Comparative effectiveness of ESPARP and superphosphate as fertiliser for perennial pasture

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Erratic rainfall patterns, fluctuating prices for animal products and a taxation system that encourages over-fertilisation in good years has resulted in a stop/start history of pasture fertilisation. A research programme is continuing at U.N.E. to develop a pasture fertiliser that has superior residual characteristics for both P and S, compared to superphosphate. Such a product, when applied in good years, would have a greater 'carry-over' effect in years when no fertiliser was applied. A two year glasshouse experiment led to the selection of an elemental sulfur containing partially acidulated rock phosphate (ESPARP), which was 50% acidulated with H_2SO_4 and contained 6% (w/w) elemental S, for evaluation in the field.

Methods

A white clover *(Trifolium repens* cv. New Zealand) and phalaris *(Phalaris aquatica* cv. Sirosa) pasture was established in a prepared seedbed, on a light textured gleyed podzolic soil, of low P status (5 0g g^{-1} Colwell P), of moderate pH (pH 6.0 in 1:5 water) and of low P sorptivity. Superphosphate and ESPARP were drilled in with the seed at 10,20,40 and 80 kg F ha^{-1} in the winter of 1982, and in the autumn of 1983 were again direct-drilled with seed into existing control plots at 20 and 40 kg P ha^{-1}. Regular pasture cuts were made from plots measuring 1.5 x 3 m, with half of the plant tops being self-mulched back into plots to simulate nutrient recycling. Spray irrigation enabled the pasture to survive during the first 10 months of the experiment when drought conditions prevailed. Above average rainfall then occurred during the winter, spring and early summer of 1983, resulting in almost continual saturation of the A2 soil horizon.

Results and Discussion

Responses to P were generally linear. This enabled the agronomic effectiveness of ESPARP relative to superphosphate (RAE) to be calculated by dividing the slope of the linear response to ESPARP by the slope of linear response to super. RAE values so calculated give the ratio of pasture yields for any given P rate.

Table 1. The agronomic effectiveness of ESPARP relative to superphosphate, in successive seasons following applications in 1982 and 1983.

Harvest No.	Seasonal growth	RAE	
		1982 applications	1983 applications
1	winter/spring (1982)	0.28	
2	summer/autumn (1982-83)	0.49	
3	winter (1983)	0.69	1.81
4	early spring (1983)	0.96	1.19
5	late spring (1983)	1.33	1.52
6	early summer (1983)	1.28	1.34
7	late summer (1984)	1.54	1.83
8	autumn (1984)	1.02	1.31

Superphosphate was more effective than ESPARP for the first 15 months following applications in 1982 (Table 1). Thereafter, the reverse occurred until the autumn of 1984 when both products were of equal effectiveness.

The decline in the relative performance of superphosphate in the second year is attributed to the leaching of sulphate-S from the superphosphate plots resulting in S deficiency. The consistent superior performance of ESPARP over superphosphate for 1983 applications is also attributed in part to the superior residual characteristics of its S component. Similar experiments have now been established at other sites to compare the residual effects of both fertilisers over a range of site by season combinations.