ROTHAMSTED RESEARCH

# Report for 1929

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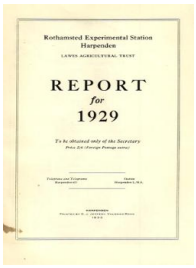


# Barley

## Rothamsted Research

Rothamsted Research (1930) *Barley ;* Report For 1929, pp 33 - 36 **- DOI: https://doi.org/10.23637/ERADOC-1-111**

| Spacing as set out | *Rothamsted.* 1928 24-inch rows. 10-inch singling. | 1929 22-inch rows. 8-inch singling. | *Woburn.* 1929 I 22-inch rows. 8-9-inch singling. | 1929 II 22-inch rows. 8-9-inch singling. |
|---|---|---|---|---|
| No. of plants expected .. | 26,000 | 36,000 | 35,000 | 35,000 |
| No. harvested .. | 17,715 | 30,350 | 31,800 | 32,700 |
| Plants obtained as percentage of what was expected .. | 68% | 83% | 88% | 94% |
| Yield tons per acre average .. | 9.15 | 7.43 | 8.07 | 8.23 |
| Average weight per root (lb.) .. | 1.16 | 0.55 | 0.57 | 0.56 |

## MANGOLDS.

The Barnfield mangold experiments bring out clearly the harmful effects of failure to balance nitrogenous manure with potash. So long as the complete fertiliser is given the plant grows well and responds to heavy dressings of manure: when potash is omitted, however, the leaves lose efficiency, they make much less root and tend to become diseased, and the whole plant is weakened so that the mortality is considerable. The plants are grown in rows 26½ inches apart: there are on the completely manured plots some 30,000 to 34,000 per acre. But where high nitrogen manuring is not balanced by potash the number of plants is much less and the roots are smaller.

This is shown in the following table:—

*Barnfield Mangolds*, 1924-29.

No. of plants and yield per acre *Roots* and *Leaves*.

| Year | Heavy Nitrogenous Manuring with Potash (Plot 4 A.C.) | | | Heavy Nitrogenous Manuring without Potash (Plot 5 A.C.) | | |
|---|---|---|---|---|---|---|
| | No. of Plants | Roots Yield per acre tons | Leaves Yield per acre tons | No. of Plants | Roots Yield per acre tons | Leaves Yield per acre tons |
| 1924 .. | 3328 | 34.16 | 5.62 | 2573 | 15.81 | 4.83 |
| 1925 .. | 3201 | 22.43 | 6.05 | 2356 | 6.30 | 4.51 |
| 1926 .. | 3035 | 25.77 | 4.12 | 1996 | 8.29 | 2.25 |
| 1927* .. | 3423 | 13.42 | 3.89 | 3263 | 12.79 | 3.59 |
| 1928 .. | 2978 | 29.22 | 5.01 | 2225 | 9.55 | 2.83 |
| 1929 .. | 3075 | 20.67 | 3.94 | 1741 | 4.71 | 2.09 |

* Swedes.

## BARLEY.

In 1929 comparisons were made between sulphate of ammonia, muriate of ammonia, cyanamide and nitrate of soda. Of these, nitrate of soda gave the largest increase, possibly as the result of the dry conditions; the others, however, came out practically alike. One cwt. of sulphate of ammonia gave its usual return of 6 bushels of barley, a second cwt. gave an additional 4 bushels. It has been our usual experience that cyanamide does as well as sulphate of ammonia. This year, in common with muriate of ammonia, it

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was, if anything, rather better. At Woburn also, muriate of ammonia was superior to sulphate of ammonia. For nitrate of soda the increased yields were 11 bushels of barley for the first cwt. and an additional 4 bushels for the second.

The figures are:—

*Barley, yield of grain, cwt. per acre.*

| Size of Dressing. | No Nitrogen | Sulphate of Ammonia | Cyan-amide | Muriate of Ammonia | Nitrate of Soda | Urea. |
|---|---|---|---|---|---|---|
| Single .. .. | 20.1 | 23.1 | 23.6 | 23.6 | 25.6 | — |
| Double .. .. | | 25.2 | 26.3 | 26.2 | 27.8 | 25.4 |
| Increase over no Nitrogen : | | | | | | |
| 1st dose .. | | 3.0 | 3.5 | 3.5 | 5.5 | 5.3 |
| Additional for 2nd dose .. | | 2.1 | 2.7 | 2.6 | 2.2 | |

At Rothamsted in 1929 potassic manures slightly depressed the yield of barley, as had also happened in 1924: the effect is most clearly seen with the double dressing of nitrogen; the figures were obtained by the sampling method and represent, in cwt. per acre:

| | GRAIN | | STRAW | |
|---|---|---|---|---|
| WITH DOUBLE NITROGEN | No Phosphate | Phosphate | No Phosphate | Phosphate |
| No Potash ... ... | 27.3 | 27.4 | 27.6 | 27.9 |
| Potash ... ... | 25.7 | 25.8 | 26.1 | 26.0 |
| *Standard Error* ... | .57 | | .63 | |
| WITH SINGLE NITROGEN | | | | |
| No Potash ... ... | 24.0 | 23.3 | 24.7 | 23.4 |
| Potash ... ... | 23.0 | 23.6 | 23.6 | 24.5 |
| *Standard Error* ... | .70 | | .78 | |
| WITH NO NITROGEN | | | | |
| No Potash ... ... | 19.5 | 21.5 | 19.1 | 21.6 |
| Potash ... ... | 21.5 | 20.1 | 21.6 | 20.4 |
| *Standard Error* ... | 1.40 | | 1.57 | |

On the light soil at Woburn, sulphate of potash markedly increased the yield where there was no nitrogenous fertiliser, and somewhat increased it where muriate of ammonia was given, but not where sulphate of ammonia was used; superphosphate had no effect however.

On another light soil, the Lincoln Heath at Wellingore, superphosphate increased the yield of grain and of straw so long as nitrogen was applied. In absence of added nitrogen, it depressed the yield.

*Yield of barley, light loam on Oolitic Limestone, Wellingore.*
*Grain, cwt. per acre.*

| | No Nitrogen. | | Nitrogen. | |
|---|---|---|---|---|
| | No Phosphate. | Phosphate. | No Phosphate. | Phosphate. |
| No Potash .. | 18.8 | 18.0 | 19.5 | 22.4 |
| Potash .. .. | 20.7 | 17.0 | 20.6 | 25.1 |
| | Standard Error = 0.89 cwt. | | | |
| | *Straw in cwt. per acre.* | | | |
| No Potash .. | 16.3 | 16.4 | 17.9 | 20.8 |
| Potash .. .. | 18.1 | 14.8 | 19.7 | 24.1 |
| | Standard Error = 0.59 cwt. | | | |

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The barley at Woburn was attacked by a common fungus disease, *Fusarium culmorum*, which did, as usual, a certain amount of damage. Dr. Mann devised a system of marks to denote the severity of the attack and obtained the following results:—

| | No Potash. | Sulphate of Potash. | No Phosphate. | Superphosphate. |
|---|---|---|---|---|
| Severity of attack | 47 | 31 | 39 | 39 |

Potash thus reduced the attack of the disease; phosphate and nitrogen did not. This is a usual property of potassic fertilisers.

*Effect of Chlorides.* Pot experiments showed that chlorides delayed the rate of ripening of the straw, giving a lower percentage of dry matter than was obtained with sulphates. When the ears were ripe for cutting, the straw of the plants manured with chlorides contained 40.9 to 44.5 per cent. of dry matter, while those manured with sulphates contained 54.3 to 57 per cent. The total weight of straw, however, was substantially the same with both groups of fertilisers.

*The Quality of the Barley.* The valuers put the barleys in the following order of merit:—

I. 43/- *to* 44/- *per quarter.* Muriate of ammonia both dressings, urea.

II. 41/- *to* 42/- *per quarter.* Nitrate of soda, sulphate of ammonia and cyanamide in the double dressing.

III. 35/- *per quarter.* Nitrate of soda, sulphate of ammonia and cyanamide in the single dressing. No nitrogen.

The nitrogenous manures this season increased the production of carbohydrates sufficiently to maintain the balance with the nitrogen taken up. In consequence, the percentage of nitrogen in the grain was hardly affected: the results were:—

*Nitrogen per cent. in Barley Grain.*

| | No Nitrogen | Sulphate of Ammonia | Cyan-amide | Muriate of Ammonia | Nitrate of Soda | Urea |
|---|---|---|---|---|---|---|
| Single Dressing .. | 1.461 | 1.456 | 1.480 | 1.469 | 1.470 | |
| Double Dressing .. | | 1.477 | 1.470 | 1.485 | 1.532 | 1.498 |

It is slowly becoming possible to form a mental picture of the relationship between growth and quality in barley. The total nitrogen in the plant depends on the amount of nitrate in the soil at the time of sowing and during the following few weeks: the greater the amount in the soil the greater the uptake by the plant. The different varieties of barley compared by Dr. Bishop took up much the same amount of nitrogen, but they produced different amounts of carbohydrate: those that produce most give the highest yields and contain the lowest per cent. of nitrogen, and *vice versa*. For any given variety, however, the total carbohydrate in the plant is not constant, but depends on the other soil conditions, the supply of potash and phosphate, and the length of the vegetative period.

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Soon after the grain begins to form, the carbohydrates and the nitrogen compounds move into it together, and the proportions in which they go remain almost constant throughout the whole process of grain formation. Not quite constant, however, for drought seems to check the flow of carbohydrate more than that of nitrogen, and therefore to raise the percentage of nitrogen in the grain.

For the maltster one of the most important properties of barley is the amount of extract obtainable from the malt. Hitherto, this has been determined by a laborious malting test. Dr. Bishop has shown that it is simply related to the moisture content, the percentage of nitrogen and the 1,000 corn weight of the barley grain: he has constructed a slide rule by means of which the chemist, knowing these three easily ascertained quantities, can read off at once the number of pounds of extract obtainable from a hundredweight of barley.

A study of the nitrogen compounds during malting has shown that hordein and glutelin both break down rapidly from the third to the sixth day on the floor to give salt-soluble compounds, chiefly non-protein nitrogen. After this there is an approximate balance due to a resynthesis in the embryo equal in amount to the breakdown in the endosperm. No marked changes take place as a result of the subsequent kilning process, nor are the proportions much altered by variations (within limits) in the amount of moisture supplied to the germinating grain, or in the time of flooring.

*Calcium Cyanamide.* Reference to the detailed tables shows that calcium cyanamide has given as good results as sulphate of ammonia for barley, and distinctly good results for sugar beet at the western centre. Both these crops require lime. On the other hand, in our earlier experiments it did not give as good results for potatoes, a crop which does not in general benefit by lime. We are following up this distinction and it may help in deciding the conditions in which the expert could advise the use of cyanamide. On the Continent farmers are sometimes advised to apply cyanamide a few days after the sowing of the seed wherever it is impossible to adopt the better plan of applying it several days before the sowing. We found no advantage in this course: no harm was done when 1 or 2 cwt. was sown with the seed, though 4 cwt. proved distinctly injurious.

## WINTER WHEAT.

The experiments with wheat were somewhat weakened by the circumstance that some of the plants died during winter and the survivors were too irregularly distributed to form good experimental material. This winter mortality probably explains the higher standard errors per plot as compared with those obtained in experiments on spring sown cereals (pages 46-7).

The results agreed with those of 1927 in that the early dressing of sulphate of ammonia was better than the late: they thus differed from the results of 1926 and 1928. Muriate of ammonia, however, gave better results late than early, again in accordance with 1927 and in opposition to 1926 and 1928.

In each year Square-Head's Master has the highest nitrogen content, Yeoman II. follows closely: then come Million III. and

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