

Overview of the North American Phosphate Industry:

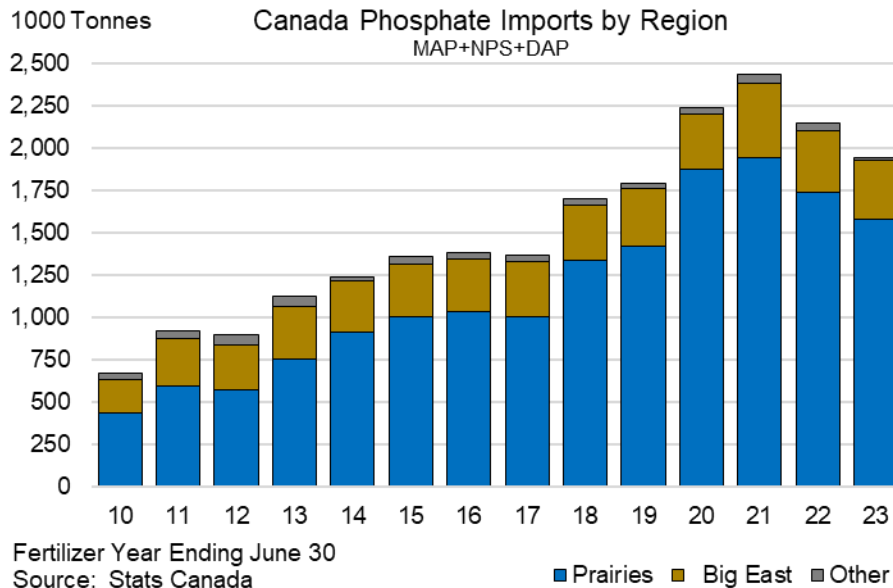
Phosphate fertilizers are used worldwide to sustain and improve crop yields, which are required to meet the needs of both a growing world population and to counter the annual depletion of soil nutrients.

Phosphates being mined and processed for profit occur in two types of rock: igneous and sedimentary. The Martison deposit is igneous and is similar to deposits being mined in Russia, Brazil and South Africa. However, sedimentary ore supplies some 80% of the world's phosphate needs. Florida is the dominant source of this type in North America, where the fine-grained concentrated apatite product is called "phosrock".

There is growing demand by chemical plants for phosphate from igneous sources, because of its low cadmium content. Cadmium is a toxic element. Restrictions on the cadmium content of both phosphate fertilizers and animal feed phosphates are a growing major concern, especially with European processors of phosphate concentrates and importers of finished phosphate products.

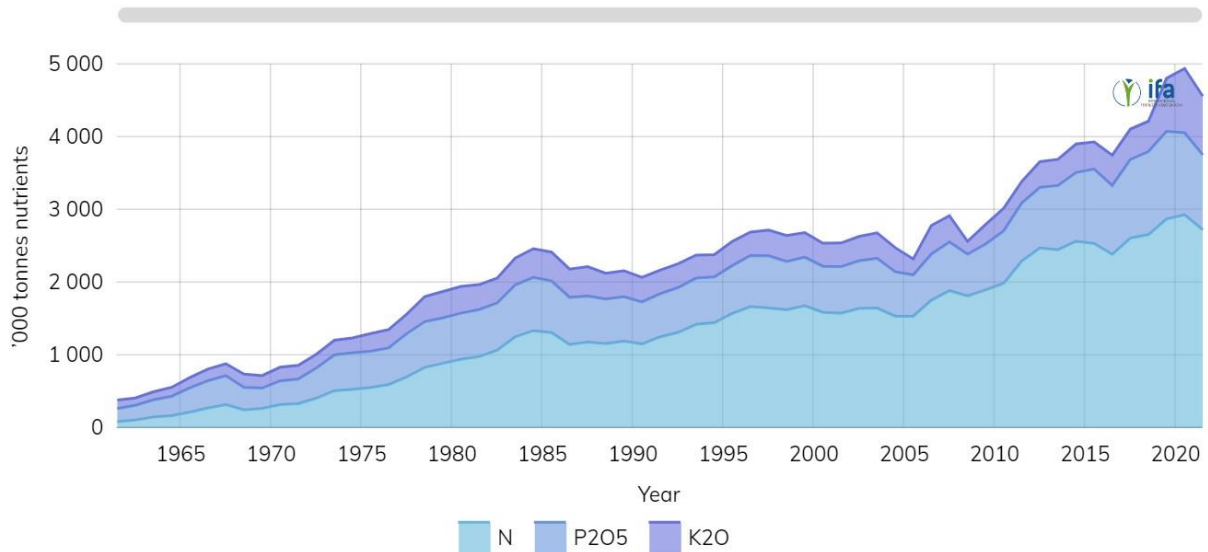
Most of the phosphate production is processed to fertilizer and shipped directly to consumer markets. The significant players in the industry are fully integrated i.e. they mine and beneficiate the ore, process the product to fertilizer and market it on a regional and global scale. For this reason, the most important factor to controlling supply in the fertilizer market is ownership of phosphate reserves. Since the largest U.S. reserves are in Florida, Idaho and North Carolina, the major U.S. producers are based in the same areas. Rising costs, diminishing grades and the costly and time consuming permitting process for new mines in Florida have raised concerns within the industry regarding Florida's ability to sustain production in the long term and compete with alternative sources of phosphate ore.

Canada imports its entire phosphate needs, most of which is now supplied by the Florida and the Idaho producers. With consumption of approximately 2.0 million tonnes of phosphate fertilizer per year, predominantly monoammonium phosphate (MAP) and a nitrogen phosphate sulphur product (NPS), Western Canada offers a growing market and will continue to do so.



1.1. Fertilizer Consumption - Historical Trends by Country or Region

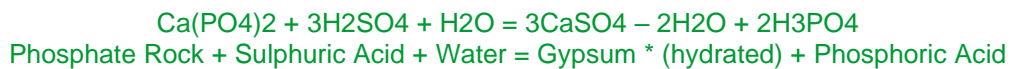
in Canada



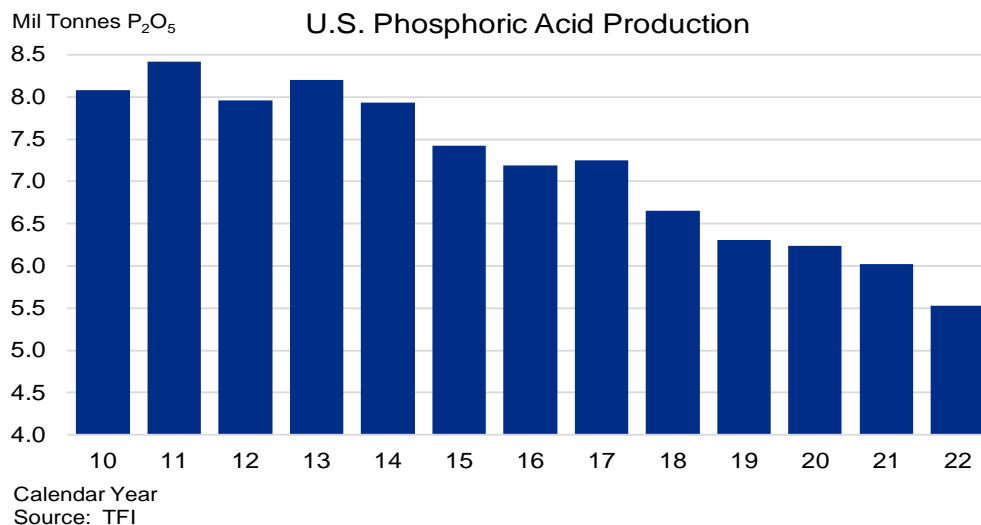
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The starting point for the manufacture of most phosphate products is phosphoric acid. It is made by the acidulation of phosphate concentrate (phosrock) using sulphuric acid and filtering out the resulting calcium sulphate (gypsum), leaving phosphoric acid containing 25% to 40% P₂O₅, depending on the process being employed. Thus, access to low-cost sulphur or sulphuric acid is also very important in the process. Acidulating one tonne of phosphate rock concentrate requires .85 to .90 tonnes of sulphuric acid depending on the quality of phosphate deposit.

Chemical-Reaction

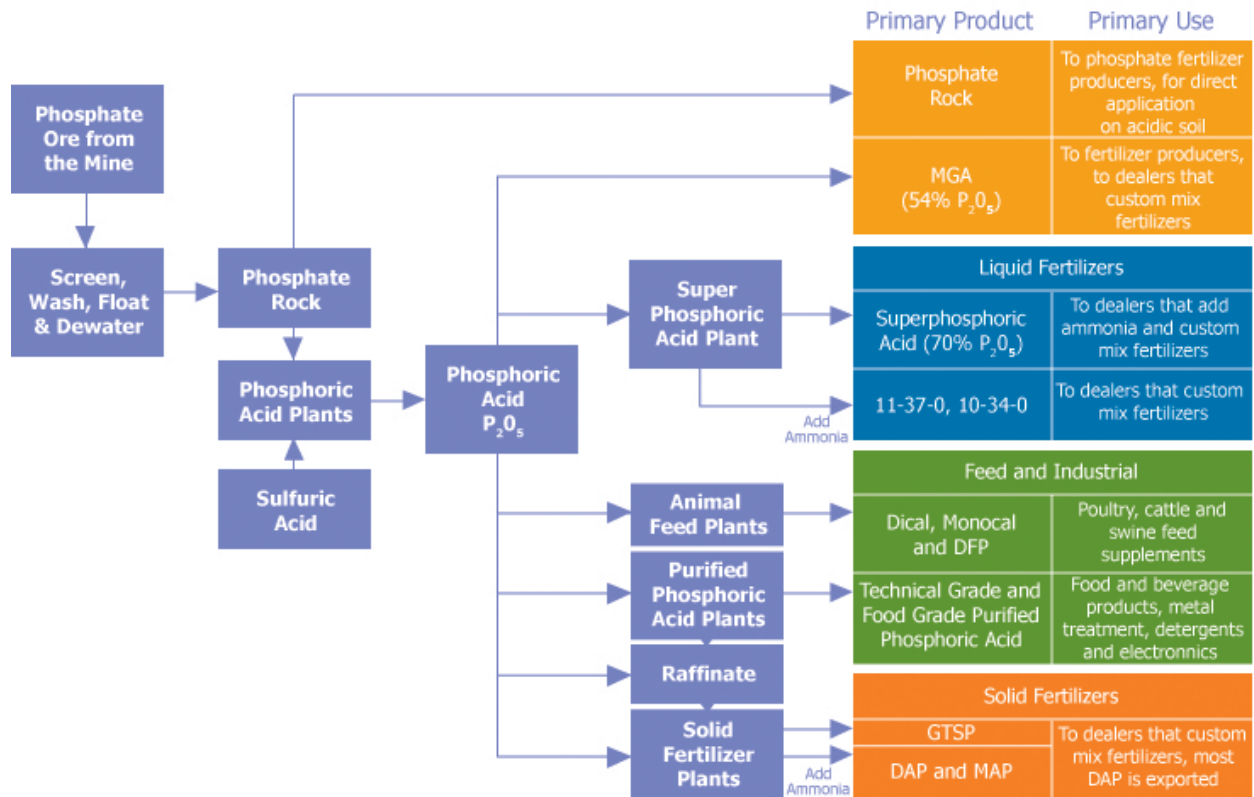


Note: * Gypsum is a waste product



As the chart above is illustrating, U.S. phosphate production is expected to continue to trend down due to eroding rock quality and closures. Phosphoric acid production totaled 5.53 million tonnes P_2O_5 in 2022, down 8% or 490,000 tonnes from a year earlier. That followed a 4% decline in 2021. Mosaic lost production in Florida due to Hurricane Ian and Nutrien reported that production was down 167,000 tonnes P_2O_5 in 2022 most likely due to the conveyor failure at Aurora (the company reported a 79% operating rate for the year and 67% in Q4). U.S. phosphoric acid production has declined 11% or 710,000 tonnes P_2O_5 during the last two years or the equivalent of more than 1.35 million tonnes of MAP.

Phosphate – A Simplified Flow Diagram Primary Products and Uses



Source: PotashCorp

Diammonium phosphate (DAP), the most widely used fertilizer, is made from phosphoric acid by interaction with anhydrous ammonia. The same reaction of the phosphoric acid and ammonia can also produce monoammonium phosphate (MAP), which is more suitable to Canadian soil conditions. The end results are the same for DAP and MAP i.e. supplying phosphorous to the soil for use by the crops. Merchant grade phosphoric acid (MGA), super phosphoric acid (SPA) are concentrated forms of phosphoric acid which also find common use as fertilizers, animal feed and maybe further upgraded by solvent extraction to purified acid (PPA) for the industrial, food and now the battery markets. With the recent development of the Lithium Iron Phosphate (LFP) battery for both the electric vehicle and energy storage markets, the PPA market is expected to expand rapidly to meet this new demand.

Due to a variety of end products, each with a different phosphate content, the industry has adopted the phosphorous pentoxide (P_2O_5) content as the unit of measure or yardstick for all phosphate material from ore to final product. This may be viewed as a measure of the relative nutrient value of the product for fertilizer and for the P_2O_5 content (strength) of the PPA used in the industrial, food and LFP product.

In the following table, the P_2O_5 content of the four common fertilizer products and the PPA used in the industrial, food and LFP markets is indicated:

	DAP	MAP	MGA	SPA	PPA
%P_2O_5	46%	52%	54%	70%	61.5%

Please see the “Investors” section of the website, under the sub-heading “Presentations”, for further details of the Martison Project, or “About Cadmium in Fertilizer” and the European phosphate restrictions.