

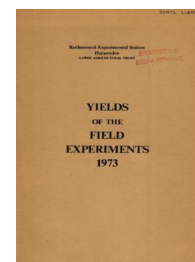
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Yields of the Field Experiments 1973

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73/W/RN/3 - Ley/ARABLE - Leys, Barley, Potatoes, Wheat

Rothamsted Research

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73/W/RN/3

LEY/ARABLE

Object: To compare the effects on soil fertility of rotations with or without three-year leys. The effects of the cropping systems on soil-borne pathogens are also studied - Woburn Stackyard D.

Sponsors: D.A. Boyd, J.M. Hirst, A.E. Johnston, F.G.W. Jones.

The 36th year, leys, potatoes, barley, wheat.

For previous years see 'Details' 1967, 68/B/2(t), 69/W/RN/3(t), 70/W/RN/3(t), 71/W/RN/3(t) and 72/W/RN/3(t).

Design: 5 series of 8 plots, split for treatments other than rotations.

Whole plot dimensions: 8.53 x 40.7. Areas harvested: Wheat, 0.00260, Barley, 1st treatment crop: 0.00570, 3rd treatment crop: 0.00601, Potatoes, 1st treatment crop: 0.00130, 1st test crop (Ley and Sainfoin): 0.00260, 1st test crop (Arable and Arable H): 0.00130.

| | |
|---|--------------------|
| Treatments: All phases of four five-course rotations are present: | ROTATION |
| Grass/clover ley: L, L, L, P, W | Ley |
| All legume ley: SA, SA, SA, P, W until 1971 then CL, CL, CL, P, W | Sainfoin Clover |
| Arable: P, R, C, P, W until 1971 then P, B, B, P, W | Arable |
| Arable with hay: P, R, H, P, W until 1971 then P, B, H, P, W | Arable H |

P = potatoes, R = rye, C = carrots, W = wheat, B = barley, H = hay, L = grass/clover ley, SA = sainfoin ley, CL = red clover ley

Additional treatments to first test crop, potatoes:-

| | | |
|------------------------|---|----------|
| 1/2 plots: | 1. Farmyard manure residues, last applied 1963: | FYMRES63 |
| | None | None |
| | 38 tonnes on each occasion | FYM |
| 1/4 plots | 2. Fumigant residues, applied 1970: | FUMRES70 |
| (AH, A rotations only) | None | None |
| | Chloropicrin, 448 kg | Chlorop |

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| | | |
|---|--|----------|
| 1/4 plots (L,S) 1/8 plots (A, AH) | 3. Fumigant applied in 1973:- | FUM73 |
| | None | None |
| | Chloropicrin, 448 kg, plus aldicarb, 6.7 kg | Chlor/al |
| Additional treatments to second test crop, winter wheat:- | | |
| 1/2 plots | 1. Farmyard manure residues, last applied 1967:- | FYMRES67 |
| | None | None |
| | 38 tonnes on each occasion | FYM |
| 1/4 plots (A,AH only) | 2. Fumigant residues, applied 1969:- | FUMRES69 |
| | None | None |
| | Chloropicrin, 448 kg | Chlorop |
| 1/4 plots (L,S) 1/8 plots (A,AH) | 3. Fumigant residues, applied 1972:- | FUMRES72 |
| | None | None |
| | Chloropicrin, 448 kg, plus aldicarb, 11 kg | Chlor/al |
| 1/8 plots | 4. Nitrogen fertiliser (kg N) in 1973:- | N73 |
| | None | 0 |
| | 63 | 63 |
| | 126 | 126 |
| | 189 | 189 |
| Additional treatments to first treatment crop, potatoes:- | | |
| 1/2 plots | 1. Farmyard manure residues, last applied 1966:- | FYMRES66 |
| | None | None |
| | 38 tonnes on each occasion | FYM |
| 1/8 plots | 2. Fumigant residues, applied 1971:- | FUMRES71 |
| | None | None |
| | Chloropicrin, 448 kg, plus aldicarb, 11 kg | Chlor/al |
| 1/4 plots | 3. Fumigant applied in 1973:- | FUM73 |
| | None | None |
| | Chloropicrin, 448 kg, plus aldicarb, 6.7 kg | Chlor/al |

NOTE: Chloropicrin was applied to plots 35, 36, 47 and 48 on 1/4 plots in error.

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Additional treatments to second treatment crop, barley:-

| | | |
|-----------|--|----------|
| 1/2 plots | 1. Farmyard manure residues, last applied 1965:- | FYMRES65 |
| | None | None |
| | 38 tonnes on each occasion | FYM |
| 1/4 plots | 2. Fumigant residues, applied 1972:- | FUMRES72 |
| | None | None |
| | Chloropicrin, 448 kg, plus aldicarb 5.6 kg | Chlor/al |

Additional treatments to third treatment crop, barley:-

| | | |
|-----------|--|----------|
| 1/2 plots | 1. Farmyard manure residues, last applied 1964:- | FYMRES64 |
| | None | None |
| | 38 tonnes on each occasion | FYM |

Corrective K dressings (in kg K₂O) as muriate of potash applied to first test crop, potatoes:-

| | No FYM half plots | FYM half plots |
|---|----------------------|-------------------|
| Continuous rotations | | |
| Ley | 502 | 502 |
| Clover | 126 | 126 |
| Arable with hay | 314 | 376 |
| Arable | 439 | 439 |
| Alternating rotations (last two rotations in order) | | |
| Ley/arable | 439 | 439 |
| Sainfoin/arable with hay | 439 | 502 |
| Arable/ley | 502 | 502 |
| Arable with hay/clover | 251 | 0 |

NOTE: For a fuller record of previous treatments see 'Details' 1967 etc.

Standard applications:-

Winter wheat: Manures: (0:20:20) at 300 kg. Magnesian limestone at 5 tonnes. Weedkillers: Paraquat at 0.56 kg ion in 280 l. Ioxynil at 0.52 kg plus mecoprop at 1.58 kg in 280 l.

Barley: Manure: (15:15:15) at 410 kg. Weedkiller: Ioxynil at 0.52 kg plus mecoprop at 1.6 kg in 280 l.

Potatoes, treatment and test crop: Manures: (13:13:20) at 1940 kg. Weedkiller: Linuron at 1.7 kg in 280 l. Fungicide with insecticide: Mancozeb at 1.3 kg plus demeton-s-methyl at 0.25 kg in 390 l. Fungicide: Mancozeb at 1.3 kg in 390 l on the first occasion and in 370 l on the second occasion.

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Hay: Manures: Nitrogen at 130 kg as 'Nitro-Chalk' plus (0:14:28) at 540 kg in spring, and (25:0:16) at 270 kg after the first cut.
Ley, 1st year: Manures: Nitrogen at 50 kg as 'Nitro-Chalk', P205 at 190 kg as superphosphate, K2O at 130 kg as muriate of potash in the seedbed. (25:0:16) at 360 kg divided between two equal applications.
Weedkiller: Benazolin with 2,4-DB and MCPA ('Legumex Extra' at 7.0 l in 280 l).

Lays, 2nd and 3rd years: Manures: (25:0:16) at 540 kg in three equal applications.

Clover 1st year: Manures: Nitrogen at 60 kg as 'Nitro-Chalk', P205 at 190 kg as superphosphate, K2O at 130 kg as muriate of potash.
Weedkiller: Benazolin with 2,4-DB and MCPA ('Legumex Extra' at 7.0 l in 280 l).

Clover, 2nd and 3rd years: Nitrogen at 60 kg as 'Nitro-Chalk', K2O at 190 kg as muriate of potash.

Varieties: Winter wheat: Cappelle, sown at 200 kg.

Barley: Julia, dressed with ethirimol, sown at 160 kg.

Potatoes: first test crop and treatment crop: Maris Piper.

Red clover: S123, sown at 45 kg.

Ley: Perennial ryegrass S23, Cocksfoot S143, late flowering red clover, Alsike clover, sown at 30 kg.

Cultivations, etc.: - Treatment crops:

Ley, 1st year: Deep-tine cultivated twice: 11 Sept, 1972, 18 Sept.

Ploughed: 2 Feb, 1973. Chloropicrin applied in error to plots in alternating rotation: 7 Feb. N, P and K applied, seeds sown: 20 Mar.

Weedkiller applied: 31 Mar. NK applied: 19 June. Cut once: 2 Aug.

NK applied: 16 Aug.

Ley, 2nd year: NK applied: 9 Mar, 1973, 2 July, 16 Aug. Cut twice: 23 June, 13 Aug.

Ley, 3rd year: NK applied: 9 Mar, 1973, 18 June, 16 Aug. Cut three times: 12 June, 2 Aug, 5 Nov.

Clover, 1st year: Deep-tine cultivated twice: 11 Sept, 1972, 18 Sept.

Ploughed: 2 Feb, 1973. Chloropicrin applied in error to plots in alternating rotation: 7 Feb. N, P and K applied, rolled, seed sown:

20 Mar. Weedkiller applied: 31 May. Cut: 2 Aug.

Clover, 2nd year: N applied: 9 Mar, 1973. K applied: 15 Mar. Cut twice: 23 June, 13 Aug.

Clover, 3rd year: NK applied: 9 Mar, 1973. Cut twice: 12 June, 2 Aug.

Potatoes, 1st treatment crop: Deep-tine cultivated twice: 11 Sept, 1972, 18 Sept. Ploughed: 2 Feb, 1973. Chloropicrin applied to continuous arable with hay plots: 7 Feb. Chloropicrin applied to plots in alternating rotations, previously omitted in error: 8 Mar. NPK applied, rotary cultivated: 9 Apr. Aldicarb applied: 16 Apr. Rotary cultivated,

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potatoes planted: 17 Apr. Weedkiller applied: 12 May. Grubbed: 1 June. Rotary ridged: 4 June. Fungicide with insecticide applied: 5 July. Fungicide applied twice: 26 July, 13 Aug. Sprayed with undiluted BOV at 220 l: 24 Sept. Lifted: 3 Oct.

Barley 2nd treatment crop: Deep-tine cultivated: 28 Sept, 1972. Spring-tine cultivated with crumbler: 9 Mar, 1973. Seed sown: 12 Mar. Seeds hay undersown (AH plots): 15 Mar. Weedkiller applied to plots not undersown: 11 May. Combine harvested: 13 Aug.

Barley, 3rd treatment crop: Deep-tine cultivated: 28 Sept, 1972. Ploughed: 29 Dec. Spring-tine cultivated with crumbler: 9 Mar. Seed sown: 12 Mar, 1973. Weedkiller applied: 11 May. Combine harvested: 13 Aug. Seeds Hay: Seeds undersown in barley: 26 Apr, 1972. N, P and K applied: 9 Mar, 1973. Cut twice: 12 June, 2 Aug. NK applied: 19 June.

Test Crops:

Potatoes, 1st test crop: Ploughed: 20 Sept, 1972. First half corrective K applied: 6 Oct. Second half corrective K applied: 1 Feb, 1973.

Chloropicrin applied: 7 Feb. NPK applied: 26 Mar. Deep-tine cultivated: 5 Apr. Aldicarb applied, all plots rotary cultivated, potatoes planted: 9 Apr. Weedkiller applied: 12 May. Grubbed: 1 June. Rotary ridged: 4 June. Fungicide with insecticide applied: 5 July. Fungicide applied: 26 July, 13 Aug. Haulm mechanically destroyed: 19 Sept. Sprayed with undiluted BOV at 220 l: 24 Sept. Lifted: 2 Oct.

Wheat, 2nd test crop: Deep-tine cultivated: 30 Sept, 1972. Magnesian limestone applied: 7 Oct. Seed sown: 20 Oct. Paraquat applied: 17 Nov. Seed resown because varieties mixed at first sowing: 24 Nov. N applied: 16 Apr, 1973. Ioxynil and mecoprop applied: 11 May. Combine harvested: 24 Aug.

NOTE: Soil samples were taken from the potato plots monthly throughout the growing season for counts of nematodes.

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TABLES OF MEANS

POTATOES 1ST TEST CROP

| | ROTATION | | | ROTATION | | |
|------------------------------|----------|----------|------|----------|----------|------|
| | Ley | Sainfoin | Mean | Arable | Arable H | Mean |
| TOTAL TUBERS: TONNES/HECTARE | | | | | | |
| FYMRES63 | | | | | | |
| None | 58.5 | 55.5 | 57.0 | 54.4 | 56.5 | 55.4 |
| FYM | 61.0 | 58.1 | 59.5 | 57.4 | 58.1 | 57.7 |
| FUM73 | | | | | | |
| None | 57.9 | 52.4 | 55.2 | 55.2 | 54.4 | 54.8 |
| Chlor/a1 | 61.5 | 61.1 | 56.8 | 56.6 | 60.1 | 58.4 |
| FUMRES70 | | | | | | |
| None | | | | 55.2 | 54.7 | 55.0 |
| Chlorop | | | | 56.5 | 59.9 | 58.2 |
| Mean | 59.7 | 56.8 | 58.3 | 55.9 | 57.3 | 56.6 |

PERCENTAGE WARE: 3.81 CM (1.5 INCH) RIDDLER

| | | | | | | |
|----------|------|------|------|------|------|------|
| FYMRES63 | | | | | | |
| None | 95.2 | 94.1 | 94.6 | 94.5 | 94.7 | 94.6 |
| FYM | 95.9 | 93.2 | 94.5 | 95.0 | 94.6 | 94.8 |
| FUM73 | | | | | | |
| None | 96.0 | 94.0 | 95.0 | 95.0 | 94.5 | 94.7 |
| Chlor/a1 | 95.0 | 93.2 | 94.1 | 94.6 | 94.8 | 94.7 |
| FUMRES70 | | | | | | |
| None | | | | 95.4 | 94.4 | 94.9 |
| Chlorop | | | | 94.1 | 94.9 | 94.5 |
| Mean | 95.5 | 93.6 | 94.6 | 94.8 | 94.7 | 94.7 |

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WHEAT 2ND TEST CROP

GRAIN: TONNES/HECTARE

| | ROTATION | | | ROTATION | | |
|-------------|----------|----------|------|----------|----------|------|
| | Ley | Sainfoin | Mean | Arable | Arable H | Mean |
| N73 | | | | | | |
| 0 | 5.17 | 4.59 | 4.88 | 4.91 | 5.16 | 5.03 |
| 63 | 4.77 | 4.19 | 4.48 | 4.64 | 4.75 | 4.70 |
| 126 | 3.84 | 3.38 | 3.61 | 4.00 | 4.06 | 4.03 |
| 189 | 3.16 | 2.76 | 2.96 | 3.28 | 3.47 | 3.37 |
| FUMRES67 | | | | | | |
| None | 4.22 | 3.76 | 3.99 | 4.22 | 4.34 | 4.28 |
| FYM | 4.25 | 3.70 | 3.98 | 4.19 | 4.37 | 4.28 |
| FUMRES72 | | | | | | |
| None | 4.32 | 3.77 | 4.04 | 4.39 | 4.41 | 4.40 |
| Chlor/al | 4.15 | 3.69 | 3.92 | 4.02 | 4.31 | 4.17 |
| FUMRES69 | | | | | | |
| None | | | | 4.20 | 4.31 | 4.25 |
| Chlorop | | | | 4.22 | 4.41 | 4.31 |
| Mean | 4.24 | 3.73 | 3.98 | 4.21 | 4.36 | 4.28 |
| Mean D.M. % | 34.8 | | | | | |

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WHEAT 2ND TEST CROP

STRAW: TONNES/HECTARE

| | ROTATION | | | ROTATION | | |
|-----------|----------|----------|------|----------|----------|------|
| | Ley | Sainfoin | Mean | Arable | Arable H | Mean |
| N73 | | | | | | |
| 0 | 4.75 | 4.11 | 4.43 | 4.44 | 4.69 | 4.57 |
| 63 | 5.33 | 4.37 | 4.85 | 5.16 | 4.76 | 4.96 |
| 126 | 5.23 | 4.90 | 5.06 | 5.43 | 5.11 | 5.27 |
| 189 | 5.22 | 5.16 | 5.19 | 4.76 | 5.09 | 4.93 |
| FYMRES67 | | | | | | |
| None | 5.01 | 4.60 | 4.80 | 5.14 | 4.78 | 4.96 |
| FYM | 5.25 | 4.67 | 4.96 | 4.76 | 5.05 | 4.90 |
| FUMRES72 | | | | | | |
| None | 4.92 | 4.70 | 4.81 | 5.18 | 5.00 | 5.09 |
| Chlor/al. | 5.35 | 4.57 | 4.96 | 4.72 | 4.83 | 4.77 |
| FUMRES69 | | | | | | |
| None | | | | 5.13 | 4.93 | 5.03 |
| Chlorop | | | | 4.77 | 4.90 | 4.83 |
| Mean | 5.13 | 4.64 | 4.88 | 4.95 | 4.91 | 4.93 |

Mean D.M. % 81.2

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POTATOES 1ST TREATMENT CROP

ROTATION

| | Ley | Sainfoin | Arable H | Arable | Mean |
|--|------|----------|----------|--------|------|
| TOTAL TUBERS: TONNES/HECTARE | | | | | |
| FYMRES66 | | | | | |
| None | 52.5 | 53.0 | 51.2 | 52.1 | 52.2 |
| FYM | 59.8 | 56.4 | 58.4 | 53.0 | 56.9 |
| FUMRES71 | | | | | |
| None | 55.5 | 54.1 | 52.5 | 50.1 | 53.1 |
| Chlor/al | 56.8 | 55.3 | 57.1 | 55.0 | 56.1 |
| FUM73 | | | | | |
| None | 55.8 | 53.1 | 50.3 | 47.3 | 51.6 |
| Chlor/al | 56.5 | 56.3 | 59.4 | 57.9 | 57.5 |
| None | 56.2 | 54.7 | 54.8 | 52.6 | 54.6 |
| PERCENTAGE WARE: 3.81 CM (1.5 INCH) RIDDLE | | | | | |
| FYMRES66 | | | | | |
| None | 92.3 | 93.5 | 94.9 | 94.2 | 93.7 |
| FYM | 93.8 | 92.7 | 94.4 | 93.5 | 93.6 |
| FUMRES71 | | | | | |
| None | 92.9 | 93.4 | 94.7 | 93.0 | 93.5 |
| Chlor/al | 93.1 | 92.9 | 94.6 | 94.7 | 93.8 |
| FUM73 | | | | | |
| None | 93.1 | 92.9 | 94.4 | 93.0 | 93.3 |
| Chlor/al | 92.9 | 93.4 | 94.9 | 94.7 | 94.0 |
| Mean | 93.0 | 93.1 | 94.6 | 93.9 | 93.7 |

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BARLEY 2ND TREATMENT CROP

ROTATION

| | Arable | Arable II | Ley | Sainfoin | Mean |
|-----------------------|--------|-----------|------|----------|------|
| GRAIN: TONNES/HECTARE | | | | | |
| FYMRES65 | | | | | |
| None | 3.61 | 3.97 | 4.73 | 5.31 | 4.40 |
| FYM | 4.18 | 4.47 | 5.19 | 5.07 | 4.73 |
| FUMRES72 | | | | | |
| None | 3.22 | 3.32 | 4.56 | 4.98 | 4.02 |
| Chlor/al | 4.58 | 5.12 | 5.36 | 5.40 | 5.11 |
| Mean | 3.90 | 4.22 | 4.96 | 5.19 | 4.57 |

STRAW: TONNES/HECTARE

| | | | | | |
|----------|------|------|------|------|------|
| FYMRES65 | | | | | |
| None | 2.30 | 3.45 | 3.11 | 3.86 | 3.18 |
| FYM | 2.77 | 3.23 | 3.90 | 3.73 | 3.41 |
| FUMRES72 | | | | | |
| None | 2.21 | 3.03 | 3.03 | 3.75 | 3.01 |
| Chlor/al | 2.86 | 3.65 | 3.98 | 3.84 | 3.58 |
| Mean | 2.53 | 3.34 | 3.51 | 3.80 | 3.29 |

Mean D.M. % Grain: 83.0
Straw: 92.9

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BARLEY 3RD TREATMENT CROP

ROTATION

| | Arable | Sainfoin | Mean |
|-----------------------|--------|----------|------|
| GRAIN: TONNES/HECTARE | | | |
| FYMRES64 | | | |
| None | 2.32 | 3.89 | 3.11 |
| FYM | 2.58 | 4.21 | 3.40 |
| Mean | 2.45 | 4.05 | 3.25 |

STRAW: TONNES/HECTARE

| | | | |
|----------|------|------|------|
| FYMRES64 | | | |
| None | 1.43 | 2.56 | 2.00 |
| FYM | 1.50 | 2.80 | 2.15 |
| Mean | 1.47 | 2.68 | 2.07 |

Mean D.M. % Grain 82.6
Straw 92.1