



BRIEFING

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Fertilizer Prices from the 1960s to 2014: A Brief Overview

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Introduction

U.S. and international fertilizer producers manufacture a broad range of fertilizer products, each of which contains differing quantities and combinations of three essential elemental plant nutrients -- Nitrogen (N), Phosphorus (P), and Potassium (K) -- and often micronutrients such as sulfur, boron, iron, and zinc. These products are used by agricultural producers around the world, and the United States is a major importer and exporter of fertilizer products. Therefore, U.S. fertilizer and agricultural producers compete in a global environment and are affected by international production fluctuations, geopolitical barriers, and transportation logistics.

This briefing paper describes how fertilizer prices have changed over the past five decades and discusses some of the major reasons underlying these changes. Changes in fertilizer prices reflect fertilizer producers' and users' responses to changing

underlying supply and demand conditions. These shifts include changes in production technologies, resource prices, production costs, crop prices, crop acreages, and other factors that affect the demand for and supply of fertilizers.

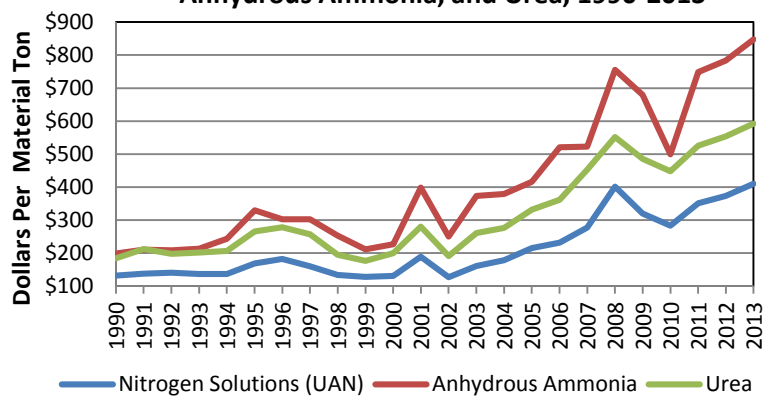
Overview of Fertilizer Price Behavior

Nitrogen Fertilizer Prices

In nominal terms (not adjusting prices for inflation), prices for all nitrogen-based fertilizer products have increased over the past fifty years (Figure 1). Price trends have been similar across many nitrogen fertilizer products. The most rapid increases in nitrogen fertilizer prices have occurred since 2000. For example, the price of nitrogen solutions (e.g., UAN), the most commonly used fertilizer in the United States, increased by 455 percent between 1960 and 2014, with the bulk of the increase occurring after 2000.

Objective
Analysis For
Informed
Decision Making

Figure 1. U.S. Prices of Nitrogen Solutions, Anhydrous Ammonia, and Urea, 1990-2013

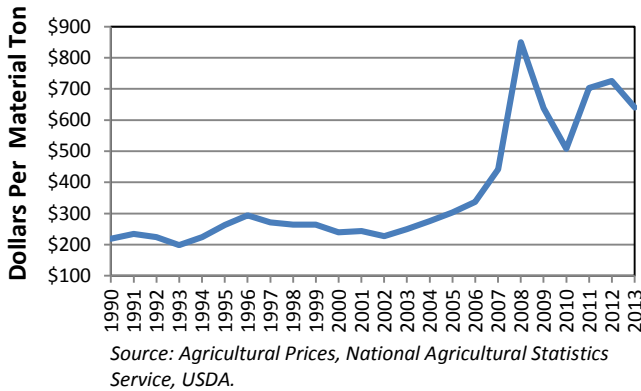


Source: *Agricultural Prices*, National Agricultural Statistics Service, USDA.

Phosphate Fertilizer Prices

Between 1990 and 2005, U.S. phosphate fertilizer prices (e.g., Diammonium Phosphate) varied between \$200 and \$300 per material ton (Figure 2). However, prices increased substantially after 2005 and reached a record high of over \$850 per ton in 2008. Since then, phosphate fertilizer prices have moderated. In 2013, the average price of Diammonium Phosphate was \$640 per ton.

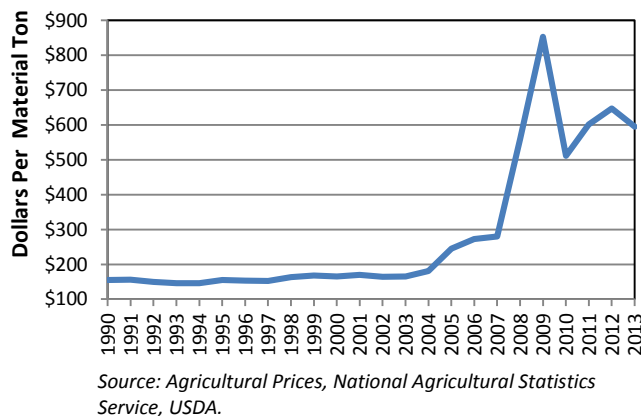
Figure 2. U.S. Price of Diammonium Phosphate, 1990-2013



Potash Fertilizer Prices

Between 1990 and 2004, the price of potash-based fertilizer products was relatively stable, averaging just over \$150 per ton (Figure 3). Like phosphate fertilizer prices, potash prices increased substantially after 2005, peaking at \$853 per ton in 2009. In 2010, potash prices declined to \$511 per ton before increasing again in 2011 and 2012. Potash prices averaged just under \$600 per ton in 2013.

Figure 3. U.S. Price of Potassium Chloride, 1990-2013



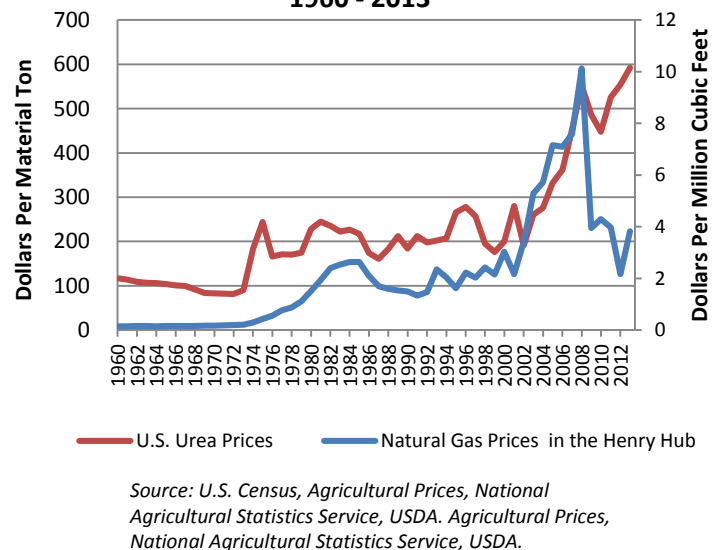
Sources of Fertilizer Price Increases

Both the supply of and the demand for fertilizer products influence market prices. Reasons for supply-side effects include changes in input prices, transportation costs, and adjustments to production capacity by U.S. fertilizer manufacturers. On the demand side, increases in crop prices and acreages planted to fertilizer-intensive crops (e.g., corn) have increased prices for all three major nutrients.

Cost Factors: Nitrogen

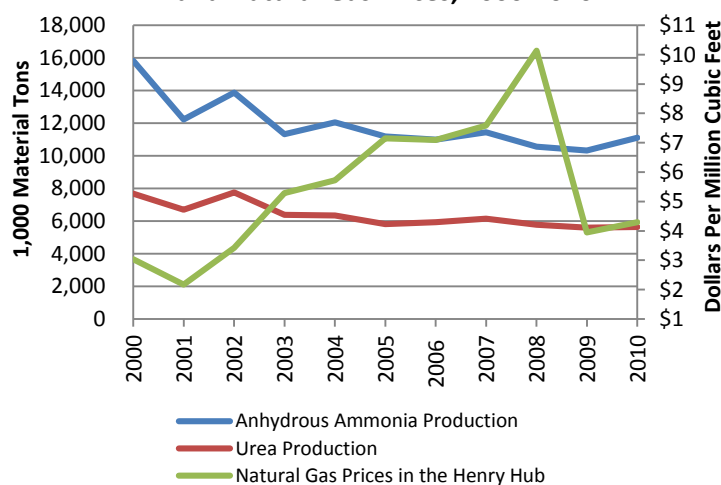
Large amounts of natural gas are needed to produce ammonia and, subsequently, nitrogen fertilizers. As a result, natural gas accounts for most of the variable costs of nitrogen fertilizer production. Therefore, changes in the prices of natural gas have been a major cause of changes in nitrogen fertilizer prices for most of the previous fifty years. Until 2008, U.S. prices of natural gas and urea (a commonly used nitrogen-based fertilizer) were highly correlated, with changes in the price of natural gas being closely followed by similar changes in the price of nitrogen fertilizers (Figure 4). This relationship no longer held after 2008 as U.S. natural gas prices declined because of new extraction technologies. While natural gas prices declined after 2008, nitrogen fertilizer (ammonia and urea) prices continued their increase that began in 2003.

Figure 4: U.S. Urea and Natural Gas Prices, 1960 - 2013



The U.S. price of natural gas and the production of nitrogen fertilizer (ammonia and urea) have moved in opposite directions since 2008 (Figure 5). Increases in natural gas prices between 2000 and 2002 coupled with low crop prices caused U.S. nitrogen fertilizer production to decline by 25 percent and eight U.S. fertilizer plants closed (GAO). After a second natural gas price spike in 2003, the U.S. fertilizer industry further reduced production capacities. The discovery and development of new natural gas resources between 2008 and 2012 was relatively unexpected. In 2008, after extensive reductions in production capacity in the late 1990s and early 2000's, U.S. fertilizer manufacturers were already producing at or near full capacity and could not readily increase production. Although recent low natural gas prices will eventually increase U.S. nitrogen fertilizer production, capital investments will be needed and the construction of new facilities will take several years.

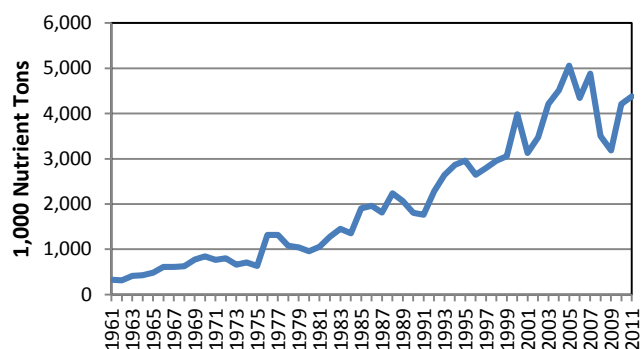
Figure 5: U. S. Ammonia and Urea Production and Natural Gas Prices, 2000-2010



Source: US Census, Agricultural Prices, National Agricultural Statistics Service, USDA.

In the early 1980's, the United States was a net exporter of nitrogen fertilizer. But as domestic fertilizer production declined during the early 2000s, U.S. fertilizer imports increased substantially. Between 1999 and 2011, nitrogen fertilizer imports increased by 43 percent and the United States became the second largest importer of nitrogen fertilizers (Figure 6). Currently, the United States obtains more than 50 percent of its total nitrogen fertilizer needs from other countries.

Figure 6. U.S. Nitrogen Imports, 1961-2011



Source: IFIA

The increased domestic reliance on imports also contributed to higher nitrogen fertilizer prices because of logistical issues and higher transportation costs. As the United States moved from being a net exporter to a net importer of nitrogen fertilizer, a substantial increase in basis costs occurred. As a net exporter, the United States shipped nitrogen fertilizers to other countries. Because of transportation costs, U.S. nitrogen fertilizer prices were lower than those in export markets. Once the United States became a net nitrogen importer, nitrogen fertilizer prices in the U.S. market had to increase to enable importers to cover the costs of transporting fertilizer to the United States from other countries. As long as the United States continues to be a net importer of nitrogen fertilizer, U.S. fertilizer prices will be determined by fertilizer prices in exporting countries plus the costs of shipping fertilizer to the United States. This shift from being a net exporter to a net importer, therefore, helps to explain why U.S. fertilizer prices have not been closely linked to domestic natural gas prices in recent years.

Domestic nitrogen fertilizer prices have also become somewhat more variable as the United States has become a net importer. Some of this variability is the result of greater complexity in transporting fertilizer to domestic distribution centers and uncertain geopolitical conditions in exporting nations. For example, weather-related disruptions at U.S. port facilities and along the Mississippi River (a major throughway by which fertilizer products are delivered from import facilities to domestic distribution centers) have occasionally hampered fertilizer deliveries and required the use of additional surface transportation assets (Lamp 2013).¹ These logistical challenges have accounted for some recent shocks to fertilizer supplies to domestic markets and, therefore, to fertilizer price variability.²

¹ Between 2005 and 2008, rail rates (per ton mile) to transport ammonia increased 63 percent (8.7 cents/ton mile to 14.2 cents/ton mile). In addition, in 2008, many major rail lines implemented a 44 percent fuel surcharge.

² Currently, the USDA estimates that transportation costs account for 22 percent of the cost of ammonia shipped from Trinidad and Tobago to the U.S. Gulf and more than 50 percent of the cost of ammonia shipped from Russia.

Cost Factors: Phosphate

Phosphate rock, sulfur, and ammonia are the three primary raw materials used to produce DAP (the most commonly used phosphorus-based fertilizer). Since 2007, these input prices have increased. In particular, prices for Moroccan phosphate rock -- the primary input for phosphorus fertilizer production -- tripled in 2007. In addition, international sulfur prices increased more than 170 percent and ammonia prices increased by 44 percent between 2007 and 2008. Prices of these raw materials continued to increase in early 2008 before declining somewhat. Higher raw materials prices increased phosphorus-based fertilizer production costs and contributed to higher phosphate fertilizer prices since 2008.

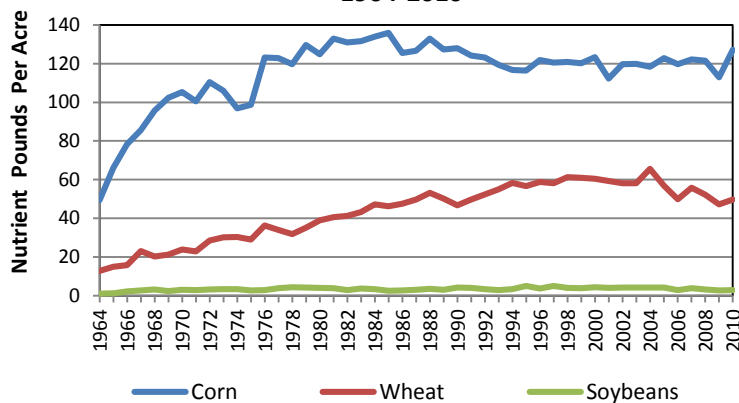
Cost Factors: Potash

The potash fertilizer market is dominated by two large producers -- Canpotex (a Canadian export association) and a Russian export association. Canada produces 28 percent of the world's potash fertilizers and Canpotex controls all Canadian potash exports. The Russian export association controls all of Russia's potash exports and produces approximately 18 percent of the world's potash fertilizers. Some reports suggest that these two organizations have periodically operated as a cartel and colluded to reduce potash output and increase potash prices. For example, in early 2008 both of these organizations reduced production by more than 400 percent relative to the preceding 18 months. By 2009, global potash production and trade volumes were at their lowest levels in 30 years. As a result, U.S. potassium chloride prices reached a record high of \$850 per material ton.

Demand Factors

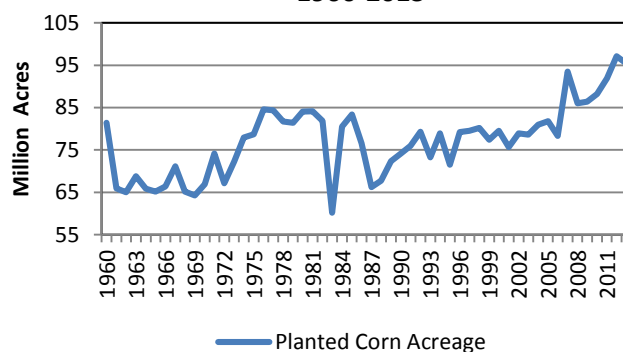
Fertilizer prices are also influenced by demand factors such as demographic changes and domestic policies. For example, world population increases and economic growth in China, India, and other developing economies has increased global demand for major agricultural commodities. In the United States, the implementation of the Renewable Fuels Standards (RFS) has increased non-food (industrial) demand for corn -- a crop that heavily relies on nitrogen fertilizer use (Figure 7). Over 40 percent of the U.S. corn crop is now being used for ethanol production. This demand shock substantially increased corn prices and corn acreage (Figure 8). Consequently, corn production now accounts for 50 percent of all U.S. nitrogen fertilizer use (Figure 9).

Figure 7: Nitrogen Fertilizer Use Per Acre by Major Crop, 1964-2010



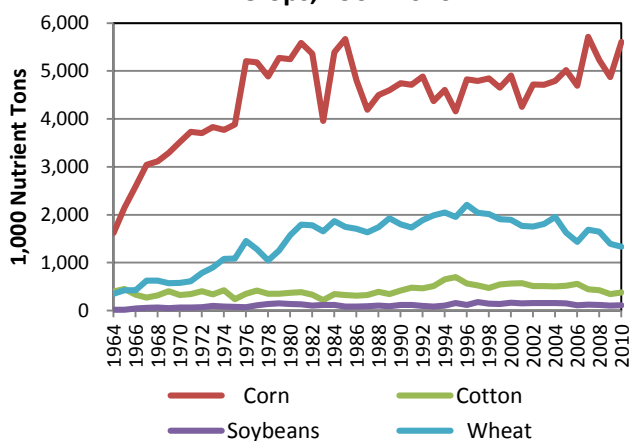
Source: USDA ERS; National Agricultural Statistics Service; Crop Production; Agricultural Prices; World Agricultural Outlook Board: World Agricultural Supply and Demand Estimates.

Figure 8: U.S. Planted Corn Acreage, 1960-2013



Source: USDA ERS; National Agricultural Statistics Service; Crop Production; Agricultural Prices; World Agricultural Outlook Board: World Agricultural Supply and Demand Estimates.

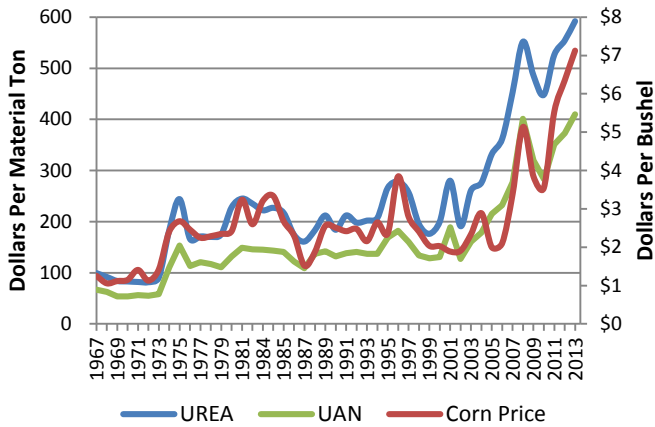
Figure 9. Total Nitrogen Use by Selected Crops, 1964-2010



Source: USDA

Higher corn prices have also contributed to higher prices of other major small grains such as wheat. As more cropland has been allocated to meet the growing demands for these crops, agricultural producers have intensified their use of fertilizers to boost yields. Thus, increased demand for fertilizer products has increased fertilizer prices (Figure 10).

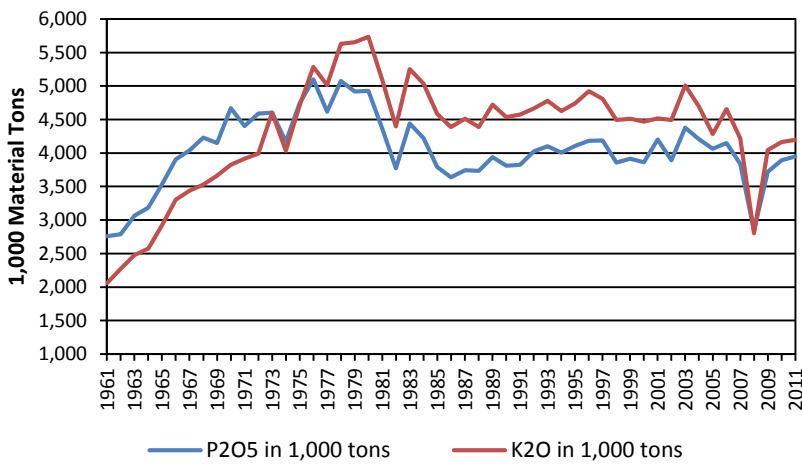
Figure 10. U.S. Urea, UAN, and Corn Prices



Source: USDA

The use of both potash- and phosphorus-based fertilizers has also increased in recent years and added upward pressure on the price of those fertilizers in U.S. markets (Figure 11). Since most potash consumed in the United States is imported, similar transportation and logistical issues that raise nitrogen fertilizer prices apply to potash and phosphorous products.

Figure 11: U.S. Use of P₂O₅ and K₂O, 1961 - 2011



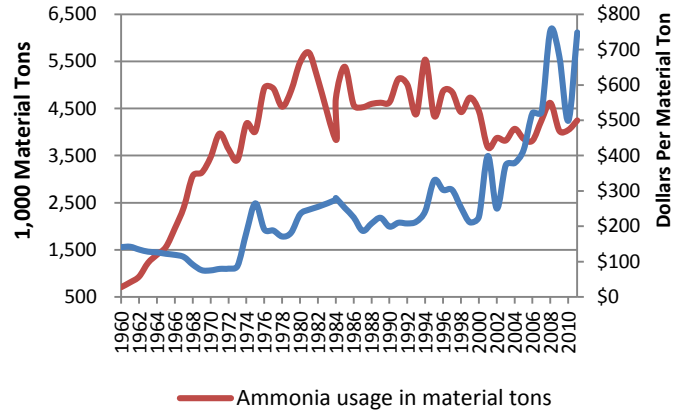
Source: IFIA

Fertilizer Prices and Fertilizer Use

Fertilizer prices have increased substantially since 2000. If the demand for fertilizers since 2000 had not increased, higher fertilizer prices would have caused a

reduction in fertilizer use. Fertilizer use, however, has steadily increased with only temporary declines in certain years because of unusual shocks to fertilizer production costs. This pattern is clearly illustrated by ammonia -- the major input used to produce nitrogen fertilizers. Between 1999 and 2001, the price per ton of ammonia increased 89 percent while ammonia use only moderated slightly (figure 12). Subsequently, the use of ammonia has exhibited a modest upward trend while ammonia prices have continued to increase.

Figure 12: Ammonia Price and Use, 1960-2011



Source: Agricultural Prices, National Agricultural Statistics Service, USDA.

Summary

Many factors influence U.S. fertilizer prices. However, changes in the price of natural gas and the price of corn have been important drivers since 2000. Recent increases in corn prices have increased the demand for fertilizers and, as a result, their prices. Increases in natural gas prices during the early 2000s contributed to higher nitrogen fertilizer production costs and prices. In addition, U.S. nitrogen fertilizer prices increased because the United States transitioned from being a net exporter to a net importer of nitrogen fertilizers.

Recent discoveries of natural gas reserves in the United States could potentially lead to lower domestic nitrogen fertilizer prices if fertilizer producers expand existing capacity and build new facilities. The United States will continue to be a net exporter of phosphate fertilizers and a net importer of potash fertilizers because the production of both depends upon the availability of specific mineral ores.

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