ROTHAMSTED RESEARCH

Report for 1927-28

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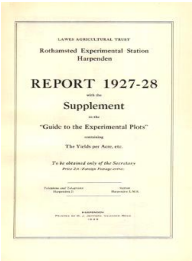

Crops, Plant Growth and Fertiliser Investigations

Rothamsted Research

Rothamsted Research (1928) *Crops, Plant Growth and Fertiliser Investigations ;* Report For 1927-28, pp 55 - 58 **- DOI: https://doi.org/10.23637/ERADOC-1-85**

SCIENTIFIC PAPERS

Published 1927 and 1928 and in the Press.

I.—CROPS, PLANT GROWTH AND FERTILISER INVESTIGATION.

(Botanical, Chemical and Statistical Departments.)

I. E. J. RUSSELL. "*The Institute of Brewing Research Scheme: Fourth Report on the Experiments on the Influence of Soil, Season and Manuring on the Quality and Growth of Barley,* 1925." Journal of the Institute of Brewing, 1927. Vol. XXXIII. (Vol. XXIV., New Series), pp. 104-110.

II. E. J. RUSSELL. "*The Institute of Brewing Research Scheme: Fifth Report on the Experiments on the Influence of Soil, Season and Manuring on the Quality and Growth of Barley,* 1926." Journal of the Institute of Brewing, 1928. Vol. XXXIV. (Vol. XXV., New Series), pp. 307-320.

III. E. J. RUSSELL. "*The Barley Experiments of the Institute's Research Scheme.*" Journal of the Institute of Brewing, 1928. Vol. XXXIV. (Vol. XXV., New Series), pp. 436-446.
See also pp. 26-30 of this Report.

IV. L. R. BISHOP. "*Composition and Quantitative Estimation of Barley Proteins I.*" Journal of the Institute of Brewing, 1928. Vol. XXXIV., pp. 101-118.

Methods have been devised and tested for the quantitative estimation of the amounts of the separate proteins in barley grain. Albumin, globulin and protein breakdown products are extracted by 5 per cent. potassium sulphate solution, 70 per cent. alcohol at 81° C. is used to extract hordein from the residue; the remaining nitrogen probably represents glutelin nitrogen.

These methods have been applied to samples of Plumage-Archer barley grown under varied conditions of season, soil and manuring. These differing conditions influenced the total nitrogen of the grain but not the regular relation shown between the amounts of the separate constituents and the total nitrogen. In the samples the total nitrogen varied from 1.2 per cent. to 2.3 per cent. and (*a*) the percentage of glutelin nitrogen remained constant at 36 per cent. of the total nitrogen, (*b*) the percentage of hordein nitrogen increased regularly with increasing total nitrogen from 28 per cent. with 1.2 per cent. total nitrogen to 40 per cent. with 2.3 per cent. total nitrogen, (*c*) the percentage of salt-soluble nitrogen fell correspondingly from 36 per cent. to 24 per cent. as the total nitrogen increased from 1.2 per cent. to 2.3 per cent.

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There appears to be a balance between the amounts of the various proteins, which adjusts itself according to the amount of total nitrogen present. For these samples therefore the total nitrogen is a good measure of the amounts of the individual proteins and varying " quality " of different samples of the same total nitrogen content is not due to differences in the amounts of the individual proteins.

V. L. R. Bishop. *" Composition and Quantitative Estimation of Barley Proteins II."* Journal of the Institute of Brewing, 1929. Vol. XXXV., pp. 316-322.

The methods for the quantitative estimation of the proteins of barley grain are extended. A detailed fractionation of the salt-soluble substances is worked out. In this extract albumin, globulin, proteose, and peptone nitrogen are estimated as well as nitrogen in the form of simple compounds such as amino-acids (" non-protein " nitrogen). It is concluded that hordein persists from the barley to malt and that the methods found suitable for barley can be applied also to malt.

The importance of fineness and evenness of grinding is shown.

VI. L. R. Bishop. *" The Changes undergone by the Nitrogenous Constituents of Barley during Malting."* Journal of the Institute of Brewing, 1929. Vol. XXXV., pp. 323-338.

As soon as active breakdown commences after steeping, the two insoluble proteins of the endosperm, hordein and glutelin, are broken down at about the same rate to give salt-soluble products chiefly non-protein nitrogen. Then the rate of disappearance of glutelin falls off. Later, the rate of disappearance of hordein becomes very small and the amount of glutelin may increase slightly. At this stage it is kilned.

The falling off in rate of disappearance of glutelin and the suggestion of a subsequent increase point to a resynthesis of this protein in the embryo. The falling off in rate of disappearance of hordein may similarly be accounted for by resynthesis in embryo.

The changes in the nitrogen compounds on the kiln when making pale malts are very slight.

Changes within limits of the amount of water supplied or the length of time on the malting floor produced but little effect on the amounts of different nitrogen compounds in the final malt, owing to the establishment of a balance between breakdown in the endosperm and resynthesis in the embryo.

VII. F. E. Day. *" Small Scale Brewing in the Laboratory."* Journal of the Institute of Brewing, 1928. Vol. XXXIV., pp. 570-573.

A technique has been devised for obtaining a reasonable top yeast crop and beer of normal flavour in the small scale brewings in the Laboratory. Filtration is avoided and brewery conditions are imitated as closely as possible by conducting the fermentation in Thermos flasks. The method can be applied to the comparison of small samples of malts and the examination of hops.

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VIII. W. E. Brenchley. *"The Phosphate Requirement of Barley at Different Periods of Growth."* Annals of Botany, 1929. Vol. XLIII., pp. 89-110.

Experiments have been made in water cultures to test the effect of depriving barley plants of phosphorus after varying initial periods during which it had been supplied, and of supplying phosphorus after initial periods of deprivation.

The provision of phosphate for the first six weeks or longer permitted normal growth to be made, as was shown by the number of tillers, ears, and grains produced, the average number of grains per ear, and the dry weights. With shorter initial periods of phosphate supply growth was seriously depressed in all these respects. If phosphate was withheld for the first four weeks, tiller production was not affected, but no ears were produced. With longer initial deprivation, growth was steadily depressed in all respects, and the type of growth gradually changed from a bushy, succulent character to a thin, lanky, untillered plant bearing the travesty of an ear.

The amount of phosphate absorbed by the plant increased steadily in more or less direct proportion to the length of time phosphate was given at the beginning of growth, but sufficient was taken up in the first six weeks to enable the plant to make its maximum dry weight. The percentage of phosphate in dry matter rapidly increased from this time onwards. The absence of phosphate supply up to the first six weeks of growth caused an extremely rapid drop in the amount of phosphate ultimately taken up by the plant, after which a more gradual decrease occurred with lengthening periods of phosphate deprivation. The probable importance of the presence or absence of phosphorus at the time tillering begins is indicated by reference to further experiments in which phosphate was supplied and withheld for alternate fortnights during growth.

IX. R. A. Fisher. *"A Preliminary Note on the Effect of Sodium Silicate in Increasing the Yield of Barley."* Journal of Agricultural Science, 1929. Vol. XIX., pp. 132-139.

The addition of sodium silicate has been found to increase the yield of barley to a considerable extent, this effect being most marked when no superphosphate is added.

The phosphatic content of the ash is not greatly increased in the grain, and is diminished in one case in the straw; the conclusion from this observation that the silicate does not act by releasing soil phosphates, but as a plant stimulus, overlooks the fact that the addition of silica to the ash naturally reduces the percentage of other constituents, and should be discounted.

The phosphate removed annually in the crop is greatly increased on the plots receiving silicate, even when this removal has continued for many years without replacement.

That additional phosphate is actually made available to the crop on the plots receiving silicate is shown by the increase in the proportion of phosphate in the dry weight of the crop, which appears on all the plots, and at all periods.

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This increase is quantitatively sufficient to account for the increased yield in grain and straw, without postulating the aid of any stimulus to plant growth.

X. T. EDEN AND R. A. FISHER. *"Studies in Crop Variation, IV. The Experimental Determination of the Value of Top Dressings with Cereals."* Journal of Agricultural Science, 1927. Vol. XVII., pp. 548-567.

A simple account of a top dressing experiment carried out at Rothamsted in 1926, with especial reference to the design of such experiments in general, to the statistical analysis of the data, and to the precision attained. The experiment was of 96 plots of winter oats and designed to test with precision the return from top dressings applied early or late, in single or double quantities, and using sulphate or muriate of ammonia. All possible combinations of these conditions were used, the whole having eight-fold replication. The results possessed a higher level of precision than on any previously attained in conditions which allow of a valid estimate of error, the standard error of each comparison being only 1.4 per cent. It is, then, of an order which allows discussion of the monetary return to the industrial farmer in relation to the cost of manure and labour. The experiment is one of a programme of research into top dressings, which it is hoped can be maintained at the same level of precision.

XI. BHAI BALMUKAND. *Studies in Crop Variation, V. "The Relation between Yield and Soil Nutrients."* Journal of Agricultural Science, 1928. Vol. XVIII., pp. 602-627.

It is shown (*a*) that it is possible to fit Maskell's Resistance formula (in which the reciprocal of the yield is expressed as the sum of terms each dependent on a specific manurial factor) to experimental data involving the simultaneous variation of two numerical factors by a sufficiently rapid process of approximation, (*b*) that in every case discussed the formula fits the facts within the limits of experimental error estimated from the experiments themselves although formulæ of other types fail strikingly to do so, (*c*) that the parameters appropriate to each nutrient are therefore independent of other conditions and are capable of direct physical interpretation. The interpretation suggested supplies a direct measure of the quantity of each soil nutrient actually available to the plant, and of its specific importance in determining yield.

II.—STATISTICAL METHODS AND RESULTS.

(Statistical Department.)

XII. R. A. FISHER. *"The General Sampling Distribution of the Multiple Correlation Coefficient."* Proceedings of the Royal Society (A), 1928. Vol. 121, pp. 654-673.

By an appropriate linear transformation of the independent variates it may be shown that the sampling distribution of the multiple correlation coefficient does not depend on the whole

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