DairyNZ farmfact

7-8 Using Sulphur fertiliser

Sulphur (S) is needed for clover growth, grass growth, and for nitrogen (N) fixation by *rhizobia* bacteria found in clover root nodules.

Plants that are S deficient look similar to those that are N deficient. They tend to be a pale green or yellow colour, with the young leaves losing colour first. Plants may appear spindly, and growth will be stunted. Clovers will show visible signs of being S deficient before grasses do, because they are less efficient than grasses at using S.

1. Target soil test S levels - for optimum pasture production

There are two commonly used tests for soil sulphur, the sulphate sulphur test and the organic sulphur test.

The **sulphate S test** measures the pool of immediately plant available sulphur. The amount of sulphate S can fluctuate over time due to addition of sulphate S as fertiliser or from mineralisation of organic matter or losses such as leaching over winter.

The **organic S test** measures the long-term supply of soil sulphur to the plants that will become available over months and years as soil organic matter mineralises.

The two tests should be used in conjunction with each other for the most accurate interpretation.

Trials have shown that target soil test levels for S are similar on all soil types in New Zealand. These are shown in the following table. If these target levels are achieved, S fertility will not limit pasture production on your farm.

Table 1. Soil test targets for Sulphur

Soil Type	Sulphate-S	Organic-S
All New Zealand soils	10-12	15-20

Source: "Fertiliser use on dairy farms' - DRC/AgResearch (1993-1995)

2. Fertiliser S required for maximum production

In terms of S requirements for maximum production, soils can be broken up into two groups as shown in table 2. High loss soils are those under high rainfall, or irrigation (above 1500mm) with little ability to hold S (a low anion storage capacity or ASC). They typically have low organic S levels and are often coarse textured. This means that the S is more susceptible to leaching. These soils require about 40-50 kgS/ha/yr to achieve maximum production. This is the amount of S required to overcome the most severe deficiency.

Table 2. The amounts of S required for maximum production.

Soil category	Soil groups	Typical properties	Fertiliser S required for maximum production
High loss	Pumice, Peats, Podzols, Sth Is. recent soils	Low ASC (<60), high rainfall (>1500mm), coarse texture, low organic S	45-50 kgS/ha/yr
Low loss	All other eg Sedimentary, volcanic	High ASC (>60), lower rainfall (<1500mm) high soil organic S	20-25 kgS/ha/yr

Source: "The Fertiliser Review", September 2003. Dr D Edmeads, agKnowledge Publishing Ltd

3. Forms and timing of S fertiliser

There are two forms of S fertiliser. Sulphate S, found in superphosphate and sulphate of ammonia, is readily available to the plants and moves freely through the soil.

Elemental S, found in sulphur-fortified superphosphate (Sulphur Super and Sulphur Gain) *Durasul*, and is usually the form of S added to RPR. Elemental S is not immediately available to the plants or prone to leaching, but must first be oxidised by soil bacteria to form sulphate S. The rate of conversion from elemental S to sulphate S depends on particle size, temperature and moisture. To fully oxidise and become plant available in the year of application, elemental S must be finer than 250 micron in warm, moist upper North Is and less than 75 microns in the cool south.

On pumice and peat soils the best form depends on when the fertiliser is applied. Larger responses are obtained from fine elemental S over sulphate S when applied in the autumn, and there is no difference when applied in the spring.

On free draining ash soils (ASC above 90) there is no difference between the form of sulphur or the timing.

On poorly drained ash soils (ASC below 90) most trials show no difference between elemental and sulphate S. However there is some evidence that elemental S will maintain more even pasture S concentrations. Short-term S deficiencies have been reported in the late winter and early spring. This can be avoided by using either elemental S in the autumn or a dressing of a sulphate containing fertiliser (e.g. Sulphate of ammonia) in the late winter- early spring.

On sedimentary soils with rainfall and irrigation above 1500mm a mix of sulphate S and fine elemental S should be applied in the spring, especially on stony free-draining soils. Alternatively, split applications of sulphate S can be made in August/September and February.

On sedimentary soils with rainfall and irrigation below 1500mm there is no difference between elemental and sulphate S. However there is some evidence that elemental S will maintain more even pasture S concentrations.

Split versus single applications. Trials show that only on peat and pumice soils is there an advantage in splitting your S application between autumn and spring. On other soils there was no benefit in terms of pasture growth.

4. Interaction of Copper (Cu), Molybdenum (Mo) and Sulphur

High levels of the trace element Mo in the diet of sheep and cattle, in the presence of S, can reduce the absorption and storage of Cu in the liver. The can result in a copper deficiency.

There has been some concern that the use of high S fertiliser can therefore induce a Cu deficiency. New Zealand trails have shown that it is the amount of Mo in the diet which is the biggest factor and that the use of high S fertilisers should not increase the incidence of Cu deficiency in grazing livestock.