Plant and Soil 44, 253–256 (1976) Ms. 2842

SHORT COMMUNICATION

# Mineralization of inositol hexaphosphate in soil at varying static moisture levels

*Summary*

Mineralization of inositol hexaphosphate in soils increased at all moisture levels during 60 days incubation. Water-logging influenced the mineralization process to the greatest extent probably by inducing a conducive environment optimum for proliferating phytase-producing microorganisms.

## *Introduction*

The determination of inositol phosphates by chromatographic techniques have demonstrated that penta- and hexaphosphates are predominant in many soils and constitute 3 to 58 per cent of the total organic phosphate[2 7 8]. The significance of the organic phosphate fraction depends on the rate of its mineralization, since plants obtain their phosphate supply mainly in the inorganic form[4]. The mineralization of soil organic phosphate, principally a microbial phenomenon, is influenced by all factors affecting microbial activity and numbers. Of these, temperatures, moisture, soil reaction and supply of energy materials are of special relevence. Species of *Aspergillus*, *Arthrobacter*, *Bacillus*, *Cunninghamella*, *Penicillium* and *Rhizopus* can synthesise the enzyme phytase which results in the degradation of inositol hexaphosphate[1]. Studies showed that considerable mineralization of inositol hexaphosphate[5] and inositol phosphates[6] occurred in submerged soils.

In this paper, the effect of varying soil static moisture levels on the degradation of inositol hexaphosphate is reported.

## *Materials and methods*

Two clay soils, Noadda series (pH 4.2, 59.5% clay, 1.6% organic carbon, 138 ppm organic P and 82 ppm inositol hexaphosphate) and Tippera series (pH 4.5, 66.2% clay, 2.8% organic carbon, 226 ppm, organic P and 141 ppm inositol hexaphosphate) were used in this study. The top 15 cm of the soils were air-dried and ground to pass a 100 mesh sieve. After thorough mixing, the soils were stored in polythene bags for incubation studies.

Ten-gram soil samples were placed in test tubes (1 cm × 10 cm) and deionized water was added to give moisture levels of 50, 75 and 100 per cent of the water-holding capacity. A further treatment involved waterlogging

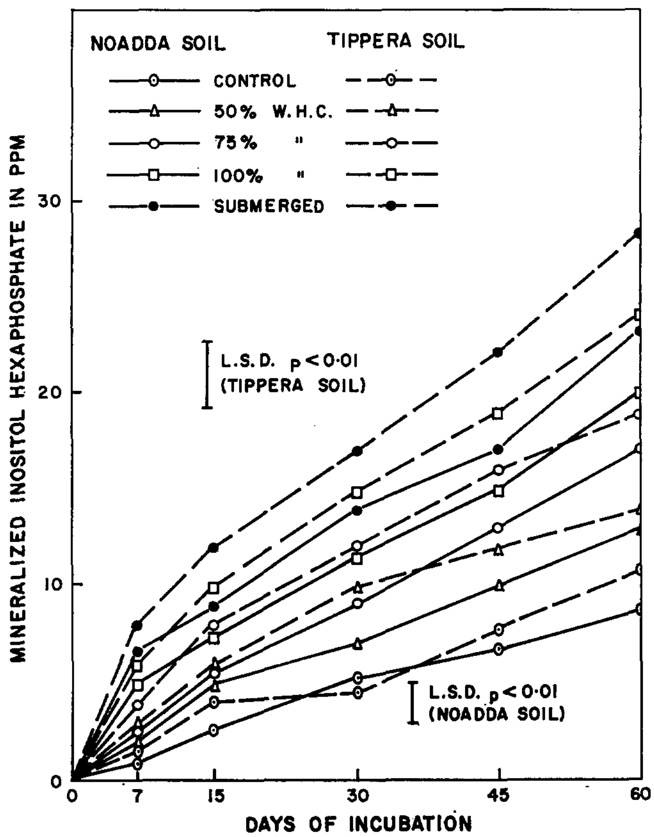


Fig. 1. Effect of varying static moisture levels on mineralization of soil inositol hexaphosphate.

the soils by the addition of sufficient water to maintain a 2 cm column on the soil surface. For control, no water was added to the air dry soil. Moisture contents were readjusted at regular intervals. All treatments were replicated four times. Soils were incubated at 30°C for 60 days. With the exception of the waterlogged treatment, the soils were incubated following the barium peroxide method[3]. Soils were analyzed at regular intervals for inositol hexaphosphate using the method of Anderson[2]. A decrease in the amount of inositol hexaphosphate with time was taken as the measure of mineralized phosphate. pH of the soils was also monitored during the incubation period.

*Results and discussion*

The effect of varying static moisture levels on mineralization of inositol hexaphosphate in soils are shown in Figure 1. Significant mineralization occurred at all moisture levels with time. In control soil, mineralization was

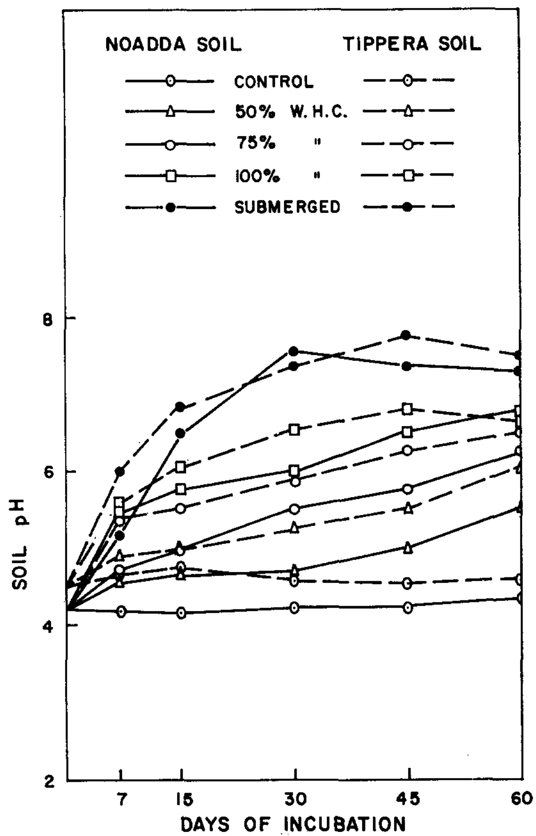


Fig. 2. Effect of varying static moisture levels on soil pH.

insignificant in comparison to other treatments. All treatments showed an increase inositol hexaphosphate mineralization in 60 days incubation. The rate of transformation was found to be lowest in soils held at 50 per cent of water holding capacity while the highest rate was observed in submerged condition. The latter observation may be attributed to the change of pH from acidity to neutrality (Fig. 2). This may have helped in the proliferation of phytase-synthesising microorganisms responsible for the breakdown of inositol hexaphosphate in soil. The higher rates of mineralization in Tippera soil compared to Noadda soil may be due to the presence of higher amounts of organic phosphate and carbon substrate in the soil. The present findings lend a support to observations made by other workers[5 6]. Alexander[1] also noted that the rate of mineralization of organic phosphate is enhanced by adjusting the pH to values conducive to general microbial metabolism, and a shift from acidity to neutrality increased phosphate release.

It would appear from results of this study that if conditions could be optimized for the rapid hydrolysis of inositol hexaphosphate in soil (*e.g.* through waterlogging), release of phosphate could be expected which may be of considerable importance for the growth of plants and microorganisms.

B. Ahmed

Dept. of Soil Science, University of West Indies,
St. Augustine, Trinidad, West Indies.

Received 26 May, 1975

*References*

1 Alexander, M., Introduction to Soil Microbiology. John Wiley and Sons, Inc., p. 361–364 (1961).
2 Anderson, G., Trans. Intern. Congr. Soil Sci. 8th Congr., 563–572 (1964).
3 Cornfield, A. H., Plant and Soil. **14**, 90–93 (1961).
4 Enwezor, W. O., Soil Sci. **103**, 62–66 (1967).
5 Furukawa, H. and Kawaguchi, K., Soil Sci. Plant Nutr. **15**, 243–250 (1969).
6 Islam, A. and Ahmed, B., J. Soil Sci. **24**, 193–198 (1973).
7 McKercher, R. B. and Anderson, G., J. Soil Sci. **19**, 47–55 (1968).
8 Omotoso, T. I. and Wild, A., J. Soil Sci. **21**, 216–223 (1970).