INTRODUCTION

Low phosphate (P) availability is one of the major problems in most Ferralsols from Angola, due to the strong ability of these soils to adsorb P, thereby limiting its bioavailability for crop production (Ouassapeu, 2006). Application of biochar as soil amendment, along with superphosphate and rock phosphate fertilizers may be useful in increasing supply of available P. However, appropriate management strategies require information on the fate of biochar and applied P fertilizers in the soil as well as on their interaction with soil colloidal constituents. Therefore, information on soil P availability using different methods, and P forms (organic and inorganic) by Hedley modified fractionation procedure (Tessier and More, 1993), early plant growth performance and P content in plant after biochar amendment along with different rates of P fertilizers, is crucial for making appropriate fertilizer and biochar recommendations for crops.

OBJECTIVES

This study was conducted to i) determine the availability of P by different methods and the amount of different P forms in soil amended with biochar along with different rates of P fertilizers by sequential fractionation, ii) evaluate the early plant growth performance of rice (Oryza eculata) on these soils, and iii) determine the relationships of content of available P by different methods and forms of fractionated P with plant nutrient uptake and with soil properties.

MATERIALS AND METHODS

Samples (Ferralsols) from the surface (0-20 cm) horizon of soils from the Chiang Agricultural Experiment Station (about 2,550 ha), Huambo, central plateau of Angola, which lies between 12º 14' and 12º 16' latitude and between 13º 48' and 15º 52' longitude (Fig. 1) were used. Their main properties are shown in Fig. 2. Each soil was amended with 30 t biochar per ha along with two inorganic containing P fertilizers at different rates, (Fig. 3) according to its P sorption maxima.

Fig. 3- Soil samples and treatments

The treatments arranged in randomized complete block design in quadruplicate were as follows: 1) C- control (soil without P2O5); 2) S1- soil + 100 mg kg−1 superphosphate; 3) S2- soil + 200 mg kg−1 superphosphate; 4) S1- soil + 100 mg kg−1 superphosphate + rock phosphate; 5) R1- soil + 100 mg kg−1 rock phosphate; 6) R2- soil + 200 mg kg−1 rock phosphate; 7) B + S1; 8) B + S2; 9) B + R1; and 10) B + R2

RESULTS AND DISCUSSION

Effects of biochar amendments along with different rates of superphosphate and rock phosphate (Frigotaga) on the amount of labile (LP), moderately labile (MLP), and non labile (NLP) fractions (mg kg−1)

The amount of MLP fraction in all treatments were higher than those of the LP and NLP fractions. The amount of LP, MLP and NLP fractions increased with biochar amendment along with P fertilizer application. Higher values were observed in soils applied alone with 200 mg kg−1 of superphosphate alone than other treatments.

The highest increase in the values of DMYR was observed in soils applied with 200 mg kg−1 of phosphate kg−1 alone.

The values of DMYR also increased in biochar amended soils along with P fertilizer application.

Correlation coefficient (r) of plant parameters with available P by different methods, content of nutrient in plant and P fractions, and some soil properties in biochar amended P fertilized Ferralsols

CONCLUSIONS

Application of superphosphate (200 mg kg−1) was more effective in improving the soil P supply and early plant growth performance in Ferralsols, than rock phosphate (Frigotaga). Plant dry matter yield and P content in plant also improved with biochar amendment along with P fertilizer application.

Mechli 3 and Olsen are better methods in assessing available P in biochar amended P fertilized Ferralsols. Biochar amendment in P fertilized Ferralsols increased all soil P fractions, and improved the nutrient content in plant, soil pH, content of total organic C and basic cations (Ca2+, Mg2+ and K+).

Results may differ when amplified under field conditions, hence field experiments are needed to evaluate such effects in soils. The effects in combination with lime on uptake of P by plants also need to be addressed further.

REFERENCES


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