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ROTHAMSTED
RESEARCH

Report for 1934

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Continuous Rotation Experiments

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FOUR COURSE ROTATION EXPERIMENT, ROTHAMSTED

RESIDUAL VALUES OF HUMIC AND PHOSPHATIC FERTILISERS

For details, see 1932 Report, p. 127

MANURES APPLIED, SEASON 1933-4

| Treatment. | Organic Fertilisers (cwt. per acre) | | | | Additional Artificial Fertilisers (cwt. per acre). | | |
|------------|-------------------------------------|-------|------------------|-------------------------------|--|-------------------------------|---|
| | Organic Matter. | N. | K ₂ O | P ₂ O ₅ | N. as S. of A. | K ₂ O as Mur. Pot. | P ₂ O ₅ as Super. |
| 1 | 50 (as F.Y.M.) | 1.364 | 1.659 | 0.944 | 0.436 | 1.341 | 0.256 |
| 2 | 50 (as Adco) | 1.717 | 0.687 | 1.454† | 0.083 | 2.313 | None† |
| 3 | 150.23 (as straw) | 0.989 | 2.637 | 0.390 | 0.811 | 0.363 | 0.810 |
| 4 | | None | | | 0.36 | 0.6 | 1.2 |
| 5 | | None | | | 0.36 | 0.6 | 1.2* |

* As mineral phosphate.

† The weight of P₂O₅ in the Adco given per acre exceeded the limit of 1.2 cwt., so that no superphosphate had to be added.

CULTIVATIONS, ETC.

| | Barley. | Seeds. | Potatoes. | Wheat. |
|--------------------------|----------------------------|---|----------------------------|----------------------------|
| Variety | Plumage Archer | Italian ryegrass and commercial white clover. | Ally | Yeoman |
| Date of Sowing .. | March 26 | April 29 | April 17 | Oct. 23 |
| Manures applied— | | | | |
| Dung and Adco .. | Oct. 30 | Oct. 30 | Oct. 30 | Oct. 16 |
| Artificials to Adco .. | Oct. 30 | | | |
| Dung | Oct. 30 | | | |
| Straw | Oct. 30 | Oct. 30, Dec. 18, April 5 | Oct. 30, Oct. 30 | Oct. 16, Oct. 16 |
| Artificials to straw .. | Oct. 30, Dec. 18, March 15 | Oct. 30, Dec. 18, April 5 | Oct. 30, Dec. 18, April 17 | Oct. 16, Dec. 18, April 6 |
| Treatments 4 and 5 | March 15 | April 5 | April 17 | Oct. 24, April 6 |
| Date of harvesting .. | Aug. 13-16 | June 28 | Oct. 10 | Aug. 8 |
| Previous crop | Potatoes | Barley | Wheat | Seeds hay |
| Cultivations— | | | | |
| Ploughing | Nov. 2-6 | | Nov. 2-6 | June 23-30, Oct. 17 and 18 |
| Harrowing | March 26 and 27 | April 29 | April 13, May 19 | Oct. 23 and 24, April 7 |
| Rolling | April 10 | | | April 10 |
| Hoing | | | May 17 | |
| Ridging | | | April 16, June 15, July 10 | |
| Grubbing | | | May 25, June 8, July 2 | |

PLAN AND YIELDS

Clover Hay—AH, plots 1-25
Yields in lb., green weights

Wheat—AW, plots 26-50
Yields in lb., grain above, straw below

| N.W. | | | | | N.W. | | | | |
|---------|---------|---------|---------|---------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 5 56 | 2 42 | 1 41 | 3 21 | 4 53 | 3 59.6 71.4 IV | 2 67.3 77.7 V | 5 63.7 76.6 I | 4 65.1 78.2 III | 1 68.4 84.4 II |
| II | V | III | I | IV | | | | | |
| 5 51 | 1 69 | 3 28 | 4 59 | 2 30 | 4 69.5 84.5 V | 2 49.9 57.1 III | 1 65.6 78.4 IV | 5 63.3 76.0 II | 3 80.5 97.0 I |
| IV | I | V | II | III | | | | | |
| 3 34 | 2 25 | 5 32 | 4 51 | 1 31 | 1 61.0 72.2 III | 4 64.5 78.8 I | 3 62.6 79.4 II | 5 71.3 87.2 V | 2 63.5 72.0 IV |
| IV | II | I | III | V | | | | | |
| 1 26 | 3 13 | 4 48 | 5 52 | 2 59 | 4 79.8 99.4 II | 5 72.7 89.8 IV | 3 78.3 94.0 III | 2 84.8 104.0 I | 1 64.9 72.6 V |
| IV | II | V | III | I | | | | | |
| 4 55 | 1 35 | 5 54 | 3 49 | 2 27 | 2 75.5 89.5 II | 4 67.7 81.8 IV | 3 69.1 81.6 V | 1 88.5 110.5 I | 5 65.9 76.8 III |
| I | II | V | III | IV | | | | | |

Barley—AB, Plots 51-75
Yields in lb. grain above, straw below

Potatoes—AP, plots 76-100
Yields in lb.

| N.W. | | | | | N.W. | | | | |
|------------------------|-------------------------|-------------------------|--------------------------|--------------------------|-----------------|----------------|-----------------|-----------------|-----------------|
| 3 71.7 71.0 V | 4 74.3 68.0 II | 1 86.1 87.9 I | 2 63.8 69.7 III | 5 64.5 77.5 IV | 4 211 IV | 2 124 V | 5 210 III | 3 262 I | 1 230 II |
| 3 81.8 77.4 I | 4 72.0 75.2 IV | 5 70.7 82.3 V | 2 64.5 73.5 II | 1 63.4 75.1 III | 5 187 I | 2 202 II | 1 152 IV | 4 239 III | 3 222 V |
| 2 71.0 71.2 V | 4 72.1 71.4 I | 3 69.5 74.8 IV | 1 69.8 74.2 II | 5 54.4 73.1 III | 2 148 III | 1 136 V | 5 195 II | 4 276 I | 3 181 IV |
| 5 59.2 62.8 I | 1 59.4 62.6 V | 3 70.0 73.5 II | 4 69.4 76.6 III | 2 56.0 69.2 IV | 2 162 IV | 4 200 II | 1 287 I | 5 148 V | 3 209 III |
| 4 67.8 68.4 V | 2 66.0 67.5 I | 1 53.1 56.6 IV | 5 58.3 60.7 II | 3 65.7 68.0 III | 5 187 IV | 2 144 I | 3 124 II | 1 138 III | 4 280 V |

SUMMARY OF RESULTS, 1934

| Manure. | Year of Cycle. | Wheat. Cwt. per Acre. | | Potatoes, tons per acre. | Barley. Cwt. per Acre. | | Seeds Hay. Cwt. per acre dry matter. |
|------------------------|----------------|--------------------------|--------|--------------------------------|---------------------------|--------|---|
| | | Grain. | Straw. | | Grain. | Straw. | |
| Manure as F.Y.M. | I | 32.4 | 40.5 | 5.49 | 31.6 | 32.2 | 19.8 |
| | II | 25.1 | 30.9 | 4.40 | 25.6 | 27.2 | 10.0 |
| | III | 22.4 | 26.5 | 2.64 | 23.2 | 27.5 | 11.8 |
| | IV | 24.0 | 28.7 | 2.92 | 19.5 | 20.7 | 7.4 |
| | V | 23.8 | 26.6 | 2.59 | 21.8 | 22.9 | 8.9 |
| Manure as Adco | I | 31.1 | 38.1 | 2.75 | 24.2 | 24.7 | 16.9 |
| | II | 27.7 | 32.8 | 3.85 | 23.6 | 26.9 | 7.2 |
| | III | 18.3 | 20.9 | 2.84 | 23.4 | 25.5 | 8.6 |
| | IV | 23.3 | 26.4 | 3.09 | 20.5 | 25.4 | 7.7 |
| | V | 24.7 | 28.5 | 2.38 | 26.0 | 26.1 | 12.1 |
| Manure as Straw | I | 29.5 | 35.6 | 5.02 | 30.0 | 28.4 | 6.0 |
| | II | 22.9 | 29.1 | 2.38 | 25.7 | 26.9 | 3.7 |
| | III | 28.7 | 34.4 | 4.00 | 24.1 | 24.9 | 14.0 |
| | IV | 21.8 | 26.2 | 3.46 | 25.5 | 27.4 | 9.7 |
| | V | 25.3 | 29.9 | 4.24 | 26.3 | 26.0 | 8.0 |
| Super. | I | 23.6 | 28.9 | 5.27 | 26.4 | 26.2 | 15.8 |
| | II | 29.2 | 36.4 | 3.82 | 27.2 | 24.9 | 16.9 |
| | III | 23.9 | 28.7 | 4.57 | 25.4 | 28.1 | 14.6 |
| | IV | 24.8 | 30.0 | 4.03 | 26.4 | 27.6 | 15.2 |
| | V | 25.5 | 31.0 | 5.34 | 24.9 | 25.1 | 13.7 |
| Rock Phosphate | I | 23.3 | 28.1 | 3.58 | 21.7 | 23.0 | 9.2 |
| | II | 23.2 | 27.9 | 3.73 | 21.4 | 22.2 | 16.1 |
| | III | 24.2 | 28.1 | 4.01 | 19.9 | 26.8 | 14.9 |
| | IV | 26.6 | 32.9 | 3.58 | 23.6 | 28.4 | 14.6 |
| | V | 26.1 | 32.0 | 2.82 | 25.9 | 30.2 | 15.5 |

The number I denotes application of manure at the beginning of the present season (1933-4)
 II application in the previous season, etc.

SIX COURSE ROTATION EXPERIMENT

SEASONAL EFFECTS OF N, P₂O₅, K₂O

(For details see 1932 Report, p. 131)

CULTIVATIONS, ETC.—ROTHAMSTED

| | Sugar Beet. | Barley. | Clover Hay. | Wheat. | Potatoes. | Rye |
|----------------------------|--|-------------------|---------------------|---------------------|----------------------------------|----------------------|
| Variety | Kuhn | Plumage Archer | Broad Red | Yeoman | Ally | |
| Date of Sowing | May 5 | March 26 | April 27 | Oct. 18 | April 18 | Oct. 16 |
| Manures applied | April 28 | March 8 | Oct. 28, April 5 | Oct. 18, April 6 | April 17 | Oct. 16, April 6 |
| Date of harvest- ing | Nov. 27 and 28 | Aug. 11 | June 28 | Aug. 3 | Oct. 11 | July 27 |
| Previous crop | Forage | Sugar beet | Barley | Clover | Wheat | Potatoes |
| Cultivations— Ploughing | June 22, Sept. 15, Feb. 23 | Nov. 27 | | Oct. 6 and 7 | Sept. 14, Feb. 24 | Oct. 9, |
| Harrowing | June 24, Sept. 28 May 2 and 5 | Mar. 9 and 26 | | Oct. 18 | Sept. 28, April 13 May 19 | Oct. 16, April 14 |
| Rolling | June 24, May 4, 5 and 11 | April 10 | | April 10 | | |
| Singling | June 15, 16 | | | | | |
| Hoeing | May 28, June 5 July 6 and 20 | | | May 22 | May 22, June 9 | May 22 |
| Ridging | | | | | April 16, June 15, July 10 | |
| Grubbing | | | | | May 25, July 3 | |

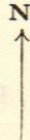
CULTIVATIONS, Etc.—WOBURN

| | Sugar Beet. | Barley. | Clover Hay. | Wheat. | Potatoes. | Rye |
|----------------------------|--|--------------------------------|---------------------|--|---|--|
| Variety | Kuhn | Plumage Archer | Broad Red | Yeoman | Ally | |
| Date of sowing | April 27 | March 9 | May 12 | Oct. 23 | April 23 | Oct. 23 |
| Manures applied | April 27 | March 9 | Oct. 23, March 6 | Oct. 23, March 7 | April 20 | Oct. 23, March 7 |
| Date of harvest | Nov. 13 | July 24 | Crop failed | Aug. 16 | Oct. 2 | July 25 |
| Previous crop | Forage | Sugar beet | Barley | Clover | Wheat | Potatoes |
| Cultivations— Ploughing | Aug. 1, Oct. 1-3, Oct. 17, Feb. 13 | Jan. 30 | | Aug. 2, Oct. 3 and 4 | Aug. 22, Oct. 1-3, Feb. 12 | Oct. 3 and 4 |
| Harrowing | Aug. 1 and 23, Oct. 17 and 23, April 12 and 27 | March 9, April 23, May 1 | May 12 | Oct. 17, 23, April 12 and 23, May 2 and 14 | Oct. 17 and 23, April 12, May 2, 14 and 23 | Oct. 17 and 23, April 12 and 23 |
| Rolling | Aug. 1, April 3 and 23, May 4 | Mar. 9, May 2 | | Aug. 2, March 9, May 4 | April 3 | March 6 |
| Singling Hoeing | June 20 May 14, June 1, 11 and 23, Aug. 18 and 19 | | | April 23 | May 31, June 11 | |
| Ridging | | | | | April 19, May 7, 16, June 29 | |

ROTHAMSTED, 1934

Sugar beet—BS, Plots 1-15.
Yields in lb., roots (dirty) above, tops centre, sugar percentage below.

| | | | | |
|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 0P 668 390 17.86 | 2N 725 392 18.00 | 2K 619 365 18.00 | 1K 692 365 17.57 | 4P 618 348 16.85 |
| 1N 735 382 18.35 | 4N 779 454 18.09 | 0N 690 328 18.81 | 2P 727 379 18.64 | 3P 736 406 17.83 |
| 3N 738 478 18.00 | 4K 724 452 18.52 | 3K 670 332 18.84 | 0K 635 356 18.32 | 1P 716 418 18.32 |



Wheat—BW, Plots 16-30.
Yields in lb., grain above, straw below.

| | | | | |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 0N 67.0 83.5 | 1P 87.3 119.2 | 4K 84.4 113.8 | 0P 87.8 120.0 | 0K 83.6 117.6 |
| 2P 71.4 96.4 | 4P 83.4 113.6 | 3K 85.3 114.0 | 2N 88.3 120.7 | 1N 77.0 107.8 |
| 3P 77.4 105.8 | 2K 90.3 122.7 | 1K 78.1 103.4 | 4N 69.3 91.9 | 3N 70.7 98.1 |

Potatoes—BP, Plots 31-45.
Yields in lb.

| | | | | |
|-----------|-----------|-----------|-----------|-----------|
| 4P 310 | 2P 380 | 2N 384 | 4N 430 | 0N 342 |
| 0K 172 | 3P 388 | 1N 378 | 1K 365 | 2K 372 |
| 1P 282 | 0P 287 | 3N 362 | 4K 441 | 3K 392 |



***Rye—BR, Plots 46-60.**
Yields in lb., grain above, straw below.

| | | | | |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 0P 77.4 119.1 | 2K 82.0 137.2 | 3N 87.9 140.1 | 1N 89.7 139.5 | 4P 77.8 126.4 |
| 3K 80.9 124.6 | 1K 83.5 141.7 | 4N 92.0 153.8 | 0N 83.9 148.9 | 3P 84.1 138.7 |
| 4K 88.1 139.1 | 2N 87.2 141.8 | 0K 82.6 140.4 | 2P 91.2 146.8 | 1P 82.4 134.6 |

Barley—BB, Plots 61-75.
Yields in lb., grain above, straw below.

| | | | | |
|--------------------|--------------------|--------------------|--------------------|--------------------|
| 1P 67.6 84.4 | 2P 83.2 88.6 | 3N 83.2 91.0 | 2N 81.1 85.6 | 3K 76.0 78.0 |
| 0K 77.6 88.2 | 3P 85.5 97.8 | 4N 76.0 89.8 | 2K 80.5 89.8 | 1K 81.6 90.6 |
| 4P 79.2 78.6 | 0P 67.7 76.0 | 1N 72.9 80.8 | 4K 79.9 88.1 | 0N 90.2 89.8 |



Clover Hay—BC, Plots 76-90.
Yields in lb., green weights.

| | | | | |
|------------|------------|------------|------------|------------|
| 1K 13.5 | 2K 21.8 | 0K 20.4 | 2N 14.1 | 2P 13.8 |
| 4K 13.8 | 0P 25.9 | 1N 26.1 | 4P 14.9 | 0N 9.7 |
| 3K 21.1 | 4N 21.9 | 3N 12.8 | 1P 18.8 | 3P 11.4 |

*From 1930 to 1933 a forage mixture was grown and nominally cut green. In fact, this crop was largely rye, which tended to be fairly mature owing to the later maturing properties of the beans and vetches.

WOBURN, 1934

Barley—CB, Plots 1-15.

Yields in lb., grain above, straw below.

| | | | | |
|--------------------|--------------------|--------------------|--------------------|---------------------|
| 4K 73.5 85.5 | 1K 74.5 90.5 | 0K 80.5 97.5 | 4P 67.0 90.5 | 0P 79.0 94.5 |
| 0N 44.5 52.5 | 2K 69.0 78.5 | 2P 84.0 96.5 | 2N 76.5 84.5 | 4N 93.0 111.0 |
| 3K 64.8 72.5 | 1P 62.0 63.8 | 3P 77.0 84.2 | 3N 76.8 88.8 | 1N 68.0 72.2 |

N.W.
↑

Clover Hay—CC, Plots 16-30.

Crop failed.

| | | | | |
|---------|---------|---------|---------|---------|
| 4N — | 2N — | 1P — | 0N — | 4K — |
| 3N — | 1N — | 3P — | 2K — | 1K — |
| 0K — | 4P — | 2P — | 0P — | 3K — |

Sugar Beet—CS, Plots 31-45.

Yields in lb., roots (dirty) above, tops centre, sugar percentage below.

| | | | | |
|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 0N 470 227 16.94 | 1K 568 274 16.99 | 0K 596 304 16.19 | 3P 720 388 16.30 | 3N 818 434 17.02 |
| 2K 730 343 16.94 | 4K 722 344 17.71 | 2P 891 409 16.85 | 2N 828 421 17.14 | 4N 938 515 17.19 |
| 3K 648 398 17.54 | 4P 508 402 17.05 | 1P 661 463 16.73 | 1N 662 498 16.82 | 0P 747 558 16.40 |

N.W.
↑

Potatoes—CP, Plots 46-60.

Yields in lb.

| | | | | |
|-----------|-----------|-----------|-----------|-----------|
| 3P 462 | 2P 486 | 0P 479 | 2K 519 | 2N 466 |
| 4P 476 | 0N 409 | 3K 532 | 0K 490 | 1N 459 |
| 1P 457 | 4K 544 | 1K 562 | 3N 547 | 4N 482 |

Wheat—CW, Plots 61-75.

Yields in lb., grain above, straw below.

| | | | | |
|--------------------|-------------------|--------------------|--------------------|--------------------|
| 3P 2.8 8.0 | 2P 2.5 5.2 | 4N 3.0 9.0 | 1N 4.5 9.0 | 0N 8.0 14.0 |
| 1P 5.5 11.5 | 4P 6.0 10.5 | 2N 7.0 11.0 | 3K 19.5 32.5 | 2K 34.5 47.0 |
| 0K 15.8 26.0 | 0P 9.8 15.5 | 3N 16.5 52.2 | 1K 26.8 37.8 | 4K 32.8 51.5 |

N.W.
↑

***Rye—CR, Plots 76-90.**

Yields in lb., grain above, straw below.

| | | | | |
|---------------------|---------------------|---------------------|---------------------|---------------------|
| 2N 65.5 106.5 | 3N 68.5 107.0 | 1P 70.5 110.5 | 2P 72.5 113.0 | 3K 73.5 116.0 |
| 4N 61.5 95.0 | 1N 63.5 98.0 | 0N 62.5 90.0 | 2K 61.5 101.0 | 1K 69.0 109.2 |
| 0K 62.0 100.0 | 3P 59.0 90.5 | 4P 56.0 85.2 | 4K 57.8 90.5 | 0P 65.0 91.5 |

*From 1930 to 1933 a forage mixture was grown and nominally cut green. In fact, this crop was largely rye, which tended to be fairly mature owing to the later maturing properties of the beans and vetches.

ROTHAMSTED, 1934

1.—Mean yields per acre and increments in yield per cwt. of N, P₂O₅ and K₂O.

| | | Average, 1930-33 | 1934 | Standard error, 1934 | | | Average, 1930-33 | 1934 | Standard error, 1934 |
|--|-------|---------------------|-------|----------------------------|--|-------|---------------------|------|----------------------------|
| Sugar Beet Roots (washed) tons | Yield | 5.63 | 11.08 | | Clover Hay Dry matter cwt. | Yield | 24.7* | 4.0 | |
| | N | 0.54 | 1.91 | ±1.35 | | N | 20.5* | 1.8 | ±2.8 |
| | P | 0.51 | -0.84 | ±1.35 | | P | 0.9* | -4.5 | ±2.8 |
| | K | 0.08 | 1.00 | ±0.81 | | K | 1.8* | -0.5 | ±1.7 |
| Tops tons | Yield | 9.14 | 6.96 | | Wheat Grain cwt. | Yield | 23.6 | 28.6 | |
| | N | 2.78 | 4.15 | ±1.26 | | N | 3.7† | -0.3 | ±5.7 |
| | P | -0.10 | -1.14 | ±1.26 | | P | 1.6 | -4.5 | ±5.7 |
| | K | -0.88 | 1.13 | ±0.75 | | K | 1.2 | 1.2 | ±3.4 |
| Sugar percentage | Mean | 16.48 | 18.13 | | Straw cwt. | Yield | 50.2 | 38.8 | |
| | N | 0.01 | -1.19 | ±1.00 | | N | 26.2† | 1.7 | ±9.3 |
| | P | -0.44 | -1.67 | ±1.00 | | P | 3.8 | -6.3 | ±9.3 |
| | K | 0.32 | 0.67 | ±0.60 | | K | 2.0 | 0.4 | ±5.6 |
| Total sugar cwt. | Yield | 19.0 | 40.2 | | Potatoes tons | Yield | 6.52 | 6.29 | |
| | N | 1.9 | 4.4 | | | N | 1.87 | 1.88 | ±1.78 |
| | P | 1.4 | -6.5 | | | P | 0.78 | 1.82 | ±1.78 |
| | K | 0.7 | 5.2 | | | K | 3.06 | 4.02 | ±1.07 |
| Barley Grain cwt. | Yield | 26.3 | 28.1 | | Rye Grain cwt. | Yield | 35.5** | 30.2 | |
| | N | 6.1 | -4.3 | ±4.3 | | N | 21.0** | 3.5 | ±3.2 |
| | P | 2.0 | 9.7 | ±4.3 | | P | -1.0** | 0.6 | ±3.2 |
| | K | 1.0 | -0.2 | ±2.6 | | K | -2.6** | 1.2 | ±1.9 |
| Straw cwt. | Yield | 31.4 | 30.9 | | Straw cwt. | Yield | | 49.3 | |
| | N | 11.8 | 2.5 | ±5.1 | | N | | 2.4 | ±6.8 |
| | P | 8.7 | 4.5 | ±5.1 | | P | | 4.4 | ±6.8 |
| | K | 4.6 | -1.8 | ±3.0 | | K | | -2.8 | ±4.1 |

*1930-32. †1931-33. ** Forage crop—total dry matter. See note on previous page. Significant results in heavy type. Negative sign means depression.

2.—Average percentage increments in yield for each application of N, P₂O₅ and K₂O.

| | N | | P | | K | | Standard error 1934 |
|--------------------------------------|--------------------|-------|--------------------|--------|--------------------|-------|---------------------------|
| | Average 1930-33 | 1934 | Average 1930-33 | 1934 | Average 1930-33 | 1934 | |
| Sugar Beet —Roots (washed) | 1.04 | 2.59 | 1.30 | -1.14 | 1.46 | 2.25 | ±1.83 |
| Tops | 4.76 | 8.94 | -0.14 | -2.46 | -1.72 | 4.07 | ±2.71 |
| Sugar percentage | 0.58 | -0.99 | -0.17 | -1.38 | 0.49 | 0.92 | ±0.83 |
| Total sugar | 0.95 | 1.64 | 0.84 | -2.41 | 2.04 | 3.21 | |
| Barley —Grain | 3.94 | -2.31 | 1.43 | 5.19 | 0.90 | -0.14 | ±2.28 |
| Straw | 6.02 | 1.23 | 4.24 | 2.20 | 3.64 | -1.46 | ±2.46 |
| Clover —dry matter | 10.99* | 6.70 | 0.42* | -16.89 | 2.05* | -2.98 | ±10.33 |
| Wheat —Grain | 3.96† | -0.17 | 1.06 | -2.38 | 0.97 | 1.05 | ±3.01 |
| Straw | 9.61† | 0.64 | 0.98 | -2.42 | 0.58 | 0.26 | ±3.58 |
| Potatoes | 4.36 | 4.48 | 2.06 | 4.34 | 11.43 | 15.99 | ±4.25 |
| Rye —Grain | 9.11** | 1.72 | -0.25** | 0.33 | -2.11** | 1.02 | ±1.61 |
| Straw | | 0.73 | | 1.34 | | -1.40 | ±2.06 |

*1930-32. †1931-33. **Forage crop—total dry matter. See note on previous page. Significant results in heavy type. Negative sign means depression.

WOBURN, 1934

1.—Mean yields per acre and increments in yield per cwt. of N, P₂O₅ and K₂O.

| | | Average 1930-33 | 1934 | Standard error 1934 | | | Average 1930-33 | 1934 | Standard error 1934 |
|--|-------|--------------------|--------------|---------------------------|--|-------|--------------------|-------------|---------------------------|
| Sugar Beet Roots (washed) tons | Yield | 6.47 | 9.73 | | Clover Hay Dry matter cwt. | Yield | 24.6* | | |
| | N | 1.61 | 10.11 | ±2.81 | | N | -9.2* | ‡ | |
| | P | -0.58 | -3.89 | ±2.81 | | P | -8.4* | | |
| | K | 0.91 | 1.84 | ±1.68 | | K | 7.5* | | |
| Tops tons | Yield | 6.60 | 7.12 | | Wheat Grain cwt. | Yield | 10.7* | 4.6 | |
| | N | 1.54 | 6.11 | ±2.36 | | N | 15.9* | 0.5 | ±4.5 |
| | P | 0.79 | -4.60 | ±2.36 | | P | -0.9* | -2.4 | ±4.5 |
| | K | 2.14 | 1.46 | ±1.42 | | K | -2.6* | 3.8 | ±2.7 |
| Sugar percentage | Mean | 17.09 | 16.92 | | Straw cwt. | Yield | 28.8* | 8.1 | |
| | N | -1.58 | 0.47 | ±0.49 | | N | 34.7* | 7.9 | ±9.9 |
| | P | -0.10 | 0.58 | ±0.49 | | P | -1.9* | -3.2 | ±9.9 |
| | K | 0.63 | 1.44 | ±0.30 | | K | -7.9* | 6.5 | ±5.9 |
| Total Sugar cwt. | Yield | 22.2 | 32.9 | | Potatoes tons | Yield | 9.29 | 8.77 | |
| | N | 3.3 | 35.3 | | | N | 5.22 | 2.79 | ±1.08 |
| | P | -2.2 | -12.1 | | | P | 0.85 | -0.01 | ±1.08 |
| | K | 3.8 | 9.0 | | | K | 0.86 | 0.55 | ±0.65 |
| Barley Grain cwt. | Yield | 21.7 | 25.9 | | Rye Grain cwt. | Yield | 38.6†* | 23.1 | |
| | N | 17.1 | 25.1 | ±5.9 | | N | 27.5†* | 0.8 | ±4.4 |
| | P | 2.1 | -2.1 | ±5.9 | | P | -0.7†* | -7.0 | ±4.4 |
| | K | 4.6 | -3.5 | ±3.5 | | K | 0.6†* | -0.6 | ±2.6 |
| Straw cwt. | Yield | 42.6 | 30.1 | | Straw cwt. | Yield | | 35.8 | |
| | N | 23.8 | 31.7 | ±7.8 | | N | | 4.5 | ±8.3 |
| | P | -1.8 | 2.9 | ±7.8 | | P | | -7.9 | ±8.3 |
| | K | 7.6 | -6.0 | ±4.7 | | K | | -1.8 | ±5.0 |

*1931-33 only. †Forage crop—total dry matter. See note on previous page. ‡ Crop failed. Significant results in heavy type. Negative sign means depression.

2.—Average percentage increments in yield for each application of N, P₂O₅ and K₂O.

| | N | | P | | K | | Standard error 1934 |
|--------------------------------------|--------------------|--------------|--------------------|-------|--------------------|-------------|---------------------------|
| | Average 1930-33 | 1934 | Average 1930-33 | 1934 | Average 1930-33 | 1934 | |
| Sugar Beet —Roots (washed) | 3.57 | 15.59 | -1.48 | -6.00 | 4.51 | 4.74 | ±4.33 |
| Tops | 3.36 | 12.87 | 1.62 | -9.70 | 7.38 | 5.12 | ±4.98 |
| Sugar percentage | -0.94 | 0.41 | -0.08 | 0.51 | 0.90 | 2.12 | ±0.44 |
| Total sugar | 2.29 | 16.09 | -1.54 | -5.49 | 5.20 | 6.80 | |
| Barley —Grain | 12.88 | 14.53 | 1.13 | -1.23 | 5.54 | -3.35 | ±3.39 |
| Straw | 8.34 | 15.79 | -0.60 | 1.43 | 4.88 | -4.99 | ±3.89 |
| Clover Hay —Dry matter | -5.58* | | -4.94* | | 7.39* | | |
| Wheat —Grain | 19.90* | 1.51 | -0.56* | -7.90 | -5.63* | 20.64 | ±14.71 |
| Straw | 17.70* | 14.63 | -0.83* | -5.95 | -6.81* | 20.12 | ±18.25 |
| Potatoes | 9.40 | 4.78 | 0.59 | -0.01 | 1.93 | 1.57 | ±1.84 |
| Rye —Grain | 11.45*† | 0.52 | -0.60*† | -4.55 | 0.08*† | -0.61 | ±2.85 |
| Straw | | 1.90 | | -3.30 | | -1.23 | ±3.46 |

*1931-33 only. †Forage crop—total dry matter. See note on previous page. Significant results in heavy type. Negative sign means depression.

THREE COURSE ROTATION EXPERIMENT ROTHAMSTED, 1934

EFFECT OF PLOUGHING IN STRAW AND OF WINTER GREEN-MANURE CROPS
For details see 1933 Report, p. 118.
CULTIVATIONS, ETC.

| | Barley | Sugar Beet | Potatoes |
|-----------------------|--------------------------------|------------------------------|-------------------------------|
| Variety | Plumage Archer | Kuhn | Ally |
| Date of sowing | March 26 | May 5 | April 18 |
| Manures applied | | | |
| Artificials .. | October 4, March 9 | September 18, May 3 | October 21, April 18 |
| Adco and straw | October 4 | September 18 | October 21 |
| Date of Harvesting .. | August 11 | October 26-30 | October 10 |
| Previous crop .. | Potatoes | Barley | Sugar Beet |
| Cultivations— | | | |
| Ploughing .. | October 5-6, February 26-27 | September 19, April 18-19 | October 21-23, April 11 |
| Harrowing .. | October 6, March 9 & 26 | September 20, May 4 & 5 | October 23, April 13 |
| Rolling .. | April 11 | May 4, 5 & 11 | |
| Singling .. | | June 18-21 | |
| Hoeing .. | | May 22-28, June 11 & 28 | |
| Ridging .. | | July 4, 20, 23 & 24 | April 17, June 16, July 10 |
| Grubbing .. | | | May 26, June 8 |

PLAN AND YIELDS

Potatoes—DP, Plots 49-72. Yields in lb.

N

| | | | | | |
|------------------|------------------|------------------|------------------|------------------|-----------------|
| St 1 R I 309 | Ad R I 294 | Ad V II 260 | Ad V I 258 | Ad R II 233 | St 1 V I 247 |
| St 1 O I 302 | St 2 V II 359 | St 1 V II 390 | St 2 V I 226 | St 2 R I 248 | St 2 O I 266 |
| Ar R I 248 | Ar R II 357 | Ar O I 237 | Ad O I 254 | St 1 O II 352 | Ar V II 338 |
| St 1 R II 351 | Ad O II 258 | St 2 R II 247 | St 2 O II 351 | Ar V I 262 | Ar O II 340 |

Barley—DB, Plots 25-48. Yields in lb., grain above, straw below.

N

| | | | | | |
|---------------------------|-------------------------|---------------------------|--------------------------|---------------------------|---------------------------|
| St 1 O II 56.7 68.8 | Ad O I 57.4 65.6 | Ad R II 39.0 43.5 | Ar V II 61.5 68.0 | Ar R I 52.8 59.2 | St 2 O I 60.9 65.6 |
| St 2 O II 60.7 79.8 | Ad V II 66.3 76.7 | St 2 R I 49.8 60.0 | St 2 V I 64.7 69.6 | St 1 R II 57.8 67.2 | Ar O I 66.7 70.3 |
| Ar R II 54.3 69.7 | Ad O II 68.1 79.9 | St 2 R II 58.6 70.6 | St 1 V I 67.0 73.5 | St 1 R I 53.7 58.3 | Ad V I 59.9 63.6 |
| Ad R I 26.1 46.4 | Ar V I 51.9 63.1 | St 1 O I 58.8 66.7 | Ar O II 60.9 71.1 | St 2 V II 63.1 69.4 | St 1 V II 50.4 61.1 |

Sugar Beet—DS, Plots 1-24. Yields in lb., roots (dirty) above, tops centre, sugar percentage below.

| | | | | | |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|----------------------------------|
| St 1 R II 624 448 19.81 | St 2 R I 665 215 20.22 | Ar R I 500 284 19.38 | St 2 O II 626 403 19.21 | Ar O II 684 519 18.09 | Ad O I 627 550 18.14 |
| St 1 O I 650 447 19.21 | St 2 R II 640 416 19.70 | St 1 O II 636 470 19.67 | Ar V II 638 506 18.95 | Ad O II 662 413 19.67 | St 2 O I 590 430 19.27 |
| Ar R II 622 438 19.56 | St 2 V II 628 546 18.60 | Ar V I 613 460 18.86 | St 1 R I 667 400 19.27 | Ad R I 455 170 19.87 | St 1 V II 565 435 19.38 |
| Ad V II 687 556 18.40 | Ar O I 621 478 18.35 | Ad V I 572 404 18.98 | St 2 V I 600 408 19.38 | St 1 V I 555 358 19.53 | Ad R II 439 271 19.32 |

GREEN MANURE CROPS—GREEN WEIGHTS—TONS PER ACRE

| | | Manured 1932-3 | | | | | Manured 1933-4 | | | | |
|----------|---------|----------------|------|-------|-------|------|----------------|------|-------|-------|------|
| | | Art'ls. | Adco | St. 1 | St. 2 | Mean | Art'ls. | Adco | St. 1 | St. 2 | Mean |
| Barley | Vetches | 0.46 | 0.23 | 0.30 | 0.32 | 0.33 | 0.40 | 0.27 | 0.35 | 0.39 | 0.35 |
| | Rye .. | 2.23 | 2.92 | 2.37 | 2.82 | 2.58 | 2.19 | 2.78 | 2.37 | 2.80 | 2.54 |
| S. Beet | Vetches | 0.55 | 0.48 | 0.45 | 0.61 | 0.52 | 0.55 | 0.62 | 0.65 | 0.87 | 0.67 |
| | Rye .. | 3.41 | 3.78 | 4.69 | 4.62 | 4.12 | 7.04 | 4.52 | 5.48 | 6.57 | 5.90 |
| Potatoes | Vetches | 0.29 | 0.43 | 0.29 | 0.34 | 0.34 | 0.49 | 0.33 | 0.41 | 0.43 | 0.42 |
| | Rye .. | 4.13 | 3.63 | 3.90 | 4.44 | 4.02 | 2.72 | 3.33 | 2.58 | 4.23 | 3.22 |

PERCENTAGE DRY MATTER

| | | Sample 1 | Sample 2 |
|---------------|---------|----------|----------|
| Barley .. | Vetches | 11.47 | 9.34 |
| | Rye | 12.28 | 13.99 |
| Sugar Beet .. | Vetches | 15.45 | 15.98 |
| | Rye | 17.26 | 17.98 |
| Potatoes .. | Vetches | 9.90 | 10.93 |
| | Rye | 9.35 | 7.98 |

For each break of the rotation, two large samples each of rye and vetches were taken for dry matter determination. These were weighed fresh, dried at 100°C, cleaned from soil as far as possible and weighed again. The dry matter percentages thus include a dirt tare correction.

SUMMARY OF RESULTS

| | | Manured 1932-3 | | | | | Manured 1933-4 | | | | |
|--|-------------|-------------------|--------------|-----------------|-----------------|--------------|-------------------|--------------|-----------------|-----------------|--------------|
| | | Artifi- cials. | Adco. | Straw. St. 1 | Straw. St. 2 | Mean. | Artifi- cials. | Adco.† | Straw. St. 1 | Straw. St. 2 | Mean. |
| Barley Grain cwt. p.a. | None | 29.8 | 25.6 | 26.2 | 27.2 | 27.2 | 27.2 | 30.4 | 25.3 | 27.1 | 27.5 |
| | Vetches | 23.2 | 26.7 | 29.9 | 28.9 | 27.2 | 27.5 | 29.6 | 22.5 | 28.2 | 27.0 |
| | Rye* | 23.6 | 11.7 | 24.0 | 22.2 | 20.4 | 24.2 | 17.4 | 25.8 | 26.2 | 23.4 |
| | <i>Mean</i> | <i>25.5</i> | <i>21.3</i> | <i>26.7</i> | <i>26.1</i> | <i>24.9</i> | <i>26.3</i> | <i>25.8</i> | <i>24.5</i> | <i>27.2</i> | <i>26.0</i> |
| Straw cwt. p.a. | None | 31.4 | 29.3 | 29.8 | 29.3 | 30.0 | 31.7 | 35.7 | 30.7 | 35.6 | 33.4 |
| | Vetches | 28.2 | 28.4 | 32.8 | 31.1 | 30.1 | 30.4 | 34.2 | 27.3 | 31.0 | 30.7 |
| | Rye* | 26.4 | 20.7 | 26.0 | 26.8 | 25.0 | 31.1 | 19.4 | 30.0 | 31.5 | 28.0 |
| | <i>Mean</i> | <i>28.7</i> | <i>26.1</i> | <i>29.5</i> | <i>29.1</i> | <i>28.4</i> | <i>31.1</i> | <i>29.8</i> | <i>29.3</i> | <i>32.7</i> | <i>30.7</i> |
| Sugar Beet Roots (Washed) Tons p.a. | None | 12.59 | 12.72 | 13.17 | 11.99 | 12.62 | 13.88 | 13.42 | 12.90 | 12.70 | 13.22 |
| | Vetches | 12.43 | 11.58 | 11.25 | 12.17 | 11.86 | 12.95 | 13.93 | 11.47 | 12.72 | 12.77 |
| | Rye* | 10.13 | 9.22 | 13.53 | 13.48 | 11.59 | 12.61 | 8.91 | 12.66 | 12.97 | 11.79 |
| | <i>Mean</i> | <i>11.72</i> | <i>11.17</i> | <i>12.65</i> | <i>12.55</i> | <i>12.02</i> | <i>13.15</i> | <i>12.09</i> | <i>12.34</i> | <i>12.80</i> | <i>12.60</i> |
| Tops Tons p.a. | None | 10.67 | 12.28 | 9.98 | 9.60 | 10.63 | 11.58 | 9.22 | 10.49 | 9.00 | 10.07 |
| | Vetches | 10.27 | 9.02 | 7.99 | 9.11 | 9.10 | 11.29 | 12.41 | 9.71 | 12.19 | 11.40 |
| | Rye* | 6.34 | 3.79 | 8.93 | 4.80 | 5.96 | 9.78 | 6.05 | 10.00 | 9.29 | 8.78 |
| | <i>Mean</i> | <i>9.09</i> | <i>8.36</i> | <i>8.97</i> | <i>7.84</i> | <i>8.56</i> | <i>10.88</i> | <i>9.23</i> | <i>10.07</i> | <i>10.16</i> | <i>10.08</i> |
| Sugar percentage | None | 18.35 | 18.14 | 19.21 | 19.27 | 18.74 | 18.09 | 19.67 | 19.67 | 19.21 | 19.16 |
| | Vetches | 18.86 | 18.98 | 19.53 | 19.38 | 19.19 | 18.95 | 18.40 | 19.38 | 18.60 | 18.83 |
| | Rye* | 19.38 | 19.87 | 19.27 | 20.22 | 19.68 | 19.56 | 19.32 | 19.81 | 19.70 | 19.60 |
| | <i>Mean</i> | <i>18.86</i> | <i>19.00</i> | <i>19.34</i> | <i>19.62</i> | <i>19.20</i> | <i>18.87</i> | <i>19.13</i> | <i>19.62</i> | <i>19.17</i> | <i>19.20</i> |
| Total sugar cwt. p.a. | None | 46.2 | 46.1 | 50.6 | 46.2 | 47.3 | 50.2 | 52.8 | 50.7 | 48.8 | 50.6 |
| | Vetches | 46.9 | 44.0 | 43.9 | 47.2 | 45.5 | 49.1 | 51.3 | 44.4 | 47.3 | 48.0 |
| | Rye* | 39.3 | 36.6 | 52.1 | 54.5 | 45.6 | 49.3 | 34.4 | 50.2 | 51.1 | 46.2 |
| | <i>Mean</i> | <i>44.1</i> | <i>42.2</i> | <i>48.9</i> | <i>49.3</i> | <i>46.1</i> | <i>49.5</i> | <i>46.2</i> | <i>48.4</i> | <i>49.1</i> | <i>48.3</i> |
| Potatoes Tons p.a. | None | 5.29 | 5.67 | 6.74 | 5.94 | 5.91 | 7.60 | 5.76 | 7.87 | 7.83 | 7.26 |
| | Vetches | 5.86 | 5.76 | 5.51 | 5.04 | 5.54 | 7.56 | 5.81 | 8.72 | 8.01 | 7.52 |
| | Rye* | 5.54 | 6.57 | 6.90 | 5.55 | 6.14 | 7.97 | 5.20 | 7.83 | 5.51 | 6.63 |
| | <i>Mean</i> | <i>5.56</i> | <i>6.00</i> | <i>6.38</i> | <i>5.51</i> | <i>5.86</i> | <i>7.71</i> | <i>5.59</i> | <i>8.14</i> | <i>7.12</i> | <i>7.14</i> |

*Rye, not ryegrass as stated in last year's Report, was the green manure crop grown in 1932-3.
 †All plots receiving Adco in the season 1933-4 were given 0.5 cwt. K₂O per acre in excess of the proper dressing.

LONG PERIOD CULTIVATION EXPERIMENT

Long Hoos V

Begun Autumn, 1933

Objects.

- (a) To compare the effects of continued ploughing, rotary cultivation with the Simar implement ("simaring") and stirring the soil with a cultivator ("cultivating") on crop yield and weed-infestation.
- (b) To investigate the value of cyanamide as a weed-killer.

Crop rotation. The following three crops are grown in rotation : wheat, mangolds, barley.

Treatments and arrangement (see plan).

All combinations of—

$$\left\{ \begin{array}{l} \text{Ploughing (P)} \\ \text{Simaring (S)} \\ \text{Cultivating (C)} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Deep cultivation (8 ins.) (D)} \\ \text{Shallow cultivation (4 ins.) (Sh)} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Cyanamide (Cy)} \\ \text{Nitro-chalk (N)} \end{array} \right\}$$

For each crop there are four blocks carrying these twelve treatments.

On two of the four blocks (labelled C on the plan) under each crop, the treatments are continued on the same plots in successive years. On the remaining two (labelled A and B on the plan) a cycle of cultivations and manuring is adopted. The object of this arrangement is to provide a standard of "direct" cultivation effects, for comparing cumulative effects of the "continuous" cultivations.

The cultivation cycles are :

- (A) Ploughing, simaring, cultivating.
 - (B) Ploughing, cultivating, simaring.
- Deep and shallow cultivations alternate in successive years.
Cyanamide and nitro-chalk alternate in two-yearly periods.
Area of each plot : 1/65 acre (139.8 lks. x 11 lks.)
There are 4 rows of mangolds per plot spaced 22 inches apart.

Times of Cultivation.

Wheat. All cultivations in autumn.
Barley. Ploughed and cultivated in autumn and again in spring. Simared in spring.
Mangolds. All cultivations in spring.

Subsidiary non-experimental cultivations.

The land is harrowed after applying fertilisers (except after top-dressing wheat where harrowing is optional), and after drilling the seed.

In 1933, half of each simared plot of the wheat break was rolled after sowing.

Application of fertilisers.

Wheat. N (as cyanamide or nitro-chalk) applied at the rate of 0.3 cwt. per acre as a spring top-dressing.

Barley. N (as cyanamide or nitro-chalk) applied at the rate of 0.2 cwt. per acre, at least one week before sowing.

Mangolds. N (as cyanamide or nitro-chalk) applied at the rate of 0.6 cwt. per acre. A basal dressing of P_2O_5 (as superphosphate) at the rate of 0.75 cwt. per acre, and K_2O (as muriate of potash) at the rate of 1.0 cwt. per acre is given to all plots. Cyanamide, superphosphate and muriate of potash are applied, at least one week before sowing. Nitro-chalk is applied half one week before sowing and half at singling.

CULTIVATIONS, ETC.

| | Wheat | Mangolds | Barley |
|--------------------|-------------------|---------------------------------------|-----------------|
| Variety | Victor | Yellow Globe | Plumage Archer |
| Date of sowing | Oct. 20 | May 3 | Mar. 29 |
| Manures applied— | | | |
| Cyanamide | Apr. 6-7 | Apr. 21 | Mar. 22 |
| Nitro-chalk | Apr. 6-7 | Apr. 21, June 29 | Mar. 22 |
| Super. & mur. pot. | — | Apr. 23 | — |
| Date of harvesting | Aug. 4 | Oct. 22-27 | Aug. 13 |
| Previous crop | Beans | Beans | Beans |
| Cultivations— | | | |
| Ploughing | Oct. 17 | Apr. 12 | Nov. 27, Mar. 9 |
| Simaring | Oct. 17 | Apr. 12 | Mar. 9 |
| Cultivating | Oct. 17 | Apr. 12 | Nov. 27, Mar. 9 |
| Harrowing | Oct. 20, Apr. 6-7 | Apr. 21, 24, 28, May 3 | Mar. 28-29 |
| Hoeing | May 22 | May 28, 31, June 9, July 17 and 19 | May 22 |
| Rolling | Oct. 20, Apr. 10 | May 3 | — |
| Singling | — | June 21-22 | — |

PLAN AND YIELDS IN LB.

Mangolds

Roots left, tops right.

| | | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|----|-----|-----|
| 1 | S Sh Cy | 543 | 133 | 1 | S Sh N | 639 | 134 | 73 | | |
| | S D Cy | 547 | 122 | | P Sh N | 652 | 122 | | | |
| | C Sh N | 594 | 128 | | P D Cy | 644 | 92 | | | |
| | P D N | 675 | 138 | | C Sh Cy | 634 | 125 | | | |
| | C D Cy | 574 | 106 | | P D N | 637 | 128 | | | |
| | B | P Sh N | 667 | | 129 | C Sh N | 577 | | 126 | A |
| | | C Sh Cy | 636 | | 134 | C D N | 704 | | 138 | |
| | | P D Cy | 620 | | 128 | P Sh Cy | 608 | | 119 | |
| | | P Sh Cy | 637 | | 134 | S Sh Cy | 607 | | 124 | |
| | | C D N | 730 | | 130 | S D N | 640 | | 124 | |
| | | S D N | 560 | | 108 | S D Cy | 586 | | 107 | |
| | | S Sh N | 602 | | 148 | C D Cy | 665 | | 124 | |
| | C | C Sh N | 644 | | 154 | C | C D Cy | | 619 | 108 |
| | | S Sh Cy | 620 | | 143 | | P Sh Cy | | 715 | 126 |
| P D Cy | | 666 | 144 | S D Cy | 713 | | 137 | | | |
| C D Cy | | 704 | 148 | P D Cy | 803 | | 138 | | | |
| C Sh Cy | | 648 | 138 | S Sh N | 640 | | 150 | | | |
| P Sh Cy | | 630 | 136 | C Sh Cy | 650 | | 138 | | | |
| S Sh N | | 592 | 126 | S D N | 616 | | 129 | | | |
| C D N | | 560 | 106 | C D N | 629 | | 130 | | | |
| S D N | | 544 | 116 | P Sh N | 621 | | 120 | | | |
| P Sh N | | 552 | 119 | P D N | 632 | | 114 | | | |
| S D Cy | 514 | 114 | S Sh Cy | 515 | 121 | | | | | |
| P D N | 542 | 117 | C Sh N | 656 | 124 | | | | | |

Wheat

Grain left, straw right

| | | | | | | | | |
|---|---------|------|------|--|---------|------|------|---|
| C | S Sh N | 29.1 | 38.1 | | S Sh N | 26.8 | 44.0 | C |
| | C Sh N | 35.1 | 42.1 | | S D Cy | 33.3 | 42.9 | |
| | C Sh Cy | 35.8 | 42.4 | | P Sh Cy | 42.3 | 55.5 | |
| | P D N | 43.1 | 53.7 | | P Sh N | 46.8 | 58.4 | |
| | C D N | 38.5 | 46.5 | | P D Cy | 45.6 | 56.4 | |
| | P Sh Cy | 42.0 | 47.5 | | C D Cy | 37.8 | 45.4 | |
| | C D Cy | 43.7 | 50.3 | | S D N | 44.3 | 57.2 | |
| | S D Cy | 36.1 | 44.7 | | P D N | 45.2 | 55.3 | |
| | P Sh N | 45.9 | 49.9 | | S Sh Cy | 39.6 | 46.6 | |
| | S Sh Cy | 38.2 | 45.0 | | C Sh N | 40.8 | 49.0 | |
| | S D N | 42.4 | 48.1 | | C D N | 47.5 | 59.5 | |
| | P D Cy | 44.8 | 52.7 | | C Sh Cy | 41.6 | 49.4 | |
| A | P D Cy | 40.5 | 46.0 | | C D N | 45.0 | 55.0 | B |
| | C Sh N | 41.0 | 47.0 | | C Sh N | 43.2 | 52.0 | |
| | C Sh Cy | 39.5 | 43.5 | | S D Cy | 43.5 | 51.3 | |
| | C D Cy | 38.0 | 43.5 | | P D N | 40.5 | 49.7 | |
| | S Sh Cy | 32.7 | 38.3 | | S D N | 35.6 | 43.9 | |
| | P Sh Cy | 39.3 | 42.2 | | S Sh Cy | 38.0 | 44.2 | |
| | S Sh N | 32.2 | 37.0 | | C Sh Cy | 40.5 | 47.7 | |
| | S D Cy | 36.2 | 40.8 | | P Sh N | 41.0 | 48.5 | |
| | C D N | 49.4 | 54.8 | | P D Cy | 48.3 | 55.9 | |
| | S D N | 39.2 | 45.0 | | P Sh Cy | 41.3 | 48.2 | |
| | P Sh N | 45.3 | 54.7 | | C D Cy | 46.1 | 53.9 | |
| | P D N | 38.5 | 47.3 | | S Sh N | 36.2 | 45.3 | |

Barley

Grain left, straw right

| | | | | | | | | |
|---|---------|------|------|--|---------|------|------|---|
| C | C Sh N | 46.0 | 43.8 | | S D Cy | 47.0 | 43.5 | A |
| | S Sh N | 48.9 | 47.6 | | S Sh Cy | 44.5 | 43.0 | |
| | P Sh Cy | 50.3 | 47.2 | | S D N | 46.8 | 45.4 | |
| | C D Cy | 49.3 | 47.4 | | C Sh N | 41.9 | 43.1 | |
| | C Sh Cy | 44.5 | 45.0 | | S Sh N | 41.8 | 38.0 | |
| | C D N | 44.4 | 43.6 | | P D Cy | 41.2 | 41.6 | |
| | S Sh Cy | 40.7 | 40.6 | | P Sh N | 47.0 | 45.8 | |
| | S D Cy | 48.7 | 46.3 | | C D Cy | 43.0 | 41.5 | |
| | P D Cy | 46.1 | 48.2 | | P Sh Cy | 43.9 | 42.1 | |
| | P Sh N | 48.3 | 48.4 | | C Sh Cy | 41.4 | 38.8 | |
| | P D N | 46.3 | 45.7 | | C D N | 42.9 | 41.1 | |
| | S D N | 52.3 | 49.2 | | P D N | 42.4 | 40.4 | |
| B | C D Cy | 48.8 | 46.0 | | S D Cy | 49.6 | 45.2 | C |
| | P Sh Cy | 47.8 | 47.0 | | C D Cy | 45.9 | 43.6 | |
| | P D Cy | 53.5 | 51.8 | | C Sh Cy | 45.1 | 43.6 | |
| | S D Cy | 49.8 | 47.2 | | P Sh N | 43.7 | 43.8 | |
| | P D N | 47.8 | 46.4 | | C D N | 45.0 | 44.0 | |
| | C D N | 50.0 | 49.0 | | S Sh N | 39.3 | 38.0 | |
| | P Sh N | 46.5 | 44.5 | | S D N | 40.0 | 39.8 | |
| | S Sh Cy | 45.0 | 40.8 | | S Sh Cy | 35.8 | 35.7 | |
| | C Sh N | 48.5 | 48.2 | | P D Cy | 42.0 | 40.8 | |
| | S Sh N | 43.0 | 39.0 | | P D N | 41.6 | 41.9 | |
| | C Sh Cy | 49.3 | 48.4 | | C Sh N | 43.4 | 42.8 | |
| | S D N | 49.3 | 47.7 | | P Sh Cy | 40.6 | 44.6 | |

SUMMARY OF RESULTS

| Last year* This year | Continuous | | | | Cycle A | | | Cycle B | | | Mean | |
|-------------------------|------------|--------|-------|-------|---------|--------|--------|---------|--------|--------|-------|--------|
| | P | S | C | Mean | C P | P S | S C | S P | P C | C S | | |
| Wheat | | | | | | | | | | | | |
| GRAIN : cwt. per acre | | | | | | | | | | | | |
| N | { D | 25.6 | 25.2 | 25.0 | 25.3 | 22.3 | 22.8 | 28.7 | 23.5 | 26.1 | 20.7 | 24.0 |
| | { Sh | 26.9 | 16.2 | 22.0 | 21.7 | 26.3 | 18.7 | 23.8 | 23.8 | 25.1 | 21.0 | 23.1 |
| Cy | { D | 26.2 | 20.1 | 23.6 | 23.3 | 23.5 | 21.0 | 22.1 | 28.0 | 26.8 | 25.2 | 24.4 |
| | { Sh | 24.5 | 22.6 | 22.5 | 23.2 | 22.8 | 19.0 | 22.9 | 24.0 | 23.5 | 22.1 | 22.4 |
| St. error | | ±1.41 | | | ±0.816 | ±2.00 | | | | | | ±0.816 |
| STRAW : cwt. per acre | | | | | | | | | | | | |
| N | { D | 31.6 | 30.6 | 30.8 | 31.0 | 27.5 | 26.1 | 31.8 | 28.8 | 31.9 | 25.5 | 28.6 |
| | { Sh | 31.4 | 23.8 | 26.4 | 27.2 | 31.7 | 21.5 | 27.3 | 28.1 | 30.2 | 26.3 | 27.5 |
| Cy | { D | 31.7 | 25.4 | 27.8 | 28.3 | 26.7 | 23.7 | 25.2 | 32.4 | 31.3 | 30.0 | 28.2 |
| | { Sh | 29.9 | 26.6 | 26.6 | 27.7 | 24.5 | 22.2 | 25.2 | 28.0 | 27.7 | 25.7 | 25.6 |
| St. error | | ±1.51 | | | ±0.873 | ±2.14 | | | | | | ±0.873 |
| Mangolds | | | | | | | | | | | | |
| ROOTS : tons per acre | | | | | | | | | | | | |
| N | { D | 33.74 | 33.34 | 34.17 | 33.75 | 36.61 | 36.78 | 40.46 | 38.80 | 41.96 | 32.19 | 37.80 |
| | { Sh | 33.71 | 35.40 | 37.36 | 35.49 | 37.47 | 36.73 | 33.16 | 38.34 | 34.14 | 34.60 | 35.74 |
| Cy | { D | 42.22 | 35.26 | 38.02 | 38.50 | 37.01 | 33.68 | 38.22 | 35.63 | 32.99 | 31.44 | 34.83 |
| | { Sh | 38.65 | 32.62 | 37.30 | 36.19 | 34.95 | 34.89 | 36.44 | 36.61 | 36.55 | 31.21 | 35.11 |
| St. error | | ±2.21 | | | ±1.28 | ±3.13 | | | | | | ±1.28 |
| TOPS : tons per acre | | | | | | | | | | | | |
| N | { D | 6.64 | 7.04 | 6.78 | 6.82 | 7.36 | 7.13 | 7.93 | 7.93 | 7.47 | 6.21 | 7.34 |
| | { Sh | 6.87 | 7.93 | 7.99 | 7.60 | 7.01 | 7.70 | 7.24 | 7.41 | 7.36 | 8.51 | 7.54 |
| Cy | { D | 8.10 | 7.21 | 7.36 | 7.56 | 5.29 | 6.15 | 7.13 | 7.36 | 6.09 | 7.01 | 6.50 |
| | { Sh | 7.53 | 7.59 | 7.93 | 7.68 | 6.84 | 7.13 | 7.18 | 7.70 | 7.70 | 7.64 | 7.36 |
| St. error | | ±0.532 | | | ±0.307 | ±0.752 | | | | | | ±0.307 |
| Barley | | | | | | | | | | | | |
| GRAIN : cwt. per acre | | | | | | | | | | | | |
| N | { D | 25.8 | 26.8 | 25.9 | 26.2 | 24.6 | 27.2 | 24.9 | 27.7 | 29.0 | 28.6 | 27.0 |
| | { Sh | 26.7 | 25.6 | 25.9 | 26.1 | 27.3 | 24.3 | 24.3 | 27.0 | 28.1 | 25.0 | 26.0 |
| Cy | { D | 25.6 | 28.5 | 27.6 | 27.2 | 23.9 | 27.3 | 25.0 | 31.0 | 28.3 | 28.9 | 27.4 |
| | { Sh | 26.4 | 22.2 | 26.0 | 24.9 | 25.5 | 25.8 | 24.0 | 27.7 | 28.6 | 26.1 | 26.3 |
| St. error | | ±1.08 | | | ±0.624 | ±1.53 | | | | | | ±0.624 |
| STRAW : cwt. per acre | | | | | | | | | | | | |
| N | { D | 25.4 | 25.8 | 25.4 | 25.5 | 23.4 | 26.3 | 23.9 | 26.9 | 28.4 | 27.7 | 26.1 |
| | { Sh | 26.8 | 24.8 | 25.1 | 25.6 | 26.6 | 22.1 | 25.0 | 25.8 | 28.0 | 22.6 | 25.0 |
| Cy | { D | 25.8 | 26.6 | 26.4 | 26.3 | 24.1 | 25.2 | 24.1 | 30.1 | 26.7 | 27.4 | 26.3 |
| | { Sh | 26.6 | 22.1 | 25.7 | 24.8 | 24.4 | 25.0 | 22.5 | 27.3 | 28.1 | 23.7 | 25.2 |
| St. error | | ±1.01 | | | ±0.581 | ±1.42 | | | | | | ±0.581 |

*These cultivations were not carried out, this being the first year of the experiment.

Mean of Nitro-Chalk and Cyanamide

| Last year* This year | Continuous | | | | Cycle A | | | Cycle B | | | Mean |
|--|---------------------------------------|--------------------|--------------------|--------------------|--------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | P | S | C | Mean | C P | P S | S C | S P | P C | C S | |
| Wheat | GRAIN : cwt. per acre (± 1.00) | | | | GRAIN : cwt. per acre (± 1.41) | | | | | | |
| D .. | 25.9 | 22.6 | 24.3 | 24.3 ² | 22.9 | 22.4 | 25.4 | 25.8 | 26.4 | 23.0 | 24.3 ² |
| Sh .. | 25.7 | 19.4 | 22.2 | 22.4 ² | 24.6 | 18.8 | 23.4 | 23.9 | 24.3 | 21.6 | 22.8 ² |
| Mean .. | 25.8 ¹ | 21.0 ¹ | 23.2 ¹ | 23.4 | 23.8 ³ | 20.6 ³ | 24.4 ³ | 24.8 ³ | 25.4 ³ | 22.3 ³ | 23.6 |
| St. errors (1) ± 0.707 , (2) ± 0.577 , (3) ± 1.00 . | | | | | | | | | | | |
| | STRAW : cwt. per acre (± 1.07) | | | | STRAW : cwt. per acre (± 1.51) | | | | | | |
| D .. | 31.6 | 28.0 | 29.3 | 29.6 ² | 27.1 | 24.9 | 28.5 | 30.6 | 31.6 | 27.8 | 28.4 ² |
| Sh .. | 30.6 | 25.2 | 26.5 | 27.4 ² | 28.1 | 21.8 | 26.2 | 28.0 | 29.0 | 26.0 | 26.5 ² |
| Mean .. | 31.1 ¹ | 26.6 ¹ | 27.9 ¹ | 28.5 | 27.6 ³ | 23.4 ³ | 27.4 ³ | 29.3 ³ | 30.3 ³ | 26.9 ³ | 27.5 |
| St. errors (1) ± 0.755 , (2) ± 0.617 , (3) ± 1.07 . | | | | | | | | | | | |
| Mangolds | ROOTS : tons per acre (± 1.56) | | | | ROOTS : tons per acre (± 2.21) | | | | | | |
| D .. | 37.98 | 34.30 | 36.10 | 36.13 ² | 36.81 | 35.23 | 39.34 | 37.22 | 37.48 | 31.82 | 36.32 ² |
| Sh .. | 36.18 | 34.01 | 37.33 | 35.84 ² | 36.21 | 35.81 | 34.80 | 37.48 | 35.34 | 32.90 | 35.42 ² |
| Mean .. | 37.08 ¹ | 34.16 ¹ | 36.72 ¹ | 35.98 | 36.51 ³ | 35.52 ³ | 37.07 ³ | 37.35 ³ | 36.41 ³ | 32.36 ³ | 35.87 |
| St. errors (1) ± 1.11 , (2) ± 0.902 , (3) ± 1.56 . | | | | | | | | | | | |
| | TOPS : tons per acre (± 0.376) | | | | TOPS : tons per acre (± 0.532) | | | | | | |
| D .. | 7.37 | 7.12 | 7.07 | 7.19 ² | 6.32 | 6.64 | 7.53 | 7.64 | 6.78 | 6.61 | 6.92 ² |
| Sh .. | 7.20 | 7.76 | 7.96 | 7.64 ² | 6.92 | 7.42 | 7.21 | 7.56 | 7.53 | 8.08 | 7.45 ² |
| Mean .. | 7.28 ¹ | 7.44 ¹ | 7.52 ¹ | 7.41 | 6.62 ³ | 7.03 ³ | 7.37 ³ | 7.60 ³ | 7.16 ³ | 7.34 ³ | 7.18 |
| St. errors (1) ± 0.266 , (2) ± 0.217 , (3) ± 0.376 . | | | | | | | | | | | |
| Barley | GRAIN : cwt. per acre (± 0.764) | | | | GRAIN : cwt. per acre (± 1.08) | | | | | | |
| D .. | 25.7 | 27.7 | 26.8 | 26.7 ² | 24.2 | 27.2 | 25.0 | 29.4 | 28.6 | 28.8 | 27.2 ² |
| Sh .. | 26.6 | 23.9 | 26.0 | 25.5 ² | 26.4 | 25.0 | 24.2 | 27.4 | 28.4 | 25.6 | 26.2 ² |
| Mean .. | 26.2 ¹ | 25.8 ¹ | 26.4 ¹ | 26.1 | 25.3 ³ | 26.1 ³ | 24.6 ³ | 28.4 ³ | 28.5 ³ | 27.2 ³ | 26.7 |
| St. errors (1) ± 0.540 , (2) ± 0.441 , (3) ± 0.764 . | | | | | | | | | | | |
| | STRAW : cwt. per acre (± 0.714) | | | | STRAW : cwt. per acre (± 1.01) | | | | | | |
| D .. | 25.6 | 26.2 | 25.9 | 25.9 ² | 23.8 | 25.8 | 24.0 | 28.5 | 27.6 | 27.6 | 26.2 ² |
| Sh .. | 26.7 | 23.5 | 25.4 | 25.2 ² | 25.5 | 23.6 | 23.8 | 26.6 | 28.0 | 23.2 | 25.1 ² |
| Mean .. | 26.2 ¹ | 24.8 ¹ | 25.6 ¹ | 25.5 | 24.6 ³ | 24.7 ³ | 23.9 ³ | 27.6 ³ | 27.8 ³ | 25.4 ³ | 25.6 |
| St. errors (1) ± 0.505 , (2) ± 0.412 , (3) ± 0.714 . | | | | | | | | | | | |

*These cultivations were not carried out, this being the first year of the experiment.

The above tables give the form in which the results will be presented in the succeeding years of the experiment. In the present year, there is no difference between the sets of treatments in the four blocks, and the summary tables below are based on means of all four blocks.

Mean of nitro-chalk and cyanamide

| | P | S | C | Mean | P | S | C | Mean |
|-----------------|--|--------------------|--------------------|--------------------|---------------------------------------|-------------------|-------------------|-------------------|
| Wheat | GRAIN : cwt. per acre (± 0.707) | | | | STRAW : cwt. per acre (± 0.755) | | | |
| D .. | 25.1 | 22.5 | 25.1 | 24.2 ² | 30.3 | 27.1 | 29.7 | 29.0 ⁴ |
| Sh .. | 24.9 | 19.8 | 23.0 | 22.6 ² | 29.4 | 24.6 | 27.1 | 27.0 ⁴ |
| Mean .. | 25.0 ¹ | 21.2 ¹ | 24.0 ¹ | 23.4 | 29.8 ³ | 25.8 ³ | 28.4 ³ | 28.0 |
| | St. errors : (1) ± 0.500 , (2) ± 0.408 , (3) ± 0.534 , (4) ± 0.436 . | | | | | | | |
| Mangolds | ROOTS : tons per acre (± 1.11) | | | | TOPS : tons per acre (± 0.266) | | | |
| D .. | 37.50 | 33.91 | 37.25 | 36.22 ² | 7.18 | 6.88 | 7.11 | 7.06 ⁴ |
| Sh .. | 36.51 | 34.18 | 36.20 | 35.63 ² | 7.22 | 7.75 | 7.67 | 7.55 ⁴ |
| Mean .. | 37.00 ¹ | 34.04 ¹ | 36.72 ¹ | 35.92 | 7.20 ³ | 7.32 ³ | 7.39 ³ | 7.30 |
| | St. errors : (1) ± 0.784 , (2) ± 0.641 , (3) ± 0.188 , (4) ± 0.154 . | | | | | | | |
| Barley | GRAIN : cwt. per acre (± 0.540) | | | | STRAW : cwt. per acre (± 0.505) | | | |
| D .. | 26.2 | 27.8 | 26.8 | 26.9 ² | 25.9 | 26.4 | 25.8 | 26.0 ⁴ |
| Sh .. | 26.7 | 24.6 | 26.1 | 25.8 ² | 26.4 | 23.4 | 25.7 | 25.2 ⁴ |
| Mean .. | 26.4 ¹ | 26.2 ¹ | 26.4 ¹ | 26.4 | 26.2 ³ | 24.9 ³ | 25.8 ³ | 25.6 |
| | St. errors : (1) ± 0.382 , (2) ± 0.312 , (3) ± 0.356 , (4) ± 0.291 . | | | | | | | |

Mean of deep and shallow cultivation

| | P | S | C | Mean | P | S | C | Mean |
|-----------------|---------------------------------------|-------|-------|--------------------|---------------------------------------|------|------|-------------------|
| Wheat | GRAIN : cwt. per acre (± 0.707) | | | | STRAW : cwt. per acre (± 0.755) | | | |
| N .. | 25.1 | 20.7 | 24.7 | 23.5 ¹ | 30.3 | 26.0 | 29.4 | 28.6 ² |
| Cy .. | 25.0 | 21.6 | 23.4 | 23.3 ¹ | 29.3 | 25.7 | 27.3 | 27.4 ² |
| Mangolds | ROOTS : tons per acre (± 1.11) | | | | TOPS : tons per acre (± 0.266) | | | |
| N .. | 35.76 | 34.72 | 36.60 | 35.69 ³ | 7.09 | 7.44 | 7.44 | 7.32 ⁴ |
| Cy .. | 38.24 | 33.37 | 36.86 | 36.16 ³ | 7.31 | 7.19 | 7.34 | 7.28 ⁴ |
| Barley | GRAIN : cwt. per acre (± 0.540) | | | | STRAW : cwt. per acre (± 0.505) | | | |
| N .. | 26.4 | 26.2 | 26.3 | 26.2 ⁵ | 25.9 | 25.0 | 25.8 | 25.6 ⁶ |
| Cy .. | 26.5 | 26.2 | 26.6 | 26.4 ⁵ | 26.4 | 24.8 | 25.7 | 25.6 ⁶ |

Standard errors : (1) ± 0.408 , (2) ± 0.436 , (3) ± 0.641 , (4) ± 0.154 , (5) ± 0.312 , (6) ± 0.291 .

Conclusions

For wheat and barley, the yields of grain and straw were significantly higher with deep cultivation than with shallow, the increases in cwt. per acre being wheat grain 1.6, straw 2.0, barley grain 1.1, straw 0.8. For mangolds there was little difference in the roots, but shallow cultivation gave a significantly higher yield of tops.

In the case of wheat, both grain and straw, and mangolds, roots only, simaring gave significantly lower yields than ploughing and cultivating. Ploughing gave somewhat higher yields than cultivating in the case of wheat, the difference being almost significant for the wheat straw. There was little difference between ploughing and cultivating in the case of mangold roots or of any of the three methods of cultivation in the tops. In the case of barley the results were similar to those for wheat as far as the shallow cultivations are concerned, but with deep cultivations simaring has actually yielded higher (significantly so in the case of the grain) than ploughing or cultivating.

There was no indication of any difference in the effects of nitro-chalk and cyanamide, except in the case of wheat straw, in which the nitro-chalk gave a slight, though not significant, increase.

In the case of wheat grain, the second order interaction was significant.