-40F*

Montana

A Micro-Meteorological Study to Quantify Ammonia Volatilization Losses from Surface Applied Urea in the Semi-Arid Northern Great Plains

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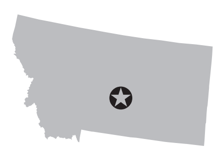

Ammonia (NH_3) losses from urea have ranged from 3 to 40% of the application rate (19.4% average) over eight gas sampling campaigns conducted to date in 2008 and 2009. In this semi-arid region, NH_3 losses are sometimes delayed by 2 weeks or more until sufficient precipitation falls to dissolve urea granules. Significant NH_3 losses may then occur over a three to six week period. Applying urea to frozen soils does not guarantee losses will be minimized. Surprisingly, some of the greatest NH_3 losses (e.g., 32, 36, and 40% of the application rate) occurred at three sites where urea was applied to moist surface soils near 0°C. Environmental conditions that result in prolonged damp conditions near the soil surface appear to promote volatilization losses. Ammonia fluxes as large as 22 kg N/ha/week have occurred under these conditions. Conversely, NH_3 losses from surface-applied urea are generally smaller (<16% of the application rate) if granules are applied to dry soils. Coating urea with an urease inhibitor like N-(n-butyl) thiophosphoric triamide (NBPT) at 4.2 ml/kg provides 2 weeks of protection against volatilization losses following fertilizer dissolution, and has reduced NH_3 losses by 62% over untreated urea.

Results from this study indicate that significant NH_3 volatilization losses can occur from cold soils when urea is surface-applied. This study will be continued for one more year. *MT-17*

North Dakota

Agronomic Evaluation of New Sulfur Sources for Canola

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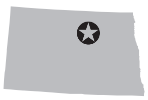

Work on this project progressed well in 2009. Growing conditions were initially cool and moist, but with warmer growing conditions the crop yielded well and demand for S was high. The objective of this study is to evaluate the effectiveness of various commercially available and potentially available sources of S fertilizer for canola production in North Dakota. Research trials were carried out at two locations near Langdon. The S products included ammonium sulfate, elemental S, compound granules of N, P, and S, gypsum from coal power plant scrubbers, and a plant growth-promoting rhizobacteria (PGPR). All treatments were compared against a monoammonium phosphate check supplying N and P. Urea was added to certain treatments to balance N rates for all seed-row treatments.

Large canola yield responses to S were present at both sites. The 2009 data along with the previous 4 years will be combined, analyzed, and a final project report will be written with recommendations for S nutrition of canola in north-central North Dakota. *ND-14F*

Nitrogen Recommendation Recalibrations for Wheat in North Dakota

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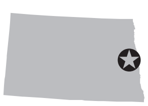

The objective of this project was to review current N recommendations for wheat to determine profitable N recommendations for spring wheat and durum in North Dakota. Over 100 site-years of data were collected during this project from archived studies and recent N-rate studies. Soil test nitrate improved the relationship between available N and yield. The Return to N approach was used to establish relationships between yield/protein response and economics of N application. This approach was modified for wheat by adding the criteria for the protein relationship. In the economic analysis, a 50% per point premium was provided between 14 to 15% protein, and a 50% per point dockage for any protein below 14%. The large number of sites made it possible to segregate different agri-climatic zones and determine whether the responses to available N were similar or different. The state was separated into the Langdon region, Eastern North Dakota, and Western North Dakota. When using the newly re-calibrated recommendations, a grower is asked to look exclusively at past field yield history and select productivity levels of low, medium, or high. The table values determined by region, productivity, wheat price and N cost are gross N requirements determined using return to N relationship equations. From this, the soil test nitrate will be subtracted. Other adjustments include previous crop N credits, additions due to short-term no-till adoption, credits due to long-term no-till adoption, and organic matter if greater than 5.9%.

The opening segment of the "North Dakota N Rate Calculator," is available on the web at this: www.soilsci.ndsu.nodak.edu/franzen/franzen.html. The final recommendation is usually plus/minus 30 lb N/A. Adjustments based on the common sense of the grower/consultant and their experience with the field area will dictate the final rate. Consideration due to protein property of the wheat variety, N application techniques that might not be 100% efficient, excessive previous year straw, and other considerations may play roles in defining the final rate. The recommendations were made available December 1, 2009, in both print form and as the web-based N calculator. *ND-15*

Nitrogen Recommendations for Dryland Corn in North Dakota

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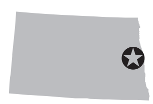

All the 2010 research sites for this project were arranged, characterized, and prepared by taking soil samples. The research experiments will be planted during the growing seasons of 2010 and 2011. Experimental factors to be evaluated are N response curves from increasing rates of N along with a zero N treatment, as well as different responses of the selected corn hybrids grown. *ND-16* ■

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