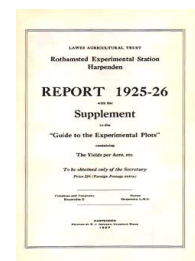


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Law of Diminishing Returns

Rothamsted Research

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error is increased by the irregularities of the pasture, the inequalities among the sheep, and the fact that the land must be very closely grazed or the herbage becomes too coarse to nourish the sheep. This close grazing is very important; at one centre the sheep did worse on the slagged land than on the unmanured, simply because the grass grew too much for them. In consequence the grazing results are not as sharp as those on arable or hay land, where the errors are much smaller.

The Rothamsted grazing plots, which were set up in 1921, were re-dressed with similar slags in 1925. During the whole six years neither the Gafsa nor the low soluble slag had any action; the high soluble slag acted better. For these high soluble slags, however, their order of efficiency was not the same as the order of solubility. The results were:—

Average Yearly Live Weight Increase in Sheep. lb. per acre.

| Description of Phosphate. | Composition. | | Rothamsted Average for | | Thrussington Average for 2 years, 1925-26. |
|---------------------------|------------------|-------------|------------------------|-------------------|--|
| | Total Phosphate. | Solubility. | 4 years, 1922-25. | 2 years, 1925-26. | |
| No Phosphate ... | — | — | 124 | 149 | 170 |
| Gafsa ... | — | — | 123 | 151 | 185 |
| Slag, Low Soluble ... | 21.1 | 27.7 | 127 | 146 | 209 |
| High Soluble ... | 19.8 | 70.9 | 159 | 180 | 181 |
| High Soluble ... | 19.8 | 70.9 | 146 | 147 | 187 |
| High Soluble ... | 42.5 | 77.2 | 120 | 150 | — |
| High Soluble ... | 18.0 | 81.3 | 106 | 138 | 216 |
| No Phosphate ... | — | — | 107 | 136 | — |

Comparison of the Rothamsted results with those obtained elsewhere brings out the very interesting fact that grassland is not readily improved by slag if an acre of it yields some 200 lbs. live weight increase in sheep. The striking results are obtained on land giving only 50 or less lbs. increase per acre. The figures are:—

| Centre. | Live Weight Increase, lb. per acre. | | | | Number of Sheep carried per acre. | | | |
|------------------|-------------------------------------|--------------------|------------|--------------------|-----------------------------------|--------------------|------------|--------------------|
| | 1925. | | 1926. | | 1925. | | 1926. | |
| | No Manure. | High Soluble Slag. | No Manure. | High Soluble Slag. | No Manure. | High Soluble Slag. | No Manure. | High Soluble Slag. |
| Fiddington ... | 242 | 212 | 187 | 93 | 6.5 | 6.5 | 6.3 | 6.3 |
| Thrussington ... | 134 | 165 | 156 | 225 | 3.7 | 3.7 | 6.0 | 6.0 |
| Rothamsted ... | 81 | 103 | 190 | 196 | 6.6 | 6.6 | 6.1 | 6.1 |
| Hebron ... | 53 | 123 | 18 | 71 | 2.0 | 4.0 | 2.0 | 4.0 |

FERTILISER ACTION AND THE LAW OF DIMINISHING RETURNS.

Periodically a good deal is heard about the Law of Diminishing Returns, and farmers are reminded that the use of fertilisers, or any other improving agents, beyond a certain point is not economically sound, the extra yield obtained not paying the additional

cost of winning the crop. This is undoubtedly true, but it is also true that many farmers are not near the point of diminishing returns and would obtain better results, both in output and financially, by putting more into the land.

Data are accumulating (see 1923-24 Report, p. 16) to show that in many instances the return from fertilisers and other improvements increases with increasing quantities before it begins to decrease. This is shown in the potato experiment of 1926, where the successive increases in yield given by successive doses of sulphate of ammonia are, in cwts. per acre:—

| Quantity of Sulphate of Potash per acre. | Successive Increases in yield for Sulphate of Ammonia. | | |
|--|--|----------|------------------|
| | 1st cwt. | 2nd cwt. | 3rd and 4th cwt. |
| 1 cwt. | 23.6 | 31.6 | 6 |
| 2 cwt. | 23.2 | 22.6 | 13.2 |
| 4 cwt. | 24.4 | 28.6 | 19.0 |
| Mean | 23.7 | 27.6 | — |

The second cwt. of sulphate of ammonia is not only profitable, but more profitable than the first.

This increasing return has so far been observed only with nitrogenous manures, and it is marked only in certain seasons. It may, however, always occur but be missed: in a field experiment only few quantities can be tested, and usually for potatoes the steps have been greater than 1 cwt. per acre.

The effect of the fertiliser is influenced by the time at which it is applied. In the experiments on oats in 1925 the late dressing gave the better result for 1 cwt. sulphate of ammonia, while in 1923 the earlier dressing had proved the better. In both years 2 cwts. per acre gave better returns when applied late. The increased yields for the early applications of the sulphate of ammonia are curiously similar: there is more difference for the late application:—

| Time of Application. | 1923. | | 1925. | |
|----------------------|--------------|--------------|--------------|--------------|
| | 1 cwt. bush. | 2 cwt. bush. | 1 cwt. bush. | 2 cwt. bush. |
| Early (a) | 8.1 | 17.3 | 9.8 | 16.8 |
| Late (b) | 5.4 | 24.5 | 14.7 | 19.7 |

(a) March 28th in 1923, March 5th in 1925.

(b) May 22nd in 1923, May 5th in 1925.

The effectiveness of the late dressing is probably in some way bound up with the relation between grain formation and growth.

METHODS OF FIELD EXPERIMENTATION.

The foregoing pages show how completely the modern fertiliser problems differ from those of the earlier days. Formerly the interest lay in showing that good crops could be obtained by the use of artificial manures, or in comparing artificials with farmyard manure. The results have now become embodied in general farming experience and no longer form the theme for