Recent developments in sulphur bentonite fertilisers

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The effectiveness of elemental sulphur (S?) as a fertiliser is dependent on the rapidity with which it is oxidised by micro- organisms to plant available SO_4-S form. Early field studies showed that particles > 0.25 mm were ineffective for sub- clover pastures (1). However, finely divided S? particles form an explosive mixture with air. Experimental S-bentonite prills made by mixing molten sulphur with sodium bentonite represents an attempt to produce safe and effective high analysis S fertiliser.

Methods

Laboratory measurements were made of both the rate of dispersion of S?-containing fertilisers in water and the distribution of S? particle sizes. The rate of release of SO_4-S from a range of S? fertilisers, applied at 50 kg S/ha, was subsequently measured from plant SO_4-S levels in a ryegrass-white clover pasture on a Warepa soil (which has low anion retention properties) at Invermay Agricultural Research Centre, N.Z. (mean annual rainfall 687 mm), during the 1982 and 1983 growing seasons.

Results and Discussion

Experimental S-bentonite materials (made in N.Z. by the Industrial Processing Division, D.S.I.R.) have shown that increasing the bentonite content from 5 to 40% progressively increased the rate of dispersion in water and the fineness of the dispersed sulphur (Table 1). There was some release of SO-S from the 40% bentonite material within 29 days after the start (DAS) of a field experiment. By 145 DAS there was a linear relationship between bentonite content and plant SO_4-S levels. Control (nil S) levels were 0.55% and 117% respectively at 29 and 145 DAS while those from gypsum fell from .134% to 100%.

Table 1 Effect of bentonite content on prill disintegration, S? particle size and sulphate release

% bentonite	Disintegration time % disintegration		Cumulative % of particles after dispersal in water		Plant SO_4-S levels (%)	
	10%	80%	< .15 mm	< .5 mm	29 DAS	145 DAS
40	10 secs	3 min	100	100	.070	.175
30	20 secs	7 min	99	100	.063	.146
20	1 min	35 min	87	100	.062	.143
10	12 min	>4 days	46	96	.055	.117
5	10 days	N/A	3	20	.055	.125

A range of alternative S fertilisers were evaluated in a separate experiment at an adjacent site for over 1 year. An experimental S-bentonite (30% bentonite) was included. There was a marked residual effect of the S-bentonite (plant SO_4-S = In contrast there was little effect from either gypsum (.093%) or a coarser (0:5-1.0 mm) fraction of S? (0.80% SO_4-S).

S-bentonite prills with at least 10% of sodium bentonite are high analysis S fertilisers which are stable for safe storage and application; readily disperse in water; and the S? is rapidly oxidised to sulphate. Despite the rapid oxidation they have a longer residual effect than can be expected from sulphate fertilisers.

1. Weir, R.G., Barkus, B., Atkinson, W.T. 1963 Aust. J. Exp. Agric. Anim. Husb. 3: 314-18.