

LEACHING AND RESIDUAL VALUE OF SUPERPHOSPHATE AND ROCK PHOSPHATE UNDER HIGH RAINFALL CONDITIONS

By R. C. BRUCE, B.Sc.

SUMMARY

Leaching of superphosphate and of rock phosphate ran fairly parallel. Residual phosphorus after 3 years from the application of 200 lb. P_2O_5 per acre was appreciable, but there was little retention from amounts of 100 lb and lower.

Introduction

While it is generally agreed that the great bulk of phosphorus added to soil in fertilizers remains near the soil surface, some workers have shown leaching losses in coarse-textured or periodically waterlogged soils.

The present study was intended to investigate whether very high rainfall on a medium-textured soil would encourage movement of applied phosphorus.

Methods

Soil was sampled from plots of a field experiment near Tully in North Queensland. The experiment was designed to compare various ratios of superphosphate and rock phosphate broadcast at pasture establishment. The soil was sampled almost 3 years after the fertilizers were applied. Rainfall was not measured at the experimental site during this 3-year period but is estimated to be well in excess of 300 in. Tully, some 9 miles away, received 511 in. during the same period.

A description of the soil is given in Table 1. The soil is of mixed alluvial origin and in the virgin state forms treeless blady grass (*Imperata cylindrica* var. *major*) plains. It would belong to the Um 4.4 Principal Profile Form of Northcote (1965).

TABLE 1
DESCRIPTION OF SOIL AT EXPERIMENTAL SITE

Horizon	Depth (in.)	Description	pH	Extractable Phosphorus (P ₂ O ₅ p.p.m.)	Total Nitrogen (N%)	Exch. Potassium (K ⁺ em-quiv. %)
A1	0-6	Very dark grey clay loam (10YR 2/1) grading to	5.0	10	0.29	0.34
A2	6-18	Dark brown silty clay loam (10YR 3/3) sharp change to	5.0	3	0.14	0.07
B2	18+	Yellowish red silty clay (5YR 6/8) with red mottle and smooth ped structure ..	4.8	4	0.06	0.05

Plots were sampled at depths 0-4 in., 4-8 in. and 8-12 in. and analysed for dilute acid extractable phosphorus by the method of Kerr and von Steiglitz (1938).

Results

Analytical results are given in Table 2.

TABLE 2
SOIL PHOSPHORUS (p.p.m. P₂O₅) AT THREE DEPTHS AS INFLUENCED BY AMOUNTS AND PROPORTION OF APPLIED SUPERPHOSPHATE AND ROCK PHOSPHATE

	Depth (in.)		
	0-4	4-8	8-12
Ratio superphosphate : rock phosphate			
0 : 1	18.2	8.1	3.4
0 : 3	17.6	7.9	3.4
1 : 1	20.7	8.1	3.3
1 : 0	18.3	8.4	2.9
Necessary differences } 1%	4.2	2.6	1.0
for significance } 5%	3.2	2.0	0.8
Amounts of P ₂ O ₅ (lb/ac)			
0	11.8	6.5	2.9
50	13.3	6.5	3.0
100	15.8	7.4	3.4
200	27.1	10.5	3.4
Necessary differences } 1%	3.7	2.3	0.9
for significance } 5%	2.7	1.7	0.7

The analyses show no differences, at any of the depths, between the various ratios of superphosphate and rock phosphate. This would indicate that rock phosphate has no advantage over superphosphate in the long term. This is verified by the pasture yield figures (Anon. 1964, p. 14) where at the second and third harvests responses occurred to phosphorus irrespective of the source, depending only on the rate of application.

Comparing the residual values (as measured by the soil analysis) of the different amounts of P_2O_5 applied, only the 200-lb application rate has any worthwhile effect. This is particularly obvious in the 0–4 in. depth, while the difference is small but highly significant in the 4–8 in. depth. Even this level only results in about 10% of the applied P_2O_5 remaining extractable in the top foot of soil. The 100-lb application rate has a small but real residual value in the 0–4 in. depth, while the 50-lb rate does not differ significantly from the control at any depth.

Movement of phosphorus in the soil appears to have occurred only with the heaviest applications. Phosphorus from these applications has moved out of the 0–4 in. layer and into the 4–8 in. layer. No differences are recorded in the 8–12 in. depth.

Even under these high rainfall conditions the phosphate fertilizers appear to be rather immobile in the soil. However, appreciable residual value of dressings of superphosphate on this soil may only be obtained from dressings of 4 cwt or more per acre.

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The author is an officer of the Agricultural Chemical Laboratory Branch, Division of Plant Industry, Department of Primary Industries, and is stationed at the Tropical Agriculture Research Station, South Johnstone.