Survey on Fertilizers

in Táchira State

AL&C CONSULTING GROUP

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Introduction

1. Introduction

This survey aims to evaluate the advantages to develop the fertilizers/ fertilizers industry in Táchira state (West of Venezuela), as a part of a joint venture investment among Venezuelan and Indian institutions and/or entrepreneurs.

To develop this survey the following activities were undertaken:

- Interviews with executives related to the productionand business sector of the Táchira state. (Annexure)
- Visits to different geographic and productive areas (in Táchira state) related to the fertilizer sector. (Annexure)
- Processing of the data gathered in the field and preparation of report.

This study will present the potential of the mining sector in Táchira state for the development of a Fertilizer and phosphate byproducts industry, considering the existing natural resources that provide opportunities for the promotion of foreign investments from highly experienced investors in the mining, fertilizers and byproduct sectors.

Conceptual Aspects of Fertilizers

2. Conceptual Aspects of Fertilizers

A mineral fertilizer is a product of inorganic origin, which contains, at least, a chemical element that a plant needs to complete its life cycle. The most important characteristic of any fertilizer is that it must have a maximum solubility in water, so that it can dissolve in the water as the nutrients enter passively and actively in the plant through the flow.

Fertilizers are classified in several ways. They are classified according to whether they provide a single nutrient (say, N; P or K), in which case they are classified as "straight fertilizers." "Multi-nutrient fertilizers" (or "complex fertilizers") providing two or more nutrients, for example N and P; Fertilizers are also sometimes classified as inorganic versus organic. Organic fertilizers are usually matter derived from plants or animals. Inorganic fertilizers are sometimes called synthetic fertilizers due to various chemical treatments involved in theirproduction.

Three main macro-nutrients:

- Nitrogen (N): favors leaf growth;
- Phosphorus (P): helps in the development of roots, flowers, seeds, fruit;
- Potassium (K): favors a strong stem growth, water movement in plants, promoting flowering and fruiting;

The most common nitrogen fertilizers are: anhydrous ammonia, urea (produced with ammonia), ammonium nitrate (produced with ammonia and nitric acid), ammonium sulfate (made from the combination of ammonia and sulfuric acid) and calcium and ammonium nitrate, or Ammonium nitrate and limestone (resulting of adding CaMg (CO3) 2 limestone to ammonium nitrate).

Some of the Phosphate fertilizers are the following: ground phosphate stone, basic scoria (a by-product of iron and steel), superphosphate (produced by treating phosphate stone ground with sulfuric acid), triple superphosphate (produced by treating phosphate stone with phosphoric acid), and mono phosphate and

diammonium. Basic raw materials for the production of fertilizers are: phosphate stone, sulfuric acid (which is usually produced at the site with elemental sulfur) and water.

All potassium fertilizers are made with brines or subterranean deposits of potash. The main formulations are potassium chloride, potassium sulfate and potassium nitrate.

Mixed fertilizers may be produced by dry mixing, granulating several intermediate fertilizers mixed in solution, or treating the phosphate stone with nitric acid (nitrophosphates).

As Táchira state has deposits of phosphate stones, the Phosphorus as mineral resource will be the focus of our study.

Phosphorus

Phosphorus is one of the vital elements for agriculture and for life in general, because it forms part of all food chains, passing from one organism to another. Phosphorus is present in almost all chemical reactions, either in mineral compounds or organic combinations (lecithin, phytins, and proteins). In plants, it can be found within the composition of phospholipids and nucleic acid. The lack of phosphorus reduces the production and their deficiency decreases the nutritional value of grains and seeds. The human beings acquire the phosphorus present in the plants directly or indirectly through the animals. Plants absorb phosphorus and other elements from the soil solution or the aqueous phase of the soil. Normally, a soil can possess phosphorus to sustain vegetal life, but often it is not sufficient to meet the demand for crops. Therefore, there is a scope for research and development in vegetal genetics.

This is the reason why phosphorus must be included as a fertilizer. There is no other source available in nature that can replenish the phosphorus that is extracted by the crops. Ensuring food production for the current and future population will depend on fertilizers.

The industry transforms phosphoric rocks containing few soluble phosphorus into ionic forms that can be used by the plants that absorb it from the soil in the form of H2PO4 ion. That is the reason why mineral components or raw materials are strategic for the fertilizer industry.

Phosphorus is present in most rocks in small amounts, but in a special type of phosphate rock, called phosphorites (marine sedimentary phosphates) the content of P2O5 generally exceeds 18%; and sometimes can reach 40%. The latter occurs when the chemical composition approximates that of the Carbonatefluorapatite [Ca5 ((PO4, CO3)) 3F]. It is present in crusts, spherulites and nodules in sedimentary horizons, constituting masses of phosphate rocks or the mineral portion of bones and teeth of vertebrate organisms.

Phosphoric rocks can be produced in various ways, using the same lines as for single superphosphate and triple superphosphate. The process selected should be the one that produces the greatest possible return on investment. To this end, the following factors were considered: the quality of the phosphoric rock existing in Riecito area, the simplicity of the process, the integration with existing facilities and the availability of other raw materials and services.

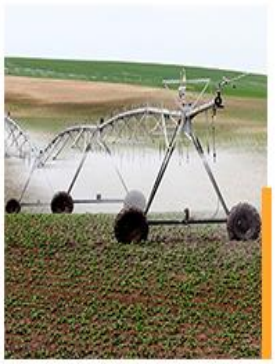
Fertilizers production system

3. Fertilizers production system

Fertilizers can be found as solid, liquid or gaseous substances, containing one or more nutrients for plants.

Fertilizers are either applied to the soil, directly on the plant (foliage) or added to aqueous solutions, to maintain soil fertility and the quality of yields and crops, and also to improve crops development.

The purpose of fertilizers is to be a complement to the natural supply of soil nutrient, build up soil fertility to satisfy the demand of crops with a high yield potential and to compensate for the nutrients taken by harvested products or lost by unavoidable leakages to the environment, to maintain good soil conditions for future cropping.



Manufactured fertilizers are classified according to the following different criteria:

Number of nutrients

- Single-nutrient fertilizers or straight fertilizers (whether for macro or micronutrients)
- Multi-nutrient fertilizers or compound fertilizers (2; 3 or more nutrients)

Type of combination

- Mixed fertilizers or 'bulk-blends', are physical mixtures of two or more single-nutrient or multi-nutrient fertilizers

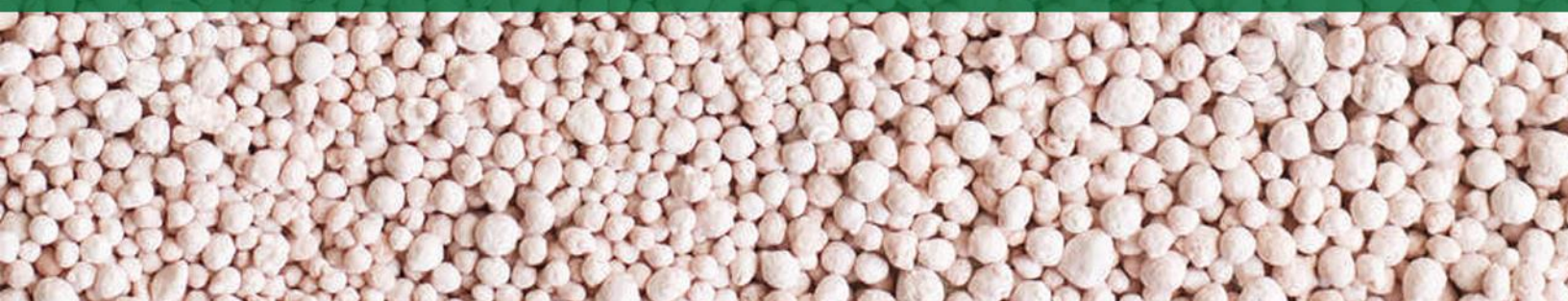
Physical condition

- Solid (crystalline, powdered, prilled or granular) of various size ranges
- Liquid (solutions and suspensions)
- Gaseous (liquid under pressure, e.g. ammonia)

Nutrient release

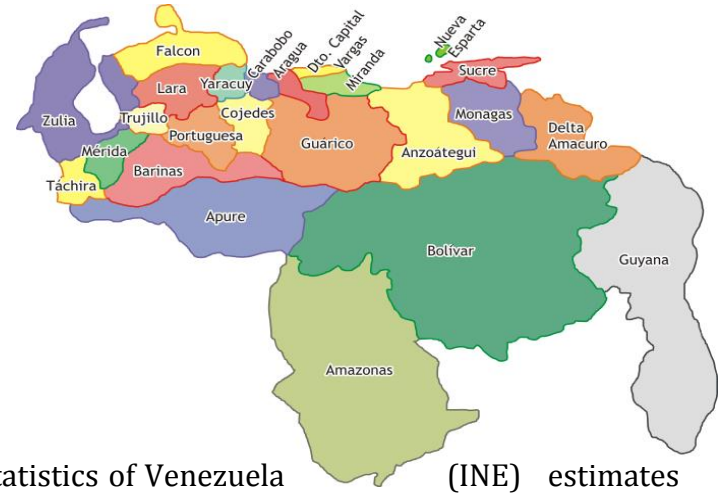
- Quick-acting (water-soluble and immediately available)
- Slow-acting (transformation into soluble form required, e.g. direct application of phosphate rock)
- Controlled-release by coating
- Stabilized by inhibitors

Táchira State characteristics



4. Táchira state characteristics:

Táchira state is located at the southwestof the country and belongs to the Andes region. Its boundaries are Zulia state to the north, Apure state to the south, Mérida state and Barinas state to the east, and Colombia to the west. It is located approximately 800 kilometers from Caracas.



According to National Institute of Statistics of Venezuela (INE) estimates by 2010, Táchira state was placed number 16 in respect of area, however is the ninth in respect to the number of inhabitants. Due to its geographical position (it is located in the Colombian-Venezuelan border axis), it presents one of the most dynamic population flows in Latin America, being a recipient of immigrants, mostly from Colombia.

Area

- 11.100 km^2 equivalent to 1.2% national territory.
- Population (According to National Institute of Statistics of Venezuela estimates by 2010): 1.242.153 inhabitants equivalent to 4.5% of the total population.

The capital of Táchira state is the city of San Cristóbal. Founded in 1561, the town became important as an agricultural and commercial center, although its boom occurred in the 19th century, with the growth of the coffee sector, which led to the

establishment of important commercial houses. The geographical location of the city is strategic and makes it the most important center of economic growth in the Andes region, thanks to the development of administrative, commercial and service activities.

Surface

Táchira state is located in southwest Venezuela, in the Andes region. It is the second highest state after Mérida state. One of its most striking characteristics is the mountainous extension of the Andes Range that crosses the state from south to northwest, dividing it into three different regions and with particular climates:

- Mountain circuit: In this region, the main urban centers of the Táchira statehave been established. This zone covers the greater part of the surface of the state and has important heights among which we can mention: El Púlpito: 3.912 meters on the level of the sea (AMSL); Mal Paso: 3,850 AMSL; Páramo del Batallón: 3,507 AMSL, and El Tamá: 3,450 AMSL.
- Pan American Circuit: located at the north of the state. This zone presents similar climatic characteristics to the southern region of Maracaibo Lake, whose main characteristics are: a tropical rainforest climate, great rainfall and high temperatures.
- Llanera Region: located to the southeast of Táchira state is a small part of the Venezuelan plains, between Barinas and Apure states. In this zone, there is a tropical climate of savannah and humidity level is lower than in the Pan-American zone.

Táchira state stands out due to its mining potential and the existence of about 140 million tons of phosphate rocks. These deposits are located in several areas of the state, such as "Monte Fresco" areas and "Nabay-Los Monos" sector, with a capacity of 65 million tons, located in the Libertador Municipality in the southern part of the

State. This mine has a composition of 17% phosphorus, 45% silica, and the remaining percentage by other minerals.

Tachira's agriculture

In Tachira there's a wide variety of climates that have an important influence in the development of its vegetation and soil, that have conditioned the development of its population, to make agriculture as the primal economic activity of its people. Tropical, tropical mountain and high tropical mountain climate are the most common climates we can find in this state, with temperatures of 18°C in average, this are associated to the three formerly described geographical areas.

Soil exploitation: Dynamics and tendencies.

The Andean region and its adjacent plains show a wide eco-diversity which allows the development of agricultural activities and most recently aquaculture activities,

adapted to tropical warm climate as well as tropical mountain climate and equally adapted to high and low humidity levels, highlighting:

- Horticultural crops and potatoes.

These are harvested mainly in high mountain zones (above 2,000 m.a.s.l.). The region's most important crops are: carrots, lettuce, garlic, onion, leeks and cabbage in the high zones and tomatoes, bell peppers and onions in the lower zones. Potatoes are mainly produced in zones above 1,800 m.a.s.l. in intensive crops that are characteristic of the high valleys of Jáuregui, Uribante, Sucre and Junín Districts of Táchira. A lower centre can be found at the Torbes River mid valley, near San Cristóbal.

- Permanent and semi-permanent crops

These are coffee, plantain, sugar cane and pineapple crops.

Currently coffee crops maintain its importance in the region due to the vast amount of people that depend directly or indirectly from it. In 1977 there were 111,327 hectares sown with coffee in the Andean region.

Plantain occupies a very important place in the agricultural production of the region; in the past, Tachira held the 4th place as a plantain producer at national level with 3,955 hectares of sown. This production is destined for national consumption as well as export. Plantain is mainly produced in the alluvial plains of the south of the Lago de Maracaibo and in a lesser extent, in the plains of the south of the state.

Sugar cane is sown in areas below 1,800 AMSL. all over the Andean region. The most important sugar cane crops are located at the Ureña surroundings.

Pineapple crops occupy some steep slopes, most of these are located at Capacho District.

- Diversified crops

Theseare the most traditional system of The Andes. These subsistence crops are characterized by the low consumption of resources for production. Corn, yucca, banana, legumes, sugar cane and citric fruits and other crops that are exploited in a semi commercial manner, coffee, celery, some fruits, among others, these kinds of crops are very common in the region, occupying a 12% of the surface of the state.

- Semi-intensive milk cattle

This system occupies the higher grounds of the Uribante river watershed, La Grita and others, generally located within the 1,800 and 2,000 AMSL. This height has a cloudy rain forest-like weather with foreign varieties of grass, mainly Kikuyo. Holstein, Jersey and Brown Swiss crossbreed cattle, among others, has been introduced in the state.

- Double purpose semi-intensive cattle

It occupies the lowlands at the south of the Lago de Maracaibo and the south of the Tachira state, and doesn't have a defined specialization. Forage species have been introduced to the zones like Guinea and German grass, woody areas in this zones are insignificant.

- Double purpose extensive cattle

This is the most extended exploitation system in the region as it occupies more than 50% of the agricultural soil. It's basically oriented towards the production of meat, although milk is also exploited for self-consumption. Technical levels are low, with traditional management practices, taking advantage of introduced grass like Capon Melao, Guinea and Elephant grass.

Agricultural production can be separated in two groups, intensive and extensive crops, each one is associated with land conditions, given the surface characteristics of the state.

Intensive crops are in the mountain region, with moor land characteristics and are dedicated to horticulture, with a consumption of fertilizers of 1000 kilos per hectare approximately.

Extensive crops are located mainly in two regions at the Pan American Circuit, with rain forest crops such as plantain, corn, coffee and cocoa, consumption of fertilizers is much lower, with a demand of less than 500 kilos per hectare.

The plains region is also characterized for having intensive crops, cattle grass mainly and low investment crops like plantains, grass, and consumption of fertilizers is lower than the national average within 100 and 200 kilos per hectare.

Source: World Bank

Tachira state associations

An important characteristic of this zone is the prevalence of non-traditional groupings for other states in the country.The main associations related to agriculture are:

- Asociación de Productores Agrícolas del Estado Táchira.
- Asociación de Pequeños Comerciantes.
- Asociación Venezolana de Caficultores.
- Asociación de Ganaderos y Agricultores del Suroeste Andino.
- Asociación de Comerciantes del Estado Táchira.
- Asociación de Ganaderos del Estado Táchira.
- Asociación de Pequeños Industriales del Estado Táchira.
- Asociación de Peritos Forestales.
- Asociación de Técnicos Superiores del Estado Táchira.
- Asociación Regional Campesina.
- Asociación de Ganaderos del Norte del Estado Táchira.
- Asociación de Ganaderos de Coloncito.
- Asociación de Ganaderos del Nula.
- Asociación del Suroeste Andino.
- Asociación de Acuicultores del Suroeste del Estado Táchira.

Fertilizers in Venezuela

5. Fertilizers in Venezuela

Direct application of phosphoric rock has received considerable attention in Latin America over the past 20 years. Experiments have been carried out to evaluate the agronomic and economic potential of local phosphoric rocks found in several countries. The main objective has been to determine whether local phosphoric rocks could be used directly after grinding or modified to produce phosphoric rocks and thus reduce countries dependence on water-soluble phosphate fertilizers that are mostly imported (FAO, 2007).

Venezuela, with 2,650 million tons, ranks third among the largest reserves of phosphoric rocks in Latin America, after Mexico and Peru. The total P2O5 content ranges from 20% to 27 %and the solubility of P2O5 in citric acid is 2%, is from low to medium, according to the solubility criterion of Hammond and Leon. (FAO, page 59, 2007).

Fertilizer production in Venezuela is controlled by PEQUIVEN (www.pequiven.com), a state company that allows the participation of mixed companies.

Fertilizer production is mostly made in three petrochemical complexes:

- Hugo Chávez Petrochemical Complex (Morón), Carabobo state.
- Ana María Campos PetrochemicalComplex (El Tablazo), Zulia State.
- José Antonio Anzoátegui PetrochemicalComplex (José), Anzoátegui State.

Fertilizers national consumption is of 1.2 million tons, of which Venezuela produces 900 tons and imports the rest. The consumption per type of fertilizer is approximately 600 tons with nitrogen base (High Nitrogen content) and 600 tons with phosphate base (High phosphorus content).

To develop the fertilizer sector, PEQUIVEN allows the participation of foreign companies for joint production through the figure "Joint Venture".

Currently, these joint ventures are:

Coramer	Tripoliven	Grupo Zuliano
Fertinitro	Propilven	Super-octanos
Polinter	Propilsur	QuimicaVenoco
Metor	Supermetanol	Produsal
Profalca	Indesca	

The Joint Venture related to Phosphate Fertilizers is TRIPOLIVEN (www.tripoliven.com), equally shareholding Pequiven S.A., Valquímica S.A. and FMC Foret S.A. (Spanish companies).

In this sense, the use of the phosphorus mines located in Táchira state, should be developed through association with PEQUIVEN.

Fertilizers marketing in Venezuela and Latin America

6. Fertilizers marketing in Venezuela and Latin America

Venezuela plans to increase cultivated land by 46% by 2018. The success of these efforts to expand the country'sagro-industrial economy will depend on many factors. The most important of these factors is related to the large quantities of fertilizer required to obtain high agricultural productivity in tropics and subtropics zones with: (i) permanent crops such as sugar cane, coffee, cocoa, fruit trees, cassava, improved pasture and cultivated forests covering more than 6 million hectares and (ii) annual crops such as maize, sorghum, rice, grain legumes, oilseed crops and cotton in more than 700,000 hectares.

However, in order to meet this challenge, Venezuela will have to face high prices of traditional water-soluble phosphate fertilizers such as simple superphosphate, triple superphosphate, NPK fertilizers and ammonium phosphates. (FAO, p. 119, 2007).

Although Venezuela is a fertilizer producing country and has three petrochemical complexes with capacity to produce fertilizers derived from oil, mainly those based on nitrogen, the country has a deficit due to the growth of its consumption in products with nitrogen base and phosphates.

Venezuela's main trade partners are United States, Colombia and Brazil for the export of products, and Russia, Poland, United States and Colombia for imports.

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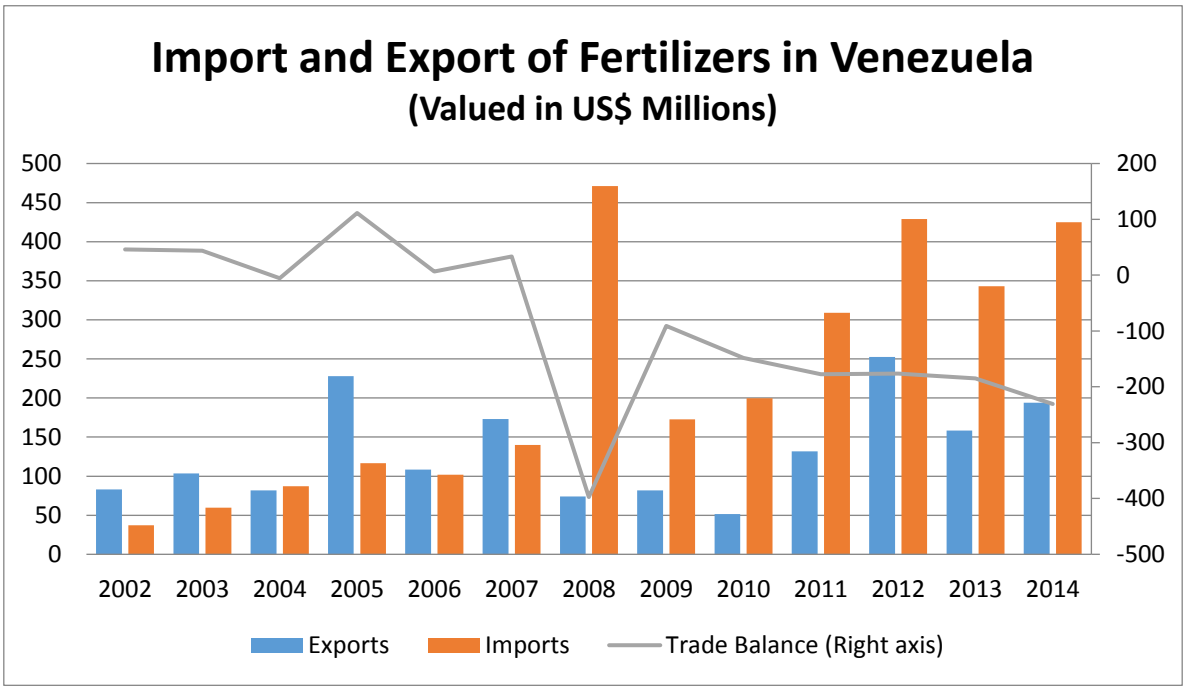

(Source: www.aladi.org)

Latin America is a region that constantly demands fertilizer, and its growing importance as a food producer for the world, influences the strengthening of the strategic role of the phosphate industry.

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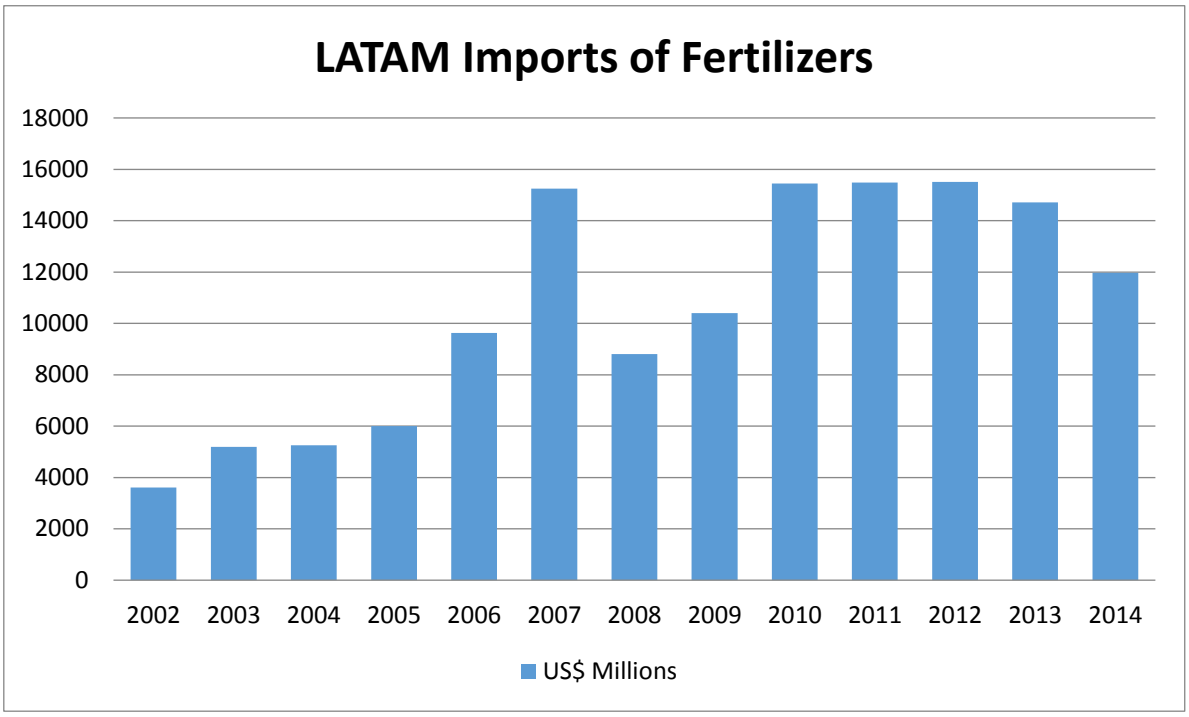

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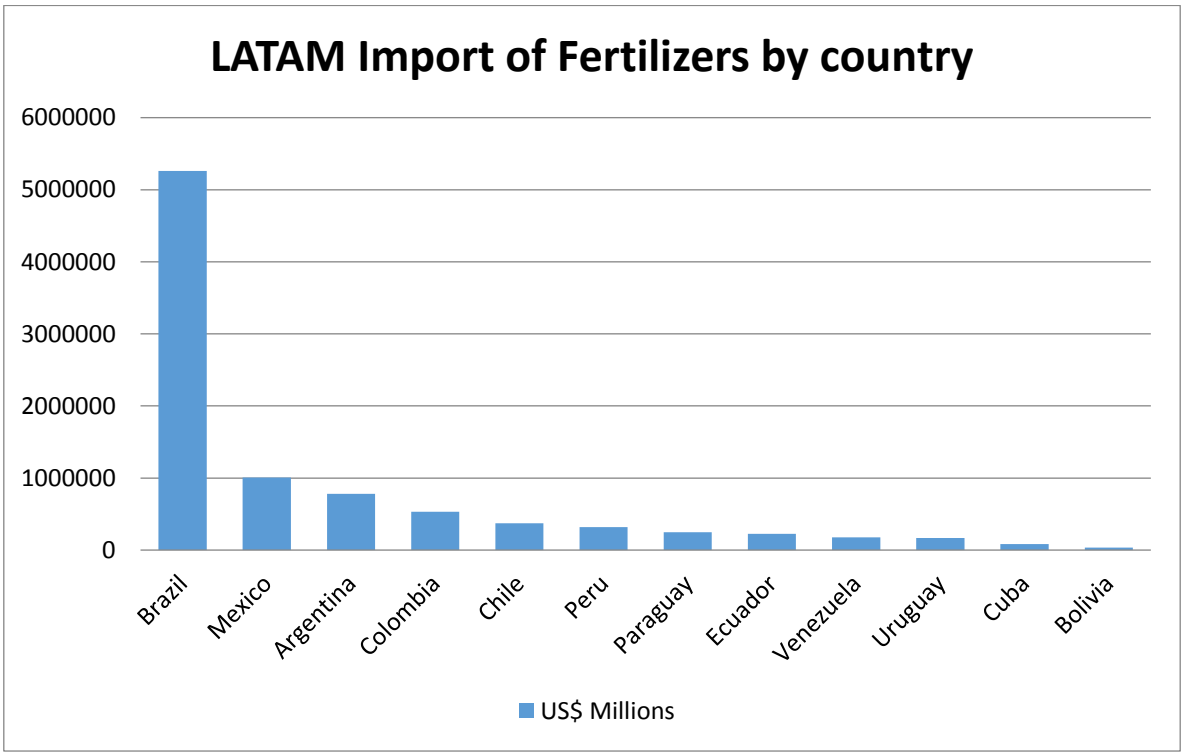
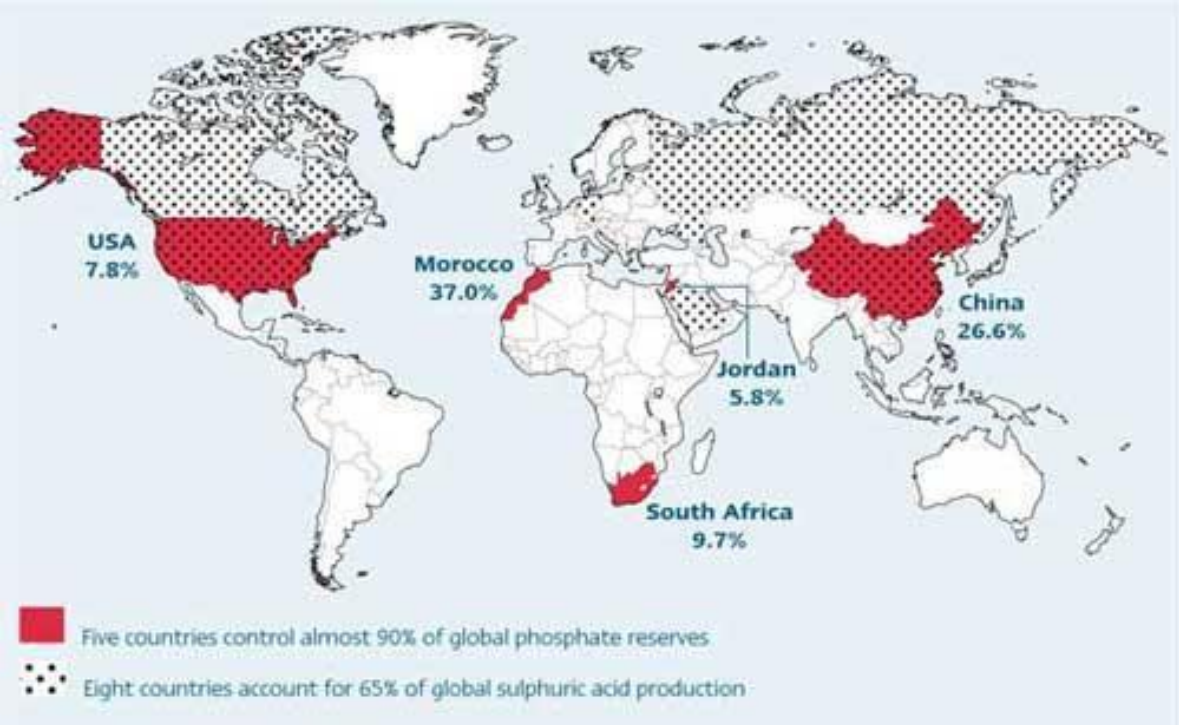


(Source: www.aladi.org)

Latin America does not have large phosphate reserves. In addition, such reserves do not have the magnitude of reserves in the US, China, Russia or North Africa (Morocco, Western Sahara, Tunisia and Israel and Jordan).

Currently, more than 30 countries are producing phosphate rock to supply both local and international markets. Only five countries (Morroco, China, South Africa, USA, Jordan) together control 90% of the phosphate rock world reserves. The first twelve producing countries in the world occupy almost 95% of the total production of phosphate. The three main producers (USA, China and Morocco), produce about two-thirds of world production.

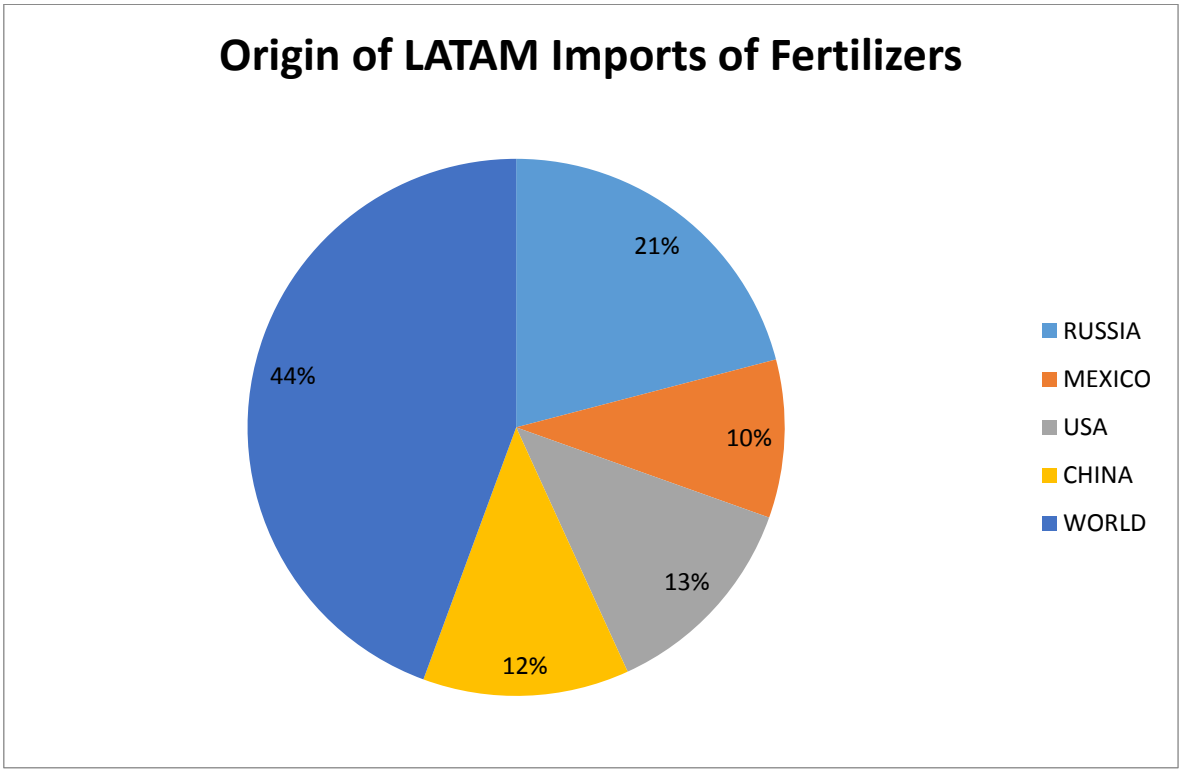


http://pepoladas.over-blog.es/article-pico-del-fosforo-un-problema-no-reconocido-69349869.html

USA has a very high production rate, and currently its own reserves are exhausted. In consequence, it begins to depend on imports to supply its local market.

The largest supplier is Morocco, together with a number of small producers, led by South Africa and Jordan. Then is India, which is almost totally dependent on foreign sources, and will be the first country to be seriously affected by the rise in world prices.

In Latin America, fertilizers production is linked to its oil production capacity, due to the development of the petrochemical industry. But, the region is still a net importer of fertilizers from Russia, Mexico, USA, and China.



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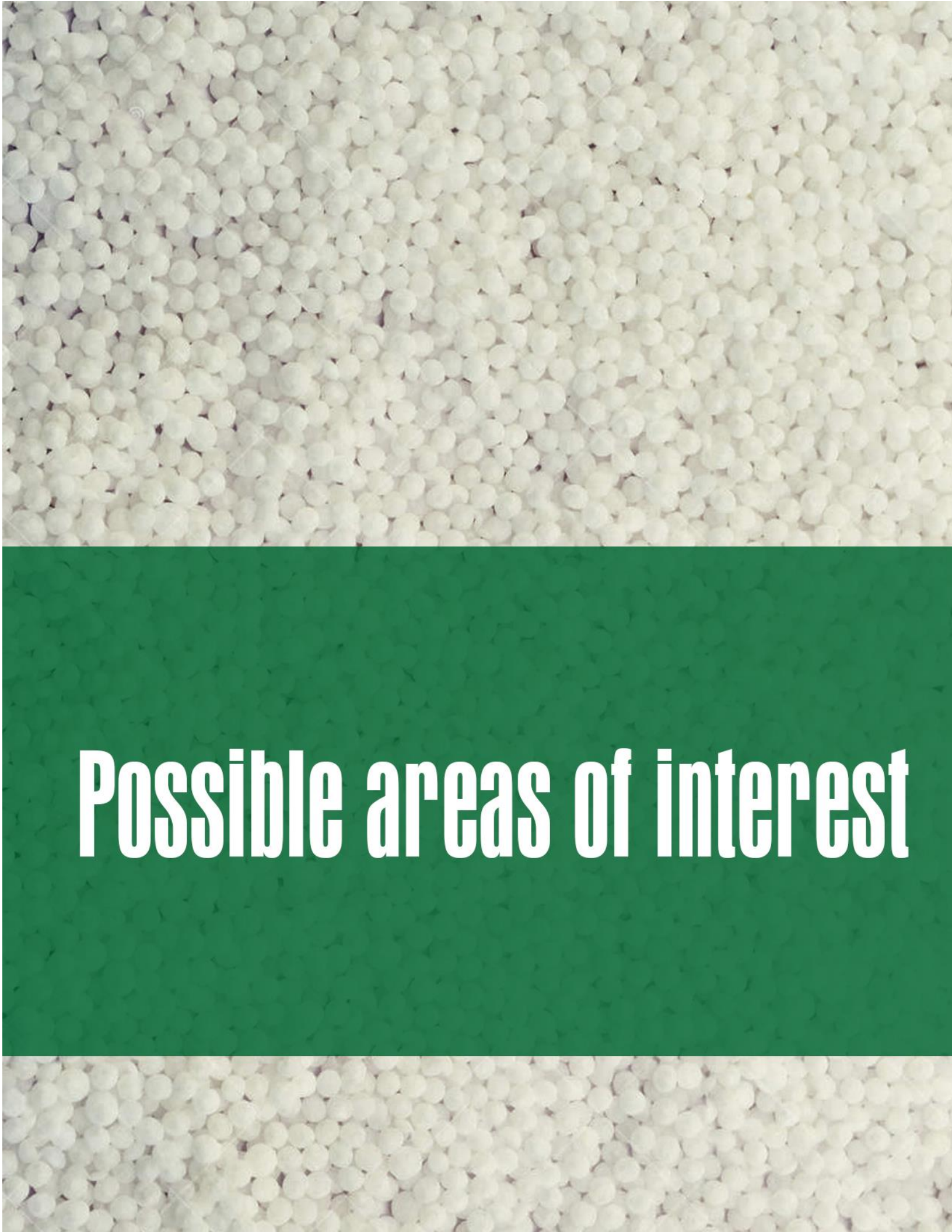

Possible areas of interest

8. Possible areas of interest

The mining potential of Táchira state allows to evaluate the pertinence of investment studies for the development of phosphate fertilizers, as well as derivatives and nutritional supplements with phosphorus content.

- Phosphates can be used for a wide variety of applications, for example:
- Preparation of yeasts and instant cereals.
- Cheese and cured hams making.
- Sour drinks.
- Treat metals making them more resistant to corrosion.
- Fertilizer.
- Clarify sugary solutions.
- Test silk fabrics.
- Make rat poisons (white phosphorus).
- Make matches (red phosphorus).
- The Mining Project Management "Minas del Nabay", attached to PEQUIVEN, shows great interest in the joint investment of foreign companies and has done the geological study for the development of the project. The General Manager, Engineer Freddy Quintero, indicates the interest in a Joint Venture for the exploitation of phosphorus mines, by using Indian technology, but getting joint development.
- "El Progreso" Industries is the leading company in the manufacture of agricultural and industrial sacks for agricultural use, and is capable to supply the fertilizer production chain. If the investment project is carried out, this company has the capacity to offer a production growth with investment support from India.

Final considerations

9. Final Considerations.

In order to evaluate the feasibility of joint investments from Indian Companies in the Fertilizer sector market, all technical and legal considerations have been considered, to show to potential investors the different perspectives to evaluate the investment in Venezuela.

Táchira State is located in the western part of the country, in the Andean region, which is suitable for intensive agricultural cultivation and at the same time, Táchira state is a flat area, pertaining to Venezuelan western plains, suitable for livestock. All of these characteristics make Táchira state one of the largest producers in the agricultural and livestock sectors in the country. Additionally, it has mineral resources for the exploitation of Phosphate, Silicon, Limestone, Coal Mineral, among others.

There is a primary exploitation of phosphate minerals in the northern region of Táchira state (Lobatera Mine) suitable for the development of phosphorus, and fertilizers based on phosphates. But the high potential of phosphate-based fertilizer production is located in the center mines (San Pedro del Río sector) and southern Táchira state (San Joaquín de Nabay sector), with more than 100 million tons of phosphate stone.

For the exploitation of these resources, investment is needed along with a high technological level, capable to make proper use of the deposits and to separate properly materials such as Phosphorus, Silicon, and Limestone, that offer an opportunity to companies with experience in the industrial mining sector.

There are three factors that would make predictions about a phosphate deposit:

1. The potential of its exploitation by dimensions (present in the report)
2. Specialized work field is required to improve accuracy and to approach to PEQUIVEN can ease the way.
3. The wealth of probable exploitation. In the world, most powerful fields, potentiality phosphates is measured regularly by using an indicator called

P2O5 richness (phosphorus pentoxide). A suitable relationship is that a deposit has between 18% and 42%, in terms of that factor of wealth. Venezuela in that field is 20% -27%.

The potential of the Táchira state reservoirs allows the creation of production lines with sufficient scale to generate a surplus of production highly above from domestic consumption of fertilizers and with a strategic possibility of exporting to South America, a region characterized by agricultural production. For example, Brazil that imports up to US$ 9 billion in fertilizers, and that can be a potential buyer of fertilizers and phosphate derivatives as food supplements for livestock and aquaculture.

It is recommended to carry out geological and financial feasibility studies to evaluate costs structures, competitiveness and possibility of insertion in international markets.

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