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## Fertilizer plan; the threats and the risks of phosphorous



Photo: EFE

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MÉXICO CITY.- The science fiction author Isaac Asimov (1920-1992) wrote that life can multiply itself until there is no more phosphate, after there is an inevitable stop that nothing can prevent. This sentence illustrates the central importance of the mineral in the life of the planet.

But the government's plan in order to empower the production of fertilizer beginning in 2015 seems not to take into account the situation of this mineral coming from phosphate rock and whose scarceness, in Mexico as well as in the world, begins to alarm the experts.

Today we have to import it. It is very centered on Morocco and the Western Sahara houses the largest quantity of phosphorous in the world. Found there is the phosphate used as fertilizer which contains all the elements for fertilizers. The scarceness is as serious as global warming. We are not aware of the problem. The resource is finite", states Jesús Valdés, researcher at the Chemical Institute of the National Autonomous University of Mexico, for this report.

México consumes more than 600 thousand tons of phosphorous annually and has some approximate reserves of 30 thousand tons, according to the United States Geological Survey.

The company Roca Fosforica Mexicana II, affiliate of the Grupo Fertinal and privatized in 1993, exploits the underground mine of San Juan de la Costa in Baja California Sur and Minerales no Metalicos does it in Puebal with some 150kt/yr.

In 2013 the production of fertilizer was situated at 1.7 million tons and nearly three million were imported to satisfy the demand.

## **Increases**

Since 2004, the use of fertilizers has increased, according to information from the World Bank (BM). Between 2004 and 2008 54.8 kilograms per hectare of cultivable land was injected and between 2009 and 2013, 61.7.

Statistics from the National Association of the Fertilizer Trade indicate that of the 16 million cultivated hectares in the country, only nine million are fertilized, and, of them, three million are considered ideally fertilized at 40 percent.

The government plans to stimulate the production of fertilizers beginning in 2015. Last January, PMI Comercio Internacional, affiliate of Petroleos Mexicanos (Pemex) agreed upon the purchase of Agro Nitrogenados, a subsidiary of Altos Homos de Mexico, for 475 million dollars (mdd).

With the rehabilitation and modernization of the Factory, Pemex hopes to manufacture up to 990 thousand tons annually of urea in Pajaritos, Veracruz, beginning in 2015. Ammonia will come from the Petrochemical Complex of Pemex in Cosoleacaque.

In this way, the importation of fertilizers will be replaced by more than 400 million dollars.

Further, the company ProMan erects a building for nitrogenized fertilizers in Topolobampo, Sinaloa, through and investment of a billion dollars.

Throughout this year, the national production of phosphate has varied. In January and February an increase was barely reported, but in March it jumped 28.5 percent and then lowered, until recovering in June with a 10 percent jump.

Since 2007, the obtaining of the mineral has been in on the rise. In 2013 nearly 150 thousand tons were extracted, while from this year the volume is around 100 thousand tons.

In parallel, in April phosphate mineral or chemical fertilizers were not imported, in May they rose to 72 thousand dollars and in June, to 19 thousand.

Phosphate is used to obtain phosphorous or phosphoric acid, substances with which fertilizers and animal feed, cosmetics, fungicides, ceramics are produced and it is a raw material for the metallurgic industry.

Phosphorous participates in the transfer and storing of energy, in the division of cells, photosynthesis, the biological fixing of nitrogen and it is vital for the formation of seeds in vegetables. For example, 80 percent of the phosphorous of corn is in the grain.

Just like nitrogen and potassium, it is the nutrient that plants absorb in the soil and it is basic for the fertility of land and the growth of crops.

The most basic and used fertilizers are composed of nitrogen (N), phosphorous (P) y potassium (K) and they are known by the initials NPK.

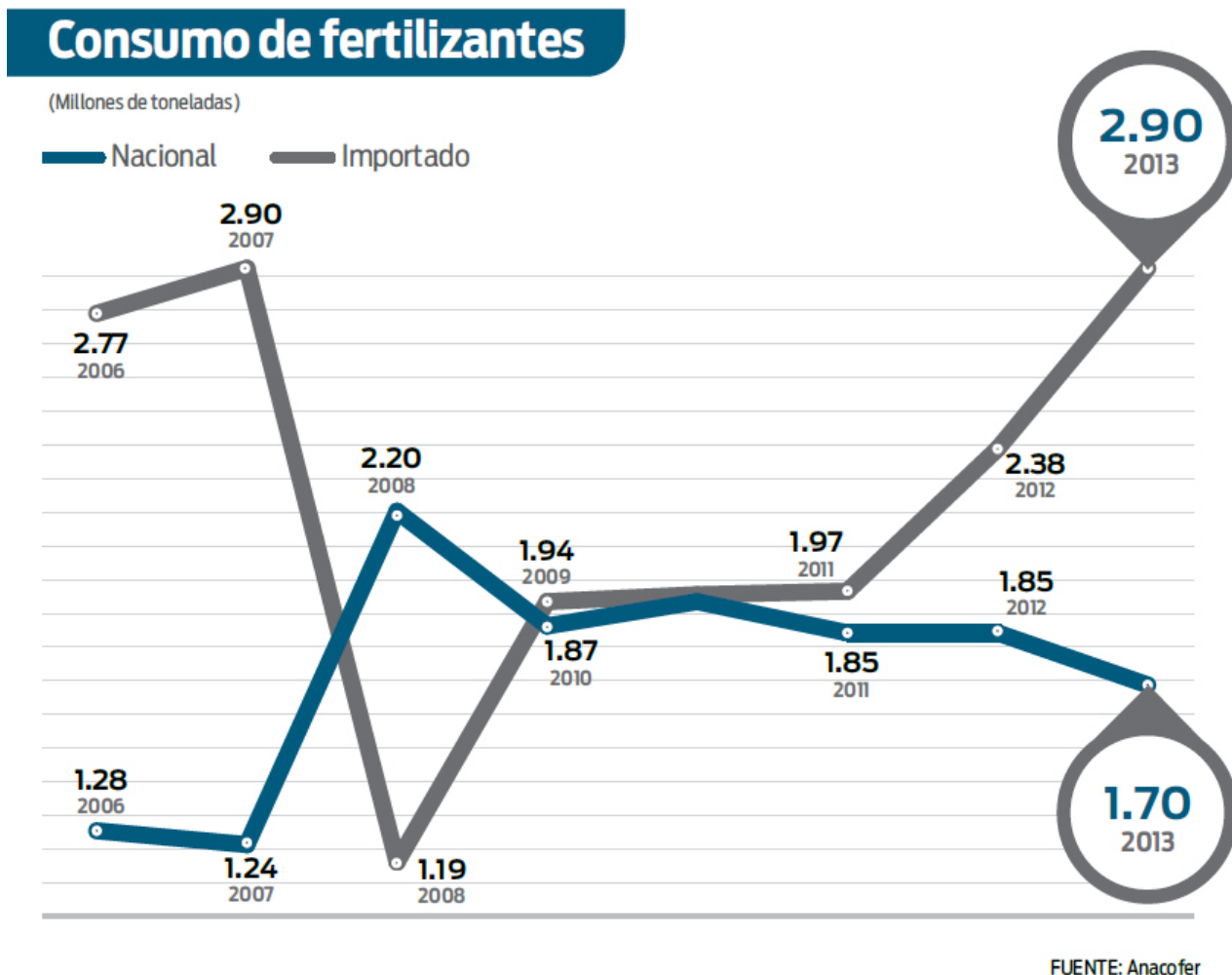


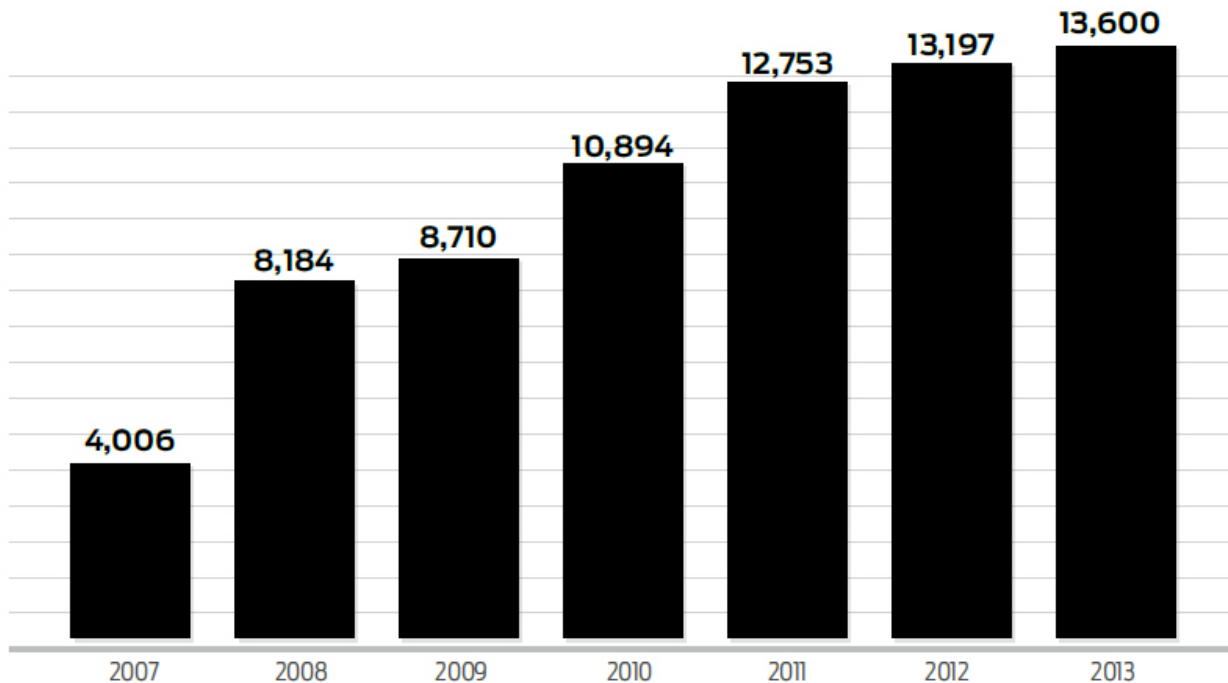
DIAGRAM: CONSUMPTION OF FERTILIZERS (MILLIONS OF TONS)

BLUE LINE: NATIONAL GREY LINE: IMPORTED

SOURCE: ANACOFER

## Valor de las ventas de fertilizantes

(Millones de pesos)



FUENTE: INEGI

DIAGRAM: VALUE OF FERTILIZER SALES (MILLIONS OF PESOS)

SOURCE: INEGI

### Increase in the demand for the mineral

Dana Cordell, academic for the Institute for the Sustainable Future at the University of Technology of Sydney considers that the time of cheap fertilizer has already passed.

While the demand continues to grow, the cost of phosphate mining is going up due to a drop in quality and a larger expense for extraction, refining and environmental handling”, the specialist states, member of the Global Phosphorous Research Initiative (GPRI, in its English initials).

The study *Current world tendencies for fertilizer and perspective for 2016*, created in 2012 by the United Nations Organization for Food and Agriculture (FAO, in its English initials), warns that the annual increase in the demand for nitrogen, phosphate and potassium is 2.7, 3.0 and 2.9 percent, respectively, between 2012 and 2016 in Latin America.

With this context, Brazil, Argentina, México and Colombia will be the largest users of fertilizer in the region.

## **Expectations**

The FAO document also expects that North American will depend more and more on the import of nitrogen fertilizers and that the export of phosphate may slowly decrease.

Further, it puts forth that Latin America and the Caribbean will become a potential provider of nitrogen beginning in 2015, while its dependence on the import of phosphate and potassium will continue during the period studied.

World consumption of fertilizers totaled 180 million tons in 2012, an increase of 1.9 percent over 2011.

The international organization projects that the world demand will grow to an annual amount of 1.9 percent from 2012 to 2016 and that the demand for nitrogen, phosphorous and potassium will increase annually at 1.3, 2.0 and 3.7 percent, respectively, during the period.

World demand for phosphate fertilizer rose from 40.6 million tons in 2011 to 41.5 million tons in 2012, an increase of 2.4 percent. This information would be located at around 45 million tons in 2016, with an escalation of 2 percent per year. 58 percent of the increase in demand will correspond to Asia, 24 percent to America, 11 percent to Europe, four percent to Africa and 3 percent to Oceania.

The world capacity for production of phosphoric acid was around 51.5 million tons in 2011 and went forth to more than 53 million in 2012. For 2016, it would climb to 61.3 million.

Of this expansion, 45 percent would happen in Asia, 35 percent in Africa, 13 percent in Latin America and the Caribbean, six percent in Europe and Central Asia and 1 percent in Oceania.

“By virtue of the situation of high food prices, and the high price of fertilizers, a mixed panorama emerges. The high price of raw agricultural materials provides incentives to growers in economies with market orientation to invest in fertilizers and other consumables for better productivity”, the FAO indicates.

But it warns that is also a reverse incentive for growers for the sale of fertilizers, in particular for those with small exploitations and with the majority of the production of food destined for household consumption.

## **Future of insufficiency in production**

The specialists warn of a critical phosphorous situation in the long term and in which demand could surpass supply. Due to its significance, the matter has adopted a geopolitical aspect.

Nearly 90% of the estimated reserves lie in Morocco, the leading world exporter, China, South Africa, Jordan and the United States.

Many of the sites that Morocco exploits are located in territory which is occupied by the military of the Western Sahara, where the site of Fos Bucra a is located, one of the richest on the planet.

The problem is that Morocco is aware that it has its White petroleum and it is going to begin to raise prices and pressure the market”, said Jesús Valdés, researcher for the Chemical Institute at UNAM.

These circumstances have caused, since February of 2007, the price of rock phosphate to have gone up 700%, but it has moderated in recent months. Since June the price per metric ton has stabilized to 110 dollars, according to the World Bank.

Specialists predict a global cut around 2040.

Like petroleum and other natural resources, the rate of economically available phosphate production will eventually reach a peak, followed by an abrupt decline and the subsequent growing gap between demand and supply”, analyzes Dana Cordell, academic at the Institute for the Sustainable Future at the University of Technology of Sydney

GPRI indicates that “all modern agricultural systems depend on the continuous entry of phosphate fertilizers derived from phosphate rock”.

This initiative, founded in 2008, gathers academics from the Institute for the Sustainable Future at the University of Technology of Sydney, from the Department of Water and Environmental Studies at the Linköping University in Sweden, the Environmental Institute of Estocolmo, of the University of British Columbia in Canada and the Dutch University of Wageningen.

## **Measures**

Blocks like the European Commission are already reacting at the prospect, since last July it incorporated phosphate on its list of Critical Raw Materials, for which the security of supply is at risk.

The threat of scarcity and its impact on food security was one of the axes of the fourth edition of the Sustainable Phosphorous Conference.

At this meeting, Nathaniel P. Springer, academic of the Institute for Agriculture Sustainability at the University of California, presented a study *The vulnerability of global food systems to the scarcity of phosphorous: an analysis of economic scenarios*, in which he exhibited a scenario in which the extraction and transport of the unprocessed mineral from north Africa is not available due to geopolitical reasons, which results in larger regional prices for phosphate.

In their study *Vulnerability of phosphorous: a new framework to evaluate the vulnerability of national and regional food systems*, Cordell and Tina-Simone Schmid Neset, of the Center for Climate Science and Policy Research of the Department of Water and Environmental Studies at Linköping University exhibited 26 biophysical, technical, geopolitical, socioeconomic and institutional factors that can bring about the vulnerability of feeding systems, from which Mexico is not free.

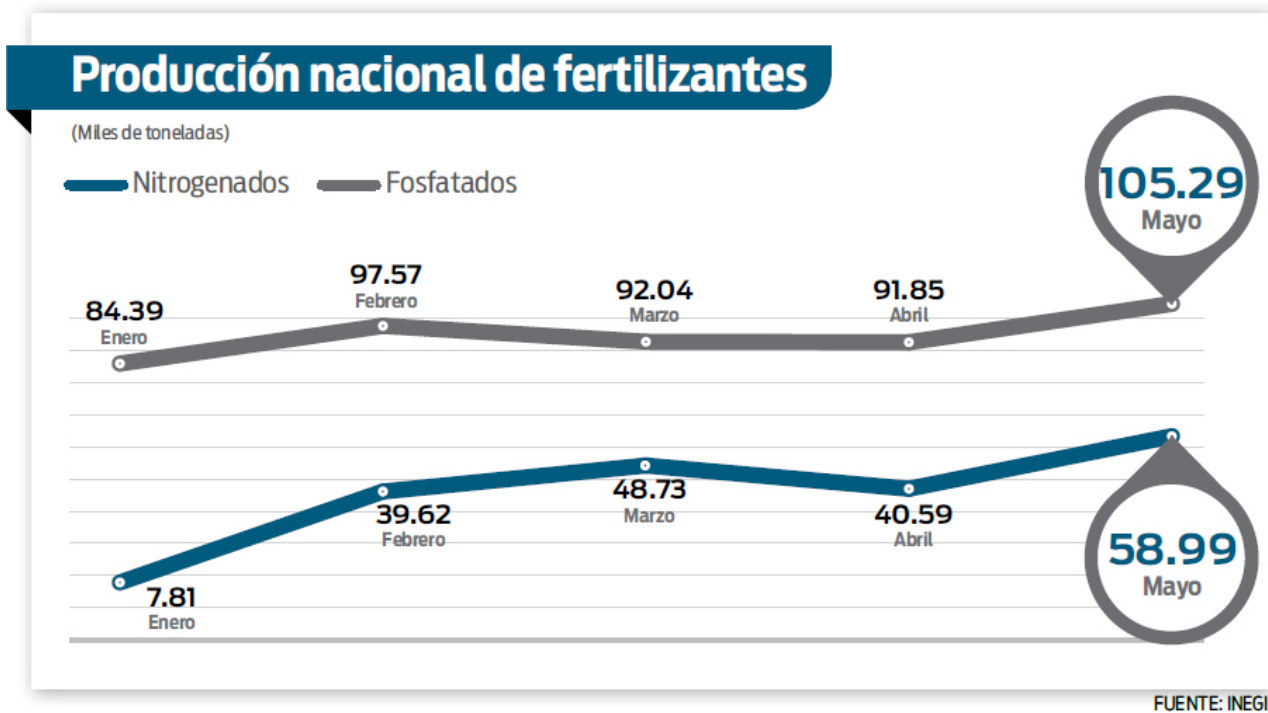


DIAGRAM: NATIONAL PRODUCTION OF FERTILIZERS (THOUSANDS OF TONS BY MONTH)

BLUE LINE: NITROGENIZED GREY LINE: PHOSPHATED

SOURCE: INEGI

### Unsustainable mining practices

Dana Cordell, academic at the Institute for the Sustainable Future at the University of Technology of Sydney, warns that the mining, processing and transport model of phosphate rock and fertilizers around the world is unsustainable, as it deals with one of the most commercialized *commodities* on the planet.

Further, the persistent use of fertilizers can cause an excess of phosphorous in bodies of water, which can bring about eutrophication, the accumulation of nutrients in an ecosystem which allows the growth of algae and other microorganisms. They use up the oxygen from the water and block the entry of light into lakes, rivers and oceans, which brings about the disappearance of species of animals and vegetables.

But phosphorous offers a consistent alternative in recycling, as well as the recovery of human biosolids, though in Mexico they are not applied.

Urine and feces are renewable and ready sources of phosphorous. Urine is essentially sterile and contains PNK in adequate proportions.

Its treatment and reuse is very simple and the World Health Organization published lines for the safe use of waste liquids, excretions and grey water in agriculture.

There is an advantage, that it can be recovered. Though phosphorous is unsustainable, it can be recycled. But recovery is not done in Mexico. It is not complex and it would seem not to be so expensive”, specifies Jesús Valdés, researcher at the Chemical Institute of the National Autonomous University of Mexico

### The projects

Countries like Sweden, Germany and the United States have projects underway to separate urine from feces, to extract phosphorous and to irrigate fields with this material.

Combined with other organic sources, like manure and food scraps, the value of the phosphorous in urine and feces can essentially replace the demand for phosphate. The cost of environmental sanitation systems around the world could be compensated for by the commercial value of phosphorous and nitrogen that they contribute”, puts forth Dana Cordell.

The question now is that the crucial phosphorous for agricultural production of the future, does not appear in the current plans of the Mexican government; an absence as serious as warned by the science fiction author Isaac Asimov.