

Stretching Fertilizer Dollars and Supplies



November 2022

Over the past two years, Manitoba farmers have experienced sizeable fertilizer price increases and some periodic shortages of fertilizer. With this in mind, farmers may wish to consider the following factors to ensure they are using fertilizers economically and efficiently.

The 4Rs of Nutrient Stewardship: the Right Rate, the Right Source, the Right Time and Right Place can be used to guide decision making.

Right Rate

1. Soil test: Many areas of Manitoba experienced yieldlimiting drought in 2021, which left much nitrogen (N) unused in the soil. Much of that nitrogen was used by the 2022 crop and soil tests are indicating more normal levels this fall, meaning more normal rates of N will be required. To ensure you are taking a proper inventory of this resource, sample the 0-6" and 6-24" depths. A single field composite should be comprised of 20 or more cores. If variability of nitrogen or yield potential is expected in the field, zone sampling and variable rate application may be warranted.
2. Consider nitrogen credits. Nitrogen needs may be fully or partially met by manure applications or previous legume or pulse crops.
 - a. Manure nutrient credits are based upon the type of manure and application rate. Book values of manure nutrient content are available at: <https://www.gov.mb.ca/agriculture/environment/nutrient-management/pubs/properties-of-manure.pdf>
 - b. Similarly, nitrogen may be available from terminated forage legumes or dry peas. The nitrogen credit from legume forages is as high as 90 lb N/ac depending on timing of termination and the density of legumes in the stand. Nitrogen credits are slight from most grain pulse crops, but dry peas can be considered to provide some 25 lb N/ac.
 - c. Green manure crops are not common, but for every 1000 lb of dry matter produced by a grain or forage legume, some 15 lb of nitrogen is available next year.
 - d. Estimates of nitrogen release from soil organic matter have proven fruitless in MB research due to our unpredictable growing season moisture.
3. Crop Selection: Crops require different levels of crop nutrients, especially nitrogen. Large nitrogen consumers are canola, wheat and corn. Modest consumers are oats, flax and sunflowers. Pulse and legume crops such as dry peas, soybeans and dry beans may have little to no need for supplemental nitrogen. Ideally, allocate those crops to fields according to soil nitrogen reserves.
4. Carefully consider crop yield potential. Lack of water reduced many yields in 2021 and if soil moisture reserves remain low, growers may wish to set conservative yield goals, which will affect nitrogen rates directly (Figure 1). These response curves are used to determine the most economical nitrogen rate for wheat and barley and can be found at:

<https://www.gov.mb.ca/agriculture/crops/soil-fertility/nitrogen-rate-calculator.html> . Nitrogen rates for other crops are often estimated from the lb of nitrogen per bu of expected yield. Be realistic in setting such yield goals.

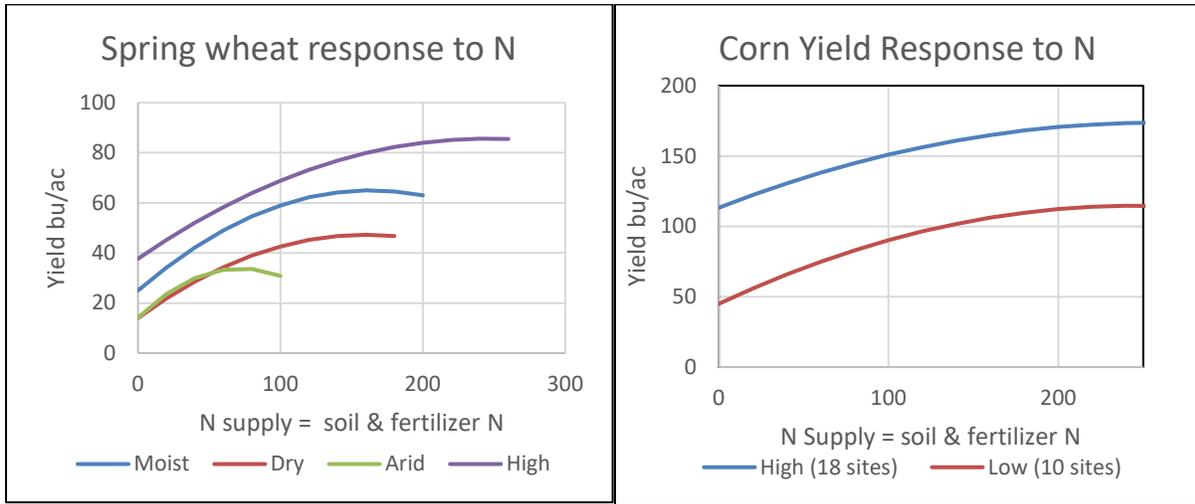


Figure 1. Wheat yield response to N under varying moisture availability, and for newer high yielding varieties

Figure 2. Corn yield response to N under high and lower yield potential sites

- When high nitrogen costs are coupled with high crop prices, the temptation to slash fertilizer rates may be unfounded. Consider using the nitrogen rate calculator for wheat, barley and canola which maximizes returns based upon fertilizer cost, expected crop prices and soil test N. (Figure 3) <https://www.gov.mb.ca/agriculture/crops/soil-fertility/nitrogen-rate-calculator.html>

Nitrogen \$ Rate of Return Calculator									
Manitoba (All)									
		Go to Marginal Revenue Chart	Go to Fertilizer Price as variable	Return to Data Entry					
Fertilizer N data									
Fertilizer Type	UREA								
Cost/ton	\$1,200								
%N	46								
Cost/Unit of N	\$1.19								
Fertilizer N increment	10								
Crop price increment, \$	\$1.0								
Soil test N (0-24")	20								
lb N/acre									
		Expected Hybrid Canola Price							
		Go to Total Net Return							
		Below							
		\$14.00	\$15.00	\$16.00	\$17.00	\$18.00	\$19.00	\$20.00	
		Yield Increase from 0 lb. N*							
		Net Return (\$/ac.)**							
		Canola:N Price Ratio							
N Rate (lb./acre)	Average yield (bu./ac.)	11.8	12.7	13.5	14.3	15.2	16.0	16.9	
90	45.3	\$103.3	\$118.3	\$133.3	\$148.3	\$163.3	\$178.3	\$193.3	
100	46.5	\$107.8	\$124.0	\$140.1	\$156.3	\$172.5	\$188.7	\$204.8	
110	47.6	\$110.9	\$128.1	\$145.4	\$162.6	\$179.8	\$197.1	\$214.3	
120	48.5	\$112.6	\$130.8	\$149.0	\$167.2	\$185.4	\$203.6	\$221.8	
130	49.4	\$112.8	\$131.9	\$151.0	\$170.1	\$189.1	\$208.2	\$227.3	
140	50.2	\$111.7	\$131.6	\$151.4	\$171.2	\$191.1	\$210.9	\$230.8	
150	50.8	\$109.2	\$129.7	\$150.2	\$170.7	\$191.2	\$211.7	\$232.2	
160	51.4	\$105.3	\$126.4	\$147.4	\$168.5	\$189.6	\$210.6	\$231.7	
170	51.9	\$100.0	\$121.5	\$143.0	\$164.6	\$186.1	\$207.7	\$229.2	
*Yield responses are averages from 34-site years									
Current N rate from your soil test report or common practice									
**Net Return = canola price x yield increase - (N price x N rate)									
Net return in blue represents maximum ± \$0.50 for the Canola:N Price Ratio range in this table and in Orange within \$1.00 of maximum									

Figure 3. Screenshot of nitrogen rate calculator for a canola example.

This calculator contains an underutilized function to account for financial risk. While returns are maximized with \$1 return back on the last \$1 fertilizer, this can take a fair bit of fertilizer for that last

bushel. If the financial risk of high rates appears excessive, consider changing your marginal return expectation, by setting it to a \$1.50 return for the last \$ spent on fertilizer.

In general, the nitrogen needs of corn , wheat and canola are high. Current economic comparisons still suggest a range of rates between 150-190 lb N/ac (total N, so subtract the soil test amount) (Tables 1 and 2).

Table 1. Economically optimum nitrogen supply (fertilizer plus soil) for high yielding wheat across a wide range of nitrogen costs and crop price.

N cost per lb of N	Wheat price \$/bushel			
	\$6.00	\$8.00	\$10.00	\$12.00
	Total N supply lb N/ac (soil nitrate plus fertilizer)			
\$0.40	200	215	220	225
\$0.60	180	200	205	215
\$0.80	160	180	195	205
\$1.00	140	165	180	195
\$1.20	120	150	170	180
\$1.40	100	135	155	170

Table 2. Economically optimum nitrogen supply for corn with high and lower yield potential, across a wide range of nitrogen costs and crop prices.

N cost per lb N	Corn price \$/bushel					
	\$6.00	\$8.00	\$10.00	\$6.00	\$8.00	\$10.00
	High yield potential			Lower yield potential		
	Total N supply lb N/ac (soil nitrate-N plus fertilizer)					
\$0.40	210	230	240	210	215	220
\$0.60	205	220	225	195	205	210
\$0.80	185	205	215	180	195	205
\$1.00	165	190	205	165	185	195
\$1.20	150	175	190	155	175	185
\$1.40	130	165	180	140	165	180

- Control weeds early in crops. Weeds compete directly for nutrients at the expense of the crop. This also occurred this past fall with uncontrolled volunteer crops and weed growth.

Right Source

- Select fertilizer sources that are effective and minimum cost. Manure can be very economical since it is often priced on its nitrogen content alone.
- Many enhanced efficiency fertilizers and additives are now available to minimize potential losses, but all at additional cost. Recognize what type of loss they are protecting nitrogen from

(leaching, denitrification or volatilization) and balance those risks with the additional fertilizer cost. If it remains dry, losses to leaching and denitrification are slight.

3. Evaluate sources based on the pounds of nutrient N, P₂O₅, K₂O supplied. Lower cost, but diluted applications may not meet crop needs and could deplete soil reserves.

Right Timing

1. Nitrogen application before or at seeding has proven to be very efficient, on average 20% more efficient than fall applications.
2. Recent studies have shown that split nitrogen applications have been effective for high yield and protein in spring wheat. If a conservative nitrogen rate is applied at seeding due to modest yield potential, the remaining amount can be applied between stem elongation and flagleaf emergence, particularly if moisture conditions and yield potential improves. But if yield potential does not improve, then this follow-up application can be withheld.

Right Placement

1. In-soil banded fertilizer maximizes the efficiency of nitrogen, phosphorus and potassium. Nitrogen efficiency is increased some 20% by band placement. Phosphorus and potassium efficiency can be increased 2 fold with banding, particularly with lower rates placed with or close to the seed, while respecting seed safety. So when costs are high or supplies short, the greatest return is with banded placement.

Summary

Farmers can and do employ many of the above strategies in efficient fertilizer use. It is extra important in a time of uncertain input prices and availability.

Farmers should maintain good communication with their trusted agricultural retailer through the winter. Opportunities to price and possibly take delivery of fertilizer should be considered.

An increasing number of farmers do have on-farm fertilizer storage that permits great flexibility in pricing and availability.

Contact Us

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