

Chemicals for the Non-Chemist

Plant Nutrients and Plant Nutrient Markets

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Andy J. Jung
Director, Market and Strategic Analysis
The Mosaic Company

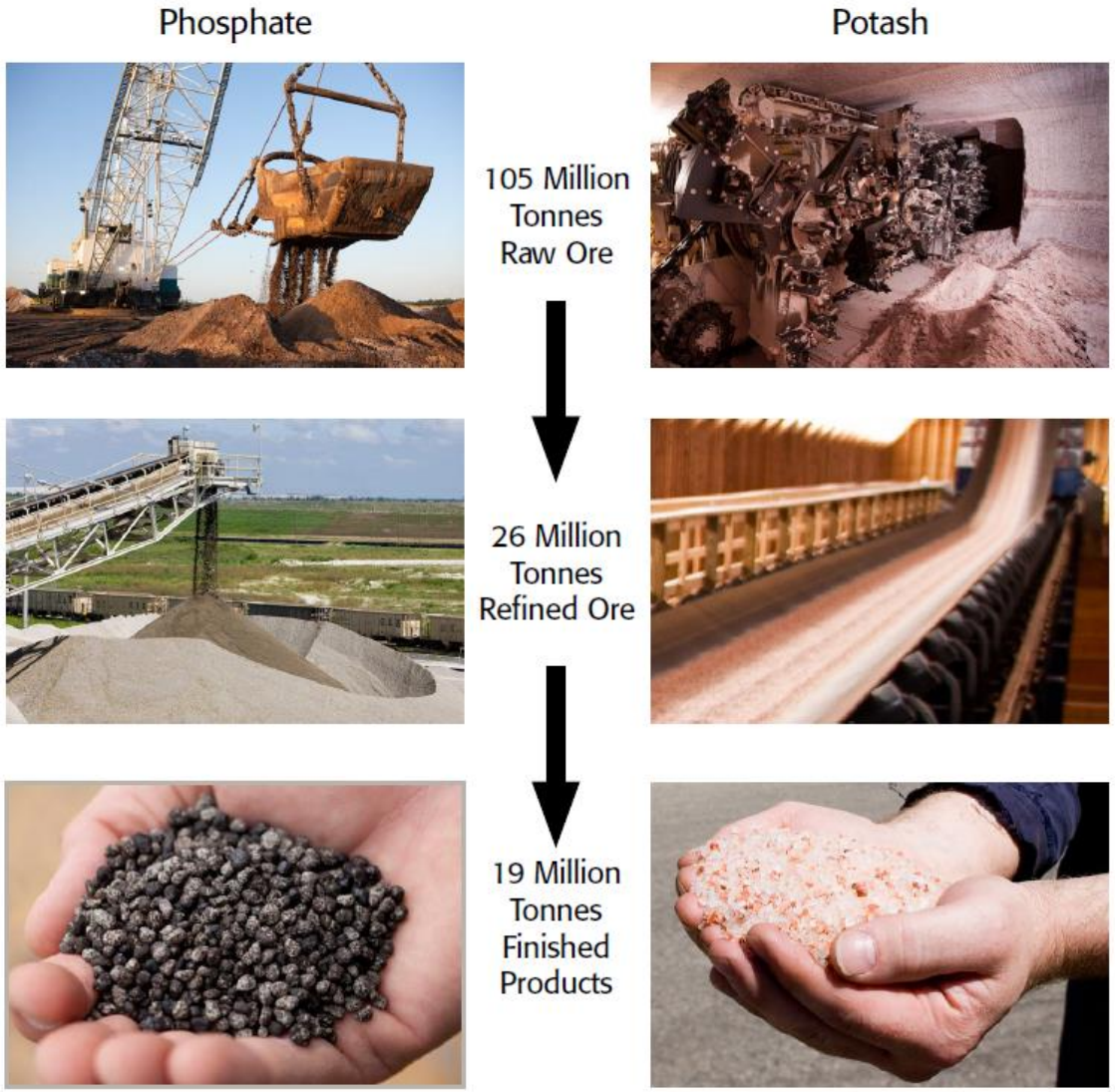
Mosaic®

Safe Harbor

This document contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Such statements include, but are not limited to, statements about the Wa'ad Al Shamal Phosphate Company (also known as MWSPC) and other proposed or pending future transactions or strategic plans and other statements about future financial and operating results. Such statements are based upon the current beliefs and expectations of The Mosaic Company's management and are subject to significant risks and uncertainties. These risks and uncertainties include but are not limited to risks and uncertainties arising from the ability of MWSPC to obtain additional planned funding in acceptable amounts and upon acceptable terms, the timely development and commencement of operations of production facilities in the Kingdom of Saudi Arabia, the future success of current plans for MWSPC and any future changes in those plans; difficulties with realization of the benefits of our long term natural gas based pricing ammonia supply agreement with CF Industries, Inc., including the risk that the cost savings initially anticipated from the agreement may not be fully realized over its term or that the price of natural gas or ammonia during the term are at levels at which the pricing is disadvantageous to Mosaic; customer defaults; the effects of Mosaic's decisions to exit business operations or locations; the predictability and volatility of, and customer expectations about, agriculture, fertilizer, raw material, energy and transportation markets that are subject to competitive and other pressures and economic and credit market conditions; the level of inventories in the distribution channels for crop nutrients; the effect of future product innovations or development of new technologies on demand for our products; changes in foreign currency and exchange rates; international trade risks and other risks associated with Mosaic's international operations and those of joint ventures in which Mosaic participates, including the risk that protests against natural resource companies in Peru extend to or impact the Miski Mayo mine; changes in government policy; changes in environmental and other governmental regulation, including expansion of the types and extent of water resources regulated under federal law, carbon taxes or other greenhouse gas regulation, implementation of numeric water quality standards for the discharge of nutrients into Florida waterways or efforts to reduce the flow of excess nutrients into the Mississippi River basin, the Gulf of Mexico or elsewhere; further developments in judicial or administrative proceedings, or complaints that Mosaic's operations are adversely impacting nearby farms, business operations or properties; difficulties or delays in receiving, increased costs of or challenges to necessary governmental permits or approvals or increased financial assurance requirements; resolution of global tax audit activity; the effectiveness of Mosaic's processes for managing its strategic priorities; adverse weather conditions affecting operations in Central Florida, the Mississippi River basin, the Gulf Coast of the United States or Canada, and including potential hurricanes, excess heat, cold, snow, rainfall or drought; actual costs of various items differing from management's current estimates, including, among others, asset retirement, environmental remediation, reclamation or other environmental regulation, Canadian resources taxes and royalties, or the costs of the MWSPC, its existing or future funding and Mosaic's commitments in support of such funding; reduction of Mosaic's available cash and liquidity, and increased leverage, due to its use of cash and/or available debt capacity to fund financial assurance requirements and strategic investments; brine inflows at Mosaic's Esterhazy, Saskatchewan, potash mine or other potash shaft mines; other accidents and disruptions involving Mosaic's operations, including potential mine fires, floods, explosions, seismic events, sinkholes or releases of hazardous or volatile chemicals; and risks associated with cyber security, including reputational loss, as well as other risks and uncertainties reported from time to time in The Mosaic Company's reports filed with the Securities and Exchange Commission. Actual results may differ from those set forth in the forward-looking statements.

The Mosaic Company

The Mosaic Company – Leading Miner of Agricultural Minerals



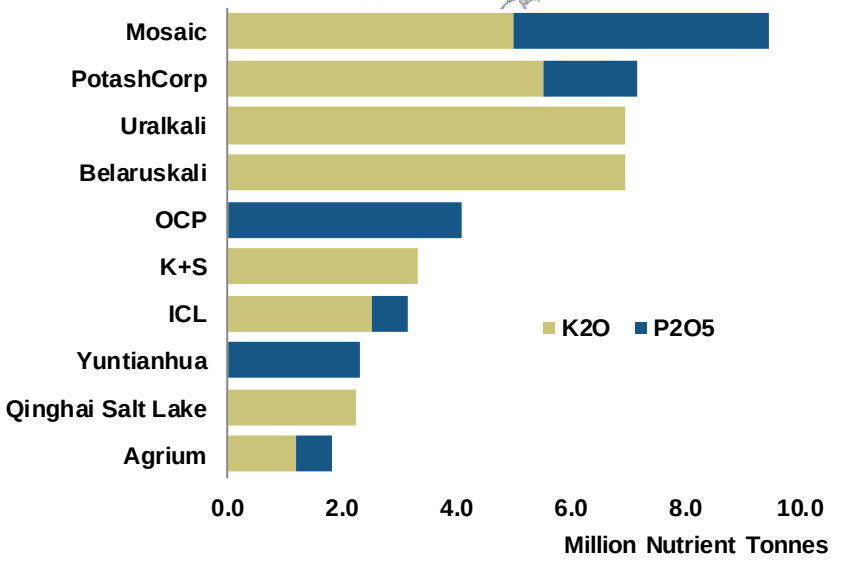
Mosaic helps the world grow the food it needs by **mining phosphorus (P) and potassium (K) minerals** and refining these ores into plant nutrient products that are essential for global agriculture.

In big round numbers, **our North American operations typically dig, pump, cut, convey and hoist 105 million tonnes of raw P&K ores** from the earth each year. We remove the sand, clay, salt and other elements to produce roughly 26 million tonnes of refined ores.

We then process these refined ores into about 19 million tonnes of finished products using an additional six million tonnes of purchased or manufactured raw materials such as sulphur and anhydrous ammonia.

The Mosaic Company

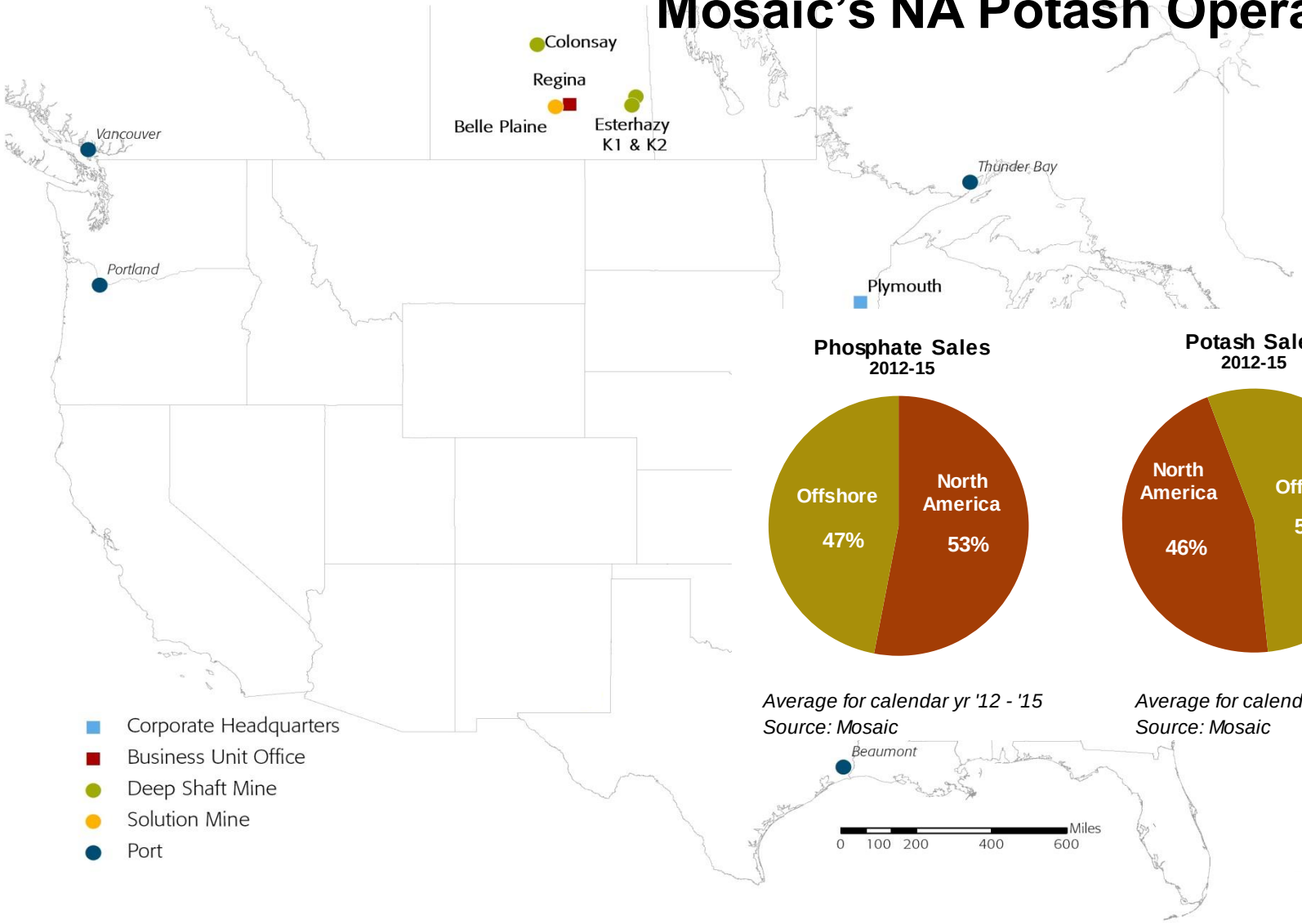
Mosaic's U.S. Phosphate Operations



Based on 2015 production
P_2O_5 production based on PACID and SSP production
K_2O production includes MOP, KMS, and SOP
Source: Company reports, IFA, CRU, and Mosaic estimates

The Mosaic Company

Mosaic's NA Potash Operations



Phosphate Sales
2012-15

Average for calendar yr '12 - '15
Source: Mosaic

Potash Sales
2012-15

Average for calendar yr '12 - '15
Source: Mosaic

Plant Nutrients

Plant Nutrients

- Plant nutrients are plant food
  (and common chemical elements)
- 17 chemical elements are required for plant growth
- N-P-K: the carbohydrates, protein and fat of a plant's diet
- Growing importance of secondary nutrients and micronutrients especially in high yield systems
- Justus von Liebig and the Law of the Minimum



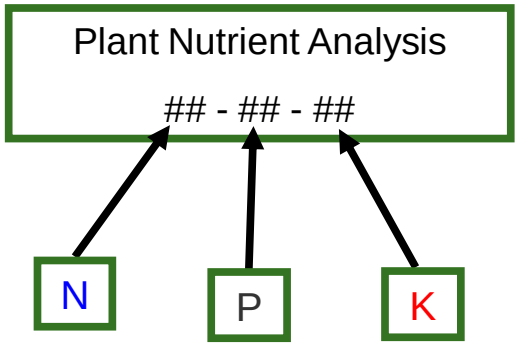
Image: TFI

Liebig's Barrel



Plant Nutrient Products

- Plant nutrients are contained in a variety of products
  - Much like nutrients for animals are contained in a variety of feed ingredients
  - Each plant nutrient product is identified by three numbers
    - Referred to as its “analysis”
    - Percentage of each primary nutrient contained in a unit of the product





Urea
46-0-0



Diammonium Phosphate (DAP)
18-46-0



Muriate of Potash (MOP)
0-0-60

The Challenge: Maintaining Soil Fertility and Safeguarding the Environment

- Soil fertility is maintained by replenishing the nutrients removed by crops each year
- Farmers maintain soil fertility and safeguard the environment by following the 4-Rs of nutrient stewardship
- The 4-Rs of nutrient stewardship
  - Right source
  - Right rate
  - Right time
  - Right place
- Best practices
  - Soil testing
  - Plant nutrient accounting
  - Variable rate technology
  - Multiple applications
  - Nitrogen inhibitors and slow release products

Nutrient Removal by Crop

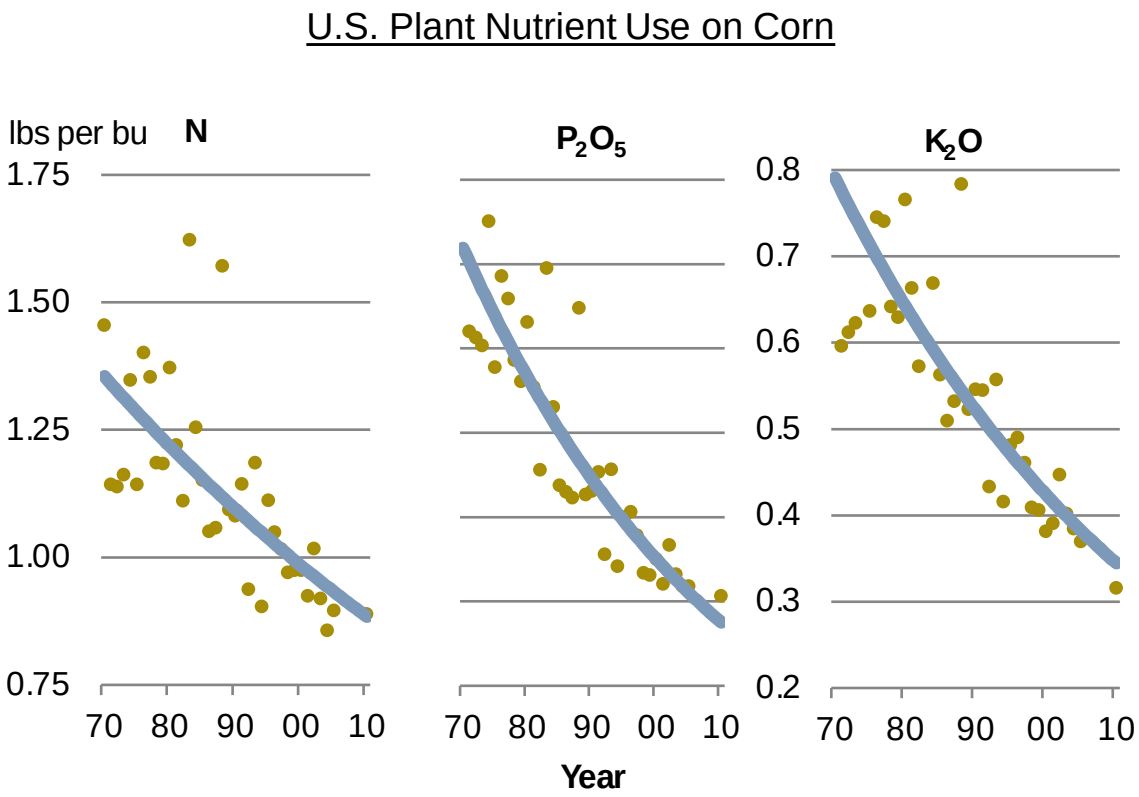
lbs Acre	N	P_2O_5	K_2O	S
Corn - 200 Bu Acre Yield				
Grain	180	76	54	16
Stalks	90	32	220	14
Total	270	108	274	30
Soybeans - 70 Bu Acre Yield				
Grain	266	59	91	13
Stover	77	17	70	12
Total	343	76	161	25
Wheat - 80 Bu Acre Yield				
Grain	120	48	27	8
Straw	56	13	96	11
Total	176	61	123	19

Source: IPNI

4 nutrient stewardship

Mosaic

Increasing Efficacy of Plant Nutrient Use



Source: USDA, AAPFCO, TFI

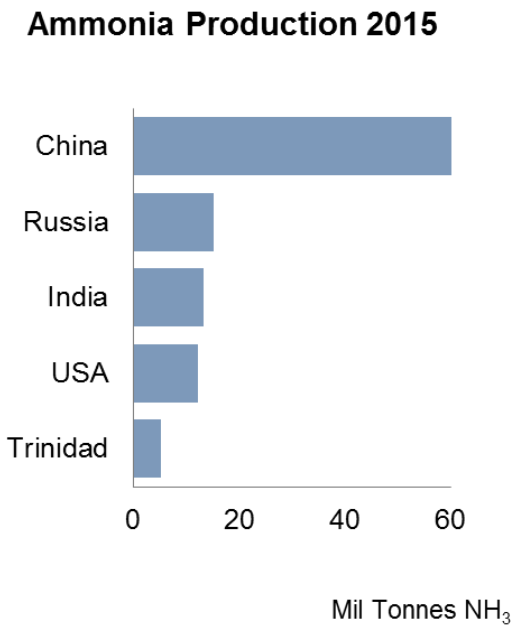
The efficacy of plant nutrient use has increased significantly in the United States during the last few decades.

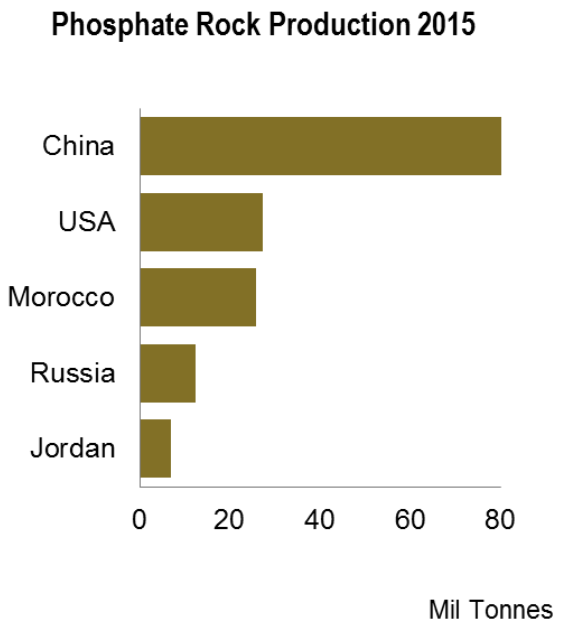
U.S. corn yield nearly doubled from 79 bushels per acre in 1970 to 157 bushels per acre in 2010. Yet primary nutrient application rates remained flat at 230 pounds per acre during the same period.

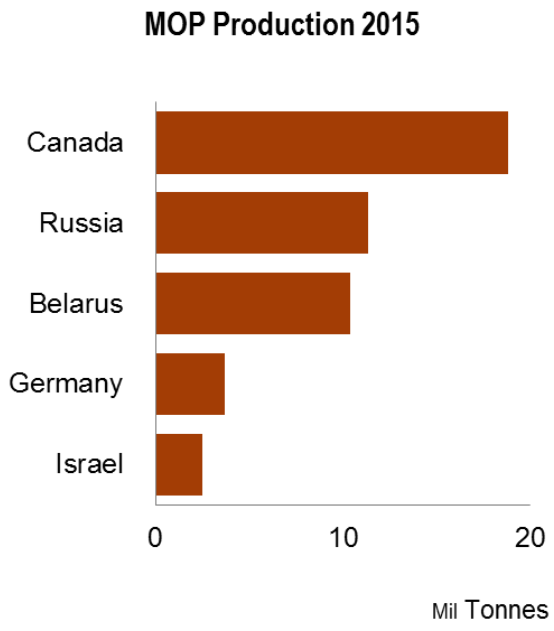
- **N** use per bushel of corn harvested declined one-third from about 1.45 pounds in 1970 to less than 0.9 pounds in 2010.
- **P_2O_5** use per bushel of corn dropped more than 60% from about 0.7 pounds in 1970 to roughly 0.3 pounds in 2010.
- **K_2O** use per bushel of corn also dropped more than 60% from about 0.8 pounds in 1970 to 0.3 pounds in 2010.

Manure usage has increased during this period, but ***U.S. farmers today are harvesting twice as much corn per acre with the same amount of commercial plant nutrients as used in 1970!***

Top Fertilizer Raw Material Producers



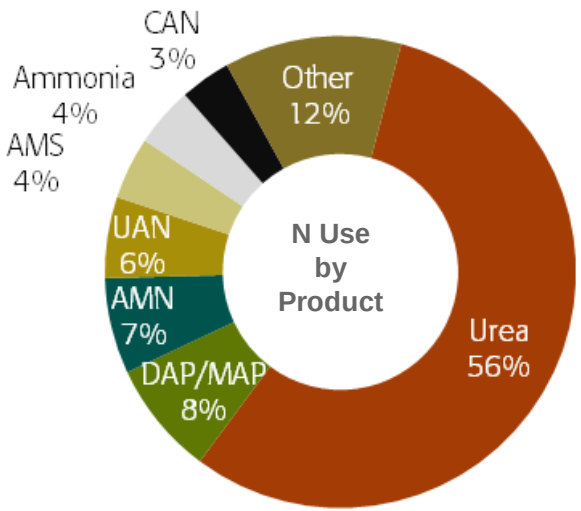


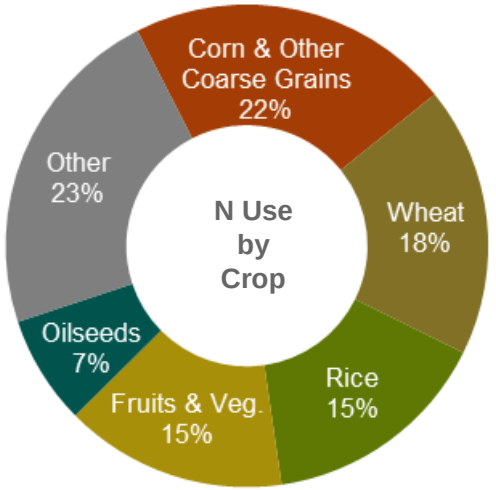


Source: CRU and Mosaic

Primary Plant Nutrient Overview

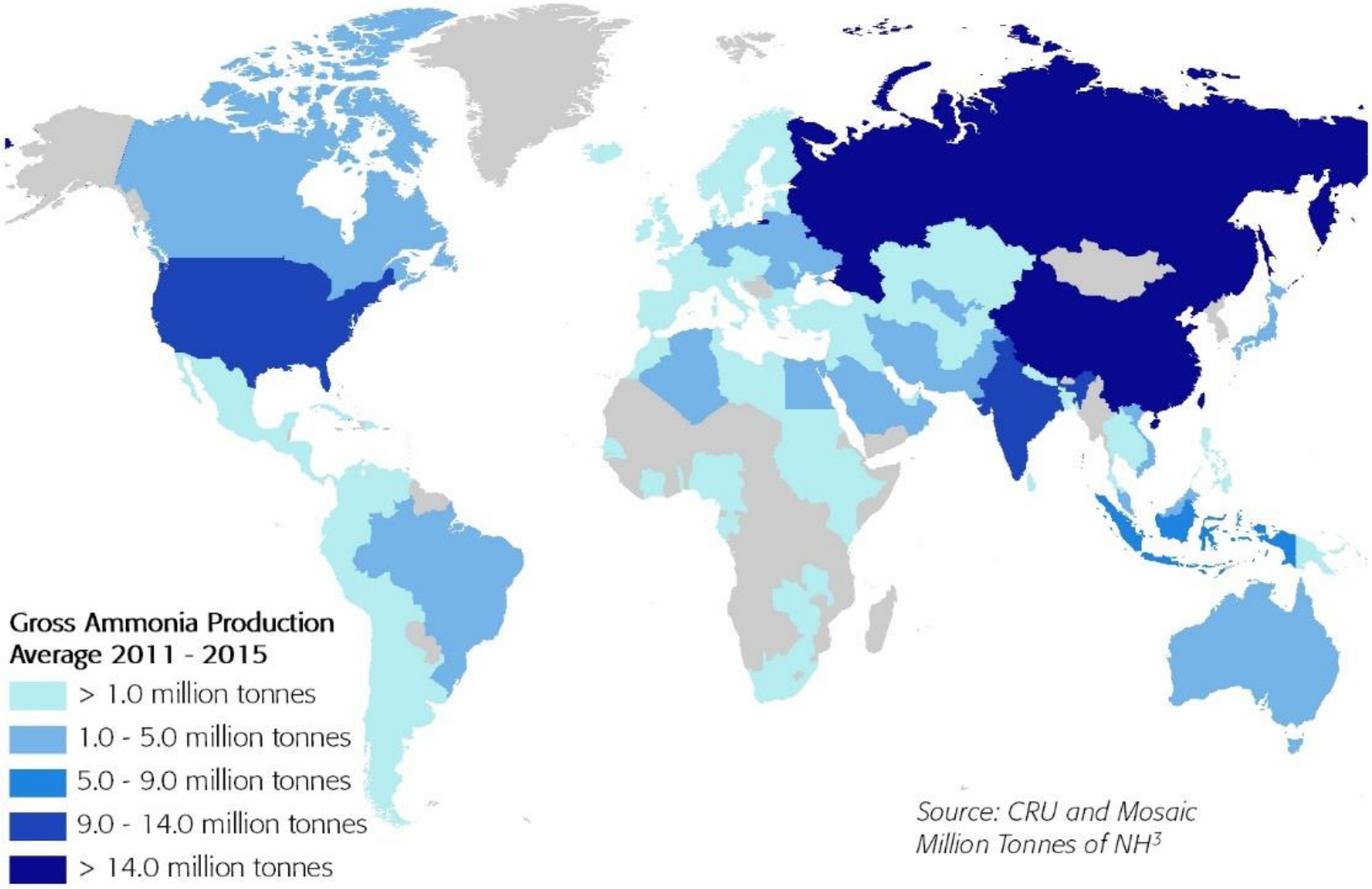
- Nitrogen (N)
  - Production process: highly energy intensive Haber-Bosch process to synthesize ammonia (NH_3) from inert atmospheric N and H
  - Key input: hydrocarbon feed stock (two-thirds produced from natural gas)
  - Global agricultural use: ~114 million tonnes N in 2014 or about 308 million tonnes of product
  - Main nitrogen products
    - Anhydrous ammonia (82% N – gas at normal temperatures and pressures)
    - Urea-ammonium nitrate (UAN) solution (28%-32% N – liquid)
    - Urea (46% N – solid)
    - Ammonium nitrate (34% N – solid)
    - Ammonium sulphate (21% N – solid)
    - Ammonium phosphate (DAP and MAP) products (10%-18% N – solid)
  - Leading producers: China, India, Russia, United States, Indonesia, Trinidad and Tobago, Ukraine, Canada, Middle East





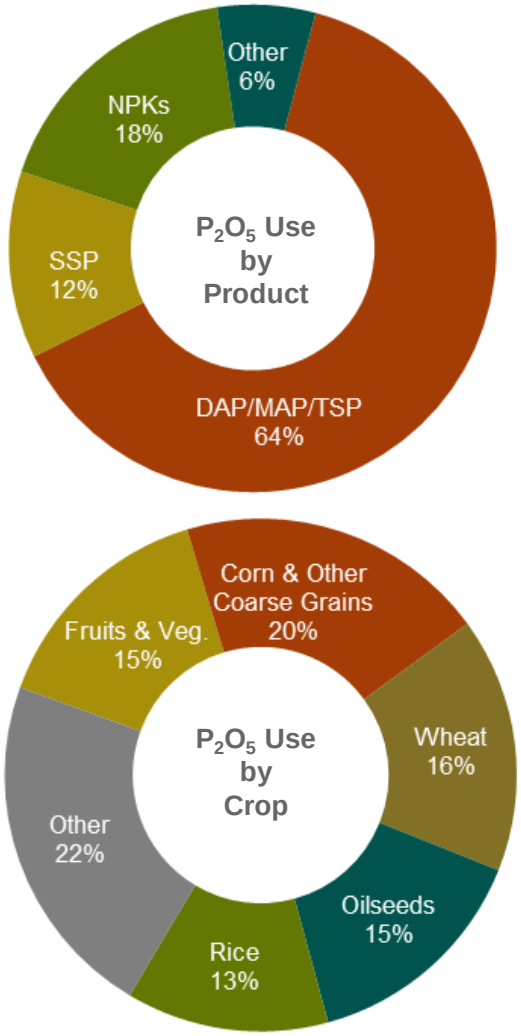
SOURCE: IFA, CRU, FERTECON AND MOSAIC

Global Ammonia Production



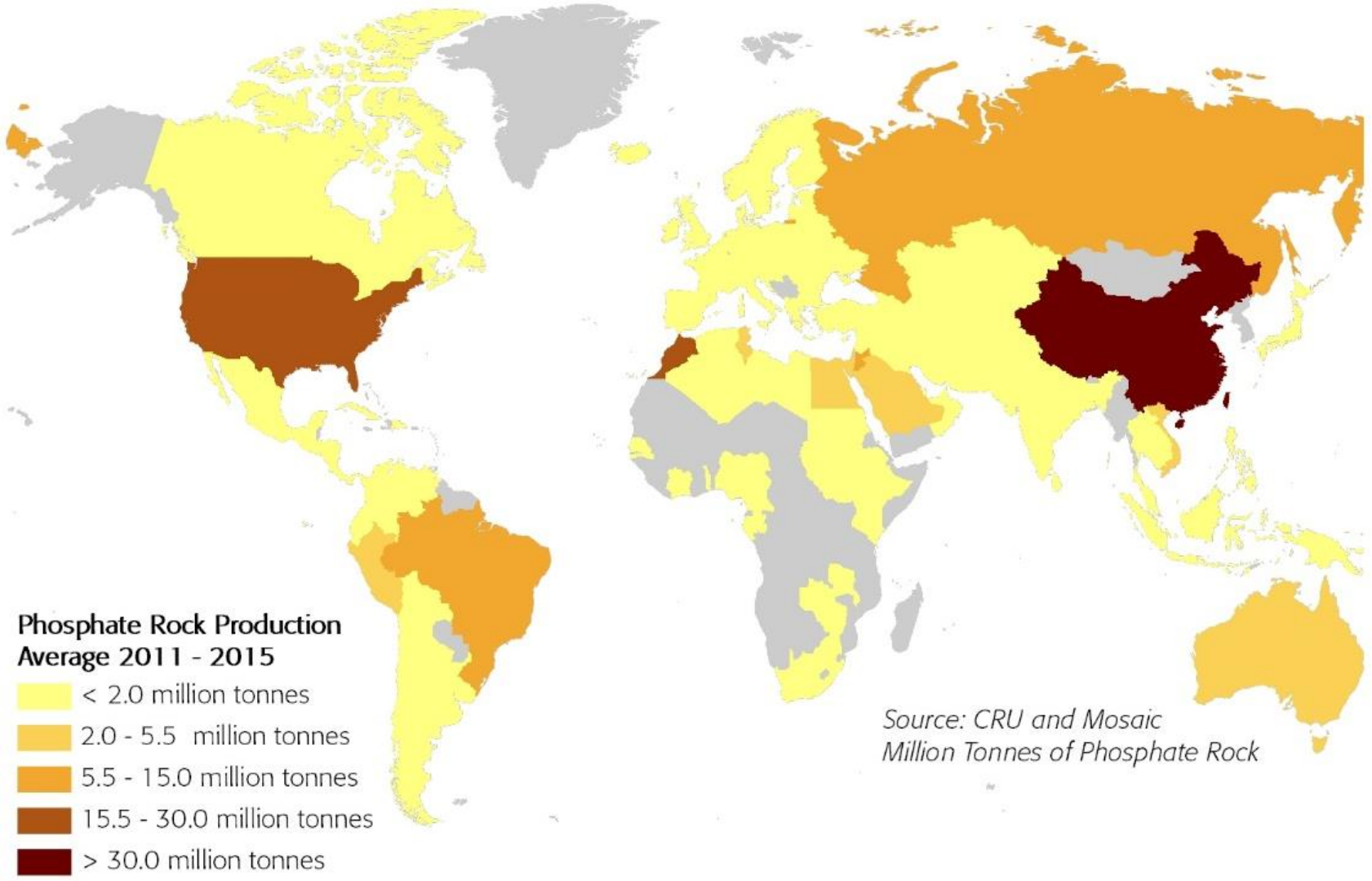
Primary Plant Nutrient Overview

- Phosphate (P)
  - The production process - making phosphorus water soluble
  - Key inputs: phosphate rock mineral ore, sulphur and ammonia
  - Global agricultural use: ~44 million tonnes P_2O_5 in 2014 or about 129 million tonnes of product
  - Main phosphate products
    - Diammonium phosphate (DAP) (46% P_2O_5 – solid)
    - Monoammonium phosphate (MAP) (52% P_2O_5 – solid)
    - Triple superphosphate (TSP) (46% P_2O_5 – solid)
    - Single superphosphate (SSP) (18%-22% P_2O_5 – solid)
    - NPK and NP compounds (% P_2O_5 varies – both solid and liquid)
  - Leading producers: China, United States, Morocco/North Africa, India, Russia, Brazil, Saudi Arabia



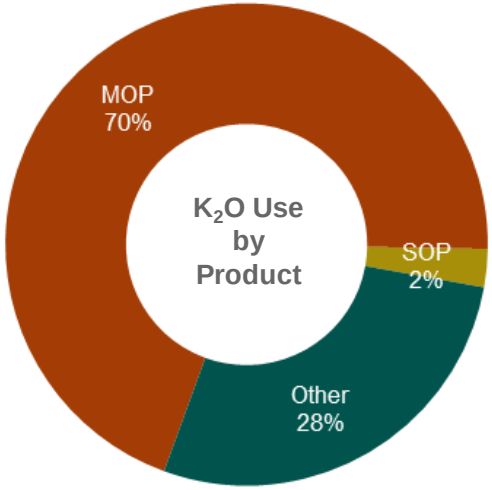
SOURCE: IFA, CRU, FERTECON AND MOSAIC

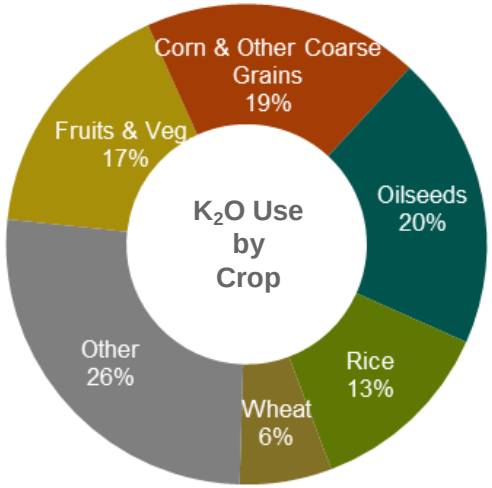
Global Phosphate Rock Production



Primary Plant Nutrient Overview

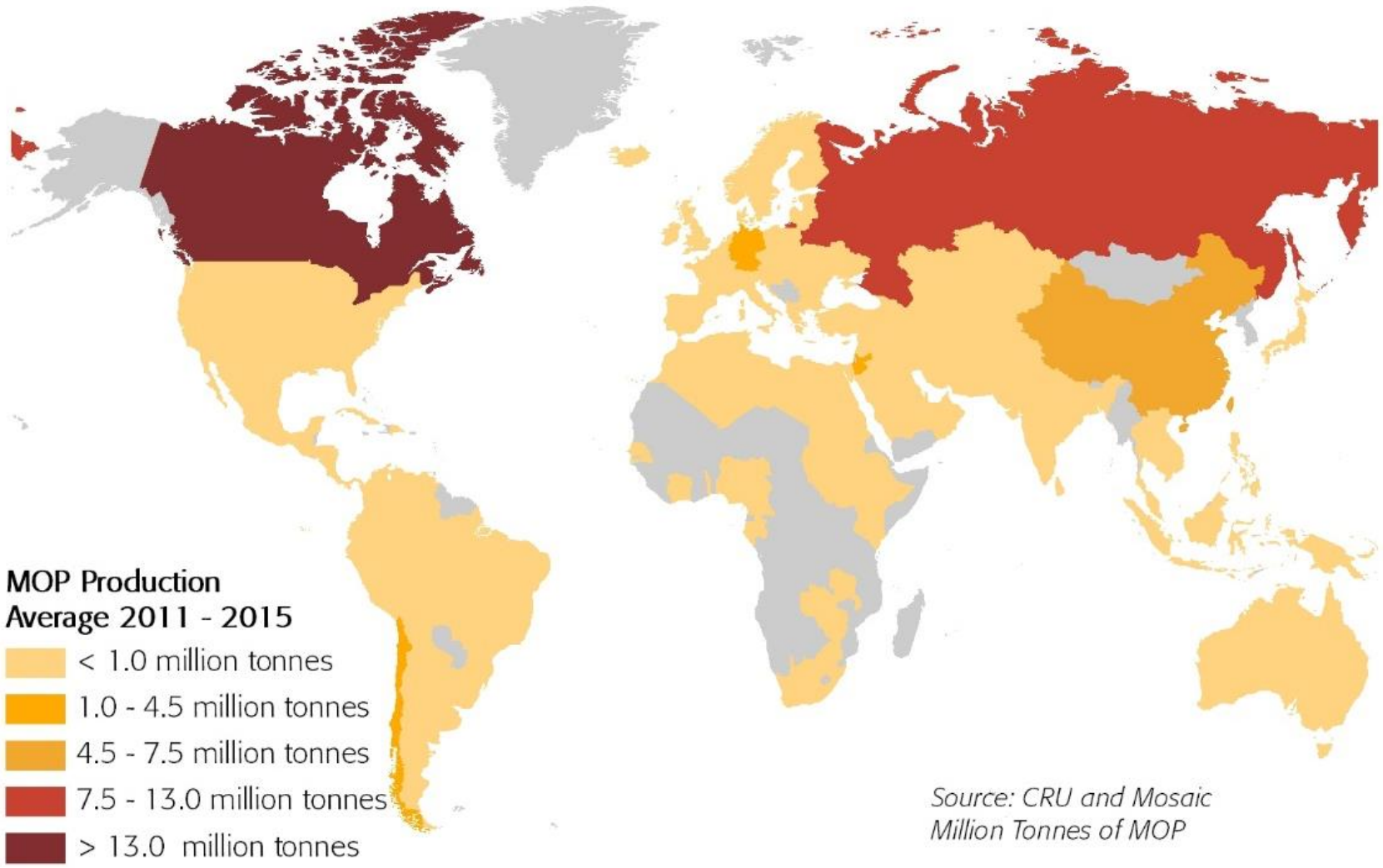
- Potash (K)
  - Production process: simple separation processes
  - Key inputs: potash mineral ore (sylvinite, carnallite and langbeinite)
    - Conventional underground mines (1000+ meters deep)
    - Solution mines
    - Salt lake brines (e.g. Dead Sea, Qinghai and Great Salt Lake)
  - Global agricultural use: ~35 million tonnes K_2O in 2013 or about 61 million tonnes product
  - Main potash products
    - Potassium chloride or muriate of potash (MOP) (60-62% K_2O – solid)
    - Potassium sulphate or sulphate of potash (SOP) (50% K_2O – solid)
    - Potassium-magnesium-sulphate (22% K_2O – solid)
  - Leading producers: Canada, Russia, Belarus, Germany, China, Israel, Jordan



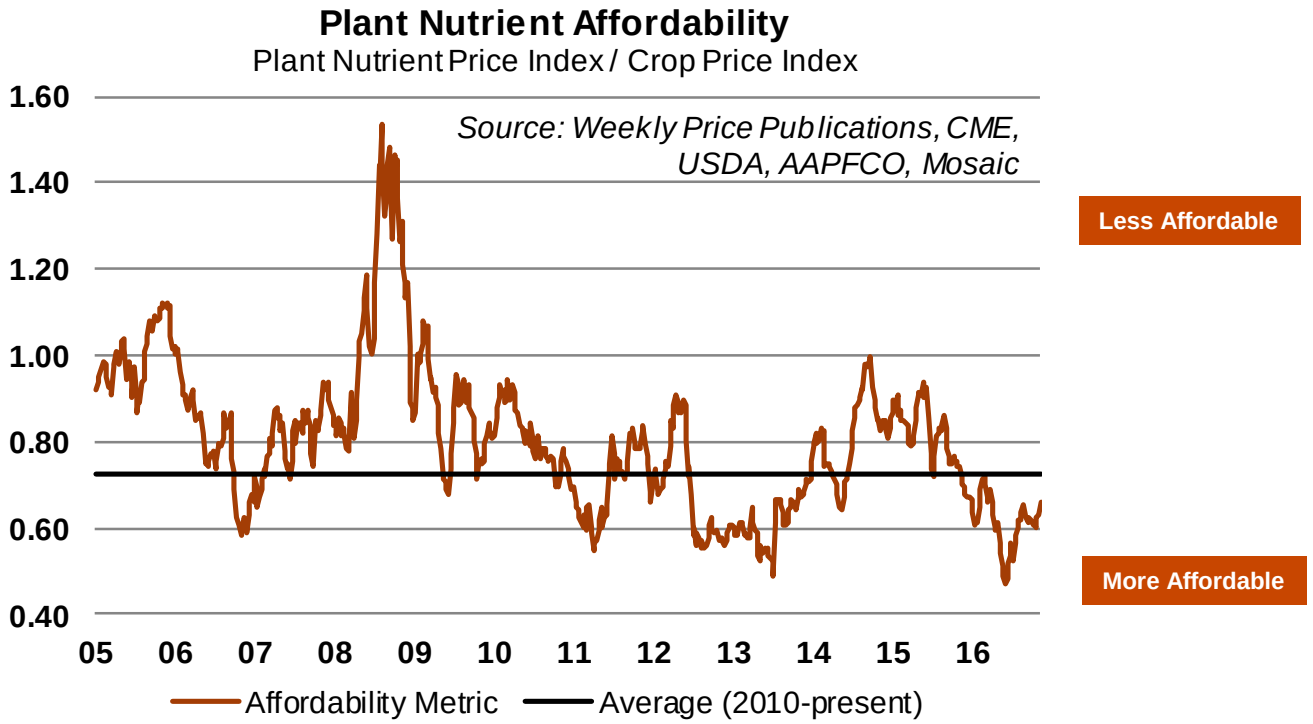


SOURCE: IFA, FERTECON AND MOSAIC

Global MOP Production



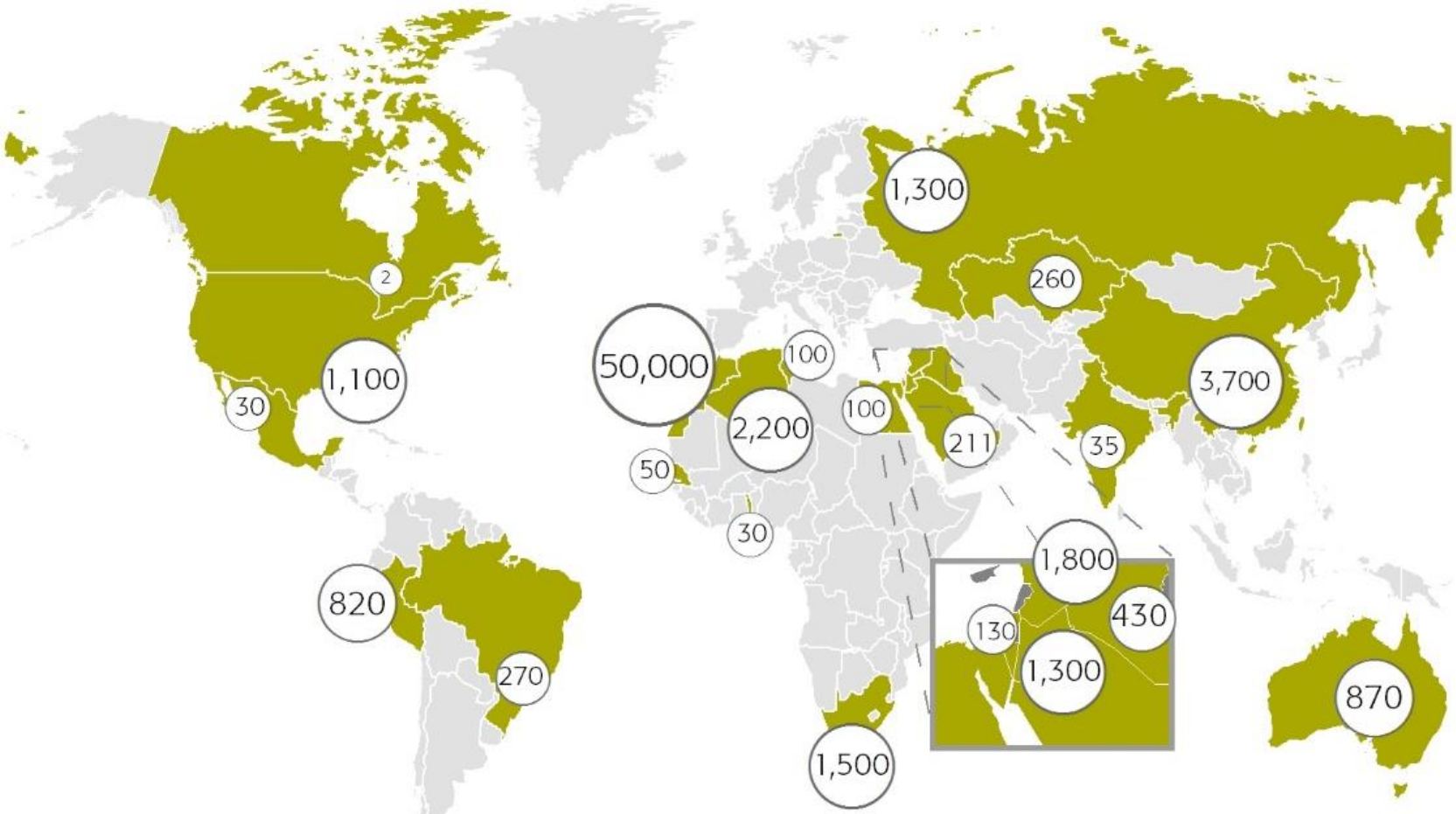
Lower fertilizer prices in 2016 underpin demand as crop nutrients became more affordable



- Our plant nutrient affordability metric has bobbed and weaved with changes in agricultural commodity and plant nutrient prices, but the current reading indicates that plant nutrients are among the most affordable they have been in the past three years.
- Versus a year ago, affordability has improved due to crop prices holding up but significantly lower plant nutrient costs.

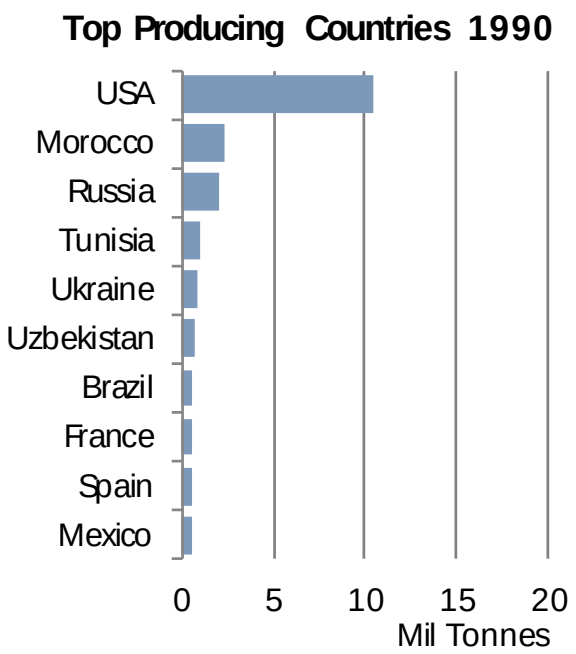
The Phosphate Market and Industry

Global Phosphate Reserves



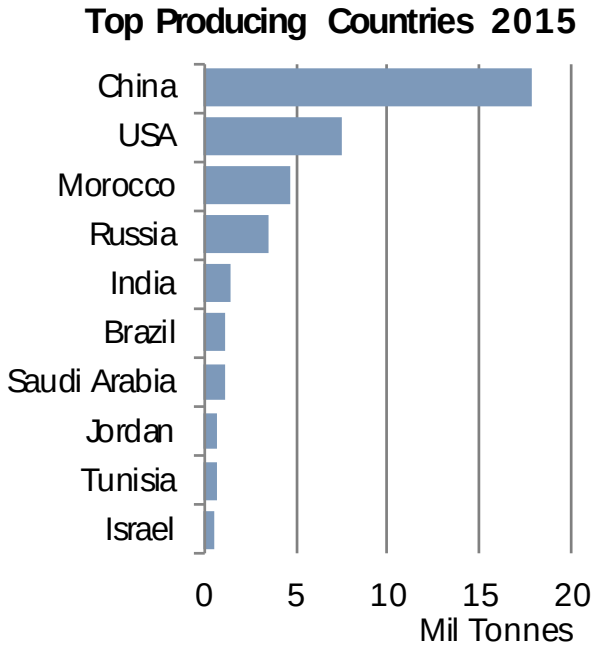
Global Phosphate Rock Reserves
Million Tonnes Phosphate Rock
Source: USGS, 2014

Global Phosphoric Acid Production: All about China over the past 25 years



Tonnes Phosphoric Acid

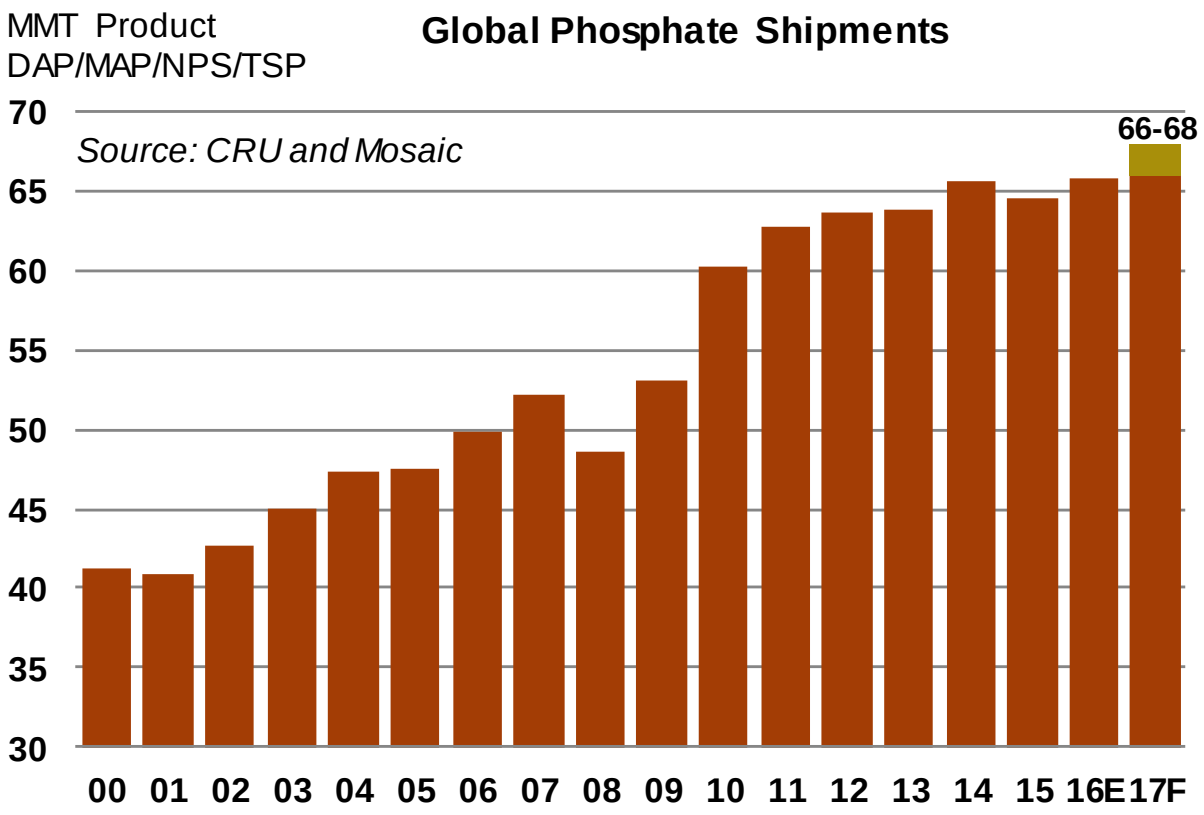
Source: Fertecon and Mosaic



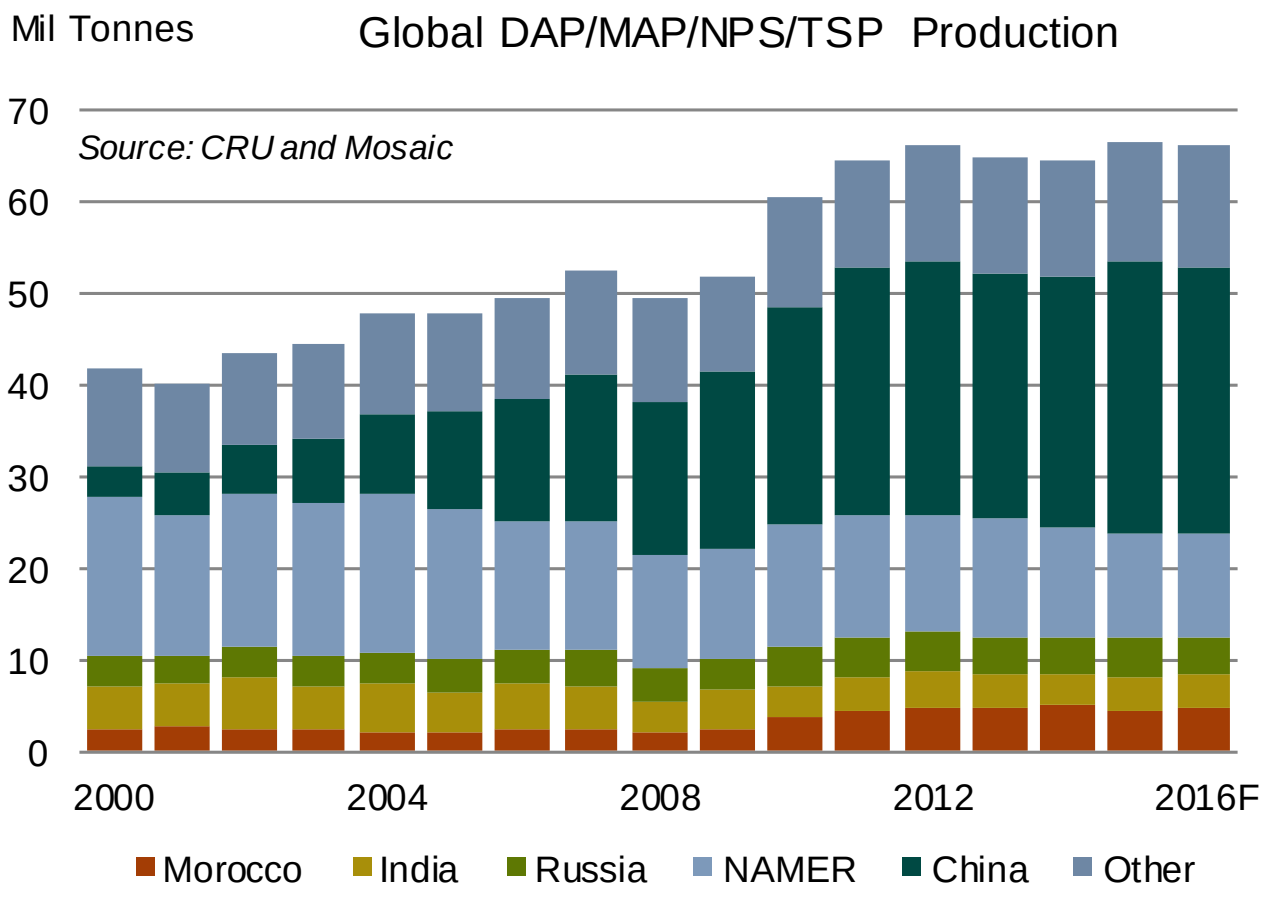
Tonnes Phosphoric Acid

Source: CRU and Mosaic

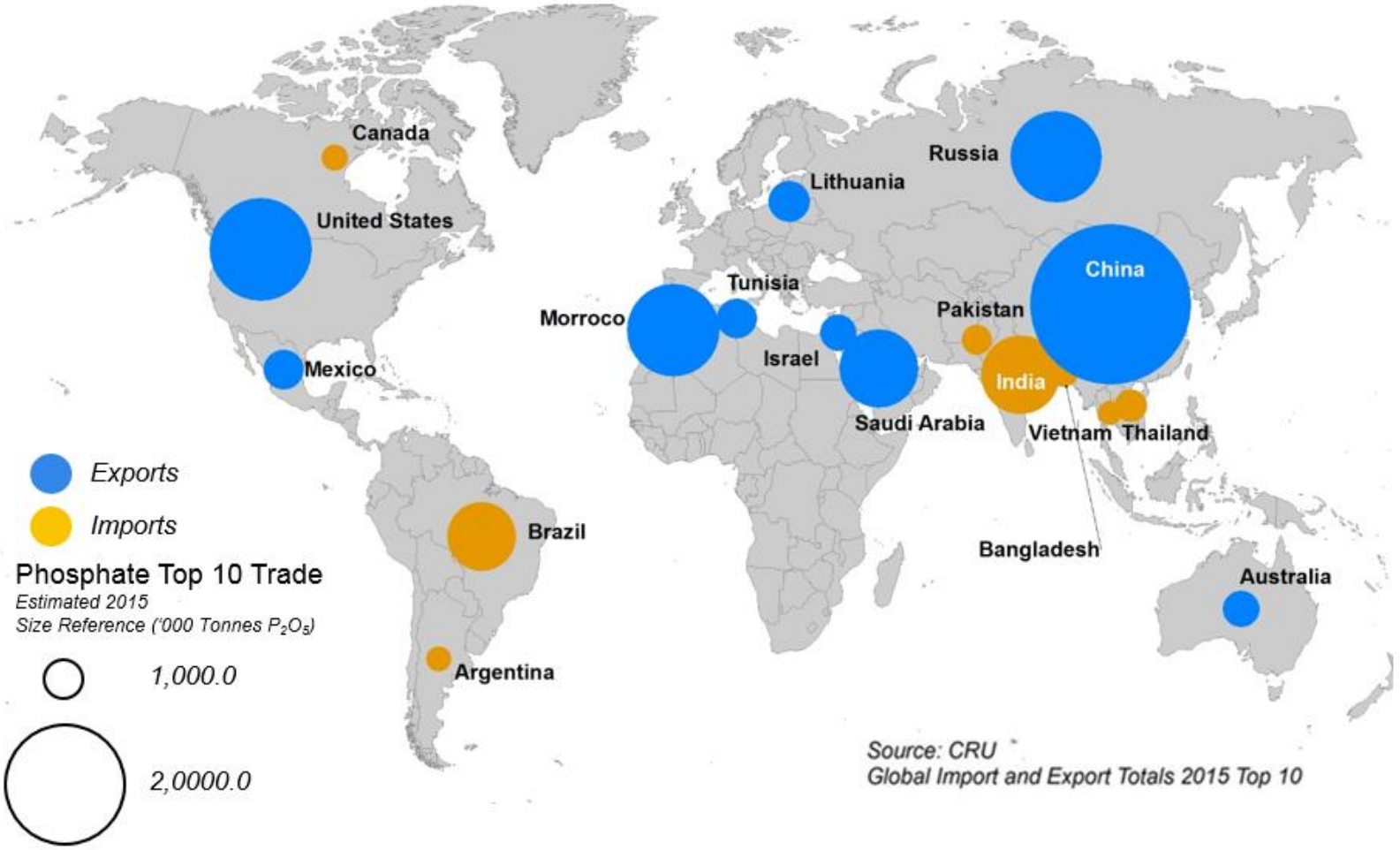
Global Phosphate Product Shipments



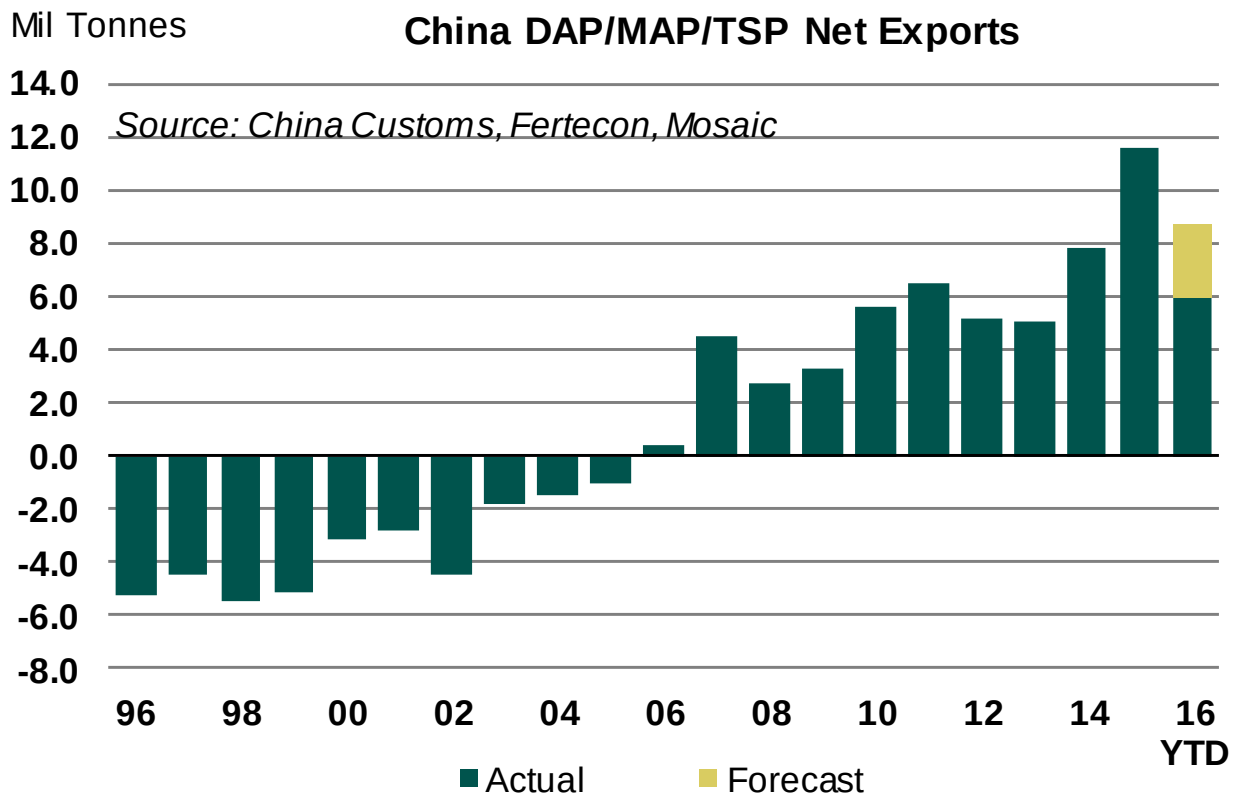
Global Phosphate Product Production (DAP/MAP/NPS/TSP)



Phosphate Product Trade (DAP/MAP/TSP)

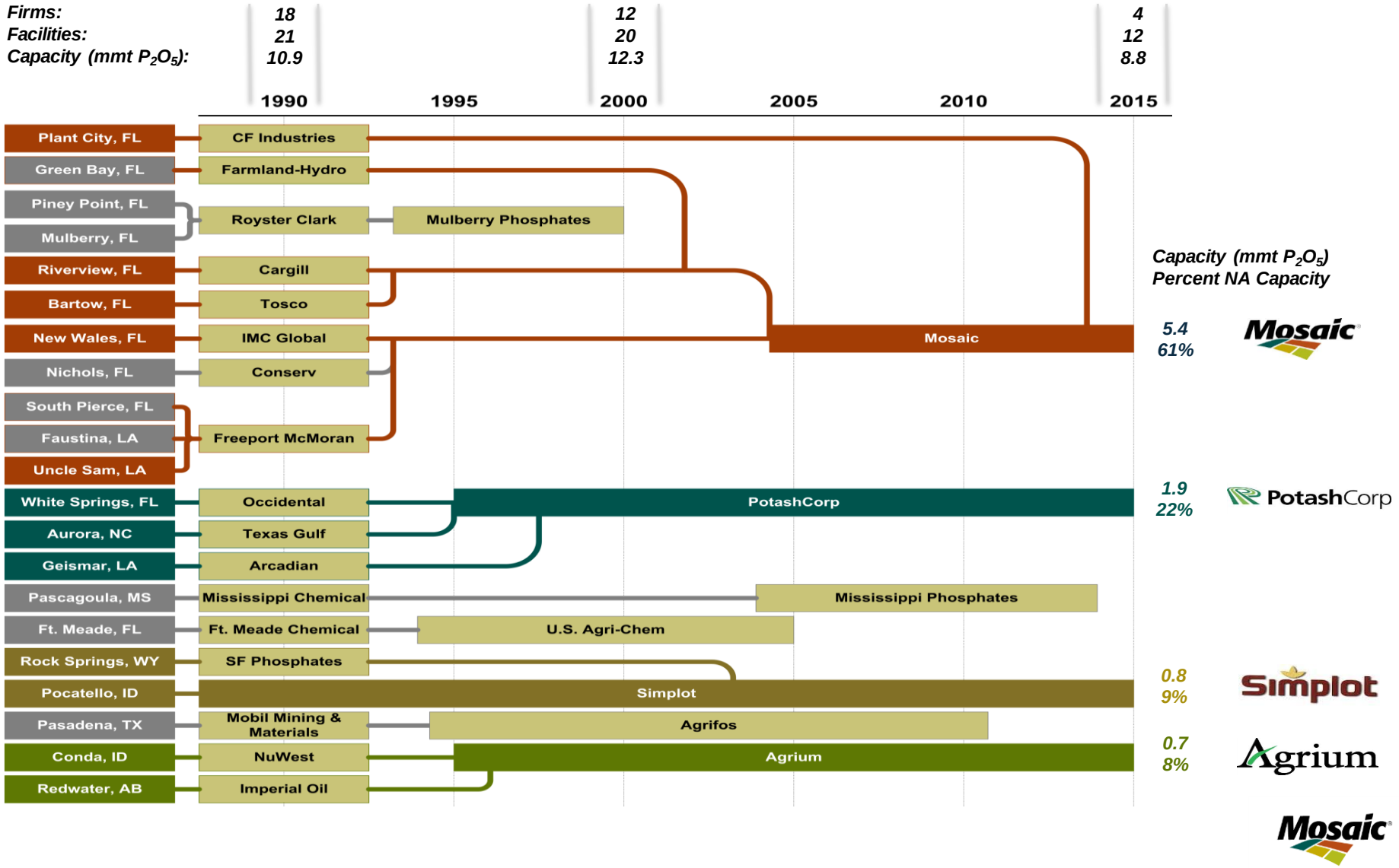


Chinese Exports Falter in 2016: A New Normal?



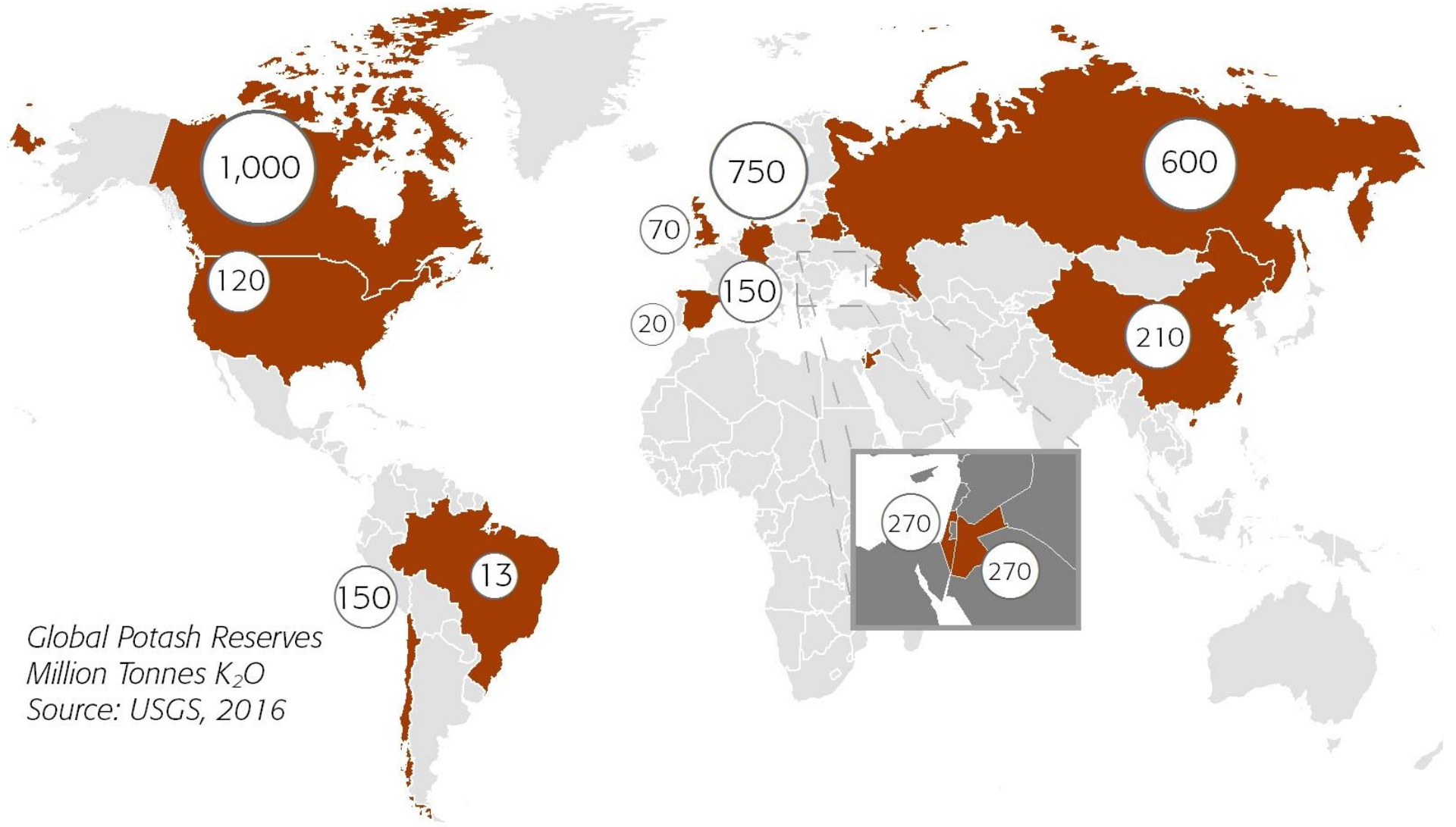
Evolution of the U.S. Phosphate Industry

(Phosphoric Acid Facilities/Capacity)

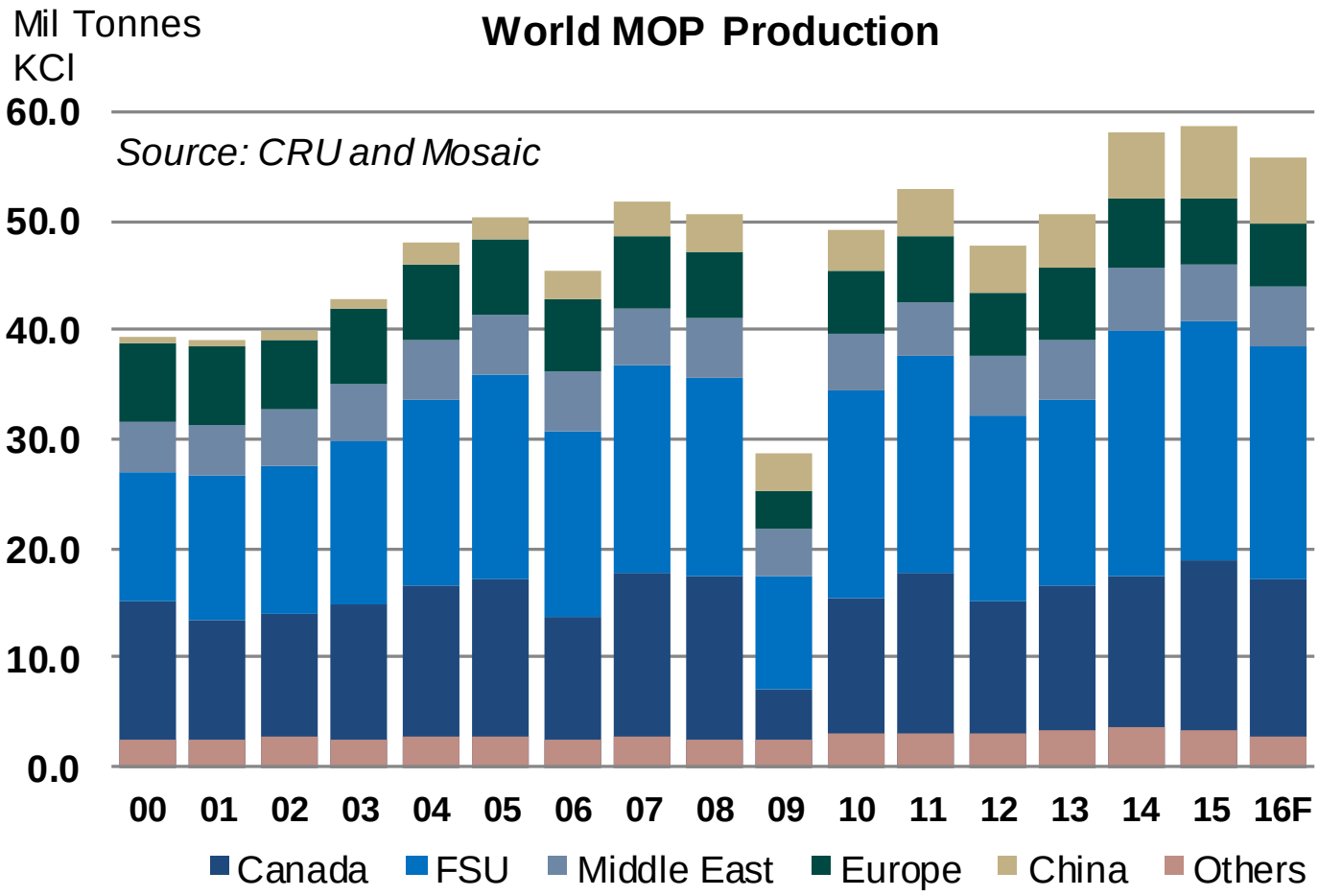


The Potash Market and Industry

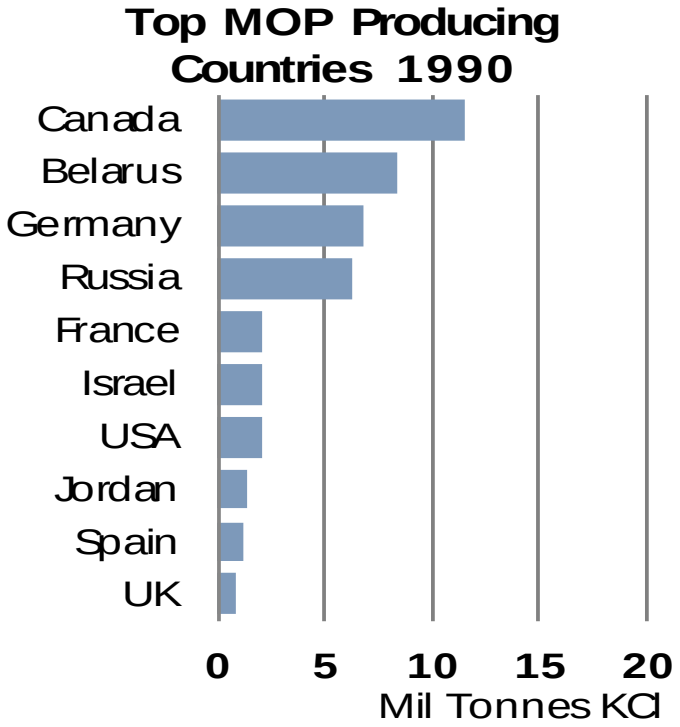
Global Potash Reserves



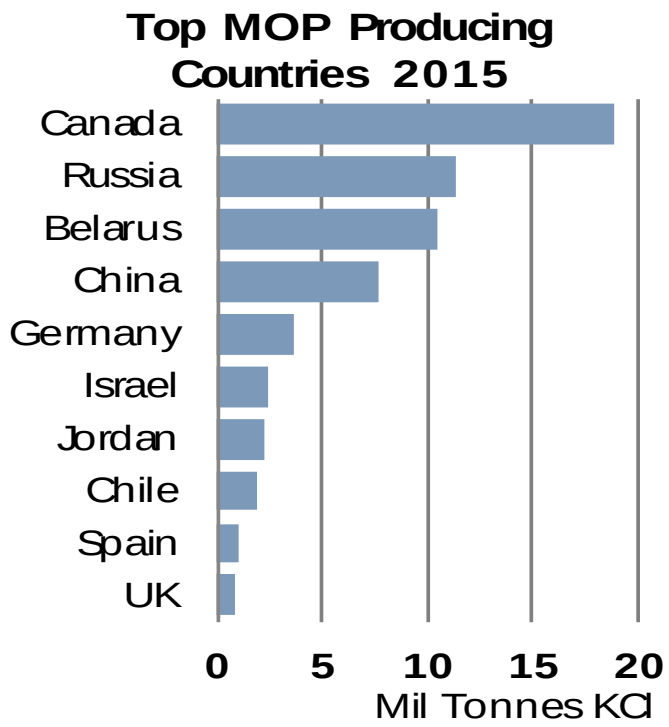
Global Potash Production (MOP)



Production in Canada and FSU has grown to meet global demand, and China built an industry

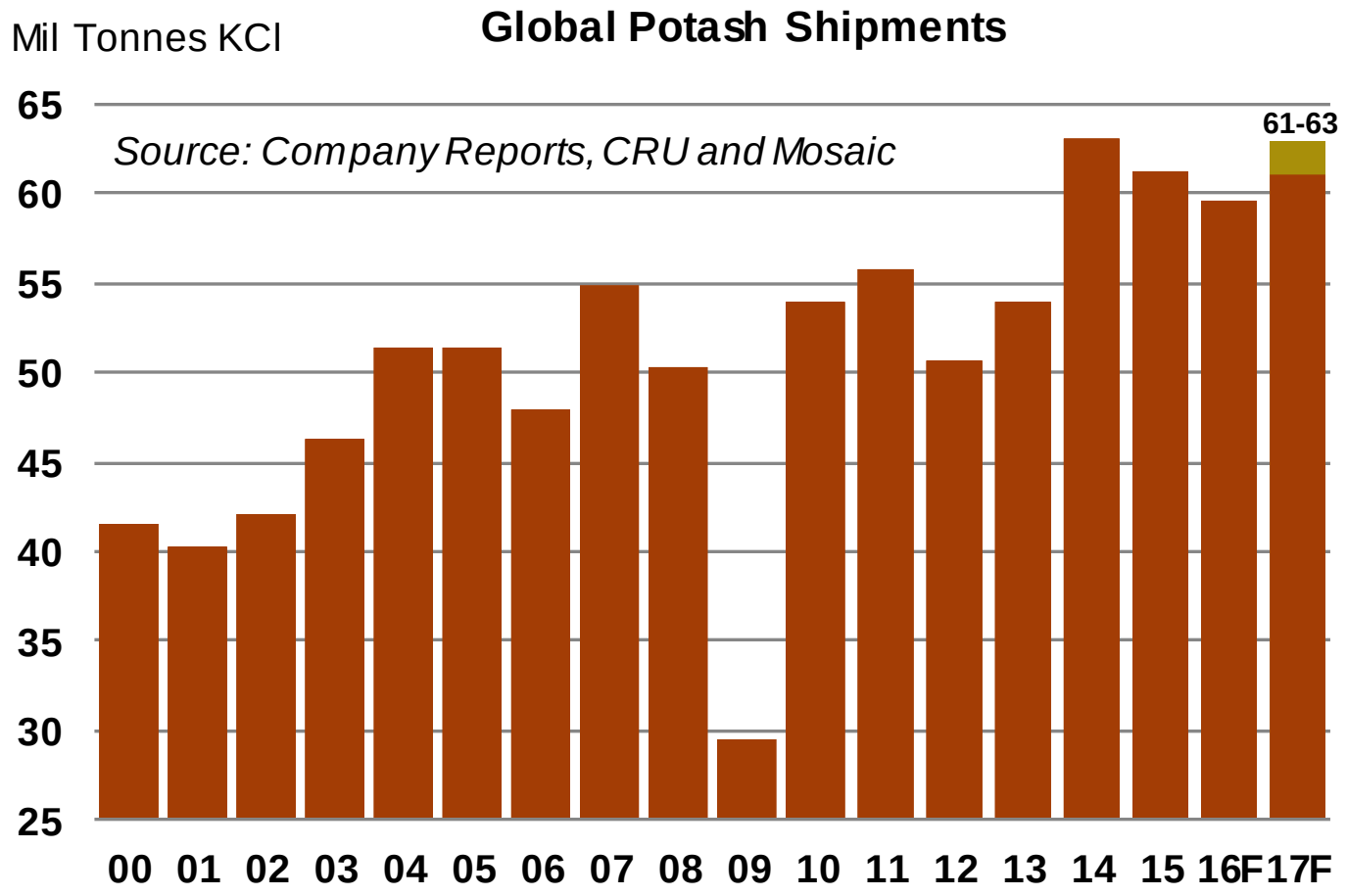


Source: Fertecon and Mosaic

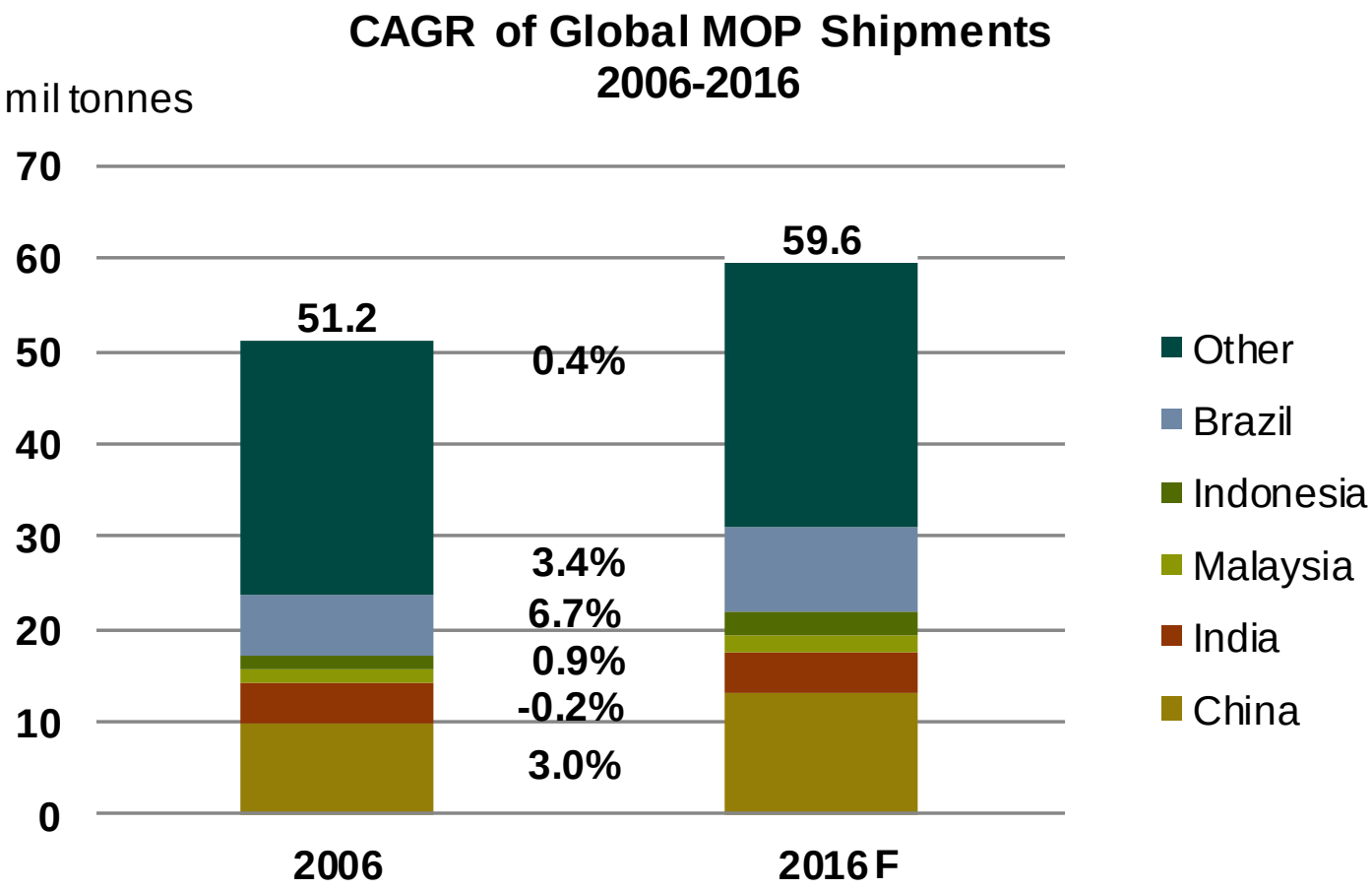


Source: CRU and Mosaic

Global Potash Shipments (MOP)

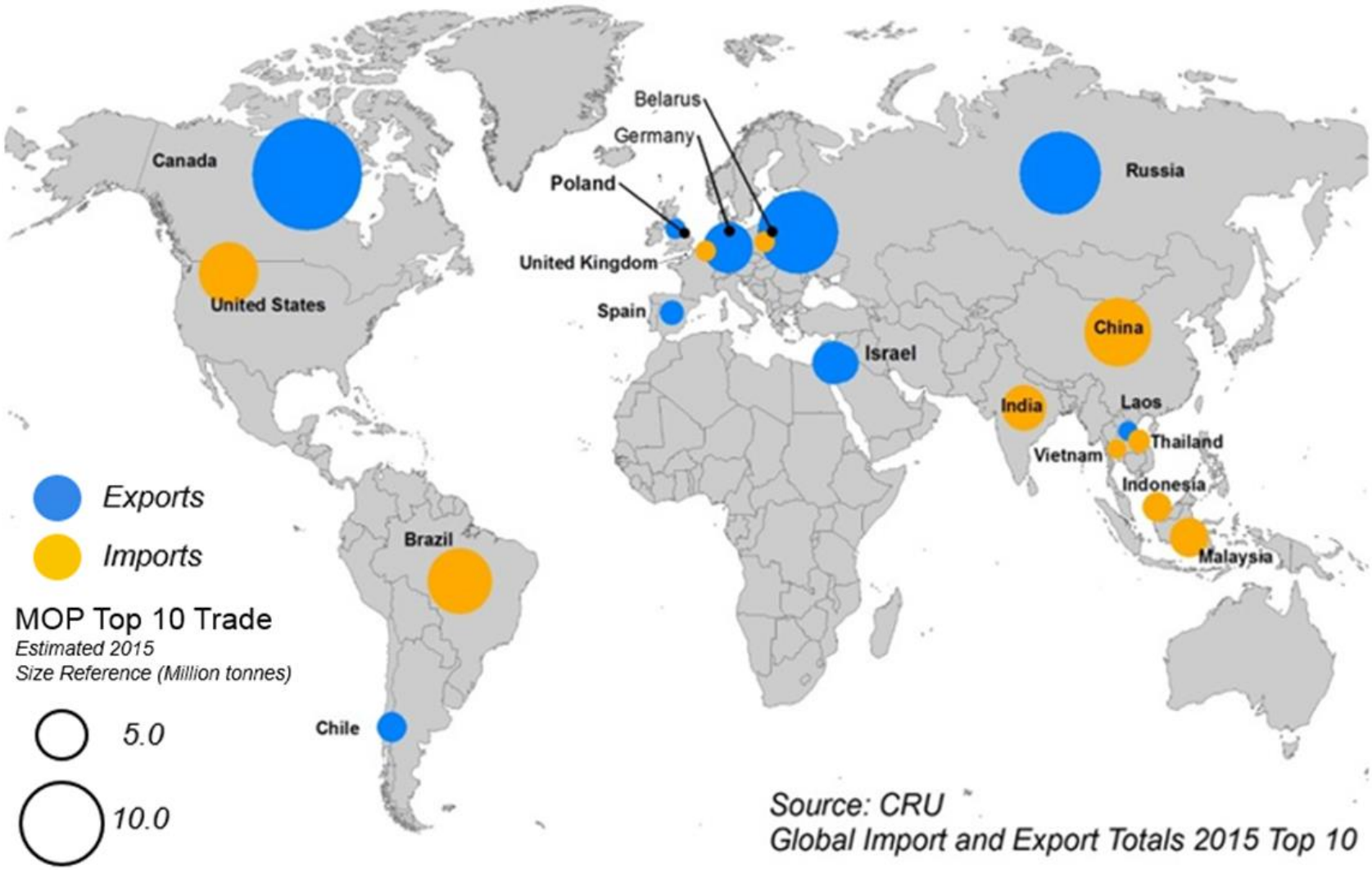


Global Potash Shipments (MOP)



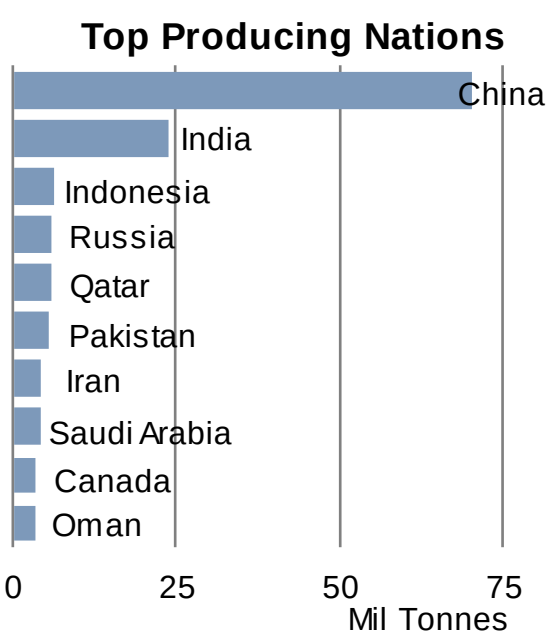
Source: Company Reports, CRU and Mosaic

MOP Trade Flows Dominated by Canada / FSU

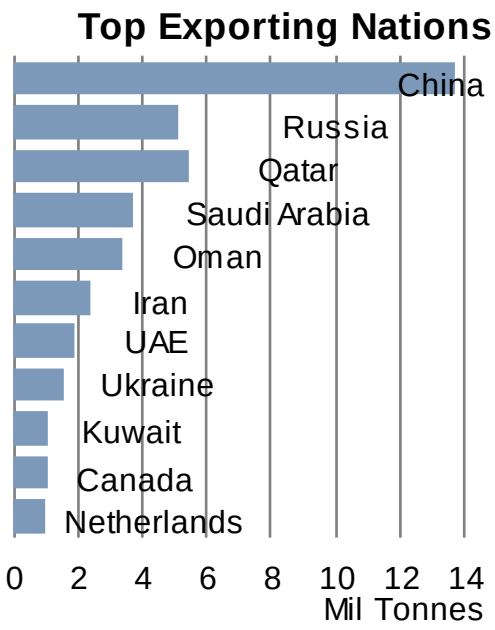


The Nitrogen Market and Industry

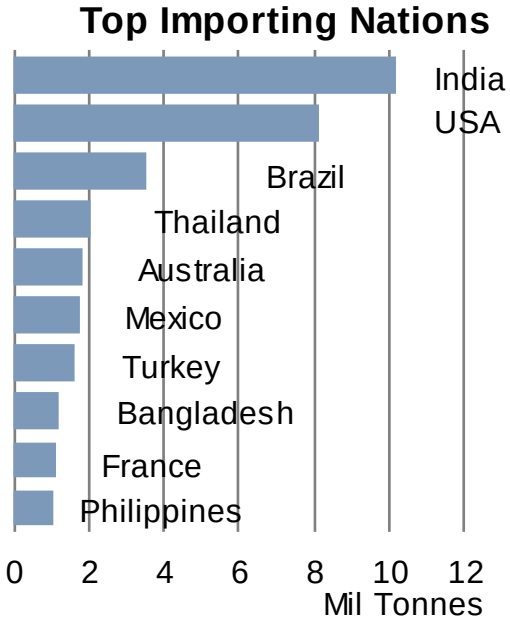
Urea Production and Trade



Source: IFA
Top producers in 2015

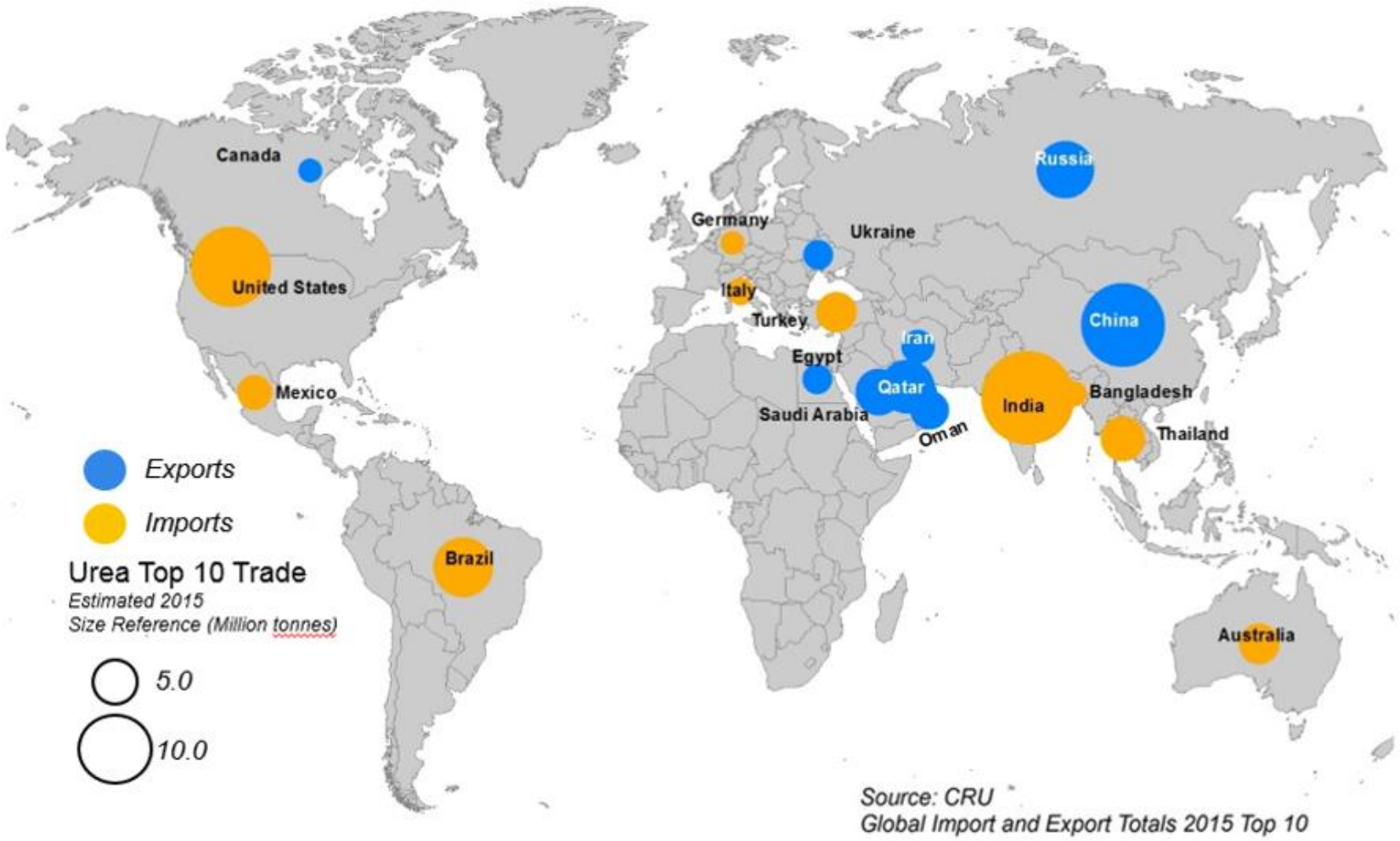


Source: IFA
Top exporters in 2015

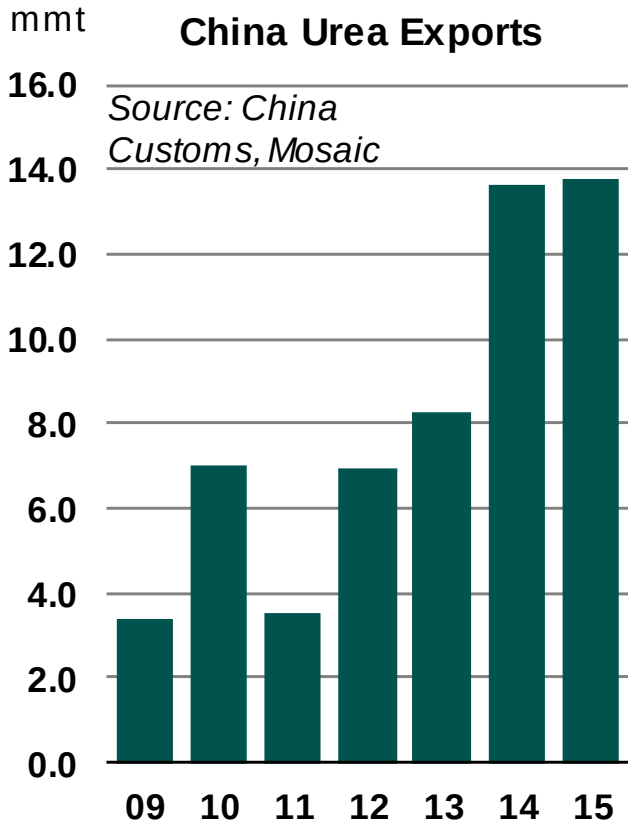


Source: IFA
Top importers in 2015

Nitrogen (urea) Trade Flows



Chinese urea exports slowed dramatically in 2016

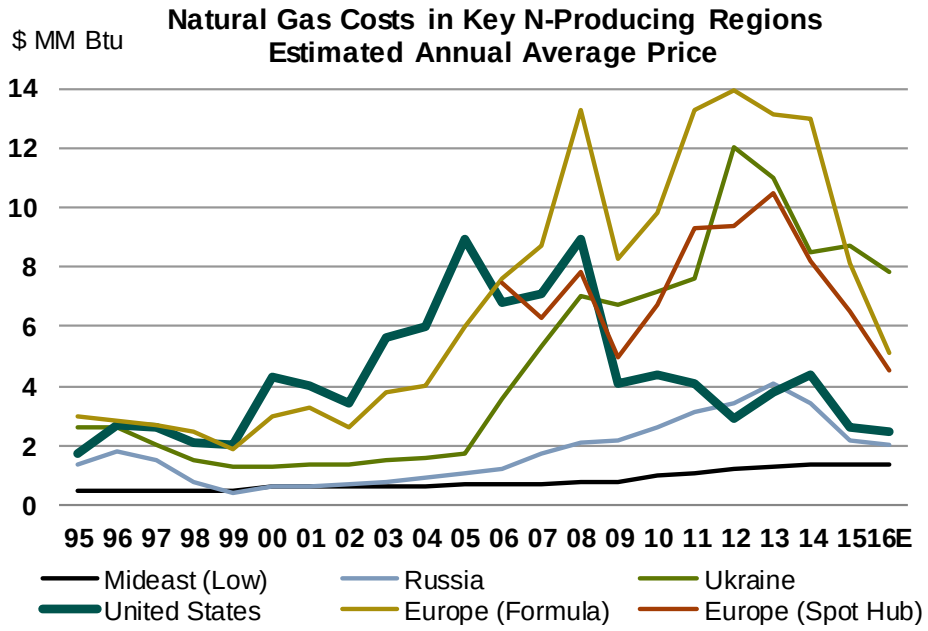


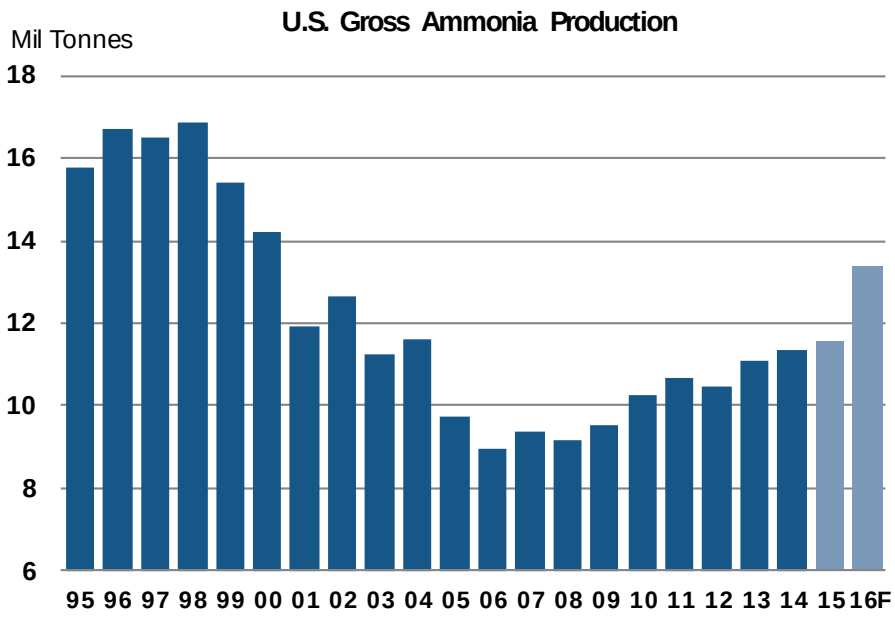
Year-To-Date

1000 MT	YTD 2016	YTD 2015	% Chg Prior Yr	7-Yr Avg	% Chg 7-Yr Avg
Urea Exports	7,459	9,529	-22%	4,390	70%

Source: China Customs (through September)

Ever Evolving U.S. Nitrogen Industry





Source: Fertecon

This presentation and other products available on the Mosaic website

- Mosaic Stakeholder Handbook
- Market Mosaic
- Market Alerts
- Past Presentations



http://www.mosaicco.com/resources/market_analysis.htm

Thank You!

Chemicals for the Non-Chemist

Plant Nutrients and Plant Nutrient Markets

Citi Basic Materials Conference
New York, NY
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Andy J. Jung
Director, Market and Strategic Analysis
The Mosaic Company

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