NEWS & VIEWS

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

WHETHER you call them best, beneficial, or better management practices, BMPs are becoming a common term used in production agriculture systems. In fact, most people are focused on BMPs which help to reduce the loss of nutrients where livestock manure is being stored and field-applied. But what about fertilizer nutrients…do we have good BMPs for their use? Yes, we do—in fact we have an abundance of information on the northern Great Plains to show that there are very effective and efficient means of dealing with fertilizer nutrients in crop production systems. Soil testing to measure residual nutrients…regionally calibrated fertilizer recommendations…over 50% of the region uses no-till seeding and almost all of this no-till land receives fertilizer application at seeding. Given the tight margins in agriculture these days, farmers on the northern Great Plains can best be described as leaders when it comes to use of BMPs and efficient fertilizer nutrient management.

Research supported by PPI/PPIC/FAR on the northern Great Plains is focused on achieving efficient use of fertilizer nutrients…for the environment and for the economic well being of farmers. We have projects that consider the effects of long-term versus short-term no-till systems on the soil supply of nutrients, developing sound fertilizer practices for forage, malt barley, and canola, and to evaluate the application of recommendations on P nutrition of potato in our local areas. Many of these projects are new, and in the future will continue to yield results to help in efficient use of fertilizer. That's another BMP for agriculture, the environment, and a profitable bottom line for farmers. Please forward any comments you may have about the summaries to Dr. Adrian Johnston at your convenience.

Alberta

Phosphorus, Potassium, and Sulfur on Malt Barley

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Balancing high yield with acceptable grain protein levels is a challenge for malt barley growers in semi-arid regions. Research in Alberta has shown that many farmers under-fertilize 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.

Phosphorus fertilizer additions provided an economic increase in barley yield at 29% of the sites in this study, fewer than past projects in the region. Hot, dry summer conditions in the study limited yield response of barley. A minimal response of both grain protein concentration and kernel size, two major factors in malt barley grading, can be attributed to the lack of P yield response at most sites. At a few of the sites, a negative response for kernel plumpness to P additions reflected on the early season soil water depletion by these crops, leading to fewer plump kernels. The small increases in grain yield from K application were found on soils with a soil test K of less than 180 lb K/A in

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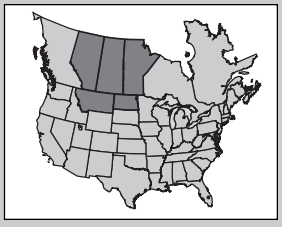

the surface 6 in. Kernel size was not affected by K application. No responses to S were recorded, even though soil S levels were quite low. Subsoil S levels was sufficient to meet the malt barley requirements. *AB-22*

Manitoba

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

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

Public concern regarding the transfer of cadmium (Cd) from P fertilizers 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, on grain yield and micronutrient concentration, total soil Cd, phyto-available Cd, and grain Cd concentration, on a range of soil types; 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 across a range of soil types and environmental conditions.

Lab studies were initiated to evaluate the impact of additions of monoammonium phosphate (MAP) fertilizer, varying in Cd concentration of 0.38, 7.3, and 211.0 mg Cd/kg of fertilizer, on soil solution and plant uptake of Cd. The study found very little relationship between Cd added to soils and Cd found in plants. Even where the concentration of Cd added to soil varied to a large degree, only small increases in solution Cd were observed. Adding the equivalent of 15 years of fertilizer MAP to soils did not result in a drastic increase in soil solution Cd, even when very high Cd concentrations were used. *MB-16*

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.

AM inoculant treatments alone provided some improvement in wheat stand density in this study. However, this advantage was lost when fertilizer P was applied with the inoculant. Fertilizer form or placement had no impact on crop emergence. At harvest, biomass yield was improved with the addition of fertilizer P alone, or in combination with AM inoculant. The higher of the two P rates considered gave the greatest biomass yield. While not significantly different, grain yields showed a minor improvement with P fertilizer additions at all locations. Little difference was also observed between P fertilizer placement in the seed row vs. the side band. This research will continue in 2005. *MB-18F*

Improving Phosphorus Management in Irrigated Potato Production Systems

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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 second year of a 3-year study was conducted in 2004 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 2004 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. Spring soil test P levels at the experimental site ranged from 20 to 29 lb $NaHCO_3$-extractable P/A across replicates, and would have resulted in a recommendation for P fertilizer. Preliminary analysis indicated that P fertilizer rate did not have a statistically significant effect on total tuber yield, which averaged 306 cwt/A, or on tuber size distribution. Phosphorus fertilizer rate had no effect on main grade or bonus tuber yield, but did affect marketable yield. Contrast analysis revealed a significantly ($p=0.005$) lower marketable yield with the application of 30 lb P_2O_5/A compared to

other treatments. However, the reason for this effect is unclear. Studies continue in 2005. *MB-19F*

Saskatchewan

Improving Forage Production and Longevity of Alfalfa Stands with Balanced Fertilization

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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.

Good growing conditions in 2004 resulted in excellent first cut alfalfa hay yields, ranging from 1.4 t/A for the check to 2.3 t/A for the highest yielding treatment. The results showed that P and S were the major limiting nutrients. Second cut hay yields were lower due to an August frost, ranging from 0.5 to 1.0 t/A. Again, increasing the rate of S fertilizer, along with P, resulted in highest alfalfa hay yields. The August frost prevented seed formation of the alfalfa crop, leaving yields of less than 40 lb/A at harvest. 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

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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 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.

In 2002, the application of P did not affect yield or protein. However, in 2003 the application of P increased seed yield. The placement of P fertilizer in the seed row vs. side banded did not affect yield in 2002, 2003, or 2004, or protein in 2002 and 2003 (2004 data not analyzed). There was an interesting interaction between N and P on hard vitreous kernels in 2002. The addition of P at the low N rate reduced the percentage of hard vitreous kernels, and the quality of the durum grain sample harvested. This did not occur in 2003. Additions of P were required to optimize the yield response to increasing N rate in 2004. The response of yield and protein to potassium chloride (KCl) was erratic and no clear conclusion can be drawn at this time. *SK-32F*

Evaluation of Agronomic Practices and Quality Parameters of Timothy Hay

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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 2003, a trial was seeded at an irrigated site to examine the effect of P applications at 90, 180, and 240 lb P_2O_5/A on timothy hay. Unfortunately, the timothy did not establish in either the spring or fall when attempts were made at seeding. In 2004, timothy was established on the site and dry matter yields of 2.9 to 3.1 t/A were harvested. However, no differences in P treatments were recorded. Additional P treatments will be applied in the spring of 2005 to monitor the yield and quality response of the timothy. *SK-33*

Forage Rejuvenation with Phosphorus Fertilizer

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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.

Final year results indicate a strong forage yield response to fertilizer P additions in all 3 years of this study. In fact, addition of N alone resulted in little or no yield increase over the unfertilized check, indicating a very P-limited condition in the field. Yield response from fertilizer addition ranged from 0.4 t/A in year 1, 0.8 t/A in year 2, and 1.0 t/A in year 3. As has been previously reported, annual fertilizer P additions result in a progressive increase in forage yields in each year the fertilizer is added. The best treatment in all years of the study was when the 3-year supply of fertilizer P was added with the annual N rate in year 1. Even though no fertilizer P was added in subsequent years, this was always the best yielding treatment. The results of this study clearly show the benefit of using fertilizer N and P to improve old established forage stand yields. *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.

Under the drier than normal conditions recorded in 2003, grain yields at the experimental site were very low. Using the same plots and fertilizer treatments, a P response was not recorded in field pea in 2004, regardless of the previous wheat crop history. For spring wheat in 2004, there was no effect of P additions on the long-term no-till site, but there was an effect on the short-term no-till site where yields were increased with the addition of up to 20 lb P_2O_5/A. These results support past work indicating a lack of response for field pea to P fertilizer additions. They also show that residual P in the long-term no-till site met the wheat P requirements, while the absence of this nutrient supply resulted in a positive response on the short-term site. This project will be continued in 2005. *SK-36F* ■

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