The Global Fertilizer Situation: What Is Going On?

2008 Alfalfa Symposium
San Diego, CA

Robert Mikkelsen
International Plant Nutrition Institute
Merced, CA
Feeling squeezed?
Alfalfa Nutrient Uptake and Removal

Alfalfa has higher demand for nutrients than most crops.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount Removed, lb/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate</td>
<td>15</td>
</tr>
<tr>
<td>Potash</td>
<td>60</td>
</tr>
<tr>
<td>Ca</td>
<td>30</td>
</tr>
<tr>
<td>Mg</td>
<td>6</td>
</tr>
<tr>
<td>S</td>
<td>6</td>
</tr>
<tr>
<td>N (through fixation)</td>
<td>60</td>
</tr>
</tbody>
</table>
How to respond to higher fertilizer prices?
Deliberate nutrient shortages…

...like taking the spark plugs from the engine of a car
Why has fertilizer price increased?

Fundamentals:

• Fertilizer is a world market commodity ... subject to supply and demand

• Price increases are a result of:
  – Global demand is increasing
  – High energy and raw materials costs
  – Higher transportation costs
  – Weak USD
  – Strong commodity prices
  – Export tariffs on fertilizer in some countries
World Nutrient Use

Source: IFA May 2008

[Bar chart showing the trend of world nutrient use from 2000 to 2012, with a steady increase over the years.]
Rock Phosphate as a P Source
Phosphate consumption, ‘000 t P$_2$O$_5$

- As of 2005 these 4 countries accounted for about 63% of world phosphate consumption
  - US 11%, Brazil 8%, China 30%, and India 14%

Source: IFA Production and Trade Statistics
Potash Ore Comes From Underground Mines
Potash consumption, ‘000 t K₂O

- As of 2005 these 4 countries accounted for about 61% of world potash consumption
  - US 17%, Brazil 14%, China 21%, and India 9%

Source: IFA Production and Trade Statistics
Global Fertilizer Consumption Forecasts to 2012/13 (Mt nutrients)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P₂O₅</th>
<th>K₂O</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ave. 2005/06 to 2007/08 (e)</td>
<td>95.5</td>
<td>38.6</td>
<td>27.6</td>
<td>162.1</td>
</tr>
<tr>
<td>2012/13 (f)</td>
<td>115.6</td>
<td>45.7</td>
<td>33.0</td>
<td>194.3</td>
</tr>
<tr>
<td>Ave. Annual Change</td>
<td>+3.2%</td>
<td>+2.8%</td>
<td>+3.0%</td>
<td>+3.1%</td>
</tr>
</tbody>
</table>

FOB World fertilizer prices, monthly averages

Source: Pike & Fischer ‘s Green Markets

From January 2000 – June 2008
Increased 268%

Source: NASS
Experts…. “Gas prices will easily be over $5.00/gallon by Christmas…”

Experts today…
DAP Price Comparison

Prices still some way from the floor

N Africa

US Gulf
Ag Supply & Demand Dynamics

Bio-fuel products have added a significant new end-market competitor for crops.

Food, Feed, Fiber...
and Fuel
Biofuel Revolution Expanding Across the Globe

Canada (wheat, barley, rapeseed)
US (corn, soybeans)
Ecuador (oil palm)
Peru (oil palm)
Colombia (sugarcane, oil palm)
India (sugarcane, sweet sorghum, jatropha)
Africa (corn, sugarcane, soybeans, jatropha)
Europe (rapeseed, wheat, corn)
China (corn, sweet sorghum, sweet potato, rapeseed)
SE Asia (oil palm, sugar cane, corn)
Argentina (sugarcane, corn, soybeans)
Oceania (wheat, corn)

Ethanol
Biodiesel
Ethanol is here to stay

U.S. Corn Used for Ethanol Production

Billion Bushels

U.S. Corn Used for Fuel Ethanol Production

Crop Year Beginning September 1

Actual/Estimate  Forecast  Percent of Crop

Source: USDA and Mosaic

% of Corn Crop
Growing Global Affluence + Fuel

USA:
Ethanol growth to 15 billion gallons by 2015

The 2008 mandate for ethanol is 9 billion gallons

China:
Middle class growth from 130 million to 690 million by 2025

India:
Middle class growth from 50 million in 2008 to 580 million by 2025
Over the past five years, potash consumption has grown at an annual average rate of 5.6 percent, while nitrogen has increased 2.7 percent and phosphate 3.8 percent.

Looking ahead, Fertecon is forecasting 4.2 percent growth in potash consumption, 1.8 percent in nitrogen and 3.1 percent in phosphate over the next five years.
World demand for food

“...food production has to increase 50% by 2013 and double in 30 years…”

(Source: Global Challenges for Humanity, 2008 State of the Future, Millennium Project)
Diets are changing ... more protein.

- Requires more feed grains to produce protein
  - 7 kg/kg beef, 4 kg/kg pork, and 2 kg/kg poultry

Source: FAO
World wheat plus coarse grains ending stocks, 1978-2008

\[ y = -1.80x + 3621 \]

\[ r^2 = 0.93 \]

USDA-FAS, 5/2008

Year (2008 = 2008/09)

Lowest 2 yrs on record
RECENT DEVELOPMENTS:

World grain stocks remain at a record low.

Despite two consecutive good harvests in 2007 and 2008, projections by the Food and Agricultural Organization of the United Nations (FAO) and the US Department of Agriculture (USDA) point to a modest recovery in 2008/09.

With such low inventories and a steadily growing population, a small 2009 harvest could raise grain prices considerably.
Low crop yields in the developing world (Ave. 2005 – 2007)

Source: FAO
Global Nutrient Demand

Potential Fertilizer Consumption Growth

Million Tonnes

- N
- P₂O₅
- KCl

China

India

Brazil

Current Potential

Current Potential

Current Potential

Current Potential

IPNI  UCD Alfalfa Workgroup
World Grain Production and Fertilizer Use Growing
Grain Demand Drives Fertilizer Use

Billion Tonnes Grain

- Grain Production
- Fertilizer Use

Million Tonnes Fertilizer

Agricultural Commodity Prices
(Index: January 1995 = 100)

Source: IFA
Crop Prices
Quarter Averages of the Daily Closing of Nearby Options

Source: CBOT and KCBOT

- Corn
- Soybean
- Wheat
Why has fertilizer price increased?

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Cumulative U.S. ammonia plant closures increase with increasing natural gas prices

1985-1997 Ave. Price of Natural Gas $1.90 MMBtu

Source: TFI
U.S. Ammonia Production and Net Nitrogen Imports

Source: TFI and U.S. Department of Commerce
Shipping and distribution costs increase

Baltic Ocean Freight Rate Index

Change in Freight Rates
Vessel Jan 08 vs Jan 03
Capesize 453%
Panamex 359%

Source: Overseas Marine Service, PotashCorp, TFI
Shipping and distribution costs increase

Rail Rates: Anhydrous Ammonia
Tariff Rates - BNSF

$/ton of ammonia

Jan 05  May 06  Mar 07  Nov 07  Jan 08

Source: Overseas Marine Service, PotashCorp, TFI
Falling U.S. dollar ... increased cost for imported fertilizer

Source: USDA Economic Research Services
Food and fertilizer exports curbs

Export tariffs on fertilizers:
- China
- Russia
- Ukraine
- Belarus
- Egypt
- Vietnam
- Indonesia
Difficulties in accessing credit to purchase agricultural inputs, including fertilizers.

Fast changing prices of agricultural commodities and inputs make it risky for farmers to invest in fertilizers.

In this context, farmers tend to reduce fertilizer application rates, in particular phosphate and potash.

Many are postponing fertilizer orders in anticipation of a possible further decline of input prices and in expectation of more predictable crop prices.
What are the global consequences of higher fertilizer prices?
Global Consequences: Greater awareness of the role of fertilizer in producing food

The hungry planet

Is fertilizer the most important business on Earth?

Sean Silcoff, Financial Post
Published: Saturday, May 24, 2008

A farmer in Vietnam sprays fertilizer. With food prices sky-rocketing so have prices of fertilizers.

VIENNA - It's the hottest commodity that nobody cared about. Until now. In the midst of a global food crisis, governments and investors are waking up to fertilizer and its soaring prices. Financial Post reporter Sean Silcoff attended this week's International Fertilizer Industry Association (IFA) conference in Vienna, where the debate rages: Are fertilizer producers the solution to the world's food crisis or part of the problem?
Global Consequences: Reduction in fertilizer use …

- Shift in crops … more soybeans
- Less P and K use … more imbalanced nutrient use
- Lower yields and less production … food prices and grain stocks
- Better environment?
Global Consequences: Increased investment by the industry in production capacity

World Fertilizer Production, 1000 t

Source: IFA
Near-Term Drivers:
- Pipeline inventory
- China exports
- India demand
- Brazil slowdown
- Raw materials
- Buyer sentiment

DAP Prices
Quarter Averages of Weekly Published Spot DAP fob Tampa

Source: Fertecon

$ tonne
1,200
1,000
800
600
400
200

Q1 07 Q2 Q3 Q4 Q1 08 Q2 Q3 Q4 Q1 09
Global Consequence: Supply will catch up to demand in next 5 years

Organic Nutrient Sources

- Provides an excellent source of plant nutrients
- Majority of nutrients in manure and composts originated from fertilizer
- Price of organic materials rise and fall in proportion to fertilizer costs (nutrient substitution value)
Global Framework for Fertilizer BMPs

Source: IPNI
Productivity

• Yield – per unit area, per unit of time
• Efficiency of all resources involved in production
• Quantity and Quality
Profitability

• Difference between value and cost of production
• Net profit per unit area per unit of time
Cropping System Sustainability

- Influence of time on resources involved
- Use of non-renewable resources
- Are yields maintained when inputs are decreased?

Rothamsted Research, 2006
Environmental Health

• Biophysical
  – Material losses to water and air
  – N, P, nitrate, ammonia, nitrous oxide

• Social
  – Demand for labor
  – Working conditions
Re-emphasize the Scientific Principles for Fertilizer Management: BMPs and improving nutrient use efficiency

<table>
<thead>
<tr>
<th>BMP Category</th>
<th>BMP Examples</th>
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</table>
| Right Product      | - Soil Testing  
                     - N, P, K, Secondary and Micronutrient Enhanced Efficiency Fertilizers  
                     - Nutrient Management Planning Select appropriate fertilizer and on-farm nutrient sources for the cropping system. |
| Right Time         | - Application Timing  
                     - Controlled Release Technologies  
                     - Inhibitors  
                     - Fertilizer Product Choice |
| Right Place        | - Application Method  
                     - Incorporation of Fertilizer  
                     - Buffer Strips  
                     - Conservation Tillage  
                     - Cover Cropping |
| Right Rate         | - Soil Testing  
                     - Yield Goal Analysis  
                     - Crop Removal Balance  
                     - Nutrient Management Planning  
                     - Plant Tissue Analysis  
                     - Applicator Calibration  
                     - Crop Scouting  
                     - Record Keeping  
                     - Variable Rate Technology  
                     - Site-Specific Management |
Thank You

www.ipni.net
UCD Alfalfa Workgroup