Following the presidential address, Brigadier H. St. J. L. Winterbotham, Director-General of Ordnance Survey, spoke on "Geography and Mathematics", detailing the many and various ways in which a knowledge of mathematics assists geographical progress.

Of the four papers which occupied the morning of January 8, that which attracted most attention was given by Mr. G. L. Parsons, of Merchant Taylors' School, under the title "The Work of a Junior Mathematical Association". The members of this Association are some eight public schools in the London area; five meetings are held each year, and a good attendance of the mathematically-minded pupils in the higher forms of these schools is obtained. Occasionally the meetings are addressed by distinguished adult mathematicians, but more frequently by the boys themselves, who are thus encouraged in habits of independent thought and research. Sir James Jeans is the president of the Association, and the president's annual essay prize attracts many excellent entries.

In the afternoon, Prof. D. R. Hartree, of the University of Manchester, gave a paper on "The Bearing of Statistical and Quantum Mechanics on School Work"; after asserting that the new mechanics has no direct bearing on school work, he explained in elementary terms some of the basic concepts of the subject in such a way as to illustrate the indirect influence the new ideas might be expected to exert on school work in mathematical physics. Following this, the warm interest which members of the Association invariably take in points of teaching practice was again demonstrated by a lively discussion on "The First Encounter with a Limit", in which teachers from the schools and universities took part. The meeting ended with a delightful lecture by Prof. G. H. Hardy on "The Theorem of the Arithmetic and Geometric Means", in the course of which he discussed several different proofs of the fundamental inequality connecting these two means, and incidentally directed attention to some very important, but much neglected, work by Dr. R. F. Muirhead on inequalities of a more general type.

## Work of the Rothamsted Experimental Station

As knowledge of plant growth accumulates, the number of points from which the problem of crop production can be attacked increases. Since the foundation of the Rothamsted Experimental Station in 1843, the activities of the Station have been steadily extended so as to make it possible to follow up some of the new problems which are continually brought to light by the work there and elsewhere. The study of quality in crops, for example, has led to a considerable amount of work in conjunction with the Institute of Brewing, the Millers' Research Association, sugar beet factories, etc. The work on malting barley, for example, has outgrown the accommodation at Rothamsted, and, having reached the stage where closer contact with the brewing industry was necessary, has been transferred elsewhere.

The Rothamsted report for 1933* gives a brief summary of the various problems under investigation during the year at Rothamsted and Woburn, and also includes trials carried out at outside centres. Though the field and laboratory work are really one, they are, for the sake of convenience, dealt with separately in the report. The report includes results of some schemes of experiments conducted on a uniform basis at a number of centres; for example, results of ten years experiments with malting barley, and of experiments on the effect of fertilisers on the yield and quality of sugar beet. A list of papers published from the Station is also included, together with comments on the contents of each.

The problem of soil organic matter continues to receive attention, the plan of investigation being one designed and begun some years ago. This problem is important in view of the possibilities of mechanised cereal growing, and the Rothamsted experiment will help in answering the question which will inevitably be asked by those contemplating farming under the new conditions—how far it is possible to practise mechanised corn-growing and pay no attention to replenishing the stocks of soil organic matter by the addition of farmyard manure, sheep folding, etc. That the solution of this problem is not so simple as was once considered is gathered from the observation in the report that green manures do not keep up the productiveness for wheat of the light soil at Woburn, and that the residual values of farmyard manure and of cake and corn fed to animals at Woburn appeared to be much less than is indicated by the recognised tables. The latter observation has also an important bearing on the existing method of assessing certain compensations due on the termination of tenancies.

Dr. R. A. Fisher, who left in October 1933 to take up his new duties as Galton professor in the University of London, has written a short account of the contribution of Rothamsted to the development of the science of statistics. One development, namely, the realisation that it was necessary to treat the question of field procedure and that of statistical analysis as but two aspects of a single problem, has resulted in definitely increasing the value of experimental work. To quote Dr. Fisher, "By applying statistical methods not only to the interpretation but also to the design of experiments, it is not uncommon for the value of the experiment to be increased five or ten fold, a result which could not be obtained from improved methods of interpretation only". It is doubtful, for example, if the capacity of superphosphate and sulphate of ammonia for reinforcing each other's effect could have been detected and estimated if it were not for the improvements in plot technique and interpretation of results. The Statistical Laboratory has tackled the problem of technique in livestock trials, having commenced by a successful pig feeding experiment; the pens and feeding arrangements have been designed so that all types of rations are distributed equally over all the groups of pens instead of all the pigs on one treatment being in the same pen.

The report is essential for those engaged in teaching or research work. The long-term experiments and the thoroughness of the liaison between field and laboratory work give added value to the work at Rothamsted. The practical farmer will also find the report interesting, but most of the results will doubtless reach him through the medium of the agricultural Press.

* Rothamsted Experimental Station, Harpenden: Lawes Agricultural Trust. Report for 1933. Pp. 200. (Harpenden: Rothamsted Experimental Station, 1934.) 2s. 6d.