SOIL PHOSPHATE STUDIES*

By B. E. BEATER.

I. **The Measurement of Phosphate Fixation in Soils** (Soil Sc. (1937) 44: pp. 277—291).

In this paper a study of our present knowledge of phosphate fixation was first made and followed by an examination of the effects of pH, exchangeable bases, organic matter, time and soil composition on this phenomenon. After making reference to the physicochemical theory of phosphate fixation, the laboratory work of other writers is discussed.

To determine phosphate fixation, the writer first used a method to distinguish the permanently fixable phosphate from that temporarily fixed by means of 1 per cent citric acid solution. Laterly it was found that the amount of phosphate fixed in the presence of 1 per cent citric acid compared very favourably with the amount finally obtained by the first procedure and an easy and rapid alternative suggested itself, as follows:—

Experimental Procedure: Ten grams of air-dried soil passed through a 1mm. sieve is refluxed for half an hour in a 250 ml. Erlenmeyer flask with 100 ml. of 1% citric acid. The contents are cooled and filtered and the amount of phosphorous unfixed is estimated. After allowance has been made for the amount dissolved by ordinary solution in 1% citric acid the amount fixed in tons per acre six inches (2,000,000 lbs. soil) can be arrived at.

In concluding this paper the writer discusses the practical issues of such a study.

II. **The Movement and Fixation of Superphosphate in Soils** (Soil Sc. (1938) 46: pp. 453—466).

A study was made of the movement and fixation of superphosphate under field conditions in two distinct soil types. This was ascertained by applying superphosphate as top dressing under irrigation, as top dressing without irrigation, in the drill and buried. The study was conducted over one year, samples being taken at six intervals after application. In these samples total, citric soluble and water soluble phosphoric acid were estimated. The conclusions drawn from this work are as follows:—

Erosion of total phosphate from surface dressings is considerable, being greater in the heavier soil type. In both soil types this has been very greatly reduced by watering. Movement of total phosphoric acid cannot be traced appreciably below the first inch from the surface, even in the lighter soil. Occasional penetration appears to take place in fissures. In neither the heavier nor the light soil has any loss from the buried superphosphate occurred. No movement below (or above) can be detected in the buried fertilizer.

Before results were interpreted an attempt was made to eliminate the effect of fixation by experimental procedure. This was not altogether satisfactory, but nevertheless warranted the drawing of the following conclusions:—

The fixation by analytical process in a heavy soil type is so much greater than that in a light soil as, perhaps, to obscure the results obtained. As a result, the fixation with time in a light soil stands out more clearly than that in a heavy type, although a heavier fixation in the heavy type actually takes place.

Watering tends to prolong somewhat the availability of phosphate.

Water-soluble phosphate is lost in considerable amounts in process of estimation in a heavy soil type, and in appreciable amounts in a lighter type. After 14 days virtually all the water-soluble phosphate has vanished from the heavy soil, but at the end of a year some still remains in the light soil, the loss being very gradual. In a heavy soil type the increase in water-soluble phosphate, due to applications of 800 pounds superphosphate per acre, is almost negligible, whether the dressing be applied in the soil or on the surface.

The fact that analytical results with respect to phosphate fixation can be very misleading if interpreted literally has been illustrated. Since the experimental procedure itself plays a disturbing part, such figures do not necessarily reflect conditions prevailing in the soil.

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