# 16th WORLD FERTILIZER CONGRESS OF CIEC

## TECHNOLOGICAL INNOVATION FOR A SUSTAINABLE TROPICAL AGRICULTURE

# PROCEEDINGS

INTERNATIONAL SCIENTIFIC CENTRE OF FERTILIZERS
NPK
C.I.E.C.

*International Scientific Centre of Fertilizers (CIEC)*

# 16th WORLD FERTILIZER CONGRESS OF CIEC

## TECHNOLOGICAL INNOVATION FOR A SUSTAINABLE TROPICAL AGRICULTURE

October 20-24, 2014
Rio de Janeiro, RJ - Brazil

# PROCEEDINGS

*Vinicius de Melo Benites*
*Adilson de Oliveira Junior*
*Paulo Sergio Pavinato*
*Paulo César Teixeira*
*Milton Ferreira Moraes*
*Regina Maria Villas Bôas de Campos Leite*
*Ronaldo Pereira de Oliveira*
Editors

Rio de Janeiro, RJ
2014

58

# RESIDUAL EFFECTS OF REACTIVE PHOSPHATES ASSOCIATED TO SOLUBLE PHOSPHOR SOURCE TO CORN PRODUCTION IN THE THIRD AGRICULTURAL CYCLE

DAYANE GOMES DOS SANTOS[(1)], EDILSON CARVALHO BRASIL[(2)], ADILSON DE OLIVEIRA JÚNIOR[(3)], LETÍCIA CUNHA DA HUNGRIA[(1)], RÚBIA CARLA RIBEIRO DANTAS[(1)], MARLENE EVANGELISTA VIEIRA[(1)]

[(1)] Agronomy, Universidade Federal Rural da Amazônia, Av. Presidente Tancredo Neves, 2501, Belém-PA, 66077-901, BRAZIL (dayanesantos_13@hotmail.com); [(2)] Brazilian Enterprise for Agricultural Research (Embrapa) Oriental Amazon, Travessa Enéas Pinheiro, n/n, Belém-PA, 66095-105, BRAZIL (edilson.brasil@embrapa.br); [(3)] Embrapa Soybean, Rod. Carlos João Strass, n/n, Distrito de Warta, Londrina-PR, 86001-970, BRAZIL (adilson.oliveira@embrapa.br)

## Introduction

In Brazil, the low availability of phosphor (P) in soil is a major limitation to plant growth and hence crop productivity and according to Novais and Smyth (1999) may be caused by its high power of adsorption/precipitation, which has conditioned the reduced efficiency of utilization of phosphatic fertilizers (Yost et al., 1981). The most widely used fertilizer in brazilian market are those with higher solubility in water (triple superphosphate and mono-ammonic phosphates), but they are more expensive. It has driven the search for alternative sources of P (Prochnow et al., 2003; Resende et al., 2006). Although soluble sources have greater capacity to provide P to soil, the use of natural phosphates minimize the fixation procedures and provide higher efficiency of utilization of nutrients by the crops, over time (Novais & Smyth, 1999). Natural sources have a higher residual effect which can keep longer the performance levels of the crops in longer production cycle (Peruzzi & Kaminski, 1997). Therefore, the association of these phosphate sources could allow greater availability of P to plants in the first year of cultivation, and ensure the maintenance of good yields over the years. This study aimed to evaluate the efficiency of the implementation of reactive phosphates associated with a soluble source of P in the nutrient utilization in the third cycle of agricultural production of corn on an Oxisol Amazon.

## Methods

The experiment was carried out at the Embrapa Amazônia Oriental, in the municipality of Paragominas (PA), in a clay dystrofic Yellow Latosol, which presented at surface layer (0-20 cm) the following chemical properties: pH ($H_2O$) equal 5.5; 21.9 g kg$^{-1}$ of organic matter; 2 and 72 mg dm$^{-3}$ of P and K (Mehlich 1), respectively; 3.1; 4.0; 0.3; and 10.1 cmol$_c$ dm$^{-3}$, of Ca, Ca+Mg, Al and CTC, respectively. The physical characteristics of the soil were: 13, 27, 260 and 700 g kg$^{-1}$ of coarse sand, fine sand, silt and clay, respectively (Embrapa, 1997).

The experimental design was a randomized block with four replications in a split plot. In plots, corrective phosphate sources (Itafós phosphate, Bayóvar thermophosphate aluminum, and triple superphosphate), plus a control treatment (no P) were tested. Subplots maintenance fertilization levels (60% and 120% of the recommended by the State of Pará, equivalent to 90 kg ha$^{-1}$ of $P_2O_5$ fertilization) were tested and a control treatment without maintenance fertilization. Corrective sources were applied at the rate of 240 kg ha$^{-1}$ $P_2O_5$, on the surface and incorporated before the first crop; water soluble phosphate sources was applied in a localized manner in rows. The correction of soil acidity was performed with dolomite limestone.

In the third agricultural cycle we proceed to sowing corn to evaluate the residual effect of the tested reactive phosphates. All plots received additional fertilization with nitrogen, potassium and micronutrients in the form of urea, potassium chloride and FTE.

## Results and discussion

Grain yield of maize was significantly affected by the interaction of applied doses and sources (Table 1). In the absence of fertilization maintenance, Bayóvar, Itafós and superphosphate triple (SFT) corrective sources showed the highest grain yield of corn and did not differ significantly from each other in relation to thermo aluminum and treatment without corrective fertilization, indicating that in the third crop, there was still residual effect of the first three sources used for the correction of the initial P concentration in soil. However, the residual effect of corrective sources, applied in the first year of cultivation, did not affect grain yield in the third year, when the maintenance fertilization was performed in both applied amounts (54 and 108 kg $ha^{-1}$ $P_2O_5$) . These results indicate that corrective fertilization, in the third year of cultivation, was not sufficient to ensure the achievement of satisfactory grain yields when fertilizers are applied annually to maintain the levels of P in the soil at adequate levels.

Increasing the dose of maintenance fertilization with soluble source (SFT) favored increased production of corn grains only in the treatment with aluminum thermo applied in the first year of cultivation and treatment without corrective fertilization. This result demonstrates the importance of applying fertilizer maintenance annually, with a soluble source when it is not performed the initial elevation of the levels of soil P (phosphate).

It was observed that there was no statistical effect on grain yield between the levels of maintenance fertilization, combined with corrective sources SFT and Bayóvar. However, for phosphate Bayóvar there was a strong trend of increasing production with increasing doses, verifying increments producing 34 and 31% at doses of 54 and 108 kg $ha^{-1}$ $P_2O_5$, respectively, regarding treatment without fertilization maintenance. The same behavior was observed for the TSP used as corrective source, where there was a tendency for increases of 17% and 27% for grain yield, at doses of 54 and 108 kg $ha^{-1}$ $P_2O_5$, respectively.

## Conclusions

Bayóvar and Itafós phosphates have residual effects in the third cycle of production of maize, when applied in the absence of maintenance fertilization with soluble source (SFT). The maintenance fertilization has great importance in the production of maize, when the phosphate is not performed.

Keywords: Fertilizers, fertilization, doses of P.

Financial support: FAPESPA/VALE

## References

EMBRAPA-CNPS. (1997) Manual de métodos de análise de solo. Rio de Janeiro: Centro Nacional de Pesquisa de Solos. (Embrapa-CNPS. Documentos, 1).

KAMINSKI, J. & PERUZZO, G. (1997). Eficácia de fosfatos naturais reativos em sistemas de cultivo. Santa Maria - RS, Sociedade Brasileira de Ciência do Solo. (Boletim Técnico no.3).

NOVAIS, R.F. de; SMYTH, T.J. (1999). Fósforo em solo e planta em condições tropicais. Viçosa: UFV.

PROCHNOW, L. I. et al (2003). Characterization and agronomic evaluation of single superphosphates varying in iron phosphate impurities. Agronomy Journal, Madison, v. 95, p. 293-302.

RESENDE, A. V.; FURTINI NETO, A. E.; ALVES, V. M. C.; MUNIZ, J. A.; CURI, N.; FAQUIN, V.; KIMPARA, D. I.; SANTOS, J. Z. L.; CARNEIRO, L. F. (2006) Fontes e modos de aplicação de fósforo para o milho em solo cultivado da região do cerrado. Revista Brasileira de Ciência do Solo, Viçosa, v. 30, n. 3, p. 453-466.

YOST, R. S.; KAMPRATH, E. J.; NADERMAN, G. C.; LOBATO, E. (1981) Residual effects of phosphorus adsorving Oxisol of Central Brazil. Soil Science Society America Journal, Madison, v.45, p.540-543.

**Table 1.** Grain production in the third agricultural cycle of maize (kg $ha^{-1}$) in function of the application of corrective phosphates sources applied in combination with a soluble source in maintenance (SFT).

| P corrective source (240 kg $ha^{-1}$) | Maintenance fertilization (SFT in kg $ha^{-1}$ de $P_2O_5$) | | |
|---|---|---|---|
| | Without P | 54 | 108 |
| Superphosphate Triple | 6702 a A | 9024 a A | 8819 a A |
| Bayóvar | 7748 a A | 9094 a A | 9801 a A |
| Itafós | 5479 a B | 8963 a A | 9282 a A |
| Thermophosphate aluminum | 1985 b B | 9002 a A | 8879 a A |
| No corrective fertilization | 3907 b B | 7060 a A | 9081 a A |

Values followed by same lowercase letters in the column and uppercase letters on line, are not significantly different at p≤0.05 by the Scott-Knott test.