16th WORLD FERTILIZER CONGRESS OF CIEC

TECHNOLOGICAL INNOVATION FOR A SUSTAINABLE TROPICAL AGRICULTURE

PROCEEDINGS

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PROCEEDINGS

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AGRONOMIC EFFICIENCY OF GRANULAR ORGANOMINERAL P FERTILIZERS PRODUCED FROM POULTRY LITTER

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Introduction

Every year, around 10 million tons of poultry litter is produced in Brazil. This material is usually destined to crop and pasture fertilizing. However, most times the poultry litter is used without criteria, resulting in low efficiency of nutrient usage. One of the alternatives for the rational use of this residue is its transformation in granular organomineral fertilizer. This process involves the physical processing of the litter, its enhancement with mineral sources and subsequent granulation and drying. The final product has characteristics that allow its usage in the same equipment used for the crop planting which use conventional mineral fertilizers. Considering the environmental role of the production of organomineral fertilizers from poultry litter, it is necessary to evaluate its relative efficiency compared to corresponding mineral fertilizers. This paper has as aim to evaluate in the field the agronomic efficiency of phosphate organomineral fertilizers produced from poultry litter in relation to mineral phosphated fertilizers in a long-term experiment. The effect of composting on the litter quality for purposes of producing organomineral fertilizers was also evaluated.

Methods

The organic mineral fertilizers used in the experiment were produced in the granulation lab of Embrapa Soils, located at the Rio Verde University, Rio Verde, GO, Brazil. Samples from chicken litter produced in comercial poultry farms in the area were collected. The average nutrient concentration in the litter is 2,4; 3,8; 3,0 g.kg^{-1} of N, P_2O_5 and K_2O, respectively, and the average moisture content is 25%. Two organic mineral formulations were made, one with the litter *in natura*, as commercialized in the region, and the other with composted litter. The composted litter went through a composting process in which sugarcane bagasse and hatchery residues were added, the material being maintained in composting for 90 days. Both materials were dried for 48 hours at 65ºC and, subsequently ground below 0,5 mm. The materials were enhanced with purified monoammonium phosphate (12% N, 60% P_2O_5), in order to produce material with 20% total P_2O_5. The mixture was homogeneously granulated in a disc granulator, using neutral sodium silicate as binding agent. The granules were dried in a heater at 65ºC and classified between 1 mm and 4 mm sieves.

The experiment was performed in the experimental area of the Comigo Technological Center, in Rio Verde, Goias. The soil is a clayey Rhodic Haploustox , cultivated previously for six years under no-till. A completely randomized block design was used, in a 3 x 5 factorial scheme (three sources and five doses), with four repetitions, totalizing 60 plots. Each plot was composed by ten lines with a 0,50 m spacing and 5 m in length. The sources studied were monoammonium phosphate (MAP), organic mineral fertilizer made from poultry litter + MAP (OMF) and organic mineral fertilizer made from composted poultry litter + MAP (COMF). The doses used corresponded to 0, 20, 40, 60 e 80 Kg of P_2O_5 ha^{-1}. The seeding of the soybeans was performed during the summer in the years 2010/2011, 2011/2012, 2012/2013 and 2013/2014, between the months of September and October. All the plots received 80 kg ha^{-1} of K_2O in the form of potassium chloride. The plots were reaped between 114 and 120 days after seeding, collecting the 4 central lines of 3 m in length, totalizing a useful area of 6 m². All the data was submitted to analysis of variance and regression using the software SISVAR 5.1. From the data regarding productivity and doses of phosphorus applied, the relative efficiency of the organic mineral fertilizers in relation to MAP was calculated.

Results e discussions

No agronomic response was observed, neither to the products nor to the P doses applied in the first crop (Figure 1a). This result reflects a residual fertility that can be observed in several agricultural soils under intensive soybean cultivation in the Brazilian Cerrado (tropical savanna). From the second crop onwards, a response to the fertilizer doses was noted, with growing gains from the third crop onwards, suggesting the depletion of P reserves in the soil (Figure 1).

On average, the P fertilization resulted in yield gains according to the quadratic model. The maximum yields were obtained with doses de P varying from 65 to 81 kg P_2O_5 ha^{-1}. However, no significant differences were observed between the organic mineral and mineral fertilizers in any of the crops evaluated. Nevertheless, evaluating the average productivity in the 4 crop seasons studied, a significant agronomic efficiency gain of organic mineral sources in relation to MAP was observed (Figure 2). Although the MAP was more efficient than the organic mineral sources in the smaller dose (20 kg P_2O_5 ha^{-1}) (Figure 2), the organomineral fertilizers presented relative agronomic efficiency up to 70% higher than the MAP in the doses around 60 kg P_2O_5 ha^{-1} (Figure 3). This result suggests a bigger residual effect of P applied via organic mineral sources. It is still expected that there will be a possible effect from the addition of organic sources on the soil microorganisms, influencing the vegetal production and the absorption of nutrients.

Conclusions

Considering the residual effect of successive fertilizations, it can be concluded that organic mineral fertilizers produced from poultry litter are more efficient than MAP as source of P for the soybean cultivation in the Cerrado conditions.

There is no difference between the composted litter and the litter *in natura* regarding agronomic efficiency of organic mineral fertilizers produced from these sources. Therefore, there is no need to do the composting when using poultry litter in the production of organic mineral fertilizers.

Although the agronomic result is consistent and statistically proved, it is not known exactly what the mechanisms related to this effect are and, therefore, more detailed studies are recommended for a better understanding of this phenomenon.

Keywords: soybean, composting, organic residues

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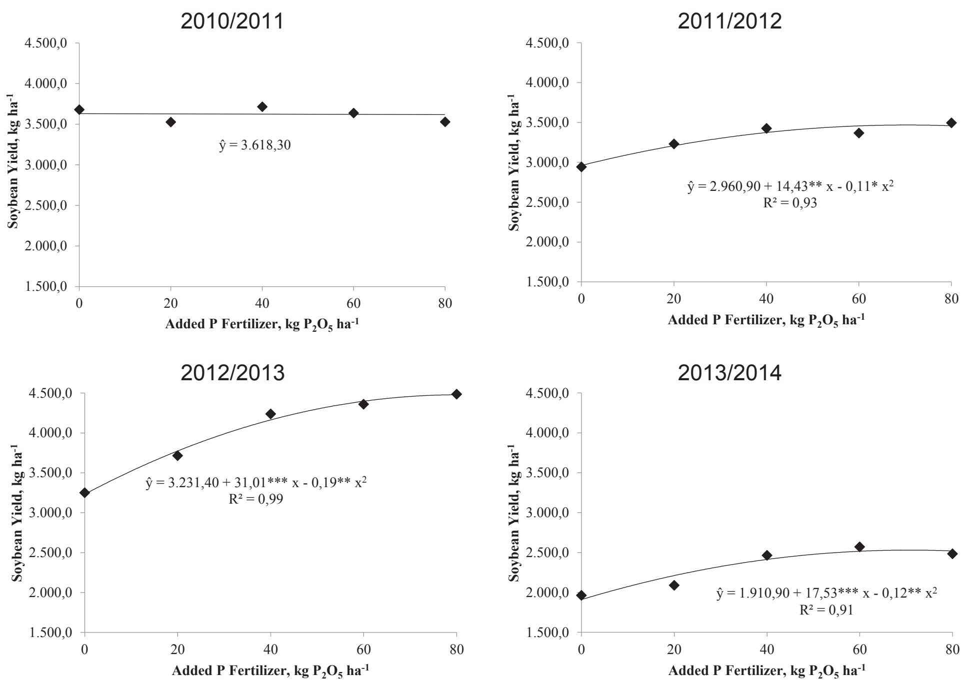

Figure 1. Soybean yield in relation to the doses of phosphate fertilizers (average of the 3 sources). *** P<0,001; ** P<0,01 and * P<0,05 for F test.

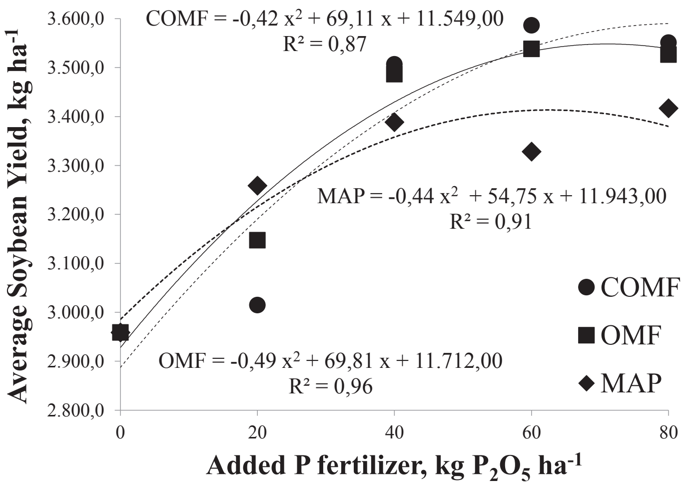

Figure 2. Average soybean yield in four years due to the application of organic mineral and mineral phosphate fertilizers; OMF – poultry litter organic mineral fertilizer; COMF – composted organic mineral fertilizer; MAP – monoammonium phosphate

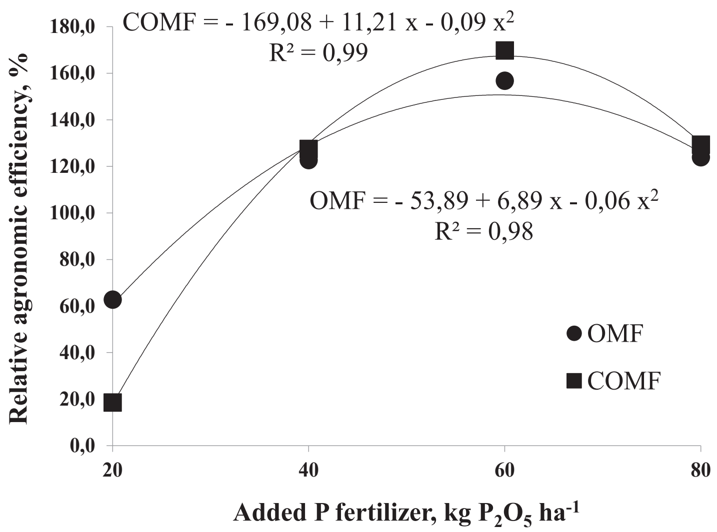

Figure 3. Relative agronomic efficiency of organic mineral P fertilizers in relation to MAP, considering the average yield in the four years evaluated. OMF – poultry litter organic mineral fertilizer; COMF – composted organic mineral fertilizer