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SULPHUR DEFICIENCY DIAGNOSIS USING PLANT TISSUE ANALYSIS

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Abstract

There are several diagnostic approaches for determining S deficiency, including modelling, soil testing and plant tissue analysis. Plant tissue analysis has been shown to be more useful than soil testing because there is a closer relation between plant S concentration and yield response to S. Unfortunately, the critical values of certain potential indicators such as total S, sulphate and glutathione change over the growth season, making them impractical for use. The N:S ratio is more stable but problems with standardisation of measuring total S among commercial laboratories mean that results depend strongly on the laboratory used. Furthermore, when S deficiency is moderate, about 20% of samples are diagnosed as being S sufficient when they are in fact deficient, resulting in yield loss and subsequent economic damage to farmers. The malate:sulphate ratio in leaves has been shown to be a reliable and practical indicator of S deficiency, with only 4% of samples incorrectly diagnosed as being sufficient when they are not.

Keywords: Malate:sulphate ratio, N:S ratio, soil testing, critical value, yield.

CROP RESPONSES TO SULPHUR FERTILISATION IN EUROPE

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Abstract

Sulphur (S) deficiency has become widespread in many countries in Europe since the 1980s. This is due to a massive decrease in the atmospheric deposition of S, a change in the use of fertilisers that contain low S and increased crop yields. This paper reviews crop responses to S in Europe, focusing on oilseed rape, cereals and grass, on which most field trials have been carried out. Multicut grass for silage has been shown to be highly susceptible to S deficiency, and yield responses to S of between 5 and 30% are common in Ireland, the UK and other countries. Oilseed rape is also susceptible to S deficiency, and S fertilisation can produce a dramatic yield response under deficiency conditions. Sulphur deficiency in oilseed rape has been widely reported in France, Germany, Denmark and the UK. Although cereals have a lower requirement for S, responses to S application of between 5 and 30% have been obtained in France, and also increasingly in the UK and Germany. In general, field trials across different countries have shown that oilseed rape responds to S applications up to 30 kg S/ha, cereals up to 20 kg S/ha, and grass between 20 and 40 kg S/ha. Sulphur deficiency not only affects yield, but also impacts on crop quality. It has been demonstrated that the S status of wheat grain has an important influence on bread-making quality. Grass low in S is nutritionally inferior for animals. Maintaining a sufficient S status also has a positive effect on the quality of legumes and sugar beet. In contrast, too much S may have a negative effect on rapeseed due to increased concentrations of glucosinolates. Occurrence of S deficiency is more likely to be found on light or shallow soils with low organic matter content, in areas of low atmospheric deposition of S and with excessive winter rainfall. Because atmospheric inputs of S will continue to decrease further in Europe, the deficit in the S input/ output is likely to increase, unless S fertilisers are used.

Keywords: Cereals, Grass, Oilseed rape, Sulphur responses, Sulphur fertilisers.

ORGANIC MANURES AS SOURCES OF FERTILISER SULPHUR

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Abstract

On a global scale, sulphur (S) excretion from domestic animals may be estimated to around 8 million tonnes per year, corresponding to 80% of the World S consumption for mineral fertiliser manufacture. The utilisation of this potential source of fertiliser-S is discussed focusing on the use of manure from housing and manure storages applied to agricultural land. Especially in the developed countries the S content of manure collected from cattle and pigs (1 million tonnes S per year) has a potential as S-fertiliser, as legal demands on the utilisation of manure nitrogen (N) and/or phosphorus (P) already require the use of animal wastes as fertilisers. Content and composition of manure-S from both monogastrics and ruminants may be extremely variable, depending on the S content of the feed. If the diet has an S content balanced according to the animal requirement then the S content of the manure will be relatively low and the main part of S is expected to be in organic forms not available to plants. If the manure is stored under anaerobic conditions over a time span of months there is considerable risk of microbial transformations of sulphate into organic S and gaseous compounds that may be lost by volatilisation. In this situation the plant-availability in the year of application may be too low to be taken into account in fertiliser practice. A residual long-term effect of the organic S fraction must be expected. The ability of a cropping system to use mineralised S depends on the length of the growing season of the crops, but mineralisation is unlikely to fully meet the S-demand of a crop. There is a need for quantitative investigations of the relations between dietary S input, loss during storage and plant utilisation in the field.

Keywords: Animal manure, organic manure, plant-availability, slurry, sulphate, sulphur.

SULPHUR FERTILISER RECOMMENDATIONS IN EUROPE

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Abstract

The last quarter of the 20th century has seen the injtorductuion of significant legislation in Europe designe to reduce the extent and quantity of atmospheric poluution. A major result of this has been the decline in the burning of sulphur-containing fossil fuels, particularly coal nad the inroduction of sulphur recovery systems to flue stacks. In addition to this there has been a major change at the same time in the composition of fertilisers. The current use of ammonium nitrate, urea, ammonium phosphates and triple superphosphate has resulted in very low adventitious sulphur inclusion compared with less concentrated historical fertilisers which often contained ammonium sulphate and single superphosphate. The reduction in anthropogenic emissions of sulphur and the replacement of sulphur-containing fertiliser raw materials has led to a situation in which for the first time since the initial development of the fertiliser industry, at least in the industrialised countries of Europe and their near neighbours, deficiencies of sulphur have appeared in many agricultural crops. The paper attempts to examine the various current recommendations for the use of sulphur-providing fertilisers from seventeen different European countries, at a time when the use of fertiliser sulphur is still developing. It is concluded that there are some similarities but also wide differences in the advice being offered in the various countries, which is only in part explained by differences in sulphur deposition, soil types, potentials for leaching losses and crop demand.
Keywords: Sulphur fertilisers, fertiliser recommendations.