



Economics of Nitrogen Fertilizer and Crop Production

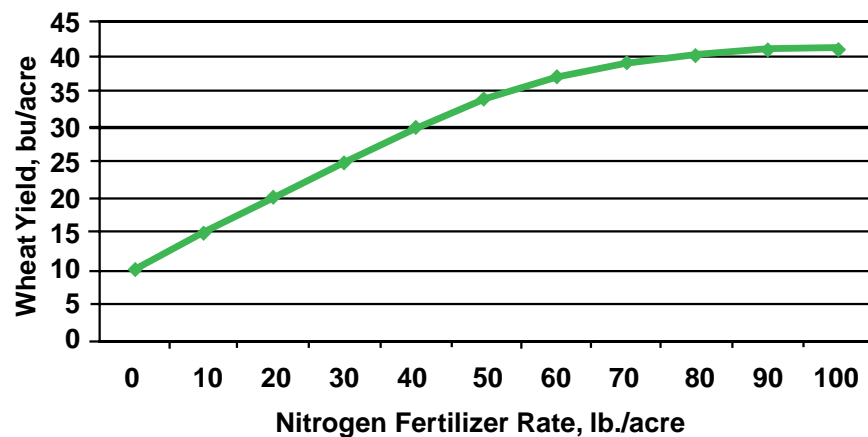
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Supply and demand economics have been the driving force behind nitrogen (N) fertilizer price increases over the past several months. Increases in natural gas prices have caused N fertilizer producers across North America to scale back production levels of N fertilizers. Higher prices for both natural gas and electricity made it uneconomic to keep production levels high. Reduction in the availability of ammonia and urea quickly led to nitrogen price increases as supplies decreased. Although natural gas prices have started to decline from the unprecedented high levels, N prices are not expected to decline because of continuing shortages in supply, coupled with the high-cost inventory produced over the winter.

As the price of N fertilizer increases, growers often wonder how the increased price affects net profit. A common question is, **“Can I reduce fertilizer inputs to save on costs, or will the yield loss result in lower profit?”** **There is no simple answer.** The rate of N fertilizer applied to a crop to achieve maximum profit shifts downward somewhat when the price of N fertilizer increases. However, the decrease in the optimum economic rate of N fertilizer often does not decrease as much as one might think.

A typical yield response curve shows the relationship between N fertilizer rate and wheat yield (*Figure 1*). The relationship shows that the majority of maximum yield results from response to N fertilizer and that yield response from each extra unit of N declines as maximum yield is achieved. The graph also illustrates that at less than maximum yield the impact of nitrogen fertilization is significant with each increment of nitrogen contributing more in value or return than in cost. As such, it is important to evaluate the level of nitrogen application versus the anticipated yield, when assessing the potential for economic return. **There may be little justification for cutting back on N fertilizer rates, when N prices increase.**

Figure 1. Typical Yield Response of Wheat to Nitrogen Fertilizer



The results from a nitrogen fertilizer response trial at Melfort, SK, conducted over three years, 1997 through 1999, is useful to demonstrate the relationship between a change in N fertilizer price and the net income from growing wheat. In *Table 1*, below, net income is calculated using three different N fertilizer prices, \$0.30, \$0.35 and \$0.40/lb. of N; and fertilizer application rates from 0 to 150 in five increments of 25 lb/acre of N. The **maximum net income** for all the fertilizer prices was realized at the N fertilizer rate of 100 lb./acre. For every price increase of \$0.05 per lb. of nitrogen, the net income decreases by \$5 per acre. **However, the fertilizer rate that maximizes net returns remains the same.**

Table 1. Net Income (\$/acre), As Affected By Nitrogen Fertilizer Price (\$/pound of N) and Rate (pound of N/acre)

		Nitrogen Rate, (lb. N/acre)						
		0	25	50	75	100*	125	150
Nitrogen Price (\$/lb. N)	0.30	132	161	184	196	225	221	207
	0.35	132	160	182	192	220	215	199
	0.40	132	158	179	189	215	209	192

Source: Melfort Research Station, AAFC, Dr. A. Johnston, presently Western Canada Director with PPIC.
Note: Table 1 was prepared using three-year yield averages, and final 1999/2000-year Canadian Wheat Board payments with protein premiums included. Additionally prices are FOB Vancouver, less \$1.00/bu. cost for freight and handling.

Another way to illustrate the effect of higher N fertilizer prices is to show the break-even yields required to cover fertilizer costs at different N prices and wheat prices (*Table 2*). In this example, wheat price has more effect on the break-even yield than does N price. Using a wheat price of \$2.50/bushel, a grower needs to raise 6 more bushels of wheat as N price goes from \$0.30 to \$0.45/lb. of N. In contrast, at a wheat price of \$4.50, a grower needs only to grow 3 bushels of wheat to cover the same N fertilizer increase. **The opportunity for making a profit with hard red spring wheat comes with capturing protein premiums and obtaining reasonable yields. The impact of reducing N rates results in both lower yields and lower levels of grain protein.**

Table 2. Break-even Wheat Production (bushels/acre). Based on Wheat and Nitrogen Prices

N Price, \$/lb	Wheat Price with protein premium after freight & Handling, \$/bu					
	2.50	3.00	3.50	4.00	4.50	5.00
0.30	38	32	27	24	21	19
0.35	40	33	29	25	22	20
0.40	42	35	30	26	23	21
0.45	44	37	31	28	24	22

Assumption: Cash cost before fert N=\$65.00/A; 100 lb N/A applied
Source: Dr. Adrian Johnston, Western Director Potash and Phosphate Institute of Canada

The greatest net profit results from growing a high-yielding crop. The fixed costs of land, equipment, labor, finance charges, fuel for seeding, weed control and harvesting operations, are similar whether the crop is low-yielding or high-yielding. Variable costs usually increase as yield increases. **If N fertilizer prices increase growers need to be careful not to cut fertilizer rates as net profits can be adversely affected.** ■

For more information, please contact:

Agrium
 13131 Lake Fraser Drive
 Calgary, Alberta
 T2J 7E8
 Telephone: 403 225 7000

www.agrium.com