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RESEARCH ARTICLE

Release of Phosphorus from Laboratory Made Coated Phosphatic Fertilizers in Soil Under Different Temperature and Moisture Regimes

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Abstract The aim of the present study was to see the release pattern of phosphorus from laboratory made coated phosphatic fertilizers in soil under different temperature and moisture regimes. Four fertilizer materials were prepared by reacting ammonia with phosphoric acid (Product-A and Product-B) and rock phosphate with sulphuric and phosphoric acid (Product-C and Product-D). These materials were coated with polyvinyl alcohol, liquid paraffin and methyl oleate at two levels (2 and 3 %). The coated phosphatic fertilizers along with diammonium phosphate were applied @ 500 mg P kg^{-1} soil and incubated at two temperatures (20 and 30 °C) and two moisture regimes (10 and 20). Results indicated that release of P showed a decline trend from first to fourth hour of incubation, then increased and finally reached to a steady state in all the products, except Product-C. The release pattern followed the order: diammonium phosphate > Product-B > Product-A > Product-D > Product-C, corresponding with the mean values of 337.4, 227.9, 211.6, 147.1 and 69.0 mg P kg^{-1} soil, respectively. Results also showed the superiority of polyvinyl alcohol coated products over liquid paraffin and methyl oleate coated products. The rate of release of P was greater with increase in temperature from 20 to 30 °C. Thus, it may be concluded that laboratory made coated fertilizers could be used as a source of P which would release P slowly than the water soluble P like diammonium phosphate and supply P for a longer period that synchronizes the crop demand and enhances P use efficiency.

Keywords Phosphorus · Coated fertilizer products · Release pattern · Olsen reagent · Temperature and moisture regime

Introduction

Phosphorus (P) plays several important physiological and biochemical functions in crop plants, animal and microorganisms in relation to nucleic acid, phospholipids, adenosine tri-phosphate (ATP) and adenosine di-phosphate (ADP) molecules and intermediate compounds of respiration and photosynthesis. Phosphorus nutrition is a global issue and a secured supply of P would be an important management for global food security. It is the 11th most abundant element in the earth's crust. At the same time it is also the least mobile element among the major plant nutrients and is unavailable under most of the soil conditions. The available P is low to medium in soils of most states in India [1]. Thus, application of phosphatic fertilizers is very much essential for sustaining crop production and maintaining the soil fertility.

At present diammonium phosphate (DAP) is the most common P-fertilizer used by farmers in India. However, the cost of DAP has increased tremendously in recent past because of the import of raw materials like rock phosphate (RP) and sulphur, required for commercial manufacturing of DAP, from other countries as there are no deposits of high-grade RP (>30 % P_2O_5) in India. According to