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ROTHAMSTED
RESEARCH

Details of the Classical and Long-term Experiments 1968-73

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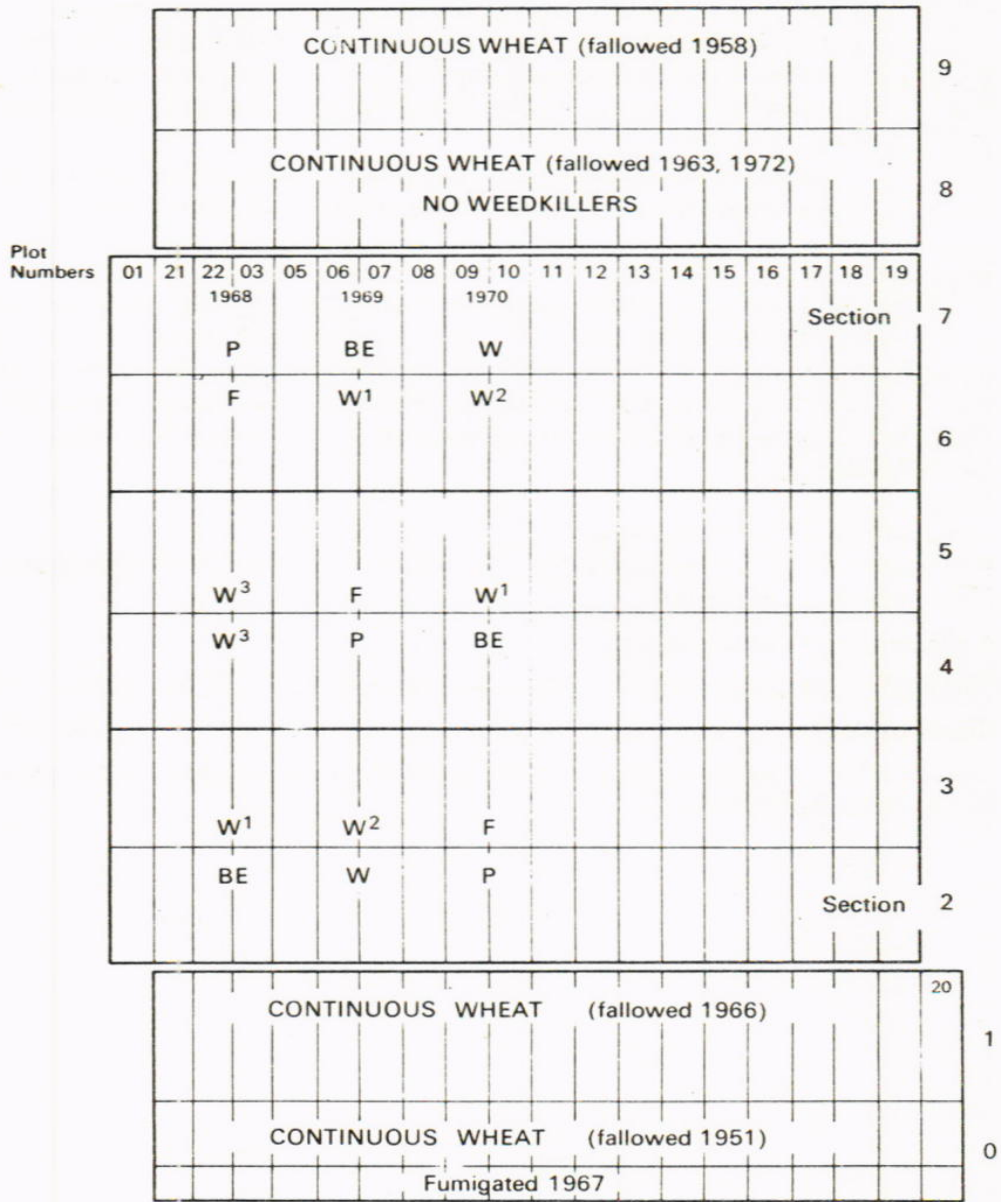


Classical Experiments

Rothamsted Research

Rothamsted Research (1977) *Classical Experiments* ; Details Of The Classical And Long-Term Experiments 1968-73, pp 4 - 35 - DOI: <https://doi.org/10.23637/ERADOC-1-193>

BROADBALK



Cut annually
Grazed area
Wilderness

BROADBALK

WHEAT AND THREE COURSE ROTATION

(R/BK/1)

The history of the experiment from the first experimental wheat crop in 1844 to that of 1967 is given in *Details 1967*, pp 11-15 and the *Rothamsted Report for 1968 Part 2*.

Important changes in cropping were introduced for the 1968 crop, the main object being to grow wheat on part of the field after a two year break. Comparisons can therefore be made of the effects of the long continued manurial treatments on wheat in rotation and on continuous wheat. At the same time some modifications were made to the manurial treatments.

Manuring from 1968

- (i) Organic manures and minerals for all crops and for fallow are now applied in autumn before ploughing whereas only farmyard manure was ploughed in previously and no manures or minerals were applied to fallows.
- (ii) All inorganic nitrogen is applied as one dressing in spring and 'Nitro-Chalk' has replaced both sulphate of ammonia and nitrate of soda but is not applied to fallows.

NOTE: A new plot (plot 1) previously untreated receives FYM plus N2PK. Plot 21, formerly 2A, now receives N2 in addition to FYM. Plot 9, previously N1PKNaMg, now receives N4PKNaMg. Plot 14, previously N2PMg, now receives N2PKMg. Plot 15, previously N2PKNaMg, now receives N3PKNaMg. Plots 17 and 18, previously N2 alternating with PKNaMg, now receive N2 and half-rate PKNaMg each year.

Symbols, materials and rates of application (annuals from 1968).

| | |
|-----------------|---|
| N1, N2, N3, N4. | 'Nitro-Chalk' to supply 48, 96, 144, 192 kg N |
| P | Powdered superphosphate (approx 20% P ₂ O ₅) to supply 34 kg P |
| K | Sulphate of potash (approx 50% K ₂ O) to supply 90 kg K |
| Na | Sulphate of soda (approx 14% Na) to supply 16 kg Na (except plot 12, 57 kg Na) |
| Mg | Sulphate of magnesia (approx 10% Mg) to supply 11 kg Mg (except plot 14, 31 kg Mg) |
| FYM | 35 t farmyard manure |
| C | Castor meal (approx 5% N) to supply 96 kg N. |

Treatments

| Plot | Treatments immediately prior to 1968 | Treatments from 1968 |
|------------------|--------------------------------------|----------------------|
| 01 | — | DN2PK |
| 21 (formerly 2A) | D | DN2 |
| 22 (formerly 2B) | D | D |
| 03 | None | None |
| 05 | PKNaMg | PKNaMg |
| 06 | P1PKNaMg | P1PKNaMg |
| 07 | N2PKNaMg | N2PKNaMg |

| Plot | | Treatments immediately prior to 1968 | Treatments from 1968 |
|------|------------|--------------------------------------|----------------------|
| 08 | | N3PKNaMg | N3PKNaMg |
| 09 | | N1*PKNaMg | N4PKNaMg |
| 10 | | N2 | N2 |
| 11 | | N2P | N2P |
| 12 | | N2PNa | N2PNa |
| 13 | | N2PK | N2PK |
| 14 | | N2PMg | N2PKMg |
| 15 | | N2 ⁺ PKNaMg | N3PKNaMg |
| 16 | | N2*PKNaMg | N2PKNaMg |
| 17 | even years | PKNaMg | N2+½(PKNaMg) |
| | odd years | N2 | |
| 18 | even years | N2 | N2+½(PKNaMg) |
| | odd years | PKNaMg | |
| 19 | | C | C |
| 20 | | N2KNaMg | N2KNaMg |

* Nitrate of soda + Applied in the autumn

- NOTES: (i) Plot 01 extends over Sections 2-7 (rotation and fallow, wheat, wheat sequences only).
(ii) Plot 20 extends over Sections 0 and 1 (continuous wheat only).

Liming

The liming scheme adopted in 1954 (*Details 1967*, p 14) continued until the autumn of 1967 but no further regular lime was applied in 1969-73.

In autumn 1967 certain plots were given additional dressings of chalk to counteract acidity shown by soil analyses.

| Plot | 7 | 8 | 11 | 13 | 14 | 15 |
|-----------|-----|-----|-----|-----|-----|-----|
| Section 1 | — | 2.9 | — | — | — | — |
| 6, 7 | — | 8.7 | 2.9 | 2.9 | — | — |
| 8 | 2.9 | 2.9 | — | 2.9 | 2.9 | 2.9 |
| 9 | 2.9 | 2.9 | — | — | — | — |

Cropping, fallowing and weed control

- (1) *Crop Sequences*. From 1968 two of the five sections which had already been subdivided (IA and B; VA and B) were allocated to continuous wheat, these sections may be fallowed occasionally to control troublesome weeds but not all in the same season. The remaining three sections (II, III, IV) were divided into halves transversely; three of the smaller sections so formed grow wheat only in a cycle of fallow, wheat, wheat and the other three follow a rotation of potatoes, spring beans and wheat. The ten sections were renumbered:

| | | Cropping and Fallowing Sequences | | | | | | | | | |
|-----------------|------|----------------------------------|----|----|---|-----|---|----|----|----|----|
| Old section No. | | IA | IB | II | | III | | IV | | VA | VB |
| New section No. | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Year | 1968 | 17 | 2 | BE | 1 | 3 | 3 | F | P | 5 | 10 |
| | 1969 | 18 | 3 | W | 2 | P | F | 1 | BE | 6 | 11 |
| | 1970 | 19 | 4 | P | F | BE | 1 | 2 | W | 7 | 12 |

| | | | | | | | | | | |
|------|----|---|----|---|----|---|---|----|---|----|
| 1971 | 20 | 5 | BE | 1 | W | 2 | F | P | 8 | 13 |
| 1972 | 21 | 6 | W | 2 | P | F | 1 | BE | F | 14 |
| 1973 | 22 | 7 | P | F | BE | 1 | 2 | W | 1 | 15 |

1, 2, 3 . . first, second, third crop of wheat after fallow, F.

BE = Spring beans, P = potatoes, W = wheat.

Section 8 (VA) continues as hitherto to receive no chemical weedkiller.

(2) *Varieties.*

Wheat: Cappelle: 1969-73 dieldrin dressed (in addition to normal dressing)
 Spring beans: Maris Bead: 1968-70 inoculated with Rhizobium.
 Potatoes: 1968 Majestic, Irish A chitted.
 1969-73 King Edward, once grown chitted from Rothamsted Farm, paracrinkle virus free.

(3) *Weed Control.*

(a) *Use of Chemicals.* All sections carrying wheat have been sprayed as thought necessary each year to control weeds with the exception of section 8 which never receives any weedkiller. Terbutryne and related triazines ('Prebane') has been applied from 1969 onwards to wheat soon after sowing to control blackgrass (*Alopecurus myosuroides*). For many years before 1969 sowing was usually delayed to allow the initial growth of blackgrass seedlings to be destroyed by cultivations.

Simazine was used on the bean crop in 1968 but discontinued thereafter because it damaged beans on plots without organic manures and did not control weeds on plots with them. No weedkillers have been used on this crop since, except paraquat prior to drilling in 1971 to kill fresh growth since autumn cultivations.

(b) *Weedkillers* (Section 8 not treated throughout):

| | | |
|----------|----------------|---|
| Wheat | 1968 | Ioxynil with mecoprop |
| | 1969-71 & 1973 | Terbutryne; dicamba with mecoprop and MCPA |
| | 1972 | Aminotriazole with ammonium thiocyanate (except section 6) to preceding stubble; terbutryne; dicamba with mecoprop and MCPA |
| Potatoes | 1968 | None |
| | 1969-73 | Linuron with paraquat |
| | 1972 | Aminotriazole with ammonium thiocyanate to preceding stubble. |

Paraquat was also used in the autumn preceding;

| | |
|------|----------------------------|
| 1969 | Wheat, potatoes and fallow |
| 1971 | Wheat, potatoes and beans |

(c) *Mechanical cultivations.* Potato plots have been grubbed and rotary ridged approximately a month after weedkiller applied. The beans have been hoed several times as necessary.

(d) *Hand weeding.* Field horsetail (*Equisetum arvense*) had been

recorded on Broadbalk since 1930 but only became troublesome in the potato crop introduced in 1968 necessitating hand pulling in some years from 1969. Wild oats (*Avena ludoviciana*) have been pulled regularly in the wheat plots, continuing the practice started in 1943. Thistles (*Cirsium arvense*) have been pulled in the wheat in 1968-70.

Other chemicals applied

- (i) Mancozeb has been applied two or three times each year to the potatoes.
- (ii) Demeton-S-methyl has been applied once annually to beans and potatoes to control aphids.
- (iii) 1968, 1970, 1972 & 1973. Potato haulm burnt off with sulphuric acid (Brown Oil of Vitriol).
- (iv) In autumn 1967 3.05 m of the eastern discards of every plot in section 0 was fumigated with methyl bromide at 975 kg and yields were compared in 1968 and 1969 with those from an equal adjoining length receiving normal treatments only.

Plot size

- (i) Wheat: From 1968 a 15-row drill was used and the cropped plot width was reduced from 36 rows (6.40 m) to 30 rows (5.33 m). Plots 21 and 22 originally 20 rows (3.56 m) each now have 22 rows (3.91 m). Rows are 17.8 cm (7 in) apart.
- (ii) Beans: 12 rows drilled in a plot width of 6.40 m, plots 21 and 22 have 7 rows in a plot width of 3.73 m. Rows are 53.3 cm (21 in) apart.
- (iii) Potatoes: 9 rows planted in a plot width of 6.40 m, plots 21 and 22 together have 11 rows in a plot width of 7.82 m. Rows are 71.1 cm (28 in) apart.

Areas manured

Manures, with the exception of 'Nitro-Chalk' continue to be applied to the full, 6.40 m, width for all crops. FYM is applied to plots 21 and 22 as though they were one plot 8.00 m wide. 'Nitro-Chalk' is applied to the drilled area for wheat and to the full width for beans and potatoes except plots 21 and 22 where the treated width is 3.96 m.

Areas harvested

| | Wheat (16 rows) | Beans (5 or 6 rows) | Potatoes (4 rows) |
|-----------|--------------------|---------------------------|----------------------|
| Section 0 | 0.00434 | | |
| 1 | 0.00798 | | |
| 2-7 | 0.00659 | 0.00618 (1968, 69, 72) | 0.00659 |
| | | 0.00741 (1970, 71, 73) | |
| 8-9 | 0.00694 | | |

Soil series Shallow Batcombe series with areas of Batcombe and Hook series.

Reference

Rothamsted Experimental Station. Report for 1968, Part 2.

HOOSFIELD

R Rotation of potatoes, beans, barley
Shaded area = Continuous barley



| | | 551 N2 PK | 561 PK | 571 N2 | 581 N2 | 5 |
|---------------------------|---|------------------|--------------|--------------|------------------|-------|
| Barley 1969 | R | N - 2 1 444 3 | 3 2 1 - | 2 - 3 1 | 3 1 2 144 - | |
| Barley 1970 | R | - 1 3 443 2 | - 2 3 1 | 2 3 - 1 | - 3 2 143 1 | 4 |
| Barley 1968 | R | 3 1 2 442 - | 1 2 - 3 | 1 3 2 - | - 1 3 142 2 | (C) |
| | | 3 2 - 441 1 | - 1 2 3 | 1 3 2 - | - 3 2 141 1 | |
| S = Silicate of soda (Si) | | | | | | |
| | | 2 - 3 S 434 1 | 2 3 1 S - | 3 - 1 S 2 | 1 - 2 S 134 3 | (AAS) |
| Barley 1970 | R | 3 - 1 S 433 2 | 1 3 2 - | 2 3 - 1 | - 1 3 133 2 | 3 |
| | R | - 1 2 432 3 | 3 2 1 - | 3 - 2 1 | - 2 1 132 3 | (AA) |
| | | 3 1 3 431 1 | 2 1 | 2 3 | 3 131 1 | |

GAUGE PLOTS

| | | 724 N 2 | 624 - | 1 | - | 1 | 3 | |
|---|--|----------------|----------|------------------|------------------|---------------|---------------|----------------------|
| 4 | | 1 | 2 | 2 | 1 | - | - | 2 |
| 3 | | FYM | None | - | 2 | 3 | 1 | (A) |
| 2 | | - | 1 | - | 2 | 3 | 1 | |
| 1 | | 721 3 | 621 3 | 3 | 3 | 2 | 121 2 | |
| | | | | | | | | |
| 4 | | 714 1 | 614 2 | - | - | 2 | 1 | |
| 3 | | 2 | - | 2 | 3 | 1 | 3 | 1 |
| 2 | | FYM 1852-71 | None | 3 | 1 | - | - | (O) |
| 1 | | 711 - | 611 3 | 1 | 2 | 3 | 111 2 | |
| | | 7 | 6 | 4 PK Na Mg | 3 -K Na Mg | 2 P- -- | 1 -- -- | Strip N ^o |

HOOSFIELD

BARLEY AND THREE COURSE ROTATION

(R/HB/2)

As on Broadbalk changes in the cropping system were made in 1968 to enable comparisons to be made of the effects of the long continued manurial treatments on barley in a rotation of potatoes, beans, barley and on continuous barley. At the same time some changes were made in the manurial treatments.

Manuring from 1968

- (i) Castor meal was discontinued after an equalising dressing in 1967 equivalent to 3 years application (144 kg N) to the half plots receiving the lower rate from 1964-66.
- (ii) FYM and minerals are now applied in autumn before ploughing.
- (iii) Sulphate of ammonia and nitrate of soda are no longer applied, and all N is given as 'Nitro-Chalk' as a top dressing for barley and in the seedbed for potatoes.
- (iv) The test of no minerals v. P v. KNaMg v. PKNaMg on the four main strips of plots (started in 1852) and the test of silicate of soda (from 1862) on plots 33-34 of strips 1-4 (formerly Series AAS) were continued.
- (v) All plots (except 551, 561, 571, 581) were split into four for a N test on barley.

Symbols, materials and rates of application

Annual dressings 1968-73

| | |
|----------------|--|
| NO, N1, N2, N3 | 'Nitro-chalk' to supply 0, 48, 96 and 144 kg N to barley (0, 96, 192, 288 kg N to potatoes in 1973). |
| P | Powdered superphosphate (approx. 20% P ₂ O ₅) to supply 34 kg P |
| K | Sulphate of potash (approx. 50% K ₂ O) to supply 90 kg K |
| Na | Sulphate of soda (approx. 14% Na) to supply 16 kg Na |
| Mg | Sulphate of magnesia (approx. 10% Mg) to supply 11 kg Mg |
| Si | Silicate of soda at 448 kg |
| FYM | Farm yard manure at 35 t |

The Series treatments discontinued after the 1966 crop (the whole area was fallowed in 1967) were:

| | |
|----|--------------------------------|
| O | None |
| A | 48 kg N as Sulphate of Ammonia |
| AA | 48 kg N as Nitrate of Soda |
| C | 48 kg N as Castor bean meal |

NOTE: Strip 3 (K, Na, Mg) has received the following additional dressings (kg/ha) because of the limitations of the fertiliser distributor.

| | | | |
|------|----------|-----------|-----------|
| 1969 | 7.2 kg K | 1.0 kg Na | 0.9 kg Mg |
| 1971 | 9.8 kg K | 1.3 kg Na | 1.1 kg Mg |

Treatments (see plan)

- (i) Strip manures (applied annually since 1852)
 - Strip 1 Nil
 - 2 P
 - 3 KNaMg
 - 4 PKNaMg
- (ii) Farm yard manure (applied annually since 1852)
Plots 721 – 724 (formerly 7-2)
- (iii) Silicate of soda (applied annually since 1862)
Plots 33-34 of strips 1-4
(formerly Series AAS)
- (iv) Nitrogen. N is applied cumulatively
 - (a) From 1968-72 potatoes received a basal dressing of 144 kg N.
 - (b) Beans receive no nitrogen
 - (c) In 1968 plots 721 and 723 received no N and 722 and 724, N1. Thereafter as shown as plan.
 - (d) In 1968 plots 611-614, 621-624, 711-714 and 721-724 received nitrogen at 63 (N1), 129 (N2), 192 (N3) kg N in error.
- (v) Plots 551, 561, 571 and 581. From 1968, N where applied, is at 96 kg, P and K are at the same rates as strips. (From 1970-72 plots 551 and 561 received 18 kg P and 168 kg K in error).

Liming. No lime was applied in the period 1968-73.

Cropping and Weed Control

In 1968 plots formerly receiving castor bean meal (Series C) were divided into four, one quarter in continuous barley and the others in an annual rotation of potatoes, spring beans and barley.

The former nitrate of soda plots (Series AA) and nitrate of soda plus silicate of soda ones (Series AAS) were each divided into two, one in continuous barley and the other in one phase of the rotation each year.

The remaining plots continue to grow spring barley each year giving the following cropping sequences.

(1) *Crop Sequences.*

| Old Series | 0 | A | AA | | AAS | | C | | | | 1N | 2N |
|--------------|-------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----|
| New Plot Nos | 111-714 | 121-724 | 131-431 | 132-432 | 133-433 | 134-434 | 141-441 | 142-442 | 143-443 | 144-444 | 551-581 | 581 |
| Year 1967 | F A L L O W | | | | | | | | | | | |
| 1968 | B | B | B | P | P | B | B | B | P | BE | B | B |
| 1969 | B | B | B | BE | BE | B | B | P | BE | B | B | B |
| 1970 | B | B | B | B | B | B | B | BE | B | P | B | B |
| 1971 | B | B | B | P | P | B | B | B | P | BE | B | B |
| 1972 | B | B | B | BE | BE | B | B | P | BE | B | B | B |
| 1973 | B | B | B | B | B | B | B | BE | B | P | B | B |

(2) *Varieties.*

| | | |
|--------|-----------|------------------------------|
| Barley | 1968 & 69 | Maris Badger |
| | 1970 & 71 | Julia |
| | 1972 & 73 | Julia dressed with ethirimol |

| | | |
|----------|--------------------|--|
| Beans | 1968-70 1971-73 | Maris Bead inoculated with <i>Rhizobium</i> Maris Bead |
| Potatoes | 1968 1969-73 | Majestic. Irish A, chitted. King Edward. Once grown, chitted from Rothamsted Farm, paracrinkle virus free. |

(3) *Weed Control*

(i) *Weedkillers.*

| | | |
|----------|--|--|
| Barley | 1968 1969 1970 1971 1972 & 73 | Dicamba with mecoprop and MCPA Non rotational barley only, paraquat in preceding autumn. Paraquat in autumn and dicamba with mecoprop and MCPA. Paraquat in autumn and ioxynil, bromo- xynil and dicamba. Paraquat in autumn and dicamba with mecoprop and MCPA. |
| Potatoes | 1968 1969 1970 & 71 1972 1973 | None Paraquat in autumn and paraquat plus linuron pre-emergence. Paraquat in autumn and linuron pre- emergence. Paraquat in autumn and paraquat plus linuron pre-emergence. Paraquat plus linuron applied pre- emergence. |
| Beans | 1968 1971 | Simazine Paraquat applied in preceding autumn. |

(ii) *Hand weeding.* Wild oats in barley have been pulled by hand once or twice each year as necessary.

Other chemicals applied

- (i) Mancozeb. has been applied annually to the potato crop on two or three occasions.
- (ii) Demeton-S-methyl has been applied once annually to the potato crop with the exception of 1971.
- (iii) Demeton-S-methyl has been applied once annually to the beans in 1969 to 1971 and in 1973, and phorate once in 1968 and 1972.
- (iv) In 1968, 1970, 1972 and 1973: Potato haulm was destroyed by sulphuric acid.

Areas harvested

(i) 1968-71

| Plot | Crop | Area harvested |
|---|----------|----------------|
| 111-424 (Old Series O & A) | Barley | 0.0035 |
| 611-724 (Old Series 6-1 and 6-2 7-1 and 7-2) | Barley | 0.0026 |
| 131-444 (Old Series AA, AAS, C) | Barley | 0.00096 |
| | Potatoes | 0.0019 |
| | Beans | 0.0018* |

551-581 (Old Series 1N, 2N, 50,
5A) Barley 0.0041

* Harvested in pairs 1968 and 1969. 0.0022 in 1971 as 6 rows harvested per sub-plot instead of 5 as in other years.

Barley was harvested by a small combine (1.4 m cut) on plots 131-444 and by a large combine (2.8 m) on the remainder as were the beans. In 1970 plots 111-724 were used for a comparison of these two combines and a 2.1 m one (See *Yields 1970*, p.257).

(ii) In 1972 and 1973 the 2.1 m combine was used on all cereal and bean plots giving the harvested areas:

| Plot | Crop | Area harvested |
|---------|----------|----------------|
| 111-424 | Barley | 0.0026 |
| 611-724 | Barley | 0.0020 |
| 131-444 | Barley | 0.0014 |
| | Potatoes | 0.0019 |
| | Beans | 0.0014 |
| 551-581 | Barley | 0.0031 |

Soil series. Batcombe series with small area of Winchester and shallow Batcombe series

WHEAT AND FALLOW, HOOSFIELD

(R/WF/3)

The wheat and fallow sequences started with a preliminary season in 1855 and following the modification in 1932, have continued unchanged providing a one and a three year fallow comparison. (*Details 1967*, pp 23-24).

Manuring. None since 1851

Cropping, fallowing and weed control

(1) *Crop Sequences.*

| New Plot Nos. | Strip A | | | | Strip B | | | |
|---------------|---------|----|----|----|---------|----|----|----|
| | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 |
| 1968 | W | W | F | W | F | F | F | F |
| 1969 | F | F | F | F | F | W | W | W |
| 1970 | W | W | W | F | F | F | F | F |
| 1971 | F | F | F | F | W | F | W | W |
| 1972 | F | W | W | W | F | F | F | F |
| 1973 | F | F | F | F | W | W | F | W |

F = Fallow W = Wheat

(2) *Variety.* Cappelle, dressed with dieldrin.

(3) *Weedkillers.* 1968-71 Ioxynil with mecoprop
1972 and 73 Dicamba, with mecoprop and MCPA.

Area harvested. 0.01483
Soil series. Batcombe series with small area of Hook series.

EXHAUSTION LAND, HOOSFIELD

(R/EX/4)

Barley has been grown continuously since fallowing in 1967 to test the residual value of manures applied 1856-1901 and N only has been applied subsequently. (*Details 1967*, pp 43-44)

Manures

Basal N at 88 kg N has been combine-drilled but no separate plot treatments have been applied.

Cropping and weed control

- (1) *Varieties.* 1968-69 Maris Badger
1970-73 Julia (dressed with ethirimol 1972 and '73)
All sown at 155 kg
- (2) *Weedkillers.* 1968-70, Dicamba with mecoprop and MCPA
1972 & '73
1969-70 Paraquat in autumn
1971 Bromoxynil with ioxynil and dichlorprop
1972 Aminotriazole with ammonium thiocyanate in autumn.

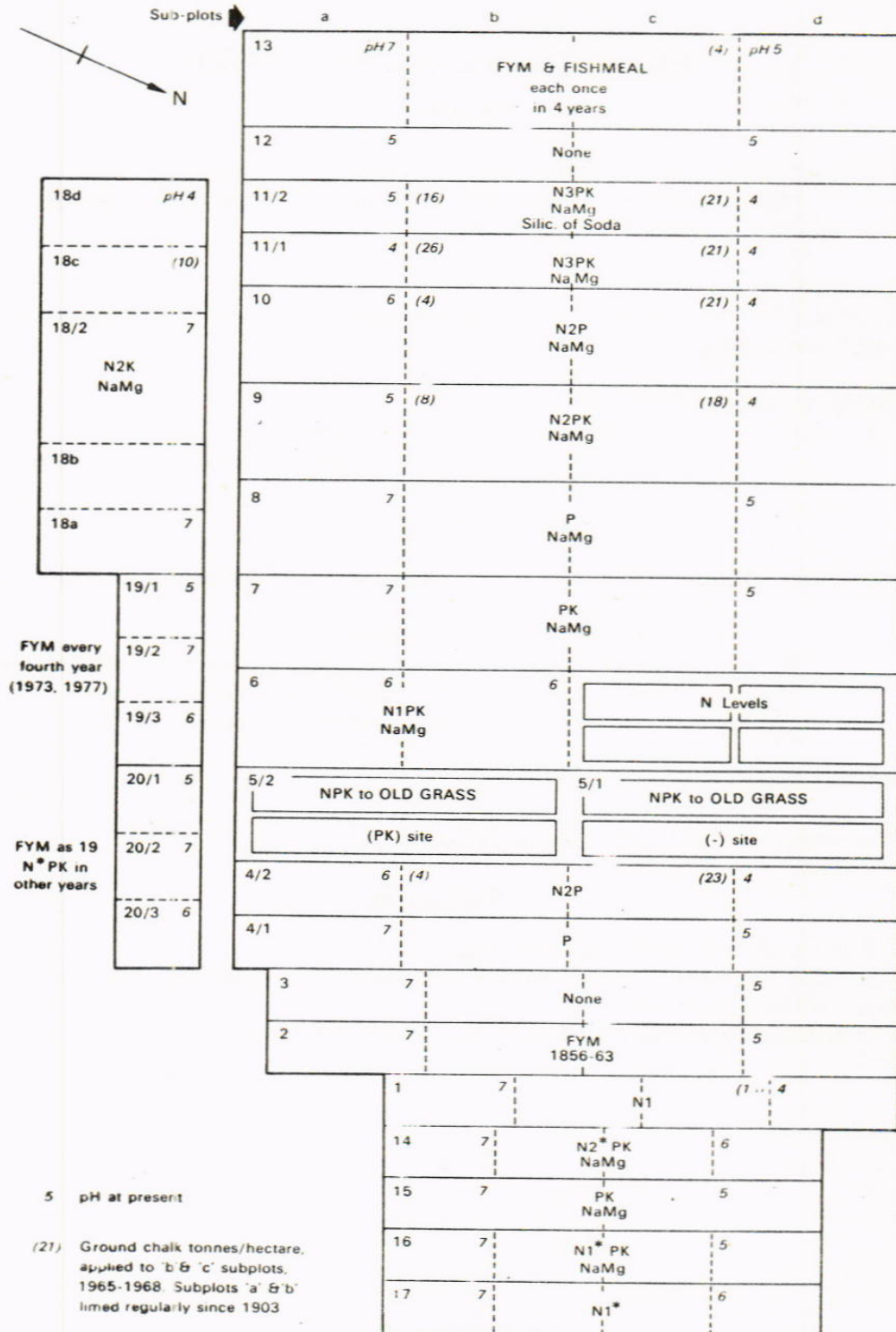
Area harvested. 0.03000

Soil Series. Batcombe with small area of Hook series.

Reference

Johnston, A.E., Warren, R.G. and Penny A. (1970)
The value to arable crops of residues accumulated from superphosphate and from potassium fertiliser.
Rothamsted Experimental Station. Report for 1969, Part 2, 39-90.

PARK GRASS



PARK GRASS

(R/PG/5)

The manuring, liming and general management of this experiment has continued as set out in *Details 1967*, pp 35-39, but the rates of application are given for convenience in metric terms.

Symbols, materials and rates of application

Manures applied annually except where indicated.

| | |
|-----------------------------------|---|
| N1, N2, N3: | Sulphate of ammonia to supply 48, 96, 144 kg N |
| N1 ^x , N2 ^x | Nitrate of soda to supply 48, 96 kg N |
| P | Powdered superphosphate (approx. 20% P ₂ O ₅) to supply 34 kg P (except plot 20) |
| K | Sulphate of potash (approx. 50% K ₂ O) to supply 224 kg K (except plot 20) |
| Na | Sulphate of soda (approx. 14% Na) to supply 16 kg Na |
| Mg | Sulphate of magnesia (approx. 10% Mg) to supply 11 kg Mg |
| Si | Silicate of soda at 448 kg water soluble powder |
| FYM | 35 t farmyard manure every fourth year (applied autumn 1968 and 1972) |
| F | Fish meal (about 6.5% N) to supply 63 kg N every fourth year (applied autumn 1970) |
| P, K, Na, Mg | applied in winter |
| N1, N2, N1 ^x | applied in one dressing about March |
| N2 ^x | Half in March and half in April/May |
| N3 | Two-thirds applied in March and one-third in April/May |

NOTES: Plot 20: In the three years between applications of FYM mineral fertilisers are applied: 30 kg N (as nitrate of soda), 17 kg P (as superphosphate) and 45 kg K (as muriate of potash)

Plots 5-1, 5-2, 6-N were used for microplot experiments during the period (see 'NPK to Old Grass' and 'N levels to Old Grass')

Plot 6-S: Excluded during the period 1965-71 and used for microplot experiments 1967-70 (simulated grazing R/CS/23; received PKNaMg 1965-71 as previous to 1965). Received N1 in 1972 and N1PKNaMg in 1973.

Liming.

Ground chalk (t CaCO₃)

| Sub-plots | Dec. 1967 | | | Nov. 1971 |
|------------|-----------|------|------|-----------|
| | a | b | c | a |
| 1 | 2.00 | — | 3.14 | 2.00 |
| 2, 3, 4/1 | 2.00 | — | — | 2.00 |
| 4/2 | 2.00 | 1.26 | 5.65 | — |
| 7/8 | 2.00 | — | — | 2.00 |
| 9 | 2.00 | 2.51 | 4.39 | 2.00 |
| 10 | 2.00 | 1.26 | 5.02 | — |
| 11/1 | 4.00 | 6.28 | 5.02 | — |
| 11/2 | 4.00 | 3.77 | 5.02 | — |
| 13 | 2.00 | — | 1.26 | 2.00 |
| 14, 16, 17 | 2.00 | — | — | 2.00 |

| | Dec. 1967 | | | Nov. 1971 | |
|-------------|-----------|------|---|-----------|------|
| | a | b | c | | a |
| 18 | | 1.14 | — | 2.51 | 1.14 |
| Whole plots | | | | | |
| 5/1 | | 6.15 | | | — |
| 5/2 | | 5.53 | | | — |
| 6 | | 7.53 | | | — |
| 1 | | — | | | — |
| 15 | | — | | | — |
| 18/2 | | 1.14 | | | 1.14 |
| 19, 20 | | 1.14 | | | — |

Soil series. Batcombe series

References

1. Edwards, C.A., Butler, C.G. & Lofty, J.R. (1976)
The Invertebrate Fauna of the Park Grass Plots II. Surface fauna.
Rothamsted Experimental Station, Report for 1975, Part 2, 63-89.
2. Edwards, C.A. & Lofty, J.R. (1976)
The Invertebrate Fauna of the Park Grass plots I. Soil fauna.
Rothamsted Experimental Station. Report for 1975, Part 2, 133-54.
3. Johnston, A.E. (1972)
Changes in the soil properties caused by the new liming scheme on Park Grass.
Rothamsted Experimental Station, Report for 1971, Part 2, 177-80.
4. Nutman, P.S. & Ross, G.J.S. (1970)
Rhizobium in the soils of the Rothamsted and Woburn Farms.
Rothamsted Experimental Station. Report for 1969, Part 2, 148-67.
5. Williams, E.D. (1974)
Changes in yield and botanical composition caused by the new liming scheme on Park Grass.
Rothamsted Experimental Station. Report for 1973, Part 2, 67-73.

AGDELL
RESIDUAL EFFECTS OF P AND K
(R/AG/6)

The cropping and management in 1968 and 1969 continued the pattern set in 1964 when large fresh dressings of P and K were applied to the sub-plots of both grass and fallow areas (*Details 1967*, pp 26-27. Note that the heading in Table 7 p. 27 should read 1920-51 and not 1920-53).

In 1970 a further scheme was introduced with annual applications of P (1970-72) and K (1973-75) to a three-course rotation of sugar beet, barley, potatoes (two crops present each year).

An outline of the layout of the plots from 1958 onwards is set out in the diagram on pages 22 and 23 to show the changes in plot boundaries and the relationship of the successive treatments. Details of treatments between 1958 and 1967 are given on pages 25-27 of *Details 1967*.

Detailed treatments 1968-73

(1) *P test half plots*

(a) 1968-69 – Half fallow, half Timothy (S 51 sown 1964) 3 dressings of 100 kg N applied each year to the grass. P and K applied each autumn or early winter to replace removals in grass the previous year, except that plots without fresh P in 1964 continued to receive none to measure the release of P residues accumulated during 1848-1951.

(b) 1970-72 – Effects of different amounts of soil P were tested in a three-course rotation – sugar beet, barley, potatoes, starting with sugar beet and barley. Fresh P was tested on the sub-plots cumulatively.

| | |
|------------|-----------------|
| Barley | None v. 27 kg P |
| Sugar beet | None v. 55 kg P |
| Potatoes | None v. 82 kg P |

Basal manuring. Sugar beet: 190 kg N; 260 kg K as muriate of potash; 60 kg Mg as kieserite.

Barley: 95 kg N, 50 kg K as (25-0-16).

Potatoes: 250 kg N, 210 kg K, 60 kg Mg – materials as for sugar beet.

(c) 1973 – Rotation ended, barley grown testing residues of P applied in 1964 and 1970-72 with a fresh N test applied in strips of sixty-fourth plots.

| | |
|----|---------|
| N1 | 63 kg N |
| N2 | 95 kg N |

(2) *K test half plots*

(a) 1968-70 – Half-fallow, half Timothy (S 51 sown 1964). 100 kg N applied three times in 1968 and 1969, twice in 1970 to the grass.

Balancing P and K applied each autumn or winter to replace removals in grass, except that plots without fresh K in 1964 continued to receive none to measure the recovery of K residues accumulated during 1848-1951 and the release of soil K.

- (b) 1971-72 – The whole area was fallowed in 1971 and cropped with oats in 1972.

Standard applications: Oats – 75 kg N, 14 kg P as (30-13-0)

- (c) 1973 – The three-course rotation commenced with sugar beet and barley.

K treatments applied in first year of rotation.

Barley None v. 50 kg K
Sugar beet None v. 257 kg K

Standard applications: Sugar beet: 190 kg N, 55 kg P as granular superphosphate, 60 kg Mg as kieserite.

Barley: 95 kg N, 18 kg P as (30-13-0).

(3) *Compensatory dressings of P and K*

Dressings of triple superphosphate and muriate of potash were applied to compensate for the removals in the grass during the years 1964-69 from the P plots and 1964-70 from the K plots. Dressings were normally applied annually to compensate for the removals during the previous season but in the period 1965-67 certain adjustments between years were made. (For details see *Results 1965 to 1970*).

No phosphate was applied to the PO plots and No K to the KO plots throughout the period.

The total removed and replaced (except on the PO and KO plots) were:

| Plot | P (kg/ha) | | | | | | | |
|------|---------------------|-----|-----|-----|---------------------|-----|-----|-----|
| | Sub-plots testing P | | | | Sub-plots testing K | | | |
| | P0 | P1 | P2 | P4 | K0 | K1 | K2 | K4 |
| 1 | (102) | 165 | 175 | 186 | 157 | 194 | 200 | 200 |
| 2 | (68) | 139 | 158 | 162 | 134 | 188 | 198 | 198 |
| 3 | (67) | 147 | 148 | 175 | 148 | 171 | 176 | 175 |
| 4 | (48) | 122 | 127 | 151 | 160 | 189 | 177 | 190 |
| 5 | (38) | 111 | 128 | 144 | 126 | 163 | 162 | 167 |
| 6 | (22) | 117 | 133 | 149 | 125 | 171 | 169 | 169 |

| Plot | K (kg/ha) | | | | | | | |
|------|---------------------|------|------|------|---------------------|------|------|------|
| | Sub-plots testing P | | | | Sub-plots testing K | | | |
| | P0 | P1 | P2 | P4 | K0 | K1 | K2 | K4 |
| 1 | 1398 | 1694 | 1664 | 1678 | (689) | 1453 | 1601 | 1787 |
| 2 | 1020 | 1481 | 1611 | 1532 | (493) | 1378 | 1631 | 1798 |
| 3 | 974 | 1525 | 1471 | 1576 | (612) | 1429 | 1441 | 1619 |
| 4 | 736 | 1387 | 1313 | 1451 | (707) | 1461 | 1509 | 1732 |
| 5 | 543 | 1303 | 1381 | 1449 | (485) | 1291 | 1423 | 1647 |
| 6 | 371 | 1311 | 1371 | 1379 | (448) | 1378 | 1363 | 1549 |

Liming

In the autumn of 1969 plots 1 and 2 and the south halves of plots 3 (P test) and 4 (K test) received ground chalk at 3 t

Cropping and Weed Control

(1) Varieties

| | |
|-------------|--|
| Sugar beet: | Klein E |
| Barley: | Julia (dressed with ethirimol 1973) |
| Potatoes: | King Edward, once grown Rothamsted paracrinkle-free seed, chitted. |
| Oats: | Manod |

(2) Weedkillers

| | |
|-----------|--|
| Potatoes: | 1971 and 1972: Linuron with paraquat |
| Oats: | 1972: Bromoxynil, ioxynil, dichloroprop and MCPA |
| Grass: | 1968: Ioxynil with mecoprop. |

Other Chemicals applied

| | |
|-------------|---|
| Sugar Beet: | 1970 and 1972: Menazon, 1972: pyrethrum |
| Potatoes: | 1971 and 1972: Menazon and mancozeb, 1972: captafol |

Areas harvested

| | |
|-------------|-------------------|
| Grass: | 0.00081 – 0.00186 |
| Barley: | 0.00061 – 0.00087 |
| Sugar beet: | 0.00077 |
| Potatoes: | 0.00069 |

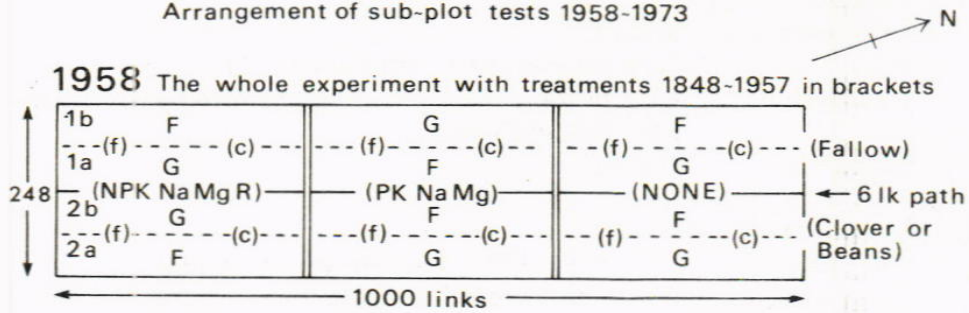
Soil series Winchester and shallow Batcombe series

References

1. Johnston, A.E., Warren, R.G., and Penny, A. (1970)
The value to arable crops of residues accumulated from superphosphate and from potassium fertiliser.
Rothamsted Experimental Station. Report for 1969, Part 2, 39-90.
2. Johnston, A.E., & Penny, A. (1972)
The Agdell Experiment 1848-1970.
Rothamsted Experimental Station. Report for 1971, Part 2, 38-68.
3. Johnston, A.E., & Mitchell, J.D.D. (1974)
Potassium in soils from the Agdell experiment.
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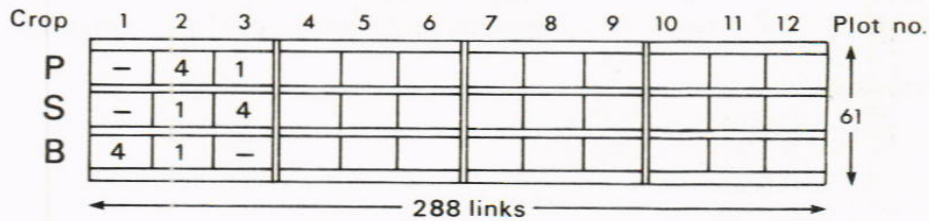
AGDELL

Arrangement of sub-plot tests 1958-1973

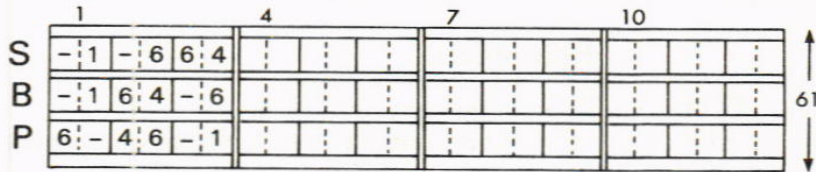


1959-63 Details of sub-plots on plot 1b (one replicate only shown)

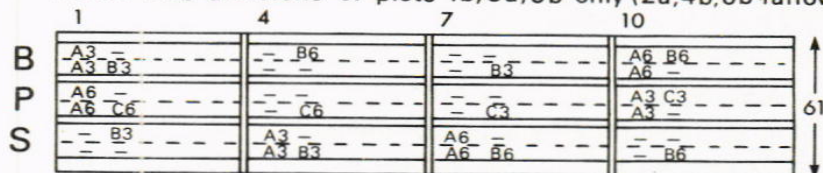
1959



1960



1961 Sub divisions of plots 1b, 3a, 5b only (2a, 4b, 6b fallowed)

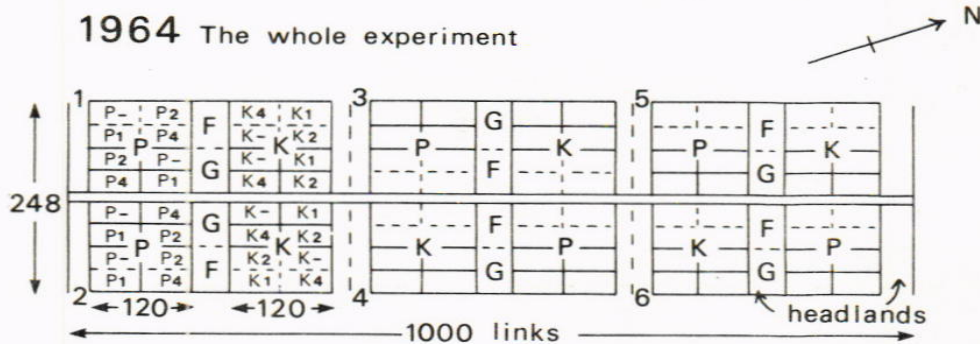


1962 Plots 2a, 4b, 6b sub divided as above (1b, 3a, 5b fallowed)

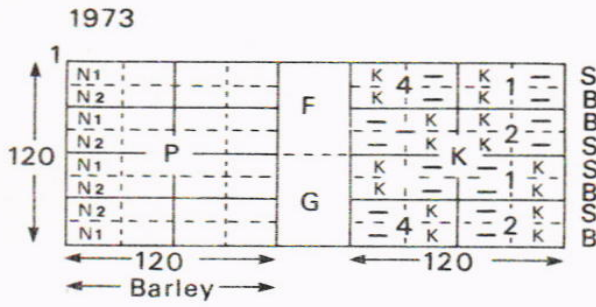
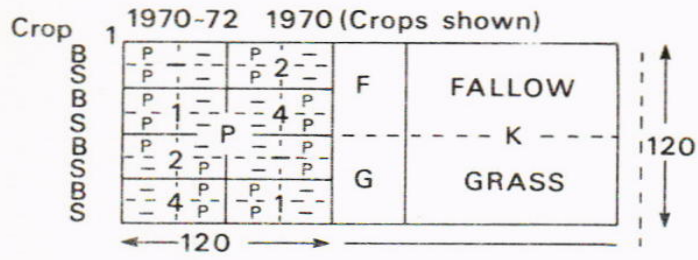
1963 All plots fallowed

(1958-63 G plots remained in grass)

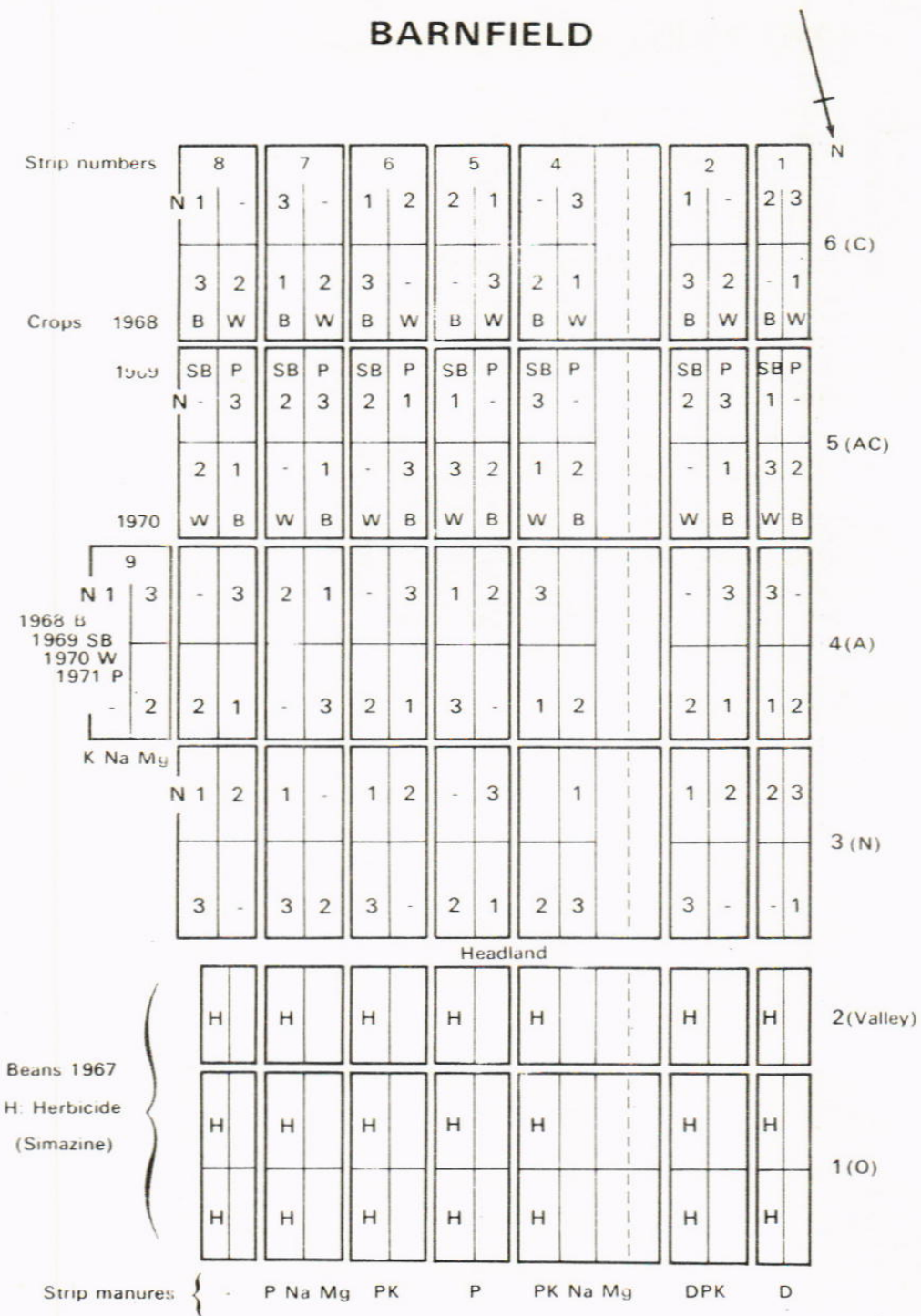
1964 The whole experiment



1970~73 Details of sub-plots on plot 1



BARNFIELD



BARNFIELD

(R/BN/7)

Mangolds were grown on all plots from 1876 to 1959; in addition sugar beet was grown on part of each plot from 1946. In the period 1960-67 the field was fallowed or cropped with mangolds and potatoes, and finally with beans in the year before the introduction of a new cropping scheme in 1968 (*Details 1967*, p 31).

The area known as The Valley, some 30 m deep between Series O and N, had been unmanured until 1967. The following season 18.5 m adjacent to Series O were brought into the manured area of each strip and included in the new scheme. The Series were therefore redesignated Sections and numbered as follows:

Section 1 (Series O), 2 (Valley), 3 (Series N), 4 (Series A)
5 (Series AC), 6 (Series C)

In the period 1968-73 beans were grown continuously on Sections 1 and 2 without fertiliser nitrogen but with the traditional strip manures. On the rest of the field a four-course rotation was followed – potatoes, barley, sugar beet, spring wheat, with only two phases present (on half strips) each year. The rotation and a new test of N at four rates were designed to test cumulative effects of the traditional strip manures and the residual effects of the Series manures, particularly of castor meal, which were discontinued in 1968.

Treatments to Sections

In Sections 1 and 2 plots were split lengthways and in Section 1 also across for a test (unrandomised) of simazine at 0 v. 1.12 kg. Three combinations of treatments have been tested:

| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 |
|-------|------|------|------|------|------|------|------|
| (i) | + | – | – | – | – | + | – |
| (ii) | + | + | + | – | + | – | + |
| (iii) | + | + | + | + | – | – | + |

On Section 1 treatment (i) was duplicated, Section 2 had treatments (i) and (ii) only. Mechanical cultivation was used to control weeds on sub-plots without simazine.

In Sections 3-6 each plot was split lengthways into two to carry two crops of the four-course rotation, barley and wheat one year, potatoes and sugar beet the following. Each half plot was further split breadthways into two and received two of the four N rates which were applied cumulatively. Each whole plot had the four N rates each year, NO and N2 on one crop, N1 and N3 on the other. In each crop on any one strip Sections 3 and 6 (without and with the castor meal residues respectively) had the same two rates of N, Sections 4 and 5 (without and with castor meal residues) the other two. In each crop on any one section strips 1, 4 and 5 had the same two rates of N, and strips 2, 6, 7 and 8 the other two (see diagram).

Strip 3, which was discarded from the experiment in 1903 as it was very narrow, has carried the same crops as the adjacent half of strip 4 and was manured at the discretion of the Head of Farms. Parts of this strip in Sections 1 and 2 have been used for experiments on the chemical control of soil-borne pathogens of beans (*Yields 70/R/BE/7, 71/R/BE/1, 72 and 73/R/CS/82*).

Plot 9 carried only one phase of the four-course rotation starting with barley in 1968. It was also divided into quarter plots to which the four rates of N are applied to each crop.

NOTE: From 1974 certain changes were made to the strip manures and most of the field (except Sections 1 and 2) was bare fallowed in preparation for a new long-term scheme.

Manuring up to 1973

The seven strip treatments (1, 2, 4, 5, 6, 7 and 8) which have been basically unchanged since 1876 have been continued:

Annual dressings per hectare

(1) *Minerals*

- P Powdered superphosphate (approx. 20% P₂O₅) to supply 34 kg P.
K Sulphate of Potash (approx. 50% K₂O) to supply 224 kg K.
Na Sodium chloride (agricultural salt approx. 39% Na) to supply 90 kg Na.
Mg Sulphate of magnesia (approx. 10% Mg) to supply 22 kg Mg.

(2) *Organic*

FYM 35 t farmyard manure. Castor meal no longer applied.

(3) *Nitrogen*

N0, N1, N2, N3 'Nitro-Chalk' to supply 0, 48, 96, 144 kg N applied cumulatively to barley and wheat, 0, 72, 144, 216 kg N to potatoes and sugar beet cumulatively. No N is applied to the beans.

(4) *Application*

P, K, Na, Mg and FYM are applied in autumn before ploughing. N applied just before or soon after sowing cereals, before planting potatoes and before sowing sugar beet (except 1969 shortly after sowing).

Treatment to strips

| | |
|--------|--------|
| 1 | D |
| 2 | DPK |
| 4 | PKNaMg |
| 5 | P |
| 6 | PK |
| 7 | PNaMg |
| 8 | None |
| Plot 9 | KNaMg |

Liming

None applied in period 1968-73.

Cropping, varieties and weed control

(1) Cropping sequences

| Sections 1 and 2 | Continuous spring beans | |
|------------------|---------------------------------------|----------------------------|
| Sections 3 – 6 | Eastern half of each strip and Plot 9 | Western half of each strip |
| 1968 | B | SW |
| 1969 | SB | P |
| 1970 | SW | B |
| 1971 | P | SB |
| 1972 | B | SW |
| 1973 | SB | P |

B = barley, SB = sugar beet, SW = spring wheat, P = potatoes

(2) Varieties and treatment of seed

Spring beans: Maris Bead uninoculated sown at 220 kg (seed was inoculated with Rhizobium in 1967)

Barley: 1968 Maris Badger, 1970 and 1972 Julia (dressed with carboxin 1970, ethirimol 1972) sown at 160 kg.

Spring wheat: Kolibri.

Sugar beet: Klein E. sown at 9.0 kg in 1969, 5.6 kg in 1971.

Potatoes: King Edward, once grown chitted paracrinkle free.

(3) Weedkillers

Weedkillers were applied in autumn as follows:

| | | |
|----------------------|------------------------------------|----------|
| Beans 1969: | Diquat | } in |
| Beans 1970: | Strips 1 and 2 only) Paraquat | |
| Beans 1971, 1972: | Paraquat | } autumn |
| Potatoes 1969, 1971: | Paraquat and linuron | |
| Spring wheat and | Dicamba with mecoprop | |
| Barley 1972: | and MCPA | |
| Sugar beet 1969: | (Strips 1 and 2 only) Phenmedipham | |

Other chemicals applied

| | | |
|-------------|---------------------|------------------|
| Beans: | 1969-71 and 1973 | Demeton-S-methyl |
| | 1968 and 1972 | Phorate |
| Potatoes: | 1969, 1971 and 1973 | Mancozeb |
| | 1969 and 1973 | Demeton-S-methyl |
| Sugar beet: | 1969, 1971 | Demeton-S-methyl |

Plot size

The original classical plots as used till 1959 ranged from 0.060 to 0.081 ha.

The areas harvested from 1968 were:

| | |
|--|---------|
| Wheat and barley (quarter plots): | 0.00781 |
| Beans (half plots): Section 1: 1968, 1969: | 0.00147 |
| 1970-73: | 0.00878 |
| Potatoes (quarter plots): | 0.00390 |
| Sugar beet (quarter plots) 1969, 1971: | 0.00130 |
| 1973: | 0.00098 |

Soil series

Winchester & shallow Batcombe series with small area of Charity Complex (Valley)

References

1. Avery, B.W. et al. (1972)
The soil of Barnfield
Rothamsted Experimental Station. Report for 1971, Part 2, 5-37.
2. Nutman, P.S. & Ross, G.J.B. (1970)
Rhizobium in the soils of Rothamsted and Woburn Farms.
Rothamsted Experimental Station. Report for 1969, Part 2, 148-167.

GARDEN CLOVER

MANOR GARDEN

(R/GC/8)

In 1968, after a number of tests in the period 1854-1967 (*Details 1967*), the area was divided into four to test all combinations of:

Nitrogen 0 v. 126 kg N per cut
Magnesium 0 v. 112 kg Mg per annum

N as 'Nitro-Chalk 21', Mg as Epsom Salts ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$), half in winter, half in summer.

In 1973, these tests being completed, a corrective dressing of Mg was applied to plots which had not previously received any and the whole area received basal N, P, K, Mg.

Basal manuring

1968-73 33 kg P, 125 kg K as (0-14-28) in winter, 62 kg K as muriate of potash, after each cut except the last.
and in 1973 only 130 kg N per cut, 110 kg Mg as Epsom Salts (half in winter after digging, half after first cut) in addition to corrective Mg.

Corrective Magnesium 1973

500 kg Mg as Epsom salts: 335 kg before digging in winter, 110 kg in winter after digging, 55 kg after first cut.

Liming 1973

Plots 2 and 4 (those receiving N1 1968-72) 2.5 t calcium carbonate as ground chalk, half before and half after digging.

Plots 1 and 3 (N0) 1.7 t calcium carbonate applied as above.

Cropping

The S 123 red clover sown in 1967 was retained in 1968, each year thereafter a fresh seeding of English Broad Red Clover was made in April. Two cuts were taken in 1968 and three each year subsequently.

Area harvested

0.00007 – 0.00010

Soil series. Disturbed soil

Rothamsted Garden Clover

Yield of dry matter (t) 1968-72

| | -- | N - | - Mg | NMg | Mean |
|------|------|------|------|------|------|
| 1968 | — | — | 4.35 | 3.95 | — |
| 1969 | 3.14 | 3.16 | 2.38 | 3.00 | 2.92 |
| 1970 | 3.99 | 3.56 | 4.87 | 5.47 | 4.47 |
| 1971 | 4.74 | 6.36 | 7.11 | 6.81 | 6.25 |
| 1972 | 3.14 | 3.58 | 4.62 | 5.47 | 4.20 |
| Mean | 3.75 | 4.17 | 4.75 | 5.19 | 4.46 |

SAXMUNDHAM

ROTATION I

(S/RN/1)

The four-course rotation of wheat, sugar beet, barley and beans was continued until the 1969 harvest. In 1970 the northern half of each plot was sown to lucerne and the southern (including the small plots of 5.5 m at the extreme southern end carrying the old treatments) to a timothy, meadow fescue mixture. The treatments first applied in 1966 (*Details 1967*, p.54) and the old treatments as modified in 1966 have been continued over the period 1968–73 with the exception of the rates of nitrogen.

NOTE: The following amendments should be made to the information given in *Details 1967*, p. 54. The P and K dressings should be regarded as an average of the period 1899-1965 rather than the original rates and the amount of P₂O₅ as 0.32 cwt rather than 0.3 cwt.

The second period started with the 1966 harvest and not 1965 as stated and the phosphate dressings were applied as triple superphosphate from that date.

Symbols, materials and rates of application

The treatments up to 1965 were based on a fixed weight of the fertiliser and did not allow for changes in composition over the years. (See reference 1 for an estimate of the average composition.) In 1966 in introducing the new treatments certain new fertilisers were substituted for those used previously and all applications were based on stated amounts of nutrients except for bone meal which was applied at the old rate.

| Symbol | Material | Treatments to 1965 | Old Treatments 1966 onwards | New Treatments 1966 onwards |
|--------|-----------------------|--------------------|-----------------------------|-----------------------------|
| D | Farmyard Manure | 15 t | 30 t | 30 t |
| B | Bone meal | 500 kg | 500 kg | 500 kg |
| N | Nitrate of soda | 250 kg | | |
| | 'Nitro-Chalk' | | 38 kg N | |
| N1, N2 | 'Nitro-Chalk' | | | 126 kg N 189 kg N* |
| P | Superphosphate | 250 kg | | |
| | Triple superphosphate | | 22 kg P | |
| P1:P2 | Triple superphosphate | | | 22 kg P 44 kg P |
| K | Muriate of potash | 125 kg | 63 kg K | |
| K+ | Muriate of potash | | | 104 kg K |

* 1968 and 1969

For full details see Reference 2 Table 6

Treatments 1966 onwards

| Plot | Old Treatments | New Treatments |
|------|----------------|----------------|
| 1 | D | D+N |
| 2 | B | B |
| 3 | N | N2P2 |

| | | |
|----|------|--------------------|
| 4 | P | N1P1 |
| 5 | K | N1P2K ⁺ |
| 6 | None | N1P2 |
| 7 | PK | N1P1K ⁺ |
| 8 | NK | N2P2K ⁺ |
| 9 | NP | N2P1 |
| 10 | NPK | N2P1K ⁺ |

NOTES :

- (i) Crops other than beans in FYM plots also received 63 kg N from 1967 onwards.
- (ii) Under the new treatments beans in plots 3, 8, 9 and 10 only received nitrogen and at N¹/₂ (63 kg).
- (iii) In 1969 the sugar beet previously receiving N2P2 and N2P1K⁺ (Plots 3 and 10) received a further top dressing of 63 kg N.
- (iv) In 1970 FYM was applied at 60 t and no more will be applied until the grass or lucerne is ploughed up.
- (v) Arable crops. As a result of the marked response by crops to nitrogen in 1967 the N1 rate (except beans and plots receiving FYM) was raised to 126 kg N in 1968 and 1969 and the N2 plots were given a top dressing of 63 kg N in addition to the N1 rate at a time decided on by periodical tissue analyses. Therefore the rates of N1 v. N2 became 1 v. 1½.
- (vi) Grass and lucerne. No N has been applied to lucerne. In 1970-73 nitrogen was applied for each cut of grass; 100 kg N to all large plots and 38 kg to N-treated small plots except in 1970 when all small plots received a dressing of 38 kg N in the autumn to aid establishment. One cut of lucerne but none of the grass were taken in 1970. Subsequently there were three cuts in 1971 and two in 1972 and 1973 of both grass and lucerne.

Varieties

| | 1968 | 1969 |
|--------------|--|------------|
| Winter wheat | Cappelle | Cappelle |
| Barley | Zephyr | Sultan |
| Beans | Maris Bead | Maris Bead |
| Sugar beet | Klein E | Klein E |
| Grass | Timothy S 352 and Meadow Fescue S 215 sown in equal proportions by weight in 1970. | |
| Lucerne | Europe | |

Weedkillers

| Year | Crop | Weedkiller |
|-------------|--------------|---------------------|
| 1968 & 1969 | Sugar beet | Pyrazone |
| | Barley | Mecoprop with 2,4-D |
| | Winter wheat | Mecoprop with 2,4-D |
| | Beans | Simazine |
| 1970 | Grass | 2,4-D |

Insecticides

| Crop | Year | Insecticide |
|------------|------|------------------|
| Sugar beet | 1968 | DDT |
| | 1969 | Demeton-S-methyl |
| Beans | 1969 | Demeton-S-methyl |

Areas harvested

| | Old Treatments | New Treatments |
|------------------------------|----------------|-------------------|
| Wheat, barley, beans 1968-69 | 0.00057 | 0.00931 – 0.0104 |
| Sugar beet 1968-69 | 0.00068 | 0.00291 – 0.00388 |
| Lucerne 1970-73 | – | 0.00106 – 0.00139 |
| Grass 1971-73 | 0.00050 | 0.000028–0.00145 |

Soil series. Beccles series (slope phase).

References

1. Cooke, G.W. and Williams, R.J.B. (1972)
Problems with soil structure at Saxmundham.
Rothamsted Experimental Station. Report for 1971, Part 2, 122-142.
2. Williams, R.J.B. and Cooke, G.W. (1971)
Results of the Rotation I experiment at Saxmundham 1964-69.
Rothamsted Experimental Station. Report for 1970, Part 2, 68-97.
3. Williams, R.J.B. (1971)
The chemical composition of water from land drains at Saxmundham and Woburn and the influence of rainfall upon nutrient loss.
Rothamsted Experimental Station. Report for 1970, Part 2, 36-76.

SAXMUNDHAM

ROTATION II

(S/RN/2)

Third period, 1969 onwards

The study of the residues of superphosphate and FYM applied from 1899 to 1964 which commenced in 1965 was completed with the barley crop of 1968 (*Details 1967*, pp 56-57). Between 1969 and 1973 the effects of these residues and those of dressings of phosphate and FYM applied in the years 1965-67 were measured (no dressings were applied in 1968). Each treatment strip was divided into five plots and cropped in a rotation of potatoes, barley, sugar beet, barley, as shown below.

In 1973 a fresh experiment testing annual and triennial dressings of P fertiliser was started on plots growing sugar beet and potatoes, to be followed by two crops of barley; the same sequence on the other two plots commenced in 1974.

The cropping sequence was therefore:

| | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 |
|--------------------|------|------|------|------|------|------|
| North block: North | B | P | B | SB | B | P |
| South | B | SB | B | P | B | SB |
| South block: North | B | B | P | B | SB | B |
| South | B | B | SB | B | P | B |

B = barley, P = potatoes, SB = Sugar beet

Treatments

| | | |
|-----------------------------|---------|---|
| (a) Barley | 1968-73 | No P |
| (b) Sugar beet and potatoes | 1969-72 | Each plot was divided into five sub-plots in 1969 and P0, P1, P2, P3 was applied cumulatively (P0 to two sub-plots per plot) |
| | 1973 | P0, P1, P3 (P3 duplicated in each plot). P1 will be applied to the P1 sub-plot in each of the next two barley crops to equal the P3 dressing. |

The plots were paired according to the P content of the soil in 1973 and the P treatments were allocated so as to balance the treatments up to 1967 and in the period 1969-72. (In 1974 the treatments were reversed as between crops.)

Potatoes 1973

| Plot No. | 1 | 2 | 3 | 8 | 4 | 6 | 5 | 7 |
|----------------------|---|---|----|------|----|----|------|----|
| Treatments 1899-1964 | 0 | D | DP | DP52 | DP | DP | DP | DP |
| Treatments 1965-67 | 0 | D | 0 | 0 | D2 | P1 | D2P1 | P2 |

P to potatoes and beet 1969 and 1971

| | | | | | | | |
|------------------------|----|-----|----|-----|----|-----|-----|
| | | ‘A’ | | ‘B’ | | | |
| | P0 | 0 | 0 | 0 | 0 | | |
| | P0 | P1 | P3 | P3 | P1 | | |
| | P1 | P3 | P1 | P1 | P3 | ‘A’ | ‘B’ |
| | P2 | P1 | P3 | P3 | P1 | | |
| | P3 | P3 | P1 | P1 | P3 | | |
| <i>Sugar beet 1973</i> | | ‘B’ | | ‘A’ | | ‘B’ | ‘A’ |

Symbols

| | | |
|-----------|--------|--|
| 1899-1964 | D = | 25 t FYM, 630 kg superphosphate (to 1920), 940 kg since 1921 applied every 4 years. |
| | DP52 = | 25 t FYM, 1260 kg superphosphate (to 1920), 1880 kg superphosphate since 1921 applied every 4 years to 1951 when manuring stopped. |
| 1965-67 | D2 = | 50 t FYM in 1966 and 1967; P1 = 82 kg P, P2 = 164 kg P annually. |
| 1969-72 | P1 = | 27.4 kg P, P2 = 54.8 kg P, P3 = 82.2 kg P as super- phosphate to potatoes and sugar beet. |

Basal applications (kg)

| | | N | K | Material |
|-------------|-------------|-----|-----|-------------------------------|
| Barley: | 1968 | 94 | 50 | (25-0-16) |
| | 1969 & 1970 | 125 | 67 | (25-0-16) |
| | 1971-73 | 100 | 53 | (25-0-16) |
| Potatoes: | 1969 | 250 | 210 | (25-0-16) + muriate of potash |
| | 1970 | 250 | 417 | (25-0-16) + muriate of potash |
| | 1971-73 | 250 | 448 | (25-0-16) + muriate of potash |
| Sugar beet: | 1969 | 190 | 314 | (25-0-16) + muriate of potash |
| | 1970 | 190 | 468 | (25-0-16) + muriate of potash |
| | 1971-73 | 190 | 415 | (25-0-16) + muriate of potash |

Varieties

| | | |
|-------------|-----------|---|
| Barley: | 1968 | Zephyr, |
| | 1969 | Sultan, |
| | 1970-73 | Julia (1973 dressed with ethirimol). |
| Potatoes: | 1969-73 | King Edward, once grown Rothamsted para- crinkle free seed, chitted. |
| Sugar beet: | 1969-1973 | Klein E |

Weedkillers

| | | |
|-------------|---------|-----------------------|
| Barley: | 1968-71 | Mecoprop with 2,4-D |
| | 1972-73 | Dichlorprop with MCPA |
| Potatoes: | 1969 | Linuron with paraquat |
| | 1970 | Linuron |
| | 1971-73 | Linuron with paraquat |
| Sugar beet: | 1969-70 | Pyrazone |

Other chemicals applied

| | | | |
|------------|----------|---------|------------------|
| Fungicides | Barley | 1972-73 | Tridemorph |
| | Potatoes | 1969 | Fentin hydroxide |

| | | | |
|-----------------------|-------------|-------------------|---------------------------------|
| | | 1970 | Captafol |
| | | 1971-73 | Mancozeb |
| Insecticides | Potatoes | 1969 | Dimethoate |
| | | 1970-73 | Menazon |
| | Sugar beet | 1969 | Dimeton-S-methyl and dimethoate |
| | | 1970 | Menazon |
| | | 1971-72 | DDT and menazon |
| | 1973 | Menazon | |
| Area harvested | | | |
| | Barley: | 0.00050 to 0.0060 | |
| | Potatoes: | 0.00078 | |
| | Sugar beet: | 0.00100 | |

Soil series. Beccles series (slope phase) and Beccles series (deeper phase).

Reference

1. Mattingley, G.E.G., Johnston, A.E. and Chater, Margaret (1970) The residual value of farmyard manure and superphosphate in the Saxmundham Rotation II Experiment 1899-1968. *Rothamsted Experimental Station. Report for 1969, Part 2, 91-112.*