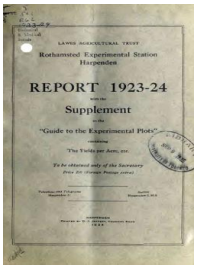
Report for 1923-1924 With the Supplement to the Guide to the Experimental Plots Containing the Yields per Acre Etc.



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Basic Slag and Grass Land

Rothamsted Research

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The result is all the more interesting in that this is the only manurial method hitherto tested which has consistently improved the quality of the grain. Other treatments have acted sometimes one way and sometimes the other, the change being usually small and unpredictable.

When yield is combined with the valuation and allowance is made for tail corn there is found to be a considerable difference in money value per acre in favour of the chloride :—

Yield (measured bushels per acre) and Money Value of Barley per Acre.

	Sulphate of Ammonium.		Ammonium Chloride.		Difference in favour of Chloride as against Sulphate.
	Yield.	Money Value per Acre.	Yield.	Money Value per Acre.	
1922 ...	36.0	136/–	35.7	156/–	20/–
1923 ...	32.5	239/–	35.6	265/–	26/–
1924 ...	29.8	238/–	29.7	249/–	11/–

In the course of the work it has become clear that the method of valuation commonly adopted does not always work out quite fairly either to the buyer or the farmer. On the loams the estimate has usually been tolerably correct; the value of the malt obtained has paid the cost of the barley, the transport, expenses and profits of malting and other charges. But on the lighter soils, the barley has not generally been as good as it looked, so that the value of the resulting malt did not pay all the charges. On the chalk and limestone soils the barley turned out better than it looked; the farmer received less than he deserved and the malt gave an additional profit to the maltster.

These results are quite intelligible. The buyer judges from certain external appearances of the barley which are on the whole correlated with the value of the resulting malt. But the correlations between the external characteristics and chemical composition are liable to be affected by changes in environment, and it need occasion no surprise that a correlation holding good on loams may be modified in one direction on a sandy soil, and in another on a chalk soil.

The malting and brewing part of the investigation lies outside the scope of Rothamsted, and is carried out entirely by the Institute of Brewing, but the Station, at the cordial invitation of the Institute, is keeping in close touch with the work.

BASIC SLAG AND GRASS LAND.

It is well known that basic slag produces excellent results on many grass fields, especially on the Boulder clays where there is much bent grass and only little wild white clover, but on a number of fields it fails to act.

Two causes of failure are already known, and methods of dealing with them have been worked out :—

(1) The land may be too sour, requiring a dressing of lime before the slag can act.

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(2) There may be insufficient potash; this may be supplied by addition of kainit, 20 per cent. potash salts, etc.

All basic slags, however, do not behave alike. Examination shows that they fall into two great groups: those in the making of which fluorspar was used: and those to which no fluorspar was added. Field experience shows that the fluorspar slags are often less effective than the others: chemical examination indicates that they contain some of their phosphate in the form of fluorapatite, a substance having little, if any, value to plants. The slags free from fluorspar, on the other hand, contain some, if not all, of their phosphate in the form of silico-phosphate, which is of very considerable value to plants. Mr. Page has developed a method for ascertaining the amount of fluorine in slags, from which can be calculated the maximum value for the quantity of fluorapatite present. Some of the results are:—

Slag No.	(1) Total Phosphate, per cent. of slag.	(2) Citric Solubility, per cent. of total phosphate.	(3) Fluorapatite (little value) per cent. of slag.	(4) Silico and other phosphates (much value) per cent. of slag.
1	42·5	77·2	1·4	41·1
2	29·2	91·0	Nil	29·2
3	28·9	16·4	26·9	2·0
4	25·1	98·4	Nil	25·1
5	24·3	30·0	22·0	2·3
6	21·1	27·7	12·3	8·8
7	19·8	70·9	Nil	19·8
8	18·0	81·3	1·3	16·7
9	17·8	37·7	17·1	0·7
10	17·2	78·7	1·4	15·7

(1) Total phosphoric oxide (P_2O_5) multiplied by 2.18 to convert into the equivalent quantity of tricalcic phosphate ($Ca_3(PO_4)_2$).

(2) Percentage of the total phosphoric oxide (P_2O_5) which is soluble in the official 2% citric acid solution.

(3) Calculated from fluorine present, assuming all to be in form of fluorapatite.

(4) The remaining phosphate.

The slags are arranged in order of total phosphate and therefore approximately in order of price. Reference to the last column shows, however, that they differ considerably in their content of effective phosphates. Thus slags 2 and 3 are rated equal by the ordinary analysis and might be offered at the same price by a merchant acting in perfectly good faith and honesty. In the field tests No. 3 is less effective than No. 2. Mr. Page's method shows that it may contain most of its phosphorus in the non-effective form of fluorapatite, while No. 2 contains all its phosphates in the effective forms. The citric solubility test discriminates between these slags but its indications are not always very clear. The fluorine method promises to be more helpful.

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The new method does not, however, enable the slag to be completely characterised and there are still differences in effectiveness which cannot be explained. Slags No. 1, 6, 7 and 8 were compared in the sheep grazing trials at Rothamsted over a period of four years. The gains in live weight of sheep over those obtained on the unmanured plots have been :—

	1921	1922	1923	1924	Total benefit in 4 years., lb. live weight per acre. Slagged over unslagged land.
Slag No. 7	50	19	62	18	149
,, ,, 8	Nil	Nil	Nil	30	30
,, ,, 6	Nil	Nil	15	Nil	15
,, ,, 1	Nil	21	7	Nil	28

It is obvious that No. 7 is by far the most effective of these slags, being better even than No. 1 which was known to act well on other soils, but no chemical test so far tried would show this superiority to a prospective purchaser. At the time we obtained the slag neither the makers nor ourselves knew or even suspected that it would prove any better than No. 8 or as good as No. 1, nor can we yet explain why it should be so. It seems clear that somewhere in its history this slag received some treatment which, if it could be repeated on other slags, might greatly enhance their agricultural value. A possible clue has been furnished by the manufacturers and an observation has been made in the chemical laboratory which may furnish the solution of a very attractive problem.

A third important chemical factor has been discovered during the past season by Dr. Brenchley and Mr. Page. Some of the slags examined were found to contain substances harmful to the plant. This does not, of course, mean that they actually damaged the crop : what happened was that in these particular slags the beneficial effect of the phosphate present was in part counteracted by the harmful substance. All these problems are being followed up and the co-operation of the slag makers is secured through the Permanent Basic Slag Committee of the Ministry of Agriculture. In the meantime farmers who have applied slag to their grass and obtained disappointing results are requested to communicate the facts to the Director.

POTATOES.

The experiments with the different potash manures begun in 1921 have been continued (p. 120). The muriate and the sulphate of potash behave nearly but not quite alike, the muriate giving sometimes a slightly better and sometimes a slightly less yield than the sulphate. The determining factor is partly rainfall, the sulphate tending to give the higher yield in drier conditions and the muriate in wetter, but there is something beside this, for in 1924 the sulphate came out the better in spite of the wetness of the season.

Addition of other chlorides (*e.g.*, salt) to the muriate, is, however, injurious; neither kainit nor sylvinite gave the full benefit expected from the potash because of the harmful effect of

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