OVERVIEW OF FERTILIZERS IN BRAZIL: A JUSTIFICATION FOR STONEMEAL

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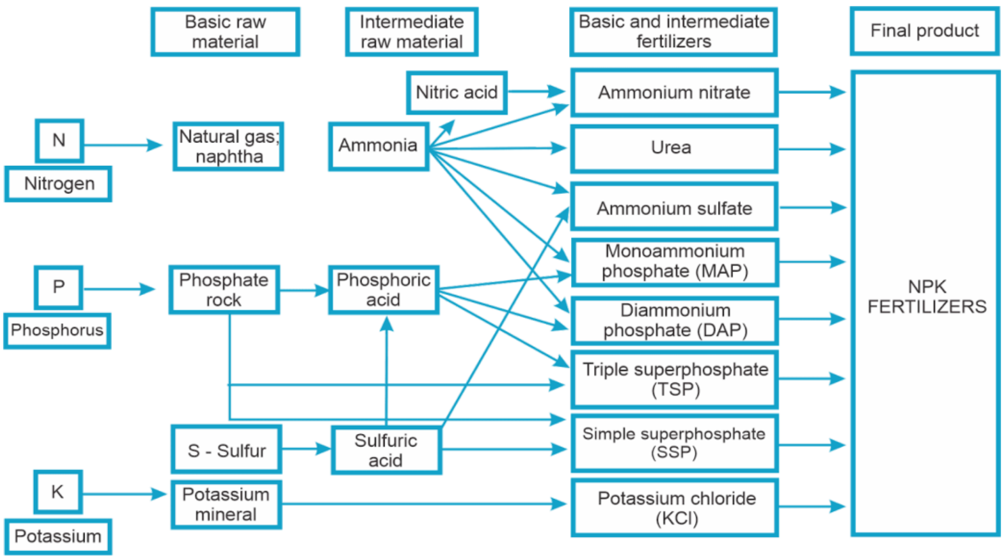
Summary: The fertilizers production chain encompasses the different raw materials (phosphate rock, sulfur, potassium, and natural gas) needed to form the intermediate products (MAP, DAP, SSP, SST, etc.) which are combined to create NPK fertilizer. Due to its huge geodiversity, Brazil has significant phosphate deposits, but the same is not true in terms of its potassium, sulfur, and nitrogen (the latter two coming mainly from the petroleum and natural gas chain) deposits. This has led the country to rely on the expensive importation of these raw materials, which might jeopardize the competitiveness of Brazilian agribusiness. Through data on reserves, production, and foreign trade, this article aims to reinforce the importance of the search for alternative sources for these raw materials.

Keywords: fertilizers chain; dependency; stonemeal.

INTRODUCTION

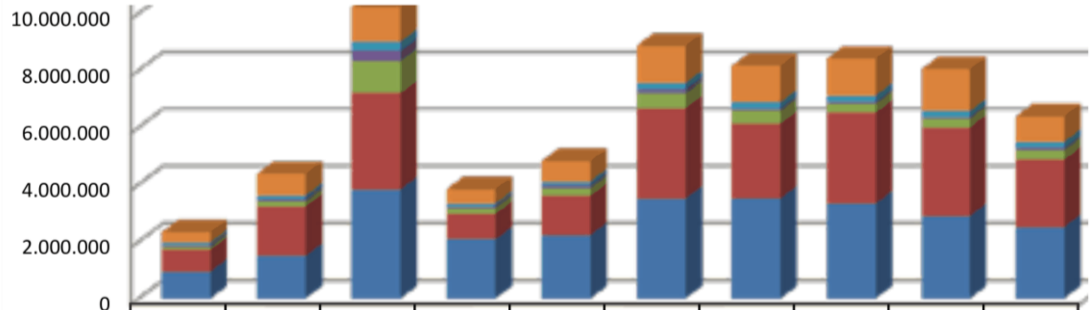
Figure 1 shows the traditional fertilizers production chain which forms NPK. Within the chain, the basic and intermediate raw materials and the basic and intermediate fertilizers are easily identifiable. The ingredients needed for the manufacture of NPK are natural gas, naphtha, phosphate rock, sulfur, and potassium rock. With the exception of potassium rock, which is already water soluble, all the other raw materials must undergo alterations in order to be usable for soil application. After conversion, the raw materials can be mixed according to the needs of each soil and culture.

Figure 1 – Fertilizer production chain. Source: Fosfértil, 2008.



It is also important to understand the evolution of fertilizer products importation in terms of expenses during the last decade, as is shown in figure 2.

Figure 2 – 2006-2015 evolution of expenditure on imports of some raw materials and intermediate products (in US $1,000). Source: SECEX/MDIC, 2006 to 2015. Product basket chosen by the author, which only partially reflects the import of fertilizers.



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Urea	364.307	766.218	1.225.330	512.460	710.347	1.317.064	1.284.739	1.305.465	1.481.472	897.592
P2O5 Concen.	66.933	104.623	311.675	83.805	134.682	206.564	205.475	219.917	187.841	205.673
Phosphoric acid	80.976	99.978	360.907	58.438	102.849	160.587	89.740	63.489	59.086	78.678
Sulfur	103.586	171.777	1.132.269	214.818	267.431	504.594	449.023	311.496	308.021	333.148
Interm. Product	763.806	1.726.338	3.369.097	886.971	1.370.218	3.174.596	2.619.062	3.185.157	3.109.591	2.355.287
Potassium	950.347	1.500.059	3.828.779	2.079.147	2.234.245	3.503.225	3.512.829	3.324.578	2.897.140	2.513.950

The discussion on fertilizers has often been dominated by the final product, while in fact the explanation for our dependence must be sought out in the context of r each of the raw materials (save nitrogen), as discussed in detail below.

PHOSPHATE

Phosphate is relatively abundant in Brazil due to a large amount of carbonatites, i.e., igneous rocks that can contain phosphate, niobium, rare-earth elements, barite and titanium mineralization, etc. In contrast to the typical global deposits of sedimentary origin whose content range from 20% to 30% of P_2O_5, Brazil's deposits contain contents around 10% of P_2O_5. Other differences between the two types of deposits include: different compositional variability for igneous deposits, different ore body geometries, different granulometry, different nutrient releases, and different levels of impurities. This is reflected by higher costs, which probably would make Brazilian phosphate uncompetitive in foreign markets, in the case of surplus production. Table 1 shows the evolution of Brazilian production and dependence.

Table 1 – Evolution of the production and apparent consumption of P_2O_5 concentrate (1000 tons).

Phosphate	Year								
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Production (1000 T)	6,185	6,727	6,084	6,192	6,738	6,740	6,715	6,513	6,100
Apparent consumption (1000 T)	7,844	8,342	7,000	7,590	7,917	8,006	7,938	7,564	7,367
Dependency (%)	**21.1**	**19.4**	**13.1**	**18.4**	**14.9**	**15.8**	**15.4**	**13.9**	**17.2**

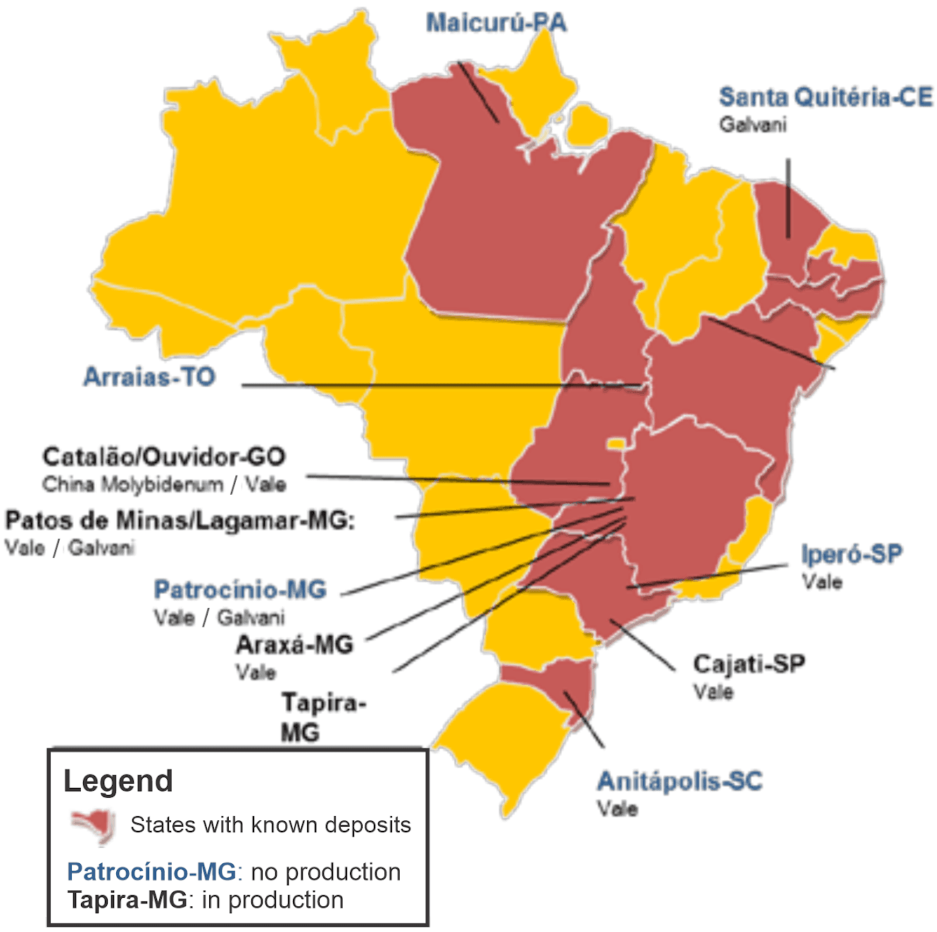
Source: DNPM, SECEX/MDIC, 2007 to 2015.

Therefore, we can verify that in terms of rock concentrates, the country has managed to reach expressive quantities. However, when the chain as a whole is assessed, the dependence level grows, which will be subsequently discussed.

This production primarily occurs in the Central-West region of Brazil, particularly in the *Triângulo Mineiro* region (municipalities of Tapira and Araxá) and in Catalão. The company Vale is the biggest national producer, followed by Anglo American. Galvani is a smaller company that also contributes to the production and might increase its production in the future with new projects.

An aspect that calls for attention is the occurrence of phosphate in several deposits in Brazil (Picture 3), which are not currently in production due to environmental issues or problems with economic viability.

Figure 3 – Main phosphate deposits in Brazil. Source: DNPM, unpublished.



POTASSIUM

The potassium supply situation is quite critical in Brazil. With few deposits and only one mine in operation (near exhaustion), in the last years, the country attended to less than 10% of its needs (Table 2) and the import of the remaining material has brought about immense expenses, as is shown in figure 2. In fact, this is one of the greatest concerns within the Brazilian agribusiness sector.

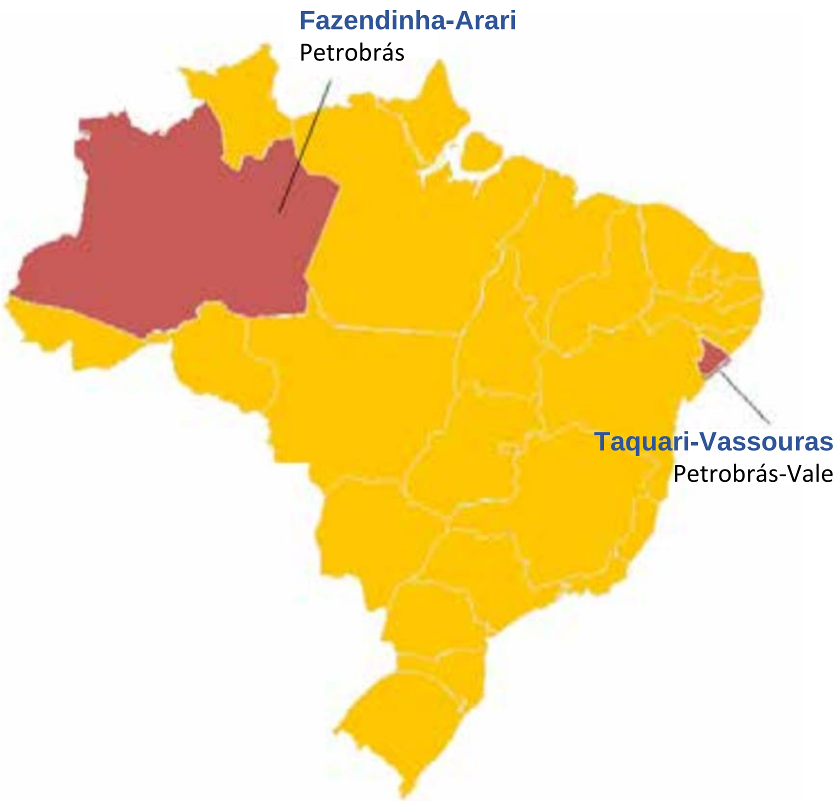
In Brazil, there are only two areas that are known to contain potassium salts. Silicate potassium rocks have been studied, but still lack economic viability.

Table 2 – Evolution of the production and apparent consumption of potassium (1000 tons).

Potassium	Year								
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Production (1000 T)	424	383	453	418	395	346	311	311	
Apparent consumption (1000 T)	4,473	4,424	3,886	4,079	5,022	4,565	5,172	5,726	
Dependency (%)	**90.5**	**91.3**	**88.3**	**89.7**	**92.1**	**92.4**	**94.00**	**94.6**	

Source: DNPM, SECEX/MDIC, 2007 to 2015

Figure 4 – Deposits of potassium originating from salts. Source: DNPM, unpublished.



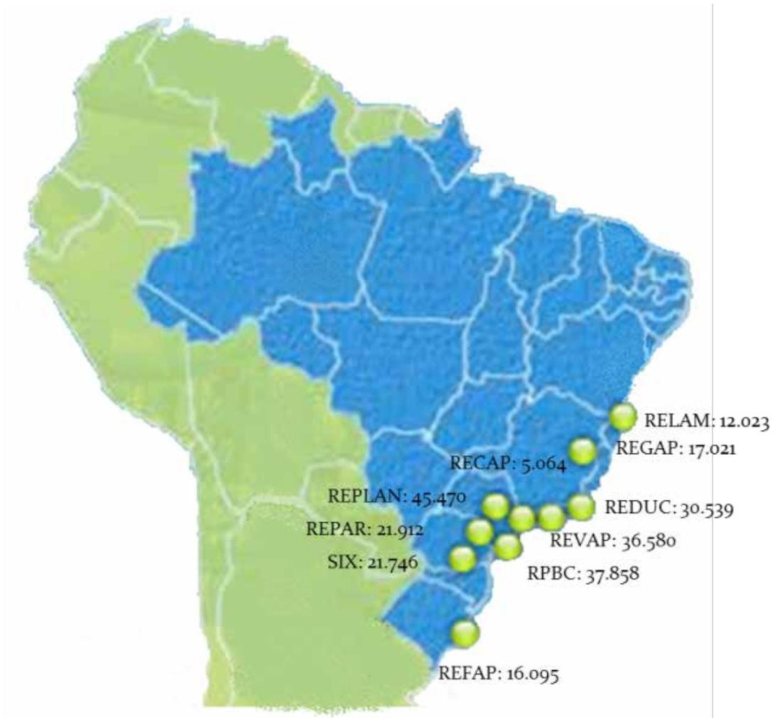
In the state of Sergipe, Vale operates a project focusing on the extraction of carnallite potassium minerals by dissolution, but its kickoff has been continually delayed. Sylvite deposits have been known to exist in the state of Amazonas since the 1970s by the former company PETROMISA. Furthermore, many companies have researched the continuity of these deposits. Nevertheless, the exploration has proven to be unviable due to technical and economic issues (e.g., the falling price of potassium in the international market). Should both projects start their production, our dependence is reckoned to decrease to 65%.

SULFUR

Although sulfur is not encompassed by the NPK acronym, it has a crucial role within the chain, as can be observed in figure 1. It is important in relation to phosphate rock, playing a part in a reaction through sulfuric acid for the liberation of phosphorus and composition of intermediate products. In Brazil, companies are highly verticalized and new deposits necessarily require sulfur import for the acid production.

In Brazil, sulfur in its elementary form is produced in Petrobras's refineries and this production has significantly increased in the last few years due to the growing imperative of cleaner fuels. This can be seen in terms of diesel production, as currently commercialized diesel has 10 ppm of sulfur as opposed to 50 ppm as seen in former years (moreover, there are types of gasoline with 50 ppm and 30 ppm). Petrobras's refineries are shown on the map below.

Figure 5 – Map showing the Petrobras' refineries and their respective production. Source: the author, based on Petrobras' information on production in 2015.



Another important source of sulfur is the sulfuric acid from the metallurgic industry, i.e., the acid produced by gold, copper, and zinc sulfides. Presently, there are four operations in Brazil: one gold-based (Anglo), two zinc-based (both by Votorantim), and one copper-based (Paranapanema). The production that comes from both petrol and metallurgy, nonetheless, has not been sufficient to attend the internal market, as shown in the table below.

Table 3 – Evolution of the production and apparent consumption of sulfur (1000 tons).

Sulfur	Year								
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Production (1000 T)	449	447	444	455	479	488	560	550	514
Apparent consumption (1000 T)	2,652	2,759	2,040	2,518	2,768	2,748	2,761	2,710	2,752
Dependency (%)	**83.0**	**84.0**	**78.0**	**82.0**	**82.0**	**82.0**	**80.0**	**80.0**	**81.0**

Source: DNPM, SECEX/MDIC, 2007 to 2015.

CONCLUSION

The features hereby approached the concern for the availability of raw materials from Brazilian subsoil for the manufacturing of fertilizers. Hence, even though there are significant Brazilian phosphate deposits, fertilizers form a chain and there is no availability of other raw materials, i.e., potassium, sulfur, and nitrogen, to compose the intermediate products, which brings about high expenses with the import of raw materials or intermediate products.

It is clear that Brazilian dependence on soluble fertilizers will persist. Thus, the search for alternatives that might replace or mitigate this dependence is essential. In respect to phosphate, over the last couple of years some companies have carried out research on sedimentary phosphate of direct application, such as the aluminum phosphates in northeast Pará/northwest Maranhão, as well as the phosphates by Grupo Bambuí in the state of Tocantins, which could potentially substitute conventional igneous deposits. Regarding potassium, rocks such as the phonolite from the region of Poços de Caldas-MG have shown to be viable sources, but there are ongoing studies on the glauconite from the region of Serra da Saudade-MG (verdigris) and glimmerites of emerald mining tailings, among other alternatives.

REFERENCES

BRASIL. Departamento Nacional da Produção Mineral. Brasília: DNPM, Sumário Mineral Brasileiro 2007 a 2016.

BRASIL. Ministério do Desenvolvimento, Indústria e Comércio – MDIC. Secretaria do Comércio Exterior – SECEX. Sistema Aliceweb, consulta às importações nos anos de 2007 a 2015. Petrobras. Informações prestadas por e-mail para confecção do Sumário do Enxofre em 2015.

UNITED STATES GEOLOGICAL SURVEY: Mineral Commodity Summaries, 2007 a 2015.

Fosfértil, Painel: Matérias Primas Fertilizantes, apresentado no 4º Congresso da Indústria Química do Mercosul e 8º Congresso Brasileiro da Indústria Petroquímica, Rio de Janeiro, maio de 2008.