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82/W/WW/2 Growth and Yield on Contrasted Sites - Winter Wheat

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82/W/WW/2

WINTER WHEAT

GROWTH AND YIELD ON CONTRASTED SITES

Object: To study the effects of a range of factors on the incidence of pests and diseases and on the growth and yield of w.wheat grown on light and heavy land and to determine the extent to which differences between the sites can be eliminated by appropriate combinations of factors - Woburn Butt Close I (BC - light land) and Broad Mead II (BM - heavy land).

Sponsors: F.V. Widdowson, P.J. Welbank, A.H. Weir.

Design: Half replicate of 2^6 , arranged as 16 whole plots split into 2 sub plots, plus 20 extra sub plots (BC) 32 whole plots, plus 20 extra plots (BM).

Whole plot dimensions: 3.00 x 30.5 (BC)
3.00 x 15.2 (BM)

Treatments: Combinations of:-

Whole plots

1. SOWDATE Dates of sowing:

| | |
|---------|--------------------|
| 23 SEPT | 23 September, 1981 |
| 23 OCT | 23 October |

Sub plots (BC), whole plots (BM)

2. WINTER N Amounts of nitrogen fertilizer applied, as 'Nitro-Chalk', on 1 Feb, 1982 (kg N):

| | |
|----|----|
| BC | BM |
| 0 | 0 |
| 60 | 30 |

3. N RATE Amounts of nitrogen fertilizer applied, as 'Nitro-Chalk', in spring (kg N):

| | |
|-----|----|
| BC | BM |
| 120 | 30 |
| 180 | 90 |

4. N TIME Times of applying spring fertilizer:

| | |
|-------|--|
| EARLY | All except 40 kg N (BC), 30 kg N (BM) on 11 Mar; remainder on 11 May |
| LATE | All except 40 kg N (BC), 30 kg N (BM) on 15 Apr; remainder on 25 May |

5. IRRIGATN Irrigation:

| | |
|------|---|
| NONE | None |
| FULL | Full (112.5 mm BC, 137.5 mm BM) to lessen deficit of 25 mm to 12.5 mm |

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6. AUT PEST Autumn pesticide:
NONE None
ALDICARB Aldicarb at 5.0 kg worked into seedbed

Plus all combinations of the following (all given irrigation and aldicarb, but not winter nitrogen):

Whole plots

1. S DATE N Dates of sowing and times of applying nitrogen fertilizer:
23 SEPT NE Sown 23 Sept, N applied at N TIME EARLY (timing and division as above)
23 OCT NL Sown 23 Oct, N applied at N TIME LATE (timing and division as above)

Sub plots (BC), whole plots (BM)

2. N SCALE Amounts of nitrogen fertilizer applied in spring (kg N):
BC BM
0 0
90 0
150 60
180 90
210 120
240 150

Plus all combinations of the following (all given 180 kg N (BC), 90 kg N (BM) in spring, aldicarb and winter nitrogen):

Whole plots

1. SDATE NX Dates of sowing and times of applying nitrogen fertilizer:
BC BM
SE 180E SE 90E Sown 23 Sept, N applied at N TIME EARLY (duplicated on BM only)
SL 180L SL 90L Sown 23 Oct, N applied at N TIME LATE (duplicated on BM only)

Sub plots (BC), whole plots (BM)

2. IRRIG X Irrigation:
NONE None
FULL Full to lessen a deficit of 25 mm to 12.5 mm

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Irrigation was applied as follows (mm water):

| Butt Close I (BC) | | Broad Mead II (BM) | |
|-------------------|-------|--------------------|-------|
| 17 May | 12.5 | 18 May | 12.5 |
| 18 May | 12.5 | 19 May | 12.5 |
| 19 May | 12.5 | 20 May | 25 |
| 20 May | 12.5 | 21 May | 25 |
| 2 June | 12.5 | 1 June | 12.5 |
| 8 June | 12.5 | 10 June | 12.5 |
| 12 July | 12.5 | 13 July | 12.5 |
| 13 July | 12.5 | 14 July | 12.5 |
| 19 July | 12.5 | 20 July | 12.5 |
| Total | 112.5 | Total | 137.5 |

Standard applications:

Butt Close I (BC) and Broad Mead II (BM): Manures: (0:14:28) at 360 kg. Chelated manganese applied on two occasions (as 'Vytel' at 2.8 l on the first and 1.4 l on the second occasion) in 280 l to (BM) only. Weedkillers: Chlortoluron at 5.6 l in 280 l, mecoprop (as 'Herrifex DS' at 4.2 l on two occasions to (BM) only and at 4.9 l to both) in 280 l. Fungicides: Benomyl at 0.24 kg in 280 l, triadimefon with captafol (as 'Bayleton CF' 2.0 kg) in 280 l on two occasions the second with the pirimicarb. Insecticides: Omethoate at 0.64 l in 280 l, pirimicarb at 0.14 kg in 280 l. Growth regulator: Chlormequat at 1.4 kg in 280 l.

Seed: Avalon, sown at 200 kg.

Cultivations, etc.:-

Butt Close I (BC): Deep-tine cultivated: 20 Aug, 1981. Spring-tine cultivated: 10 Sept. Previous crops: S. barley 1980, potatoes 1981. Broad Mead II (BM): Heavy spring-tine cultivated twice: 10 Sept, 1981. Mecoprop applied: 19 Nov, 23 Mar, 1982. Manganese applied: 17 May, 7 June. Previous crops: W. wheat 1980, potatoes 1981. (BC) and (BM): PK applied: 11 Sept, 1981. Aldicarb applied, rotary cultivated and seed sown for SOWDATE 23 SEPT: 23 Sept. Aldicarb applied, rotary cultivated and seed sown for SOWDATE 23 OCT: 23 Oct. Chlortoluron applied: 28 Oct. Growth regulator applied to SOWDATE 23 SEPT: 26 Mar, 1982, SOWDATE 23 OCT: 22 Apr. Mecoprop applied: 26 Mar. Omethoate applied: 5 Apr. Benomyl applied: 22 Apr. 'Bayleton CF' applied, with the pirimicarb on the second occasion: 2 June, 14 June. Combine harvested: 12 Aug.

NOTE: Measurements were made of plant and shoot numbers, dry weight of tops and ears, leaf area and N, P and K contents during growth. Weekly measurements were made of soil moisture (between April and harvest). Plant water stress and stomatal resistance were measured. Disease assessments were made during the growing season. Soil samples were taken in autumn and spring to determine N contents.

82/W/WW/2 BUTT CLOSE I (BC)

MAIN FACTORIAL PLOTS

GRAIN TONNES/HECTARE

***** TABLES OF MEANS *****

| | | | |
|----------|-------|------|------|
| N RATE | 120 | 180 | MEAN |
| SOWDATE | | | |
| 23 SEPT | 6.89 | 8.26 | 7.57 |
| 23 OCT | 6.49 | 8.38 | 7.43 |
| MEAN | 6.69 | 8.32 | 7.50 |
| N TIME | EARLY | LATE | MEAN |
| SOWDATE | | | |
| 23 SEPT | 7.56 | 7.59 | 7.57 |
| 23 OCT | 7.55 | 7.32 | 7.43 |
| MEAN | 7.55 | 7.45 | 7.50 |
| N TIME | EARLY | LATE | MEAN |
| N RATE | | | |
| 120 | 6.56 | 6.81 | 6.69 |
| 180 | 8.54 | 8.09 | 8.32 |
| MEAN | 7.55 | 7.45 | 7.50 |
| WINTER N | 0 | 60 | MEAN |
| SOWDATE | | | |
| 23 SEPT | 6.91 | 8.23 | 7.57 |
| 23 OCT | 6.92 | 7.95 | 7.43 |
| MEAN | 6.91 | 8.09 | 7.50 |
| WINTER N | 0 | 60 | MEAN |
| N RATE | | | |
| 120 | 6.17 | 7.21 | 6.69 |
| 180 | 7.66 | 8.97 | 8.32 |
| MEAN | 6.91 | 8.09 | 7.50 |
| WINTER N | 0 | 60 | MEAN |
| N TIME | | | |
| EARLY | 7.02 | 8.08 | 7.55 |
| LATE | 6.81 | 8.10 | 7.45 |
| MEAN | 6.91 | 8.09 | 7.50 |
| IRRIGATN | NONE | FULL | MEAN |
| SOWDATE | | | |
| 23 SEPT | 7.34 | 7.80 | 7.57 |
| 23 OCT | 6.98 | 7.88 | 7.43 |
| MEAN | 7.16 | 7.84 | 7.50 |

82/W/WW/2 BUTT CLOSE I (BC)

MAIN FACTORIAL PLOTS

GRAIN TONNES/HECTARE

***** TABLES OF MEANS *****

| | | | |
|----------|------|----------|------|
| IRRIGATN | NONE | FULL | MEAN |
| N RATE | | | |
| 120 | 6.39 | 6.99 | 6.69 |
| 180 | 7.93 | 8.70 | 8.32 |
| MEAN | 7.16 | 7.84 | 7.50 |
| IRRIGATN | NONE | FULL | MEAN |
| N TIME | | | |
| EARLY | 7.18 | 7.92 | 7.55 |
| LATE | 7.14 | 7.76 | 7.45 |
| MEAN | 7.16 | 7.84 | 7.50 |
| IRRIGATN | NONE | FULL | MEAN |
| WINTER N | | | |
| 0 | 6.74 | 7.09 | 6.91 |
| 60 | 7.58 | 8.60 | 8.09 |
| MEAN | 7.16 | 7.84 | 7.50 |
| AUT PEST | NONE | ALDICARB | MEAN |
| SOWDATE | | | |
| 23 SEPT | 7.59 | 7.56 | 7.57 |
| 23 OCT | 7.21 | 7.65 | 7.43 |
| MEAN | 7.40 | 7.60 | 7.50 |
| AUT PEST | NONE | ALDICARB | MEAN |
| N RATE | | | |
| 120 | 6.42 | 6.96 | 6.69 |
| 180 | 8.38 | 8.25 | 8.32 |
| MEAN | 7.40 | 7.60 | 7.50 |
| AUT PEST | NONE | ALDICARB | MEAN |
| N TIME | | | |
| EARLY | 7.48 | 7.62 | 7.55 |
| LATE | 7.32 | 7.58 | 7.45 |
| MEAN | 7.40 | 7.60 | 7.50 |
| AUT PEST | NONE | ALDICARB | MEAN |
| WINTER N | | | |
| 0 | 6.95 | 6.88 | 6.91 |
| 60 | 7.85 | 8.33 | 8.09 |
| MEAN | 7.40 | 7.60 | 7.50 |

82/W/WW/2 BUTT CLOSE I (BC)

MAIN FACTORIAL PLOTS

GRAIN TONNES/HECTARE

***** TABLES OF MEANS *****

| AUT PEST IRRIGATN | NONE | ALDICARB | MEAN |
|----------------------|------|----------|------|
| NONE | 6.89 | 7.43 | 7.16 |
| FULL | 7.91 | 7.78 | 7.84 |
| MEAN | 7.40 | 7.60 | 7.50 |

EXTRA PLOTS

| N SCALE S DATE N | 0 | 90 | 150 | 180 | 210 | 240 | MEAN |
|---------------------|------|------|------|------|------|------|------|
| 23 SEPT NE | 1.98 | 5.58 | 5.51 | 8.57 | 7.73 | 8.95 | 6.39 |
| 23 OCT NL | 1.78 | 5.01 | 7.85 | 7.05 | 8.13 | 6.55 | 6.06 |
| MEAN | 1.88 | 5.30 | 6.68 | 7.81 | 7.93 | 7.75 | 6.22 |

| IRRIG X SDATE NX | NONE | FULL | MEAN |
|---------------------|------|------|------|
| SE 180E | 7.83 | 8.62 | 8.23 |
| SL 180L | 7.54 | 8.29 | 7.92 |
| MEAN | 7.69 | 8.46 | 8.07 |

GRAND MEAN 7.29

SED FOR TABLES EXCEPT THOSE INVOLVING S DATE N, N SCALE, SDATE NX, IRRIG X AND WINT NX ARE

MARGINS OF 2 WAY TABLES 0.161
TWO WAY TABLES 0.228

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

| STRATUM | DF | SE | CV% |
|---------|----|-------|-----|
| WP | 10 | 0.456 | 6.1 |

GRAIN MEAN DM% 85.3

PLOT AREA HARVESTED 0.00202

82/W/WW/2 BROAD MEAD II (BM)

MAIN FACTORIAL PLOTS

GRAIN TONNES/HECTARE

***** TABLES OF MEANS *****

| | | | |
|----------|-------|------|------|
| N RATE | 30 | 90 | MEAN |
| SOWDATE | | | |
| 23 SEPT | 7.77 | 8.67 | 8.22 |
| 23 OCT | 7.56 | 7.96 | 7.76 |
| MEAN | 7.67 | 8.31 | 7.99 |
| N TIME | EARLY | LATE | MEAN |
| SOWDATE | | | |
| 23 SEPT | 8.21 | 8.24 | 8.22 |
| 23 OCT | 7.73 | 7.78 | 7.76 |
| MEAN | 7.97 | 8.01 | 7.99 |
| N TIME | EARLY | LATE | MEAN |
| N RATE | | | |
| 30 | 7.78 | 7.55 | 7.67 |
| 90 | 8.16 | 8.47 | 8.31 |
| MEAN | 7.97 | 8.01 | 7.99 |
| WINTER N | 0 | 30 | MEAN |
| SOWDATE | | | |
| 23 SEPT | 8.05 | 8.39 | 8.22 |
| 23 OCT | 7.64 | 7.87 | 7.76 |
| MEAN | 7.85 | 8.13 | 7.99 |
| WINTER N | 0 | 30 | MEAN |
| N RATE | | | |
| 30 | 7.61 | 7.73 | 7.67 |
| 90 | 8.09 | 8.54 | 8.31 |
| MEAN | 7.85 | 8.13 | 7.99 |
| WINTER N | 0 | 30 | MEAN |
| N TIME | | | |
| EARLY | 7.84 | 8.10 | 7.97 |
| LATE | 7.86 | 8.16 | 8.01 |
| MEAN | 7.85 | 8.13 | 7.99 |
| IRRIGATN | NONE | FULL | MEAN |
| SOWDATE | | | |
| 23 SEPT | 8.09 | 8.36 | 8.22 |
| 23 OCT | 7.91 | 7.60 | 7.76 |
| MEAN | 8.00 | 7.98 | 7.99 |

82/W/WW/2 BROAD MEAD II (BM)

MAIN FACTORIAL PLOTS

GRAIN TONNES/HECTARE

***** TABLES OF MEANS *****

| | | | |
|----------|------|----------|------|
| IRRIGATN | NONE | FULL | MEAN |
| N RATE | | | |
| 30 | 7.56 | 7.77 | 7.67 |
| 90 | 8.44 | 8.19 | 8.31 |
| MEAN | 8.00 | 7.98 | 7.99 |
| IRRIGATN | NONE | FULL | MEAN |
| N TIME | | | |
| EARLY | 7.85 | 8.09 | 7.97 |
| LATE | 8.15 | 7.87 | 8.01 |
| MEAN | 8.00 | 7.98 | 7.99 |
| IRRIGATN | NONE | FULL | MEAN |
| WINTER N | | | |
| 0 | 7.79 | 7.91 | 7.85 |
| 30 | 8.21 | 8.06 | 8.13 |
| MEAN | 8.00 | 7.98 | 7.99 |
| AUT PEST | NONE | ALDICARB | MEAN |
| SOWDATE | | | |
| 23 SEPT | 7.97 | 8.48 | 8.22 |
| 23 OCT | 7.48 | 8.04 | 7.76 |
| MEAN | 7.72 | 8.26 | 7.99 |
| AUT PEST | NONE | ALDICARB | MEAN |
| N RATE | | | |
| 30 | 7.51 | 7.83 | 7.67 |
| 90 | 7.94 | 8.69 | 8.31 |
| MEAN | 7.72 | 8.26 | 7.99 |
| AUT PEST | NONE | ALDICARB | MEAN |
| N TIME | | | |
| EARLY | 7.72 | 8.22 | 7.97 |
| LATE | 7.73 | 8.29 | 8.01 |
| MEAN | 7.72 | 8.26 | 7.99 |
| AUT PEST | NONE | ALDICARB | MEAN |
| WINTER N | | | |
| 0 | 7.59 | 8.11 | 7.85 |
| 30 | 7.86 | 8.41 | 8.13 |
| MEAN | 7.72 | 8.26 | 7.99 |

82/W/WW/2 BROAD MEAD II (BM)

MAIN FACTORIAL PLOTS

GRAIN TONNES/HECTARE

***** TABLES OF MEANS *****

| AUT PEST IRRIGATN | NONE | ALDICARB | MEAN |
|----------------------|------|----------|------|
| NONE | 7.75 | 8.24 | 8.00 |
| FULL | 7.69 | 8.27 | 7.98 |
| MEAN | 7.72 | 8.26 | 7.99 |

EXTRA PLOTS

| N SCALE S DATE N | 0 | 60 | 90 | 120 | 150 | MEAN |
|---------------------|------|------|------|------|------|------|
| 23 SEPT NE | 7.22 | 8.25 | 7.58 | 8.95 | 8.71 | 7.99 |
| 23 OCT NL | 7.55 | 8.21 | 6.90 | 8.76 | 7.83 | 7.80 |
| MEAN | 7.39 | 8.23 | 7.24 | 8.85 | 8.27 | 7.89 |

| IRRIG X SDATE NX | NONE | FULL | MEAN |
|---------------------|------|------|------|
| SE 90E | 8.06 | 8.56 | 8.31 |
| SL 90L | 7.91 | 8.39 | 8.15 |
| MEAN | 7.99 | 8.48 | 8.23 |

GRAND MEAN 8.00

SED FOR TABLES EXCEPT THOSE INVOLVING S DATE N, N SCALE, SDATE NX
AND IRRIG X ARE

MARGINS OF 2 WAY TABLES 0.190
TWO WAY TABLES 0.269

***** STRATUM STANDARD ERRORS AND COEFFICIENTS OF VARIATION *****

| STRATUM | DF | SE | CV% |
|---------|----|-------|-----|
| WP | 10 | 0.539 | 6.7 |

GRAIN MEAN DM% 86.1

PLOT AREA HARVESTED 0.00202