Plant and Soil 116, 95–101 (1989).

PLSO 7789

Effect of elemental sulphur on chemical changes and nutrient availability in calcareous soils

A.S. MODAIHSH, W.A.AL-MUSTAFA and A.I. METWALLY
Department of Soil Science, College of Agriculture, University of King Saud, Riyadh, Kingdom of Saudi Arabia

Received 9 May 1988. Revised January 1989

Key words: available phosphorus, calcareous soils, elemental sulphur, micronutrients, sulphur oxidation

Abstract

Elemental sulphur was added to three calcareous soils varying in texture, $CaCO_3$ content, native phosphorus and micronutrient content at a rate of 0.5, 1.5 and 3.0% (w/w). The experiment was carried in soil columns which were intermittentantly leached and incubated at 30°C for 3,6,9, and 18 weeks. Sulphur applied at a rate of 0.5% significantly decreased the pH and increased the EC and the soluble sulphate content in all three soils and their leachates with slight differences among soils. Sulphur application generally increased 0.5*M* $NaHCO_3$ extractable P and DTPA extractable Mn, slightly increased DTPA extractable Fe and Cu but had no significant effect on DTPA extractable Zn. The decrease in soil pH and the increase in DTPA extractable P,Mn,Fe, and Cu upon S-addition were higher with lower $CaCO_3$ content, lower $CaCO_3$/clay ratio and with higher extractable content of these nutrients. Most chemical changes occurred at rate of 0.5% sulphur within 9 weeks of incubation and were largely confined to the soil surface where sulphur was mixed with soil. DTPA extractable Fe and Cu, however, were affected only at higher rates of S-application.

Introduction

There has been an increasing interest in using elemental sulphur to increase the solubility of phosphorus and micronutrients and to correct their deficiencies in alkaline and calcareous soils (Abd-Elfattah and Hilal, 1985; Hilal and Abd-Elfattah, 1987; Kashirad and Bazargani, 1972). This is of special interest in Saudi Arabia since most soils are calcareous and elemental sulphur is readily available (annual production 1.4 × 10^6 ty^{-1}).

The effect of sulphur application on lowering soil pH and increasing phosphorus and micronutrient availability was found to be considerably higher in noncalcareous than in calcareous soils (Shadfan and Hussen, 1985). In some calcareous soils, S-application increased the chemically available P from native soil apatite or added rock phosphate (Garcia and Carloni, 1977), where in others it increased available P only when P-fertilizer was added to the soil but soil P was not affected (Gupta and Mehla, 1980). EDTA-extractable Fe, Mn, Zn, and Cu were also reported to be affected differently in calcareous soils (Dawood *et al.*, 1985; Hoeft and Sorensen, 1969; Morsey, 1985). The variable results obtained by many workers seem to be related to the soil chemical properties that affect their buffering capacities in addition to their native nutrient content. Various rates of S-application and incubation periods also contributed to the variable results.

The present work was carried out to study the effect of S-application on pH, EC, $SO_4^{=}$ content and nutrient availability in three soils representing calcareous soils of Saudi Arabia. Soils selected varied in texture, $CaCO_3$ content and extractable nutrients (P, Mn, Fe, and Cu). These chemical properties were also evaluated as a function of the rate of S-application, period of incubation and soil depth.