

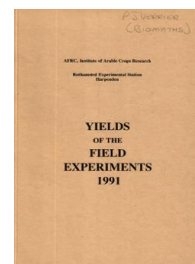
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91/R/CS/10 and 91/W/CS/10 Long-term Liming - W. Oilseed Rape

Rothamsted Research

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91/R/CS/10 and 91/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.

Sponsors: S.P. McGrath, P.B. Barraclough, G.F.J. Milford.

The 30th year, w. oilseed rape.

For previous years see 'Details' 1967, 1973 and 74-90/R&W/CS/10.

Design: 2 randomised blocks of 16 plots split into 2.

Whole plot dimensions: 6.0 x 18.3.

Treatments: All combinations of:-

Whole plots

1. **CHALK** Residual effects of ground chalk (tonnes CaCO₃) (total applied 1962-87):

| | | Rothamsted total | | Woburn total | |
|------|------|------------------|---------|--------------|---------|
| R | W | 1962-78 | 1982-87 | 1962-78 | 1982-87 |
| 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 | R | W |
| 0 | 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 P1, P2, P3, P4 = 25, 50, 75, 100 kg P as superphosphate

Sub plots

3. **SULPHUR** Sulphur (kg S, as calcium sulphate):

0
30

- 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 and 1990).
(2) Sulphur was applied as gypsum (17.5% S) on 13 Mar, 1991 (R), 21 Mar (W).
(3) Test manganese was applied cumulatively, 1987-90.

91/R/CS/10 and 91/W/CS/10

Basal applications:

Sawyers I (R): Manures: (25:0:16) at 200 kg. 'Nitram' at 640 kg. Magnesium at 0.13 kg as 'Vytel Liquid Magnesium' in 200 l. Manganese at 0.093 kg as 'Vytel Liquid Manganese' in 200 l. Weedkillers: Metazachlor at 0.75 kg in 200 l. Clopyralid at 0.10 kg in 200 l. Fungicide: Prochloraz at 0.50 kg in 200 l and on a second occasion at 0.40 kg in 200 l. Insecticide: Deltamethrin at 6.2 g in 200 l and at 12 g in 200 l on a second occasion. Desiccant: Diquat at 0.60 kg ion applied with wetting agent, 'Vassgro' at 0.52 l, in 520 l. Irrigation: 25 mm applied on two occasions.

Stackyard C (W): Manures: (25:0:16) at 200 kg. Magnesium at 0.13 kg as 'Vytel Liquid Magnesium' in 200 l. 'Nitram' at 580 kg. Manganese at 0.078 kg as 'Vytel Liquid Manganese' in 300 l. Weedkillers: Quizalofop-ethyl at 38 g with metazachlor at 0.75 kg applied with adjuvant 'Cropspray 11 E' at 2.0 l in 220 l. Fungicide: Prochloraz at 0.28 kg applied with the second insecticide in 200 l. Insecticide: Deltamethrin at 6.2 g in 220 l and on a second occasion at 12 g. Desiccant: Diquat at 0.60 kg ion applied with a wetting agent, 'Agral' at 0.40 l, in 400 l.

Seed: Libravo, dressed fenpropimorph, gamma-HCH, and thiram, at 6.0 kg (R & W).

Cultivations, etc.:-

Sawyers I (R): N and K applied: 23 Aug, 1990. Ploughed: 28 Aug. Rolled: 29 Aug. Rotary harrowed: 30 Aug. Rotary harrowed, seed sown, harrowed, rolled, metazachlor applied: 31 Aug. Irrigated: 21 and 27 Sept. Deltamethrin applied: 7 Nov. Prochloraz and Mg applied: 3 Dec. Clopyralid applied: 17 Dec. N applied: 4 Mar, 1991. Second deltamethrin applied: 12 Apr. Second prochloraz and Mn applied: 23 Apr. Desiccant with wetting agent applied: 30 July. Combine harvested: 7 Aug.

Stackyard C (W): Disced: 15 Aug, 1990. Subsoiled with tines 1.5 m apart, 0.4 m deep: 21 Aug. Ploughed and rolled: 22 Aug. N and K applied: 28 Aug. Rotary harrowed with crumbler attached, seed sown: 30 Aug. Weedkillers and adjuvant applied: 1 Nov. Deltamethrin applied: 15 Nov. Mg applied: 3 Dec. N applied: 15 Mar, 1991. Second deltamethrin applied with fungicide: 12 Apr. Mn applied: 9 May. Desiccant with wetting agent applied: 1 Aug. Combine harvested: 13 Aug.

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

GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

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

| P | O | P1 | P2 | P3 | Mean |
|----------------|----------------|------|------|------|------|
| CHALK | | | | | |
| 0 | 0.39 | 1.20 | 1.67 | 2.29 | 1.39 |
| 15 | 1.96 | 2.94 | 3.08 | 1.54 | 2.38 |
| 24.5 | 2.46 | 1.83 | 2.07 | 2.11 | 2.12 |
| 52.5 | 2.91 | 2.22 | 2.68 | 2.44 | 2.56 |
| Mean | 1.93 | 2.05 | 2.38 | 2.10 | 2.11 |
| SULPHUR | | | | | |
| | 0 | 30 | Mean | | |
| CHALK | | | | | |
| 0 | 1.38 | 1.39 | 1.39 | | |
| 15 | 2.52 | 2.25 | 2.38 | | |
| 24.5 | 2.06 | 2.17 | 2.12 | | |
| 52.5 | 2.33 | 2.80 | 2.56 | | |
| Mean | 2.07 | 2.15 | 2.11 | | |
| SULPHUR | | | | | |
| | 0 | 30 | Mean | | |
| P | | | | | |
| 0 | 1.99 | 1.87 | 1.93 | | |
| P1 | 1.98 | 2.11 | 2.05 | | |
| P2 | 2.15 | 2.61 | 2.38 | | |
| P3 | 2.16 | 2.03 | 2.10 | | |
| Mean | 2.07 | 2.15 | 2.11 | | |
| CHALK | | | | | |
| | SULPHUR | 0 | 30 | | |
| P | | | | | |
| 0 | O | 0.52 | 0.27 | | |
| | P1 | 1.05 | 1.34 | | |
| | P2 | 1.35 | 1.99 | | |
| | P3 | 2.61 | 1.97 | | |
| 15 | O | 2.47 | 1.44 | | |
| | P1 | 3.12 | 2.77 | | |
| | P2 | 2.94 | 3.22 | | |
| | P3 | 1.53 | 1.55 | | |
| 24.5 | O | 2.40 | 2.52 | | |
| | P1 | 1.91 | 1.74 | | |
| | P2 | 1.96 | 2.19 | | |
| | P3 | 1.98 | 2.25 | | |
| 52.5 | O | 2.59 | 3.23 | | |
| | P1 | 1.85 | 2.59 | | |
| | P2 | 2.33 | 3.02 | | |
| | P3 | 2.53 | 2.35 | | |

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

GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

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

| | CHALK | P | SULPHUR | CHALK P |
|---|------------------|--------------|-----------------------|------------|
| | 0.419 | 0.419 | 0.210 | 0.838 |
| | CHALK SULPHUR | P SULPHUR | CHALK P SULPHUR | |
| | 0.514 | 0.514 | 1.027 | |
| Except when comparing means with the same level(s) of | | | | |
| CHALK | 0.420 | | | |
| P | | 0.420 | | |
| CHALK.P | | | 0.839 | |

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

| Stratum | d.f. | s.e. | cv% |
|-------------|------|-------|------|
| BLOCK.WP | 15 | 0.838 | 39.7 |
| BLOCK.WP.SP | 16 | 0.839 | 39.8 |

GRAIN MEAN DM% 76.3

SUB PLOT AREA HARVESTED 0.00079

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

GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

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

| P | O | P1 | P2 | P3 | Mean |
|---------|------|------|------|------|------|
| CHALK | | | | | |
| 0 | 0.35 | 0.56 | 1.95 | 1.76 | 1.16 |
| 9 | 2.15 | 2.65 | 2.56 | 2.31 | 2.41 |
| 25.5 | 2.25 | 2.72 | 2.71 | 2.77 | 2.62 |
| 45.5 | 2.84 | 2.39 | 2.66 | 2.85 | 2.69 |
| Mean | 1.90 | 2.08 | 2.47 | 2.42 | 2.22 |
| SULPHUR | 0 | 30 | Mean | | |
| CHALK | | | | | |
| 0 | 1.16 | 1.15 | 1.16 | | |
| 9 | 2.20 | 2.63 | 2.41 | | |
| 25.5 | 2.58 | 2.65 | 2.62 | | |
| 45.5 | 2.52 | 2.86 | 2.69 | | |
| Mean | 2.12 | 2.32 | 2.22 | | |

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

GRAIN (AT 90% DRY MATTER) TONNES/HECTARE

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

| SULPHUR | 0 | 30 | Mean |
|---------|------|------|------|
| P | | | |
| O | 1.80 | 2.00 | 1.90 |
| P1 | 1.95 | 2.21 | 2.08 |
| P2 | 2.35 | 2.60 | 2.47 |
| P3 | 2.36 | 2.48 | 2.42 |
| Mean | 2.12 | 2.32 | 2.22 |

| | SULPHUR | 0 | 30 |
|-------|---------|------|------|
| CHALK | P | | |
| 0 | O | 0.41 | 0.29 |
| | P1 | 0.14 | 0.98 |
| | P2 | 1.99 | 1.91 |
| | P3 | 2.09 | 1.43 |
| 9 | O | 1.94 | 2.35 |
| | P1 | 2.65 | 2.65 |
| | P2 | 2.23 | 2.89 |
| | P3 | 1.99 | 2.62 |
| 25.5 | O | 2.10 | 2.40 |
| | P1 | 2.86 | 2.59 |
| | P2 | 2.62 | 2.81 |
| | P3 | 2.76 | 2.79 |
| 45.5 | O | 2.75 | 2.94 |
| | P1 | 2.17 | 2.62 |
| | P2 | 2.56 | 2.77 |
| | P3 | 2.60 | 3.10 |

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

| | CHALK | P | SULPHUR | CHALK P |
|---|------------------|--------------|-----------------------|------------|
| | 0.168 | 0.168 | 0.115 | 0.337 |
| | CHALK SULPHUR | P SULPHUR | CHALK P SULPHUR | |
| | 0.234 | 0.234 | 0.469 | |
| Except when comparing means with the same level(s) of | | | | |
| CHALK | 0.230 | | | |
| P | | 0.230 | | |
| CHALK.P | | | 0.461 | |

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

| Stratum | d.f. | s.e. | cv% |
|-------------|------|-------|------|
| BLOCK.WP | 15 | 0.337 | 15.2 |
| BLOCK.WP.SP | 16 | 0.461 | 20.8 |

GRAIN MEAN DM% 90.5

SUB PLOT AREA HARVESTED 0.00182