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ROTHAMSTED RESEARCH

# Rothamsted Report for 1932

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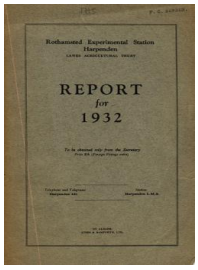


# Woburn Experimental Farm Report 1932

## Dr J. A. Voelcker

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# WOBURN EXPERIMENTAL FARM REPORT FOR 1931-32

By Dr. J. A. Voelcker, C.I.E., M.A.

A favourable period was experienced for the sowing of winter corn and the weather remained mild and open and without much rain through the early part of the winter. Throughout February and March cold east winds with night frosts checked the winter crops and made the period of sowing spring crops unfavourable. Growth was slow in April, but improved in May.

An abundant yield of hay was obtained and the sowing conditions for root crops were good. Corn crops made fair progress during June and July, and were reaped early in August.

The rainfall for the harvest year was 25.51 inches, as against 29.08 inches in 1930-31.

**METEOROLOGICAL RECORDS.**

| | *Rainfall.* | | | *Temperature (Mean).* | | | |
|---|---|---|---|---|---|---|---|
| | Total Fall. | No. of Rainy Days | Bright Sun-shine. | Max. | Min. | 1 ft. in Ground. | Grass Min. |
| 1931— | Ins. | No. | Hours. | °F. | °F. | °F. | °F. |
| Oct. .. | 0.64 | 5 | 100.9 | 55.2 | 37.8 | 49.3 | 35.5 |
| Nov. .. | 2.61 | 17 | 59.8 | 50.5 | 40.0 | 45.1 | 35.5 |
| Dec. .. | 0.88 | 12 | 34.6 | 45.4 | 35.9 | 41.5 | 33.2 |
| 1932— | | | | | | | |
| Jan. .. | 1.44 | 16 | 42.5 | 47.6 | 36.6 | 41.9 | 33.5 |
| Feb. .. | 0.23 | 9 | 49.5 | 41.4 | 30.1 | 38.1 | 26.6 |
| Mar. .. | 1.79 | 13 | 123.0 | 48.0 | 30.4 | 39.5 | 25.7 |
| April .. | 2.21 | 22 | 117.1 | 51.2 | 37.4 | 44.7 | 34.6 |
| May .. | 4.92 | 21 | 106.0 | 57.9 | 43.0 | 52.2 | 41.2 |
| June .. | 0.67 | 5 | 177.5 | 66.4 | 46.7 | 61.8 | 44.6 |
| July .. | 3.80 | 15 | 116.4 | 68.5 | 53.4 | 64.4 | 50.7 |
| Aug. .. | 4.31 | 11 | 171.9 | 72.3 | 53.9 | 65.6 | 51.3 |
| Sept. .. | 2.01 | 19 | 109.0 | 63.4 | 46.9 | 57.5 | 44.5 |
| Oct. .. | 3.43 | 22 | 98.4 | 54.2 | 40.7 | 48.8 | 37.4 |
| Nov. .. | 1.22 | 14 | 43.2 | 48.2 | 38.0 | 43.7 | 34.7 |
| Dec. .. | 0.48 | 9 | 49.6 | 45.5 | 35.4 | 40.5 | 31.6 |
| Total or mean of 1932 .. | 26.51 | 176 | 1204.1 | 55.4 | 41.0 | 49.9 | 38.0 |

## CONTINUOUS GROWING OF WHEAT AND BARLEY.

### Stackyard Field, 56th Year

(No manure since 1926)

*Wheat.*—" Red Standard " wheat, dressed with " Corvusine," was drilled on October 15th, 1931 and, watching being adequately provided, little damage was experienced from pheasants, though starlings were frequently troublesome. The wheat came up well, and showed a fair plant even on the very " acid " plots 2, 5 and 8 ; but

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the limed portions were better, though lime had in no case been put on since 1918. The best yield was given on plot 11b, which received farmyard manure up to 1926. Owing to the initial weediness and favourable conditions for weed growth, the crops on many plots were seriously affected. Mayweed was thick over all the plots, as also was a newcomer, *Holcus mollis*. Twitch and coltsfoot were abundant, as was vetchling on the nitrate of soda plots. Never before in the 56 years' experience have the plots been so weedy. The crop results are given in Table I.

**Table I.—CONTINUOUS GROWING OF WHEAT, 1932.**
**Stackyard Field—Produce per acre.**

| Plot. | Manures Applied Annually to 1926 (before the two years Fallow 1926-28). For amounts see Report 1927-28. No Manures in 1929, 1930, 1931 or 1932. | Dressed Corn per acre. Bushels | Total Corn per acre. Cwt. | Weight per bushel. lb. | Straw, Chaff, etc., per acre. Cwt. |
|---|---|---|---|---|---|
| 1 | Unmanured .. .. .. .. .. .. | 5.4 | 2.79 | 56.0 | 10.98 |
| 2a | Sulphate of Ammonia .. .. .. .. | — | — | — | 5.61 |
| 2aa | As 2a, with 5 cwt. Lime, Jan. 1905, repeated 1909, 1910, 1911 .. .. .. .. .. .. | 5.3 | 2.70 | 54.0 | 8.50 |
| 2b | As 2a, with 2 tons Lime, Dec., 1897 .. .. | 6.8 | 3.51 | 56.0 | 9.64 |
| 2bb | As 2b, with 2 tons Lime, repeated Jan., 1905 | 6.5 | 3.45 | 57.0 | 9.07 |
| 3a | Nitrate of Soda = 50 lb. Ammonia .. .. | 4.9 | 2.56 | 57.0 | 9.21 |
| 3b | Nitrate of Soda = 25 lb. Ammonia .. .. | 4.2 | 2.13 | 55.0 | 7.32 |
| 4 | Mineral Manures (Superphosphate and Sulphate of Potash) .. .. .. .. .. | 5.8 | 2.91 | 55.5 | 13.23 |
| 5a | Mineral Manures and Sulphate of Ammonia .. | 7.6 | 3.98 | 57.0 | 16.04 |
| 5b | As 5a, with 1 ton Lime, Jan., 1905 .. .. | 8.1 | 4.34 | 59.0 | 12.16 |
| 6 | Mineral Manures with Nitrate of Soda .. .. | 7.7 | 3.90 | 56.2 | 13.64 |
| 7 | Unmanured .. .. .. .. .. .. | 3.8 | 1.88 | 54.5 | 9.66 |
| 8a | Mineral Manures and, in alternate years, Sulphate of Ammonia .. .. .. .. .. | — | — | — | 2.43 |
| 8aa | As 8a, with 10 cwt. Lime, Jan., 1905, repeated Jan., 1918 .. .. .. .. .. .. | 4.4 | 2.24 | 56.0 | 9.32 |
| 8b | Mineral Manures and Sulphate of Ammonia (omitted in alternate years) .. .. .. | — | — | — | 4.28 |
| 8bb | As 8b, with 10 cwt. Lime, Jan., 1905, repeated Jan., 1918 .. .. .. .. .. .. | 7.6 | 4.01 | 58.0 | 10.89 |
| 9a | Mineral Manures and, in alternate years, Nitrate of Soda .. .. .. .. .. .. | 6.5 | 3.38 | 57.0 | 14.55 |
| 9b | Mineral Manures and Nitrate of Soda (omitted in alternate years) .. .. .. .. | 7.3 | 3.72 | 56.0 | 16.46 |
| 10a | Superphosphate and Nitrate of Soda .. .. | 9.0 | 4.58 | 56.5 | 11.28 |
| 10b | Rape Dust .. .. .. .. .. .. | 6.5 | 3.38 | 57.0 | 9.04 |
| 11a | Sulphate of Potash and Nitrate of Soda .. | 9.9 | 5.17 | 57.5 | 14.43 |
| 11b | Farmyard Manure .. .. .. .. .. | 12.3 | 6.22 | 55.0 | 19.00 |

Noticeably better crops than last year were given on Plots 1 (unmanured), 4 (mineral manures), and 11b (farmyard manure). In contrast to last year no yield was obtained on the plots previously treated with sulphate of ammonia without lime, 2a, 8a, and 8b.

*Barley.*—Seed, treated with "Corvusine," was drilled on March 16th. As in 1931, two varieties, "Plumage" and "Archer," were drilled in alternate strips.

On 8, 9, 10a and 11a, manurial treatment was renewed, minerals and sulphate of ammonia on 8, minerals and nitrate of soda on 9, superphosphate and nitrate of soda on 10a, and sulphate of potash and nitrate of soda on 11a. The quantities supplied were as given in the Table on page 96 of the 1931 Report, except that on 10a and 11a the amount of ammonium sulphate was reduced to the equivalent of 25 lb. of ammonia per acre.

As the season went on, spurry showed thickly on most of the plots, and, later, other weeds became prominent as with the adjoining wheat; mayweed, however, was not in such abundance. On the acid

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## Table II.—CONTINUOUS GROWING OF BARLEY, 1932.

### Stackyard Field — Produce per acre.

| Plot | Manures Applied Annually to 1926. (before the two years' Fallow 1926-28). For amounts see Report 1927-28. No manures in 1929, 1930 or 1931. For manures in 1932 see footnote. | Plumage. Dressed Corn per acre. bushel. | Plumage. Total Corn per acre. cwt. | Plumage. Weight per bushel. lb. | Plumage. Straw, Chaff, etc., per acre. cwt. | Archer. Dressed Corn per acre. bushel. | Archer. Total Corn per acre. cwt. | Archer. Weight per bushel. lb. | Archer. Straw, Chaff, etc., per acre. cwt. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Unmanured | 0.3* | 0.20 | — | 2.25 | 0.2** | 0.15 | — | 2.78 |
| 2a | Sulphate of Ammonia | | No | yield. | | | No | yield. | |
| 2aa | As 2a, with 5 cwt. Lime, Mar., 1905, repeated 1909, 1910, 1912 and 1923 | 0.7* | 0.43 | — | 2.21 | 1.1** | 0.78 | — | 3.50 |
| 2b | As 2a, with 2 tons Lime, Dec., 1897, repeated 1912 | 0.7* | 0.50 | — | 2.07 | 0.7** | 0.43 | — | 2.71 |
| 2bb | As 2a, with 2 tons Lime, Dec., 1897, repeated Mar., 1905 | 0.7* | 0.57 | — | 2.43 | 0.9** | 0.64 | — | 2.57 |
| 3a | Nitrate of Soda = 50 lb. ammonia | 2.2* | 1.28 | — | 4.78 | 3.2** | 1.71 | — | 6.78 |
| 3aa | As 3a, with 2 tons Lime, Jan., 1921 | 2.2* | 1.21 | — | 4.42 | 2.7** | 1.36 | — | 4.57 |
| 3b | Nitrate of Soda = 25 lb. ammonia | 1.5* | 0.71 | — | 4.28 | 2.4** | 1.36 | — | 5.57 |
| 3bb | As 3b, with 2 tons Lime, Jan., 1921 | 2.1* | 1.07 | — | 5.07 | 2.5** | 1.43 | — | 5.28 |
| 4a | Mineral Manures (Superphosphate and Sulphate of Potash) | 0.5* | 0.32 | — | 2.32 | 0.4** | 0.25 | — | 2.46 |
| 4b | As 4a, with 1 ton Lime, 1915 | 0.2* | 0.14 | — | 1.25 | 0.2** | 0.18 | — | 2.25 |
| 5a | Mineral Manures and Sulphate of Ammonia | | No | yield. | | | No | yield. | |
| 5aa | As 5a, with 1 ton Lime, Mar., 1905, repeated 1916 | | No | yield. | | | No | yield. | |
| 5b | As 5a, with 2 tons Lime, Dec., 1897, repeated 1912 | 2.8* | 1.43 | — | 6.50 | | No | yield. | |
| 6 | Mineral Manures and Nitrate of Soda | 4.2 | 1.73 | 39.0 | 6.75 | 4.9 | 2.21 | 42.0 | 7.71 |
| 7 | Unmanured | 1.0* | 0.57 | — | 4.37 | 1.2** | 0.64 | — | 5.04 |
| 8a | Mineral Manures and, in alternate years, Sulphate of Ammonia | | No | yield. | | | No | yield. | |
| 8aa | As 8a, with 2 tons Lime, Dec., 1897, repeated 1912 | 12.5 | 5.57 | 46.0 | 11.00 | 17.8 | 7.78 | 45.0 | 16.28 |
| 8b | Mineral Manures and Sulphate of Ammonia (omitted in alternate years) | | No | yield. | | | No | yield. | |
| 8bb | As 8b, with 2 tons Lime, Dec., 1897, repeated 1912 | 16.7 | 7.21 | 44.0 | 14.21 | 20.1 | 9.00 | 47.0 | 16.43 |
| 9a | Mineral Manures and, in alternate years, Nitrate of Soda | 18.5 | 7.75 | 43.0 | 16 78 | 25.2 | 10.43 | 44.5 | 20.36 |
| 9b | Mineral Manures and Nitrate of Soda (omitted in alternate years) | 21.8 | 8.98 | 43.2 | 20.46 | 27.6 | 11.61 | 44.7 | 21.57 |
| 10a | Superphosphate and Nitrate of Soda | 2.1* | 0.92 | — | 8.17 | 2.9** | 1.37 | — | 8.62 |
| 10b | Rape Dust | | No | yield. | | | No | yield. | |
| 11a | Sulphate of Potash and Nitrate of Soda | 3.0* | 1.65 | — | 12.58 | 5.3 | 2.44 | 41.0 | 13.69 |
| 11b | Farmyard Manure | 8.5 | 3.99 | 41.0 | 12.94 | 9.9 | 4.74 | 45.0 | 13.76 |

*Estimated from average bushel weight (42.7).

**Estimated from average bushel weight (44.2).

Manuring in 1932:

| Plots. | Quantity per acre. |
|---|---|
| 1-7 | Unmanured. |
| 8a, 8b, 8aa, 8bb | 3 cwt. Superphosphate, 1½ cwt. Sulphate of Potash, 1¾ cwt. Sulphate of Ammonia. |
| 9a, 9b | 3 cwt. Superphosphate, 1½ cwt. Sulphate of Potash, 2.28 cwt. Nitrate of Soda. |
| 10a. | 3 cwt. Superphosphate, 2.36 cwt. Nitrate of Soda. |
| 10b. | Unmanured. |
| 11a. | 1½ cwt. Sulphate of Potash, 2.36 cwt. Nitrate of Soda. |
| 11b. | Unmanured. |

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plots 2a and 5a, sorrel to a great extent had replaced spurry, though it was not to be seen on the limed plots.

The barley began to look yellow and unhealthy, with very short straw. There was little difference between "Plumage" and "Archer."

The crop was cut with the scythe—August 15th to 23rd—and threshed in the field September 6th to 13th.

The results are given in Table II.

The harvest results were the lowest recorded since the cessation (after 1926) of manurial applications. Since the barley grew well at first, the chief adverse factor was, no doubt, the prevalence of weeds, especially spurry, mayweed, chickweed and *Agrostis*. On the unmanured (1932) plots the produce was in no case above 4 bushels per acre, that of the continuously unmanured plot being only 0.7 bushels per acre; farmyard manure (last applied 1926) gave considerably the highest return, *viz.* 9.3 bushels per acre (11b). The very acid plots, 2a, 5a, 8a and 8b, gave no yield whatever, but wherever lime had been previously given some produce was obtained. Lime, however, in addition to mineral manures alone, proved no benefit (4a, 4b); rape-dust also gave a very small yield. In the case of the plots which received manurial dressings in 1932, plots 8 and 9 showed by their yields, amounting to 15.2 bushels per acre on plot 8aa and 24.7 bushels per acre on plot 9b, that the land was capable of responding to a stimulus. The low yields of 10a and 11a have not been accounted for.

The yields from the plots which received nitrate of soda up to 1926 and nothing since were superior to those from plots receiving sulphate of ammonia up to 1926 and, likewise, nothing since that date.

"Archer" gave a greater yield than "Plumage," whether the plot was actually manured in 1932 or had received no manure since 1926.

## ROTATION EXPERIMENTS

### The Unexhausted Manurial Value of Cake and Corn (Stackyard Field)

*Series C.* The Alsike presented a good appearance until towards the end of January, 1932, when it became very weedy. A month later there was very little clover visible on either half. About the middle of March, a striking recovery set in and when cut for seed in July, the alsike yielded a crop far better than at once time seemed possible. The growth was patchy, but there were less weeds on the corn-fed half. The weights of clover (Alsike) hay per acre were: Corn-fed Plot, 15.2 cwt.; Cake-fed Plot, 10.2 cwt.

*Series D.* After ploughing up the red clover, alsike and tares of 1931, "Red Standard" wheat, at the rate of 12 pecks per acre, was drilled on October 16th. The wheat grew well throughout, giving an excellent crop for this light land. It was cut on August 16th. The results are given in Table III.



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**Table III.—WHEAT AFTER CLOVER.**
**Produce per acre.**

| Plot. | *Head Corn.* | | *Tail Corn.* | *Straw, Chaff, etc.* |
|---|---|---|---|---|
| | Bushels. | Weight per Bushel lb. | lb. | cwt. |
| 1. Corn-fed .. | 16.6 | 63.2 | 13 | 16.3 |
| 2. Cake-fed .. | 18.5 | 63.2 | 22 | 20.5 |

The yield differences between the two plots were, as usual, small in comparison with the amounts of nitrogen supplied to the plots when the root crop was fed off in 1929 (corn plot, 24.6 lbs. per acre ; cake plot, 56.5 lbs. per acre of nitrogen).

## GREEN CROP AND GREEN MANURING EXPERIMENTS

(a) *Stackyard Field—Series A*

*Upper half.* 1932. *Green Crops.* Tares were drilled on April 11th, mustard on May 10th—the usual mineral manures (superphosphate 3 cwt., and sulphate of potash 1 cwt. per acre) being given previously. Fair crops were obtained, and these were successively fed off with sheep receiving for each crop 1½ cwt. per acre mixed linseed and undecorticated cotton cake. Second crops of tares and mustard were sown which grew slowly and gave small yields. They were in turn fed off with cake as before. The two feedings of cake provided an additional 15.92 lbs. of nitrogen per acre. After this the land was ploughed and prepared for wheat. Samples of the green crops were analysed (Table IV).

**TABLE IV.—GREEN MANURING EXPERIMENT, STACKYARD FIELD.**
**(Upper Half, 1932).**

| Plots | *First Crop.* | | | | *Second Crop.* | | | | *Tota .* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Green Matter per acre. lb. | Dry Matter per acre. lb. | Nitrogen per cent. | Nitrogen per acre. lb. | Green Matter per acre. lb. | Dry Matter per acre. lb. | Nitrogen per cent. | Nitrogen per acre. lb. | Green Matter per acre. lb. | Dry Matter per acre. lb. | Total Nitrogen, peracre lb. |
| Mustard unlimed | 3400 | 690 | 1.92 | 13.2 | 1440 | 249 | 3.71 | 9.3 | 4840 | 939 | 22.5 |
| Mustard limed .. | 2020 | 376 | 2.06 | 7.7 | 1140 | 235 | 2.75 | 6.5 | 3160 | 611 | 14.2 |
| Tares unlimed | 8250 | 1659 | 2.72 | 45.1 | 460 | 96 | 2.94 | 2.8 | 8710 | 1755 | 47.9 |
| Tares limed .. | 8560 | 1669 | 3.00 | 50.1 | 460 | 93 | 2.98 | 2.8 | 9020 | 1762 | 52.9 |

*Lower half,* 1932. *Wheat after Green crops fed off by sheep.*

" Red Standard " wheat, at the rate of 12 pecks per acre, was drilled on October 23rd. The wheat was drilled closely in 7-inch rows instead of the usual 9 inch, but this did not have the hoped-for effect of keeping the weeds in check. The principal weeds were twitch, veronica, shepherd's purse, mayweed, and chickweed ; they

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were more plentiful on the tares portion than on the mustard one. The plant of wheat was never strong and was always inferior to the adjoining permanent wheat. But in the warmer weather of May, there was not the sudden failure and withering up which had been noticed generally in earlier years. In appearance there was nothing to choose between the two portions. The crop was cut August 16th. The results are given in Table V.

**Table V.—WHEAT AFTER GREEN CROPS, FED OFF BY SHEEP. Produce per acre.**

| Plot. | *Head Corn.* | | *Tail Corn.* | *Straw, Chaff, etc.* |
|---|---|---|---|---|
| | No. of Bushels. | Weight per Bushel lb. | lb. | cwt. |
| 1. After Tares fed off (unlimed) .. | 6.0 | 58.0 | 16 | 9.8 |
| 2. After Tares fed off (limed) .. | 8.2 | 57.0 | 54 | 14.5 |
| 3. After Mustard fed off (unlimed) .. | 9.0 | 59.0 | 10 | 11.1 |
| 4. After Mustard fed off (limed) .. | 5.7 | 58.5 | 6 | 8.0 |

These results are even lower than those of 1931, the first year in which the falling away of the crops in May had not been experienced.

(*b*) *Lansome Piece. Green crops ploughed in.*

Green crops of mustard and tares were sown in 1932. Tares were drilled on April 8th and mustard three weeks later. The green crops were ploughed in and second crops drilled in July, these in turn being ploughed in. Table VI gives the weights of green and dry matter and nitrogen supplied in each crop.

**Table VI.—GREEN MANURING EXPERIMENT, 1932. Lansome Piece.**

| Plot. | *First Crop.* | | | | *Second Crop.* | | | | *Total.* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Green Matter per acre. lb. | Dry Matter per acre. lb. | Nitrogen per cent. | Nitrogen per acre. lb. | Green Matter per acre. lb. | Dry Matter per acre. lb. | Nitrogen per cent. | Nitrogen per acre. lb. | Green Matter per acre. lb. | Dry Matter per acre. lb. | Total Nitrogen, peracre lb. |
| 1. Mustard old series | 2240 | 352 | 2.20 | 7.7 | 2980 | 492 | 2.83 | 13.9 | 5220 | 844 | 21.6 |
| 2. Tares old series | 2700 | 505 | 2.11 | 10.7 | 5380 | 933 | 2.98 | 27.8 | 8080 | 1438 | 38.5 |
| 3. Mustard new series | 2440 | 386 | 2.41 | 9.3 | 2820 | 418 | 3.13 | 13.2 | 5260 | 804 | 22.5 |
| 4. Tares new series | 2150 | 389 | 2.65 | 10.3 | 3000 | 630 | 3.05 | 19.2 | 5150 | 1019 | 39.5 |
| 5. Control new series | 2500 | 410 | 2.29 | 9.4 | 560 | 105 | 2.86 | 3.0 | 3060 | 515 | 12.4 |

It will be observed that a considerable amount of nitrogen was supplied on the control plot by weeds. Wheat was sown, following the ploughing-in of the second green crops.

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### LUCERNE INOCULATION, LANSOME FIELD, 1932

Inoculated and uninoculated seed were sown in strips on April 21st, with a small proportion of mustard seed for the purpose of a cover crop. The lucerne grew well, and a first cutting was taken on August 16th. The average yield of hay was just over 13 cwt. per acre. No significant effect of inoculation was observed, in contrast to the results obtained in 1927-29, when a 23 per cent. increase was secured. The experiment is being continued.

### MANURING OF GRASS LAND, BROAD MEAD, 1932

The five plots of this area were again closely grazed, and the herbage continued to improve. That on the farmyard manure plot has become much less rank. The limed plot—which remains distinguishable from the others by its profusion of daisies—is still the most closely grazed plot.

### POT-CULTURE EXPERIMENTS

*Green Manuring.* To test whether quantities of green manure greater than those grown in the experiments in Lansome and Stackyard fields would give increased yields in the following cereal crop, a series of pot cultures was done. Earthenware drainpipes 20 inches in depth, open at the bottom to allow free drainage, were sunk into the ground and filled in March, 1929, with soil from the headland of Stackyard Field. The experiment was in quadruplicate, and three successive crops of mustard and of tares, were grown in 1929 and turned in. Wheat was grown in 1930, the green cropping was repeated in 1931, and wheat again grown in 1932.

The results follow :

**Average Produce of Corn, 1930 and 1932, after Green-manuring (1929 and 1931)**

| | Corn Grammes | Straw Grammes |
|---|---|---|
| 1. Without Green-manure .. .. | 78.7 | 130.1 |
| 2. Mustard.. .. .. .. .. | 90.9 | 193.9 |
| 3. Tares .. .. .. .. .. | 86.8 | 166.5 |

It appears that a more liberal green manuring than that used in the field condition has but little effect on the yield of grain, though the effect on the straw is greater. There is no marked difference between the effects of tares and mustard.

Pot experiments in which drainage is permitted or prevented, at different periods, are now in progress.

## WOBURN FARM

### REPORT BY H. G. MILLER, 1932

The weather, though favourable to the root crops and grassland was much less favourable to corn crops. The spring rains, coming shortly after the application of manures, caused serious leaching. The contrast between yields of barley, and in particular wheat, in the 6 course Rotation Experiment at Woburn and Rothamsted is most striking. The Woburn wheat was practically a