NEWS & VIEWS

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Dr. Adrian Johnston, Northern Great Plains Director
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Northern Great Plains Research Report

Every year it seems that we hear more about agriculture and the environment. While much of the information we see in the press is not positive, farmers in the northern Great Plains have made major advances in improving the agricultural environment. Conservation tillage practices have reduced the extent of wind and water erosion to a fraction witnessed in past decades, while at the same time improving crop yields and efficiency of water use. No-till seeding practices have moved a major portion of the fertilizer used to spring application at seeding, further increasing nutrient use efficiency and reducing losses. And soil testing is on the increase, a testament to the cooperative effort between Crop Advisers and farmers, working to optimize the use of soil and fertilizer nutrients. Taken together, it is ironic that these science-based efforts on the part of farmers have not become the focus of society when recognizing environmental achievement.

Research projects carried out in the northern Great Plains have focused on both efficient use of nutrients, and fertilizer impacts on the environment. Understanding the impact of tillage and management practices on fertilizer response, developing regional specific phosphorus guidelines for potato production, and evaluating the impact of fertilizer phosphorus varying in cadmium concentration are just a few of the projects which highlight the role of balancing crop production with environmental impact. With the environmental spotlight on agriculture, these activities provide the opportunity to not only address the many challenges, but also highlight our achievements. Please forward any comments you may have about the enclosed summaries to Adrian Johnston at your convenience.

Alberta

Phosphorus, Potassium, and Sulfur on Malt Barley

Project Leader: Dr. Ross McKenzie, Alberta Agriculture, Food and Rural Dev., Agriculture Centre, Bag Service 3014, Lethbridge, AB T1J 4C7, Telephone: 403-381-5842, E-mail: ross.mckenzie@gov.ab.ca.

Balancing high yield with acceptable grain protein levels is a challenge for malt barley growers in semiarid regions. Research in Alberta has shown that many farmers underfertilize their malt barley with nitrogen (N) to avoid high protein, leading to grain yield losses of 10 to 40%. The objective of this research is to evaluate the necessary balance between N, phosphorus (P), potassium (K), and sulfur (S) fertilizer rates to maximize yield and ensure optimum malt barley quality.

The field trials were established at four locations, using two malt barley varieties...a 2-row and a 6-row. For each nutrient, separate trials were established, one evaluating four rates of P, one for three rates of K, and one for three rates of S. In 2002, P addition at one of the four sites increased grain yield, while kernel plumpness was increased at another site. Potassium addition increased yield at one site and S addition decreased plumpness at one site. All responses recorded to date were minor and of little agronomic or economic impact. *AB-22*

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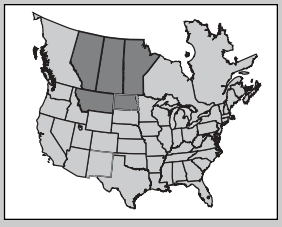

Manitoba

Impact of Long-Term Phosphate Application and Level of Fertilizer Cadmium on Crops and Soils

Project Leader: Dr. Cynthia Grant, Agricuture and Agri-Food Canada, Brandon Research Centre, Box 1000A, RR #3, Brandon, MB R7A 5Y3, Telephone: 204-578-3570, E-mail: cgrant@agr.gc.ca

Project Cooperators: R. Garrett, Sebastien Sauve, Don Flaten

Public concern regarding the transfer of cadmium (Cd) from fertilizer P products to soils, and uptake by crops, has increased interest in evaluating the true impact of fertilization practices on food nutrient content. The objectives of the study are:1) determine the cumulative impact of applying fertilizer P, varying in Cd concentration; 2) determine the impact of soil characteristics on availability of native soil Cd and Cd added with P fertilizer, and; 3) determine the effectiveness of several soil testing methods in predicting availability of native and applied Cd.

Field studies were initiated at seven sites across western Canada using a 4-year crop rotation of durum wheat, flax, durum wheat, and flax (may be replaced with soybean). Phosphorus application increased the grain yield of durum wheat at two of the seven locations in 2002, and two locations with flax in 2003. Soil and grain samples are being evaluated for concentration of Cd and other nutrients. Greenhouse studies are also ongoing to establish the speciation and phyto-availability of the Cd from the various P fertilizer sources on the soils from the seven locations. *MB-16*

Optimizing Canola Production: Fertilization, Crop Protection, and Genetic Yield Potential

Project Leader: Dr. Don Flaten, University of Manitoba, Department of Soil Science, Room 362, Ellis Bldg, Winnipeg, MB R3T 2N2, Telephone: 204-474-6257, E-mail: flatendn@MS.umanitoba.ca.

Project Coordinators: Craig Linde, Byron Irvine, Rob Park

Canola production has become increasingly reliant on purchased inputs. New technologies, whether they are improved genetics, crop protection, or fertilizers, all claim to provide the farmer with incremental yield benefits that will help increase profits. This research project tests the performance of low, medium, and high levels of fertilization, pesticides, and genetic yield potential on canola yield, quality, and profitability.

Canola yields varied considerably in this study across the three years and three trial locations. The yield responses recorded from the combined application of inputs at low, medium, or high levels were impacted significantly by local weather and pest extremes. While gross revenues generally increased with the progressive addition of inputs from low to medium to higher levels, the margin (or profit) per acre rarely increased in a similar manner. When the final grain yield potential was high, the net return for intensive use of crop inputs also tended to be high. However, the inability to predict the environmental impact on the maximum potential seed yield increased the risk of using a high level of crop production inputs. Considering individual groups of inputs, applying high rates of fertilizer provided the largest increase in yield and gross revenue, when other inputs were also employed at the high rate. Management of pesticides at the high level resulted in the largest increase in cost of production, supporting the need to use field scouting and weather monitoring when making decisions on pesticide applications. As expected, the actual total yield increase from application of all inputs at a high level was less than the sum of the equivalent responses for each individual group of inputs, reducing the potential increase in yield and profit for the intensive cropping system as a whole. The results of this study clearly indicate that canola is a high risk crop to grow. *MB-17F*

Improving the Phosphorus Nutrition of Wheat

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Project Cooperator: George Clayton

In western Canada, early season P supply may be limited due to cold temperatures and calcareous soils. Fluid P sources have been shown to enhance early season P supply and provide a yield benefit relative to traditional granular sources on highly calcareous soils in Australia. Arbuscular mycorrhizae (AM) also play a role in P and zinc (Zn) nutrition of crops. The objective of this research is to investigate applications of AM inoculant in combination with and without side-banded monoammonium phosphate (MAP) and side-banded and surface dribble-banded ammonium polyphosphate (APP). It also evaluates effects of combined application of fertilizer P and AM on P and Zn nutrition.

Phosphorus and AM inoculant treatments generally had little effect on wheat stand density at any of the three locations. Early biomass yield (6 weeks after emergence) at all locations was greater with high rates of P application than low rates. There was no benefit at this stage in applying AM inoculant, either with or without P. Biomass yield at wheat heading also showed no beneficial effect from AM inoculant while application of P fertilizer enhanced biomass yield. At two of the three trial sites, grain yield was

increased by P application, but not by use of the AM inoculant alone. When the AM inoculant was applied with P fertilizer, grain yield tended (p=0.07) to be lower than P fertilizer alone at one site, but was improved at another. At the two P-responsive locations, side-banded MAP and APP produced similar grain yield, but grain yield was higher when the APP was side-banded than when it was surface-dribble banded. *MB-18F*

Improving Phosphorus Management in Irrigated Potato Production Systems

Project Leader: Dr. Ramona Mohr, Agriculture and Agri-Food Canada, Brandon Research Centre, Box 1000A, RR 3, Brandon, MB R7A 5Y3, Telephone: 204-578-3556, E-mail: rmohr@agr.gc.ca.

Project Cooperator: Dale Tomasiewicz

Rapid expansion of the processing potato industry in Manitoba has generated a need for information regarding fertilizer management strategies for irrigated potato. The objective is to determine the impact of P fertilizer rate on potato tuber yield and quality, and the effectiveness of petiole P concentration in assessing P status of potato (cv. Russet Burbank).

A field experiment was conducted at one location near Carberry in 2003 to assess the effect of four P rates (0, 30, 60, and 90 lb P_2O_5/A as broadcast/incorporated monoammonium phosphate) on tuber yield and quality, petiole P status, and post-harvest soil P status. Preliminary analysis indicated that P fertilizer rate had no effect on total tuber yield, which averaged 380 cwt/A, or on tuber size distribution. Specific gravity of tubers was lower for the highest P rate compared to the other treatments. Preliminary soil test results indicated that $NaHCO_3$-extractable P levels for the plot area averaged 13 parts per million (ppm), 0 to 6 in., which would have resulted in a recommendation for application of 40 to 45 lb P_2O_5/A based on provincial guidelines. Analysis of petiole and soil samples is ongoing. *MB-19F*

Saskatchewan

Improving Forage Production and Longevity of Alfalfa Stands with Balanced Fertilization

Project Leader: Dr. Sukhdev Malhi, Agriculture and Agri-Food Canada, Box 1240, Melfort, SK S0E 1A0, Telephone: 306-752-2776,230, E-mail: malhis@agr.gc.ca.

Project Cooperators: Clayton Myhre, Wen Chen

Alfalfa is a large consumer of P, K, and S. In northeastern Saskatchewan, it is grown on approximately 200,000 acres for the dehydrated pellet market. Alfalfa for seed is grown on more than 120,000 acres in western Canada. In the absence of nutrient inputs, alfalfa cannot maintain its original productivity after about 3 years of hay production. The objective of this project is to determine the influence of balanced fertilization on alfalfa forage production, seed yield, and longevity of seed stands.

This research project was plagued with drought for the third year in a row in 2003, resulting in reduced hay and seed yields. Forage yields were low, with high variability among treatments and few significant responses. While not significant (p=0.10), alfalfa yield trended higher relative to the unfertilized check with P and K (27%; 0.17 t/A), and with a blend of P, K, and S (64%; 0.40 t/A). While alfalfa seed yields were very low (less than 80 lb/A), addition of P and K...or P, K, and S...significantly increased seed yields. The project is scheduled to continue for an additional year, during which time forage and seed yields will continue to be assessed relative to annual fertilizer applications. *SK-26F*

Improving the Quality and Profitability of Durum Wheat through Nutrient and Disease Management

Project Leader: Mr. William May, Agriculture & Agri-Food Canada, Indian Head Experimental Farm, Box 760, Indian Head, SK S0G 2K0, Telephone: 306-695-4244, E-mail: mayb@agr.gc.ca

Project Cooperators: Guy Lafond, Fernando Selles, Myriam Fernandez, Brian Marchylo

Optimizing yield and quality of durum wheat are key to making it a profitable crop in the semi-arid regions of western Canada. While many growers are increasing the N used on their durum crops, they often use only minimal rates of P, increasing concern that they are not making full use of the N applied. Grain protein is one of the most important factors determining durum wheat quality, and premium durum markets consistently demand a protein content of 13% or higher. The objective of this research is to develop soil fertility management strategies geared to maximizing production and improving grain protein of durum wheat.

Growing season conditions were good in 2002, with trial yields ranging from 45 to 50 bu/A. Increasing N rate up to the soil test recommended rate resulted in positive yield responses. While additional N did not lead to further increases in grain yield, it did increase grain protein. No yield response to application of either P or K fertilizer occurred in the first year of this trial. In 2003, under very dry conditions, P application significantly increased durum grain yield, with the 0, 18, and 36 lb P_2O_5/A treatments yielding 33.6, 36.2, and 37.1 bu/A, respectively. Quality analysis will be used to assess the impact of P application on durum grain protein. *SK-32F*

Evaluation of Agronomic Practices and Quality Parameters of Timothy Hay

Project Leader: Dr. Bruce Coulman, Agriculture & Agri-Food Canada, Research Center, 107 Science Place, Saskatoon, SK S7N 0X2, Telephone: 306-956-7240, E-mail: coulmanb@agr.gc.ca.

Project Cooperators: Dave Christenson, Vern Racz, Randy Pastl

Production of timothy hay for the export market has been a major growth industry in western Canada over the last 10 years. The effect of annual maintenance applications of P, K, and S on timothy yield, persistence, and quality... and the effect of copper (Cu) applications on hay color...is an area that requires supporting data for growth of the industry. The objective of this study is to determine the importance of maintenance fertilizer management on the yield and quality of timothy.

In 2002, a demonstration trial was established in the Outlook area to examine the effect of P applications at 100, 150, and 250 lb P_2O_5/A on irrigated timothy. Positive yield responses to applied P occurred. Soil samples taken in 2003 showed residual P levels of 40 lb in the high, 35 lb in the medium, and 32 lb for the low P rates. Tissue samples were taken just prior to cut 1 and cut 2. Fiber and P levels were identical in all treatments, while crude protein was slightly higher in cut 1 for the high P treatment, likely due to delayed maturity. A small plot trial initiated in 2003 will evaluate timothy hay responses to P applications ranging from 0 to 300 lb P_2O_5/A applied each year. This will provide data to make more precise recommendations on the amount of P required for this high yielding, shallow-rooted crop. *SK-33*

Forage Rejuvenation with Phosphorus Fertilizer

Project Leader: Mr. Stewart Brandt, Agriculture & Agri-Food Canada, Box 10, Scott, SK S0K 4A0, Telephone: 306-247-2011, E-mail: brandts@agr.gc.ca

Project Cooperator: Guy Lafond

Established forage stand productivity is seriously limited by nutrient supply in most areas of western Canada. While only limited acres of forage grass crops are fertilized, past research has shown it to be one of the most responsive crops to N application. The objective of this study is to evaluate the management of dry and fluid P fertilizers, applied with N, to restore the productivity of established, low-yielding forage stands.

Field studies were initiated at two locations using established forage stands that were low yielding. Fertilizer P was applied as either surface broadcast MAP, or surface dribbled or coulter injected APP. Along with an unfertilized check and a coulter check, there was a coulter-injected N only treatment. The P was applied at either an annual rate, or three times the annual rate. All treatments received the soil test recommended rate of N, and a blanket application of potassium and sulfur. Application of N and P increased forage yields from 12 to 53% in 2003. Application of N alone always yielded less than when applied with P. Using P at three times the annual rate provided the highest forage yield, indicating that the annual rate was P-limiting at both locations. *SK-35.*

Evaluation of Long-Term No-Till Effects on Soil Fertility

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Project Cooperator: Jim Halford

The adoption of no-till seeding systems in western Canada has been driven by a variety of factors, with moisture conservation and economic efficiency the major ones. The conversion of fields to no-till has been shown to increase soil organic carbon (C) and N as well as water use efficiency by crops. Together, these factors lead to increased productive potential of the soil. This project was initiated on two adjacent fields, one recently converted to no-till and the other with a 20-year no-till history, to determine the differences in N and P nutrient supply and fertilizer response.

Drier than normal conditions were recorded in 2003, limiting yield potential at the experimental site. An N response trial with wheat and oats on the two soils indicated that the long-term no-till field reached maximum yield at about 27 lb N/A less than the short-term no-till. Spring wheat and field pea were grown at various fertilizer P rates. However, no differences in yields were observed due to P addition, even though the long-term field had four times the soil test P of the short-term field [9 parts per million (ppm) vs. 2 ppm]. Finally, N timing was evaluated on the short- vs. long-term no-till fields. While no difference was recorded between the split and all post-emergence application timing on the long-term no-till, the split N application significantly increased yields on the short-term no-till field. Again, this reflected an increased N-mineralization capability for the long-term no-till field, supporting early season crop development. *SK-36F* ■

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