Sediment removal

Financial support: AGFOREE Doctoral School and University of Helsinki Future Fund

(3682 - 2943) Improving bone-based phosphate fertilizer by pyrolysis

Cristiano Dela Piccolla[1]; Dean Hesterberg[2]; Etelvino Henrique Novotny[3]; Takashi Muraoka[4]; Thalita Cardoso Anastacio[1]; Josimar Vieira dos Reis[1]

Soil Science Department, Luiz de Queiroz College of Agriculture, University of Sao Paulo[1]; Crop and Soil Science Department - North Carolina State University[2]; Embrapa Soils[3]; Center of Nuclear Energy in Agriculture - University of Sao Paulo[4]

Phosphorus is a macronutrient for all organisms, and its projected future scarcity generates a need for more efficient P recycling technologies. Because animal bones are rich in P, they could be employed to recycle part of P fertilizer inputs in agriculture, while diminishing environmental issues and health risks associated with cadmium in phosphate rock-based fertilizers. Moreover, pyrolysis is an alternative treatment to calcination that could both eliminate disease sources from bones and generate an efficient fertilizer ("bone char"). Our aim was to evaluate the physical and chemical characteristics of P in pyrolized pig bones as affected by temperature (400, 550 and 800 °C) and atmospheric conditions (sealed chamber, purging with N_2, or steam activation). In addition to characterization of specific surface areas, porosities, and mineralogy, pyrolysis products were evaluated for their potential to provide P to plants using chemical extractions with water, neutral ammonium citrate, and 2% citric acid. All bone chars met the minimum total-P requirements and maximum cadmium restrictions for commercialization in Europe, a reference market. Bone chars also showed higher solubility than bone subjected to calcination. Synchrotron-based X-ray diffraction showed that bones are composed of hydroxyapatite (HAP), and pyrolysis in a sealed chamber or with flux of N_2 diminished HAP crystallinity compared with pyrolysis performed under steam flux and calcination (800 °C). Linear combination fitting of calcium K-edge XANES spectra revealed that the 20% of poorly crystalline HAP was entirely converted to highly ordered HAP as pyrolysis temperature rose from 400 °C in a sealed chamber to 800 °C under steam activation. Triggered by organic matter losses, HAP crystallization decreased bone char surface area and solubility. Pyrolysis carried out in a sealed chamber at 550 and 800 °C showed higher total and citric-acid-soluble P contents, thus being recommended for a bone based-fertilizer production, whereas the 400 °C treatment diminished bone char pore volume, surface area, and 2% citric-acid-soluble P/total P. Pyrolysis is a promising waste-treatment technology in which the final product can be potentially used to fertilize P-deficient soils in the tropics. Moreover, the acidity of most tropical soils would promote HAP dissolution and P release.

Keywords: alternative phosphate fertilizer; bone treatment; synchrotron radiation

Financial support: The Brazilian agencies CNPq and Capes provided scholarships; University of Sao Paulo and NC State University Department of Crop and Soil Science provided resources; and XRD1, SXS and PGM beamlines of the Brazilian Synchrotron provided facilities.

(2357 - 3111) Maize cob productivity fertilized with different phosphorus sources and dosage

Ianna Bizerra Barros[1]; Iolanda Maria Soares Reis[2]; Carlos Alberto Costa Veloso[3]; Arystides Resende Silva[4]; Eduardo Jorge Maklouf de Carvalho[4]

Universidade Federal de Viçosa[1]; Universidade Federal do Oeste do Pará[2]; Embrapa Amazonia Orienatl[3]; Embrapa Amazônia Oriental[4]

The organic and inorganic phosphorus forms of the soil are influenced by the soil use and management. In cultivated soils, where there are periodic phosphates additions, the management system determines changes in the distribution of forms and phosphorus concentrations in the profile and, more specifically, in the surface layer. The objective of this work was to evaluate the maize cob yield fertilized with different phosphorus sources and dosages. The experiment was carried out in the experimental field of Embrapa Amazônia Oriental, in Belterra City - PA, under a dystrophic Yellow Latosol, with a clay texture. The experimental design was randomized blocks, arranged in a 3x5 factorial scheme, with three replications. Three sources (Simple Superphosphate (SS), Triple Superphosphate (ST) and Natural Reactive Phosphate (Arad) were used and five dosages (0; 60; 120; 180 and 240 kg ha-1) of P2O5 were used. The experimental plots, except control treatment, received mineral fertilization of 120 kg ha-1 of N (urea) and 90 kg ha-1 of K2O (Potassium Chloride), divided in sowing and cover. The maize cultivar used in seeding was AG 7088 PROX, with three seeds per linear meter, whose plots presented dimensions of 5x8 m. The harvest occurred at 141 days after seeding, to determine the maize cobs yield. The data were submitted to variance analysis and the means adjusted to the quadratic polynomial regression and compared by the Tukey test at 5% of probability. The interaction between phosphorus sources and dosages was significant for cob yield. The Arad proved to be inefficient in terms of phosphorus supply to the plants, in view of the non-occurrence of cob yields at any of the applied doses. This fact can be attributed to the low solubility of this type of fertilizer, which promotes longer phosphorus availability. The most efficient interaction in terms of cob yield (6.111 t ha-1) occurred between ST and the dose of 120 kg ha-1 of P2O5, decreasing thereafter. In general, the highest increase in cob yield for both SS and TS occurred until the dosage of 120 kg ha-1 of P2O5, making it unnecessary to apply higher dosages, noting that dosages greater than 120 kg ha-1 of P2O5 cost of production and reduce production. The maize cobs productivity presents a significant response to phosphorus application. The dosage of 120 kg ha-1 of P2O5, with ST as the source, provides higher cob productivity. There was no response in productivity when fertilized with Arad.

Keywords: phosphate fertilization, tropical soils, soil management

Financial support: Embrapa Amazônia Oriental and Fapemig

(8339 - 940) Natural phosphate efficiency use in corn applied with different nitrogen sources

Moniki Campos Janegitz[1]; Gustavo Faria Seródio[1]; Rafael de Paiva Andrade[1]

Colleges Gammon of Paraguaçu Paulista[1]

Phosphate (P) fertilizers as nitrogen are essential for high crop production. Ammonium application can improve phosphorus efficiency use and phosphorus available in soil to the crops. The aim of this study is evaluate the effect of ammoniacal fertilization impacts in the natural P efficiency use to the development initial of maize plants. The experiment was carried on greenhouse at Colleges Gammon in Paraguaçu Paulista –SP from June to September, 2017. The experimental design was randomized blocks in factorial: two nitrogen fertilization (ammonium sulfate and urea) x five doses of natural phosphate (0, 40, 80, 120, 180 mg P dm-1 of soil) with four replications. The experimental condition was in pots with 15 dm-3 of soil. After 30 days of emergency plants height, shoot dry matter, root dry matter, root/ shoot rate and natural phosphate efficient use were determined. Doses of P resulted in higher dry matter yield, plants height and efficient use of P in initial development corn plants. Ammonium sulfate plus doses of P, decreased the root / shoot rate. Natural phosphate efficient use was in 80 mg dm-3, independent of the source of nitrogen applied.

Keywords: Phosphate fertilization, N ammoniacal, ammonium sulfate

Financial support: