



# BRIEFING

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## An Overview of the U.S. Fertilizer Industry

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### Introduction

The global and U.S. fertilizer industries produce a broad range of products, each of which contain differing quantities and combinations of essential plant nutrients and micronutrients. The basic inputs used to manufacture fertilizer products are produced in many countries. Consequently, U.S. agricultural producers and fertilizer manufacturers compete in a global market. In 2011, for example, the United States was both the third largest fertilizer user and the third largest fertilizer importer (International Fertilizer Industry Association). The United States is also a major fertilizer producer -- globally ranking third in nitrogen production, second in phosphate production, eighth in potash production, and fourth in ammonia production.

### Common Agricultural Fertilizers

Although a wide range of fertilizer products are available, most contain varying amounts of three primary plant nutrients that are important for plant nutrition and growth -- Nitrogen (N), Phosphorus (P), and Potassium (K). Table 1 provides a list of the seven fertilizer products most commonly used in the United States.

### U.S. Fertilizer Use

U.S. fertilizer use has increased substantially over the past five decades (Figure 1).<sup>1</sup> Nitrogen fertilizer use has grown most rapidly, increasing by 369% between 1960 and 2011.

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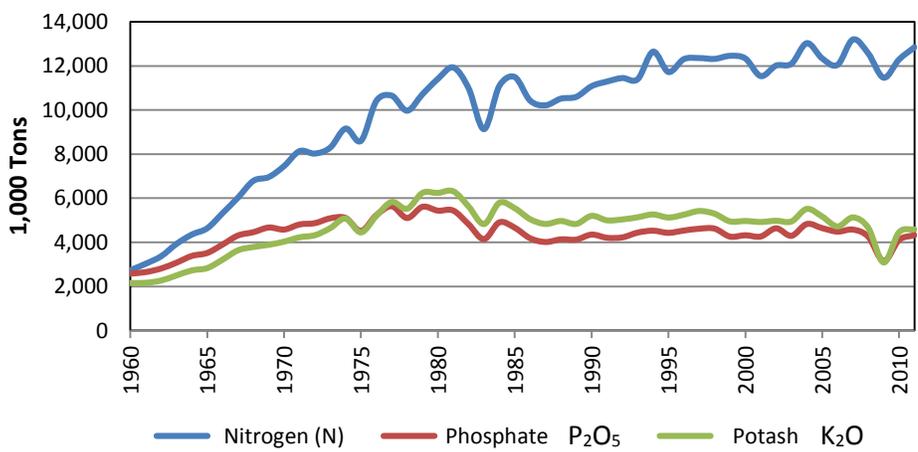
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**Objective**  
**Analysis For**  
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**Figure 1. U.S. Consumption of Plant Nutrients, 1960-2011**



Source: USDA data from ERS, TVA (Tennessee Valley Authority), AAPFCO (Association of American Plant Food Control Officials), TFI.

<sup>1</sup> For regulatory reasons, ammonium nitrate is the one exception to this upward trend.

**Table 1: Major fertilizer products ranked in order of usage in terms of number of product tons applied in the United States, 2010-2011**

Fertilizer	Commonly Known As	Typically Applied as	Approximate Percent of Nitrogen in product	Basic Purpose	Basic origins
Urea Ammonium Nitrate	UAN or nitrogen solutions	Fluid blend	28% or 32 %	Essential in protein formation	Ammonium nitrate, urea, and water
Urea	Urea	Prills, granules or liquid	46%	Essential in protein formation	Liquid ammonia and carbon dioxide
Anhydrous ammonia	NH3 or ammonia	Liquid or combined to make other fertilizer products	82%	Essential in protein formation	Nitrogen in the air and natural gas
Ammonium Nitrate		Prills, granules or solution form	34%	Essential in protein formation	Ammonia and nitric acid
Potassium Chloride	Muriate of potash or KCl	Granules	0% N 40-63% K	Improves crop quality	Mined potash ore reserves left behind by evaporation of ancient sea water deep underground
Diammonium phosphate and monoammonium phosphate	DAP or MAP Sometimes called ammoniated phosphates	Granules	11 – 18%	Essential for photosynthesis, cell enlargement, cell division, energy storage, and energy transfer	Mined phosphate rock in shallow deposits formed from the decay of ancient sea life
Single Superphosphates and triple superphosphates	SSP or TSP Sometimes called superphosphates	Granules	0% N SSP: 16-22% P TSP: 44-52% P	Essential for photosynthesis, cell enlargement, cell division, energy storage, and energy transfer	Mined phosphate rock in shallow deposits formed from the decay of ancient sea life

Source: USDA data and TFI

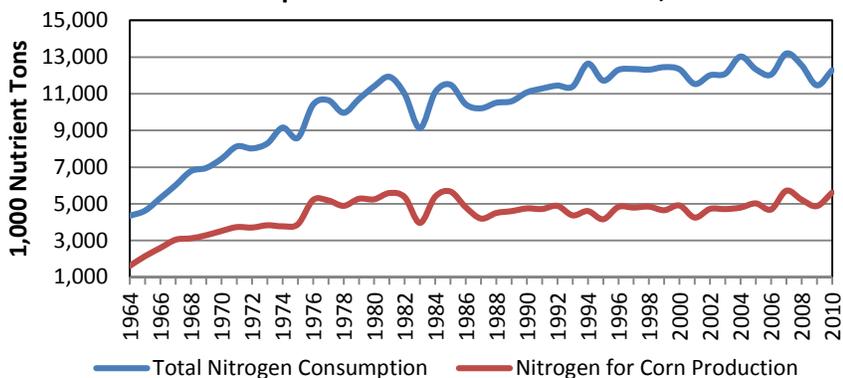
Much of the increase in nitrogen use is attributable to increased crop land allocated to corn production, which has almost doubled since 1980. Corn production requires more nitrogen per acre than most other crops and now accounts for approximately one-half of U.S. nitrogen fertilizer use (Figure 2).

Not surprisingly, nitrogen fertilizer use is concentrated in the Corn Belt states which accounted for approximately 51 percent of all fertilizer purchased in 2003, and an even larger proportion (58 percent) in 2011.<sup>2</sup> In 2011, Iowa, Illinois, Nebraska, California, Minnesota, North Dakota, and Kansas were the largest users of nitrogen fertilizer.<sup>3</sup> Fertilizer use has also increased because increasing crop prices and technological change has encouraged more intensive input use.

### Changes in the Mix of Nitrogen Fertilizers Used by U.S. Agricultural Producers

In 1960, ammonium nitrate was the most commonly applied nitrogen fertilizer in the United States. The product served as a cost effective and efficient

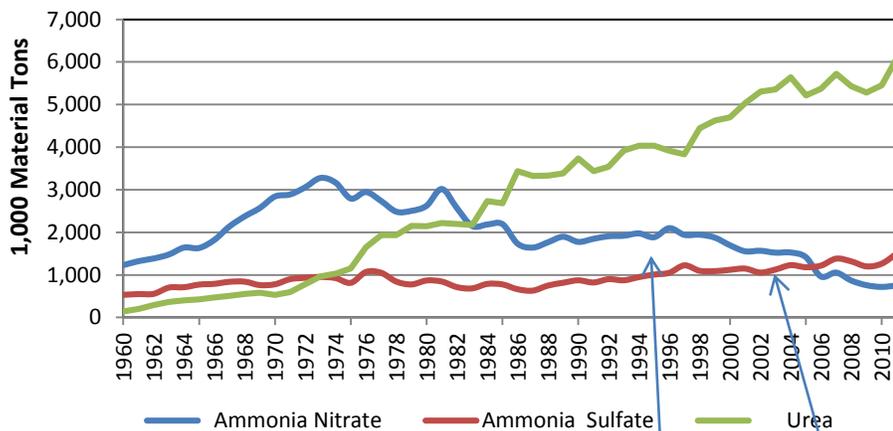
**Figure 2. Total U.S. Nitrogen Consumption and Nitrogen Consumption Used for Corn Production, 1964 - 2010**



Source: USDA

means for applying nitrogen especially for mid-summer top- or side-dressing applications. U.S. agricultural producers applied an average of 1.2 million material tons of nitrogen per year in the 1960s, and larger amounts in the 1970s and early 1980s. The use of ammonium nitrate waned, however, following the 1995 terrorist bombing of the Murrah Federal Building in Oklahoma City (Figure 3). The primary explosive ingredient used by the terrorists was 4,000 pounds of ammonium nitrate.

**Figure 3. U.S. Consumption of Selected Nitrogen Fertilizers, 1960-2011**



means for applying nitrogen

1995: OKC Bombings

Chemical detection tags added to A.N.

→May have influenced the effectiveness of A.N. fertilizers

Government asks dealers to create voluntary checks, ask for ids, keep records, and refuse to sell to suspicious individuals

2004: US Coast Guard Transportation Regulations

Required any vessel or facility holding or transporting A.N. to hire 24 hour security patrols, implement security systems, and hold and record security training drills. It also labeled A.N. shipments "Dangerous Cargo" which mandated restricted areas in the facilities.

→Increased producer's costs and liability to handle A.N.

→Some producers exited this market segment

2011: Ammonium Nitrate Security Program

Anyone who buys, sells, or transfers 25 pounds or more of the chemical must apply to register with the HSD in advance of purchase and be cross checked against a federal watch list database. If approved a registration number would be assigned giving them permission to buy, sell or transfer the product. A photo ID and the registration number would then be shown at the time of purchase.

The law also increases dealer costs by requiring producers to keep records of all sales for two years after a transaction.

<sup>2</sup> IA, IL, NE, MN, ND, KS, IN, SD, MO, and OH

<sup>3</sup> The top 5 nitrogen-using crops in California are cotton, almonds (UAN is commonly applied), rice, wheat, and lettuce.

<http://californiaagriculture.ucanr.edu/landingpage.cfm?article=ca.E.v067n01p68&fulltext=yes>

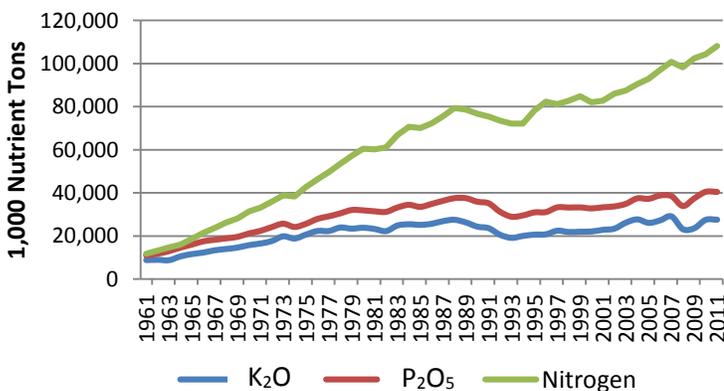
In response to this terrorist act, several regulatory changes were eventually implemented. Those changes reduced producers' access to ammonium nitrate and also increased its cost. For example, many wholesalers/retailers do not stock ammonium nitrate because of added record-keeping and security costs. The adverse impact on ammonium nitrate use in the United States was substantial. In 2011, agricultural producers purchased only 753,356 tons of ammonium nitrate, and many had switched to nitrogen solutions (UAN) or urea.

### Global Fertilizer Use

Globally, total fertilizer nutrient consumption (N, P, and K) increased from 31.6 million tons in 1961 to 176.2 million tons in 2011 – an increase of 456 percent (International Fertilizer Industry Association). In part, the increase has been associated with a modest expansion in global crop land acreage. However, most of the increase has been associated with more intensive production, partly driven by new technologies (for example, higher yielding varieties of crops such as corn, cotton, wheat, and soybeans) and, in inflation adjusted terms, shifts in relative crop prices, fertilizer prices, and the prices of other inputs.

Figure 4 presents global fertilizer use from 1961 to 2011 by nutrient type. Over that fifty-year span, potash fertilizer use increased by 212 percent, phosphate fertilizer use by 267 percent, and nitrogen fertilizer use by 817 percent.<sup>4</sup>

**Figure 4: Global Fertilizer Use, 1961 - 2011**

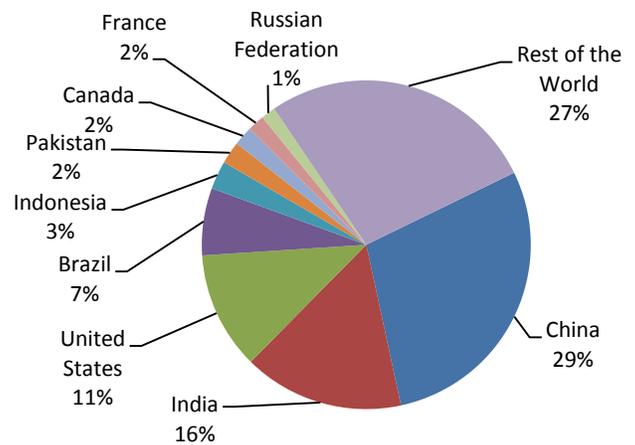


Source: IFIA

### U.S. Fertilizer Use

The United States is a major user of fertilizer products (Figure 5). In 2011, U.S. agricultural producers and horticulturists used 20.4 million tons of fertilizer (11 percent of total global fertilizer use) and the United States ranks as the third largest user of fertilizer behind China (29 percent), and India (16 percent). The top nine fertilizer users are China, India, the United States, Brazil, Indonesia, Pakistan, Canada, France, and Russia (Figure 5). These nine countries account for 72 percent of global fertilizer use.

**Figure 5: Global Fertilizer Use (N, P & K) in 2011**



The United States uses approximately 11 percent of annual global nitrogen fertilizer production and is the third largest user of phosphorus (approximately 10 percent of global phosphorus production). The United States is also the second largest user of potash (accounting for approximately 14 percent of global potash production).

<sup>4</sup> The largest increase in potash usage came from a substantial increase in potassium chloride (KCl), which constituted a 1,303% increase in material ton consumption.

## Summary

Global fertilizer use has expanded substantially over the past fifty years. The United States is a major user of all fertilizer types. Most projections indicate that these trends are likely to continue, especially if corn prices remain high and other agricultural inputs such as farm labor become more expensive.

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