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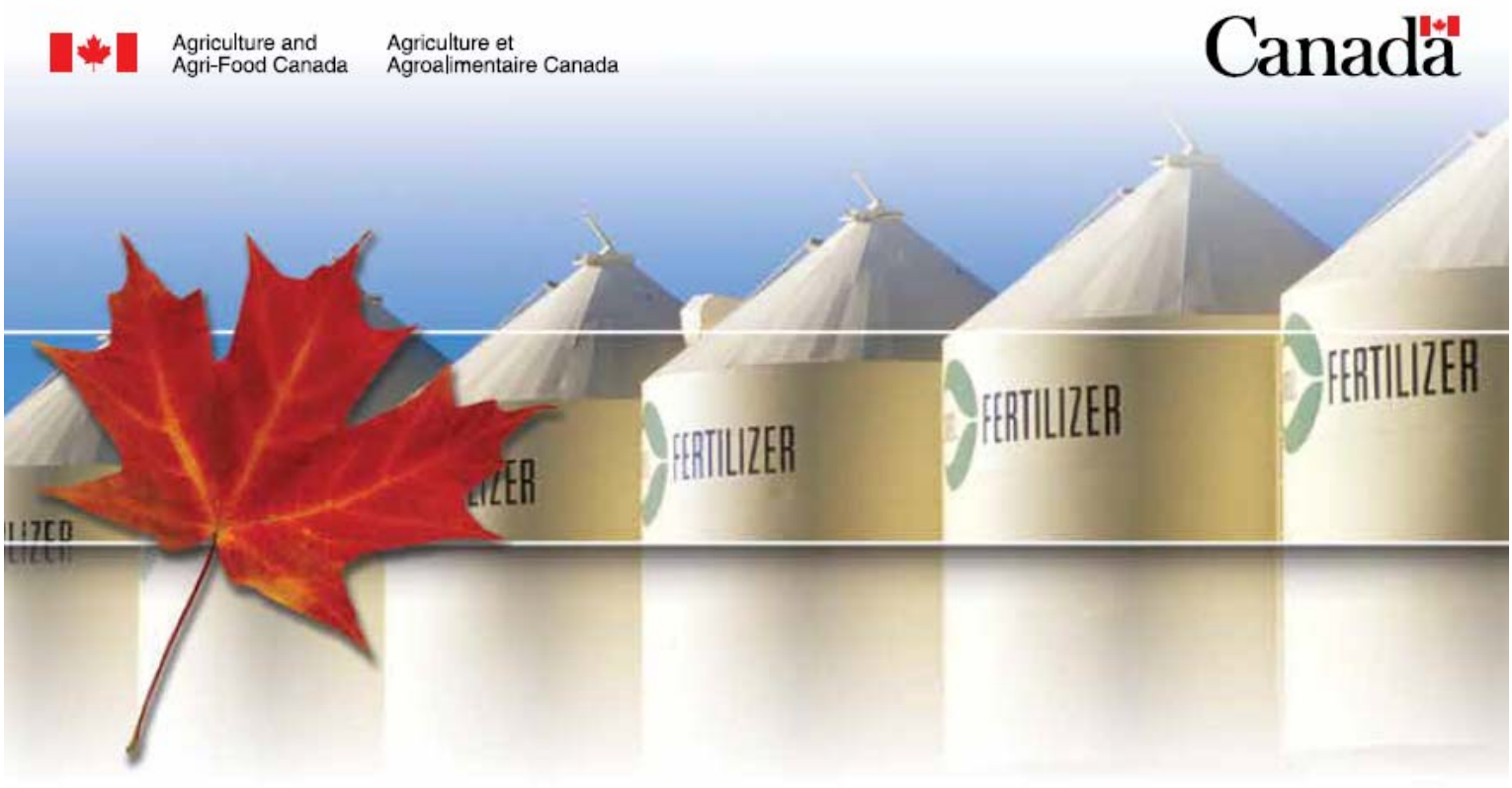

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Canadian Farm Fuel and Fertilizer: Prices and Expenses

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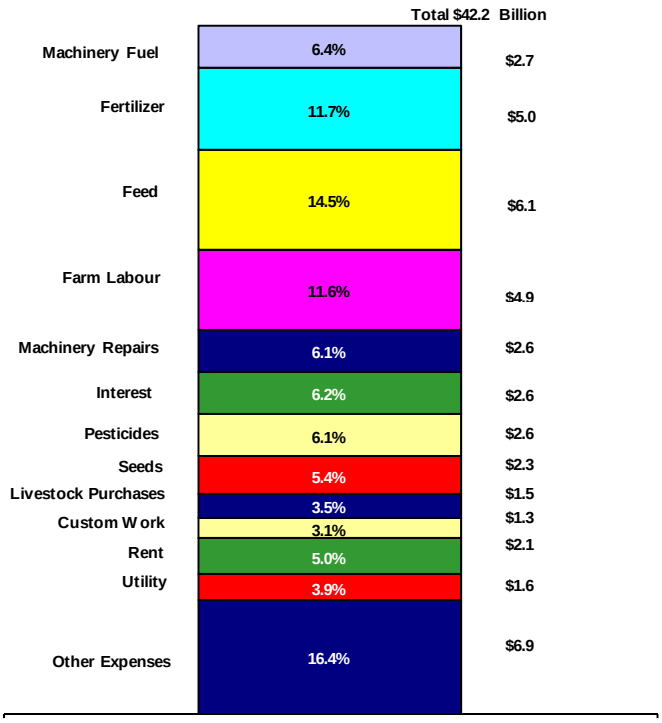
CANADIAN FARM FUEL AND FERTILIZER: PRICES AND FARM EXPENSES

This issue of the Market Outlook Report examines the situation and outlook for farm fuel and fertilizer prices and expenses in Canada for 2013 and 2014. Expenditures for fuel and fertilizers represented about 18% of farm operating expenses in Canada in 2013. Prices of fuel for farm machinery increased in 2013 and were higher for the year overall in 2014. Fertilizer prices decreased in 2013 and remained stable in 2014.

SUMMARY

Production and profitability in the primary agriculture is highly dependent upon fuel and fertilizer. Figure 1 shows the components of 2013 Canadian farm operating expenses. Fuel and fertilizer costs accounted for 18% of total Canadian farm expenses, or $7.7 billion (bln). For every one cent per litre increase in fuel prices, Canadian farmers' annual machinery fuel bill increases by about $27 million (mln). For fertilizer, every ten dollar per tonne increase in the price adds about $68 mln to Canadian farmers' annual fertilizer bill.

Figure 1_CANADA: FARM OPERATING EXPENSES, 2013



Notes: (1) Rent includes cash rent and share rent. (2) Utility includes electricity, telephone and heating oil. (3) Other expenses include taxes, repairs to building and fences, irrigation, twine & wire, crop insurance premiums, al & vet, business insurance, stabilization premiums, legal and accounting fee and other expenses.
Sources: (1) Statistics Canada; (2) AAFC calculations.

Fuel prices increased by 123% between 2003 and 2008, but the global recession led demand for energy to weaken and fuel prices to fall in 2009. However, fuel prices started to rise again in 2010 and this trend continued between 2011 and 2013 because of growing energy demand in emerging economies and slowing growth in supply. Fuel prices continued to rise for most of the year in 2014 as a result of geopolitical tensions in the major oil exporting regions.

Natural gas supplies have become more plentiful in North America as a result of advances in horizontal drilling and hydraulic fracturing technologies (fracking) for extracting shale gas. This kept US and Canadian gas prices depressed in 2011-2012. In 2013, natural gas prices rebounded somewhat in both the US and Canada, driven by increasing demand and declining production, but prices still remained below 2011 levels. Prices continued to increase in 2014.

Fertilizer prices in Canada began rising steadily in 2003, but increased sharply to reach an historical high in 2008. These increases abruptly halted in 2009 as a result of falling commodity prices, restricted availability of credit, and a sudden fall in energy prices, the result of a global financial crisis. Fertilizer prices resumed their climb in 2011 and continued to increase in 2012. However, prices decreased in 2013 in response to stagnant global fertilizer demand and oversupply in the global markets. Prices were projected to remain stable in 2014.

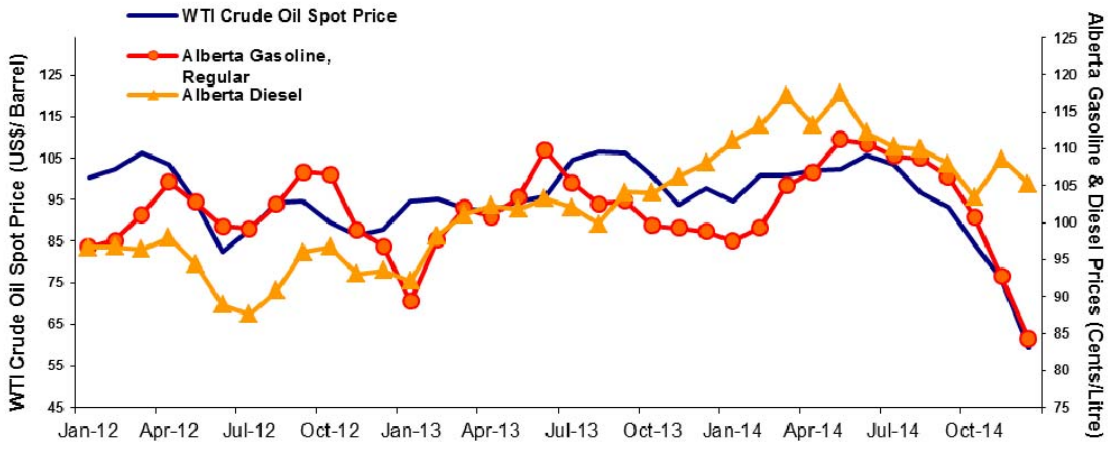
SECTION 1 - FARM MACHINERY FUEL

The Canadian agricultural sector relies heavily on petroleum to meet a variety of energy needs. Farm machinery fuel expenses consist mainly of diesel and gasoline, but also include lubricants. The price of fuel is generally determined by the forces of global supply and demand, and the agricultural sector is largely a price taker for both diesel and gasoline.

FUEL PRICES

Canadian fuel prices closely follow US energy prices. Figure 2 shows the actual energy price pattern in the US and Canada over 2012-2014. The West Texas Intermediate (WTI) crude oil price averaged about US$98 per barrel in 2013, 4% higher than in 2012[1]. Agriculture and Agri-Food Canada (AAFC) estimates that the prices paid by Canadian farmers for farm machinery fuel increased by 2.6% in 2013 over 2012.

Figure 2_ ENERGY PRICES IN ALBERTA AND UNITED STATES



[1] Source: the US Energy Information Administration (EIA).

Sources: (1) Alberta Agricultural Input Monitoring System (AIMS), Alberta Agriculture and Food, Economics and Competitiveness Division, Statistics and Data Development Unit; (2) United States Energy Information Administration (EIA); (3) Forecast from EIA and AAFC.

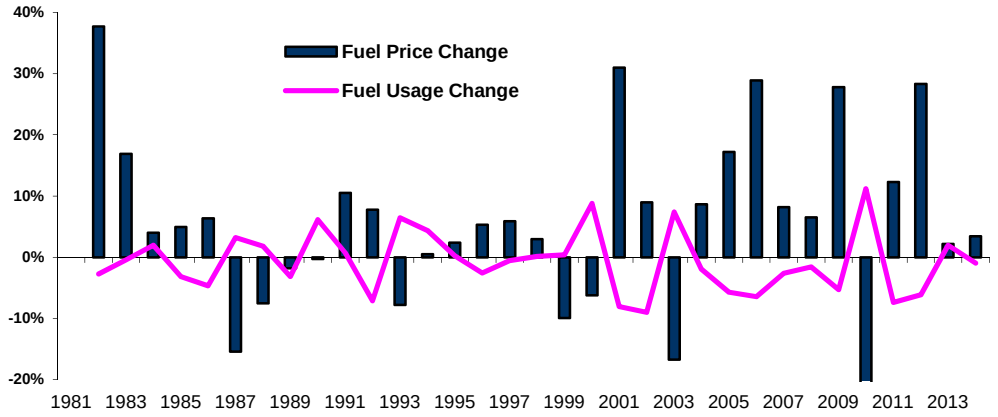
Fuel prices continued to increase for most of the year in 2014. However, crude oil prices started to drop significantly in October as Saudi Arabia was no longer willing to cut its oil production to support higher prices. At the same time, global demand growth slowed and a US shale oil boom increased the supply. In spite of the dramatic decline in the crude oil price during the third quarter of 2015, the drop in gasoline price didn't carry over to diesel due mainly to stronger heating fuel demand in the winter and the use of expensive additives in diesel for cold weather conditions that are not related to crude oil price. The US Energy Information Administration (EIA) estimated the price for WTI crude oil to average US$93 per barrel in 2014, down 4.8% from the 2013 average.

Based on information available up to November 2014, AAFC expected that fuel prices for farm machinery in Canada would increase by about 4.8% in 2014 compared to 2013. This would translate into a $127M increase in Canadian farmers' machinery fuel bill for 2014.

FARM FUEL USAGE

Price elasticity of demand measures the percentage change in quantity demanded resulting from a percentage change in price. Using 33 years of historical data from Statistics Canada, the price elasticity of demand for farm fuel in Canada is estimated at -0.25. This means that, on average, when fuel prices rise 10% Canadian farmers reduce fuel usage by 2.5%. Farmers' demand for fuel is relatively insensitive to price changes in the short-term because fuel is a necessity for farming and there are no immediate substitutes. Figure 3 illustrates the inverse relationship between fuel price and fuel usage over 1981-2013.

Figure 3 _CANADA: FARM MACHINERY FUEL PRICE AND USAGE CHANGE FROM PREVIOUS YEAR



Sources: (1) Statistics Canada and AAFC; (2) AAFC calculations.

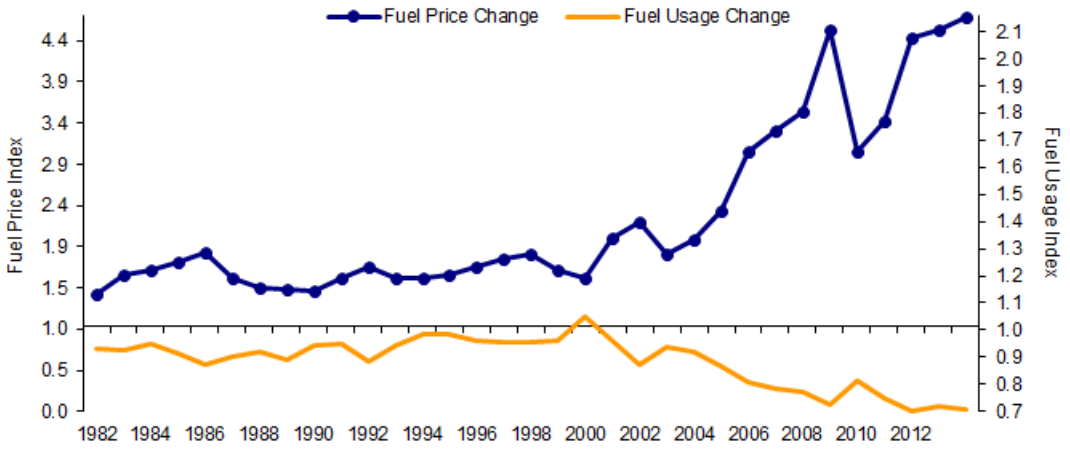
Figure 4 indicates that before 2000, farmers' long-term fuel usage was actually quite steady, averaging a 0.5% annual growth rate, with no significant variability in fuel prices. However, the volume of fuel used by farmers decreased by an average of 2.5% annually following a string of nearly continuous hikes in fuel prices over 2000-2013. Therefore, although higher fuel prices may reduce farmers' fuel usage in any given year, the price increase would have to persist for a longer period of time in order to reduce the fuel consumption trend.

In response to higher fuel prices, farmers have begun to factor in fuel efficiency into their machinery purchase decisions and have also altered their production practices. For example, they have adopted conservation tillage

practices such as no-till or minimum tillage that save fuel as well as provide other economic and environmental benefits.

Given the estimated elasticity and other factors such as seeded and harvested area, Canadian farm machinery fuel usage decreased by 1% in 2013. AAFC estimated Canadian farm machinery fuel usage was flat in 2014.

Figure 4_ CANADA: LONG-TERM TRENDS IN FARM MACHINERY FUEL PRICE AND USAGE (BASE YEAR=1980)



Sources: (1) Statistics Canada and AAFC; (2) AAFC calculations

FARM FUEL EXPENSES

Given changes in both the price and quantity of farm fuels, Canadian farm machinery fuel expenses were $2.7 bln in 2013, an increase of 2% over 2012, and above the 2008-2012 average of $2.4 bln. Total expenses for farm machinery fuel were forecast to increase by 4% to $2.8 bln in 2014.

SECTION 2 - FARM FERTILIZERS

Canada is one of the world's major producers of fertilizers, particularly nitrogen and potash. Production is located primarily in Alberta and Saskatchewan. In 2013, Canada exported about 67% of its potash production and more than a quarter of its nitrogen production, mainly to the US.

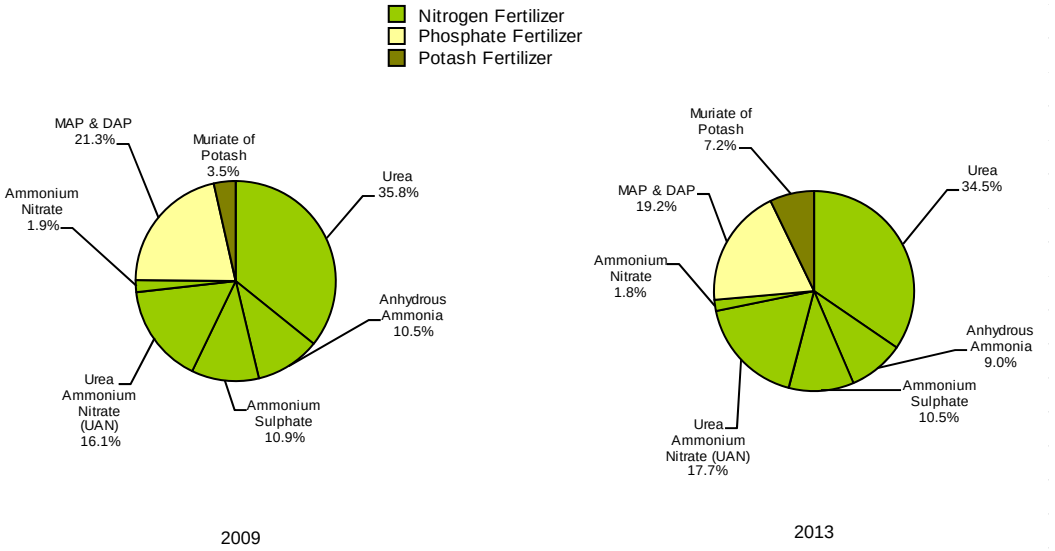
FERTILIZER TYPES IN CANADA

Fertilizers contain one or more of three key nutrients: nitrogen, phosphate and potassium. The nitrogen fertilizers that are currently used in Canadian agriculture are primarily anhydrous ammonia, urea, nitrogen solution, ammonium nitrate and ammonium sulphate. The phosphate fertilizers are monoammonium phosphate (MAP) and diammonium phosphate (DAP), both produced from phosphate rock. The other major nutrient used in crop production is potash fertilizer, which is important in soybean and corn production. The majority of potash production in North America takes place in Saskatchewan.

Figure 5 shows the usage of the major types of fertilizers used in Canadian agriculture in 2009 and 2013. Because of nitrogen's importance to plant growth and development, nitrogen is the most common nutrient used in agricultural production, accounting for 74% of total fertilizer usage, or about 5 million tonnes in 2013. The usage of nitrogen increased at an annual growth rate of 4.8% from 2009 to 2013, with urea representing the largest

volume used. Phosphate fertilizers accounted for 19% of total fertilizer usage, or about 1.3 million tonnes in 2013. Potash fertilizer accounted for 7% of total usage, or about 0.5 million tonnes in 2013.

Figure 5_ CANADA: FERTILIZER TYPES AND USAGE, 2009 AND 2013



Sources: (1) Statistics Canada; (2) AAFC calculations

DETERMINATION OF FERTILIZER PRICES

The traditional factors for determining fertilizer prices are production costs, market demand and competition. In addition, prices for all three types of fertilizers at the retail level are affected by prices for gasoline and diesel because transportation costs represent an important part of the cost of marketing fertilizer. Other factors, such as exchange rates and government policies, also have an effect on fertilizer pricing.

Production Costs

The factors affecting the cost of production are different for each type of fertilizer. The following section will discuss each of the cases for nitrogen, phosphate and potash fertilizers, respectively.

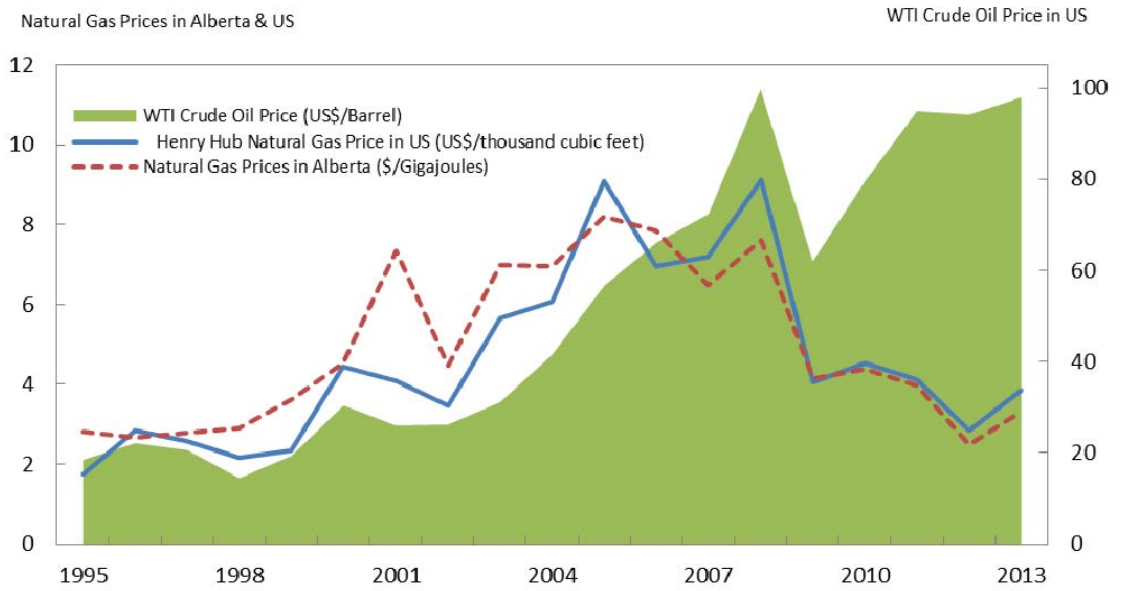
(1) Natural Gas Prices

Anhydrous ammonia is the primary component of nearly all nitrogen fertilizers produced in the world. Ingredients for the production of anhydrous ammonia are air, steam and natural gas, with the latter accounting for 70-90% of the production cost of ammonia. Therefore, natural gas prices are one of the key determinants of nitrogen fertilizer prices.

Figure 6 shows natural gas prices in comparison with crude oil prices in Alberta and the US over 1995-2013. In the past, natural gas and crude oil prices were highly correlated, so that changes in the price of oil translated into changes in the price of natural gas. However, the massive gas supply that has resulted from the proliferation of shale gas wells has kept US and Canadian natural gas prices low in recent years, causing natural gas and crude oil prices to decouple from one another after 2010. Though natural gas prices rebounded somewhat in 2013, they still remained below the 2011 levels. The US natural gas Henry Hub spot price averaged US$3.84 per thousand

cubic feet in 2013, 36% higher than in 2012[2]. Similarly, AAFC estimates that the natural gas price in Alberta increased by 33% in 2013. The US Energy Information Administration (EIA) projected that natural gas prices would continue to increase in 2014.

Figure 6_ NATURAL GAS AND CRUDE OIL PRICES IN ALBERTA AND THE UNITED STATES, 1995-2013



Sources: (1) Alberta Agricultural Input Monitoring System (AIMS), Alberta Agriculture and Food, Economics and Competitiveness Division, Statistics and Data Development Unit; (2) United States Energy Information Administration.

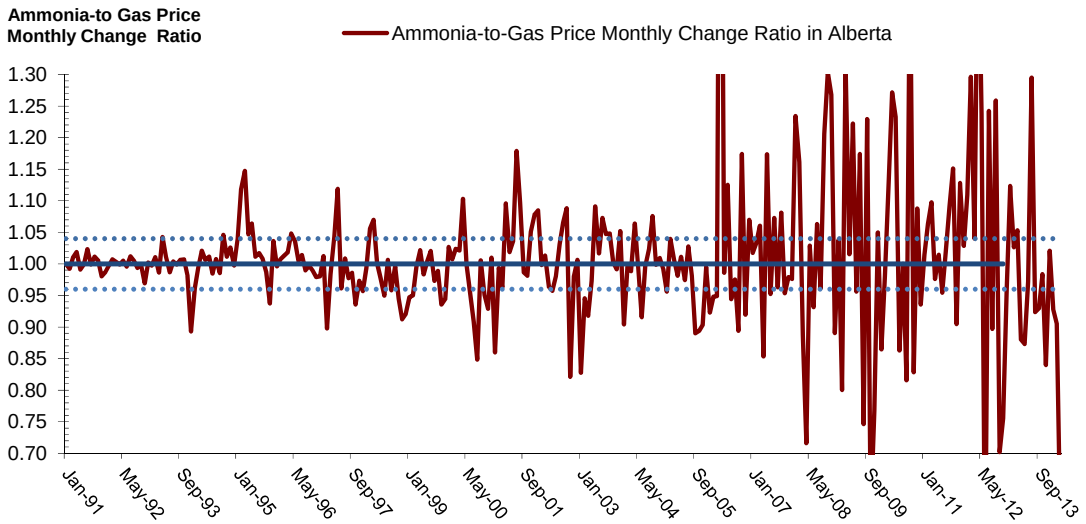
It is important to examine whether the plunging natural gas price has led to lower nitrogen prices in recent years. The ammonia-to-gas monthly price change ratio[3] measures whether or not nitrogen fertilizer prices track natural gas prices. A ratio equal to 1 means that nitrogen prices track natural gas prices. A ratio above 1 indicates that nitrogen prices change at a greater pace than natural gas prices, while a ratio below 1 indicates the reverse. Figure 7 illustrates that the ratios were mostly within +/- 0.04 of 1 over 1991 to 2006, meaning that the nitrogen fertilizer price generally tracked natural gas price closely for that period. However, the two prices series appear to have disconnected from one another after 2006 with most of the ratios swinging away from 1.

The correlation coefficient is another indicator that is used to measure the degree to which two variables are associated, with values close to ±1 indicating that the two variables are highly related. The estimated correlation coefficients between natural gas prices and fertilizer prices confirm the previous finding, with an estimated correlation coefficient of 0.81 over 1991-2006, but only 0.13 over 2007-2013. Therefore, natural gas prices appear to have had less impact on fertilizer prices in recent years than they used to.

Low natural gas prices, abundant natural gas supplies, and solid nitrogen prices have led to investment in new fertilizer capacity including the construction of new plants, restarting closed plants and possible expansion at existing facilities. This will likely put downward pressure on fertilizer prices when these projects come on stream. However, there also may be a host of obstacles, such as environmental issues and long-term financial risks that could make construction of new sites untenable.

[2] Based on information from the US Energy Information Administration (EIA) in August 2014.
[3] Computed by dividing the monthly change in ammonia price by the monthly change in natural gas price.

Figure 7_AMMONIA-TO-GAS PRICE MONTHLY CHANGE RATIO IN ALBERTA, 1991-2012



Sources: (1) Alberta Agricultural Input Monitoring System (AIMS), Alberta Agriculture and Food, Economics and Competitiveness Division, Statistics and Data Development Unit; (2) AAFC calculations.

(2) Coal

China is the largest consumer and also a significant supplier of fertilizers. Unlike the rest of world, the primary feedstock for producing ammonia there is coal instead of natural gas, which reflects China's resource endowments - only 1% of the world's proven natural gas reserves, but 14% of the world's coal reserves[4]. The Chinese government in the past had an export subsidy to encourage the fertilizer industry to increase its production capacity. However, the government canceled the fertilizer export subsidy after 2008 and applied an export tax in the peak season to ensure an adequate supply for its domestic needs. Meanwhile, the export tax was lower during the off season[5]. The role of China as a major exporter of urea and phosphate fertilizers has been increasing in recent years, making China one of the most prominent players in determining prices globally. Figure 8 shows that the structure of the Chinese export tariff resulted in huge swings in volumes sold offshore and volatility in global fertilizer prices between the low-tariff season and the high-tariff season. As China has the least expensive coal-based fertilizer producers, any shifts in the Chinese supply/demand balance could have a major impact on global markets.

(3) Ammonia, Phosphate Rock and Sulfur Prices

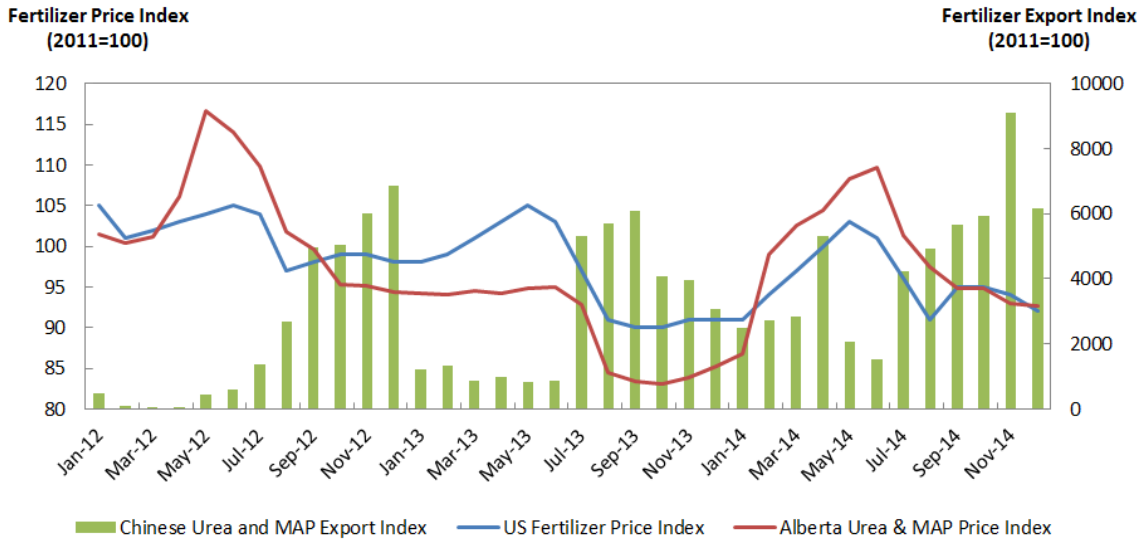
Ingredients for the production of phosphate fertilizers (MAP and DAP) are ammonia, phosphate rock and sulfur. Figure 9 shows how increased ammonia, phosphate rock and sulfur prices had profound implications on phosphate fertilizer prices over the period 2002-2014. Although prices of ammonia, phosphate rock and sulfur generally remained flat with no significant variability until 2006, markets began to tighten in 2007, with prices of these raw materials reaching a peak in 2008. This dramatic increase in raw material prices significantly drove up phosphate fertilizer prices during 2007 and 2008. However, the situation reversed itself in 2009 and 2010,

[4] Toward Sustainable Use of Nitrogen Fertilizers in China, Giannini Foundation of Agricultural Economics, University of California.

[5] For urea, July 1 to October 31 has been the off-season since 2011. For phosphate, June 1 to September 30 was the off-season before 2013, while May 16 to October 15 has been the off-season since 2013.

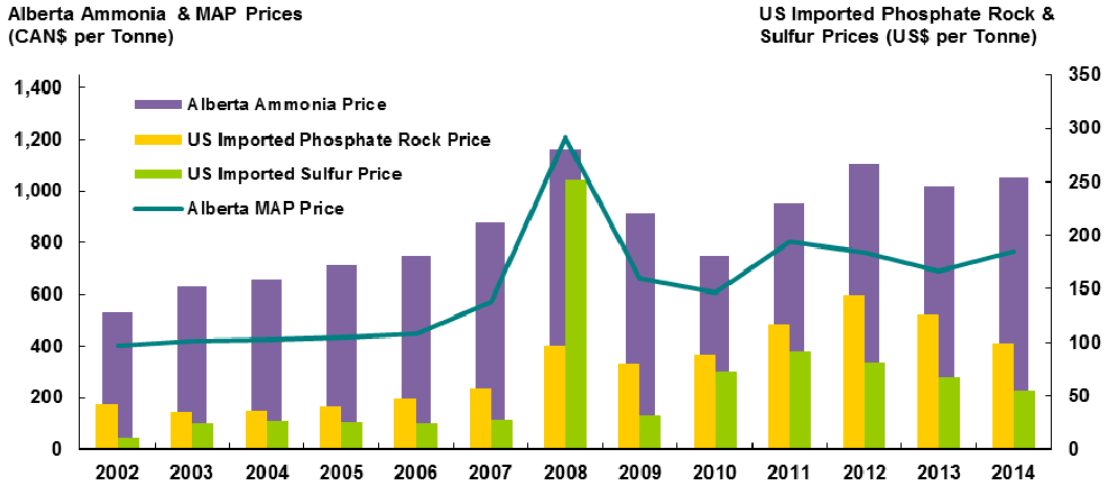
resulting in falling phosphate fertilizer prices. After 2010, rising raw material prices again pushed up phosphate fertilizer prices.

Figure 8_ CHINESE UREA & MAP EXPORT INDEX AND FERTILIZER PRICE INDEX IN US AND ALBERTA



Sources: (1) Agricultural Prices , USDA, National Agricultural Statistics Service; (2) Alberta Agricultural Input Monitoring System (AIMS), Alberta Agriculture and Food, Economics and Competitiveness Division, Statistics and Data Development Unit; (3) www.fert.cn; (4) AAFC calculations.

Figure 9_ MAP, AMMONIA, PHOSPHATE ROCK & SULFUR PRICES



Sources: (1) Alberta Agricultural Input Monitoring System (AIMS), Alberta Agriculture and Food, Economics and Competitiveness Division, Statistics and Data Development Unit; (2) The United States Geological Survey; (3) US Census Bureau data as adjusted by US Geological Survey and PentaSul North America Sulphur Service; (4) AAFC calculations.

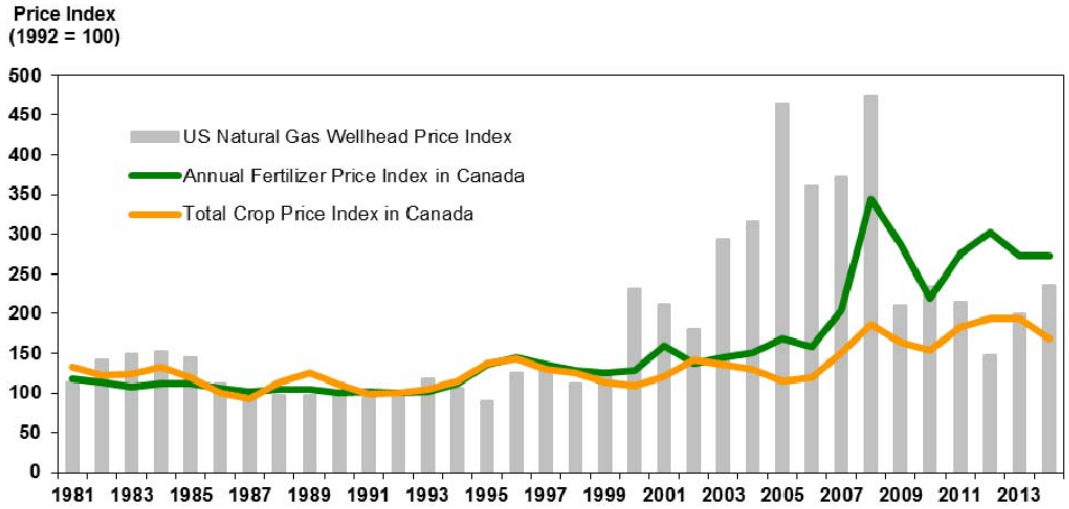
(4) Production Costs for Potash

Potash is primarily mined from underground ore deposits. Production costs for potash are generally affected by a mine's geology (such as ore thickness, consistency, continuity, depth and grade), energy and water management costs, the level of mill recovery, operational capacity and the degree of automation.

Market Supply and Demand

As in the case of fuel, fertilizers are internationally traded commodities and their prices are determined by global supply and demand factors. World demand for agricultural commodities is rising, driven by growing populations, increasing demand for meat and government biofuel initiatives. This rising demand has pushed up agricultural commodity prices, which in turn has led to higher profit margins for farmers, enabling them to increase fertilizer usage to boost yields as a means of increasing production. The resulting increase in global demand for fertilizer has contributed to a significant increase in fertilizer prices. Figure 10 shows how nitrogen fertilizer prices responded to agricultural commodity prices in Canada.

Figure 10_ PRICE MOVEMENT FOR FERTILIZER, CROP AND NATURAL GAS



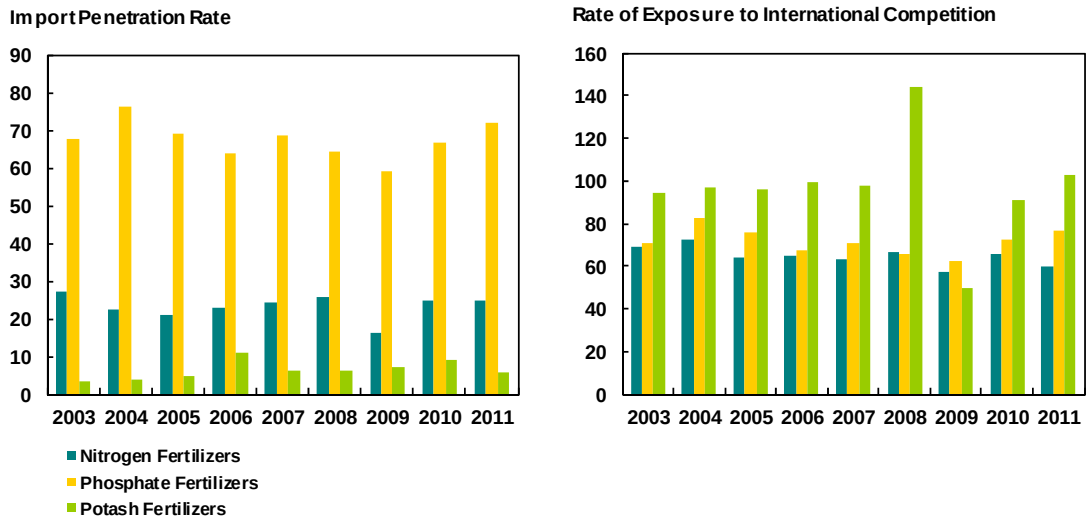
Sources: (1) Statistics Canada; (2) United States Energy Information Administration; (3) AAFC calculations.

The increase in the fertilizer price index occurred roughly at the same time the crop price index increased. For example, strong fertilizer demand, driven by high crop prices, kept fertilizer prices high despite low natural gas prices over 2007-2012. A similar situation happened in the mid-1990s. Therefore, although natural gas prices have declined, nitrogen prices can still move higher independently of the price of their natural gas feedstock if supply is unable to keep up with the demand for fertilizer. The graph confirms that fertilizer prices have been more tied to international demand and supply factors than to natural gas prices in recent years.

Competition

Canada is one of the world's major exporters of fertilizer, but also an important importer. In 2011, Canadian fertilizer exports represented more than half of its production while imports accounted for 33% of domestic fertilizer consumption. The largest portion of Canadian fertilizer exports are destined for the US while most of the imports are also from the US. With increasing globalization and market liberalization, Canadian fertilizer production targeted at domestic markets experiences competition from imports. Meanwhile, Canadian fertilizer exports also face international competition in global markets. Figure 11 presents measures of exposure to foreign competition for the Canadian fertilizer industry over 2003-2011.

Figure 11_ MEASURES OF EXPOSURE TO FOREIGN COMPETITION
FOR THE CANADIAN FERTILIZER INDUSTRY



Sources: (1) Food and Agriculture Organization of the United Nations, FAOSTAT database;
(2) AAFC calculations.

Import penetration rates[6] show the high magnitude of foreign competition faced by Canadian phosphate fertilizer producers within the domestic market. Meanwhile, Canadian nitrogen fertilizer producers confront relatively little foreign competition, and potash producers face almost no foreign competition as the domestic market is supplied almost exclusively by domestic production. When domestic and global markets are considered together, the rates of exposure to international competition[7] show that Canadian potash producers, with their high export orientation, are exposed to the highest level of foreign competition, followed by phosphate fertilizer producers.

Canadian fertilizer prices reflect a balancing of several factors. Given that there are foreign competitors within domestic and global markets, Canadian fertilizer suppliers have little choice but to match world market prices in order to establish market share. However, there are five countries (China, India, US, the Russian Federation and Canada) that control 50-80% of the world production capacity for the major nitrogen, phosphate and potash fertilizers. Among the major producing countries, with the exception of China, there are four firms in each country that generally control more than half of production capacity. The high levels of concentration in the industry may result in market power being exerted by dominant firms and tacit collusion among competitors[8].

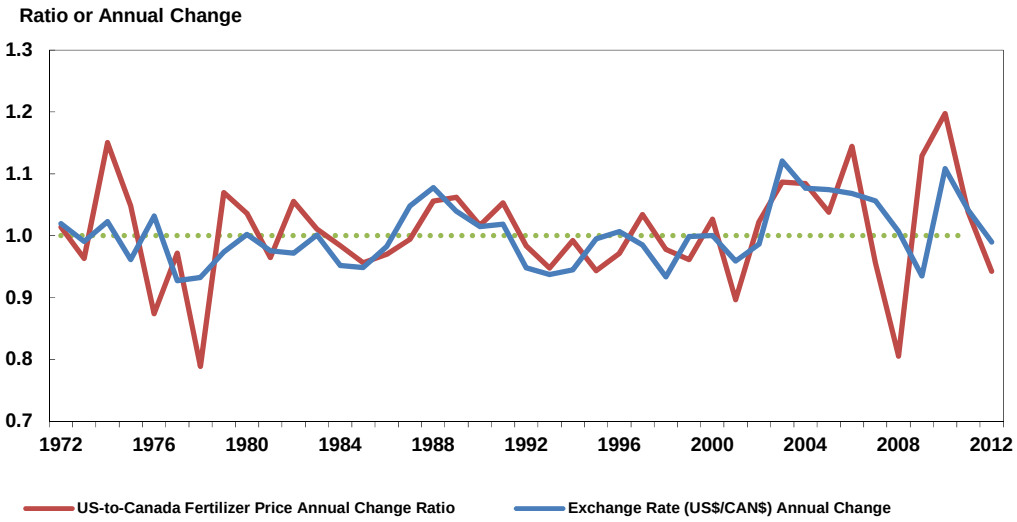
Other Factors

Exchange rates also have an effect on fertilizer pricing as Canadian fertilizer prices must either rise or decline to the level of import prices to remain competitive. The US-to-Canada fertilizer price annual change ratio[9] is created to show what impact the exchange rate has on fertilizer prices in the US and Canada. Figure 12 illustrates that Canadian fertilizer prices seem to reflect long-run movement in Canadian dollar exchange rates. It would appear that appreciation of the Canadian dollar has had a beneficial impact on fertilizer prices for Canadian farmers. For

[6] Import penetration rate = imports/consumption*100.
[7] Rate of exposure to international competition = (exports/production + (1 - exports/production) * (imports/consumption))*100.
[8] M. A. Hernandez & M. Torero, Market Concentration and Pricing Behavior in the Fertilizer Industry: A Global Approach, IFPRI.
[9] US-to-Canada fertilizer price annual change ratio = US fertilizer price annual change / Canadian fertilizer price annual change. When the exchange rate (US$/CAN$) increases, the US-to-Canada fertilizer price annual change ratio should also rise, reflecting a US fertilizer price being translated into a lower Canadian fertilizer price in the domestic market, and vice versa.

example, when the Canadian dollar appreciated over 2003-2006, Canadian farmers saw a relative advantage as fertilizer prices in Canada increased by only 9%, slower than in the US (40%) during this period. Conversely, Canadian farmers saw a relative disadvantage compared to American producers when the Canadian dollar depreciated over 1977-1986, and Canadian fertilizer prices rose at a greater pace than in the US (53% in Canada versus 25% in US).

Figure 12_ US-TO-CANADA FERTILIZER PRICE ANNUAL CHANGE RATIO & EXCHANGE RATE ANNUAL CHANGE



Sources: (1) USDA National Agricultural Statistics Service (NASS); (2) Statistics Canada; (3) AAFC calculations.

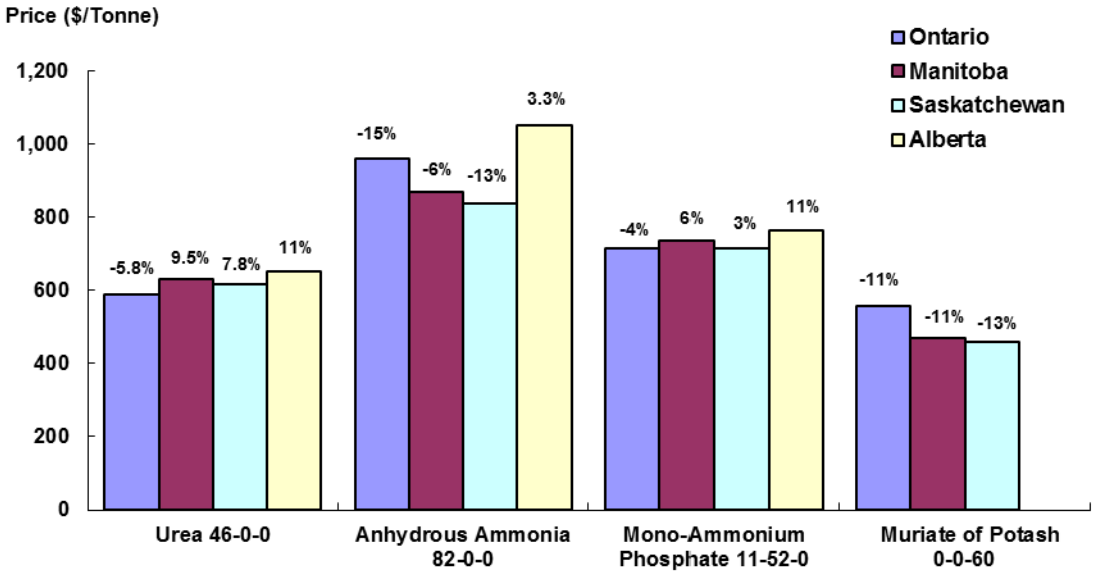
Besides exchange rates, government policies in major fertilizer exporting and importing countries can influence fertilizer prices in global markets. For example, with tight global supplies of fertilizers, higher export taxes on urea, di-ammonium phosphate and mono-ammonium phosphate implemented by China in 2008 further tightened world fertilizer supplies. This likely resulted in higher fertilizer prices than would otherwise have been the case during 2008 and 2009. A fertilizer subsidy implemented by the Indian government has also been affecting the world fertilizer prices.

FERTILIZER PRICE TRENDS

Stagnant demand and oversupply of fertilizers in global markets due in part to significant increase in Chinese exports and the breakup of Russia's Uralkali from its partnership with the Belarusian potash company Belaruskali, resulted in price declines of more than 10% in 2013.

Figure 13 shows prices of the major types of fertilizers, as well as the percentage changes of prices in 2014 compared to 2013 in Ontario, Manitoba, Saskatchewan and Alberta. AAFC estimates that the average prices paid for all fertilizers in Canada remained stable in 2014. Although relatively high seasonal demand and challenges with respect to rail logistics led to higher fertilizer prices in the Prairies during the spring of 2014, this increase was offset by lower fertilizer prices during the second half year, attributed to low fertilizer demand as crop prices declined and China continued to export large volumes of fertilizers.

Figure 13_ FERTILIZER PRICES IN 2014 AND THEIR PERCENTAGE CHANGES FROM 2013 IN ONTARIO, MANITOBA, SASKATCHEWAN AND ALBERTA



Sources: (1) AAFC Farm Input Price Survey; (2) Alberta Agricultural Input Monitoring System (AIMS), Alberta Agriculture and Food, Economics and Competitiveness Division, Statistics and Data Development Unit; (3) AAFC calculations.

FARM FERTILIZER USAGE

Using 1981-2013 annual historical data, the elasticity of fertilizer consumption with respect to the seeded area of major grain and oilseeds was estimated to be 0.88 in Canada. In other words, on average, a 1% increase in seeded area resulted in a 0.88% increase in fertilizer use. Given seeded area and other factors, Canadian fertilizer usage was estimated to be higher in 2013 compared to last year. AAFC estimated Canadian fertilizer usage would remain flat in 2014.

FARM FERTILIZER EXPENSES

Farm fertilizer expenses include all costs associated with the purchase of fertilizer and lime, including application costs if they are included in the price paid by a farmer. In Canada, when price and usage changes were considered together, fertilizer expenses were estimated to have reached $4.95 bln in 2013, a decline of 6% over 2012, but still greater than the 2008-2012 average annual expense of $4.2 bln. Fertilizer expenses in 2014 were forecast to be flat compared to 2013.