Rothamsted Report for 1938

The Soil

Rothamsted Research

the accuracy of various alternative methods of sampling which might have been used. These estimates are helpful in increasing the efficiency of sampling in future studies on similar material. The use of the analysis of variance of the sampling results for this purpose is discussed and illustrated by a numerical example. The case in which an appreciable fraction, say, more than 10 per cent., of the total population is sampled is discussed briefly. The estimate of the relative accuracy of two methods of sampling is shown to be in most cases a simple function of the variance ratio, so that its sampling limits are easily obtainable. Some advice is given on the problem of analysing the results of large samples without excessive labour.

XXVIII.   W. G. COCHRAN. *" The Information Supplied by the Sampling Results."* (Appendix to a paper by W. R. S. Ladell). Annals of Applied Biology, 1938, Vol. XXV, pp. 383-389.

In any field experiment which involves sampling of a laborious nature, it is important to know as soon as possible what degree of accuracy in the treatment mean values will be reached with a given amount of work, how much work must be done to reach a given standard of accuracy and how best to distribute one's resources between the amount of sampling and the amount of replication.

The first sampling, whether it contains experimental treatments or is uniformly treated, can supply information on all these points if properly carried out. Ladell's first wireworm sampling is taken as a simple numerical example of the way in which these questions can be answered with the help of an analysis of variance.

The sampling and experimental errors of Ladell's experiments are discussed. The sampling error accounts for a large proportion of the experimental error in most cases, as it is always advisable where the labour involved in sampling is high.

Ladell's sampling errors agree well with those obtained under widely different conditions by Jones, and both may be recommended to other workers as an indication of the amount of variability to be expected in field sampling for wireworms.

XXIX.   W. G. COCHRAN. *" Expected Errors in Diluting Bacterial Suspensions."* (Appendix to a paper by H. L. A. Tarr). Annals of Applied Biology, 1938, Vol. XXV, pp. 633-643.

A knowledge of the amount of variation introduced by the process of dilution in the number of spores or vegetative cells in a solution is often of interest to bacteriological workers. The variations introduced by diluting consist of two parts (1) a sampling error, which with careful work will tend to follow a Poisson series distribution (2) the error involved in extracting rather more or less than the volume of liquid stated on the pipette. By making reasonable assumptions about the second source of error, standard errors and 5 per cent. limits of variation can be assigned to the number of spores or vegetative cells in the volume which is being used for experimental purposes. A table of these errors and limits is given, covering the range from 10^6 to 10 spores per unit volume. Examples of its use are worked out.

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(Departments of Chemistry and Physics)

XXX.   G. NAGELSCHMIDT. *" On the Atomic Arrangement and Variability of the Montmorillonite Group."* Mineralogical Magazine, 1938, Vol. XXV, pp. 140-155.

A classification of clay minerals is based on their lattice structures and the quality of their X-ray powder diagrams. The montmorillonite group, with a three layer lattice and poor powder diagrams, is shown to have three end-members, which in the completely dehydrated state and free from isomorphous replacements are montmorillonite $Al_2Si_4O_{11}$, nontronite $Fe_2Si_4O_{11}$ and magnesium beidellite $Mg_3Si_4O_{11}$. Calculations of the isomorphous replacements for six of these materials showed that the excess cations balanced the negative charges resulting from the replacements. Further it was shown that for three of these materials all the excess cations were exchangeable, though there were discrepancies with magnesium beidellite.

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The hypothesis is advanced that a certain amount of isomorphous replacement of silicon by aluminium and perhaps of aluminium by magnesium is essential for this structural type. This may explain both the high water content, which is due to the excess cations, and the poor diffracting power for X-rays, which is due to the lack of regularity in the lattice.

X-ray powder data for the six samples and the values for the lattice shrinkage upon dehydration are given and discussed.

XXXI.   E. W. RUSSELL.   "*Soil Structure.*"   Imperial Bureau of Soil Science, Technical Communication No. 37, 1938. Price 2s.

The problems concerned with the production and maintenance of a good soil structure, which is a fundamental element in good tilth, have been extensively investigated during the last few years. This review describes the many methods that have been devised for measuring the soil structure quantitatively, the degree of control that can be obtained over the soil structure by weathering, cultivation, the application of manures and the growing crops and the theories that have been put forward to explain the results.

XXXII.   R. K. SCHOFIELD.   "*Pore-Size Distribution as Revealed by the Dependence of Suction (pF) on Moisture Content.*" Transactions of the First Commission of the International Society of Soil Science, 1938, Vol. A, pp. 38-45.

By following the invasion of air into the pores of soil samples as the pF rises and its replacement by water as the pF falls a measure is obtained of the pore-size distribution.

When the suction does not exceed pF 6 (50 per cent. R.H.) there are good reasons for believing that results of the right order of magnitude are obtained by assuming the normal value for the surface tension.

Above pF 6 the direct adhesion of the water molecules to the solid surfaces and to the hydration of the exchangeable ions are probably the controlling factors.

XXXIII.   B. A. KEEN.   "*What Happens to the Rain ?*" Quarterly Journal of the Royal Meteorological Society, 1939, Vol. LXV, pp. 123-137.

An annual rainfall of 30 in. means that 3,000 tons of water fall on an acre of land. In the course of the year this all disappears, by run-off, evaporation, transpiration through vegetation, and by downward percolation. The relative importance of these factors in British and overseas conditions is discussed. Many of the traditional beliefs among farmers and gardeners were based on a theory of water movement that was attractively simple to understand—but incorrect. It is only in recent years that the true picture of the movement of water in the soil has been built up. In consequence, some of the traditional practices need revision, while others now have a different explanation. The new work has also clarified some of the concepts used in hydrology.

XXXIV.   R. K. SCHOFIELD.   "*The Representation of Soil Colour by Means of the C.I.E. Co-ordinates.*" Transactions of the First Commission of the International Society of Soil Science, 1938, Vol. A, pp. 54-59.

The way in which C.I.E. colour co-ordinates can be computed from the Maxwell spinning disk is explained.

A numerical example is worked out in detail by way of illustration, the hue wave-length, the purity and the relative brightness being also evaluated.

The cause of the differences in the matches obtained between soils and Munsell colour disks by different observers is explained, and it is concluded that such matches obtained by observers of unknown visual characteristics do not provide a satisfactory basis for soil colour nomenclature.

Various ways are discussed in which better results might be obtained.