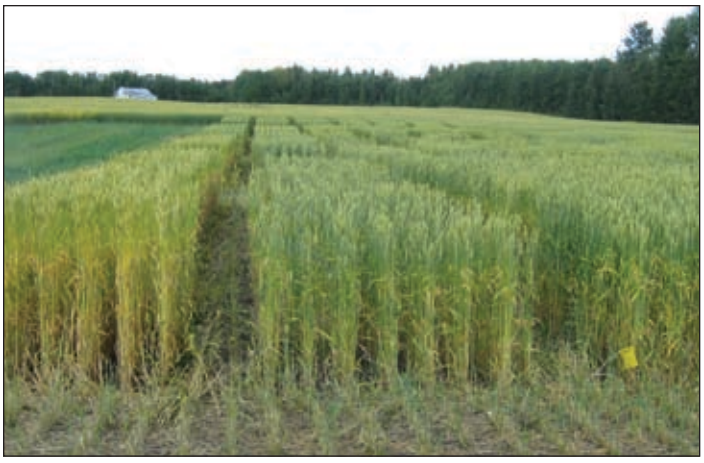
A Public-Private Cooperative Model for Updating Nitrogen Fertilizer Recommendations – the Manitoba Experience

By Rigas Karamanos, John Heard, and Tom Jensen

Field research results in Manitoba and adjacent areas in Saskatchewan conducted from 1989 through 2004 were used to update N fertilizer recommendations for wheat, barley, and canola in Manitoba. This was accomplished through a joint effort of a private industry soil fertility research unit (now part of Viterra, Inc.) and Manitoba Agriculture, Food and Rural Initiatives (MAFRI). They cooperated in reviewing, evaluating, and extracting pertinent research results to use in the updating. This is an example of cooperation between private industry research and government extension to improve fertilizer recommendations for use by farmers.

In Manitoba, as in most states and provinces in the Northern Great Plains (NGP), general fertilizer recommendations for N, P, and K are developed to assist growers in deciding what rate of fertilizer to use. In the province, these recommendations are reviewed and updated every 10 to 15 years depending on research data availability and the amount of changes in cropping systems to warrant an update. The latest update for N recommendations for spring wheat, barley, and canola, was released in March 2009 after adoption by the Manitoba Soil Fertility Advisory Committee, consisting of industry, government, and university researchers. This release was developed based on field research results from N response field experiments conducted from 1989 through 2004. These experiments were conducted by a private industry soil fertility research unit (now part of Viterra, Inc.) headquartered in Regina, Saskatchewan.

In 2004, MAFRI contacted Viterra, Inc. to determine whether or not their research database could be used to update the N fertilizer recommendations for spring wheat, barley, and canola. The last previous update in Manitoba was released in 1990. It was thought that an update was needed because of changes in the way soil fertility research trials were conducted, in relation to tillage systems, crop rotation, N fertilizer placement, and the availability of higher yielding varieties of wheat, barley, and canola.



Field research trials are used to generate data for development of nutrient recommendations.

Abbreviations and notes: N = nitrogen; P = phosphorus; K = potassium.

Hybrid canola grown in Manitoba.

For canola, there has been the introduction and widespread adoption of higher yielding hybrid seed compared to open-pollinated canola seed used for the 1990 recommendations. Research trials used for the previous 1990 recommendations were based on soils that were either summer-fallowed the previous year or followed cereals with full conventional tillage with applied N broadcast and incorporated prior to planting. The more recent research was on land continuously cropped. It was planted using no-tillage or direct-seeding into standing stubble from the previous crop, and N fertilizer was generally applied in subsurface bands prior to or during the planting operation. The fields received a pre-plant weed and volunteer crop control application using a non-selective herbicide. Additionally, foliar applications of fungicides were made if leaf fungal populations reached threshold levels as assessed visually at each individual research site and year. Earlier studies did not receive foliar

Table 1. Average yield potentials for wheat and barley (bu/A) by moisture environment, crop, and year of update of N recommendations.

Moisture categories	Wheat		Barley	
	Pre-1990	2009	Pre-1990	2009
Moist	48	65	76	124
Dry	42	48	67	106
Arid	33	34	52	59

fungicide applications. The updated guidelines continue to be based on soil nitrate-N in the 0 to 24 in. depth.

The experiments were grouped and separate yield response equations developed for three agro-climatic categories, described as moist, dry, and arid for wheat and barley, and only moist for canola at present (there were not sufficient site-years for the arid and dry environments). However, canola is also grown throughout the province in all agro-climatic environments. The respective yield response equations are available for the various crop-environment combinations. These

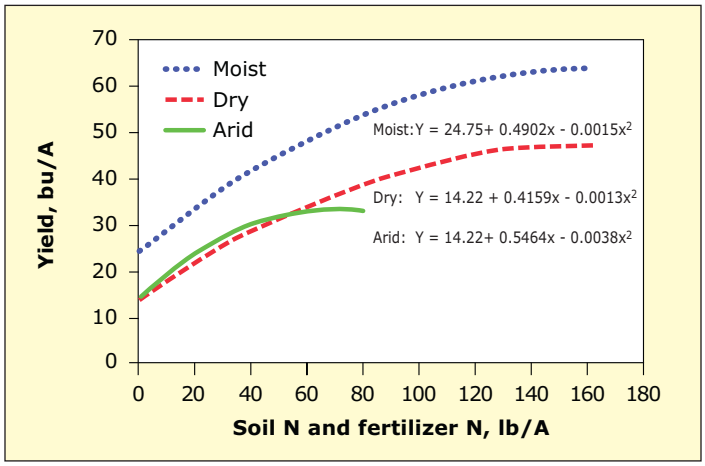


Figure 1. CWRS wheat response to N; 147 sites in three agro-climatic environments. Respective yield formulas are shown with corresponding curves.

improved yield response equations are useful to help growers better determine fertilizer N rates because yield potentials for most of the crop-climate combinations have increased from the 1990 recommendations as shown in **Table 1**. These increases are a result of improvements in genetic yield potentials, moisture conserving no-till cropping, more diversified crop rotations, N fertilizer placement in bands, and use of fungicides when beneficial for leaf fungal disease control.

General recommendations for fertilizer rates are available to farmers in the Manitoba Soil Fertility Guide (MAFRI, 2007), offered in both a printed hard-copy, or as an on-line version on the Manitoba Agriculture and Rural Initiatives website. The latest version of this guide contains the N recommendations based on the 1990 recommendations, and was updated and released in the year 2007.

Nitrogen Rate of Return Calculator
Wheat, Barley, Canola & Hybrid Canola
Manitoba

Fertilizer N data	
Fertilizer Type	UREA
Cost/tonne	$400
%N	46
Cost/Unit of N	$0.40
Fertilizer N increment	10
Crop price increment, $	$0.50
Soil test N (0-24") lb N/acre	30
Fertilizer price increment, $/tonne	$50
Yellow Cells Can be Modified	

Crop and Economic data	Current N Rate (lb N/acre): Moist	Dry	Arid
CWRS Wheat	90	70	40
Barley	90	60	40
Canola	70		
Canola (hybrid)	100		
Expected prices ($/bushel):			
CWRS Wheat	$5.00		
Barley	$2.50		
Canola	$9.00		
Canola (hybrid)	$9.00		

Figure 2. Partial view of the input screen for the MAFRI N Calculator.

The 2009 release of information as described in this article uses the refined and updated recommendations based on the Viterra research. Dr. Karamanos has prepared an Excel spreadsheet N Calculator using the yield equations derived from the field research experiments. An example of the yield equations for Canadian Western Red Spring (CWRS) wheat is shown in **Figure 1**. The calculator presents an easy-to-use format for estimating N fertilizer rates. Not only does it esti-

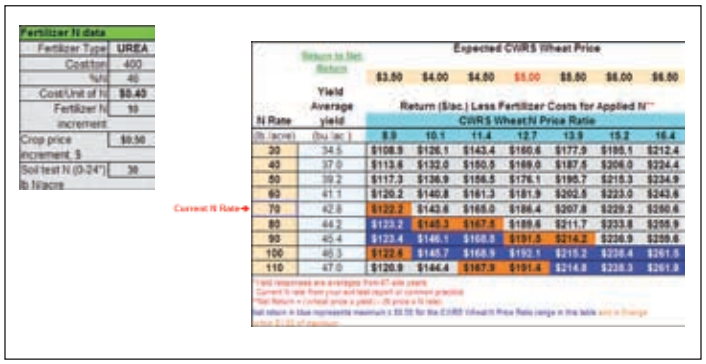


Figure 3. Screen shot of return ($/A) for wheat in a dry agro-climatic environment, as calculated using Manitoba N Calculator.

mate the rate, but it includes an economic component based on the principle of net return described by Dr. M. Rankin of the University of Wisconsin (Rankin, 2005). The calculator is available on the MAFRI website: >http://www.gov.mb.ca/agriculture/financial/farm/nitrogencalc.html<. A partial screen shot of the input form of the calculator is shown below in **Figure 2**. The user can enter values for the fertilizer type and cost, percent N in the fertilizer, fertilizer N increments, expected crop prices, crop price increment, and soil test N, as lb N/A. The calculator will then determine the economic N rate for spring wheat, barley, open-pollinated canola, and hybrid canola based on the applicable moist, dry, and arid agro-climatic environments. An example of the output screen for spring wheat in the dry agro-environment is shown in **Figure 3**.

Conclusion

The Manitoba N Calculator is a valuable tool to assist Manitoba growers in deciding what rate of N fertilizer to apply to a crop of wheat, barley, or canola. It updates Manitoba N fertilizer guidelines to reflect current cropping practices. It is an excellent example of how private field research data can be used to improve agronomic extension activities. The cooperative efforts of Viterra, Inc. and MAFRI have produced a tool that will help increase net returns for Manitoba farmers. BC

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Rankin, M. 2005. Nitrogen $ Rate of Return Calculator Version 3. University of Wisconsin–Extension: http://www.uwex.edu/ces/crops/NComparison.htm.