The Global Fertilizer Situation: What Is Going On?

Nitrate & Nutrient Interconnections
Santa Maria, CA

Robert Mikkelsen
International Plant Nutrition Institute
Merced, CA
Feeling squeezed?
Why has fertilizer price increased?

• 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
FOB World fertilizer prices, monthly averages

Source: Pike & Fischer’s Green Markets

From January 2000 – June 2008
Increased 268%

Source: NASS
World Fertilizer Consumption, ‘000 t

Source: IFA
# Global Fertilizer Consumption Forecasts to 2012/13 (Mt nutrients)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>P$_2$O$_5$</th>
<th>K$_2$O</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>

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
Biofuels: Continued expected growth … increasing demand for corn and other crops

Source: FAPRI 2008
Ethanol is here to stay

U.S. Corn Used for Ethanol Production

Billion Bushels

Source: USDA and Mosaic
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 million to 690 million by 2025

India:
Middle class growth from 5 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.
“...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
Meat Production is Grain Intensive
Desire for Protein-Rich Diets Puts Strain on Grain Supply

Kilograms of Feed Grain to Produce 1 Kilogram of Meat

- Beef
- Pork
- Poultry
World wheat plus coarse grains ending stocks, 1978-2008

\[ y = -1.80x + 3621 \]
\[ r^2 = 0.93 \]

Year (2008 = 2008/09)

USDA-FAS, 5/2008
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
World Grain Production and Fertilizer Use Growing
Grain Demand Drives Fertilizer Use

Billion Tonnes Grain

<table>
<thead>
<tr>
<th>Year</th>
<th>Grain Production</th>
<th>Fertilizer Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980/81</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>1984/85</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>1988/89</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>1992/93</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>1996/97</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>2000/01</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>2004/05</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>2008/09F</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

Million Tonnes Fertilizer

100 - 180
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

$ bushel

Q1  Q2  Q3  Q4  Q1  Q2  Q3  Q4  Q1  Q2  Q3  Q4  Q1
05  06  07  08  09
Why has fertilizer price increased?

• fertilizer is a world market commodity ... subject to supply and demand
• Price increases are a result of:
  – Global demand is increasing
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  – Weak USD
  – Strong commodity prices
  – Export tariffs on fertilizer in some countries
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

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Jan 08 vs Jan 03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capesize</td>
<td>453%</td>
</tr>
<tr>
<td>Panamex</td>
<td>359%</td>
</tr>
</tbody>
</table>

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

Rail Rates: Anhydrous Ammonia
Tariff Rates - BNSF

$/ton of ammonia

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

Value of U.S. Dollar (Jan. 03 – Dec. 07)

5 U.S. Relative to Country Currency:
- Canada ↓ 35 %
- Euro ↓ 27 %
- Russia ↓ 23 %
- China ↓ 11 %
- Kuwait ↓ 8 %

Source: USDA Economic Research Services
Food and fertilizer exports curbs

Export tariffs on fertilizers:
- China
- Russia
- Ukraine
- Belarus
- Egypt
- Vietnam
- Indonesia
What are the global consequences of higher fertilizer prices?
Global Consequences: Greater awareness of the role of fertilizer in producing food

The New York Times

World Business

The Food Chain

Shortages Threaten Farmers’ Key Tool: Fertilizer

XUAN CANH, Vietnam — Truong Thi Nha stands just four and a half feet tall. Her three grown children tower over her, just as many young people in this village outside Hanoi dwarf their parents.

The biggest reason the children are so robust: fertilizer.

The hungry planet

Is fertilizer the 'most important business on Earth?'

Sean Silcoff, Financial Post

Published: Saturday, May 24, 2008

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?

Lofty Prices for Fertilizer Put Farmers in a Squeeze

By LAUREN ETTER
May 27, 2008; Page A1

At a time when food prices are soaring world-wide, so is the price of fertilizer, producing huge profits for leading fertilizer makers and stirring anger among farmers in the U.S. and India.

Fertilizer prices are rising faster than those of almost any other raw material used by farmers. In April, farmers paid 65% more for fertilizer than they did a year earlier, according to the U.S. Department of Agriculture. That compares with price increases of 43% for fuel, 30% for seeds and 3.8% for chemicals such as weedkillers and insecticides over the same period, according to Agriculture Department indexes.
Global Consequences: Increased investment by the industry in production capacity

Source: IFA
DAP Prices
Quarter Averages of Weekly Published Spot DAP fob Tampa

Source: Fertecon

Near-Term Drivers:
- Pipeline inventory
- China exports
- India demand
- Brazil slowdown
- Raw materials
- Buyer sentiment
DAP: U.S. Gulf Barge
July 2008 through Present (Weekly Average)

Source: Green Markets Historical Pricing Database
Global Consequence: Supply will catch up to demand in next 5 years

Global Framework for Fertilizer BMPs

**ECONOMIC**
- Quality
- Energy
- Resource use efficiencies:
  - Nutrient
  - Water
- Net profit
- Return on investment
- Adoption

**ECOLOGICAL**
- Soil productivity
- Cropping system sustainability
- Yield stability
- Farm income
- Working conditions
- Water & air quality
- Ecosystem services
- Biodiversity
- Nutrient balance
- Nutrient loss
- Soil erosion

**SOCIAL**
- Farm income
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- Soil erosion

**Profitability**
- Rate
- Source
- Place
- Time

**Productivity**
- Yield
- Yield stability
- Nutrient balance
- Nutrient loss
- Soil erosion

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
- “Outputs do not decrease when inputs are not increased” (Monteith, 1990)

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>
</tr>
</thead>
</table>
| Right Product         | - Soil Testing  
- N, P, K, Secondary and Micronutrients  
- 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 |
Scientific Principles for Fertilizer BMPs –
Source

- Ensure a balanced supply of essential nutrients.
- Supply plant-available forms.
- Suit soil physical and chemical properties.
- Recognize:
  - synergisms among nutrient elements and sources;
  - blend compatibility;
  - associated nutritive or non-nutritive elements.
Scientific Principles for Fertilizer BMPs – Rate

• Assess:
  – Soil nutrient supply;
  – All available nutrient sources;
  – Plant demand.

• Predict fertilizer use efficiency.
Scientific Principles for Fertilizer BMPs – Timing

• Match timing of crop uptake.
• Assess dynamics of soil nutrient supply.
• Recognize timing of weather factors influencing nutrient loss.
• Evaluate logistics of field operations.
Scientific Principles for Fertilizer BMPs – Placement

- Recognize root-soil dynamics.
- Manage spatial variability.
- Avoid detrimental effects on plant roots, leaves and seedlings.
- Limit potential off-field transport of nutrients.
Implications of this change-induced agronomic “perfect storm”

“In times of rapid change, experience could be your worst enemy”. J. Paul Getty

- Future management decisions may need to be more measurement based rather than historical
- Past performance in a region may not reflect future performance ...
  – your future may be more like someone else’s past than your own past.
- Changes in genetics, climate, economics, objectives
Global Framework For Fertilizer BMPs

**ECONOMIC**
- Net profit
- Return on investment
- Adoption
- Soil productivity
- Yield stability
- Farm income
- Working conditions
- Water & air quality

**ECOLOGICAL**
- Biodiversity
- Ecosystem services
- Ecosystem services
- Water & air quality

**SOCIAL**
- Farm income
- Working conditions
- Water & air quality
Thank You

www.ipni.net
Crop Nutrients Remain Essential

- Continuing grain & oilseed demand growth
- Low stock to use ratios
- Maximum yields required
- Attractive farmer economics
Scientific Principles for Fertilizer Management

- Right Product
- Right Rate
- Right Time
- Right Place
Investing in determination of right source, rate, time and place for inputs helps manage the much higher risk of today’s market.
We’re under the magnifying glass... like never before

- Food prices & supply
- Encroachment on natural lands
- Nitrates in water
- Hypoxic zones
- GHG emissions
- Air quality

As we strive to increase productivity
This is a long-term story. GDP has been growing at strong rates for many years in countries like China and India, and the impact on diets is now becoming evident. The average daily protein intake in China has increased by 40 percent over a 20-year period, with the greatest percentage of that increase coming from meat consumption.

According to the director of the World Food Program in China, a six year old boy in China today is six kilograms heavier and six centimeters taller than he would have been 30 years ago. That’s a strong indication that people are better nourished.

With GDP growth in many of these emerging nations expected to be strong in the coming years, this trend should continue.
Genetic improvement in corn yields

Current rates of gain in crops yields are inadequate to meet expected demands …

Breaking the 112 kg/ha/yr barrier will require our best agronomic science plus our grower’s best agronomic management
The demand for potash is not tied to one crop or one country. Familiar staples that are grown around the world – wheat, rice, corn, soybeans and sugar cane – consume roughly 50 percent of the world’s potash. The remainder is split among various fruits and vegetables, cotton, oil palm, rubber, coffee, cocoa and other crops.

Some people have tried to connect the growth in potash demand to the expectation of US corn going to ethanol production. In reality, this market accounts for only 2 percent of world potash consumption.