



# Managing Fertilizer Price Risk

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During 2007 and 2008, fertilizer prices in the U.S. became extremely volatile. Low fertilizer inventories combined with increased domestic and global demand led to an unprecedented spike in fertilizer prices. Prices of some fertilizer products more than doubled. Prices began to moderate by the end of 2008 as the fertilizer supply chain responded and demand in both the U.S. and global markets declined in response to the high prices. The rapid price changes of 2007-2008 were caused by structural changes within the U.S. fertilizer industry including a growing reliance on imported production. Because the structural changes in the fertilizer market have created the potential for increased volatility, it is important for producers to understand the relative importance of fertilizer price risk, understand the factors that cause volatility in fertilizer prices and identify strategies to reduce and manage fertilizer price risk. This Fact Sheet focuses on the third issue, discussing strategies for managing fertilizer price risk.

## Overview of Risk Management Strategies

Agricultural producers are subject to a wide range of risks including production risk, price risks of both outputs and inputs and risks from government policy and regulations. Risks are inherent to agricultural production and to any business operations. Managing risks involves identifying and prioritizing risks, determining your "risk appetite" and ability to absorb risk and employing strategies to reduce risk. The major strategies for managing risks are avoiding risks, reducing or sharing the risks or accepting the risk as an acceptable part of doing business. Strategies for reducing or sharing risk involve diversification, hedging, or insurance. Most of these strategies can be applied to reducing fertilizer price risk.

Diversification is the simple concept of not having all of your eggs in one basket. Having a mix of crop or livestock activities or spreading purchases or sales throughout the year are obvious examples of diversification. Hedging strategies reduce the exposure to downside risk, while sacrificing opportunities for gain. The mechanics may involve purchasing or selling contracts on the futures market or making forward purchases or sales to lock in on a price. Hedging is essentially paying someone else to take the risks inherent to price volatility. In addition, while hedging can result in lower prices if the market prices are higher than expected, it can also result in costs higher than the market, if the market falls.

Purchasing insurance is another strategy to reduce downside risk. Purchasing insurance essentially allows you to accept a sure loss that is small (you pay a premium) to

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avoid the possibility of a large loss in the future. Farmers can purchase crop insurance and there are many forms of business insurance available. In addition, some financial derivatives such as options, which gives the holder the right (but not the obligation) to purchase or sell something at a specified price in the future, can serve as a form of insurance.

## Fertilizer Price Risk

Fertilizer accounts for a significant portion of total operating costs averaging around 30 percent for winter wheat production, 20 percent grain sorghum and up to 40 percent for intensive corn production. If fertilizer price volatility could be completely eliminated the result would be roughly two-thirds as effective as eliminating yield variability in terms of overall risk reduction. In the past, U.S. fertilizer prices have tended to move somewhat in tandem with crop prices. Because U.S. fertilizer markets are increasingly impacted by global supply and demand factors, high fertilizer prices can occur even when U.S. crop prices are relatively soft. This scenario of low crop prices coupled with high fertilizer prices would stress farm profits. Farms with higher than average fertilizer usage or a limited ability to rotate to less fertilizer-intensive crops would be particularly vulnerable.

## Forward Pricing Strategies

Fertilizer price risk management strategies using futures or over the counter (OTC) derivatives are limited. Fertilizer contracts on the Chicago Mercantile Exchange were discontinued due to a lack of liquidity while transactions on the Direct Hedge Exchange, based in Switzerland, has a 5,000 ton contract size for fertilizer that is not workable for many retailers, much less producers. OTC strategies require relationships with a brokerage firm or OTC derivative provider and the expertise to manage the required transactions. Basis risk, the difference between the closing future market contract price and the farm level price for fertilizer, can also be substantial. In the absence of futures market tools, opportunities for locking in fertilizer prices involve forward contracting or pre-purchasing fertilizer with a local fertilizer dealer.

Historically, fertilizer dealers have attempted to forecast producer demand and have purchased and inventoried fertilizer with no off-setting purchase commitment from the producer. Because much of the U.S. fertilizer supply is imported, retailers must buy six to nine months in advance with

no opportunity to hedge. This exposes the dealer to the risk that they will inventory product only to have prices fall during the application season and be forced to drop prices to meet those of competing suppliers. In recent years, price swings within the year have been much higher than dealer handling margins. Many dealers examined their risk exposure and increased efforts to offer producers forward contracting or pre-purchasing opportunities. Opportunities for forward pricing obviously vary across dealers and product form.

Because forward contract and pre-purchase opportunities vary among fertilizer dealers it is difficult to directly research their effectiveness as a risk reduction tool. However, forward contract opportunities usually reflect the dealer's opportunity to purchase and warehouse fertilizer prior to the application season. Under this assumption, the effectiveness of forward contracting can be inferred from cash purchase and storage strategies. Research at Oklahoma State University examined optimal fertilizer purchasing and warehousing strategies for fertilizer dealers. This research which was based on 17 years of fertilizer weekly price data (adjusted for storage and interest) at central Oklahoma fertilizer terminals, determined the impact on price and year-to-year price variability of purchasing and warehousing fertilizer at specified dates during the year.

The research examined the optimal purchase dates (dates minimizing year-to-year price variation) relative to purchases during the peak application seasons for three types of fertilizer urea, UAN (urea ammonium nitrate) and DAP (Diammonium phosphate). The application periods were split between early February and early August. In simple terms, the research examined the effectiveness of taking advantage of seasonal trends to reduce price risk.

Table 1 provides a summary of the results. Spring was the least favorable period to purchase fertilizer with the most favorable times (depending on the specific fertilizer product) being either mid-summer or late fall. Purchasing outside of the peak application periods had a moderate impact on average price (3 percent to 4 percent) and a substantial impact (17 percent to 54 percent) on the year-to-year variation in prices. The intuition behind these results is straightforward. Fertilizer prices, like crop prices, respond to supply and demand conditions. However, because of the lengthy supply chain, fertilizer availability and price during peak application periods is a function of the dealer's accuracy in forecasting and pre-positioning product. More extreme price movements occur during these time periods.

**Table 1. Optimal Cash Purchase Strategies for Fertilizer in Central Oklahoma.\***

	UREA	UAN	DAP
Optimal purchase date	1 <sup>st</sup> week in July	2 <sup>nd</sup> week in Nov.	1 <sup>st</sup> week in Nov.
Worst purchase date	1 <sup>st</sup> Week in April	2 <sup>nd</sup> week in April	4 <sup>th</sup> week in March
Average price reduction	5%	7%	4%
Risk reduction	17%	23%	57%
Price difference best to worst	14%	16%	9%
Risk difference best to worst	55%	65%	54%

\* Relative to purchasing during application seasons of early February and Early August.

This cash market data suggests that strategies of routinely locking in the price on a portion of anticipated fertilizer needs prior to the application season can reduce price risk. A producer's risk reduction would be lower than the levels suggested in Table 1 since most producers choose to lock in only a portion of their anticipated needs. Not all dealers offer forward contracting or pre-purchase options but these tools are becoming increasingly available. Producers considering pre-purchase programs should consider both the tax and cash flow implications along with the financial stability of the fertilizer dealer.

## Protecting a Profit Margin

Another perspective for adopting forward pricing strategies is to lock in a profit margin. Controlling only commodity price risk leaves a producer open to yield risk. For this reason, many producers combine crop insurance with hedging or forward contract strategies. The remaining risk is the risk of an increase in the cost of production. At times the market provides producers the opportunity to lock in favorable commodity prices. Simultaneously contracting fertilizer and commodity prices can be part of a sound marketing plan. There is an old saying "you can't go broke locking in a profit."

## Other Strategies to Manage Fertilizer Price Risk

Other options for managing fertilizer price risk include diversifying to less fertilizer intensive crops, considering other product forms, and shifting application within the production year or between years. The impact of changes in fertilizer prices varies across crops. Producers can choose to avoid fertilizer price risk by shifting crops. 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 production, for example, but fertilizer expenses amount to less than 20 percent of the operating cost for those cropping systems. Fertilizer accounts for roughly 30 percent of operating costs in winter wheat production, 19 percent in grain sorghum and an fairly insignificant percentage in soybeans.

Depending on the cropping system and application equipment, a producer may be able to shift between product forms. For example, nitrogen is available in anhydrous ammonia (82-0-0) urea (46-0-0), ammonium nitrate (34-0-0) and UAN (32-0-0). The source of imported fertilizer varies by product. This implies that different forms of fertilizer may be impacted differently by global factors. Roughly half of U.S. ammonia fertilizer is imported from the Caribbean while 70 percent of urea is imported from Canada, Eastern Europe, China and Venezuela. On a percentage basis, more UAN is produced domestically. The U.S. imports roughly 30 percent of its UAN from Canada, Russia and Eastern Europe.

The theoretical price ratio of urea relative to UAN fertilizer based on nitrogen content is 1.45. Fertilizer price data for Central Oklahoma during the 1991 to 2007 time periods reveal the variation around this ratio. Not surprisingly, the average price ratio of these products from 1991 to 2997 averaged 1.45. However during this period (875 weeks) the price ratio ranged from a low of 1.02 to a high of 1.83. Producers who are able to shift between product forms are, in some cases,

able to mitigate price variations. Shifting between product forms may be interrelated with decisions on fertilizer timing (pre-plant versus top dress) and with forward pricing strategies. Opportunities to forward price often vary across product form.

Fertilizer applications can also be shifted within the production year (pre-plant versus top dress) and to some extent between years. Applying the entire nitrogen needs of a crop at the time of planting may allow a producer to use a less expensive form of fertilizer such as anhydrous ammonia. Disadvantage of this method include the inability to gauge the crop potential at the time of application and the possibility of nitrogen loss. Split applications of nitrogen increase nitrogen use efficiency and allow the producer to adjust application to reflect growth and yield potential. Splitting fertilizer applications between pre-plant and top-dress also decreases price risk since purchases are diversified across the market year.

In many situations producers also have the potential to shift fertilizer application between production years. The science behind fertilizer recommendations is a complex subject, but basically involves predictions of obtaining a response to additional fertilizer and the economically optimal rate given the predicted response using prevailing prices for fertilizer and crop. Philosophies about soil test recommendations vary. Some focus on minimizing the possibility of yield loss from under fertilization in the short run, while others consider the additional amounts needed to increase or maintain the soil at optimal levels over time. Most represent a balance of these

approaches. These philosophies also vary across nutrients. Soils can generally be managed for maintenance, buildup or draw down of P and K while nitrogen must be more closely balanced with current crop needs.

While maintaining soil fertilizer at the optimal levels is, in general, a good practice, fertilizer rates on soils indicated to have moderate to optimal levels of nutrients can generally be decreased with a low probability of a yield loss. This is because the recommended rate was designed to maintain the soil test value. Fertilizing below the recommended rate may be a valid strategy when the fertilizer/grain price ratio is higher than usual, when land tenure is uncertain or when fertilizer prices appear to be a function of short-run supply chain issues. The fertilizer reduction is temporary since higher application rates will be needed in the future. During periods of rapidly rising fertilizer prices it can be advisable to work with a crop consultant to determine how prices have impacted the optimal level and the likelihood that rates could be temporarily reduced without a yield impact.

## Summary

Structural changes in the U.S. fertilizer supply chain have increased the opportunity for price volatility. Strategies for managing fertilizer price risk include forward contracting or pre-pricing with a local fertilizer dealer, diversifying across less fertilizer intensive crops, using alternative product forms and shifting application within or between crop years.

## The Oklahoma Cooperative Extension Service

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The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
  - It is administered by the land-grant university as designated by the state legislature through an Extension director.
  - Extension programs are nonpolitical, objective, and research-based information.
  - It provides practical, problem-oriented education
- for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
  - It utilizes research from university, government, and other sources to help people make their own decisions.
  - More than a million volunteers help multiply the impact of the Extension professional staff.
  - It dispenses no funds to the public.
  - It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
  - Local programs are developed and carried out in full recognition of national problems and goals.
  - The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
  - Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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