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## Yields of the Field Experiments 1996

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### 96/R/CS/10 and 96/W/CS/10 Long Term Liming - W. Wheat

#### Rothamsted Research

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## 96/R/CS/10 and 96/W/CS/10

### LONG TERM LIMING

**Object:** To study the effects of different amounts of lime, phosphate and sulphur on the yields and compositions of a sequence of crops - Rothamsted (R) Sawyers I and Woburn (W) Stackyard C.

**Sponsor:** S.P. McGrath.

The 35th year, w. wheat.

For previous years see 'Details' 1967, 1973 and 74-95/R&W/CS/10.

**Design:** 2 randomised blocks of 16 plots split into 2 sub-plots.

**Whole plot dimensions:** 6.0 x 16.1.

**Treatments:** All combinations of:-

Whole plots

1. **CHALK** Residual effects of ground chalk (tonnes CaCO<sub>3</sub>) (total applied 1962-87):

|      |      | Rothamsted total |         | Woburn total |         |
|------|------|------------------|---------|--------------|---------|
|      |      | 1962-78          | 1982-87 | 1962-78      | 1982-87 |
| R    | W    |                  |         |              |         |
| 0    | 0    | 0                | 0       | 0            | 0       |
| 15   | 9    | 7                | 8       | 6            | 3       |
| 24.5 | 25.5 | 15               | 9.5     | 14           | 11.5    |
| 52.5 | 45.5 | 30               | 22.5    | 23           | 22.5    |

2. **P** Residual effects of P fertilizer applied:

|    |  | Until 1978 | 1981  | 1982  | 1983 |    | 1988 |    |
|----|--|------------|-------|-------|------|----|------|----|
|    |  | R & W      | R & W | R & W | R    | W  | R    | W  |
| 0  |  | 0          | 0     | 0     | 0    | 0  | 0    | 0  |
| P1 |  | 0          | P1    | P1    | 0    | P2 | P1   | P1 |
| P2 |  | P          | P1    | 0     | P2   | P2 | P1   | P1 |
| P3 |  | P          | P3    | P1    | P2   | P4 | P3   | P3 |

Rates 1981-83 and 1988 P1, P2, P3, P4 = 25, 50, 75, 100 kg P as superphosphate

Sub-plots

3. **SULPHUR** Sulphur (kg S, as calcium sulphate), applied cumulatively since 1991:

0  
30

# 96/R/CS/10 and 96/W/CS/10

- NOTES:** (1) Until 1978 test P was applied cumulatively, rates varied with crop, none in 1979 and 1980. K was also applied cumulatively, to P1 and P3 plots. Since 1981 K has been applied basally (none in 1986, 1987, 1989, 1990 and 1993 to 1996).  
(2) Test manganese was applied cumulatively, 1987-90.

## Experimental diary:

### Sawyers I (R):

10-Aug-95 : B : Straw baled.  
22-Aug-95 : B : Sub-soiled.  
25-Sep-95 : B : Ploughed.  
28-Sep-95 : B : Rotary harrowed, Hereward, dressed Panocrine, drilled at 380 seeds per m<sup>2</sup>.  
11-Mar-96 : B : 34.5% N at 116 kg.  
09-Apr-96 : T : **SULPHUR** 30: Gypsum (17.5% S) at 171 kg.  
15-Apr-96 : B : 34.5% N at 463 kg.  
26-Apr-96 : B : Ally at 30 g with Cheetah Super at 1.25 l and Barclay Holdup at 2.3 l in 200 l.  
13-Jun-96 : B : Alto 100 SL at 0.6 l with Mallard 750 EC at 0.4 l in 300 l.  
09-Aug-96 : B : Combine harvested.

### Stackyard C (W):

25-Aug-95 : B : Sub-soiled.  
19-Sep-95 : B : Ploughed.  
23-Sep-95 : B : Rolled.  
03-Oct-95 : B : Rotary harrowed, Hereward, dressed Sibutol, drilled at 375 seeds per m<sup>2</sup>.  
13-Nov-95 : B : Panther at 2.0 l in 200 l.  
13-Mar-96 : B : 34.5% N at 116 kg.  
19-Mar-96 : T : **SULPHUR** 30: Gypsum (17.5% S) at 171 kg.  
16-Apr-96 : B : 34.5% N at 348 kg.  
30-Apr-96 : B : Halo at 1.5 l in 200 l.  
06-Jun-96 : B : Silvacur at 1.0 l in 300 l.  
19-Aug-96 : B : Combine harvested.

**NOTE:** At Rothamsted, most **CHALK** 0 plots failed. They have been omitted from the analysis.

## 96/R/CS/10 SAWYERS I (R)

### GRAIN TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

| P            | 0    | P1   | P2   | P3   | Mean |
|--------------|------|------|------|------|------|
| <b>CHALK</b> |      |      |      |      |      |
| 15           | 7.47 | 8.38 | 8.91 | 8.44 | 8.30 |
| 24.5         | 8.38 | 8.83 | 8.74 | 9.20 | 8.79 |
| 52.5         | 8.03 | 8.94 | 8.69 | 8.86 | 8.63 |
| Mean         | 7.96 | 8.72 | 8.78 | 8.83 | 8.57 |

96/R/CS/10 SAWYERS I (R)

GRAIN TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

| SULPHUR | 0    | 30   | Mean |
|---------|------|------|------|
| CHALK   |      |      |      |
| 15      | 8.44 | 8.16 | 8.30 |
| 24.5    | 8.73 | 8.85 | 8.79 |
| 52.5    | 8.74 | 8.52 | 8.63 |
| Mean    | 8.63 | 8.51 | 8.57 |

| SULPHUR | 0    | 30   | Mean |
|---------|------|------|------|
| P       |      |      |      |
| 0       | 8.21 | 7.71 | 7.96 |
| P1      | 8.64 | 8.79 | 8.72 |
| P2      | 8.84 | 8.71 | 8.78 |
| P3      | 8.83 | 8.83 | 8.83 |
| Mean    | 8.63 | 8.51 | 8.57 |

|       | SULPHUR | 0    | 30   |
|-------|---------|------|------|
| CHALK | P       |      |      |
| 15    | 0       | 7.99 | 6.94 |
|       | P1      | 8.30 | 8.46 |
|       | P2      | 9.05 | 8.76 |
|       | P3      | 8.40 | 8.48 |
| 24.5  | 0       | 8.50 | 8.26 |
|       | P1      | 8.75 | 8.92 |
|       | P2      | 8.51 | 8.97 |
|       | P3      | 9.16 | 9.25 |
| 52.5  | 0       | 8.15 | 7.91 |
|       | P1      | 8.88 | 9.00 |
|       | P2      | 8.97 | 8.40 |
|       | P3      | 8.95 | 8.77 |

\*\*\* Standard errors of differences of means \*\*\*

| P     | CHALK | SULPHUR | P<br>CHALK |
|-------|-------|---------|------------|
| 0.263 | 0.227 | 0.108   | 0.455      |

| P       | CHALK   | P                |
|---------|---------|------------------|
| SULPHUR | SULPHUR | CHALK<br>SULPHUR |
| 0.304   | 0.263   | 0.526            |

Except when comparing means with the same level(s) of

|         |       |       |
|---------|-------|-------|
| P       | 0.217 |       |
| CHALK   |       | 0.188 |
| P.CHALK |       | 0.375 |

96/R/CS/10 SAWYERS I (R)

GRAIN TONNES/HECTARE

\*\*\*\*\* Stratum standard errors and coefficients of variation \*\*\*\*\*

| Stratum     | d.f. | s.e.  | cv% |
|-------------|------|-------|-----|
| BLOCK.WP    | 11   | 0.455 | 5.3 |
| BLOCK.WP.SP | 12   | 0.375 | 4.4 |

GRAIN MEAN DM% 87.8

SUB-PLOT AREA HARVESTED 0.00150

96/W/CS/10 STACKYARD C (W)

GRAIN TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

| P              | 0    | P1   | P2   | P3   | Mean |
|----------------|------|------|------|------|------|
| <b>CHALK</b>   |      |      |      |      |      |
| 0              | 3.58 | 3.63 | 4.12 | 4.45 | 3.95 |
| 9              | 7.81 | 8.19 | 8.12 | 8.30 | 8.10 |
| 25.5           | 7.58 | 7.04 | 7.76 | 7.54 | 7.48 |
| 45.5           | 6.74 | 8.14 | 7.46 | 7.92 | 7.56 |
| Mean           | 6.43 | 6.75 | 6.86 | 7.05 | 6.77 |
| <b>SULPHUR</b> |      |      |      |      |      |
|                | 0    | 30   | Mean |      |      |
| <b>CHALK</b>   |      |      |      |      |      |
| 0              | 4.03 | 3.86 | 3.95 |      |      |
| 9              | 8.09 | 8.12 | 8.10 |      |      |
| 25.5           | 7.43 | 7.53 | 7.48 |      |      |
| 45.5           | 7.51 | 7.61 | 7.56 |      |      |
| Mean           | 6.77 | 6.78 | 6.77 |      |      |
| <b>SULPHUR</b> |      |      |      |      |      |
|                | 0    | 30   | Mean |      |      |
| <b>P</b>       |      |      |      |      |      |
| 0              | 6.25 | 6.60 | 6.43 |      |      |
| P1             | 6.65 | 6.85 | 6.75 |      |      |
| P2             | 6.90 | 6.82 | 6.86 |      |      |
| P3             | 7.26 | 6.84 | 7.05 |      |      |
| Mean           | 6.77 | 6.78 | 6.77 |      |      |

96/W/CS/10 STACKYARD C (W)

GRAIN TONNES/HECTARE

\*\*\*\*\* Tables of means \*\*\*\*\*

| CHALK | SULPHUR | 0    | 30   |
|-------|---------|------|------|
|       | P       |      |      |
| 0     | 0       | 3.28 | 3.88 |
|       | P1      | 3.32 | 3.95 |
|       | P2      | 3.87 | 4.38 |
|       | P3      | 5.68 | 3.22 |
| 9     | 0       | 7.40 | 8.21 |
|       | P1      | 8.42 | 7.97 |
|       | P2      | 8.31 | 7.93 |
|       | P3      | 8.25 | 8.35 |
| 25.5  | 0       | 7.73 | 7.43 |
|       | P1      | 6.77 | 7.30 |
|       | P2      | 7.78 | 7.73 |
|       | P3      | 7.44 | 7.64 |
| 45.5  | 0       | 6.59 | 6.89 |
|       | P1      | 8.10 | 8.17 |
|       | P2      | 7.66 | 7.26 |
|       | P3      | 7.69 | 8.14 |

\*\*\* Standard errors of differences of means \*\*\*

| CHALK                                                 | P       | SULPHUR | CHALK |
|-------------------------------------------------------|---------|---------|-------|
|                                                       |         |         | P     |
| 0.548                                                 | 0.548   | 0.133   | 1.097 |
| CHALK                                                 | P       | CHALK   |       |
| SULPHUR                                               | SULPHUR | P       |       |
|                                                       |         | SULPHUR |       |
| 0.580                                                 | 0.580   | 1.159   |       |
| Except when comparing means with the same level(s) of |         |         |       |
| CHALK                                                 | 0.266   |         |       |
| P                                                     |         | 0.266   |       |
| CHALK.P                                               |         |         | 0.531 |

\*\*\*\*\* Stratum standard errors and coefficients of variation \*\*\*\*\*

| Stratum     | d.f. | s.e.  | cv%  |
|-------------|------|-------|------|
| BLOCK.WP    | 15   | 1.097 | 16.2 |
| BLOCK.WP.SP | 15   | 0.531 | 7.8  |

GRAIN MEAN DM% 90.8

SUB-PLOT AREA HARVESTED 0.00143