Knowledge grows

Where Does Your Fertilizer Come From & What Determines Cost?

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Fertilizer Production
Fertilizer production routes

- Natural gas (coal, oil)
- Air
- Rock (P)
- Sulphur (S)

Ammonia plant
- Ammonia
- CO₂

Nitric acid plant
- Ammonia
- Nitric acid

Phosphoric acid plant
- H₃PO₄

Sulphuric acid plant

Finished fertilizer products
- Ammonia
- Urea
- Ammonium Nitrate (AN)
- Urea-Ammonium Nitrate (UAN)
- Calcium Ammonium Nitrate (CAN)
- DAP / MAP
Nitrogen value chain

- Natural gas
  - Ammonia
  - Nitric acid

Intermediate products:
- Ammonia
- Nitric acid

Finished products:
- H, Ar, CO etc
- CO₂
- Ammonia
- Urea
- Nitric acid
- Nitrates
- Calcium Nitrate

Industrial products:
- Industrial gases
- Environmental products
- Industrial nitrogen chemicals
Nitrogen Technology Evolution

- Birkeland-Eyde electric arc method
- Cyanamid method
- Haber-Bosch synthesis
- Steam reforming natural gas

GJ/tN

Theoretical minimum

Main ammonia trade flows

Million tonnes

Source: IFA 2015 trade statistics (covering 85% of total trade)
Main urea trade flows

Million tonnes

Source: IFA 2015 trade statistics (covering 87% of total trade)
The Fertilizer Industry
The N industry is fragmented, while the P and K industries are more concentrated

2015 figures\(^1\), million tonnes nutrient

**Nitrogen\(^1\)**

- Despite a consolidation trend, the industry is still higher fragmented
- Top 3 producers account for only \(~15\%\) of world capacity

**Phosphate**

- More concentrated than N-industry
- Top 3 producers account for \(~24\%\) of capacity

**Potash**

- Highly concentrated industry
- Top 3 producers account for \(~48\%\) of capacity

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1. Nitrogen: 2013 figures  
Source: IFA
Fertilizer Company Comparison

Revenues - USD billion

<table>
<thead>
<tr>
<th>Company</th>
<th>L4Q</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yara</td>
<td>12.2</td>
<td>13.4</td>
</tr>
<tr>
<td>Agrium</td>
<td>13.9</td>
<td>14.8</td>
</tr>
<tr>
<td>Mosaic*</td>
<td>7.5</td>
<td>8.9</td>
</tr>
<tr>
<td>PCS</td>
<td>5.3</td>
<td>6.3</td>
</tr>
<tr>
<td>K+S</td>
<td>3.9</td>
<td>4.6</td>
</tr>
<tr>
<td>ICL</td>
<td>5.5</td>
<td>5.4</td>
</tr>
<tr>
<td>CF</td>
<td>3.9</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Source: Thomson Worldscope
Key global fertilizer products

- **Nitrogen N**: 108 million tonnes*
  - Urea 58%
  - Ammonia 4%
  - DAP/MAP 7%
  - NPK 6%
  - AN/CAN 9%
  - Other 11%

- **Potash K₂O**: 32 million tonnes
  - MOP/SOP 76%
  - NPK 21%
  - Other 3%

- **Phosphate P₂O₅**: 41 million tonnes
  - DAP/MAP 57%
  - SSP 9%
  - NPK 18%
  - TSP 6%
  - Other 10%

Source: IFA 2015 (nutrient totals) and 2014 (product split)  
* Does not include industrial nitrogen applications
Nitrogen fertilizer application by region and product

Source: IFA 2014

- **China (32.9 mt)**
  - Urea: 33%
  - Nitrates: 43%
  - UAN: 11%
  - NPK: 6%
  - DAP/MAP: 3%
  - Other: 8%

- **West /central Europe (11.4 mt)**
  - Urea: 11%
  - Nitrates: 43%
  - UAN: 12%
  - NPK: 11%
  - DAP/MAP: 3%
  - Other: 11%

- **USA (11.8 mt)**
  - Urea: 55%
  - Nitrates: 12%
  - UAN: 23%
  - Ammonia: 27%
  - DAP/MAP: 7%
  - Other: 7%

- **Brazil (3.9 mt)**
  - Urea: 22%
  - Nitrates: 27%
  - UAN: 28%
  - Ammonia: 27%
  - DAP/MAP: 7%
  - Other: 7%

- **India (16.8 mt)**
  - Urea: 84%
  - Nitrates: 9%
  - UAN: 6%
  - NPK: 7%
  - DAP/MAP: 5%
  - Other: 1%
Nitrogen fertilizer application by region and crop

Source: IFA 2010/11
Industrial use accounts for 21% of global nitrogen consumption

~30 million tonnes N
- Chemicals: 76%
- Explosives: 18%
- Environment: 6%

~21% of total nitrogen consumption

~9.5 million tonnes N as urea
- Glue: 58%
- Melamine: 21%
- Other: 11%
- Environment: 10%

~12-13% of total urea consumption

Source: Yara estimates 2015, IFA, Fertecon, CRU
Fertilizer Price Influencers
Two kinds of factors influence global demand and supply:

- Structural factors are long-term effects (e.g., world population)
- Variable factors are short-term effects (e.g., weather conditions)

As an example, we are examining how world population and world economic trend influence fertilizer prices.
Global ammonia trade

10 largest exporters (2015)

- Trinidad: 4.5 million tonnes
- Russia: 3.6 million tonnes
- Algeria: 1.2 million tonnes
- Canada: 1.2 million tonnes
- Indonesia: 1.1 million tonnes
- Saudi Arabia: 1.0 million tonnes
- Qatar: 0.8 million tonnes
- Iran: 0.7 million tonnes
- Ukraine: 0.7 million tonnes
- Netherlands: 0.4 million tonnes

10 largest importers (2015)

- USA: 5.4 million tonnes
- India: 2.3 million tonnes
- Korea: 1.0 million tonnes
- Belgium: 0.9 million tonnes
- Morocco: 0.9 million tonnes
- France: 0.8 million tonnes
- Germany: 0.7 million tonnes
- Taiwan: 0.6 million tonnes
- Turkey: 0.6 million tonnes
- Spain: 0.5 million tonnes

Source: IFA
Global urea trade

10 largest exporters (2015)

- China: 13.7
- Qatar: 5.4
- Russia: 5.0
- Saudi Arabia: 3.7
- Oman: 3.4
- Iran: 2.6
- UAE: 1.9
- Ukraine: 1.6
- Algeria: 1.5
- Malaysia: 1.0

10 largest importers (2015)

- India: 10.6
- USA: 7.9
- Brazil: 4.2
- Thailand: 2.1
- Australia: 1.8
- Turkey: 1.7
- Mexico: 1.2
- Bangladesh: 1.1
- France: 1.0
- Canada: 0.9

Source: IFA
Chinese domestic urea price and export tax set the global floor price

Source: China Fertilizer Market Week, International publications
Fertilizer Price Drivers
# Nitrogen fertilizer value drivers

<table>
<thead>
<tr>
<th>Drivers</th>
<th>Effect on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese coal prices</td>
<td>Supply-driven price for urea</td>
</tr>
<tr>
<td>Grain inventories/prices</td>
<td>Urea demand</td>
</tr>
<tr>
<td>New urea capacity vs. closures</td>
<td>Urea supply</td>
</tr>
<tr>
<td>Global urea demand vs. supply</td>
<td>Urea price (above floor)</td>
</tr>
<tr>
<td>Urea price</td>
<td>Most other nitrogen fertilizer prices</td>
</tr>
<tr>
<td>Oil product prices and LNG capacity expansion</td>
<td>Gas cost in Europe</td>
</tr>
</tbody>
</table>
Drivers of fertilizer consumption growth

- **Food demand drives fertilizer consumption**
  - Population growth of about 80 million each year
  - Economic growth change diets
    - Higher meat consumption in developing countries
    - More protein-rich diets
    - More fruit and vegetables
    - Reduce hunger
  - Biofuels

- **Industrial consumption**
  - Economic growth
  - Environmental limits (e.g. reduction of NOx emissions)
Price Predictors

Figure 1: The increase in fertilizer prices is generally accompanied by a simultaneous increase in cereal prices. Fertilizer cost remains a fraction of gross farming income, even in inflationary periods [5].

Figure 2: The prices of gas, ammonium nitrates & the FAO Food Price Index all tend to follow the same trends. The FAO Index is based on an average world market price for five product groups (meats, dairy products, cereals, oils/fats & sugar) [5].
Grain prices important for fertilizer demand

Source: World Bank, Fertilizer publications
China drives recent years’ increases in global grain stocks

Grain stocks – China versus the rest

Days of consumption in stocks

Source: USDA December 2016
Global pricing moving higher, pulling China along
Final Thoughts
Nitrogen has many industrial applications

- Ammonia
- Nitric acid
- H₂S abatement in sewage
- Technical nitric acid
- Concentrated nitric acid
- Cleaning/scrubbing
- Aqueous ammonia
- Glue
- NOₓ abatement
- AdBlue®/heavy-duty vehicles
- Vessels
- Stationary sources
- Dry ice
- Applic. LIC
- LIC wholesale
- NH₃
- N₂O abatement
- TAN
- Acrylonitrile
- Nitric acid
- Urea
- Melamine
- CO₂
- Industrial gases
- Formates
- Propane
- Nitrogen
- Oxygen
- Argon
- Propane
- H₂S abatement in oil fields
- NITCAL®
- DIPCAL®
- ANFO Emulsions
- NH₃
- Vessels
- Stationary sources
- Dry ice
- Applic. LIC
- LIC wholesale
- NH₃
- Nitrogen
- Oxygen
- Argon
- Propane
- H₂S abatement in oil fields
- NITCAL®
- DIPCAL®
- ANFO Emulsions
- NH₃
Fertilizer reduces the carbon footprint of farming

**Fertilizer - an efficient solar energy catalyst**
- Production is a marginal part of the carbon footprint; efficient application is more important
- Huge positive effects of fertilizer use, since higher yields enable lower land area use

**Production**
- More energy-efficient than in the past (depending on place of production)

**Application**
- Higher efficiency with nitrates
- Precision farming tools
Sources of market information

- **Fertilizer market information**
  - FMB
  - Ferteco
  - Fertilizer Week
  - Profercy
  - The Market
  - Green Markets (USA)
  - Beijing Orient Business (China)
  - China Fertilizer Market Week

- **Fertilizer industry associations**
  - International Fertilizer Industry Association (IFA)
  - Fertilizers Europe (EFMA)

- **Food and grain market information**
  - Food and Agriculture Organization of the UN
  - International Grain Council
  - Chicago Board of Trade
  - World Bank commodity prices
  - US Department of Agriculture (USDA)