Sulphur requirements of winter wheat

Extent of deficiency
This project work was led by IACR in collaboration with ADAS, Newcastle University and the Campden and Chorleywood Food Research Association.

Between 1995 and 1999, 14 field trials were carried out on 4 potentially deficient sites. Locations were Bridgets, Hampshire (chalk soil), Woburn, Bedfordshire (sandy soil), Raynham, Norfolk (sandy-loam) and sites in the Borders region (loam).

Yield responses to added S were significant in 4 trials (Table 1). The first 20 kg S/ha gave most of the yield increase (Figure 1).

Comparison with earlier years’ data confirms that the extent of S deficiency in the UK is increasing year by year. Figure 2 indicates current deficiency risk based on soil type, proximity to coal-burning power stations, prevailing wind direction and rainfall.

Breadmaking quality
Sulphur affects the composition of grain proteins glutenin and gliadin, which are essential for well-risen loaves.

S application improved quality more often than yield. Early spring applications significantly increased loaf volume at all 4 sites, and in 6 of the 10 trials where the grain was suitable for breadmaking.

Loaf volume correlated more closely with grain S concentration than with grain N (protein). All varieties responded similarly to added S. Grain that was S deficient usually had N:S ratios above 16:1.

Using fertilisers
Pot and lysimeter trials were carried out at Rothamsted in collaboration with Stefes. Fertilisers containing elemental S were

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### Table 1. Yield responses of winter wheat to S applications

<table>
<thead>
<tr>
<th>Site</th>
<th>Year</th>
<th>Response (tonnes/ha)</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridgets</td>
<td>1995</td>
<td>1.15</td>
<td>13.6</td>
</tr>
<tr>
<td></td>
<td>1997</td>
<td>0.59</td>
<td>13.9</td>
</tr>
<tr>
<td>Woburn</td>
<td>1995</td>
<td>0.79</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>2.11</td>
<td>84.2</td>
</tr>
</tbody>
</table>

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**Figure 1. Response of winter wheat to S (Bridgets, 1995)**
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Summary

Topic Sheet No.1 summarised HGCA-funded research results up to 1996 on effects of sulphur on wheat yields and presented a risk deficiency map for the UK.

In subsequent trials effects on grain quality were more frequent than on yield, sometimes in the absence of visual symptoms. The extent of S deficiency has continued to spread, with 25% of the UK wheat crop now at risk. Work is continuing on diagnosis of deficiency and forms of fertilisers.

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Tel: 01582 763133

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Ongoing projects 1803, 1912, 1919

Ammonium sulphate and gypsum (calcium sulphate) were immediately available to the plant but leached very rapidly. In pot experiments, severe deficiency decreased grain yield mainly by reducing ear number/plant and grain number/ear. Additional S only increased yields if applied during stem elongation.

Spring applications produced the best responses in the field (Figure 3). Generally over 15 kg/ha S corrected deficiency. Effects of foliar ammonium sulphate applied at the milky-ripe stage on both yield and quality were inconsistent. Sometimes leaves were scorched and yields were reduced.

Plant symptoms did not always occur and are easily confused with nitrogen or manganese deficiency. Research is continuing on plant tissue testing as the basis for a field test.

Figure 2. Predicted risk of S deficiency in winter wheat

Figure 3. Timing of S application to winter wheat (Bridgets, 1995)