

SULPHUR THE HIDDEN ELEMENT

Sulphur (S) is absorbed by plants primarily as the sulphate anion and can enter plant leaves from the air as sulphur dioxide gas. Sulphur is a part of every living cell and is a constituent of three of the twenty one amino acids which form proteins. It is also involved in the formation of vitamins and has been shown to be particularly important in the nutrition in a number of plant species.

Sulphur promotes nodule formation on legumes and stimulates seed production in many plants. Along with Phosphorus it is a key element in the development of improved pastures throughout Australia.

The incidence of S-deficiency has increased over recent years with a number of factors contributing to this situation.

- The use of high analysis fertilisers such as MAP and DAP which contain little sulphur.
- A significant reduction in atmospheric sulphur due to a decrease of fuels high in S and improved S-removal from industry.
- Reduced applications of Superphosphate (11% Sulphur)
- An increased awareness of sulphur for crop yields and pastures production.

Plant Deficiency symptoms.

Plants deficient in sulphur show a pale green colouring of the younger leaves, although the entire plant can be pale green and stunted in severe deficiencies. An example of this effect occurs where plants having a high supply of nitrogen, usually show sulphur deficiency symptoms initially on young leaves. In plants with a marginal supply of nitrogen, sulphur deficiency produces a general paleness with symptoms occurring on older leaves.

Canola is particularly susceptible to S-deficiency with a 1 tonne/hectare crop removing 10 kg of sulphur. Clover leaves are lemon-yellow in colour where S is a limiting factor. Plants such as sorghum have poor vigour, are stunted, pale green in colour and have thin stems.

Plant Removal of Sulphur

The following table provides a guide to the removal of sulphur by crops and dairy production.

CROP	YIELD	SULPHUR kg/ha
Wheat (Grain)	1 tonne/hectare	2
Sunflower (Grain)	1 t/ha	5.2
Canola (Grain)	1 t/ha	10
Cotton (Lint & Seed)	1 bale/hectare	3.3
Potato (Tuber)	10 tonne/ha	5
Banana (Fruit)	1 t/ha	0.4
Grape (Fruit)	1 t/ha	1.5
Dairy Cows (Milk)	1000 litres	0.6

Example: A 3 t/ha wheat crop removes approximately 6kg of sulphur/ha.

Availability to Plants

Sulphur must be in the sulphate form to be readily available to plants. Elemental S must be oxidized to the sulphate form before plants can absorb it. Conversion of elemental S to sulphate S is carried out mainly by a group of bacteria known as thiobacilli, which are present in the majority of soils. This process of oxidation is favoured by the following:

- Acid Soils
- Warm soil temperatures
- Soil moisture
- Soil aeration
- Fine particle size of sulphur

Reducing soil pH on alkaline soils

Because of this acidifying process sulphur can be applied to highly alkaline soils to reduce the pH. The acidifying effect of sulphur fertilisers must be considered when making a fertiliser choice as products containing elemental sulphur can cause a reduction in pH.

Organic Matter and Sulphur

Organic matter may contain between 70-90% of the soils sulphur levels. Soils with organic matter levels less than 2% are likely to be S deficient however the use of soil analysis can be used as a guide in determining organic matter levels.

Where soils are cultivated, the mineralisation of soil organic matter and the release of sulphate sulphur are accelerated. Fertiliser sulphur is also more likely to be required where no-till farming practices are carried out.

Fertiliser Recommendations

Cropping: Cereal crops do not have a high requirement for Sulphur, however the use of high analysis fertilisers, and the increased area under no-till systems is expected to see an increased requirement for Sulphur.

Root and vegetable crops tend to have higher requirements for Sulphur with recommendations up to 30kg/ha of Sulphur.

Pastures: When determining a topdressing fertiliser for pastures, consideration should be given to soil phosphorus levels. Where levels are low an application of fertiliser containing similar percentages of phosphorus and sulphur should be recommended.

Where a straight sulphur product is required gypsum can be considered for both pastures and crops. Rates of gypsum between 1-2.5 tonne/hectare whilst supplying available sulphur can also help to improve soil structure in many cropping areas. Gypsum should be incorporated into the soil profile.

The use of soil and plant analysis can provide the basis for determining fertility levels, and should be used when making a fertiliser decision.