

A MODIFIED RESIN EXCHANGE METHOD FOR MEASUREMENT OF AVAILABLE PHOSPHATE IN SOILS DERIVED FROM VOLCANIC ASH

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An experimental method to determine available phosphate in soils using anion exchange resin as an extractant has been described (3, 5). However, when this method is applied to volcanic ash-derived soils, some problems arise. First of all, the original method is based on the phosphate retention capacity of an anion exchange resin which is brought into contact with the soil and then separated from it by mechanical means (screening). This separation presupposes that the resin particles are of a greater size than the soil particles. Therefore the soil has first to be air-dried, ground and sifted. Besides, when using the above technique many resin particles are broken during shaking, which may prevent their recovery.

The volcanic ash-derived soils in Chile have a high water retention capacity, a high permeability and porosity. Therefore, they can not easily be ground and sifted through a fine screen in their moist state. Furthermore, the drying process affects their chemical and physical properties, changing, for instance the solubility of the phosphates present (2, 7). Using the field-moist soil, the resin method has been used in Chile and the results obtained were highly satisfactory, showing a good correlation with some biological methods (1, 4, 9). However, the procedure involved is bothersome and tedious when applied to volcanic ash-derived soils.

In this note we report a modification of the technique which eliminates the tedious separation of soil particles from the resin spheres, preventing the loss of resin. It has been successfully applied to volcanic ash-derived soils.

The soils used in this work, Temuco, Osorno, Puerto Octay, and Santa Bárbara are derived from volcanic ashes. They are all silt loam and

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have a high P-fixing capacity (1, 8). Soil samples were obtained from the surface horizon of unfertilized road-side cuts and placed in plastic bags that were sealed and left unopen until immediately before use. Some of their characteristics have been reported previously (1, 8, 9).

Procedure. Exactly 1-2 g. of field moist soil is placed in a plastic bottle. Using a scoop similar to the one previously described (3, 5), 5 ml. of a strong anion resin saturated in chloride is placed in a small cloth bag made of synthetic fiber devoid of phosphorus; (in this work Dowex 2 x-4, 20-50 mesh, total exchange capacity of 3.4 meq./g. (dry basis) was used); the open end of the bag is tied with a rubber band and the bag placed inside the plastic bottle. 50 ml. of distilled water are added and the bottle shaken during 16 hours at 25°C. The bag is then removed, its outside washed with a stream of distilled water, and its content emptied quantitatively into a 50 ml. beaker and washed by decanting with distilled water to remove any fine soil particle that could have found their way into the bag. The resin is eluted with 1 N KCl solution in an elution tube like the one described by Hislop and Cooke (5), or in a discontinuous process with seven 6-ml. fractions. The total volume is made up to 50 ml. and phosphate determined in an aliquot. The chloromolibdic acid method was used for all P-determinations, the color being measured at 660 nm. (6).

To study the new procedure, separate portions of field moist soil samples were mixed thoroughly with three different amounts of Ca (H₂PO₄)₂·H₂O. Parallel determinations of available phosphate were made in the moist samples by both the Cooke and Hislop (3) and the proposed technique. In the Cooke and Hislop method, the resin was separated from the soil by straining through a fine polyester screen and removing carefully any soil particles that were retained. All the experiments were performed in triplicate, and average values reported.

Table 1 shows a significant correlation be-

TABLE 1
Available phosphate extracted by an anion exchange resin

Soil	Added P*	Cooke and Hislop Technique		Proposed Technique	
		P Extracted*	Correlation† Coefficients	P Extracted*	Correlation† Coefficients
Puerto Octay	39	4.3	0.984†	5.4	0.904†
	118	13.1		14.1	
	236	27.9		42.6	
Osorno	35	12.2	0.997†	14.5	0.985†
	105	38.2		47.7	
	210	81.1		108.1	
Temuco	34	13.2	0.901†	10.8	0.955†
	102	18.3		18.0	
	204	26.3		29.4	
Santa Bárbara	37	21.5	0.973†	16.8	0.969†
	111	45.5		45.7	
	222	132.8		147.7	

* Expressed as ppm of P on oven-dry basis.

† 9 samples for each soil.

‡ Significant at $p < 0.001$.

tween P-added and P-extracted by both resin techniques. This means that both techniques have equal utility in assessing the available phosphate status of volcanic ash-derived soils. The slightly higher values obtained when the resin was used inside the bag, could be due to the fact that by this procedure, none of the resin that has extracted phosphate is lost.

The application of this technique to soils derived from volcanic ashes would allow an accurate and ready determination of their available phosphate, which can be useful in routine analysis of these soils. This technique could be applied to other types of soils in which the determination of available phosphate by means of anion resin poses similar problems.

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