Nitrogen, Phosphorus, and Potassium Fertilizer Management for Oats

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Oat yield was optimized when soil plus fertilizer nitrogen (N) was at 90 to 100 lb/A. Response to phosphorus (P) and potassium chloride (KCl) was minor in these trials.

Oat production in the northern Great Plains has increased in recent years. Production on the Canadian prairies currently accounts for more than half of the total Canadian oat crop and exports.

Despite the growing prominence of oats in today's production systems, limited research on fertilizer management for oats has been conducted in this region. Fertilizers often account for a significant proportion of total input costs in cereal production systems, and may strongly influence crop growth, development, yield, and quality. Moreover, improved fertilizer management of oats may help to enhance crop quality and thus the potential for producing high-quality oats that are suitable for more specialized milling and horse feed markets offering price premiums.

A 3-year field study was initiated in 2000 with the objectives of determining the effect of N, P, and KCl on the growth, yield, and quality of oats, and to determine the impact of varying combinations of the nutrients. Field experiments were established at two sites in the area of Brandon, Manitoba. One site was located on a Newdale clay loam containing low levels of soil nitrate-N (NO_3-N) and extractable-P. The second site was located on a Stockton fine sandy loam or Wellwood loam soil containing low levels of soil NO_3-N and higher extractable-P levels, but considered marginal based on soil test results.

Experimental treatments consisted of a factorial combination of four N rates (0, 36, 72, 108 lb N/A as urea), three P rates (0, 27, 54 lb P_2O_5/A as monoammonium phosphate [MAP]), and two potassium (K) rates (0 and 36 lb K_2O/A as KCl). Each treatment received an additional 12 lb N/A as urea or MAP in addition to the N rate indicated, to account for N supplied by the highest P rate. An unfertilized control treatment was also included. Oats (cv. AC Assiniboia) were direct-seeded using a plot seeder equipped with hoe openers on 9 in. row spacing. At time of seeding, urea and KCl were sidebanded and MAP was placed with the seed. Grain yield was determined by straight-combining the entire plot, and oat test weight, kernel weight, and percentage of plump kernels were determined.

Soil test nutrient levels at the trial sites ranged from low to medium for N (8 to 15 parts per million [ppm] in the top 24 in.), low to sufficient for P (4 to 15 ppm P in top 6 in.), and medium to sufficient for K (113 to 246 ppm K in top 6 in). Soil nutrient analysis used an extraction with $NaHCO_3$. Nitrate-N was determined by hydrazine reduction, P (PO_4) was by molybdate/ascorbic acid, and K was by atomic absorption. Grain yield responses were expected for N and P, while no response was expected for K.

Low rates of fertilizer N were found to increase oat grain yields at all locations, with the crop response leveling off or declining at higher rates. While maximum oat yield was typically attained at the 36 to 72 lb N/A rate, the optimum relative yield was achieved with a total of soil + fertilizer N of approximately 90 lb N/A

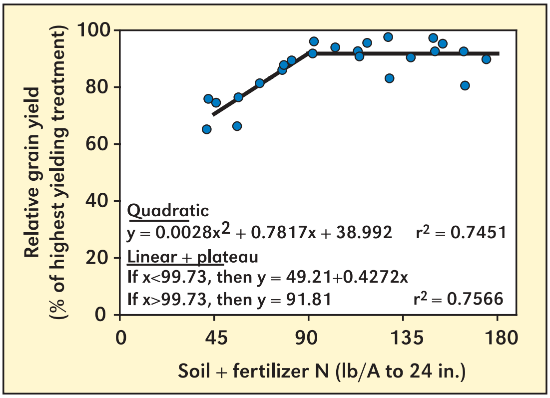

Figure 1. Effect of soil NO_3-N level (to 24 in. deep) plus fertilizer N on relative yield of oats at six field sites. (Treatments not receiving P were not included in the calculation of the means.)

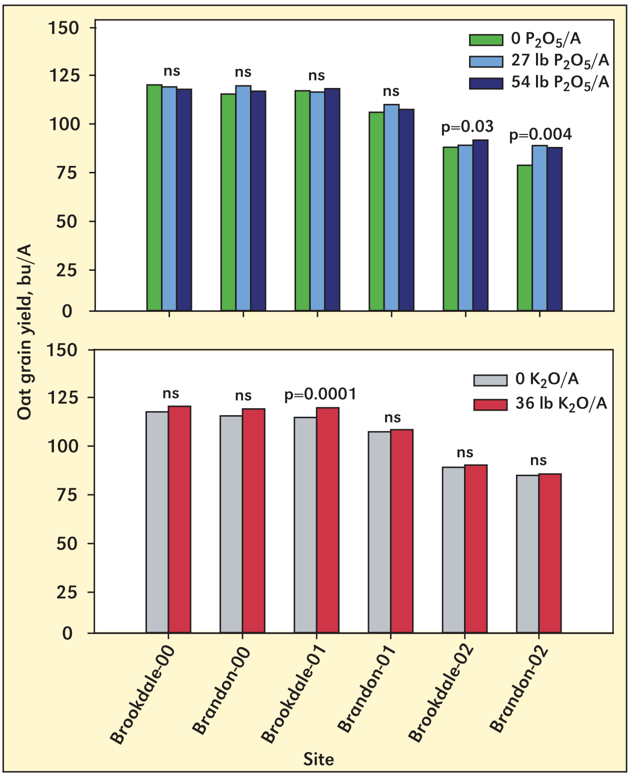

Figure 2. Oat grain yield in reponse to P and K application; mean of all N rates. (Note: ns indicates that differences among treatments within a site were not statistically significant at p=0.05.)

(**Figure 1**). In this study, optimum yields ranged from 90 to 135 bu/A of oats. Nitrogen additions had the most consistent impact on the grain quality of the oat crop. Increasing N rates always resulted in a small but significant decline in oat test weight, kernel weight, and the percentage of plump kernels for both trial locations and all years.

Phosphorus application was found to increase oat grain yield at two of the six trial site-years (**Figure 2**). This occurred despite increased early season crop biomass yield at tillering with P application at both sites and all years (data not shown). In addition, plant development assessment showed that P application significantly advanced the developmental stage of the main stem and tillers arising from the coleoptile (T0) and the first leaf (T1). The observed crop response to fertilizer P application did not appear to be closely linked to soil test P levels. The response to P addition in 2002 may reflect the very dry spring soil moisture conditions, reducing the availability of soil P to plants and contributing to the positive crop response to fertilizer P. No consistent grain quality effects were observed with the application of P fertilizer to the oat crop.

Potassium fertilizer use was found to provide a small but statistically significant oat grain yield increase at one of the six trial locations (**Figure 2**). While a similar trend was observed at the two locations in 2000, these were not significant. The use of KCl increased the plumpness of oat kernels at three of the six locations (data not shown). The test weights of oats were also increased at one of the six locations, and decreased at another. While significant, these grain quality differences were relatively small in magnitude. While interactions among nutrients applied occurred in a number of instances, there was no strong or consistent pattern.

The results of this study support previous research indicating that oats remove less nutrients per bushel of production than many of the other crops grown on the northern Great Plains. Nutrient removal in oats is approximately 0.5 to 0.8 lb N/bu, 0.23 to 0.28 lb P_2O_5/bu, and 0.17 to 0.20 lb K_2O/bu. While fertilizer N additions increased oat yields, application in excess of rates required to optimize yield should be avoided to maintain grain quality. Fertilizer P additions improved early season plant development, at all locations, and grain yield at two of the six trials. Potassium fertilizer application resulted in small improvements in both oat yield and quality.

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InfoAg 2005 Set for July 19 to 21, InfoAg Midsouth February 7 to 9

The popular Information Agriculture Conference series returns July 19 to 21, with **InfoAg 2005 in Springfield, Illinois**. For veterans of the conferences as well as newcomers, the program will feature the latest in precision farming practices, data analysis from yield monitors and field geographic information systems (GIS), communications tools, and information management. A large exhibit hall and hands-on computer workshops are planned.

A special, regional **InfoAg Midsouth** conference is planned for February 7 to 9, 2005, in Tunica, Mississippi. Targeting innovative consultants and farmers, the program will concentrate on technology and information management for cotton, rice, and soybean production systems. Much of the program will be built around individuals sharing their experience, with updates on new technology and research from universities and industry, geared to real-world applications.

Additional information is available at these websites:

>**www.farmresearch.com/infoag**< or >**www.ppi-far.org**<.

FAR Involved in Soybean Rust Focus

Asian soybean rust in South America is the focus of a new project sponsored by the Institute for Technology Development, National Aeronautics and Space Administration. The Foundation for Agronomic Research (FAR) will coordinate assistance in collecting ground measurements to be used in interpreting remote sensing imagery. The Brazilian government research organization (EMBRAPA) and U.S. aerospace companies will also cooperate.

"The goal is to develop an early warning and tracking system for the disease…to help manage it in Brazil and in the U.S., if it eventually comes to this country," explains Dr. Harold F. Reetz, President of FAR.

For more about this and other FAR programs, contact Dr. Reetz.

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