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Report for 1927-28

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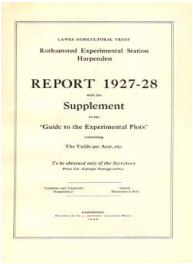
LAWES AGRICULTURAL TRUST
Rothamsted Experimental Station
Harpenden
REPORT 1927-28
Supplement
"Guide to the Experimental Plots"
The Yields per Acre, etc.

Effect of Fertilisers on Composition and Quality of the Grain

Rothamsted Research

Rothamsted Research (1928) *Effect of Fertilisers on Composition and Quality of the Grain ;* Report For 1927-28, pp 29 - 30 **- DOI: https://doi.org/10.23637/ERADOC-1-85**

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barley, and apparently to sulphate of potash, for it has been observed with muriate of potash only in 1924; whether the chlorine ion is beneficial and the sulphate ion harmful, is not known.

Effect of Fertilisers on Composition and Quality of the Grain.

The percentage of nitrogen in the grain of barley depends on the amount of nitrogen the plant has taken from the soil and on the amount of carbohydrate it has synthesised during its growth. A high nitrogen uptake makes possible considerable growth and sufficient carbohydrate formation to over-balance the nitrogen: the grain then has a low nitrogen content. It depends on the favourableness of the conditions whether this possibility eventuates. Late sowing, or a check in growth due to drought, or a late supply of nitrogen to the plant, may so cut down the available time that the plant cannot make the necessary carbohydrate: the nitrogen content of the grain then becomes high. On the other hand, high rainfall in the weeks after sowing, by reducing the nitrate in the soil, but otherwise favouring growth, lowers the nitrogen content of the grain, as shown by the following data, obtained at Woburn:—

Nitrogen per cent.	2.01	1.95	1.71	1.57	1.23
Year	1925	1922	1923	1926	1924
Barley sown ...	March 31	April 19	April 10	March 4	March 11
Rainfall in inches after sowing.					
March ...	—	—	—	0.09	0.35
April ...	1.59	1.93	1.34	2.59	2.97
May 1st-15th inclusive	1.18	0.35	0.79	1.43	1.35

In sufficiently favourable conditions, sulphate of ammonia may still further increase the carbohydrate production and thus further reduce the proportion of nitrogen in the grain; in less favourable seasons, however, insufficient carbohydrate is produced and the nitrogen content of the grain may be raised. As the nitrogen content is already low in favourable and high in unfavourable seasons, it follows that sulphate of ammonia tends to lower the nitrogen content of the grain in years when it is low and to raise it in years when it is high. Larger quantities (2 cwt. per acre) tend to raise it in any case. The Rothamsted results have been:—

Percentage of Nitrogen in Grain.

	1925.	1926.	1927.	1928.	
No Nitrogen...	1.597	1.599	1.452	1.915	
				Single.	Double dressing.
Sulphate of Ammonia ...	1.585	1.711	1.442	2.029	2.220
Muriate of Ammonia ...	1.552	1.684	1.438	1.985	2.112

As in previous years muriate of ammonia gave grain of lower nitrogen content than sulphate of ammonia. Potassic fertilisers counteract to some extent the tendency for sulphate of

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ammonia to raise the percentage of nitrogen; at Woburn, in 1928, the percentages of nitrogen in the grain were :—

Effect of Sulphate of Ammonia. Superphosphate and Sulphate of Potash.		Effect of Sulphate of Potash. Superphosphate and Sulphate of Ammonia.		Sulphate of Ammonia and Sulphate of Potash. No Superphosphate.
+Sulphate of Ammonia.	No Sulphate of Ammonia.	+Sulphate of Potash.	No Sulphate of Potash.	
1.372	1.310	1.372	1.398	1.346

The nitrogen content of the barley, more than any other single factor, determines its malting value. It is closely connected with the amount of " extract " and with the diastatic power of the malt, the extract varying inversely and the diastatic power directly with the nitrogen : it has also more subtle effects.

The investigations by Mr. Bishop on the nitrogen compounds of the barley grain have reached an interesting stage. The proportions of hordein, glutelin, and salt-soluble compounds are all connected with the percentage of nitrogen in the grain : for different samples of the same variety (Plumage-Archer) the glutelin increases proportionately to the nitrogen, the hordein increases more rapidly, and the salt-soluble compounds less rapidly than the nitrogen. The relationships are the same, whether the variation results from changes in soil, season or manuring; it appears, therefore, that the ratio glutelin/nitrogen may be a varietal constant of considerable interest to the breeder of barley for quality, and this is being determined for some of the new barleys grown by the National Institute of Agricultural Botany : the barleys are also being malted by the experts of the Institute of Brewing.

The large number of analyses of British-grown barleys made in recent years at Rothamsted has shown that the grinding barleys are richer in protein than is usually supposed. The figure quoted in the standard British tables is 8.6 per cent. of protein, corresponding to 1.38 per cent. of nitrogen; our results show that the figures have been, for barleys which buyers would not take for malting :—

	Valuation 45/- and less	Valuation below 40/-
1922	1.72 ...	1.76
1923	1.73 ...	1.95
1925	1.86 ...	2.16
1926	1.58 ...	1.65
Mean	1.72 ...	1.88
Protein on conventional basis ...	10.8% ...	11.8 %

The results show that less protein concentrates, such as decorticated cotton seed cake or meal, or decorticated ground nut cake, than is usually recommended, need be mixed with barley meal for feeding to farm animals.

Winter-Sown Oats and Wheat.

The experiments have given further information as to the effect of time of application of the sulphate of ammonia, and we are now able to sketch out the following as the probable