

Phosphorous Availability in Low Phosphorous and Acidic Soils as Affected by Liming and Phosphorous Addition

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Abstract

Acidic soils typically suffer from high phosphorus (P) retention, a problem that can be dealt with greater application of P fertilizers, soil liming, or both. The aim of this research was to examine which of these practices bears the more beneficial results. An incubation study was conducted in the laboratory of the Department of Soil Science, Faculty of Agriculture, Mapalana, to determine the effect of lime as CaCO_3 and P as TSP on soil pH and available soil P in an acid soil. Three rates of lime equivalent to 0, 1 000, 2 000 $\text{kg}(\text{CaCO}_3)\text{ha}^{-1}$ and three rates of TSP equivalent to 0, 50 and 100 $\text{mg}(\text{P})\text{kg}^{-1}$ were applied in combinations as treatments. The soil was incubated at field capacity and soil P, pH, inorganic nitrogen ($\text{NH}_4^+\text{-N}$ and $\text{NO}_3^-\text{-N}$) and Ca content were determined at 3, 7, 14, 21, 28, 42 and 56 days after the treatments which replicated three times. Soil P was extracted using Borax, Olsen and Bray and Kurtz-1 methods to determine the relationship among the soil test P extraction methods. Soil pH was significantly increased with the increasing rate of lime. The pH of the initial soil was 4.75 which increased up to 5.4 and 6.4 at the end of the incubation respectively, for the 1000 kg/ha and 2000 kg/ha lime treated soil. Both lime and TSP had significant effects ($P < 0.001$) on P availability at three soil test P extraction methods. The highest available phosphorus in the soil was noticed with the application of lime at 2000 kg/ha at all the extraction methods. Bray and Kurtz-1 method extracted the largest amount of P (5.63 – 66.69 mg/kg) while Borax extracted the smallest amount (3.42 – 42.42 mg/kg). The mean extractable P in soils was found to be in the order of Borax<Olsen<Bray and Kurtz-1. The available Ca of the initial soil was 117 mg/kg soil which increased to 625 and 400 mg/kg soil at the end of the incubation respectively, for the 1000 kg/ha and 2000 kg/ha lime treated soil. Despite the varied $\text{NH}_4^+\text{-N}$ and $\text{NO}_3^-\text{-N}$ contents, the $\text{NH}_4^+\text{-N}$ content decreased and NO_3N content increased in all the treatments when incubation progressed. According to the results it can be concluded that lime addition with P is a better practice than liming alone and P alone to increase soil pH and P availability in acidic, low-P soils. However, if there is relatively high P content in soil, liming alone may be sufficient to increase soil pH.

Key words: Acidic soil, incubation, Lime, Phosphorous, Phosphorous extraction methods

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