The Global Potassium Market

Dr. Michael R. Rahm
Vice President – Market and Strategic Analysis
The Mosaic Company

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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 our proposed acquisition of the global phosphate and potash operations of Vale S.A. ("Vale") conducted through Vale Fertilizantes S.A. (the "Transaction") and the anticipated benefits and synergies of the proposed Transaction, 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 possibility that the closing of the proposed Transaction may be delayed or may not occur, including delays or risks arising from any inability to obtain governmental approvals of the Transaction on the proposed terms and schedule, any inability of Vale to achieve certain other specified regulatory and operational milestones or to successfully complete the transfer of the Cubatão business to Vale and its affiliates in a timely manner, and the ability to satisfy any of the other closing conditions; our ability to secure financing, or financing on satisfactory terms and in amounts sufficient to fund the cash portion of the purchase price without the need for additional funds from other liquidity sources; difficulties with realization of the benefits of the proposed Transaction, including the risks that the acquired business may not be integrated successfully or that the anticipated synergies or cost or capital expenditure savings from the Transaction may not be fully realized or may take longer to realize than expected, including because of political and economic instability in Brazil or changes in government policy in Brazil; 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, the ability of the Wa'ad Al Shamal Phosphate Company (also known as 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; 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.

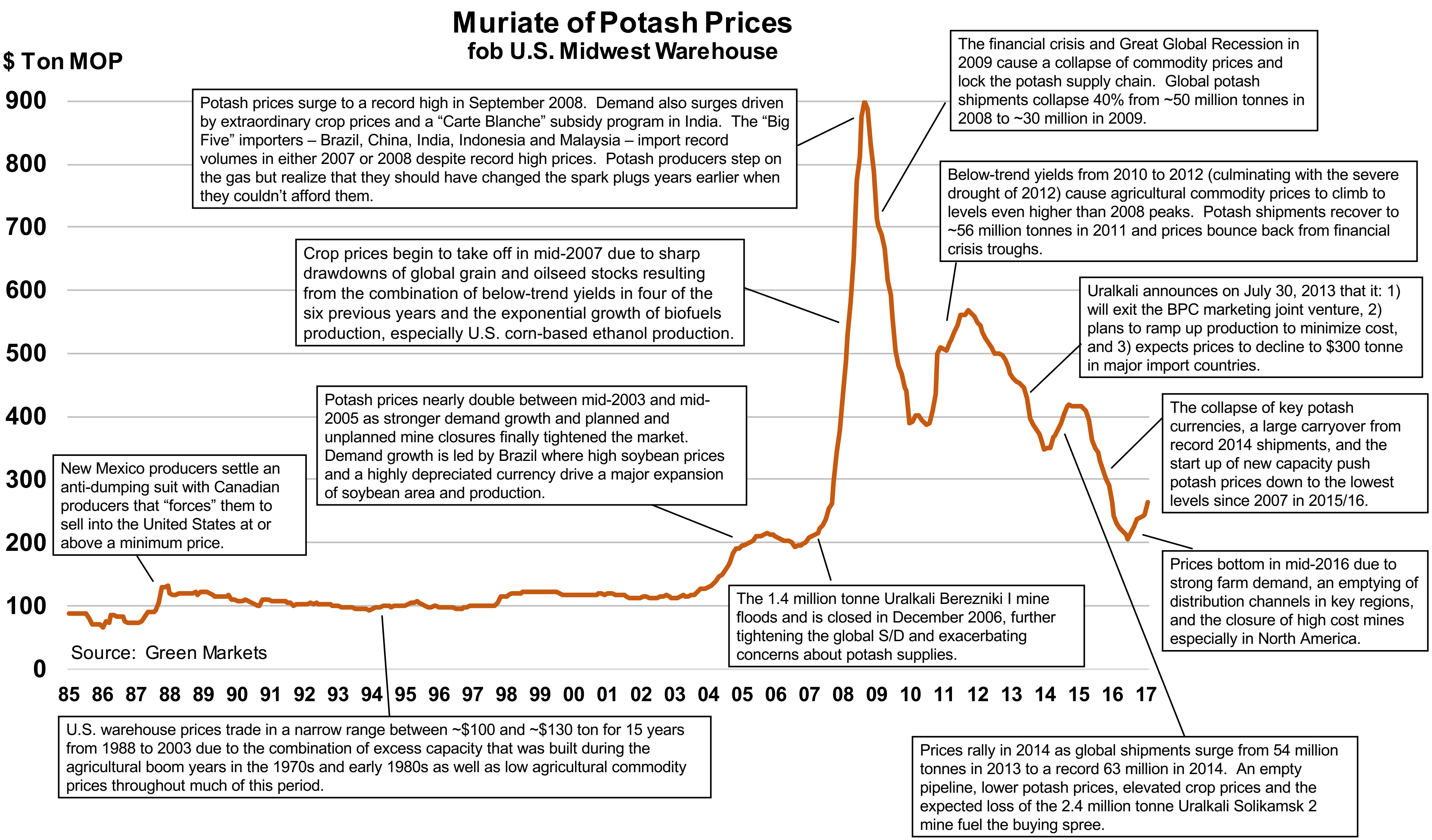
Preliminaries

- Market focus (plus an economist's non-technical explanation of a few scientific subjects)
- Potassium chloride focus (not the 80-20 rule but the 95-5 rule)
- Primary statistical source: IFA (International Fertilizer Association)
- Unit: metric tonnes K_2O (potassium oxide)

Topics

- Historical Perspective
- Supply
  - Potassium minerals, ores, reserves and resources, project economics
  - Potassium products and 2015 potassium production
  - The mining and refining of sylvinite ore
  - Potassium chloride production
- Demand
  - A few preliminaries
  - Global potassium demand by use and by crop
  - Potassium chloride shipments – all uses
- Trade and the Global Supply Chain
  - Potassium chloride trade
  - The long and large global supply chain

Historical Perspective



Supply

Potassium Minerals

- Several potassium minerals but sylvite the most common

Mineral	Chemical Name	Chemical Formula	Potassium Content (K_2O)
Sylvite	Potassium Chloride	KCl	63.2%
Carnallite	Potassium Magnesium Chloride	$KMgCl_3$	16.9%
Kainite	Magnesium Sulphate Potassium Chloride	$MgSO_4 \cdot KCl$	19.3%
Langbeinite	Potassium magnesium sulphate	$K_2Mg_2(SO_4)_3$	22.7%
Polyhalite	Potassium Calcium Magnesium Sulphate	$K_2Ca_2Mg(SO_4)_4$	15.6%

- Potassium minerals recovered from ores found in . . .
  - Deep underground deposits
    - Formed millions of years ago from ancient lake and sea waters
    - Potassium crystalized in sedimentary rock basins
  - Potassium-rich surface brines
    - Most are remnants of these ancient lake and sea waters

Potassium Ores

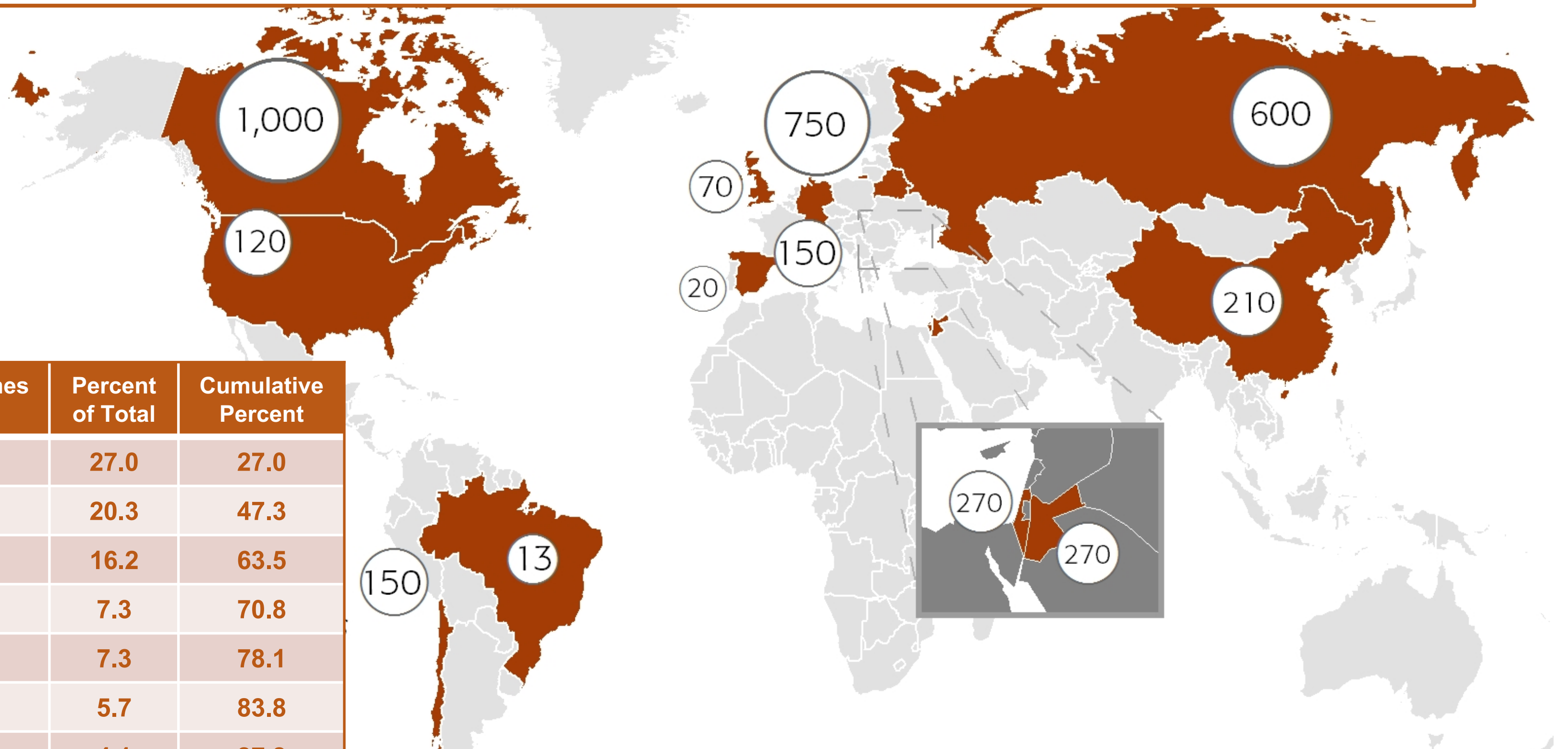
- Most common potassium ores
  - **Sylvinite** - most common by a wide margin and made up of:
    - Sylvite: potassium chloride (KCl) (~50%)
    - Halite: sodium chloride (NaCl) (~50%)
  - **Carnallitite** – second-most common ore made up of:
    - Carnallite: potassium magnesium chloride ($KMgCl_3$)
    - Halite: sodium chloride (NaCl)
- Other less common ores (mostly double salts containing soluble sulphate)
  - **Hartsalz** - sylvite (KCl), halite (NaCl), kieserite ($MgSO_4$) and/or anhydrite ($CaSO_4$)
  - **Kainitite** - $MgSO_4 \cdot KCl$
  - **Langbeinite** - $K_2Mg_2(SO4)_3$
  - **Polyhalite** - $K_2Ca_2Mg(SO_4)_4$
- Potassium-rich surface brines (current operations recover mostly carnallite and kainite)

Reserves vs. Resources: General Definitions

- Reserves
  - Mineral deposits that are economically recoverable based on:
    - Expected product prices and capital costs, and
    - Current mining and processing technologies
  - Potassium *reserves* are concentrated in a small number of regions
- Resources
  - Reserves plus
  - Mineral deposits that may become economically viable based on:
    - Higher product prices and/or lower capital costs, and/or
    - Potential advances in mining and processing technologies
  - Potassium *resources* are abundant and found on five continents

2016 USGS Reserve Estimates

Global *reserves* are equal to more than 90 years of production at current rates. The three largest producing countries account for nearly two-thirds of global *reserves* and have roughly 80-120 years of *reserves* at current production rates.



Source: USGS, 2016.

Country	Mil Tonnes K_2O	Percent of Total	Cumulative Percent
Canada	1,000	27.0	27.0
Belarus	750	20.3	47.3
Russia	600	16.2	63.5
Israel	270	7.3	70.8
Jordan	270	7.3	78.1
China	210	5.7	83.8
Chile	150	4.1	87.8
Germany	150	4.1	91.9
USA	120	3.2	95.1
Other	180	4.9	100.0
World	3,700	100	

The largest producing countries possess large reserves. Most new supplies have or will come from brownfield expansions by current producers or a few greenfield projects by new entrants in Canada, Russia and Belarus. The potassium farmers use 50 or even 100 years from now likely will come from the same places as today.

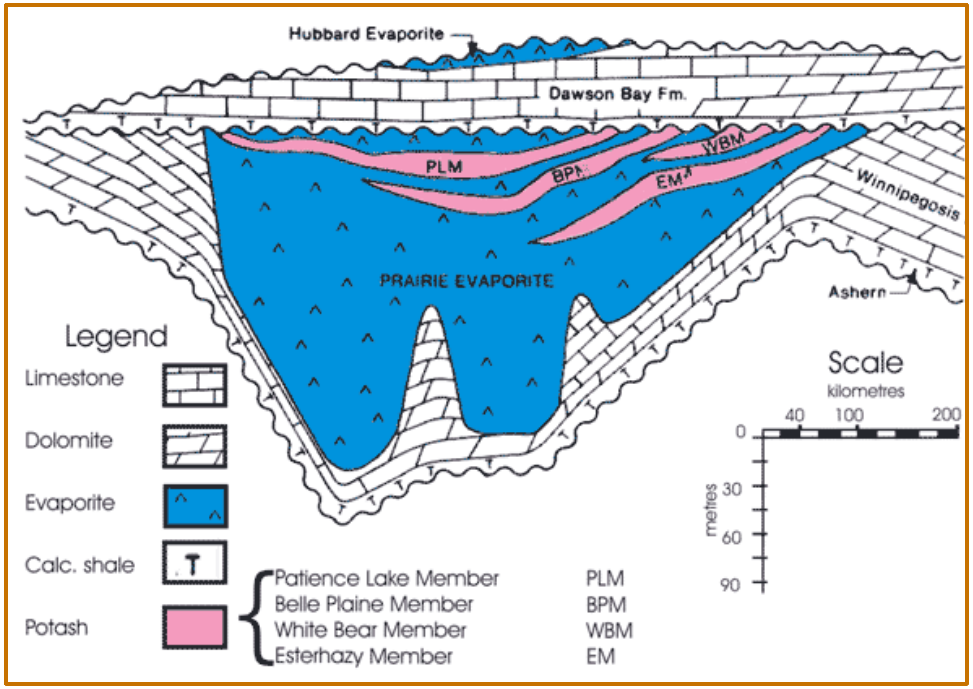
Abundant Resources

- Potassium ores are not rare
- No precise estimate but it is a big number
  - Current USGS global estimate: 250 billion tonnes K_2O
    - Equal to 6,173 years of production at 2015 output of 40.5 mil tonnes K_2O
  - USGS 2010 potassium resource study (data base updated following 2007/08 price spike)
    - Most current and comprehensive inventory of global potassium deposits
    - Documents 981 deposits/occurrences on five continents
    - Identifies 84 tracts with best potential for development

> *"Potash-bearing basins may host tens of millions to more than 100 billion metric tonnes of potassium oxide (K_2O)."*
>
> USGS 2010

- 2007/08 price spike spawns interest in:
  - Global resource estimates (but interest in potassium not to the extent of peak phosphorus)
  - New project development (all majors expand production and dozens of "junior" projects crop up)

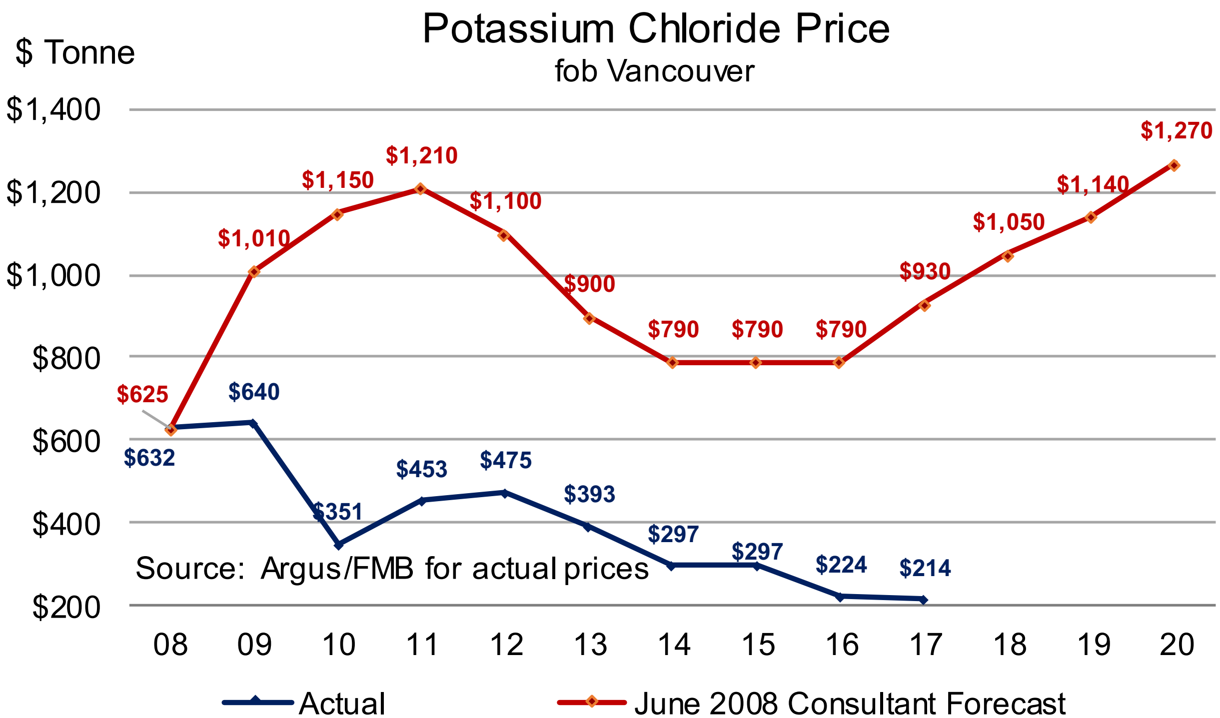
Saskatchewan: Prairie Evaporate Deposit



- Saskatchewan possesses some of the largest and highest quality potassium deposits in the world. Deposits typically are characterized by thick flat beds of sylvinite ore that contain up to 40% potassium chloride.
- The Prairie Evaporate Deposit in the Elk Point Basin extends throughout the southern plains of Saskatchewan and dips into western Manitoba, northeastern Montana and northwestern North Dakota.
- The Saskatchewan government in 1969 estimated that resources in the province totaled 65 billion tonnes K_2O. Even after accounting for nearly 50 years of production, current resources equal more than 5,500 years of production at current output rates.
- Rich potassium ore is found in different layers or what are termed members of the Prairie Evaporate Deposit. Members in production today include the Patience Lake member (at depths of up to 800 meters), the Belle Plaine member (at depths of up to 1,000 meters) and the Esterhazy member (at depths of up to 1,500 meters).

Greenfield Project Economics

- Impact of 2007/08 price spike
  - Forecasts of commodity super cycles
  - Proliferation of new project development
  - The five most dangerous words in a commodity business



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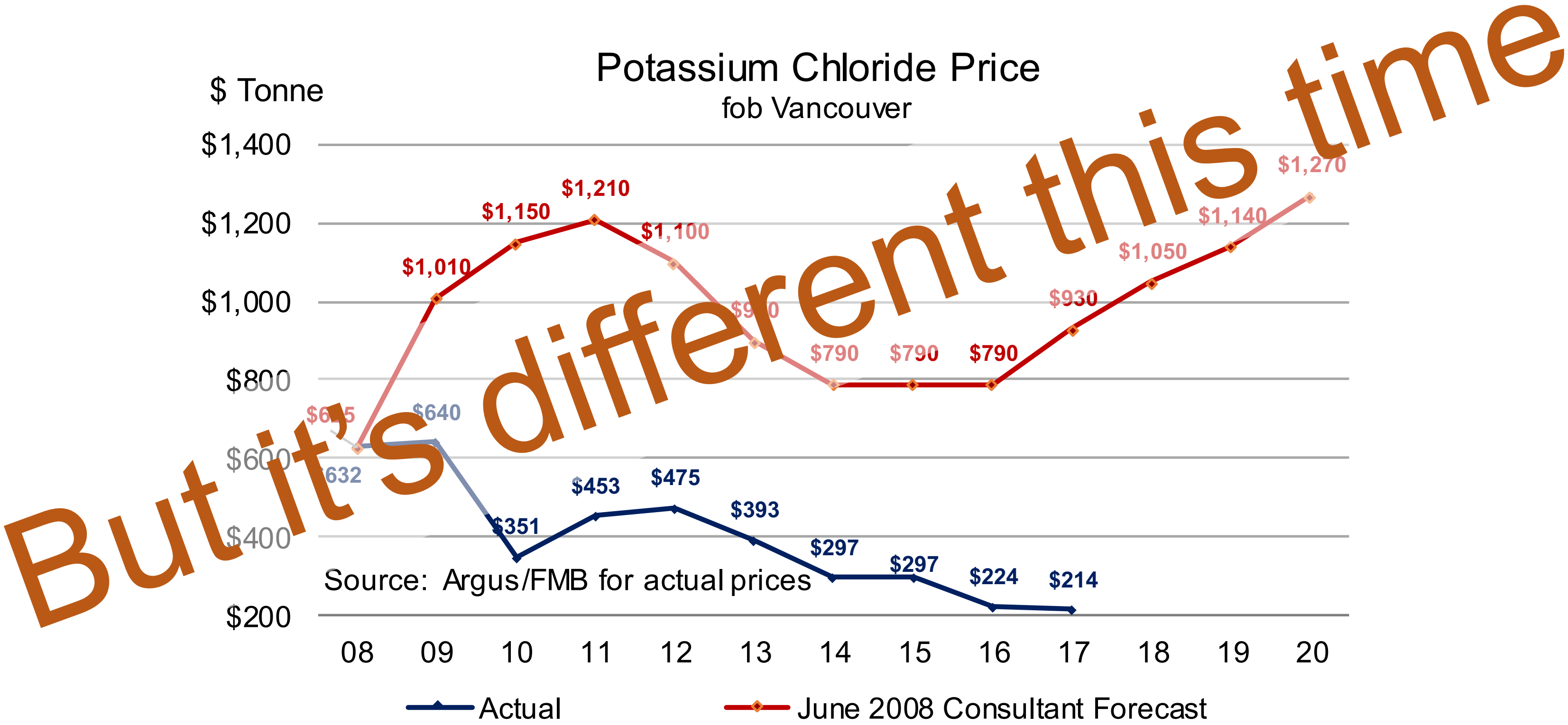
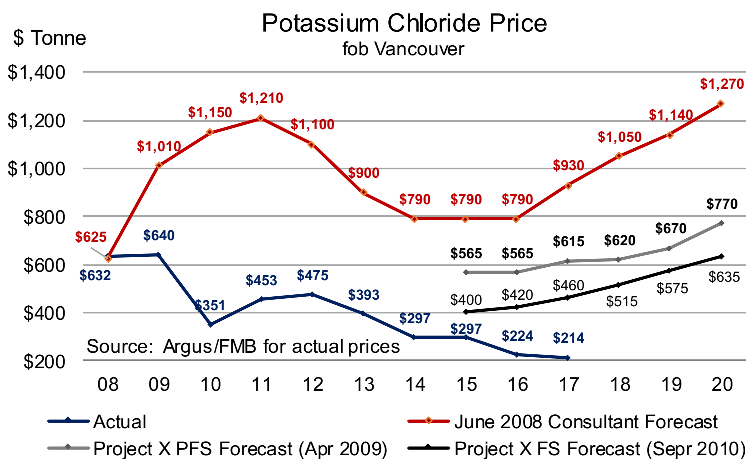


Greenfield Project Economics

- Project X case study
  - Actual pre-feasibility study (PFS) and feasibility study (FS) estimates
    - April 2009 PFS prices and capital cost assumptions = 34.3% IRR
    - September 2010 FS prices and capital cost = 17.9% IRR
  - Our assessment: a sustained mine price of $500 to $600 per tonne is required just to earn a hurdle ROI on a lot of capital put at risk



Generic Greenfield Project Evaluation

Mine development time	6 years
Operating rate upon completion	80%
Maintenance capital	2% of initial cost
Annual maintenance capex escalation	2%
Cash operating cost per tonne (Yr 1)	$79
Annual operating cost escalation	1%
Perpetuity growth rate	1%
SG&A % of sales	5%
Income tax rate	27%
Financing	100% Equity

New Entrant Breakeven Price

$ Tonne fob Mine

	Mine Size*	2.0	4.0	8.0
	Capital Cost**	$3.3	$4.9	$8.4
Hurdle Rate	8%	$530	$410	$370
	9%	$610	$470	$420
	10%	$690	$530	$470
	11%	$780	$600	$530
	12%	$880	$670	$590
	13%	$990	$750	$660

* Million tonnes annual capacity

** Billion $

Potassium Production

- Potassium products
  - Potassium chloride (muriate of potash or MOP – 60%-62% K_2O)
    - From sylvinite ore
      - Simple and low cost separation process (separate sylvite from halite)
    - From carnallitite ore
      - Carnallite decomposed into potassium chloride (dissolve carnallite and recrystallize potassium chloride)
      - More complicated, energy intensive and higher cost (large volume of magnesium chloride byproduct)
  - Specialty products from other potassium minerals (or secondary production)
    - Potassium sulphate (sulphate of potash or SOP – 50% K_2O)
      - Primary production from kainite or langbeinite ores
      - Secondary production by reacting potassium chloride and sulphuric acid (Mannheim process)
    - Potassium magnesium sulphate (branded products - 22% K_2O, 18% S, and 10%-18% MgO)
      - Primary production from langbeinite ore
    - Potassium nitrate – secondary production (13% N, 44% K_2O by reacting KCl with nitrogen source)
    - Polyhalite -- potential primary production

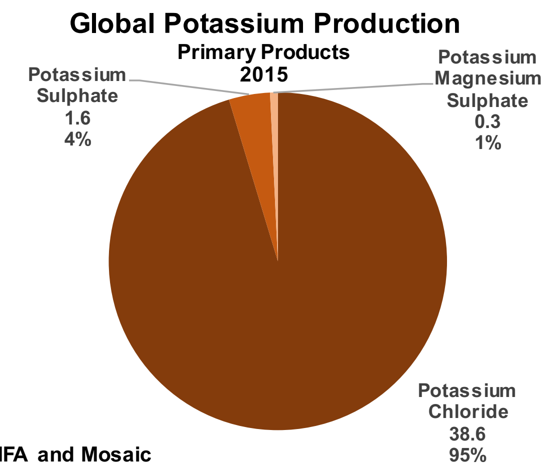
Global Potassium Production 2015

- By primary product
  - Potassium chloride dominates
  - Also used to produce secondary products
- By final product
  - Secondary products
    - NPK/PK compounds (e.g. ~25% potassium applied as NPK/PK in India)
    - Potassium sulphate
    - Potassium nitrate

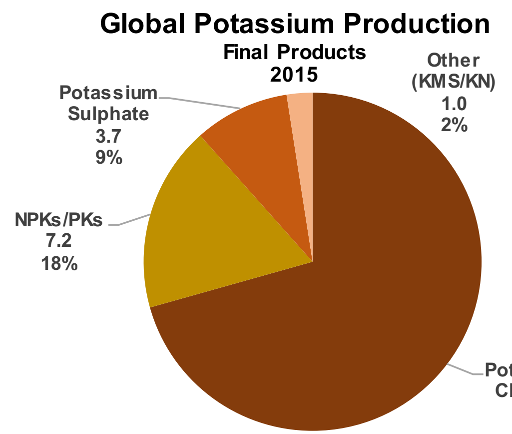
2015 Global Primary Potassium Production

Million Tonnes	K_2O	Product	Percent of Total
Potassium Chloride	38.6	63.3	95.3%
Potassium Sulphate	1.6	3.2	3.9%
Potassium Magnesium Sulphate	0.3	1.4	0.7%
Total	40.5	67.8	100.0%

Source: IFA and Mosaic.
Assumes that 0.3 million tonnes of potassium sulphate production was reported as potassium chloride from producers in Germany and Chile.



Source: IFA and Mosaic



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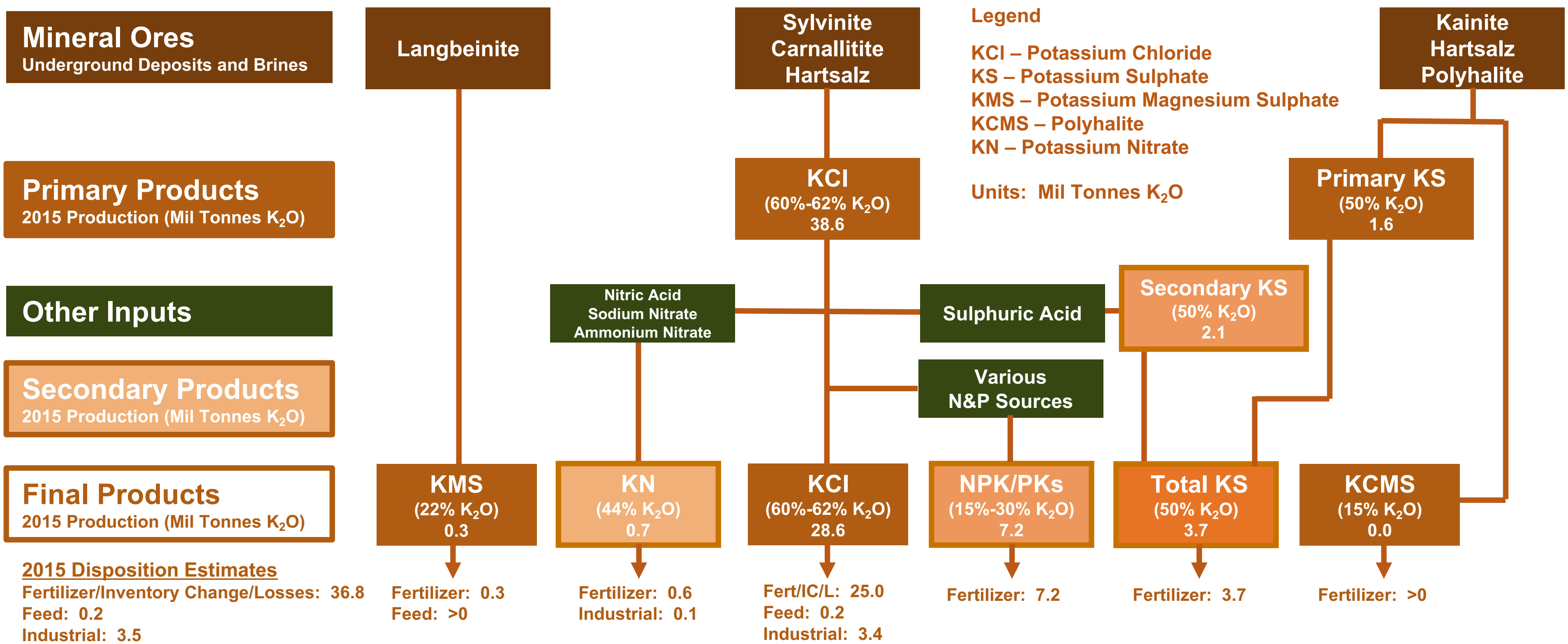
Global Potassium Production 2015

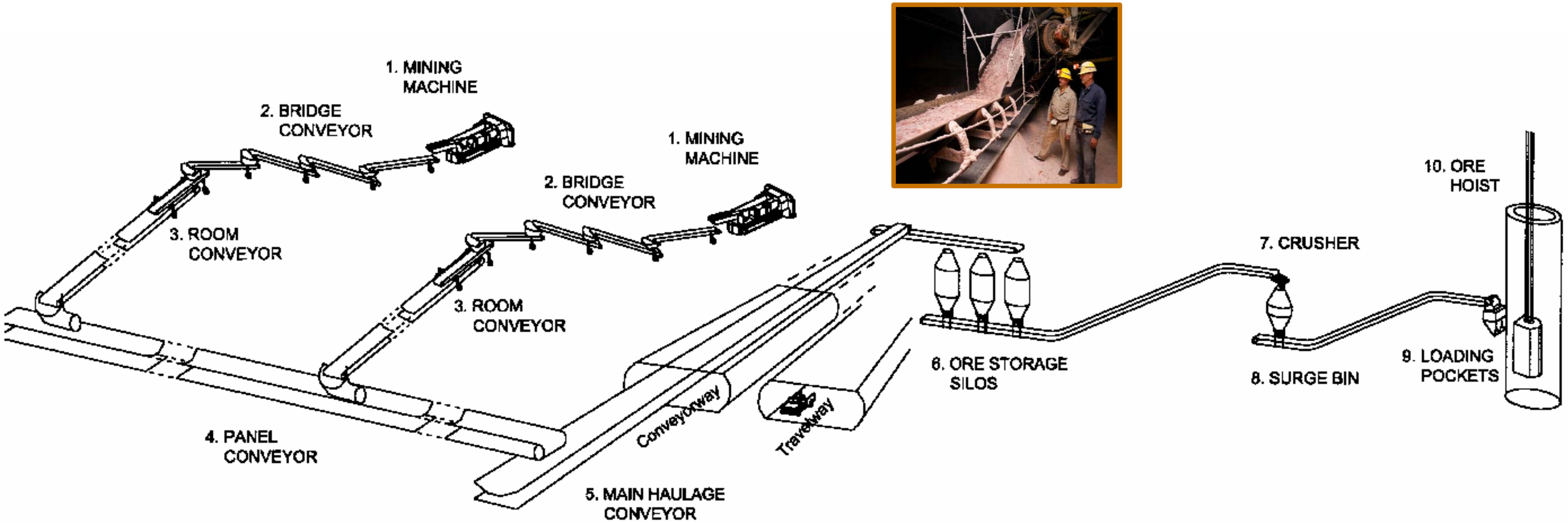


Potassium Production

- Typical mining and refining operations
  - Much simpler than nitrogen and phosphate processes
    - No chemical reaction (unlike Habor process for ammonia synthesis or wet process phosphoric acid production)
    - Just separating potassium from other minerals in the ore
  - For underground deposits
    - Shaft mining and flotation (e.g. flat/thick sylvinite deposits 500-1000 meters deep)
    - Shaft mining and selective crystallization (e.g. milling carnallitite ore to potassium chloride)
    - Solution mining and selective crystallization (e.g. deeper and/or more difficult deposits)
  - For potassium-rich surface brines (e.g. Dead Sea, Qinghai Salt Lake, Great Salt Lake)
    - Solar evaporation for selective crystallization
    - Floating dredges or other heavy equipment used to harvest pond minerals
    - Further processing typically required (e.g. carnallite main ore from Dead Sea and Qinghai Salt Lake)

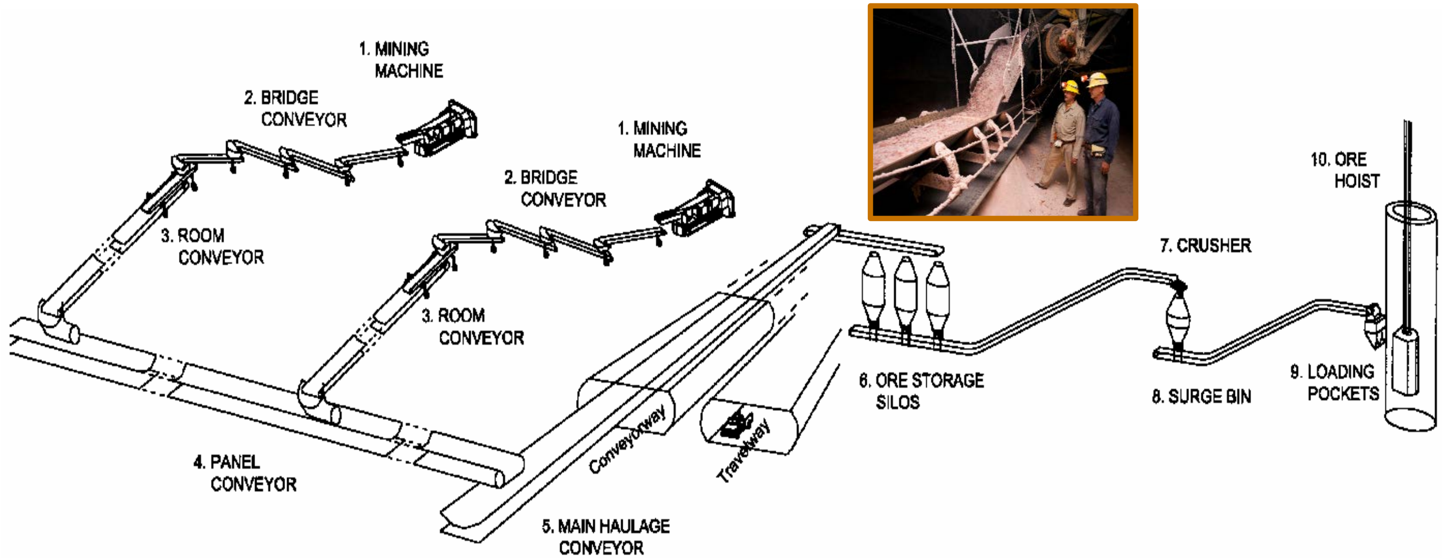
Mining Sylvinite Ore – Shaft Operations

- *Shaft mining is the most widely used method for extracting sylvinite ore from deep underground deposits. Typical shaft mining operations utilize mining machines, a system of conveyors or fleet of specialized vehicles, and a powerful hoist to extract, transport and lift ore from deep underground deposits to the surface.*
- *Most operations include two shafts – a production shaft and a service shaft. The production shaft contains the guides, cables and skips that are used to hoist ore as well as a cage that transports workers and some supplies into and out of the mine.*
- *The service shaft typically is used to ventilate the mine, deliver electricity and transport larger equipment as well as workers and supplies into and out of the mine.*



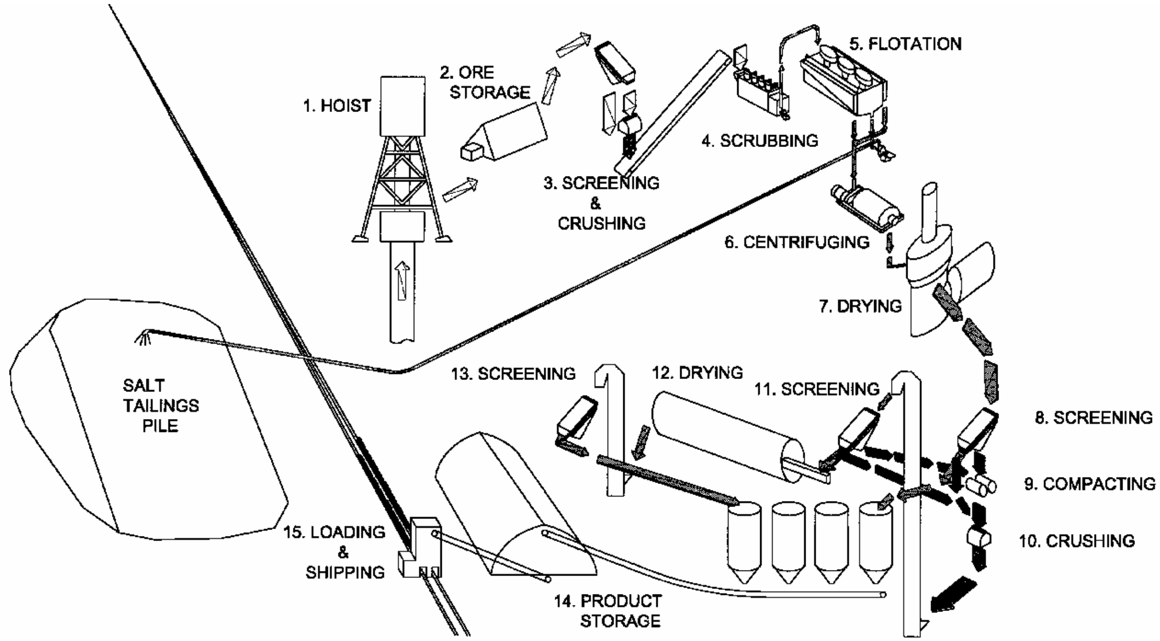
Mining Sylvinite Ore – Shaft Operations

- *The head frame over the production shaft houses a large electric motor that turns a hoist drum to lift skips from the bottom of the mine to the surface. A skip is a long narrow vessel that typically carries 25 to 50 tons of ore from the mine to the surface. Two are used in this process. The skips are attached at the ends of a long and large cable. The drum alternates first rotating clockwise and then counterclockwise so one skip loads at the bottom of the shaft while the other discharges in the dump in the head frame.*
- *Most underground operations utilize room and pillar mining techniques. Sylvinite ore typically is soft rock, so the ore is extracted using continuous mining machines that cut into the face of the deposit. Bridge conveyors transport the ore from mining machines to room conveyors that deliver it to panel conveyors. Panel conveyors run across several rooms or mine cuts and move ore to the main haulage conveyor. This large conveyor then transports the ore often long distances to storage bins near the production shaft. The ore moves from a storage bin to a surge bin, through a crusher and finally to the loading pocket. From the loading pocket the ore is dumped into the skip and then hoisted to the surface for processing.*



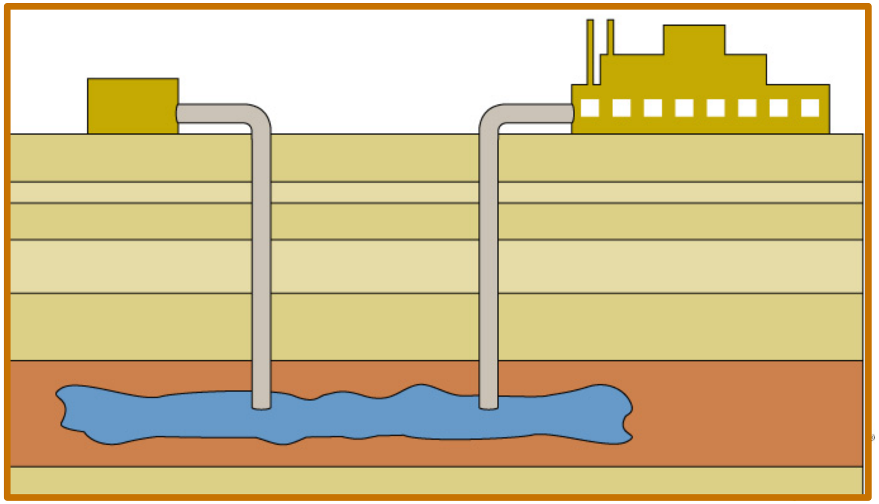
Refining Sylvinite Ore – Flotation Separation

- *The most widely used separation technology is a common flotation process.*
- *In the case of sylvinite ore, the ore first is crushed in order to liberate sylvite crystals (potassium chloride) from halite crystals (sodium chloride).*
- *The crushed ore is mixed with saturated brine and then flotation agents are added to this slurry. Sylvite crystals attach to these agents, float to the top of the slurry and are paddled off and separated from halite crystals that sink to the bottom of the slurry. Halite crystals are pumped to a salt tailings area where they are de-watered and stored.*
- *The sylvite ore is fed through a centrifuge or cyclones where insoluble materials or slimes are separated from the ore. The ore then is dried, screened and compacted to produce different grades of potassium chloride.*



Solution Mining and Selective Crystallization

- *Solution mining is a less widely used method for extracting sylvinite and other ores from deep underground deposits. Hot water initially is pumped through a series of bore holes or “clusters” in the ore. Because sylvinite is soluble, the hot water dissolves the ore and a cavity or cavern forms in the deposit. Once the cavity is formed, hot brine (salt water) is pumped into the cavity. Brine will selectively dissolve the potassium chloride resulting in less sodium chloride in the solution.*
- *The life of a typical cavity is about 20 years. Production peaks from year four to year eight and then declines steadily. Production at year 20 typically drops to 10% to 20% of peak volume before the cavity is abandoned.*
- *Potassium-rich solution is pumped from several cavities to the refinery for processing. No chemical reactions take place during this process. Potassium chloride simply is separated from sodium chloride in the saturated brine. The most widely used separation technology in solution mining operations is selective crystallization. For sylvinite ore, potassium can be separated from salt because the solubility of potassium chloride declines more quickly than the solubility of sodium chloride as the saturated brine cools. In short, potassium chloride crystals form sooner than sodium chloride crystals as the brine temperature falls.*
- *Solution mining is energy intensive, but this technology has advantages over shaft mining in certain circumstances. This technology is better suited to mine extremely deep deposits or deposits that are more difficult, costly and unsafe to mine with underground mining machines. The technology also is better suited to mine and process some types of ore such as carnallite. The development of a solution mine requires less capital and time than a deep shaft mine. There are no flooding risks, and solution mining yields less sodium chloride tailings.*



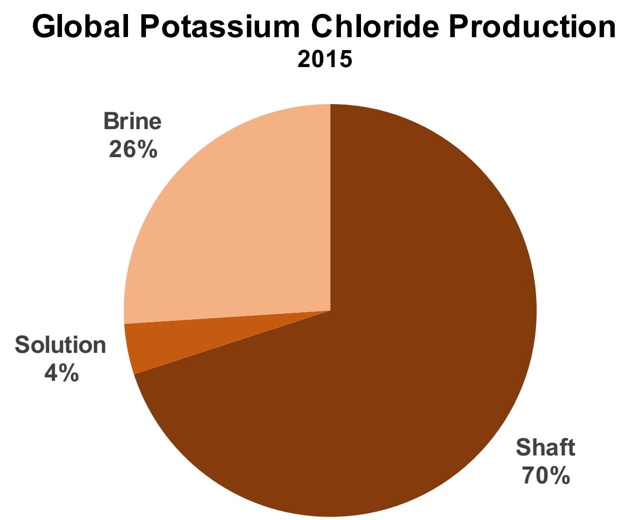
Solution Mining and Selective Crystallization

- *There is an indoor and outdoor version of selective crystallization. The indoor version takes place in vessels called crystallization circuits. In this case, the saturated brine first is heated to 80^o to 100^{o}C in large evaporators to vaporize water. The highly concentrated brine then is fed into the crystallizer where potassium chloride is precipitated and harvested. The brine containing sodium chloride is pumped to a salt tailings pile where it is dewatered and stored. In this case, both the mining and refining processes require significant amounts of energy – mostly natural gas – to heat water and brine. This process often is referred to as hot leaching.*
- *The outdoor version of this process works on the same principle, but the beginning and ending temperatures are much lower, and it takes more time to crystallize potassium chloride from the brine. This technique typically is employed by companies that operate solution mines in cold climates. In this case, the brine from the cavities is pumped into large cooling ponds. Potassium chloride crystallizes as the solution temperature declines and then is harvested with floating dredges. This process, often referred to as cold crystallization, is particularly efficient during frigid winter months.*
- *The potassium chloride from either process is dewatered, dried, cooled, screened and compacted to make finished potash products for agricultural and industrial uses. Because iron oxide is not water soluble, it remains in the cavity rather than the solution. As a result, the higher purity products from solution mining operations are white rather than red, typically contain more than 62% K2O, and are used in many food, pharmaceutical and industrial applications.*

Mosaic's Belle Plaine Saskatchewan operation is the largest potash solution mine in the world. About one million tonnes or roughly 40% of production was harvested from ponds in 2015.

Global Potassium Chloride Production 2015

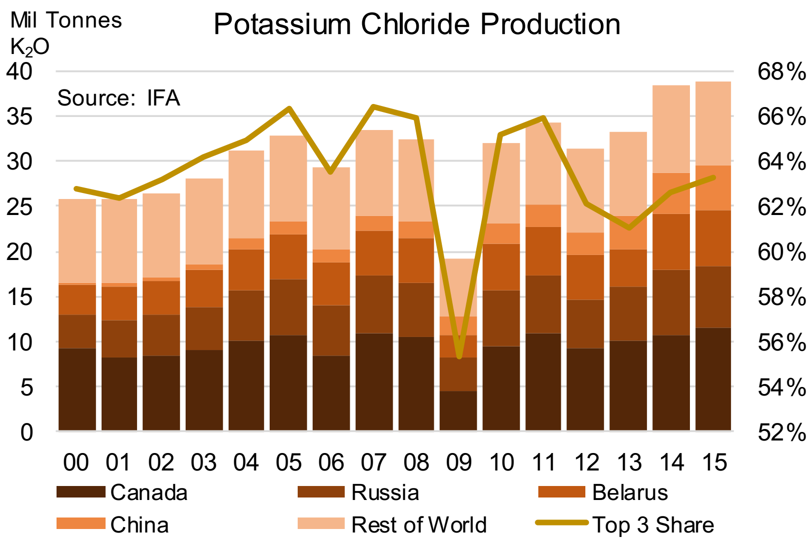
- By type of operation
  - Underground deposits account for about three-fourths of global output
    - 70% from shaft mining operations
    - 4% from solution mining operations
  - Surface brines account for more than one-fourth of global output
    - Percentage has trended up due to large increases in Chinese production



Source: IFA, Company Reports and Mosaic

Potassium Chloride Production

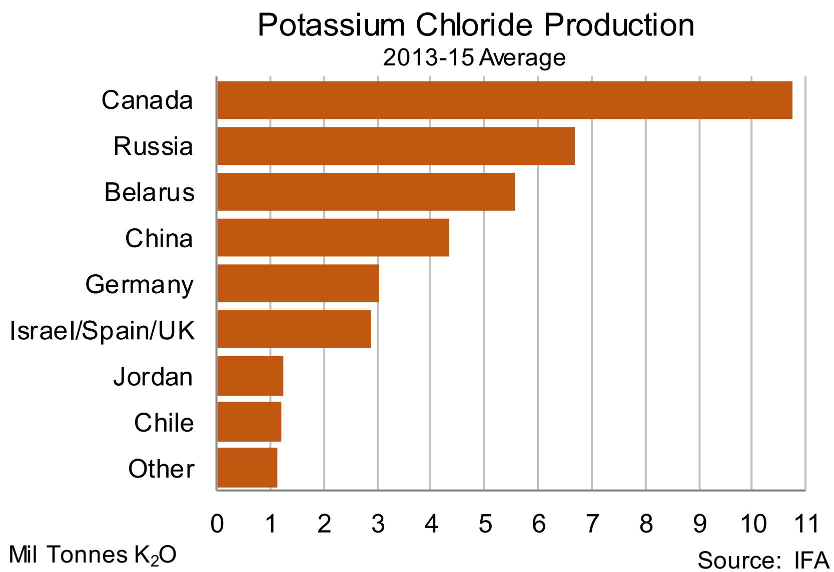
- Global production since 2000
  - Increased at a CAGR of 2.7% (from 25.8 million tonnes K_2O in 2000 ton 38.6 million in 2015)
  - Erratic production mirroring erratic shipments/volatile prices
    - Surges in 2004-05 and again in 2014
    - Flat from 2005-2013 with a big drop during the great global recession
  - Top three countries account for more than 60% of global output
    - Share is trending down due to increases in Chinese production

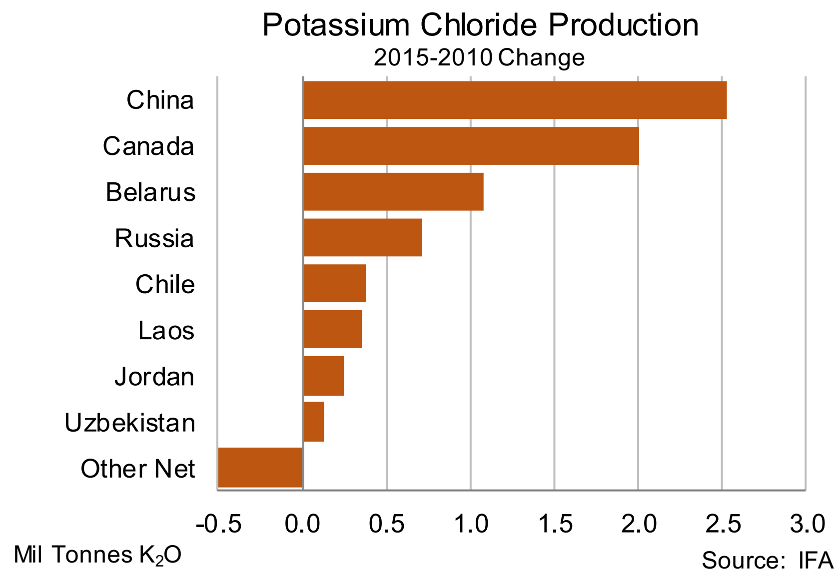


2013-15 Average Country	Mil Tonnes K_2O	Percent of Total	Cumulative Percent
Canada	11,748	29.1	29.1
Russia	6,700	18.2	47.3
Belarus	5,559	15.1	62.4
China	4,350	11.8	74.2
Germany	3,026	8.2	82.4
Israel/Spain/UK	2,899	7.9	90.2
Jordan	1,238	3.4	93.6
Chile	1,218	3.3	96.9
Other	1,146	3.1	100.0
World	36,584	100.0	

Potassium Chloride Production

- Production by country
  - Only 14 countries produce potassium chloride today (#15 expected in 2017)
  - Only 8 countries produce more than the output of a world-scale mine
  - China now ranks #4 and posted largest production gain since 2010
  - Over-investment in new capacity following the 2007/08 price run-up
    - But optimization of operations underway in a lower price environment





Demand

Preliminaries – The K Nutrient

- Plant nutrition 101
  - Plant nutrients are common chemical elements
  - 17 elements are required for plant growth
  - N-P-K are the carbohydrates, protein and fat for a plant
    - Inert N from atmosphere is fixed to hydrogen (Habor-Bosch process)
    - P&K from mineral ores
  - Growing importance of secondary nutrients and micronutrients
  - No substitutes for these nutrients in a plant's diet
  - Justus von Liebig's Law of the Minimum

Image: TFI

Liebig's Barrel

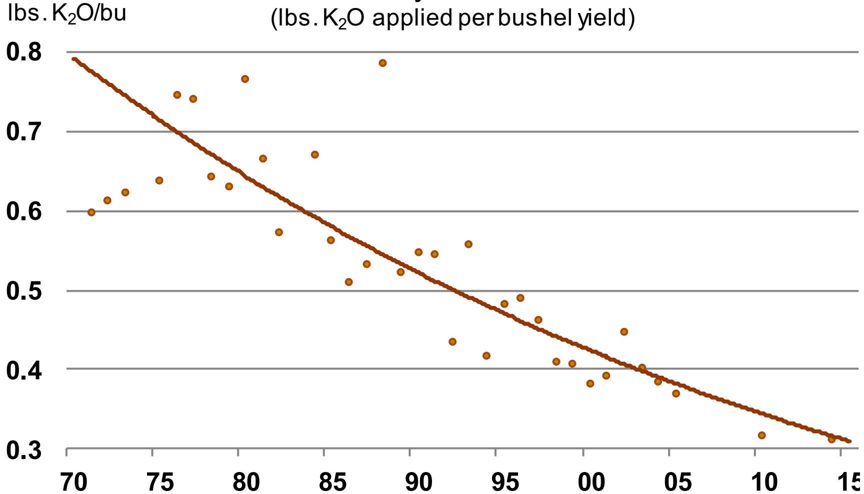
Preliminaries – The Role of Potassium

- The Regulator and Quality Nutrient
  - Essential for controlling critical plant processes
    - Nitrogen uptake
    - Photosynthesis
    - Protein and starch formation
    - Enzyme activation
  - Therefore potassium is vital for healthy plant metabolism
    - Promotes development of strong roots, stalks and stems
    - Improves the plant's ability to utilize water
    - Increases resilience to plant stressors (drought, wind, variable temperatures)
    - Boosts disease and pest resistance
  - Well-earned reputation as the quality nutrient
    - Improves overall plant health
    - Enhances appearance, taste, nutritional value, and self life

Preliminaries -- Safeguarding the Environment

- Case study: Efficacy of potassium in U.S. corn production
  - Corn yields increased from 79 bu ac in 1970 to 171 bu ac in 2014
  - Potassium application rates <u>declined</u> slightly during this period
  - Potassium use per bushel of corn dropped about 60% from more than 0.7 pounds to 0.3 pounds during the same period
  - U.S. farmers today are harvesting more than twice as much corn per acre using approximately the same amount of potassium as in 1970

4R nutrient stewardship



Source: USDA

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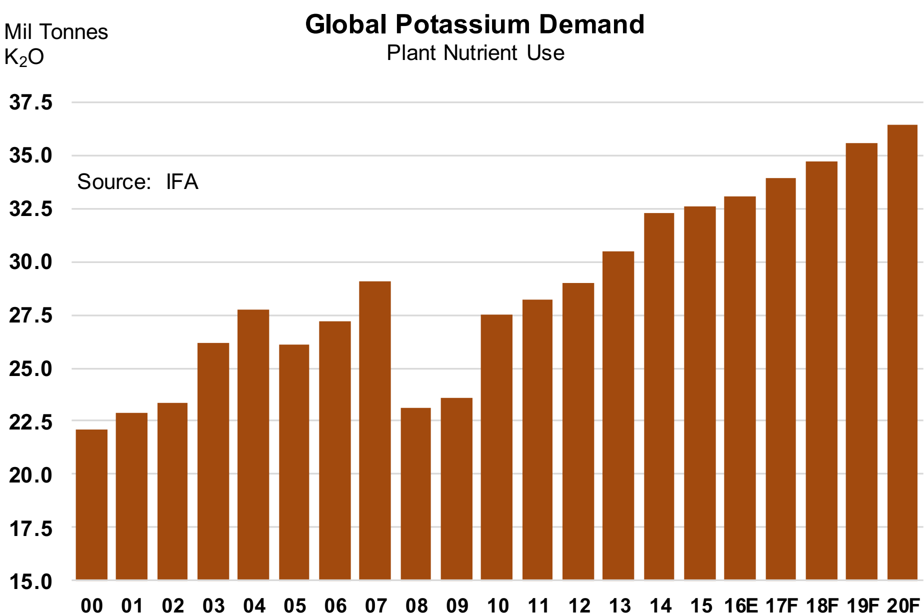
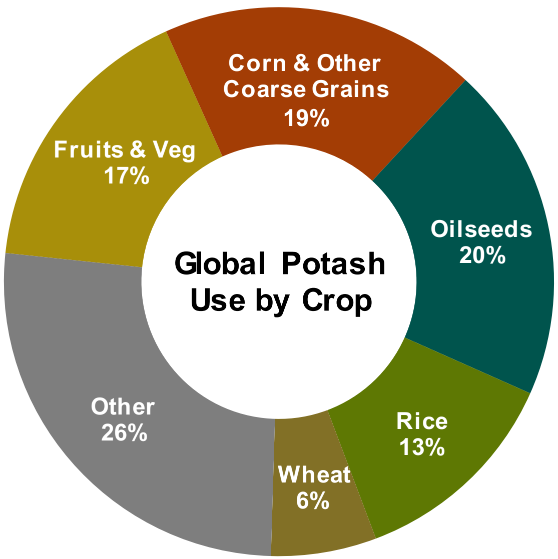
Global Potassium Demand – Plant Nutrient Use



- Based on the most recent IFA statistics, global demand for agricultural uses increased at a compound annual growth rate (GAGR) of 2.6% per year from 22.1 million tonnes K_2O in 2000 to 32.6 million in 2015.
- The chart shows that growth was erratic as a result of moderate changes in on-farm use but also from large swings in global channel inventories during this period.
- Demand is projected to increase at a CAGR of 2.2% from 2015 to 2020 with global use hitting 36.4 million tonnes K_2O by the end of the decade, according to IFA forecasts.
- Demand is expected to increase at a more consistent pace due to a less volatile price environment, but unexpected swings in pipeline stocks still likely will occur.

(IFA demand statistics do not mesh perfectly with implied shipments calculated from production and trade statistics)

Global Potassium Use by Crop



Source: IFA

- Soybeans and other oilseeds are the largest consumers of potash and account for 20% of global potash use. Brazil and the United States make up the lion's share of use on soybeans. In Indonesia and Malaysia, palm oil accounts for 62% and 86% of total potash use, respectively.
- Field crops are heavy potassium users by virtue of the large area under cultivation. Corn and other coarse grains account for 19% of global potash use, and rice and wheat combined capture an equivalent share. In the United States, corn accounts for almost one-half of domestic use. In India, one out of every three tonnes of potash goes down on rice.
- Fruits and vegetables account for 17% of global potash use. These crops are farmed intensively especially in large and rapidly growing countries such as China and India. In China, 40% of potash consumed is applied to fruits and vegetables.
- Fruits and vegetables are potassium intensive crops. Bananas are the top banana. According to the International Plant Nutrition Institute (IPNI), bananas require more potassium per unit of production than any other crop – as much as 1,000 kilograms per hectare.

Global Potassium Demand – Industrial Uses

- Several industrial uses of potassium
  - Leading technical grade uses (>98% KCl purity)
    - Potassium hydroxide (KOH)
      - Dominant industrial use (~70% to 75% of total in most regions)
      - Used in a wide range of products from glass to LED screens to soaps
    - Water conditioning
    - Food and pharmaceutical
  - Leading non-technical grade uses
    - Flux (for aluminum recycling)
    - Drilling muds
    - De-icing
- No reliable demand statistics
  - Global estimates: 3.0-3.5 mil tonnes K_2O
    - China, North America and Europe account for ~75% of use
  - North American estimates: 0.6-0.8 mil tonnes K_2O
    - Mosaic Belle Plaine largest producer of industrial products
      - More than one-third of facility production
      - More than 20 products that serve nearly all industrial segments

Industrial Use Estimates

Mil Tonnes K_2O	2015	2020
Global (IFA)	3.1	3.5
Global (CRU)	3.4	3.8
North America (CRU)	0.8	1.0

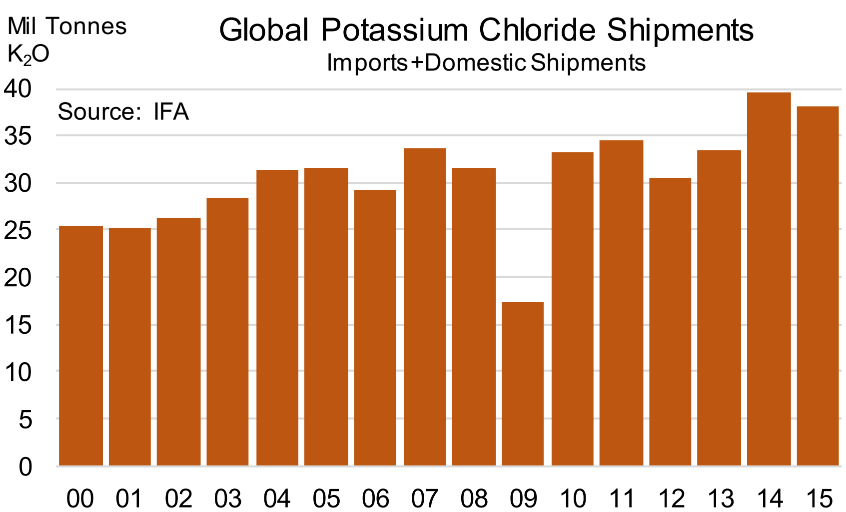
1000 Tonnes K_2O

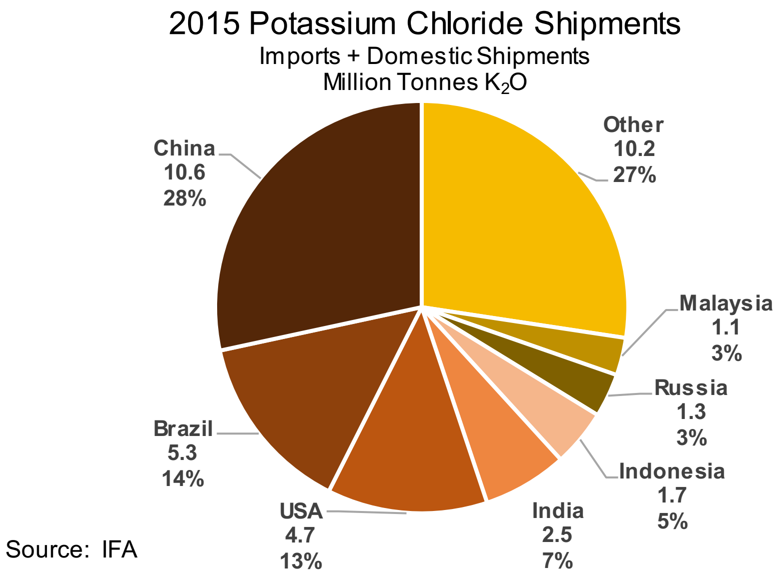
Technical Grade Uses		**525**
Potassium Hydroxide	*460*	
Water Conditioning	*25*	
Pharma	*20*	
Other	*20*	
Non-Technical Grade Uses		**100**
Flux	*40*	
Drilling Muds	*25*	
De-icing	*5*	
Other	*30*	
Total Industrial Uses		**625**

Source: Mosaic

Potassium Chloride Shipments – All Uses

- Big Six importing countries dominate (China, Brazil, USA, India, Indonesia, and Malaysia)
  - Accounted for ~70% of global KCl shipments in 2015
  - Accounted for ~85% of the increase in global KCl shipments since 2000
  - Projected to account for ~90% of the projected increase in KCl shipments between 2015 and 2020





Trade and the Supply Chain

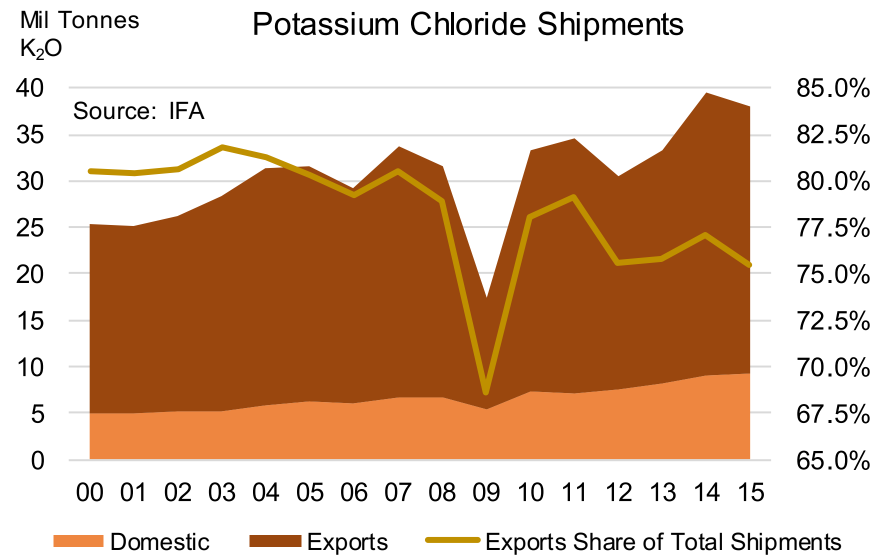
Potassium Chloride Trade

- Trade accounts for about 75% of global shipments/use
  - Much higher percentage than grain
  - Higher percentage than main nitrogen and phosphate products
- This percentage is trending down due to:
  - Big increases in Chinese production and domestic shipments
  - Demand recovery in the former Soviet Union

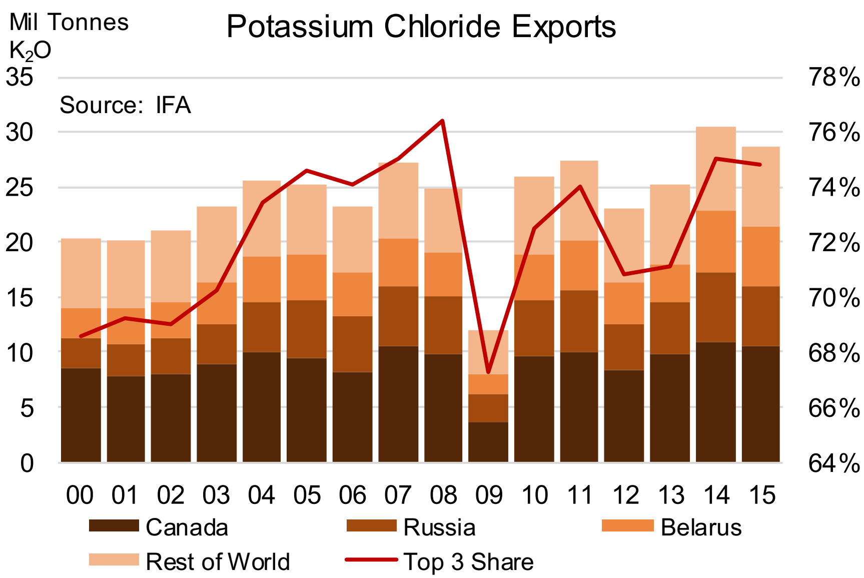
Global Plant Nutrient and Grain Trade (Million tonnes)

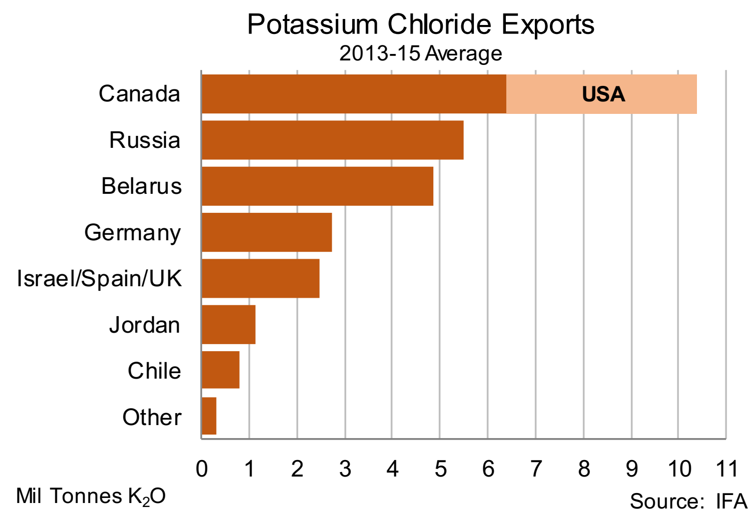
	Global Use	International Trade	Trade as a % of Use
Coarse Grain	1,238.8	164.8	13%
Wheat	704.4	163.5	23%
Rice	471.3	41.3	9%
Total Grain	2,414.5	369.5	15%
Urea	156.9	44.8	29%
DAP/MAP/TSP	62.7	25.5	41%
MOP	56.4	43.5	77%
Total Nutrients	276.0	113.8	41%

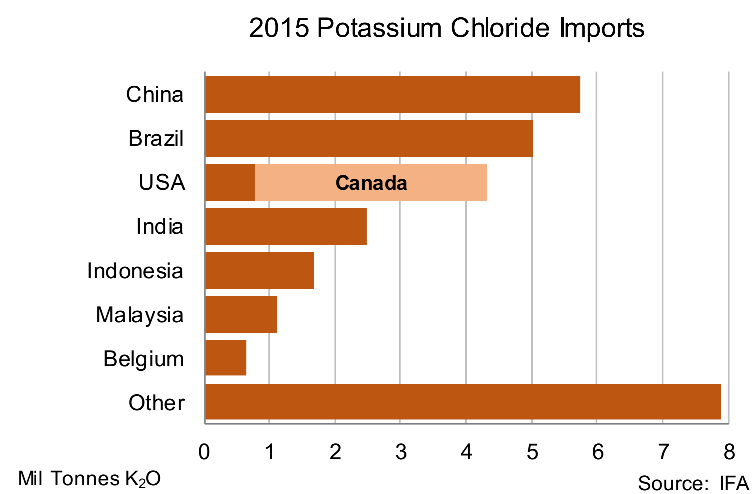
Source: USDA, CRU, Mosaic
Grain use and trade average 2012- 2016 crop years
Fertilizer use and trade average 2011 - 2015



Potassium Chloride Trade – Key Players







- One dozen countries exported potassium chloride in 2015 and the top three – Canada, Russia and Belarus – accounted for 74% of the total.
- IFA statistics show that producers shipped potassium chloride to 122 countries in 2015. The Big Six accounted for more than 70% of the total.

A Long and Large Potassium Supply Chain

- A long supply chain
  - Largest producing regions are far from the largest using regions
  - Case study – from Saskatchewan mine to Mato Grosso field
- A large supply chain
  - At start: mines and mills operate 24-7-365 to meet annual demand
  - At end: products used during one or two short application windows
  - The challenge
    - Position enough product where and when farmers need it
    - Run mines and mills at steady rates so adequate supply to meet demand
    - <u>Keep product flowing regularly</u> in order to supply farmers and run mines
    - Several factors speed up or slow down this flow and exacerbate volatility
      - Weather
      - Price expectations
      - Systemic supply or demand changes

A Long Supply Chain – Case Study

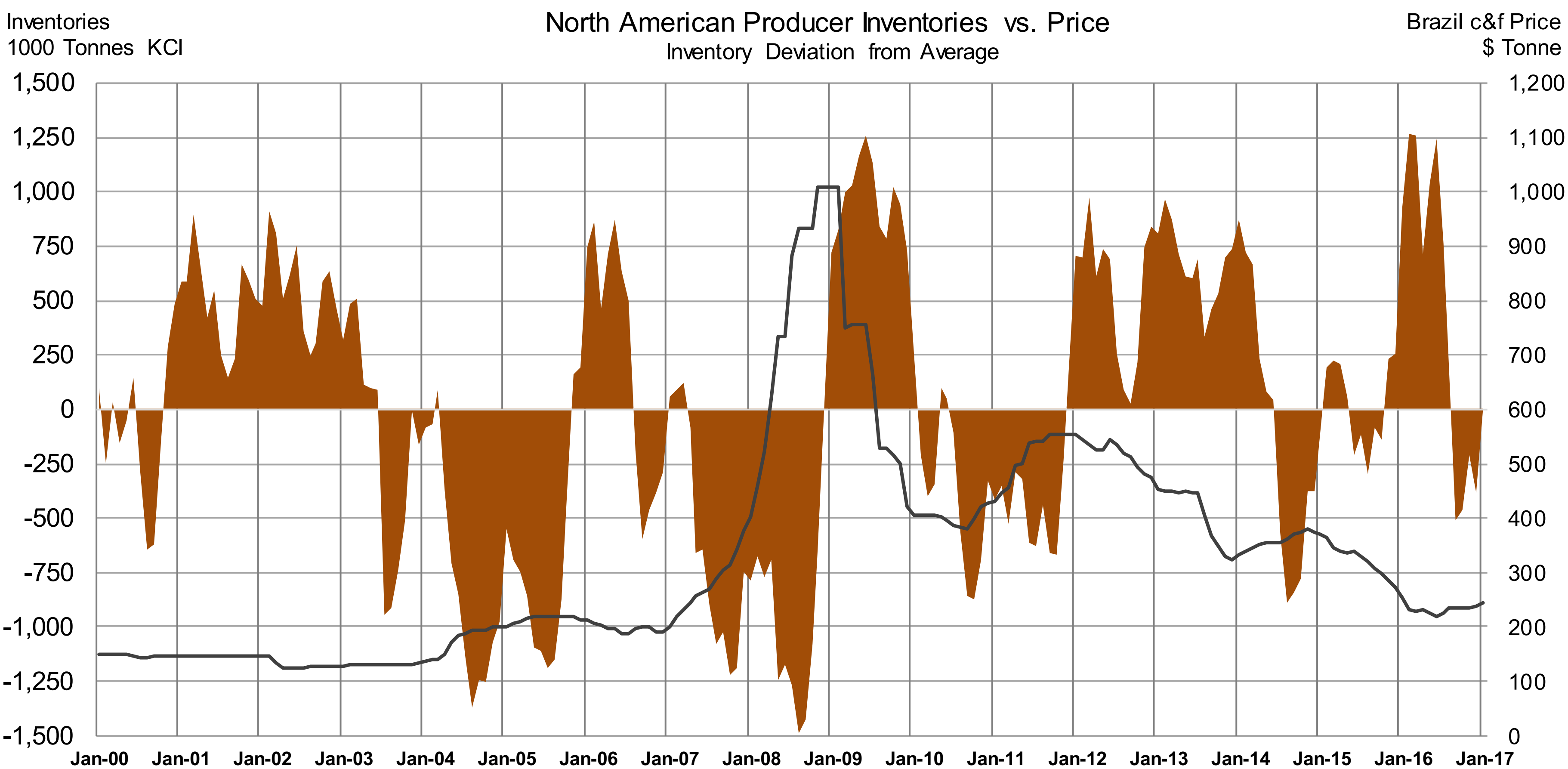
Days	Best Case	Worst Case
Load Unit Train at Mine	1	2
Rail from Mine to Port	12	16
Discharge at Port and Load Vessel	2	3
Sail from Port to Port	15	30
Berth and Discharge at Port	7	14
Truck to Interior Warehouse	3	4
Blend and Deliver to Farm	2	3
Total	**42**	**72**

From Saskatchewan Mine to Mato Grosso Field

- It typically takes 6 to 10 weeks to move potash from a mine in Saskatchewan to a soybean field in Mato Grosso.
- Canpotex rails product from mines in Saskatchewan to export terminals in Vancouver or Portland in 170 to 185 car unit trains. Loading a unit trains at the mine takes one to two days.
- The trip through the Canadian Rockies to Vancouver takes about 12 days, and the trip to Portland takes about 14 days. Snowstorms or avalanches sometimes delay trains during the winter.
- It typically takes 2 to 3 days to load a 40,000 tonne vessel. Sailing time from the west coast of North America to Brazil ranges from about 15 days if the vessel moves through the Panama Cannel to roughly 30 days if it sails around Cape Horn.
- Port infrastructure development has not kept pace with plant nutrient demand growth in Brazil. As a result, port access may take weeks or even months depending on the port and season. This analysis assumes 7 to 14 days to berth and discharge the vessel.
- Once the product is discharged, it typically is transported by truck to a warehouse in Mato Grosso where it is blended with other products, bagged into 50 or 1,000 kilogram bags and delivered to a farm. This journey and operation typically takes 5 to 7 days.

Mosaic

A Large Supply Chain – Rhythm of the Flow



Source: IPNI, ICIS, Argus and Mosaic

Thank You!

The Global Potassium Market

Dr. Michael R. Rahm
Vice President – Market and Strategic Analysis
The Mosaic Company

Frontiers of Potassium Conference
Rome, Italy
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