THE UPTAKE OF PHOSPHORUS BY WHEAT AND CLOVER FROM FOUR INORGANIC SOIL PHOSPHATE FRACTIONS AFTER THE ADDITION OF CONTRASTING TYPES OF PHOSPHATIC FERTILIZER

by A. N. SMITH

N.S.W. Department of Agriculture, Agricultural Research Institute, Wagga Wagga, N.S.W. Australia

When soluble phosphatic fertilizers are applied to moist soil, reaction products are formed. The nature and properties of these products depends on the type of fertilizer used and the kind of soil. When phosphatic fertilizers of low water-solubility are mixed with soil there is no such large accumulation of reaction products, since only small amounts of soluble phosphate are released by the fertilizer. Reaction products formed between soil and soluble fertilizers have received much attention. In contrast the study of the forms into which less-soluble fertilizers slowly change in the soil has been virtually neglected. In the present paper a pot experiment is described in which both immediate and residual changes in four inorganic phosphate fractions were studied after the addition of soluble and insoluble phosphate fertilizers and after the growth of clover or wheat.

EXPERIMENTAL DETAILS

The experiment was conducted in two stages. In the first stage it was of $3 \times 4 \times 2$ factorial design with three replications. There were three levels of fertilizer application to supply $0(P_0)$, $50(P_1)$, and $100(P_2)$ ppm P to the soil. Four fertilizers were used, namely: basic slag (B), calcined rock phosphate (C), monocalcium phosphate (M) and rock phosphate (R). On half the pots clover (S) was grown whilst the remainder were maintained free of vegetation (N) – this provided crop and no-crop treatments. One hundred and eight additional pots carried clover during the first stage of the experiment – these
were the pots to be used in the second stage. The experimental design for this was 3 × 4 × 3 with three replications. The same fertilizers were applied initially at the same rates but after the first clover crop both clover (S) and wheat (W) were grown as crop treatments to compare with the no-crop treatment (N) as before.

Each pot contained 1,000 g of dry soil in a plastic bag. There was thus no loss of nutrients by leaching. During the experiment water was maintained in all pots at approximately 60 per cent of field capacity by daily weighing and replacement of moisture lost.

Each fertilizer was mixed with dry soil prior to the start of the experiment. The soil was then wetted to 60 per cent of field capacity and left for four days. At the end of this time 24 pots (one replicate) were taken and sampled for subsequent soil analysis. Triplicate samples of each fertilizer were weighed out and mixed with acid-washed sand to give a concentration of 100 ppm P in each case. These were also kept for subsequent analysis.

For the first period 15 clover seeds (*Trifolium subterraneum* L. var. Marrar) were sown in each of the 24 pots receiving the crop treatment. The number of plants was reduced to ten after germination. The clover was cut 29 days after sowing. The material from both tops and roots was taken, the roots being washed as free as possible from the adhering soil. The plant material was dried at 50°C, weighed, then milled and stored for analysis. Soil samples were taken from all pots in the experiment, dried at 50°C then ground to pass a 33-mesh sieve and stored for analysis.

The tops of the clover plants growing in the pots that were to continue on as the second stage of the experiment were cut at the same time. The pots were then left for 48 days after which time the soil was brought back to 60 per cent of field capacity by the addition of water. Fifteen seeds of clover or wheat (*Triticum aestivum* L. var. Falcon) were sown in each of the pots receiving the crop treatment. This number was subsequently reduced to ten. The experiment was terminated 25 days after sowing when top and root material and soil samples were taken. The clover at this time was, as near as could be judged, at the same stage as the clover in the first period when it was harvested.

The experiment lasted from 24 November, 1964 to 4 March, 1965, i.e. during the southern summer. It was conducted in a glasshouse fitted with evaporative cooling to reduce the excess temperature. The control was set for 80°F but in practice this temperature was exceeded during the hottest days.

**MATERIALS USED**

The soil was a typical red-brown clay-loam (Gombalin clay-loam) from Wagga district, N.S.W. It had a pH of 4.9 in M/100 CaCl₂. The properties of the fertilizers used are shown in Table 1.