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Northern Great Plains Research Report

EFFICIENCY of applied fertilizers is the theme of this issue of *INSIGHTS*. There are two reasons there is interest in improving the use of fertilizers. One is because the dramatic rise of fertilizer prices during the first half of 2008 has increased growers' interest in making wise use of their fertilizer inputs. The other reason is the increased need for the agricultural community to show the general public that they are doing their part to help protect the environment. There have been technological advancements that significantly reduce the environmental footprint of fertilizer use on our ecosystems, and many of the research projects included in this report are conducted to make further improvements.

This issue of *INSIGHTS* contains brief Interpretive Summaries of research projects supported or arranged by IPNI in the Northern Great Plains Region in 2008. 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 in Alberta

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Project Cooperators: Claire Langlois, Guy Lafond, and Brian Hellegards

This project consisted of two experiments (each at Ellerslie and Breton, Alberta) evaluating the effect of adding the Avail® polymer to P fertilizers as well as a single experiment at Ellerslie which evaluated the effect of adding the Nutrisphere® polymer to granular urea fertilizer. This study was initiated in April 2008 and repeated again in 2009.

In the P experiments, eight treatments compared two P fertilizer products [granular monoammonium phosphate (11-52-0) and liquid polyphosphate (10-34-0)], two P rates (15 and 30 kg P_2O_5/ha), and P fertilizer product with and without the Avail® fertilizer additive. A check treatment (no P fertilizer) was included to determine the overall response to the addition of P. A modest response to P was observed at both sites. At Ellerslie there was a significant difference between the 30 and 15 kg P_2O_5/ha rates, yielding 94.6 and 85.6 bu/A, respectively. There was no observable difference between the two P fertilizer products, or whether Avail® was added or not. At Breton, there was a significant difference between form of P with 10-34-0 averaging 26.6 bu/A compared to 11-52-0 averaging only 16.6 bu/A. There was no difference between rate of P, or whether or not Avail® was added.

In the N experiment, a similar experimental design was used to compare four forms of N (urea, ESN® or controlled release urea, Nutrisphere®-treated urea, and Super Urea), two rates of N (60 or 120 kg N/ha), and two N placements including side-banded N placed 2 in. to the side of the seed row, and surface broadcast just prior to no-till seeding. A no-N check was included to determine if there was a response to N. Significant responses were found for N rate (46 and 41 bu/A respectively for 120 and 60 kg N/ha), and N placement (45.5 and 41.5 bu/A, respectively, for broadcast and banded N). No difference was noted between the forms of N fertilizer. *AB-26F*

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British Columbia

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

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This project consisted of two field research experiments. One evaluated the effect of adding the Avail® polymer additive to granular and liquid phosphate fertilizers. The second project evaluated the effect of adding the Nutrisphere® polymer additive to granular urea fertilizer. Both experiments were conducted at a field research site about 10 km northeast of Dawson Creek, British Columbia (BC). The research was conducted by the BC Grain Producers Association research group.

Growing season weather was much drier than nomal and the resulting barley crop grown in both experiments produced low yields, about half of normal for the area. A weather station at the site determined that 117 mm of growing season precipitation, or 38% of normal, was received. Both the P and N experiments showed no significant response to the addition of nutrients, and no observable effect of Avail® or Nutrisphere®. The research is planned to be repeated next year and hopefully the growing season moisture will be closer to normal levels. *BC-17F*

Manitoba

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

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Project Cooperators: Claire Langlois, Dick Puurveen, and Guy Lafond

This project consisted of two field research experiments. One evaluated the effect of adding the Avail® polymer additive to granular and liquid phosphate fertilizers. The second project evaluated the effect of adding the Nutrisphere® polymer additive to granular urea fertilizer. This study was initiated in April 2008.

In the P experiment, eight treatments compared two P fertilizer products [granular monoammonium phosphate (11-52-0) and liquid polyphosphate (10-34-0)], two P rates (15 and 30 kg P_2O_5/ha), and P fertilizer product with and without the Avail® fertilizer additive. A check treatment (no P fertilizer) was included to determine the overall response to the addition of P. No response to P was observed at the test site and thus no observable differences between the two P fertilizer products (with or without Avail®) or rates of P were found.

In the N experiment, a similar experimental design was used to compare forms of N (urea, Nutrisphere®-treated urea, and Super Urea), two rates of N (60 or 120 kg N/ha), and two N placements, including side-banded N placed 2 in. to the side of the seed row, and surface broadcast just prior to no-till seeding. A no N check was included to determine if there was a response to N. A modest response to N fertilizer, with the check treatment yielding less than the 120 kg N/ha rates of Super Urea and Nutrisphere®-treated urea, 20.7, 34.7, and 31.4 bu/A, respectively. However, no statistical differences were observed between the forms of N, rates of N, or N placements.

An alternate site with lower levels of available P and N is currently being located to repeat the experiments in 2009. *MB-21F*

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

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

The objectives of this research are to: (1) determine the relative effects of traditional and enhanced efficiency fertilizers in terms of safe rates for seed-row placement, and effects on crop yield, crop maturity, and seed quality and (2) determine if canola cultivars differ in response to seed-placed P fertilizer.

In the first study, a no P control was compared to standard monoammonium phosphate (MAP), a polymer-coated controlled-release product (CRP) MAP product formulated for broadacre agriculture, Avail®-treated MAP designed to sequester antagonistic ions and reduce soil P reactions, liquid ammonium polyphosphate, Avail® liquid P, and Polyon®-coated MAP formulated for horticulture. Each of the P sources was applied at 10, 20, 40, and 80 kg P_2O_5/ha. A single 0 kg P_2O_5/ha treatment was included for a total of 25 treatments per site. Seedling damage occurred with high rates of uncoated P fertilizer, with the damage mainly occurring on a fine sandy loam (FSL) textured soil, but not on the clay loam textured soil. Both the CRP and Polyon®-coated product prevented seedling damage. Seed yield on the FSL soil increased with low rates of liquid P then decreased when rates were increased to 40 kg P_sO_5/ha or higher. Seed yields on the FSL tended to be higher with high rates of Avail® MAP than with the high rates of CRP or uncoated MAP.

In the second study, yellow- and black-seeded canola cultivars were seeded following the methodology described for the previous study. Yellow-seeded canola was slightly more prone to reduced emergence with seed-placed MAP than was the black-seeded cultivar. There appears to be a number of differences in the sensitivity and responsiveness of the black- and yellow-seeded canola cultivars to seed-placed P. Samples have been submitted for quality analysis. *MB-22*

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

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The objective of this project is to demonstrate that the use of reduced rate (8 lb P_2O_5/A) P-based starter solutions is not a superior strategy compared to the common practice of using granular monoammonium phosphate (11-52-0) or liquid ammonium polyphosphate (10-34-0) at

rates close to that removed within harvested grain product (typically 25 to 35 lb P_2O_5/A). This research will balance strong marketing claims suggesting low rate products are superior in efficacy. It is foreseen that the in-year costs of low P rate strategies may be less, but the actual cost per applied pound may be greater. The concern is that small, short-term cost advantages will be realized, but crop yields will not be improved, and long-term reliance on sub-crop removal P rates will lower yield potential for growers.

The project will begin by installing a liquid fertilizer kit on an existing demonstration-research planter that has the capability of applying granular MAP now. At least three demonstration sites will be established to compare the low-rate liquid starter system against a similarly low rate, and normal rate, of granular or liquid P seed-row applications. One of the sites will be situated within the Diagnostic Field School site at Carman, Manitoba, where 400 agronomists, Certified Crop Advisers, crop consultants, and progressive growers are expected to attend. In-season growth of treatments will be documented and will be inspected by tours of interested growers and crop advisers. *MB-23*

Saskatchewan

The Effects of Potassium and Chloride Nutrition on Seed Yield of Canaryseed in Saskatchewan

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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 at Melfort, Stewart Valley, Regina, and two locations south of Indian Head on Vale Farms. In 2008, another location on Indian Head Research Farm was added. Only the Vale farm sites showed strong yield responses 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. The two sites south of Indian Head had low levels of soil Cl^- while the Regina and Stewart Valley sites had moderate levels of Cl^-. Using a conventional soil test, the Melfort site and one of the sites south of Indian Head had low levels of K in the soil, while the other site south of Indian head had moderate levels. The other two sites had high levels of K in the soil. Similar results were obtained when soil K supply rates were measured. However, the Stewart Valley site did have a lower K supply rate than would have been suggested by the conventional soil test.

In 2008, both Vale Farm sites had a Cl^- response which followed the pattern seen in 2007. The yield response at the Vale farm site occurred when yield conditions were quite good (40 to 50 bu/A). *SK-38F*

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

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

This project consisted of three experiments each comparing three forms of N fertilizer including regular granular urea, Nutrisphere®-treated urea, and Super Urea. The three experiments were conducted on spring wheat, barley, and canola. This study was initiated in April 2008 and it is planned to be repeated in 2009.

In wheat and barley, the three forms of N were applied at 45, 90, or 135 kg N/ha. All N was side-banded 2 in. to the side of the seed row using a no-till seed drill. A zero N check was included to determine if there was a response to N at the site. A response to N was found in both wheat and barley, but no difference was found between the three N application rates. The wheat experiment showed a difference between the forms of N with Nutrisphere®-treated urea and Super Urea yielding significantly more than regular urea. There was no difference between Nutrisphere®-treated urea and Super Urea in wheat. In the barley experiment, there was no significant difference between forms of N.

The canola experiment used one rate of N (90 kg N/ha) and four forms of N, including urea, Nutrisphere®-treated urea, Super Urea, and ESN® or controlled-release urea. A significant response to N fertilizer was apparent, but no significant response to the forms of N was observed. *SK-40F*

Montana

A Micrometeorological Study to Quantify Ammonia Volatilization Losses from Surface Applied Urea in the Semiarid Northern Great Plains

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Top-dress or surface application of urea is a common practice for Montana's winter wheat producers. However, urea applied to the soil surface is susceptible to volatilization losses as ammonia (NH_3-N). The objective of this study is to quantify the extent of ammonia loss from top-dress urea applications, applied in the early fall, late fall, and early spring to winter wheat using a mass-balance micrometeorological approach referred to as the integrated horizontal flux (IHF) method. This method involves sophisticated calculations based on airflow at the site measured at three heights on a mast located in the center of the 100 m diameter treatment area. Two

research sites were established near Havre, Montana, in the fall and early winter of 2008. Each site had three macro-field applications of urea-N fertilizer including a control with no urea applied, 100 kg N/ha of urea, and 100 kg N/ha using urea treated with Agrotain®.

Ammonia losses were greatly affected by the timing and amount of precipitation received at the respective sites. Weather at the site located west of Havre was initially very dry, with no rain occurring for three weeks following the N application on October 9. During this time, urea granules remained on the soil surface and never dissolved and no ammonia emissions were detected. After 38 mm of precipitation (snow and rain) between Nov 2 and 9, sufficient urea moved into the soil, but ammonia losses from this site have been small (about 3.1% of the applied N rate for the urea treatment). Results were quite different at the second field site located north of Havre. Urea and Agrotain®-treated urea were applied to moist ground on November 14. Urea granules dissolved within the first day and ammonia losses from untreated product over the next three weeks amounted to 29% of application rate. Losses from Agrotain®-treated urea were one-tenth as high so it appears that the addition of Agrotain® can significantly reduce urease activity and the associated volatile ammonia losses. *MT-17*

North Dakota

Development and Implementation of Fertilizer BMP Guides for Six Selected Major Cropping Systems--Suggested Practices for Semiarid North Dakota

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Good progress was made in finalizing agreements regarding what fertilizer BMPs should be suggested for North Dakota in the Northern Great Plains (NGP). A publication was written and published describing these BMPs and how growers could evaluate their cropping system to see if improvements might be possible. The publication was finalized, printed, and distributed in September of 2008. All committee members were supplied with copies of the publication and they were made available to the North Dakota State University (NDSU) Extension Service and the Agricultural Research Service of the USDA. Copies were distributed throughout the NGP Region. *ND-12F*

Agronomic Evaluation of New Sulfur Sources for Canola

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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 (AS), elemental sulfur (ES), 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 (MAP) check supplying N and P. Urea-N 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 N+P check at the two sites yielded 1,319 and 651 lb/A while the highest yielding treatment at each site was 2,378 and 1,642 lb/A, respectively. Averaged over both locations, treatments of AS, AS+ES, or gypsum with 15 lb S/A or higher yielded 182 to 190% more than the MAP check. Similar treatments with 5 to 10 lb S/A yielded 171 to 180% of the check. The treatments supplying 40 lb ES/A, no AS, produced 143% more than the check. Application of PGPR at the three-leaf stage as a foliar spray, with no S, was only nominally (15%) better than the check. Research will continue on this project for at least one more year. *ND-14F*

Nitrogen Recommendation Recalibrations for Wheat in North Dakota

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The current N recommendations for spring wheat in North Dakota (2.5 X Yield Potential less credits) were developed more than 30 years ago when there was no ability to vary rates within a field and N prices were less than 10 cents/lb of N. Our review of old and more modern N calibration data do not support our current recommendations, especially considering cost increases for N fertilizer and grain prices, as well as improved methods of planting and fertilizer application. Growers need updated recommendations to determine required N rates that are economical and relevant to their wheat-growing abilities. The objective of this 2-year study is to add necessary modern sites, complete with modern soil analysis, to our older data in order to develop better, more efficient N recommendations for growers in every corner of North Dakota.

Progress on the field research required to generate the database to recalibrate the N fertilizer recommendations for North Dakota has proceeded well. *ND-15* ■

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