

SULFUR FACTSHEET

December 2003

SULFUR IN SOILS

70 - 90% of the soil sulfur is present in the organic matter. This sulfur is not available for plant uptake until it has been converted to sulfate (SO_4^{2-}) by soil bacteria, a process known as mineralization.

Mineralization occurs more rapidly when the soil is warm and moist, and has been cultivated. Consequently, sulfur fertilizer is more likely to be needed in pasture than in crops.

Some sulfur is also received in rain (near industrialised areas and the sea). In Australia, this can exceed 10 kg/ha/annum S; but in inland areas, e.g. the New England Tableland, is often no more than 1-2 kg/ha S per year. The use of low sulfur fuels and added emphasis on air pollution control has reduced the amount of atmospheric sulfur reaching agricultural land through rainfall in many parts of the world.

Compared to phosphate and ammonium ions, sulfate is not as strongly adsorbed onto clay and organic colloids. Consequently leaching losses can be appreciable on light textured soils in areas of high rainfall. In drier areas and in soils of a heavier texture, leaching is less significant. In these situations, crystalline calcium sulfate (gypsum) may accumulate in the sub-soil. Where this occurs, sulfur is seldom limiting as a plant nutrient, provided it is accessible by plant roots.

SULFUR IN PLANTS

Sulfur (S) is taken up by plants in slightly smaller amounts than phosphorus. It is absorbed by plant roots almost exclusively as the sulfate ion (SO_4^{2-}). Sulfur is a constituent of protein, and is necessary for the development of chloroplasts and in photosynthesis.

DEFICIENCY

The incidence of sulfur deficiency in plants has increased with greater use being made of high analysis fertilizers with a low sulfur content, e.g. urea in place of sulfate of ammonia, and the ammonium phosphates (DAP and MAP) in place of single superphosphate (SSP); and the adoption of reduced tillage practices (resulting in less sulfur being mineralized in the soil). Responses to sulfur are most likely to occur on lighter textured (sandy) soils with a low organic matter content. In Australia, deficiency most commonly occurs in legume-based pastures, and in canola, which has a high requirement for sulfur.

Because nitrogen and sulfur are important in the formation of chlorophyll (the green pigment in plant leaves) and the synthesis of protein, deficiency symptoms of both are similar, i.e. poor growth, reduced tillering in cereals, and pale green to yellow foliage. Nitrogen, however, is more readily relocated from old to young leaves within the plant, so that in nitrogen deficiency, symptoms first appear in the old leaves, whereas in sulfur deficiency it is usually evident in the young leaves. Sulfur deficient plants are often rigid and brittle, and the stems remain thin. As is the case with nitrogen deficiency in grain crops, a shortage of sulfur will at first be reflected by a decline in protein, before yield is affected. In legumes, the nitrogen-fixing root nodules are often reduced in both size and number in sulfur deficient plants.

SULFUR FERTILIZERS

Sulfur can be applied as sulfate compounds (in combination with other nutrients, e.g. as ammonium, potassium or calcium sulfate), or in the elemental form. The analyses of some Incitec Pivot products commonly used to supply sulfur are given in the following table.



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Incitec Pivot Product	Analysis				
	% N	% P	% K	% S	%Ca
Gran-am	20.2			24	
Granulock 15	14.7	11.8		11.8	
SuPerfect		8.8		11	20
Sulfate of Potash			41	18	
Sulfur Bentonite Granules				90	
Phosphogypsum				14.5	18.5

Gran-am (granulated ammonium sulfate) is commonly used in combination with other nitrogen fertilizers in fertilizer programs, rather than be applied on its own as the sole source of nitrogen. It contains approximately equal parts of nitrogen and sulfur, whereas most plants take up ten or more times as much nitrogen as sulfur. Gran-am is manufactured in Brisbane.

Granulock 15 is a compound ammonium phosphate sulfate (APS) fertilizer that is manufactured at Newcastle. It is primarily used at planting in oilseed, grain and forage crops, to meet the crop's phosphorus and sulfur requirements, and supply some starter nitrogen.

SuPerfect (Single Superphosphate or SSP) is ideally suited for top-dressing perennial pastures, where both phosphorus and sulfur are usually required. High analysis phosphorus fertilizers such as DAP and MAP contain very little sulfur. SSP is manufactured at Portland, Geelong and Newcastle. Sulfur-fortified grades are also available for soils with a moderate to high phosphorus status.

Sulfate of Potash (potassium sulfate) supplies sulfur as well as potassium. However, it is more expensive than potassium chloride (Muriate of Potash), and unless there are reasons to avoid using Muriate of Potash (on account of its chloride content), the use of alternative sulfur-containing fertilizers is likely to be more economical.

Sulfur Bentonite Granules is a dispersable elemental sulfur fertilizer. The granules disperse on wetting after application to release fine sulfur particles. Elemental Sulfur is not immediately available for plant uptake. It must first be oxidized to the sulfate form, a bacterial process that occurs in the soil. The finer the particle size, the more quickly oxidation occurs.

Gypsum (Calcium Sulfate) - Naturally occurring gypsum is used as a sulfur fertilizer in pastures in some districts with soils high in phosphorus, e.g. at 100 - 200 kg/ha per annum. Gypsum is also used at higher rates as a soil ameliorant (to improve soil structure) in cropping soils. Where this is done, it will not be necessary to apply additional sulfur. Incitec Phosphogypsum, a byproduct of the manufacture of phosphoric acid, is available ex Brisbane. It is no longer available ex Newcastle.

FURTHER READING - An Agritopic on "Sulfur" is available if more detailed information is required.

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