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# Recent Volatility in U.S. Fertilizer Prices Causes and Consequences

Wen-yuan Huang  
whuang@ers.usda.gov

William McBride  
wmcbride@ers.usda.gov

Utpal Vasavada  
vasavada@ers.usda.gov

- Strong domestic and global demand, coupled with tight supplies and low inventories, contributed to record fertilizer prices in early 2008.
- Softening global fertilizer demand, disruptions in U.S. farmer application of fertilizers, an increase in fertilizer imports, and tighter credit for purchasing inputs contributed to the decline in fertilizer prices in late 2008.
- Fertilizer price volatility affects the profitability of corn and small grains, where fertilizer accounts for a relatively large share of production costs, compared with that for soybeans and cotton.

During 2007 and 2008, farmers saw a rapid runup in fertilizer prices to record highs, followed by lower prices in late 2008. The significant ups and downs of the market in 2008 can serve as a textbook example of supply-and-demand analysis in price determination.

Though U.S. nominal prices of nitrogen, phosphate, and potash fertilizers, among others, began trending upward as early as 2002, they increased sharply and reached historic highs in mid-2008. During the 12 months ending in April 2008, nitrogen prices increased 32 percent, phosphate prices 93 percent, and potash prices 100 percent. This price surge in 2008 was due to strong domestic and global demand for fertilizers, low fertilizer inventories, and the inability of the U.S. fertilizer industry to adjust production levels (see charts on page 43).

But by late 2008, monthly average prices had fallen. Global fertilizer demand softened in response to the record-high fertilizer prices and declining crop prices. Some U.S. farmers postponed fer-

tilizer application, tighter credit availability slowed fertilizer purchases, and fertilizer supplies from overseas increased, all contributing to the price decline.

## Global Demand for Agricultural Products Pushed Fertilizer Prices Higher

Since 2000, rising populations (roughly 75 million additional people worldwide per year) and strong global growth in average incomes, particularly in developing countries, have increased food and feed demand. Consumers in developing countries not only increased consumption of staple foods but also diversified diets to include more meats, dairy products, and vegetable oils. This, in turn, amplified rising demand for the feed grains and oilseeds used to produce these foods.

Between January 2007 and mid-2008, corn prices increased 100 percent, wheat prices rose 83 percent, and soybean prices were up 112 percent. At the same time, growth in worldwide biofuel



Lynn Betts, USDA/NRCS

production diversified the use options of grains, sugarcane, soybeans, and rapeseed and contributed to higher prices for biofuel feedstocks, particularly corn.

High agricultural commodity prices encouraged producers to expand total crop acres, adjust the mix of crops planted, and increase fertilizer use to boost yields, all of which led to increased global fertilizer demand.

The fertilizer price surge in 2008 was partially triggered by low fertilizer inventories at the beginning of the year, resulting from an additional 15 million corn acres planted and over 3 million more wheat acres planted in 2007. As fertilizer demand increased in 2007, U.S. nitrogen inventory fell 15 percent to 0.88 million tons by the end of 2007. U.S. phosphate inventories dipped 27 percent to 0.59 million tons in late 2007. Potash inventories in North America (including Canada) dropped by 1 million tons (49 percent) to 0.9 million tons at the end of 2007. Domestic and foreign fertilizer producers were not able to quickly adjust production as inventories dwindled.

### **Fertilizer Prices Fueled by Costs of Raw Inputs, Energy, and Transport**

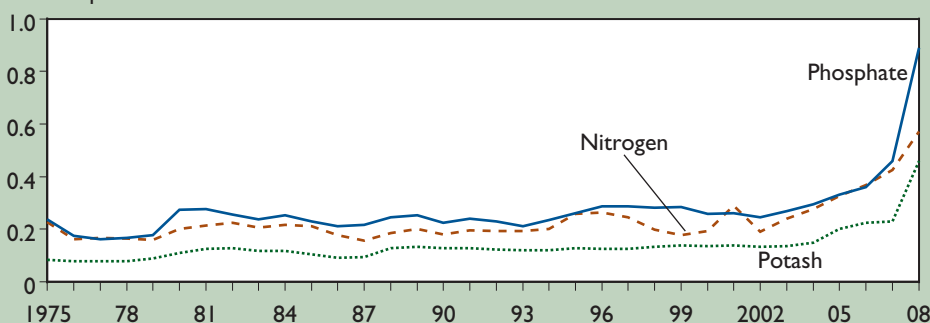
The influence of raw input material prices also contributed to the surge in fertilizer prices. Prices of phosphate rock, sulfur, and ammonia—raw input materials used to produce diammonium phosphate and other fertilizers—increased from January 2007 to early 2008. Moroccan phosphate rock contract prices tripled, international contract prices of sulfur increased more than 170 percent, and Tampa prices of ammonia doubled.

Rising energy prices also increased the cost of producing and delivering fertilizers. Prices of natural gas, which is used to produce ammonia, the main input in all nitrogen fertilizers, rose more than 550 percent over the past 10 years. Between June 2007 and June 2008, natural gas prices increased more than 65 percent. As a result, the cost to produce nitrogen fertilizer increased.



### Prices of fertilizer nutrients increased sharply to historical highs in 2008

Dollars/pound of nutrient



Price is the average for April of each year. Nitrogen prices are average prices of nitrogen nutrient in anhydrous ammonia, nitrogen solution, and urea. Phosphate prices are the  $P_2O_5$  prices of superphosphate. Potash prices are the  $K_2O$  prices of muriate of potash.

Source: USDA, Economic Research Service.

Rapidly rising fuel costs also translated into higher transportation costs. In 2007, 58 million tons of fertilizers were shipped to U.S. agricultural producers by ocean freight, railroads, trucks, barges, and pipelines. Transportation is a significant component of total fertilizer costs, accounting for about 22 percent of the cost of ammonia shipped from Trinidad and Tobago to the U.S. Gulf Coast, and more than 50 percent of the cost of ammonia shipped from Russia to the U.S. Gulf Coast. In addition, the cost of transporting fertilizers from the U.S. Gulf Coast to farmers throughout the Midwest rose dramatically. Specifically, over the 3 years ending in January 2008, U.S. rail rates to transport ammonia increased 63 percent, and an additional 44-percent fuel surcharge was added to U.S. rail transport costs in July 2008 because of high fuel prices.

### Global Trade and Financial Events Also Affected Fertilizer Prices

In 2007, imports accounted for 49 percent of the nitrogen fertilizer supply in the U.S. and 85 percent of the U.S. potash supply. The value of the U.S. dollar relative to the currencies of major nations supplying fertilizer to U.S. farmers, except Mexico and Trinidad and Tobago, has declined since 2003. For example, relative to the

Brazilian real, the U.S. dollar dropped 48 percent from January 2003 to January 2007. As a consequence, fertilizer imports became more expensive, and U.S. exports of phosphate products became more attractive to foreign buyers.

Facing short supplies, China increased its export taxes on fertilizers from 35 percent in 2007 to 135 percent in 2008 to ensure that domestic production remained in the country. China is the world's largest exporter of urea—a major source of nitrogen fertilizer—and the second largest exporter of phosphate. China provided roughly 17 percent of the urea and 18 percent of the phosphate traded

globally in 2007. The announcement of higher export taxes tightened the global supply of phosphate and urea, contributing to upward pressure on prices in 2008.

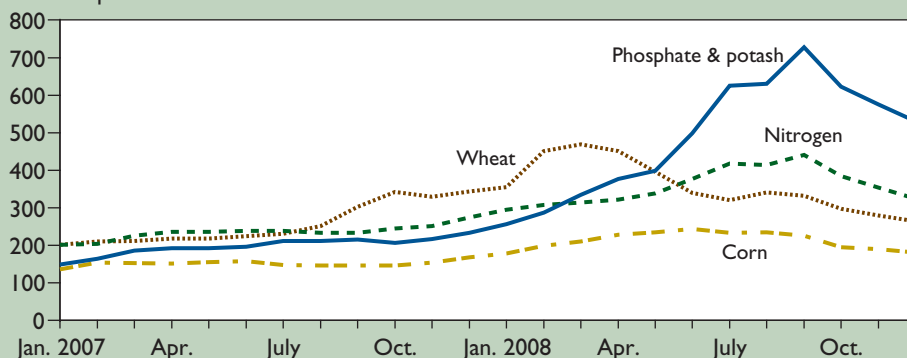
### Fertilizer Prices Have Softened Recently, But the Future Is Uncertain

Fertilizer prices continued increasing in early 2008 and were 26 percent higher in August than in April. But prices began to decline in October, particularly for nitrogen fertilizer. The decline in monthly average prices might be attributed to several factors: (1) softening global fertilizer demand in reaction to the fertilizer price surge and declining crop prices; (2) a shortened window for U.S. application of fertilizer in fall 2008, caused by wet weather that delayed spring plantings and fall crop harvests; (3) an increase in fertilizer supplies from overseas (from July to October); (4) tighter credit availability, making debt-financed fertilizer purchases more difficult; and (5) congested distribution supply chains due to farmers postponing purchases.

Price volatility in the U.S. differs among fertilizer nutrients because of fundamental differences in nutrient markets. Nitrogen markets are more volatile than phosphate and potash markets. Volatility in the price of natural gas—a basic input in the manufacture of nitrogen—contributes to swings in nitrogen prices. Price swings are less likely

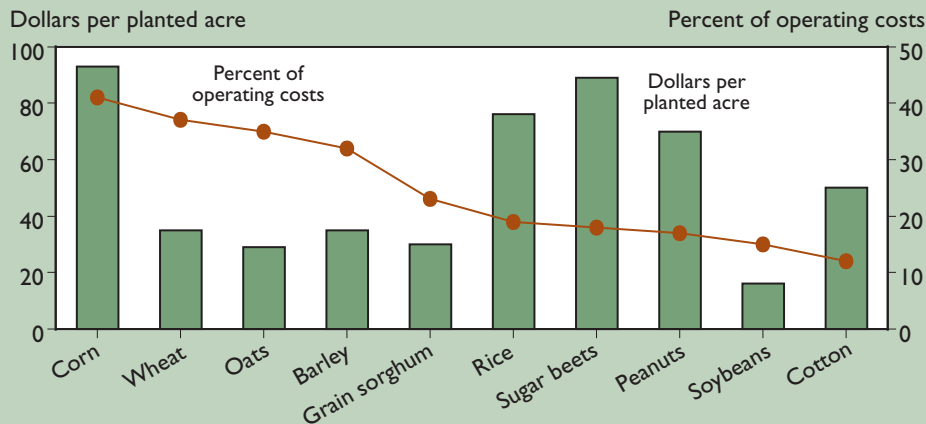
### Mid-2008 fertilizer prices continued high, even as crop prices began to decline

Index of prices



Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service.

### Corn had highest fertilizer costs per acre and as a share of total operating costs in 2007



Source: USDA, Economic Research Service.

for phosphate and potash, whose underlying input markets are more stable.

The recent decline in fertilizer prices, however, may not be sustainable. While a deepening global economic slowdown would put downward pressure on fertilizer prices, fertilizer markets could also be affected by unforeseen weather events or by changes in global fertilizer trade. It is possible that the prices of U.S. fertilizers could again move higher during spring 2009.

Many of the causes of the recent spike in fertilizer prices could still put upward pressure on fertilizer prices in early to mid-2009. Meanwhile, commodity prices for corn, wheat, and soybeans, for example, while lower than their peaks in 2008, remain high relative to historic averages (see "Fluctuating Food Commodity Prices—A Complex Issue With No Easy Answers," *Amber Waves*, November 2008). Thus, while planted acreage in 2009 may fall from that in 2008, overall plantings are likely to remain high. In addition, low fertilizer prices (as of January 2009), particularly for nitrogen, may favor corn planting in spring 2009, continuing to hold up fertilizer demand.

### Fertilizer Price Volatility Impacts Relative Crop Profitability

Crops requiring heavy application of fertilizers are not necessarily those for

which fertilizer makes up the greatest share of total costs. Fertilizer use is relatively high for sugar beet, rice, and peanut producers, for example, but fertilizer expenses amount to less than 20 percent of their operating costs.

Among major U.S. field crops, corn uses the most fertilizer, has the highest fertilizer costs per acre (\$93 at average 2007 prices), and has the highest fertilizer costs as a share of operating costs for planting, growing, and harvesting (41 percent). But producers of wheat, oats, and barley are also sensitive to fertilizer price swings, despite having relatively low fertilizer costs per acre (less than \$40), because fertilizer costs account for more than 30 percent of their operating costs.

Rising fertilizer prices make crops such as soybeans attractive alternatives to crops for which fertilizer costs are higher. Soybeans compete for acreage with corn and other feed grains and wheat in the Corn Belt and Plains States. Higher fertilizer prices may encourage the cultivation of more soybeans and result in less acreage planted to corn, wheat, and other feed grains in these areas. In the South, cotton has been losing acreage to corn in recent years due to high corn prices. Corn production in the South requires more fertilizer than in other areas to compensate for lower quality soils. Higher fertilizer prices may entice farmers

in the South to plant more soybeans or to switch back to more traditional southern crops, such as cotton, rice, and peanuts, for which fertilizer costs per acre are lower.

### High Commodity Prices May Not Compensate for High Fertilizer Prices

While higher farm commodity prices in 2008 offset much of the negative effect of higher fertilizer prices on farm incomes, fertilizer prices in the U.S. do not necessarily move in tandem with food and feed grain prices. Fertilizer prices approaching those experienced in late 2007, caused mainly by global demand and tight supply factors, might be sustainable even if U.S. and world commodity prices continue to soften.

With lower crop prices, high fertilizer prices would place downward pressure on farmers' net returns. Farms with higher than average fertilizer costs, a greater need to use fertilizers on the crops they grow, and/or a limited ability to either move away from fertilizer-intensive crops or substitute other inputs will be especially vulnerable if fertilizer prices increase once again. *W*

#### This article is drawn from ...

*Factors Contributing to the Recent Increase in U.S. Fertilizer Prices, 2002-08*, by Wen-yuan Huang, AR-33, USDA, Economic Research Service, February 2009, available at: [www.ers.usda.gov/publications/ar33/](http://www.ers.usda.gov/publications/ar33/)

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