

Chemicals for the Non-Chemist

Plant Nutrients and Plant Nutrient Markets

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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 the Ma'aden joint venture), the acquisition and assumption of certain related liabilities of the Florida phosphate assets of CF Industries, Inc. ("CF") and Mosaic's ammonia supply agreements with CF; repurchases of stock; 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 the Ma'aden joint venture 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 the Ma'aden joint venture and any future changes in those plans; difficulties with realization of the benefits of the long term ammonia supply agreements with CF, including the risk that the cost savings from the agreements may not be fully realized or that the price of natural gas or ammonia changes to a level at which the natural gas based pricing under one of these agreements becomes 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, 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 Ma'aden joint venture, 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 share repurchases, 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 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

Phosphate

Potash



105 Million Tonnes Raw Ore





26 Million Tonnes Refined Ore





19 Million Tonnes Finished Products



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.

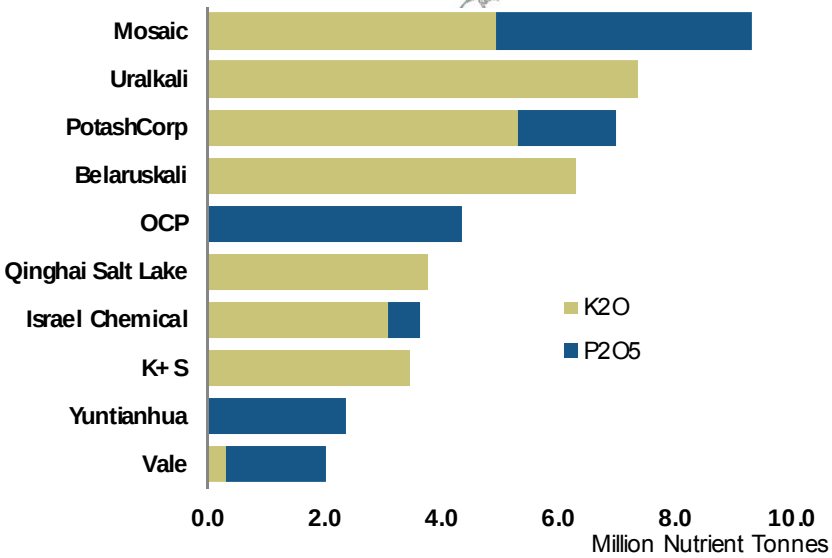
In big round numbers, our North American operations typically dig, pump, cut, convey and hoist 105 million tonnes of raw P&K ores from the earth each year. We remove the sand, clay, salt and other elements to produce roughly 26 million tonnes of refined ores.

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.

Mosaic

The Mosaic Company

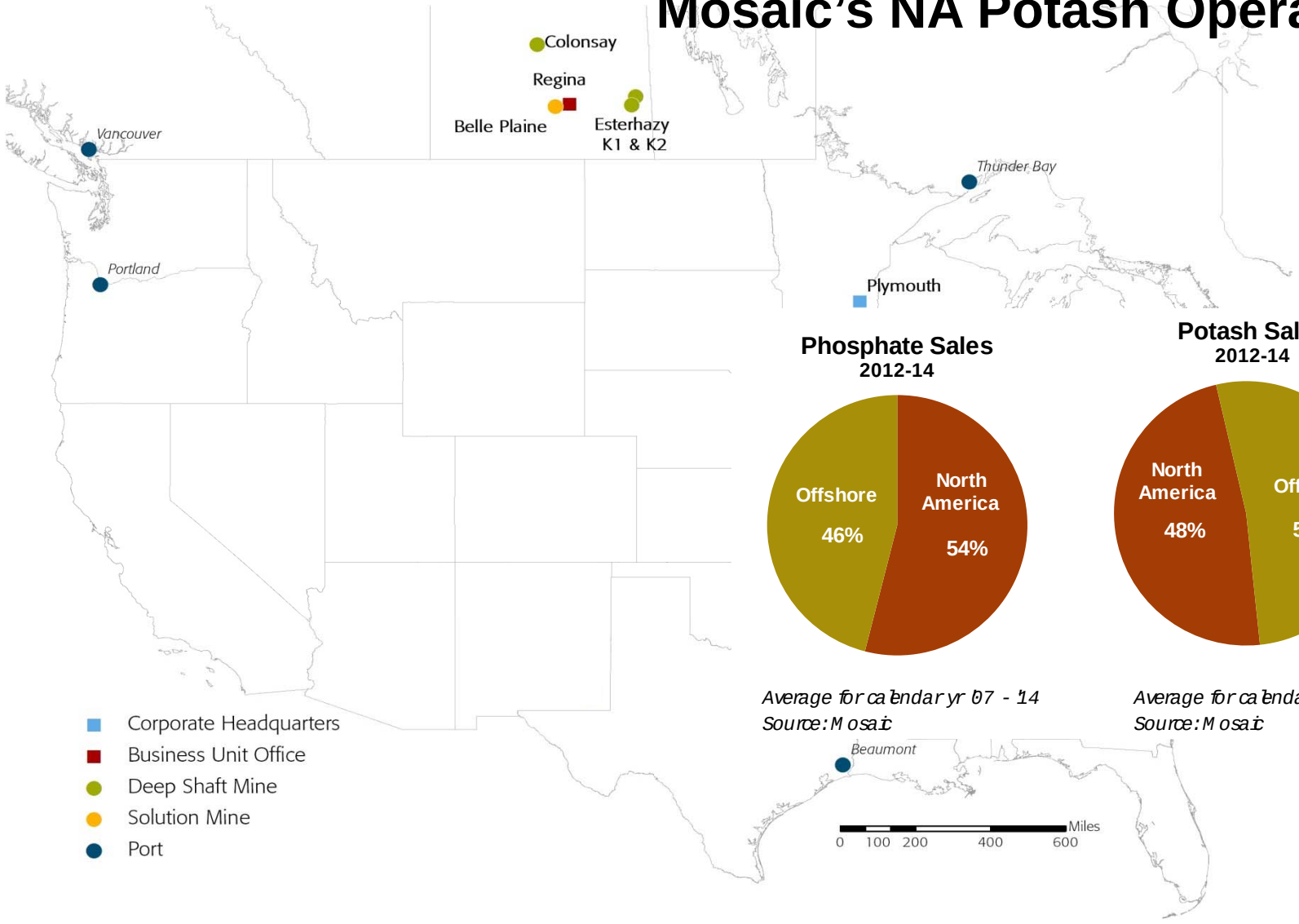
Mosaic's U.S. Phosphate Operations



Based on 2014 production
Mosaic's P_2O_5 production includes CF Industries' phosphate business
P_2O_5 production based on PACID and SSP production
K_2O production based on MOP, SOP, and KMS production
Source: Company reports, IFA, CRU, and Mosaic

The Mosaic Company

Mosaic's NA Potash Operations



Phosphate Sales
2012-14

Average for calendar yr '07 - '14
Source: Mosaic

Potash Sales
2012-14

Average for calendar yr '07 - '14
Source: Mosaic

Plant Nutrients

Plant Nutrients

- Plant nutrients are plant food (and common chemical elements)
- 17 chemical elements are required for plant growth

Non-Mineral Elements	Macronutrients		Micronutrients	
	Primary	Secondary		
C - Carbon	K - Potassium	Ca - Calcium	B - Boron	Mn - Manganese
H - Hydrogen	N - Nitrogen	Mg - Magnesium	Cl - Chlorine	Mo - Molybdenum
O - Oxygen	P - Phosphate	S - Sulphur	Cu - Copper	Ni - Nickel
			Fe - Iron	Zn - Zinc

- Justus von Liebig and the Law of the Minimum
- 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

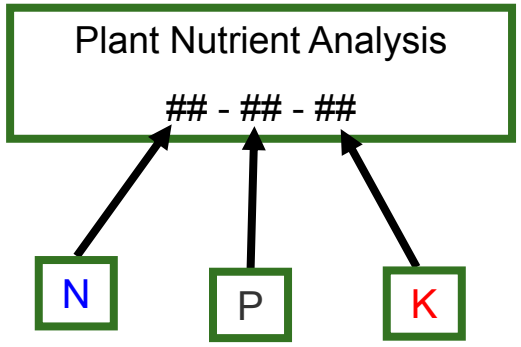


Liebig's Barrel

Image: TFI

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





29-0-4 Lawn Fertilizer



20-0-0 Liquid Fertilizer



20-27-5 Starter Fertilizer



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

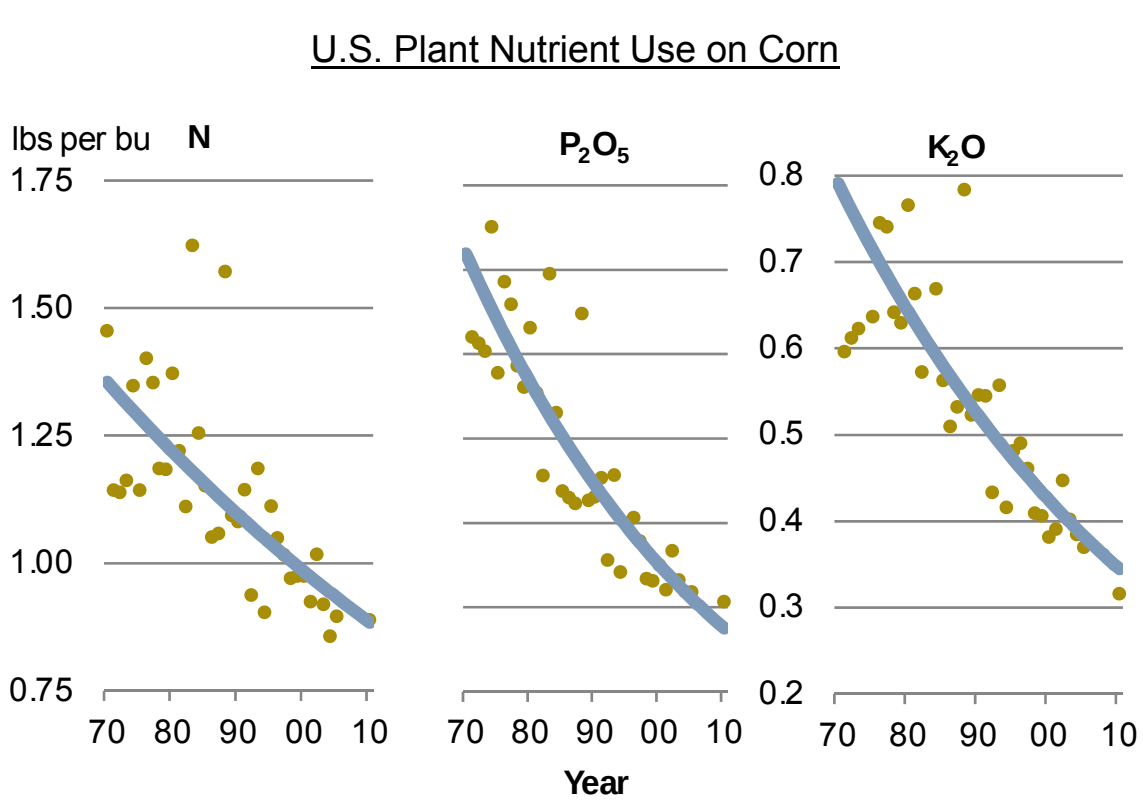


Nutrient Removal by Crop

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

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. Department of Agriculture data show that the three-year average 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.

Nitrogen use per bushel of corn harvested declined one-third or from about 1.45 pounds in 1970 to less than 0.9 pounds in 2010. Phosphorus use per bushel of corn dropped more than 60% from about 0.7 pounds in 1970 to roughly 0.3 pounds in 2010. Potassium 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!*

Critical Role of Plant Nutrients

- Plant nutrients are responsible for 40% to 60% of crop yields
- Vital role in meeting the challenge of feeding more than nine billion people in 2050



Dr. Norman Borlaug
1914-2009

No one understood this challenge better or communicated it more effectively than Dr. Norman Borlaug. Borlaug, widely acclaimed as the Father of the Green Revolution, developed disease resistant and high yielding wheat varieties that are credited with saving hundreds of millions of people from starvation in the 1960s and 1970s. India's wheat output doubled from 12 million tonnes in 1965 to 24 million tonnes in 1975. Veterans of the Green Revolution joyfully recount how the country frequently ran out of jute bags to store and transport the bountiful harvests.

Borlaug, the strong farm boy (and accomplished wrestler) from Cresco, Iowa and a proud graduate of the University of Minnesota, won the Nobel Peace Prize in 1970 for the development of these new varieties as well as his tireless efforts to work with farmers to gain their acceptance. Borlaug was driven by his strong conviction that it is impossible to build a peaceful world on empty stomachs.

"Farmers can feed the world. Better seeds and fertilizer, not romantic myths, will let them do it."

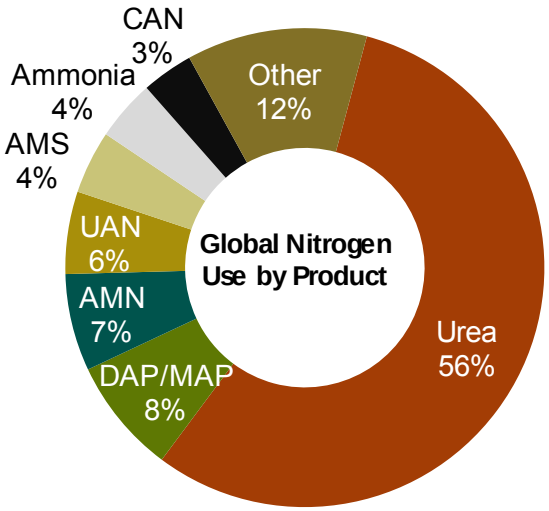
Dr. Norman Borlaug
Wall Street Journal
July 30, 2009

"This is a basic problem – to feed 6.6 billion people. Without chemical fertilizer, forget it. The game is over."

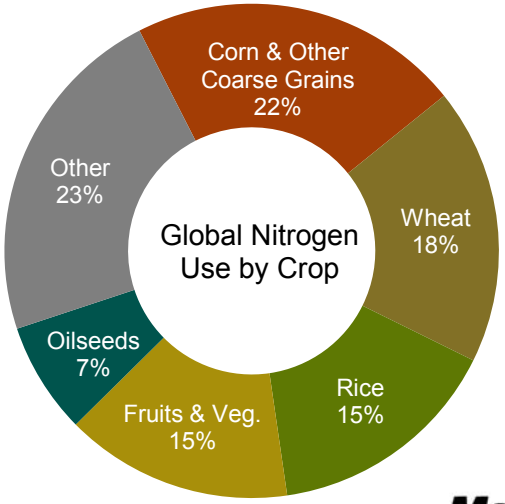
Dr. Norman Borlaug
New York Times
April 30, 2008

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

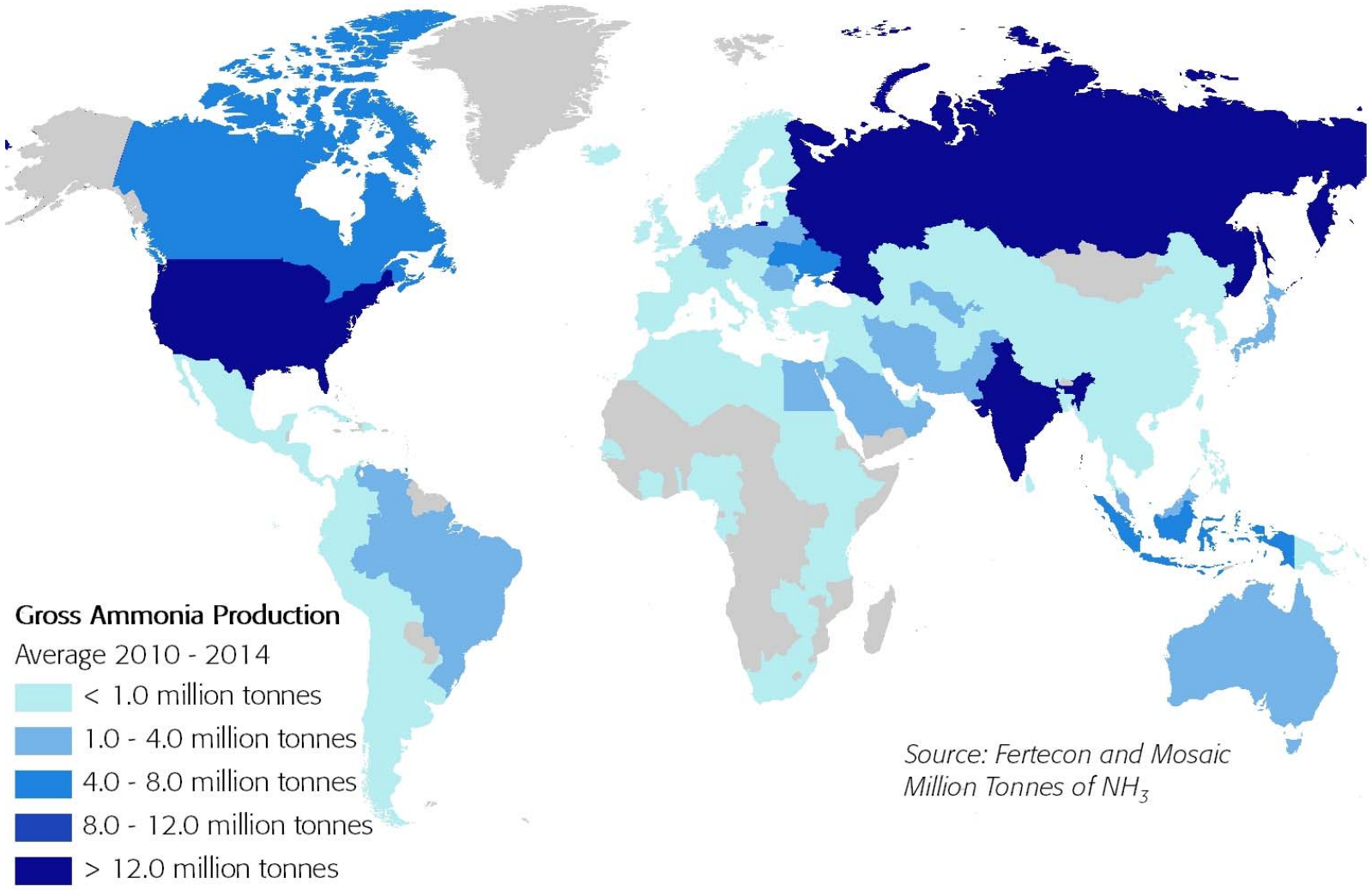


Source: Fertecon and Mosaic Average 2010-2014



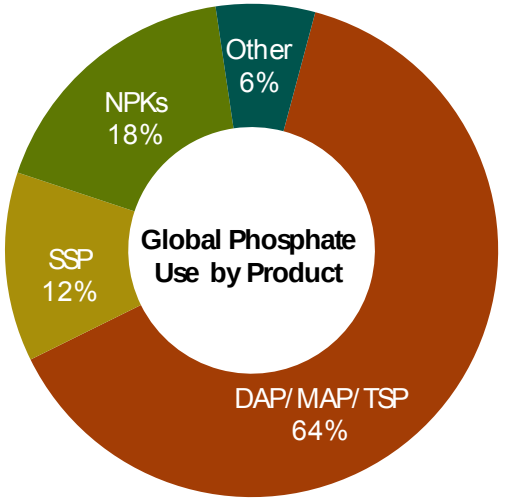
Source: IFA Fertilizer Use 2010/11

Global Ammonia Production

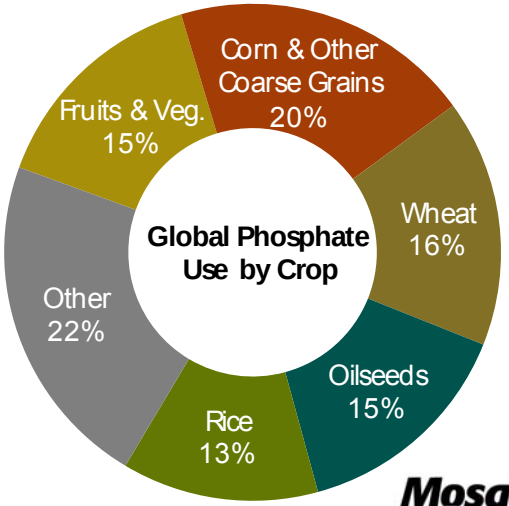


Primary Plant Nutrient Overview

- 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

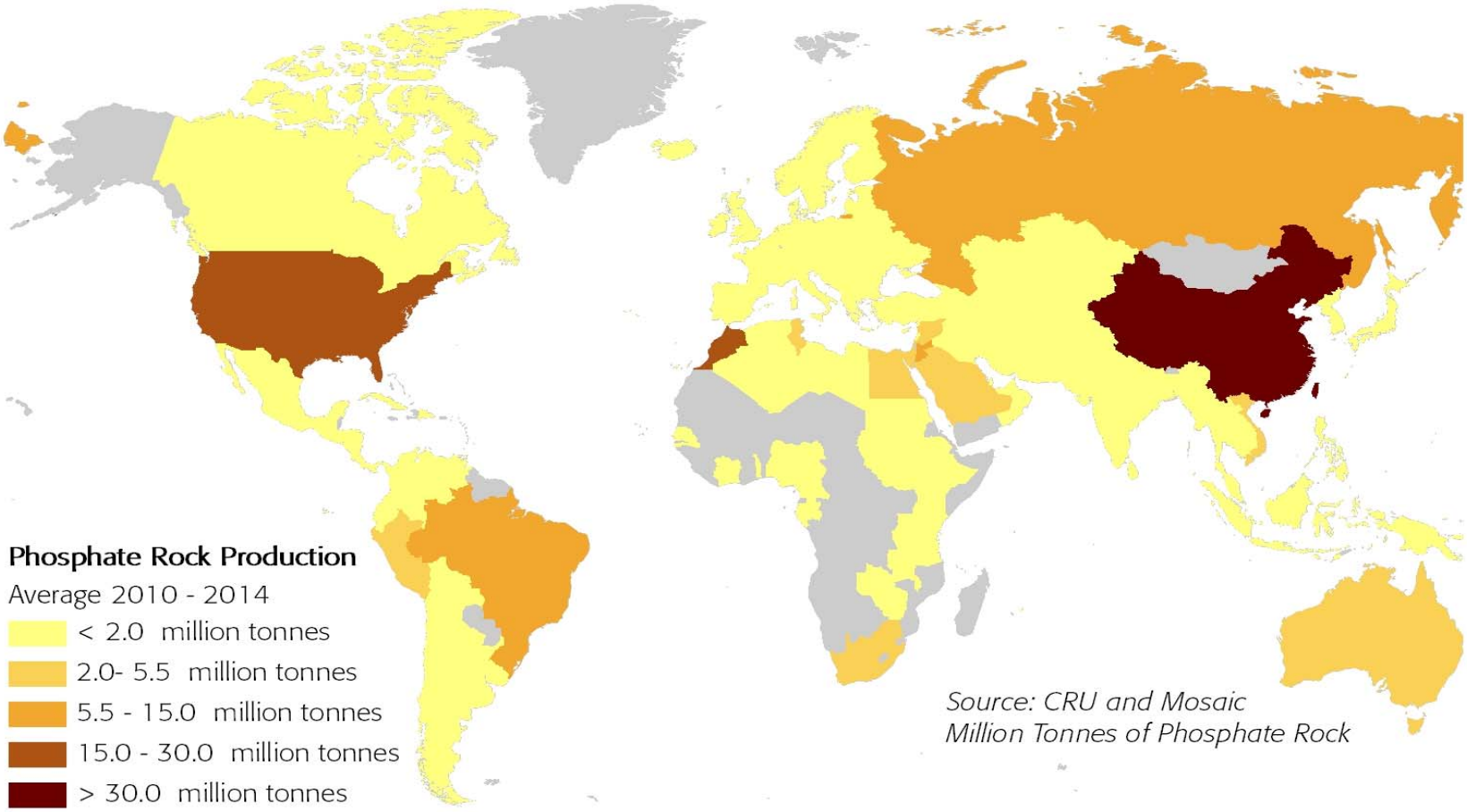


Source: CRU and Mosaic Average 2010-2014



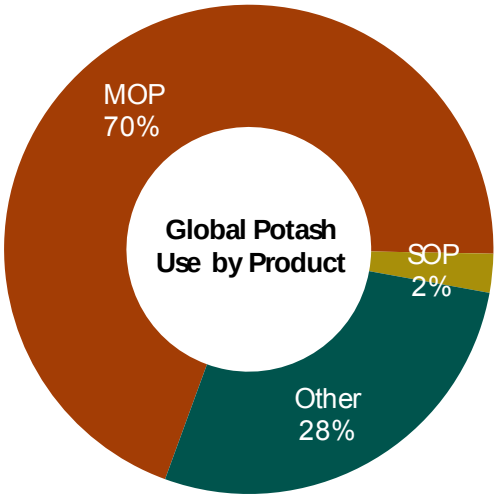
Source: IFA Fertilizer Use 2010/11

Global Phosphate Rock Production

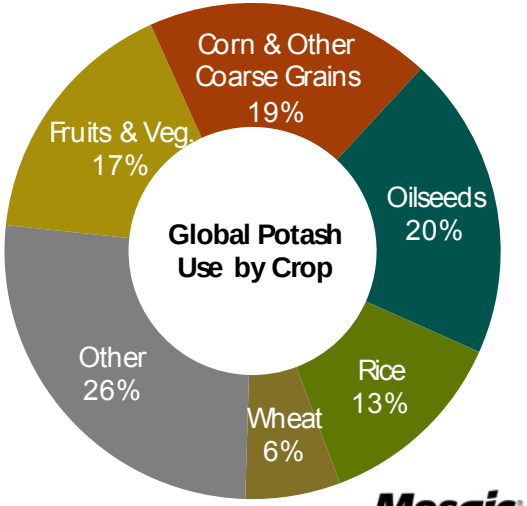


Primary Plant Nutrient Overview

- 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

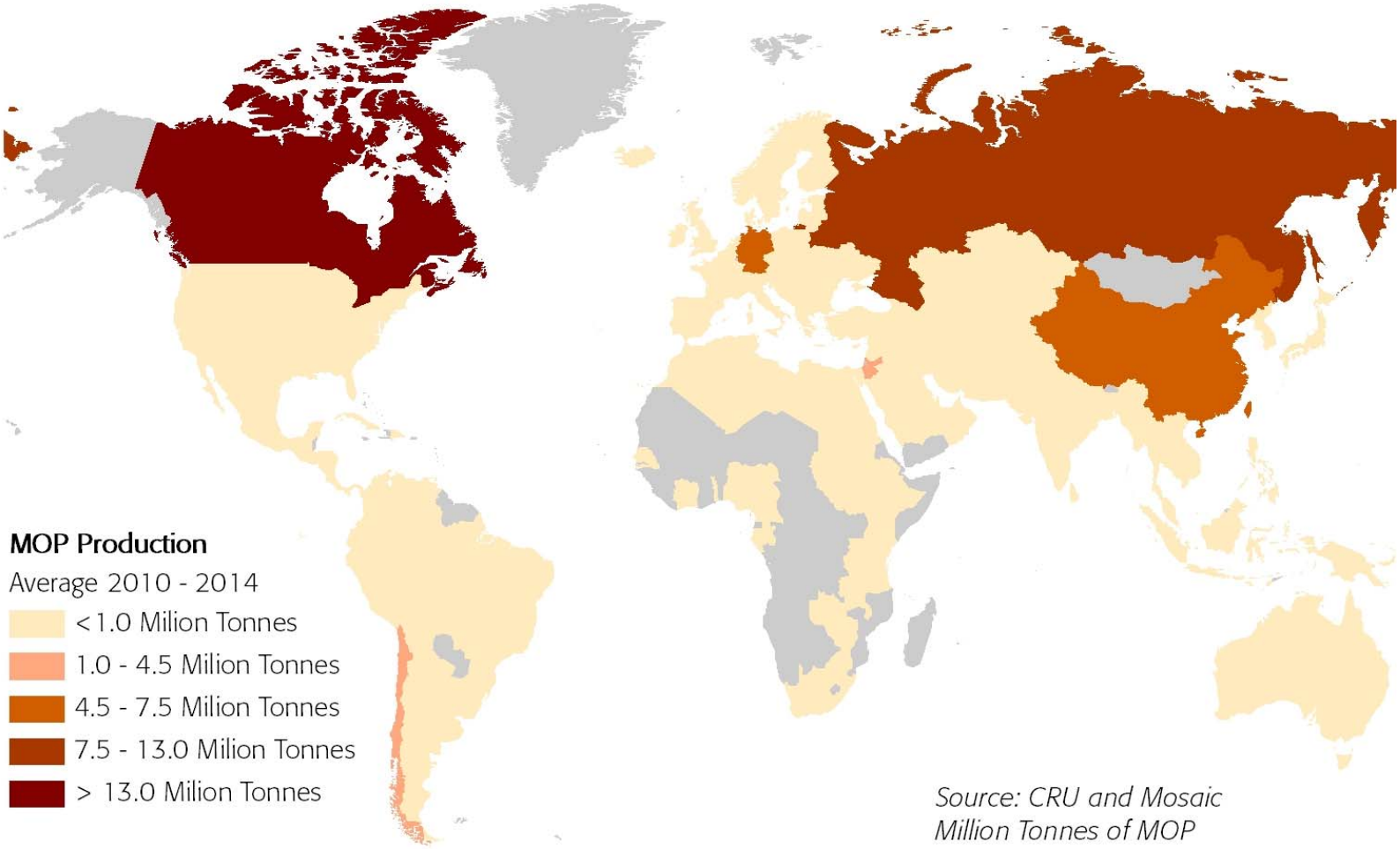


Source: IFA and Mosaic Average 2010-2014



Source: IFA Use in 2010/11

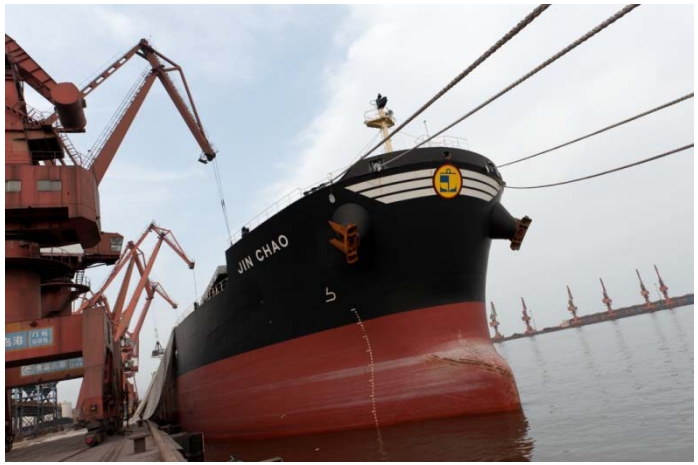
Global MOP Production



Source: CRU and Mosaic
Million Tonnes of MOP

Crop Nutrient Market Characteristics

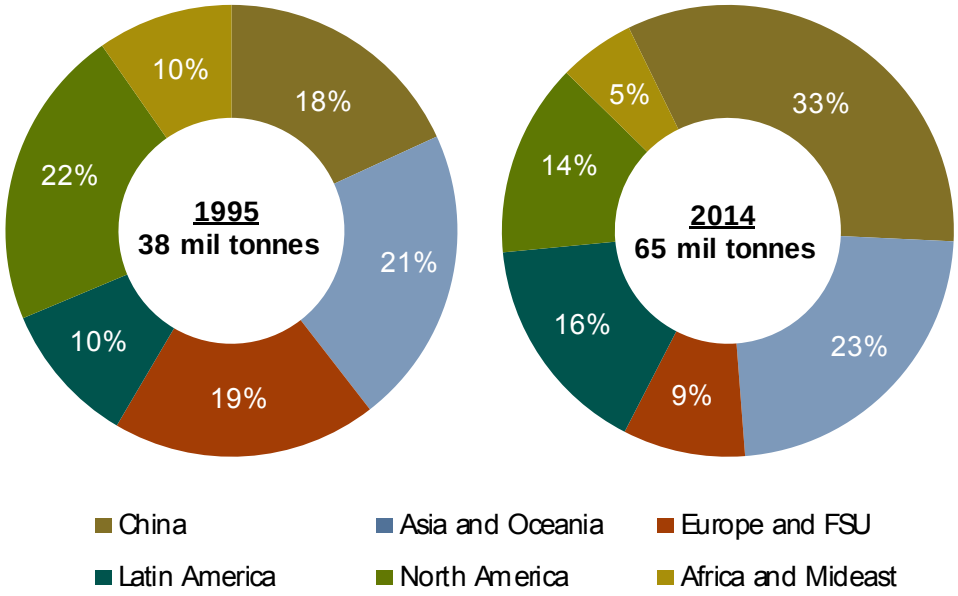
- Long and large supply chain
  - Production
    - Typically located near the source of the natural resource (i.e. long pipeline)
    - Operates 24-7-365
  - Farm application
    - One or two short application windows (i.e. large pipeline)
  - Pipeline flow
    - Regular flow required to
      - Have product in place when farmers want to apply it
      - Keep mines and plants running
    - Flow impacted by
      - Weather
      - Price expectations
      - Supply/demand changes



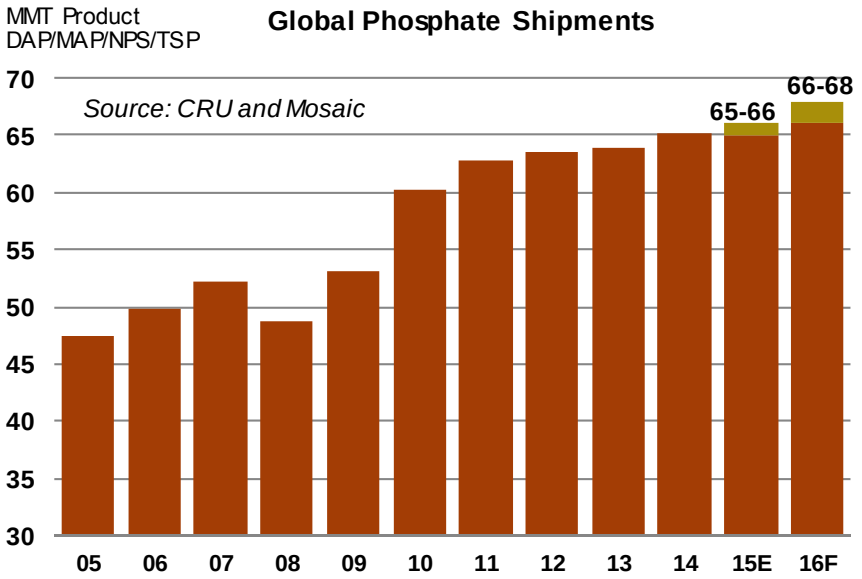
The Phosphate Market and Industry

Global Phosphate Product Shipments

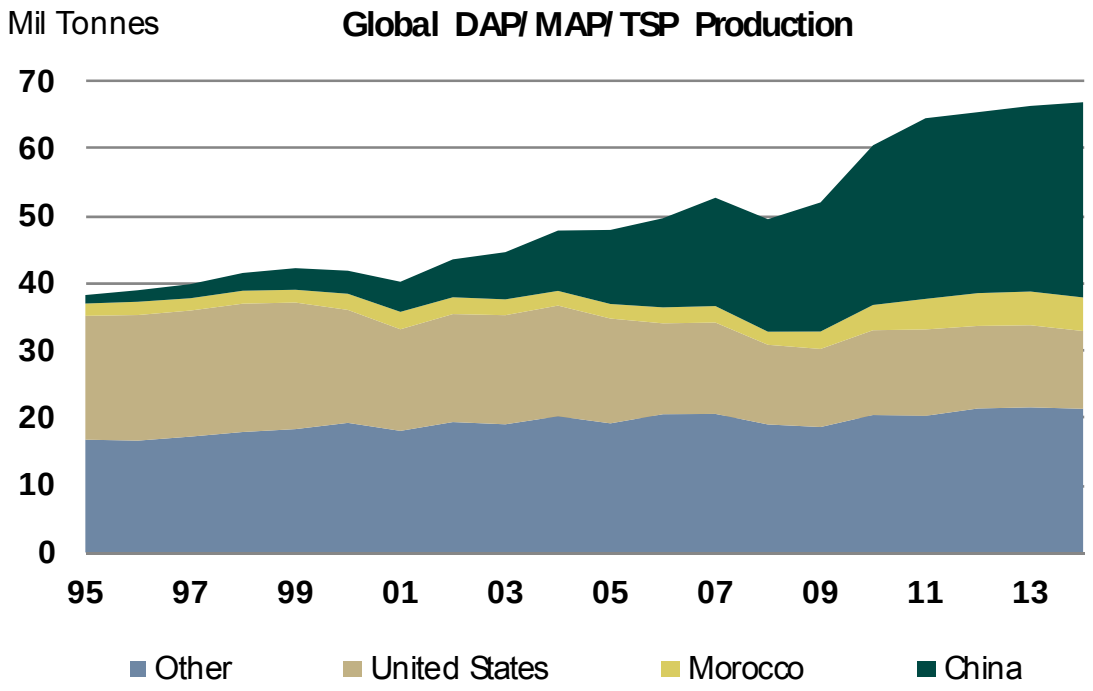
High Analysis Phosphate Shipments by Region

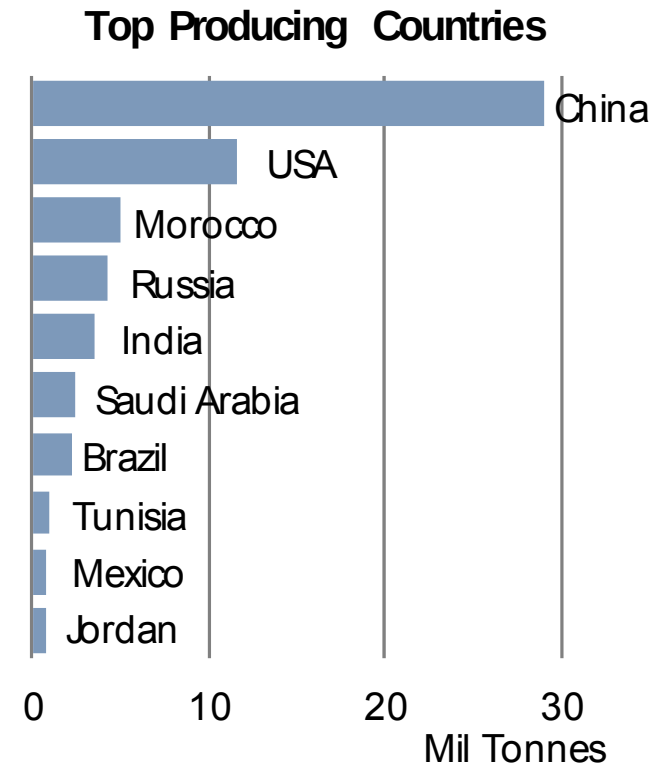


Source: CRU, IFA and Mosaic



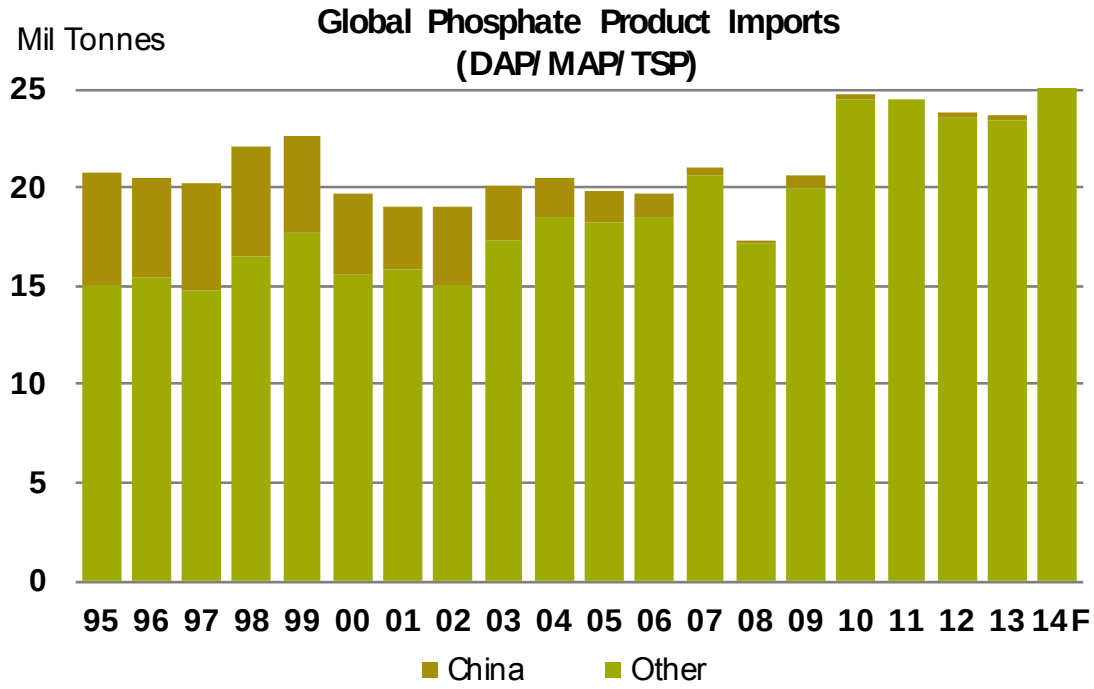
Global Phosphate Product Production (DAP/MAP/TSP)

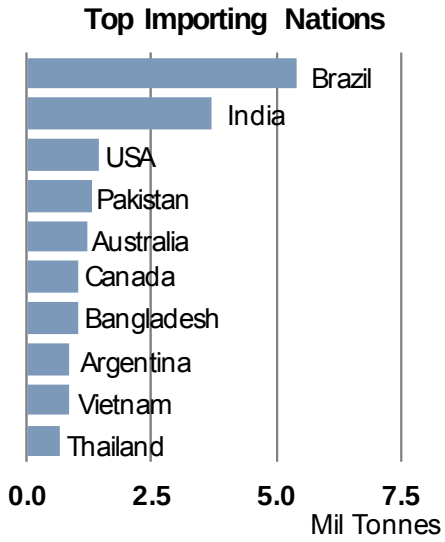




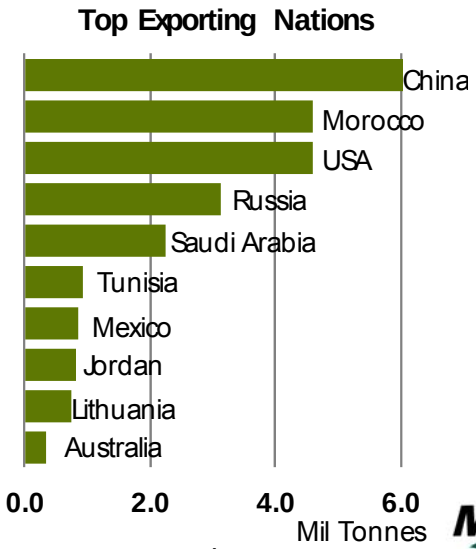
Top producers in 2014
Source: CRU, IFA and Mosaic

Phosphate Product Trade (DAP/MAP/TSP)



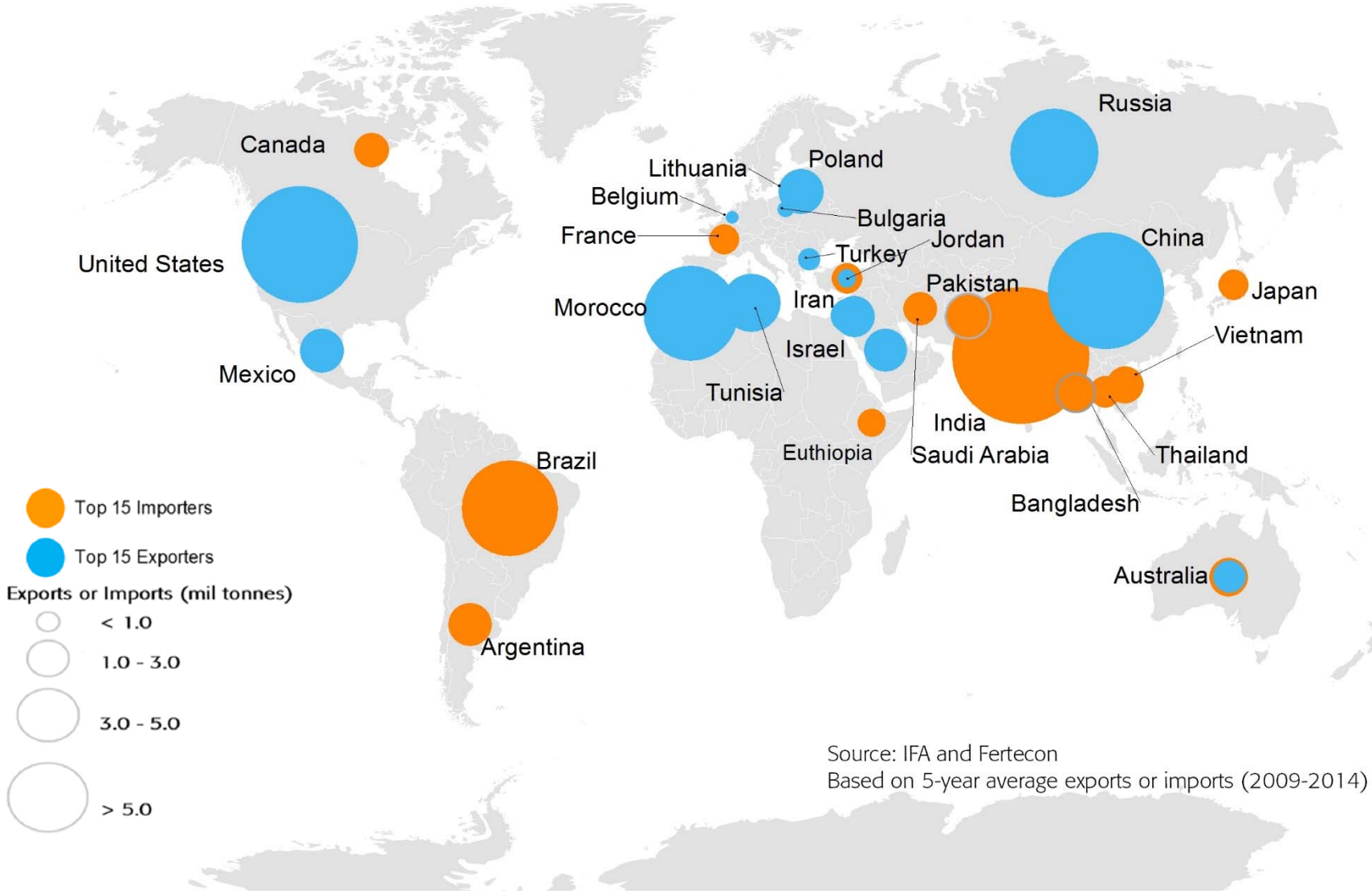


Top importers in 2014
Source: CRU, IFA and Mosaic

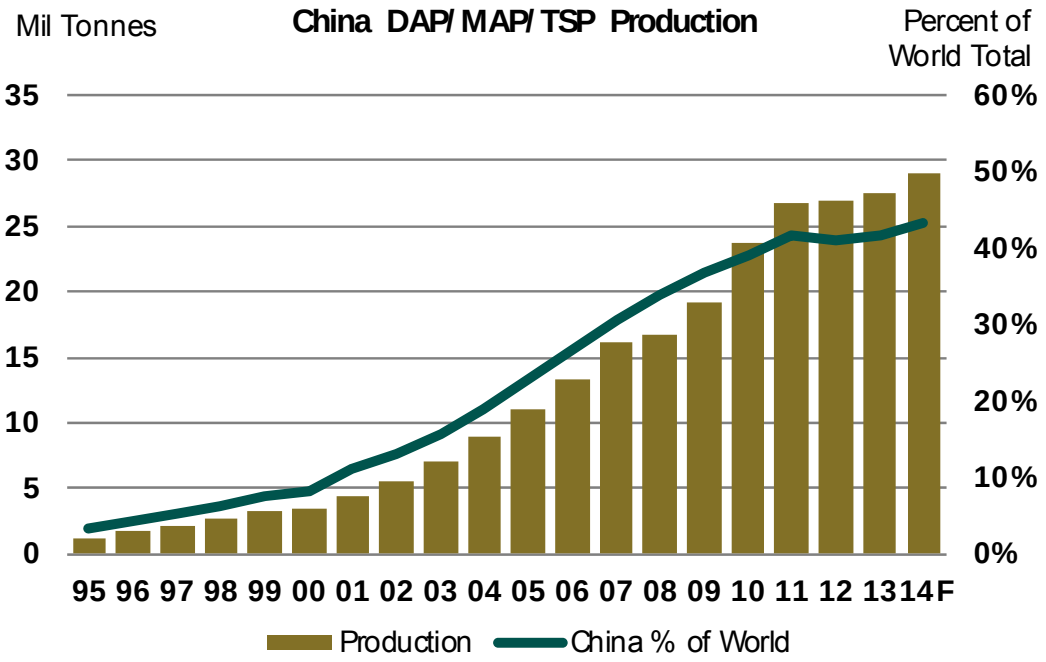


Top exporters in 2014
Source: CRU, IFA and Mosaic

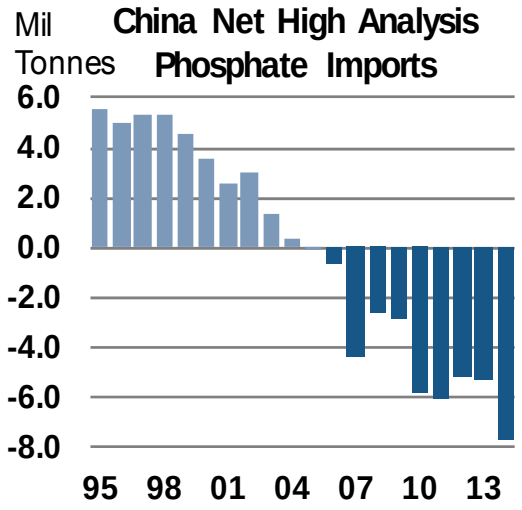
Phosphate Product Trade (DAP/MAP/TSP)



Transition of the Chinese Phosphate Industry

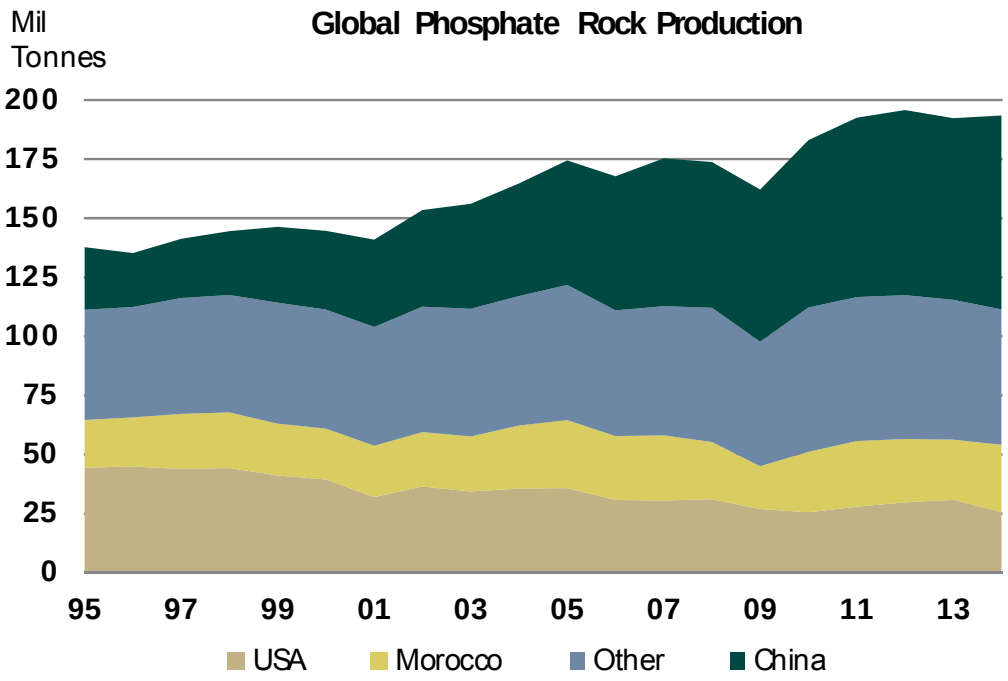


Source: CRU, IFA and Mosaic

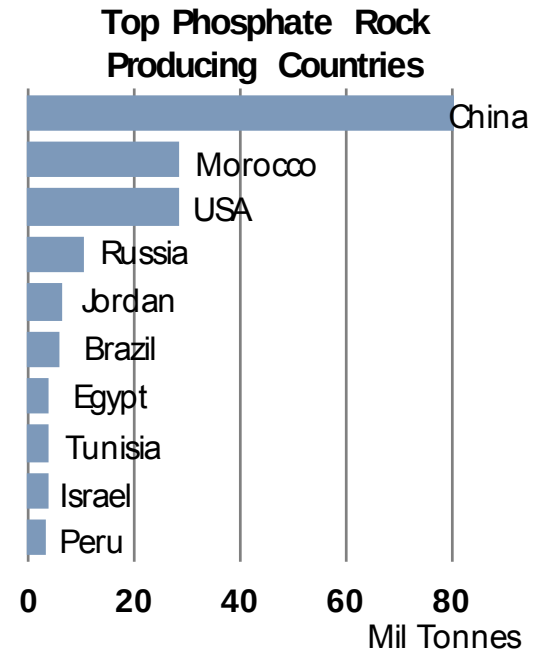


Source: Fertecon, IFA and Mosaic

Global Phosphate Rock Production

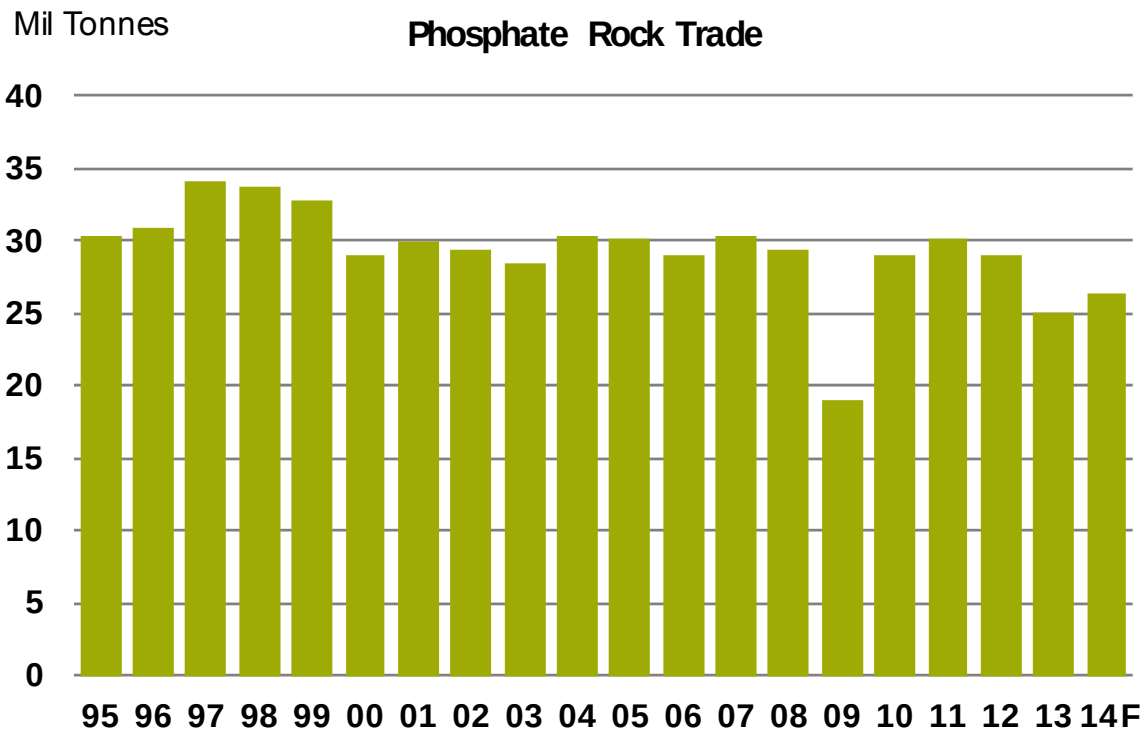


Source: CRU, IFA and Mosaic

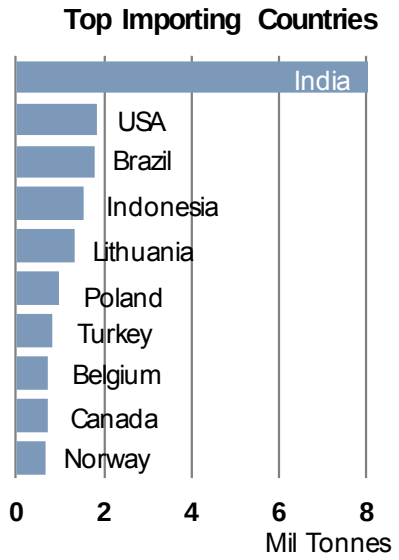


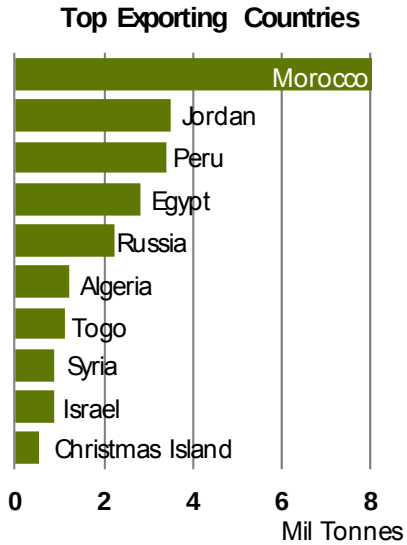
Source: CRU IFA and Mosaic
Top producers in 2014

Phosphate Rock Trade



Source: CRU, IFA and Mosaic

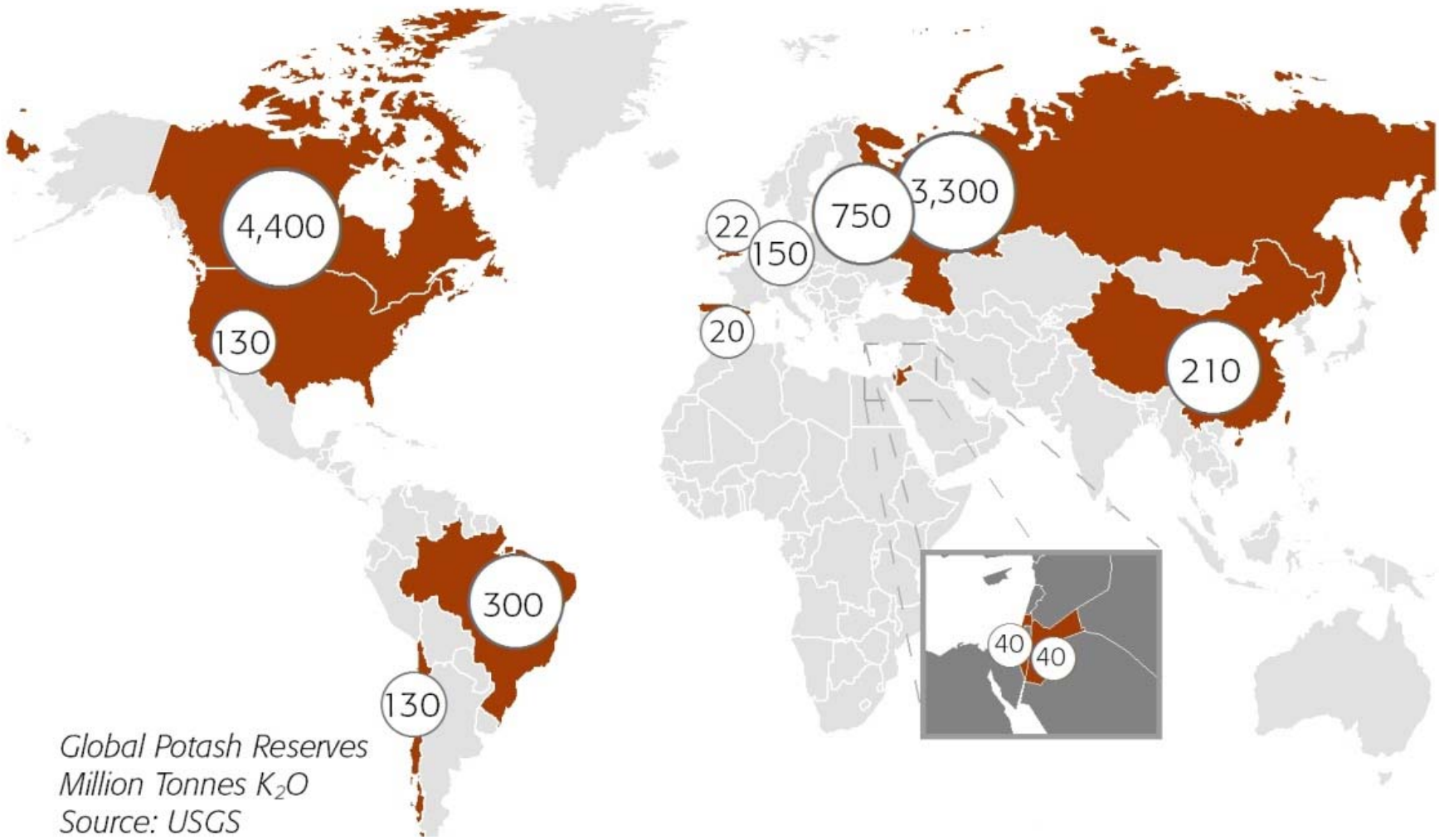




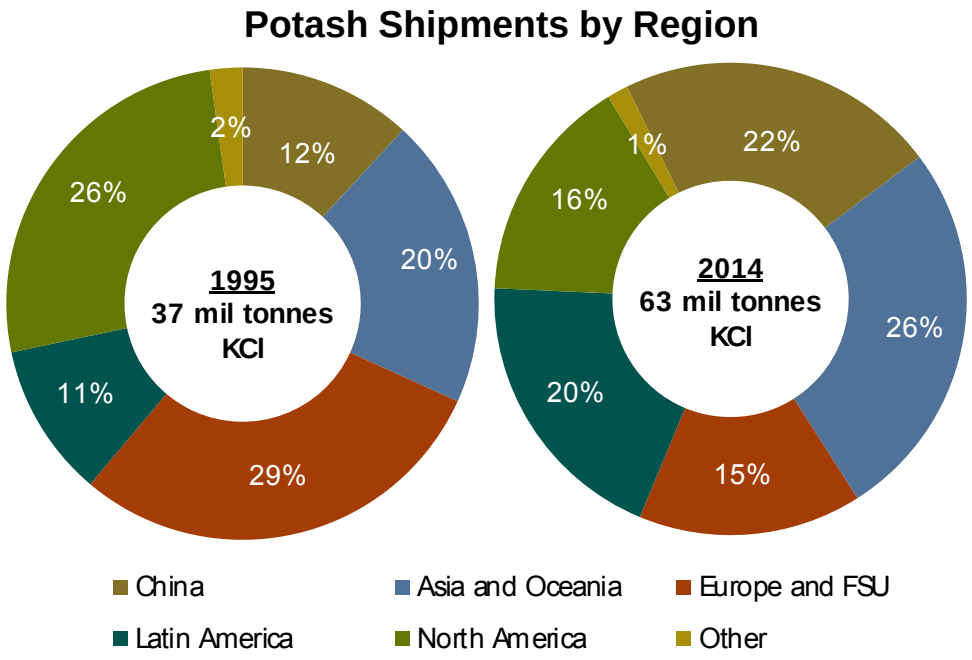
Source: CRU, IFA and Mosaic 2014

The Potash Market and Industry

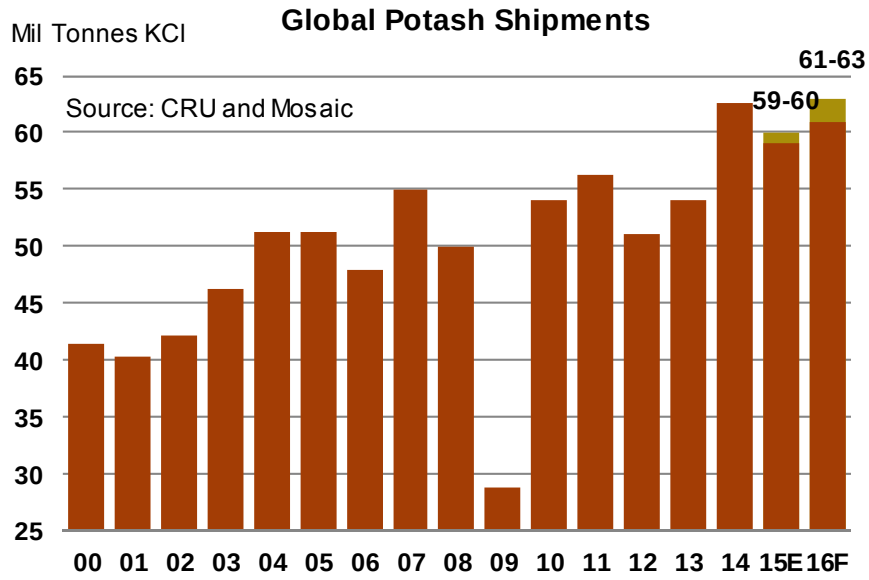
Global Potash Reserves



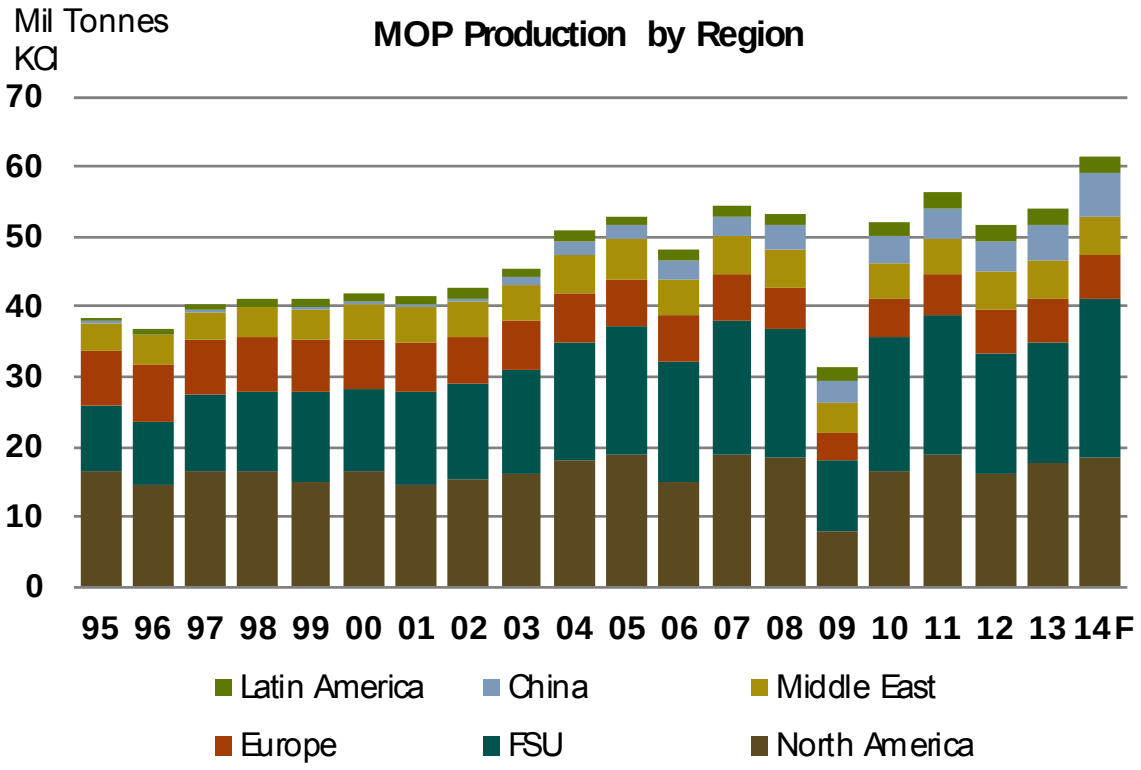
Global Potash Shipments (MOP)



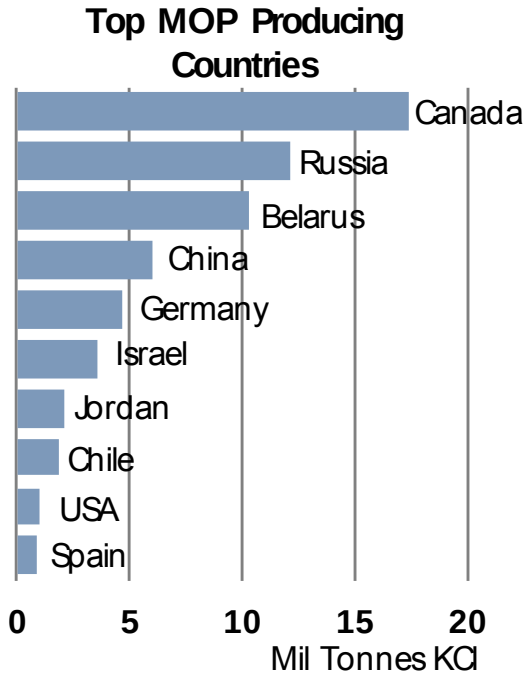
Source: CRU and Mosaic



Global Potash Production (MOP)

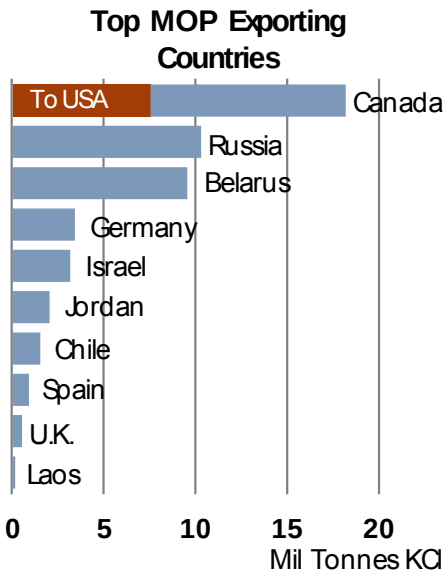


Source: CRU and Mosaic

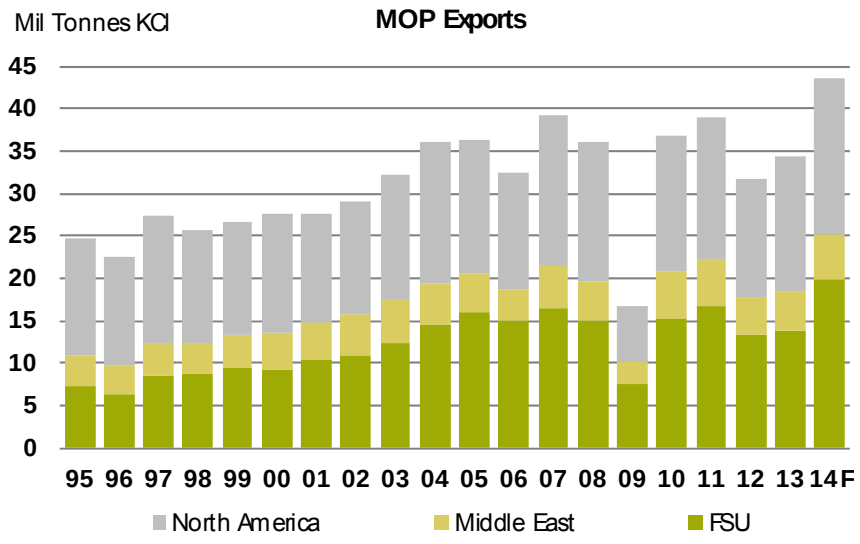


Source: CRU and Mosaic
Top producers in 2014

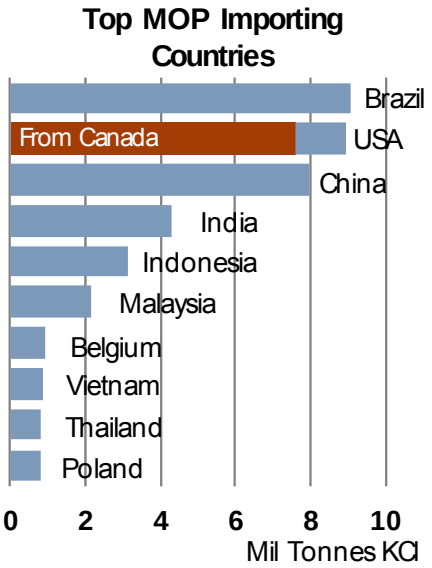
Potash Trade (MOP)



Top exporters in 2014
Source: IFA, CRU and Mosaic



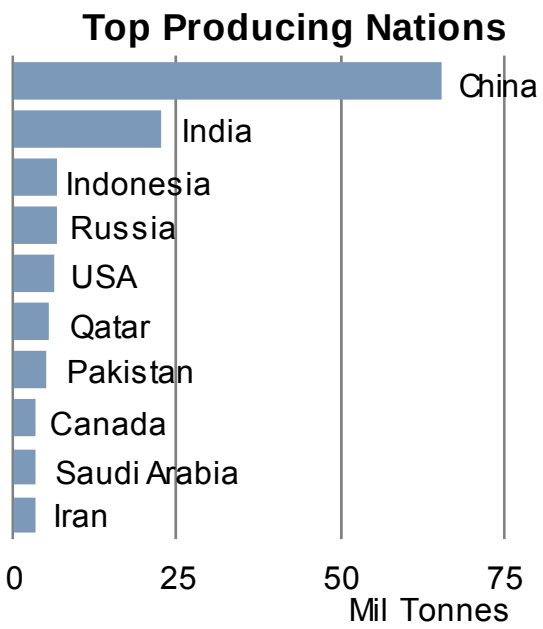
Source: CRU and Mosaic
Includes inter-regional transactions



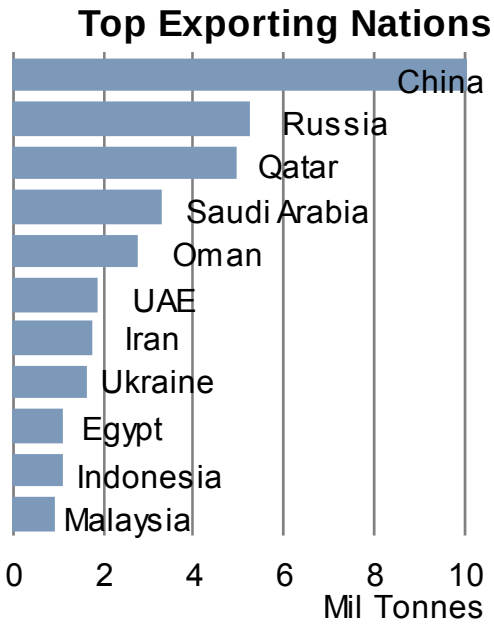
Top importers in 2014
Source: IFA, CRU and Mosaic

The Nitrogen Market and Industry

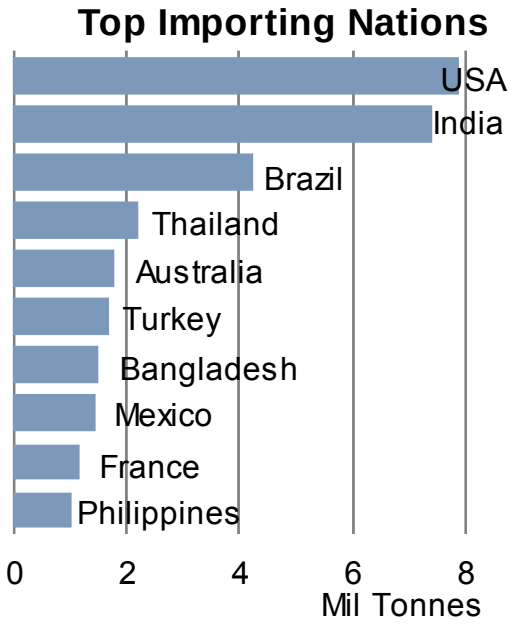
Urea Production and Trade



Source: IFA
Top producers in 2014

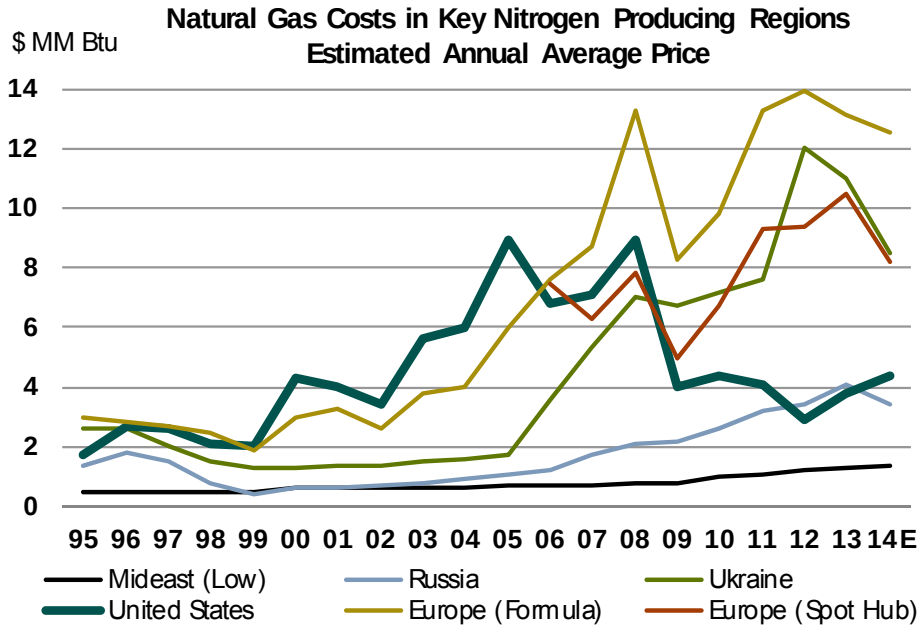


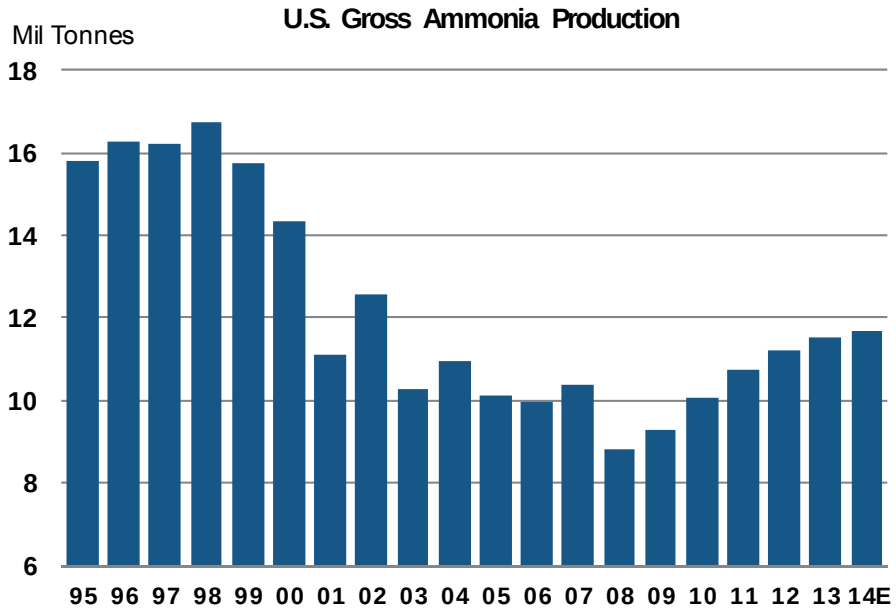
Source: IFA
Top exporters in 2014



Source: IFA
Top importers in 2014

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
November 30, 2015

Andy J. Jung
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The Mosaic Company