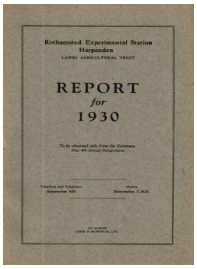
ROTHAMSTED RESEARCH

Report for 1930

Full Table of Content



Summaries of Papers Published in 1930 I. Scientific Papers:

Rothamsted Research

Rothamsted Research (1931) *Summaries of Papers Published in 1930 I. Scientific Papers: ;* Report For 1930, pp 72 - 94 **- DOI: https://doi.org/10.23637/ERADOC-1-63**

SCIENTIFIC PAPERS

Published 1930

CROPS, PLANT GROWTH AND FERTILISER INVESTIGATIONS

Statistical Mycological Fermentation and Chemical Departments; and the Imperial College Staff)

I. F. E. ALLAN AND J. WISHART. *"A Method of Estimating the Yield of a Missing Plot in Field Experimental Work."* Journal of Agricultural Science, 1930. Vol. XX, pp. 399-406.

In cases where a yield or other value from one plot of a field experiment is missing, a method has been developed for furnishing an estimate of the missing figure, based on all the other values. The calculation is given for experiments of the Randomised Block and Latin Square arrangements.

II. R. A. FISHER AND J. WISHART. *"The Arrangement of Field Experiments and the Statistical Reduction of the Results,* 1930." Imperial Bureau of Soil Science—Technical Communication No. 10, H.M. Stationery Office.

This memorandum aims at explaining the principles underlying the field experimental technique recently elaborated at Rothamsted, and gives, with appropriate illustrations from actual experiments, the full arithmetical working involved in the statistical reduction of the data. The memorandum stresses two points of importance: (1) the desirability of uniformity of procedure, and (2) the necessity for a field technique which shall minimize experimental errors, and at the same time provide for an estimate of these errors by valid statistical methods.

III. J. WISHART AND W. A. MACKENZIE (TYRRELL). *"Studies in Crop Variation VII. The Influence of Rainfall on the Yield of Barley at Rothamsted."* Journal of Agricultural Science, 1930. Vol. XX, pp. 417-439.

The method elaborated by R. A. Fisher in his study of the effect of rainfall on wheat is here applied to the barley crop in Hoos Field, and curves are published showing for thirteen plots the benefit or loss to the final yield in bushels per acre due to an additional inch of rain over the average at any given period of the year. The main effects noted are these: (1) Excess of rain is beneficial to the barley crop for a short period in summer and, in the case of certain plots, over the autumn and winter period. (2) Rainfall over the six months when the barley is not in the ground is

https://doi.org/10.23637/ERADOC-1-63

just as important as rainfall in spring and summer, and the time at which the rain falls in winter is important. (3) The curves for 2-O and 2-A are essentially different in character from those of the other plots, and point to the important effect of excess of winter rain in reducing the yield of the plots having phosphate but no alkali salts (*i.e.*, no potash, soda or magnesia). (4) Excess of rain at time of sowing is harmful in all cases. (5) The curves of the "O" series (without nitrogen) are much flatter than those of the "A" series, which have a nitrogenous dressing in addition. (6) The indication of summer benefit is not inconsistent with the conclusions of Hooker that a cool summer is desirable for barley. (7) The farmyard manure plot 7–2 bears certain resemblances to the curve for the corresponding plot 2b on Broadbalk.

IV. R. J. KALAMKAR. "*Studies in Crop Variation VIII. An Application of the Resistance Formula to Potato Data.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 440-454.

In this paper a further test is made of the validity of the Resistance Formula suggested by Maskell to formulate the yield—nutrient relation in a crop. The material investigated consists of the results of the Rothamsted Potato experiment of 1929, designed to give information as to the effect on yield of applying nitrogenous, potassic and phosphatic fertilisers in various quantities. The experiment confirms the conclusions of Balmukand's paper as to the possibility of fitting the Resistance Formula to experimental data. The nitrogen constants are of the same magnitude as before, but the corresponding constants for potash cannot yet be regarded as well determined.

V. J. WISHART. "*On the Secular Variation of Rainfall at Rothamsted.*" Memoirs of the Royal Meteorological Society, 1930. Vol. III, No. 27, pp. 127-137.

A detailed study of the rainfall at Rothamsted over the 76 harvest years, 1854-1929, has revealed the fact that not only have there been sensible changes in the average yearly rainfall of a similar character to those observed at other stations in England and Wales, but the distribution of rainfall throughout the year has changed. The maximum in autumn (and equally the minimum in spring) occurs significantly later to-day than was the case 76 years ago, but there is some sign that this movement is now reversing its direction, as appeared to have happened towards the end of the eighteenth and again in the middle of the nineteenth centuries, as judged from early records at a number of other stations.

VI. S. H. JENKINS. "*The Determination of Cellulose in Straws.*" Biochemical Journal, 1930. Vol. XXIV, 1429-1432.

Cellulose in straws may be readily determined by treating the straw with hot dilute alkali and mineral acid, and then with cold alkaline hypochlorite solution. The new method gives results which are practically idential with those obtained by the Cross and Bevan procedure. The advantages of the hypochlorite method are

https://doi.org/10.23637/ERADOC-1-63

that 12 to 16 determinations per day can be carried out by one worker, and large scale preparations of the cellulose in straws may be made without inconvenience.

VII. A. G. NORMAN. *"The Biological Decomposition of Plant Materials. I. The Nature and Quantity of the Furfuraldehyde-yielding Substances in Straw."* Biochemical Journal, 1929. Vol. XXIII, pp. 1353-1366.

A method is given for determining the content of hemicelluloses in a plant tissue. Figures quoted for "pentosan" obtained by use of the Krober factor are unreliable because of the hexose and uronic acid groups in the hemicelluloses, and the furfuraldehyde-yielding groups intimately associated with the cellulose. If allowance be made for these and for the pectin present, a valid figure may be obtained for the pentose units of the hemicelluloses. A preparation is then made of the hemicellulose of any tissue and its pentose content determined, thus giving a factor for that material.

The nature of the hemicelluloses of oat and rye straws is described and the furfuraldehyde-yielding substance associated with the cellulose in each case, shown to be xylan.

VIII. A. G. NORMAN. *"The Biological Decomposition of Plant Materials. II. The Role of the Furfuraldehyde-yielding Substances in the Decomposition of Straws."* Biochemical Journal, 1929. Vol. XXIII, 1367-1384.

The course of the decomposition of straws is followed by frequent analyses. The most prominent feature is the rapid loss of cellulose, accounting for the major part of the lost organic matter. There is a marked early loss of hemicelluloses, which is by no means complete, as certain groups are biologically less available. Subject to structural and physical variations, it is agreed that the decomposition of mature plant materials in the presence of assimilable nitrogen depends on the balance between cellulose and the available hemicelluloses on the one hand, and the resistant materials, chiefly lignin, on the other. No evidence exists for stating that the hemicelluloses are of pre-eminent importance as satisfactory decompositions have been observed in the case of straws extracted to be practically hemicellulose-free.

IX. A. G. NORMAN. *"The Biological Decomposition of Plant Materials. Part III. Physiological Studies in some Cellulose-Decomposing Fungi."* Annals of Applied Biology, 1930. Vol. XVII, pp. 575-613.

Certain fungi were isolated which, though actively attacking cellulose in straws, make only a meagre growth on cellulose agar plates. All had their optimum temperature above that usual for fungal growth; three, indeed, could develop at 50°C. The thermogenic power of the organisms individually was tested on sterile straw. A considerable and rapid rise in temperature was observed in most cases, and some rise in all. The highest temperature attained was 49°C due to *Trichoderma sp.* The period of maximum heat production was shown to correspond closely with that of rapid loss of hemicelluloses. Cellulose decomposition does not appear to result in the production of much heat. Certain combinations of organisms were tested and the theoretical differences between competitive and co-operative association defined.

https://doi.org/10.23637/ERADOC-1-63

X. A. G. NORMAN AND F. W. NORRIS. *"Studies on Pectin. Part IV. The Oxidation of Pectin by Fenton's Reagent and its Bearing on the Genesis of the Hemicelluloses."* Biochemical Journal, 1930. Vol. XXIV, pp. 402-409.

Pectin readily undergoes oxidation by Fenton's reagent at 30°C, yielding products giving on hydrolysis, galactose and galacturonic acid. These are probably polymers containing mainly galactose-monogalacturonic acid and galactose-digalacturonic acid. The products resemble in appearance and general properties the structural hemicelluloses, and some support is lent to the view that the hemicelluloses may be formed in nature by the protracted mild oxidation of pectin.

XI. A. G. NORMAN AND J. T. MARTIN. *"Studies on Pectin. Part V. The Hydrolysis of Pectin."* Biochemical Journal, 1930. Vol. XXIV, pp. 649-660.

Hydrolyses of pectin were carried out with hot dilute alkali and acid, and the rate of hydrolysis followed by analyses. The pectin ring seems peculiarly susceptible to the former and is very rapidly destroyed. Certain dienolic fission products of sugars are formed, and render the determination of the uronic acid content unreliable. In the course of mild acid hydrolysis there is firstly a production of pentose by simple decarboxylation of the uronic groups. Later, degradation products probably of a furan type are formed.

No conclusions as to the arrangement of the units in the pectin molecule, or as to the type of linkage involved can be drawn from hydrolytic studies owing to the production of degradation compounds interfering with analyses.

XII. L. R. BISHOP. *"The Proteins of Barley during Development and Storage and in the Mature Grain."* Journal of the Institute of Brewing, 1930. Vol. XXXVI, pp. 336-349.

The proteins of all varieties of barley behave in a similar regular manner. For each variety studied, the proteins all increase regularly with the total nitrogen content. The rates of increase of the different proteins differ—calculated as a percentage on total nitrogen the percentage of hordein nitrogen increases regularly with increasing total nitrogen content, the percentage of salt-soluble nitrogen decreases correspondingly while the percentage of glutelin nitrogen remains constant. The actual quantities of salt-soluble nitrogen and glutelin nitrogen for any given total nitrogen content differ between different varieties which consequently are characterised by them. This applies only to mature grain. In immature grain the salt-soluble nitrogen is high and the glutelin nitrogen low, a condition which has also been found to occur in partly developed grain.

The formation of the separate proteins has been followed in barley grain as it develops on the plant, and it is concluded that development of the proteins in the barley grain is essentially a synthesis of the simple compounds which enter it up to a definite equilibrium point controlled only by the total nitrogen content and the variety.

https://doi.org/10.23637/ERADOC-1-63

XIII. L. R. BISHOP. *"The Nitrogen Content and 'Quality' of Barley."* Journal of the Institute of Brewing, 1930. Vol. XXXVI, pp. 352-364.

An attempt has been made to summarise the factors and properties which are of value in guiding anticipations of the brewing quality of the barley in each season and district.

Soil and season are the most important factors governing yield and quality. Variety and artificial nitrogenous manures have less effect. It is suggested that the most important aspect of soil composition is the absence or presence of organic nitrogenous matter which is regarded as resulting in nitrification in summer which supplies nitrogen late in the plant's life with resultant high nitrogen grain.

These considerations and previously published statistical work on weather effects could be used to guide anticipations of yield and quality of harvest in any district and season.

After harvest judgment of yield and quality can be assisted by a knowledge of the nitrogen content and thousand corn weight from which can be predicted the amount of "extract" on malt acid "permanently soluble" nitrogen in the wort.

XIV. L. R. BISHOP. *"The Prediction of Extract."* Journal of the Institute of Brewing, 1930. Vol. XXXVI, pp. 421-434.

By a statistical study it is established beyond doubt that there is an inverse relation between the nitrogen content of barley of one variety and the extract yield of the resulting malt. An increase of extract with increase of grain size is demonstrated almost as conclusively.

The use of this relation is in assisting the valuation of barley, and in the control of malting operations, for which it is accurate enough to be of considerable value in practice.

XV. E. M. CROWTHER. *"Note on the Phosphoric Acid of Barley Grain."* Journal of the Institute of Brewing, 1930. Vol. XXXVI, pp. 349-351.

Determinations of phosphoric acid in barley grain from experimental plots conducted in connection with the Institute of Brewing Research Scheme, showed that the total range of values was rather narrow (0.74 to 1.18 per cent P_2O_5 in dry matter) and not closely connected with other analytical data from the samples. There was evidence that it was slightly increased by phosphatic and slightly decreased by nitrogenous manuring.

XVI. A. W. GREENHILL. *"The Availability of Phosphatic Fertilisers as shown by an Examination of the Soil Solution and Plant Growth."* Journal of Agricultural Science, 1930. Vol. XX, pp. 559-572.

The rate of growth of barley and changes in the phosphate concentration of the soil solution were followed in pots containing an acid soil limed at two rates and comparing slag, superphosphate, and no phosphate treatment. Liming increased the phosphate concentration. The effects of phosphatic fertilisers were somewhat variable; on lightly limed soil they reduced the phosphate con-

https://doi.org/10.23637/ERADOC-1-63

centration. There was no correlation between crop growth and phosphate concentration. It is suggested that barley can take up phosphoric acid directly from the solid particles of soil or fertiliser.

XVII. J. CALDWELL. "*A Note on the Dichotomous Branching of the Main Stem of the Tomato* (*Lycopersicum esculentum*)." Annals of Botany, 1930. Vol. XLIV, pp. 495-498.

Occasionally in the experimental material it was noticed that plants appeared having dichotomously branched stems. One of these is described in this note. It is shown that the arrangement of the leaves indicates that the bifurcation is of the main stem and not axillary in origin. The stelar tissue divides exactly into two—one half going to each of the limits of the fork.

STATISTICAL METHODS AND RESULTS

(Statistical Departments)

(*a*) General

XVIII. F. E. ALLAN. "*The General Form of the Orthogonal Polynomials for Simple Series, with Proofs of their Simple Properties.*" Proceedings of the Royal Society of Edinburgh, 1930. Vol. L, pp. 310-320.

In "Statistical Methods for Research Workers." R. A. Fisher has given a numerical method of polynomial fitting by means of orthogonal functions, developed from their terminal differences. It is shown here that the use of terminal differences may be made to supply direct and simple proofs of the algebraic properties of these polynomials, and a general formula for them.

XIX. F. E. ALLAN. "*A Percentile Table of the Relation between the True and the Observed Correlation Coefficient from a Sample of Four.*" Proceedings of the Cambridge Philosophical Society, 1930. Vol. XXVI, pp. 536-537.

In this paper a table is furnished, for samples of four, of the 95 per cent values of the transformed correlation, z, for different values of the correlation ζ in the population sampled. The table is based on the distribution of the correlation coefficient given by R. A. Fisher in 1915.

XX. R. A. FISHER. "*Moments and Product Moments of Sampling Distributions.*" Proceedings of the London Mathematical Society, 1929. Vol. XXX, Series 2, pp. 199-238.

Much previous work has been expended in studying the distributions of various symmetric functions of the sample values of a variate having a known distribution, and it has been recognised that the moment functions of such statistics must be expressible in terms of the moment functions of the distribution sampled.

Only a few such expressions had, however, been obtained with exactitude, and the great complexity of these gave little promise of a solution of the general problem. It is here shown that, when the Pearsonian moments are replaced by more suitable statistics,

https://doi.org/10.23637/ERADOC-1-63

the expressions are greatly simplified and may be obtained by a direct algebraic method. Further their general form may be derived in terms of combinatorial analysis by the use of two-way partitions, and certain pattern formulae which are the same alike for uni-variate and multi-variate problems. Rules are given, with a general demonstration, by which any particular term of any of these formulae may be obtained independently. The paper contains a table of the pattern formulae of most frequent occurrence, and a table of all the uni-variate formulae required up to the 10th degree, together with a few others of special importance. From these all the corresponding multi-variate formulae may readily be derived.

XXI. R. A. FISHER. "*The Sieve of Eratosthenes.*" The Mathematical Gazette, 1929. Vol. XIV, pp. 564-566.

The note suggests that the celebrated sieve of Eratosthenes has been misunderstood through lack of recognition of the fact that its author probably had in mind not a method of testing whether any particular number is a prime, but a labour-saving device for finding all the primes in a given range of natural numbers.

It is pointed out that a very simple diagrammatic method of doing this has in fact much the appearance of a wicker sieve, and it is suggested that the sieve connected with Eratosthenes' name was in fact a wall diagram of this sort.

XXII. R. A. FISHER. "*Inverse Probability.*" Proceedings of the Cambridge Philosophical Society, 1930. Vol. XXVI, pp. 528-535.

That the principle of inverse probability includes an arbitrary and unsatisfactory element has been recognised by many writers; but their criticism has failed to settle the controversy, since they have supplied no alternative account in mathematical terms of the process of learning by experience.

This paper briefly summarises the author's view that confusion has arisen through assuming that mathematical probability is the only measure of rational belief, and is applicable to all kinds of uncertain knowledge. It is suggested that from knowledge of a population we can express our incomplete knowledge of a sample in terms of probability, whereas knowing a sample we must express our incomplete knowledge of the population in terms of a different mathematical quantity, termed *likelihood*, which does not obey the laws of probability.

There are, however, certain cases in which statements in terms of probability can be made with respect to unknown populations. These are the typical statements of tests of significance, and the logical distinction between these and the statements of inverse probability, to which they bear a superficial resemblance, is examined.

XXIII. J. O. IRWIN. "*On the Frequency Distribution of the Means of Samples from Populations of Certain of Pearson's Types.*" Metron, 1930. Vol. VIII, pp. 1-55.

In a previous paper the author has given a general solution for the frequency distribution of the means of samples of any size, drawn at random from any population whatever, expressed as a definite integral. The present paper applies this solution to the

https://doi.org/10.23637/ERADOC-1-63

particular cases of Pearsonian Type I and Type VII curves for integral values of the exponents p and q, which enter into the equation of the Type I curve, and of the exponent m which enters into the equation of the Type VII curve.

The cases $p = 1, 2, 3, 4$, $q = 1, 2, 3, 4$ are discussed in detail for samples of size 2, 3 and 4 from Type I populations, as are the cases $m = 2, 3, 4$ from samples of size 2, 3 and 4 from Type VII populations. For the Type VII populations the cases $m = 1$ for any size of sample, and $m = 5, 6, 7, 8$ for samples of 2 have also been considered in detail.

XXIV. H. G. SANDERS. *"A Note on the Value of Uniformity Trials for Subsequent Experiments."* Journal of Agricultural Science, 1930. Vol. XX, pp. 63-73.

The question attacked is whether soil variations are sufficiently constant from year to year to give useful corrections to the yields of experimental plots from their yields under previous uniformity trials, and the data investigated were the published results of uniformity trials carried out on two fields at Aarslev (Denmark) between 1906 and 1911. In one case the plots did tend to keep constant in their relative yields, and the precision of an experiment would be increased by nearly 150 per cent, if the regression on the mean yield in the three previous years were used; with the other field, however, the plots showed no constancy in yield (when the variation due to strips was taken out as in modern experimental methods), and consequently previous uniformity trials could give no assistance.

XXV. J. WISHART. *"The Derivation of Certain High Order Sampling Product Moments from a Normal Population."* Biometrika, 1930. Vol. XXII, pp. 224-238.

In a recent paper on the derivation of moments and product moments of sampling distributions, R. A. Fisher dealt among other things with measures of departure from normality, and gave approximate expressions for the semi-invariants of these statistics. If a higher degree of approximation is desired, further high order product moments are required, and these are deduced in this paper, while certain simple relations existing between the formulae, which will be demonstrated elsewhere, are stated, for sampling from a normal population, thus enabling the high order results to be derived from simple expressions already known.

(*b*) Genetics

XXVI. R. A. FISHER. *"The Evolution of Dominance; Reply to Professor Sewall Wright."* The American Naturalist, 1929. Vol. LXIII, pp. 553-556.

The calculations which led Professor Sewall Wright to consider that the selective intensities available for the modification of dominance, are insufficient to have brought about great results are, in a different notation, identical with those that originally led the

https://doi.org/10.23637/ERADOC-1-63

author to attach importance to them. A slight mathematical error has, however, led Professor Wright in the special case chosen for examination, to the conclusion that the selective intensity starting from a low value decreases continuously, whereas in reality, it increases in that case without limit. The conclusion that mutations have had time to become in many cases completely recessive can only be rejected by assuming that small selective intensities do not bring about effects proportional to their magnitude. Although it is inevitably impossible to demonstrate extremely slow processes experimentally, yet there are general reasons for concluding that there is no such restriction upon such small selective intensities as Professor Wright is obliged to postulate.

XXVII. R. A. FISHER. *"The Evolution of Dominance in Certain Polymorphic Species."* The American Naturalist, 1930. Vol. LXIV, pp. 385-406.

Polymorphism in wild populations must usually imply a balance of selective agencies, of which the simplest type is a selective advantage of the heterozygote over both homozygotes. Such a condition should not be confused with the maintenance of a rare mutant type against counter-selection by means of repeated mutations. While such mutations should, on the theory of the selective modification of dominance, tend to become recessive, heterozygotes in polymorphic species will tend to resemble in external appearance whichever homozygote it is most advantageous to resemble. The selective balance must then be maintained by some constitutional disadvantage of the homozygous dominant.

Nabours' experiments with the grouse locust *Apotettix* do, in fact, show such a deficiency of homozygous dominants as is required by this thoery. The average amount of the deficiency is about 7 per cent. In six individual cases the deficiency is statistically significant, and six more show a non-significant deficiency, against two showing a non-significant excess.

The incidence of dominance and linkage in the fish *Lebistes reticulatus* strongly suggests that the colour genes found by Winge are advantageous in the male, but disadvantageous in the female.

The association of the three peculiarities of polymorphism, close linkage and the universal recessive type of dominance is found in molluscs, arthropods and vertebrates. It is tentatively suggested that, at least in the grouse locusts and the snails, the primary cause of the two other phenomena may be found in the closeness of linkage within or between chromosomes. This condition presents an obstacle to normal evolutionary development by gene substitution, and so makes it possible for abnormalities such as duplications to possess occasional advantages, so setting up the stability if the gene-ratio necessary for polymorphism; if the advantage lies in the external appearance, the polymorphism will be manifest, and the variant form will tend to become dominant.

XXVIII. R. A. FISHER. *"Note on a Tri-Colour (Mosaic) Mouse."* Journal of Genetics, 1930. Vol. XXIII, pp. 77-81.

The occurrence is reported of a female mouse showing both black and chocolate markings. Only one such case has occurred out of about 1,500 blacks heterozygous for chocolate, bred in the

https://doi.org/10.23637/ERADOC-1-63

same colony. Mating with a chocolate son gave 30 chocolates, 16 blacks and no tri-colours. The case resembles that of a male guinea-pig reported by Wright and Eaton, which also shows a deficiency of heterozygous offspring. The most probable explanation of both cases is that we have a mosaic, both somatically and in the germinal tissue, originating in non-disjunction. Some apparently analogous cases in mice and rabbits point, however, to a different interpretation for these cases.

XXIX. R. A. FISHER. *"The Distribution of Gene Ratios for Rare Mutations."* Proceedings of the Royal Society of Edinburgh, 1930. Vol. L, pp. 204-220.

The discussion of the distribution of the gene ratio of the author's paper of 1922 is amended by the use of a more exact form of the differential equation to be satisfied. A method of functional equations is developed for dealing with the termini, and is shown to lead to the same solutions as the amended differential equations, in the central portion of the range, for which the latter are valid, and further to give the terminal distribution of rare allelomorphs. The method requires the investigation of a continuous function u_v, of argument v, satisfying the recurrence formula

$$u_{v+1} = e u_v - 1$$

From the asymptotic form of this function its expansion in the neighbourhood of $u=o$ is derived, giving the frequencies of the required distributions.

Exceedingly minute values for the selective advantage or disadvantage make a great difference to (i) the chance of success of a mutation, and (ii) the contribution of such mutations to the specific variance. The order of magnitude to be considered is the inverse of the population of the species. The neutral zone of selective advantage in the neighbourhood of zero is thus so narrow that changes in the environment, and in the genetic constitution of species, must cause this zone to be crossed and perhaps recrossed relatively rapidly in the course of evolutionary change, so that many possible gene substitutions may have a fluctuating history of advance and regression before the final balance of selective advantage is determined.

XXX. J. B. HUTCHINSON. *"The Application of the 'Method of Maximum Likelihood' to the Estimation of Linkage."* Genetics, 1929. Vol. XIV, pp. 519-537.

The "Method of Maximum Likelihood," developed by Dr. R. A. Fisher, is applied to the problem of estimating linkage in cases involving complementary and duplicate factors.

Variances are calculated for existing formulae, and their efficiencies are determined to show that the "Method of Maximum Likelihood" is in all cases superior to any other method of estimation.

The amount of information supplied per plant by Maximum Likelihood formulae for F_2's and backcrosses, and by other formulae for F_2's is calculated and compared with the amount of information supplied per plant by a simple—that is, completely classified—backcross. From figures 2, 3 and 4 of this paper it is possible to estimate the size of family necessary to give any required degree of accuracy.

F

https://doi.org/10.23637/ERADOC-1-63

THE SOIL

(Chemical and Physical Departments)

(*a*) General

XXXI. E. M. CROWTHER. *"The Relationship of Climatic and Geological Factors to the Composition of Soil Clay, and the Distribution of Soil Types."* Proceedings of the Royal Society (B), 1930. Vol. CVII, pp. 1-30.

An attempt has been made to separate the effects on soil formation of quantitative climatic factors (mean annual rainfall and temperature) and a qualitative geological grouping by the examination of American data for the composition of colloidal clay, using a statistical method which is capable of application to other geographical and ecological problems. Earlier contradictory statements on the relation of temperature to the composition of the clay fraction are shown to depend on a failure to recognise the positive correlation of rainfall and temperature over the greater part of U.S.A. The ratio of silica to alumina in the clay fraction is now shown to be correlated negatively with rainfall and positively with temperature, and the relative effects are such that for similar parent materials constant SiO_2/Al_2O_3 ratios are found when an increase of mean annual temperature of 1°C is accompanied by an increase of 4 cms in annual rainfall. It is suggested that this factor provides a rough measure of the joint action of rainfall and temperature on drainage and leaching in soils. The relative effects on clay of rainfall and temperature on clay composition are closely parallel to their effects on the amount of drainage in Rothamsted lysimeter experiments, if the mean monthly values of the latter be regarded as samples of different climates.

If the average rainfall and temperature factors are used to calculate the contribution of soil clay in the representative and essentially immature American soils studied by Robinson and Holmes, increasingly siliceous clays are obtained as the parent material changes through the series: hard rocks, alluvium from hard rocks, limestone, marine deposits, glacial and loessial deposits, alluvium from loess. This is roughly according to the amount of reworking in water. Highly siliceous clays may be produced either in arid climates or from repeatedly reworked material in humid ones.

A statistical attempt has been made to deduce the relative importance of rainfall and temperature in soil formation from the distribution of established soil types in U.S.A. Among Marbut's Pedocals rainfall is the more important factor but among his Pedalfers temperature is more closely correlated with the distribution of soils.

The iron-aluminium ratio of the colloidal clay changes in characteristic manner through the soil profile and it appears that its fuller examination may provide a more definite criterion for distinguishing between types of leached soils.

https://doi.org/10.23637/ERADOC-1-63

(*b*) Mechanical Analysis

XXXII. B. A. KEEN AND R. K. SCHOFIELD. "*Formation of Streamers in Sedimentation.*" Nature, 1930. Vol. CXXVI, pp. 93-94.

A discussion is given of the system proposed by C. E. Marshall for mechanical analysis of clays with the aid of a high-speed centrifuge. The method consists essentially in pouring a thin layer of aqueous clay suspension on the top of a sugar solution. The streamers which form when this system is left under the influence of gravity, are attributed to the formation of a clay laden layer of sugar solution immediately below the aqueous layer. This layer, having a greater density than the solution below, breaks up and streams downwards. The authors inquire whether this phenomenon may not render invalid Marshall's calculation, in which it is supposed that the particles sediment individually through the sugar solution.

(*c*) Physical Properties

XXXIII. B. A. KEEN "*'Single Value' Soil Properties. A Study of the Significance of Certain Soil Constants. IV. A Further Note on the Technique of the 'Box' Experiment.*" Journal of Agricultural Science, 1930. Vol. XX, 414-416.

Experiments on the effect of impacts on the amount of precipitated silica that can be packed into a Keen-Raczkowski box, suggest that, like the weight per unit volume, the "swelling" is a function of the degree of packing to which the material is subjected during the filling of the box. Further, the fact that such inert material as precipitated silica can show a "swelling" when saturated with moisture, raises the question as to how far imbibitional moisture is concerned in the volume expansion of soil.

XXXIV. W. B. HAINES. "*Studies in the Physical Properties of Soil, V. The Hysteresis Effect in Capillary Properties, and the Modes of Moisture Distribution associated therewith.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 97-116.

A further study is made of water distribution in an ideal soil by means of carefully piled bronze balls and paraffin oil. A distinction is drawn between the conditions of rising and falling "moisture." For falling moisture the pressure deficiency, for which the meniscus can retreat into the internal cellular structure, is in the neighbourhood of 12 T/r, while for rising moisture the liquid can return whilst still under a pressure deficiency of 6.9 T/r. An examination of water equilibrium in "glistening dew," forms a link with the behaviour of soil, and the investigation illustrates the importance of hysteresis in capillary properties of soil.

XXXV. R. K. SCHOFIELD AND G. W. SCOTT BLAIR. "*The Influence of the Proximity of a Solid Wall on the Consistency of Viscous and Plastic Materials.*" Journal of Physical Chemistry, 1930. Vol. XXXIV, pp. 248-262.

If, in considering the flow of a plastic material through a narrow tube, it be assumed that the velocity gradient at any point depends only on the stress at that point, it necessarily follows that the mean

https://doi.org/10.23637/ERADOC-1-63

velocity for a given stress at the wall of the tube should be directly proportional to the radius of the tube. Although thick soil pastes conform closely to this requirement, thinner pastes, whether they show rigidity or not, give marked discrepancies. These discrepancies can be accounted for by assuming that in the immediate proximity of the wall a modification of the plastic properties occurs, which imparts an additional velocity to the bulk of the material. By first subtracting this velocity a viscosity constant is obtained, independent of the dimensions of the tube.

XXXVI. G. W. Scott Blair. "*A Further Study of the Influence of the Proximity of a Solid Wall on the Consistency of Viscous and Plastic Materials.*" Journal of Physical Chemistry, 1930. Vol. XXXIV, pp. 1505-1508.

In a previous paper (R. K. Schofield and G. W. Scott Blair) it had been shown that in order to account for the flow properties of clay pastes, an anomalous region must be postulated in the neighbourhood of the wall of the tube through which the paste is caused to stream. It was assumed that this layer was relatively thin, and a single correction is made for its effect in the modified Poiseuille formula used. In this paper the modified layer is accorded a separate term in the integration, assuming for it consistency constants differing from those of the bulk of the material. The earlier "correction" term is then expressible in terms only of these consistency constants (modified and normal); of the thickness of the modified layer; and of the radius of the tube.

(*d*) Soil Cultivation

XXXVII. B. A. Keen and the Staff of the Soil Physics Department. "*Studies in Soil Cultivation. V. Rotary Cultivation.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 364-389.

Experiments in rotary cultivation extending over four years (1926-1929) yielded the results that with spring-sown crops—swedes and barley—rotary cultivation gives earlier and better germination and better early growth. In every experiment, however, the final yield has either been no better or else significantly below that obtained for the plots cultivated in the usual way. Meteorological factors exercise a predominating influence—the implement used being only secondary. Rotary cultivation appears to be most effective on an unkindly soil. Sieving measurements show that it does not produce an appreciably finer tilth than the usual imple ments, but leaves the soil initially in a much looser condition.

(*e*) Physical Chemistry

XXXVIII. E. M. Crowther and S. G. Heintze. "*Report of the Soil Reaction Committee of the International Society of Soil Science. I. Results of Comparative Investigations on the Quinhydrone Method. II. Conclusions and Recommendations.*" Soil Research, 1930. Vol. II, pp. 28-139, 141-152.

This is the report of a Committee set up at Budapest in 1929 as a result of criticism of the standard quinhydrone method for soil reaction measurements made by S. G. Heintze and E. M. Crowther (Paper

https://doi.org/10.23637/ERADOC-1-63

XVIII, Report, 1929, p. 58) and others. Comparative determinations in seven laboratories confirmed the conclusions that in many common soils the quinhydrone method may give quite erroneous results. It was recommended that a rapid preliminary test of the suitability of the soil for the quinhydrone technique should precede all precise measurements. In a special section of Part I, E. M. Crowther and S. G. Heintze bring forward additional evidence that the errors are due to the reduction of manganese dioxide to an alkaline product.

(*f*) Soil Organic Matter

XXXIX. H. J. Page. "*Studies on the Carbon and Nitrogen Cycles in the Soil. I. Introductory.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 455-459.

The term "humic matter" is defined as the dark coloured, high molecular, colloidal organic matter which is a characteristic constituent of the soil, and "non-humic matter" includes colourless chiefly soluble organic substances and undecomposed plant residues.

XL. C. W. D. Arnold and H. J. Page. "*Studies on the Carbon and Nitrogen Cycles in the Soil. II. The Extraction of the Organic Matter of the Soil with Alkali.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 460-477.

Although the total organic carbon in the soils of various plots of the classical permanent experiments at Rothamsted receiving, respectively, organic, artificial and no manures, varied between 0.81 and 2.91 per cent, and in the subsoils between 0.54 and 1.04 per cent of the oven dry samples, there was a marked similarity between the properties of their organic matter, especially in its behaviour on extraction with cold and hot dilute caustic code. Colorimetric examinations of the extracts indicate that the organic carbon of the surface soils is more deeply coloured than that of the corresponding subsoils, that the organic carbon is most deeply coloured in extracts from surface soils receiving annual dressings of dung, and that that from subsoils of plots receiving no manure is least coloured.

XLI. H. M. S. Du Toit and H. J. Page. "*Studies on the Carbon and Nitrogen Cycles in the Soil. III. The Formation of Natural Humic Matter.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 478-488.

Decomposition experiments in which soil extracts and nutrient salts were added to plant materials such as wheat straw, clover hay, maize cobs and pine sawdust, and to purified preparations of plant constituents, including lignin, cellulose, xylan, xylose, potato starch, dextrose and protein in the form of commercial blood fibrin, indicate that the formation of humic matter is more closely related to the change in lignin content of the original material than to the change in content of any other groups of plant constituents estimated.

(*g*) Analytical

XLII. R. G. WARREN AND A. J. PUGH. "*The Colorimetric Determination of Phosphoric Acid in Hydrochloric Acid and Citric Acid Extracts of Soils.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 532-540.

The existing macromethods for the determination of phosphoric acid in soils are unsuitable for large numbers of analyses as the time and labour involved are excessive, especially for such empirical determinations as "Available Phosphoric Acid," by means of citric acid. Further in certain cases these methods are not free from serious errors. These disadvantages have prevented extensive work on soil phosphorus and attention has therefore been given to the application of colorimentric methods so that analyses may be made rapidly.

Accurate colorimetric determination of phosphoric acid in soil extracts demands not only the absence of large amounts of silica and organic matter, and a controlled acidity for development of colour, but also the absence of ferric iron. To satisfy these conditions a method was devised in which the organic matter, including citric acid, was oxidised by sodium permanganate in hydrochloric acid solution. Silica was only removed from solution for soils that contained less than .02 per cent P_2O_5 soluble in hydrochloric acid. Ferric iron was precipitated with potassium ferrocyanide, and the excess which would redissolve the iron and cause interference during colour development, was removed by ensuring the presence of sufficient manganese. Finally, the acidity was adjusted by utilising the blue to purple colour change of the precipitated ferrocyanide instead of an added indicator. Two colorimetric methods, Deniges and Fiske-Subbarow, were applied to solutions prepared in this way, and good agreement was obtained with the gravimetric method. In this method lengthy operations such as quantitative filtration, evaporation and ignition of organic matter were eliminated or reduced to a minimum.

Correction to above paper. On p. 539, l. 5, should read: "Rinse into a 1 litre graduated flask containing 500 cc. of 10 *N* sulphuric acid."

THE SOIL POPULATION AND ITS BEHAVIOUR

(Bacteriological and General Microbiological Departments)

XLIII. H. G. THORNTON. "*The Influence of the Host Plant in Inducing Parasitism in Lucerne and Clover Nodules.*" Proceedings of the Royal Society (B), 1930. Vol. CVI, pp. 110-122.

The formation of fresh nodules upon inoculated lucerne seedlings placed in the dark soon ceases, and there is a cessation of cell division throughout the root. The bacteria become parasitic upon the host tissues. In old nodules on lucerne and clover plants growing in the light, the bacteria behave similarly. Bacteria from the original infection thread invade the nodule tissue, causing it to disintegrate. It is suggested that lack of carbohydrate is the basal factor in both conditions. When the air supply to lucerne seedlings growing in agar is limited, the nodules do not function normally but, carbohydrate supply not being the limiting factor, the host tissue is not then injured.

https://doi.org/10.23637/ERADOC-1-63

XLIV. H. G. THORNTON. "*The Early Development of the Root Nodule of Lucerne* (*Medicago sativa*, *L.*)." Annals of Botany, 1930. Vol. XLIV, pp. 385-392.

Bacteria infect the root hairs, the infection threads passing into the cortex without invading the central cylinder of the root. Cell division is thereby induced. The infection threads, naked at their growing points, tend to swell into zoogleal masses. In the older portions of the thread, a sheath is formed round them continuous with the wall of the host cell. The zoogleal masses remain unsheathed and release bacteria into the host cytoplasm. Division of the host cells ceases by the time the infection thread sheath is formed. The host cells are apparently uninjured by the bacteria save in old nodule tissue.

XLV. H. G. THORNTON AND P. H. H. GRAY. "*The Fluctuations of Bacterial Numbers and Nitrate Content of Field Soils.*" Proceedings of the Royal Society (B), 1930. Vol. CVI, pp. 399-417.

Samples of field soil were taken at two hourly intervals. Fluctuations in bacterial numbers greatly exceeding the variation in bacterial content of simultaneous samples, were found to occur by day and by night. To reduce sampling errors, a plot of soil was specially prepared, and in soil from this plot significant fluctuations in bacterial numbers were found, greatly exceeding the variation between simultaneous samples. The maximum count usually occurred about 10 a.m. No correlation between the changes in bacterial numbers of soil moisture content was found ; correlations of bacterial numbers with rainfall soil temperature, and nitrate content of soil, were doubtful. Results were examined statistically, and the methods of statistical analysis are given in full in the paper.

XLVI. H. L. JENSEN. "*Decomposition of Keratin by Soil Micro-organisms.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 390-398.

Keratin, prepared from horn meal, added to moist soil and allowed to decompose in the laboratory, was found to undergo a decomposition resulting in a slow accumulation of ammonia and nitrate. The addition of keratin produced no significant increase in the number of bacteria able to grow on agar, but markedly increased the number of actinomycetes, especially in garden soil. Two strains of actinomycetes were isolated and found capable of thriving in pure culture on keratin and forming ammonia therefrom.

XLVII. A. KALNIŅŠ. "*Aerobic Soil Bacteria that Decompose Cellulose.*" (With summary in Latvian.) Latvijas Universitātes Raksti, Lauksaimniecibas Fakultātes, Serija I, 1930. Vol. XI, pp. 221-312.

A number of aerobic bacteria that decompose pure cellulose, have been isolated from 28 samples of English soils. Forty-eight strains are described. All except one are widely distributed in English soils and appear to belong to new species. The conditions of growth have been studied in considerable detail It was found that the organisms can derive energy from other carbohydrates besides

cellulose. One species, *Bacterium protozoides*, was able to produce a substance resembling glucose from cellulose in quantities up to 30 per cent of the original cellulose.

XLVIII. JANE MEIKLEJOHN. "*The Relation between the Numbers of a Soil Bacterium and the Ammonia produced by it in Peptone Solutions ; with Some Reference to the Effect on this Process of the presence of Amoebae.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 614-637.

Using a soil bacteria " YB " alone in liquid cultures, an inverse linear relation was found between bacterial numbers and efficiency, and the greatest rate of production of ammonia was found to correspond to a bacterial content of about 500 million per cc. ; the rate was lowered by any increase in numbers above this figure.

A greatly increased lag period was observed as a result of diluting the inoculum ten times.

Comparing a soil protozoo an *Hartmanella* and "YB" against " YB " alone in sand cultures, it was found that the presence of the amoebae, while lowering the bacterial numbers, seemed to increase the rate of ammonia production.

THE PLANT IN DISEASE ; CONTROL OF DISEASE

(Entomological, Insecticides and Fungicides, and Mycological Departments)

(*a*) Insect Pests and Their Control

XLIX. H. F. BARNES. "*On the Biology of Gall-Midges affecting Meadow Foxtail Grass.*" Annals Applied Biology, 1929. Vol. XVII, pp. 339-366.

Three midges do serious damage to the seeding of meadow foxtail grass ; they are *Dasyneura alopecuri* (Reuter). *Stenodiplosis geniculati* (Reuter) and *Contarinia merceri* n. sp. All three occur almost wherever the grass is grown. " Blindness " or empty husks in meadow foxtail grass is due very largely to attacks of *C. merceri*, which midge does the most extended damage. Keys are given for the separation of larvae, pupae and adults. Control measures are discussed and a method of keeping sheep on the grass until a certain safety date, *i.e.*, a date when the crest of emergence of the female midges is over, is strongly advocated in districts where the bionomics is known.

L. H. F. BARNES. "*Unisexual Families in Rhabdophaga heterobia.*" The Entomologist's Monthly Magazine, 1929. Vol. LXV, pp. 256-257.

Describes experimental observations showing that unisexual families occur in this midge. This feature is extremely rare among animals with bisexual reproduction and the facts recorded are comparable with Metz's work dealing with various species of *Sciara*.

LI. H. F. BARNES. "*A New Thrips-Eating Gall Midge, Thripsobremia liothripis, Gen. et. sp. n. (Cecidomyidae).*" Bulletins of Entomological Research, 1930. Vol. XXI, pp. 331-332.

This new species of gall midge is described from material received from Trinidad by the Imperial Institute of Entomology. Its

https://doi.org/10.23637/ERADOC-1-63

larvae are predaceous upon *Liothrips urichi* Karny, a species of thrips living upon the Melastomaceous plant, *Clidemia hirta*.

LII. H. F. BARNES. "*On Some Factors Governing Emergence of Gall-Midges.*" Proceedings of the Zoological Society, 1930. Part II, pp. 381-393.

The times of emergence of about 100,000 individual midges has been investigated under several environmental conditions, including those in which both light and temperature have been varied. The effect of extra heat, while causing earlier than normal emergence, decreases the percentage emergence, while that of extra cold is less marked. Hymenopterous parasites appear to be less affected by cold than their host midges. It is suggested that variation in the relative times of emergence of hosts and parasites, due to differential weather effects, causes sudden marked fluctuations in degree of parasitism.

LIII. H. F. BARNES. "*On the Resistance of Basket Willows to Button Gall Formation.*" Annals Applied Biology, 1930. Vol. XVII, pp. 638-640.

A preliminary account of experiments showing that different varieties of basket willow show different degrees of susceptibility to attack by the midge *Rhabdophaga heterobia*. Whereas the variety "Harrison" showed complete immunity from attack through three generations of the insect in question, five other varieties tested all proved to be heavily attacked.

LIV. H. F. BARNES. "*Gall Midges* (*Cecidomyidae Dipt.*,) as *Enemies of Aphids.*" Bulletin of Entomological Research, 1929. Vol. XX, pp. 433-442.

Vague statements have been made that in certain outbreaks Aphids have been controlled by the larvae of gall midges, but no exact proofs based on counts of the number of Aphids killed, the fecundity of the midge compared with that of the Aphid, the appetite of the midge larvae, etc., have been given. With a view to stimulating research along these lines, the species of Cecidomyidae, of which the larvae have been reported, as prey on or parasitising Aphids are enumerated, and an alphabetical list is given of the Aphids attacked by midge larvae (where the Aphid has not been identified, its food-plant is substituted).

LV. H. F. BARNES. "*Gall Midges* (*Cecidomyidae*) *as Enemies of the Tingidae, Psyllidae, Aleyrodidae and Coccidae.*" Bulletin of Entomological Research, 1930. Vol. XXI, pp. 319-329.

This paper is the second of a series on the zoophagous Cecidomyids of the world. An annotated list is given of the Cecidomyid larvae that have been reported to prey on Tingids, Psyllids, Aleurodids and Coccids, as well as alphabetical lists of the latter insects showing the Cecidomyids attacking them and the country in which the observations were made.

https://doi.org/10.23637/ERADOC-1-63

LVI. E. E. EDWARDS. *"On the Morphology of the Larva of 'Dorcus Parallelopipedus.'"* Journal of the Linnean Society of Zoology, 1930. Vol. XXXVII, pp. 93-108.

Describes the detailed external morphology of this type and the salient features connected with the digestive and nervous system. Apart from other characters the larva of *Dorcus* can be separated from those of other genera of European Lucanidae by the form and arrangement of the tubercles composing the coxal and trochanteric stridulatory areas. In its digestive system it exhibits affinities with the Scarabaeidae, while the nervous system is of a primitive type approaching that of *Lucanus*. The Malpighian Tubes are exceptional in that their distal extremities are confluent in pairs and assume, in consequence, a looped condition.

LVII. A. D. IMMS. *"Observations on some Parasites of Oscinella frit. Part I."* Parasitology, 1930. Vol. XXII, pp. 11-36.

Describes two years' observations and experiments with reference to the natural infestation of the stem generation of the frit fly by parasites. Four species of parasites were found to attack this host, one of which, *Callitula bicolor*, was previously unknown in this relation. Owing to these several species being little known, and in order to establish their identity as clearly as possible, detailed descriptions are provided and their morphological characteristics fully illustrated. During the two years in which the investigations were carried out, the total destruction of frit fly in Harpenden plots by parasites amounted to 27 per cent in 1926, and 37 per cent in 1927. Evidence afforded by field plot experiments showed that the parasites, collectively, become more abundant as the season advances with the result that frit fly, affecting late sown oats, suffers markedly heavier mortality from parasites than when it attacks oats drilled earlier in the season.

LVIII. D. M. T. MORLAND. *"On the Causes of Swarming in the Honey Bee (Apis mellifica); an Examination of the Brood Food Theory."* Annals Applied Biology, 1930. Vol. XVII, pp. 137-149.

The influence of nitrogenous food is discussed in its bearing on the question of swarming and theories of the origin of the brood-food are examined. The division of labour among bees of various ages is considered in its relation to the brood-rearing cycle. A critical surplus of nurse bees is found to be associated with the formation of queen cells in preparation for swarming, and in this connection swarm control measures are reviewed and also in relation to the brood-food theory.

(*b*) Fungus Pests and Their Control

LIX. MARY D. GLYNNE. *"A Note on Some Experiments dealing with Sulphur Treatment of a Soil and its Effect on Wheat Yield."* Proceedings of the Royal Society (Victoria), 1929. Vol. XLII, pp. 30-35.

Sulphur and sulphur derivatives were applied to Australian soil reported to be too badly infested with disease-causing fungi to

https://doi.org/10.23637/ERADOC-1-63

support more than a very poor crop of wheat. Remarkable increases in crop up to 821 per cent increase over controls were obtained.

Disease appeared no more common in controls than in untreated plots suggesting a soil deficiency supplied by the treatment. This might be a deficiency of sulphur, of some element or compound set free in the soil or of something supplied by micro-organisms influenced by the treatment. A stimulation of nitrogen fixing organisms is suggested. Soil acidity also received consideration.

LX. W. A. ROACH. "*Sulphur as a Soil Fungicide against the Potato Wart Disease Organism.*" Journal of Agricultural Science, 1930. Vol. XX, pp. 74-96.

Thiosulphuric acid has been shown to exist in a free state. It is relatively stable in dilute solution; an M/200 solution is only half decomposed at the end of one day, and an M/400 solution at the end of ten days only.

This degree of stability is sufficient to account for the fungicidal action of acidified thiosulphate solutions in terms of the liberated thiosulphuric acid.

It can be calculated that it is only necessary to assume 6 per cent of the minimum quantity of sulphur found effective against wart disease in the field to be in the form of thiosulphuric acid over a period of ten days in order to account for its toxicity.

Experiments of a preliminary nature carried out on sulphur-treated soil, proved the formation of pentathionate in Rothamsted soil kept at 30°C., but not in Ormskirk soil kept at the same temperature, nor in either soil at the lower temperatures of 0° and 15°C.

No definite evidence of the accumulation of appreciable quantities of thiosulphuric acid in the soil was obtained, but reasons are given why this negative evidence is by no means final.

Chemical considerations and the work of others suggest that the pentathionate actually identified in the soil solution arose from the thiosulphuric formed in an early stage of the oxidation of the sulphur.

The explanation of the fungicidal action of sulphur towards wart disease in soil in terms of the formation of thiosulphuric acid is alone in harmony with the ascertained facts.

(*c*) Bacterial Diseases

LXI. R. H. STOUGHTON. "*The Morphology and Cytology of 'Bacterium Malvacearum' E.F.S.*" Proceedings of the Royal Society, 1929. Vol. CV, pp. 469-484.

Bacterium malvacearum, the causal organism of the "Black Arm" disease of cotton, has been found to possess certain internal structures and a variety of different morphological forms. An internal structure is described, which passes through a division-cycle and is suggestive of a nucleus. Small granules are described, which are found in the wall of the cell and freed by a process of extrusion. These bodies resemble the "gonidia" of other writers. The occurrence and mode of formation of spherical coccus-like bodies is described. Various a-typical forms are found to occur in old cultures.

https://doi.org/10.23637/ERADOC-1-63

LXII. R. H. STOUGHTON. "*The Relation of Environmental conditions to Angular Leaf-Spot Disease of Cotton, 'Bacterium Malvacearum' E.F.S.*" Annals of Applied Biology, 1929. Vol. XVI, pp. 188-189.

An account of experiments carried out in a small experimental chamber, showing that temperature and humidity are interrelated factors in their effect on disease. An abstract of a paper read to the Association of Economic Biologists.

LXIII. R. H. STOUGHTON. "*Apparatus for the Growing of Plants in a Controlled Environment.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 90-106.

An account of the construction of tanks and chambers for the growing of plants under independently controlled conditions of soil temperature, air temperature and air humidity. Artificial illumination is provided by two floodlights, one over each chamber.

LXIX. R. H. STOUGHTON. "*Thionin and Orange G for the Differential Staining of Bacteria and Fungi in Plant Tissues.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 162-164.

An account of a new and simple method of differentially staining fungal and bacterial parasites in plants.

LXV. R. H. STOUGHTON. "*The Influence of Environmental Conditions on the Development of the Angular Leaf-Spot Disease of Cotton. II. The Influence of Soil Temperature on Primary and Secondary Infection of Seedlings.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 493-503.

Using the apparatus described in the previous paper it is found that the amount of primary infection of seedlings raised from infected seed decreases at soil temperatures above 30°C., but infection is not inhibited at 40°C. Soil temperature has little or no effect on secondary infection resulting from spray inoculation of the leaves.

(*d*) Virus Diseases

LXVI. J. CALDWELL. "*The Physiology of Virus Diseases in Plants. I. The Movement of Mosaic in the Tomato Plant.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 429-443.

A method is described whereby it is shown that the virus agent in an infeated area of a plant does not travel across dead tissue even in the water stream; but can pass over if a bridge is left of living cells. Evidence is adduced to show that the agent apparently travels normally in the plant along the protoplasmic connections from cell to cell of the ground tissue, and that it does not travel exclusively in the vascular tissue.

LXVII. M. A. HAMILTON. "*Notes on the Culturing of Insects for Virus Work.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 487-492.

(1) Use of Cellophane for Breeding Cages.

Cellophane is recommended as a material to replace muslin or glass for the caging and isolation of small insects. Metal frameworks are described as a basis for the material, and some of its

https://doi.org/10.23637/ERADOC-1-63

properties, *i.e.*, permeability to moisture and gases, and ultra violet light, general transparency and shrinkage are discussed.

(2) Artificial feeding of *Myzus persicae*.

A method is described by which *M. persicae* may be fed on artificial media. It consists of a pair of glass capsules, the upper one having a floor of fine gut skin, through which the insects, caged in a lower capsule, will absorb dyes and culture fluids.

LXVIII. P. H. JARRETT. "*Streak—a Virus Disease of Tomatoes.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 248-259.

Streak disease of tomatoes, derived from commercial glasshouses, and experimental streak, produced by combined inoculation of the viruses of potato mosaic and tobacco mosaic are compared.

Glasshouse streak and tobacco mosaic show an equal resistance to alcohol, heat and ageing in vitro and have, in addition, an identical host range. Treatment for one hour with 90 per cent alcohol, and for ten minutes at 85°C., did not destroy the infectivity of either of these viruses.

Glasshouse streak is shown not to contain the virus of potato mosaic, but is of itself able to produce necrosis in tomatoes without the participation of potato mosaic.

It is concluded that tobacco mosaic and the mosaic of glasshouse streak are probably identical, and that much of the streak occurring in glasshouses is due to a single virus, and not a mixed infection of this with potato mosaic.

LXIX. P. H. JARRETT. "*The Role of 'Thrips tabaci' Lindeman in the Transmission of Virus Diseases of Tomato.*" Annals of Applied Biology, 1930. Vol. XVII, pp. 444-451.

A description is given of experiments designed to show the role of *Thrips tabaci* Lindeman in the transmission of virus diseases of tomatoes.

The diseases tested were tobacco mosaic and glasshouse streak singly, and the viruses of each of these two combined with a potato mosaic virus to give a disease termed experimental streak.

The source of the materials used and the methods employed are described in detail.

In no case was transmission of any of the viruses recorded, although the insects had fed freely on all the plants. It is concluded that *Thrips tabaci* does not transmit virus diseases of tomatoes under all conditions. The importance of this insect as a vector of these diseases in commercial glasshouses in England is therefore doubtful.

LXX. F. M. L. SHEFFIELD AND J. HENDERSON SMITH. "*Intracellular Bodies in Plant Virus Diseases.*" Nature, 1930. Vol. CXXV, p. 200.

When *Solanum nodiflorum* is infected with yellow or aucuba mosaic of tomato, it is possible to follow the development within the living cell of the protein X-bodies. A few days after inoculation, innumerable small particles appear and move passively in the

https://doi.org/10.23637/ERADOC-1-63

cytoplasmic stream. They enlarge, aggregate and fuse until ultimately a single large mass, the X-body, is formed accompanied by a crystalline spike but by no other abnormal inclusions. In old leaves the X-body tends to crystallise out.

LXXI. J. HENDERSON SMITH. *"Intracellular Inclusions in Mosaic of 'Solanum Nodiflorum.'"* Annals of Applied Biology, 1930. Vol. XVII, pp. 213-222.

The inclusions formed after inoculation with aucuba mosaic are described in detail and illustrated. They correspond to the vacuolate amoeboid bodies produced in other hosts by other viruses, are protein in nature, and tend to crystallise. Their mode of formation by aggregation of small particles has been followed throughout in individual living cells, and accounts satisfactorily for the appearances which have led other observers to believe that they are parasitic organisms, a view for which no support has been obtained in this work.

TECHNICAL AND OTHER PAPERS

GENERAL

LXXII. E. J. RUSSELL. *"Agricultural Science and Arable Farming."* National Farmers' Union Year Book, 1930, pp.

LXXIII. E. J. RUSSELL. *"Agricultural Research Institutes and Agricultural Colleges. The Rothamsted Experimental Station."* Superphosphate, 1930, pp. 149-157.

LXXIV. E. J. RUSSELL. *"Winter Keep for Dairy Stock."* Year Book of the Central Council of Milk Recording Societies, 1930.

LXXV. E. J. RUSSELL. *"Agricultural Developments in South Africa."* Geography, 1930. Vol. XV, pp. 445-451.

LXXVI. E. J. RUSSELL. *"Palestinian Agriculture and its Possibilities."* The Monthly Pioneer, May, 1930, pp. 5-6.

LXXVII. B. A. KEEN. *"New Steps in School Broadcasting."* The Listener, 1930. Vol. IV, p. 452.

CROPS, SOILS AND FERTILISERS

LXXVIII. E. J. RUSSELL. *"Manuring and Cultivation of Sugar Beet."* Report of Third Conference held at Harper Adams Agricultural College, March 13th, 1930, pp. 4-9.

LXXIX. E. J. RUSSELL. *"Soils and Fertilisers."* Agricultural Research in 1929, pp. 120-152. (Royal Agricultural Society of England, 1930.)

LXXX. E. J. RUSSELL *"The Influence of Fertilisers on the field and Composition of Plants."* British Association, Report of Bristol Meeting, 1930, pp. 418-419.

LXXXI. W. E. BRENCHLEY. *"Mineral Elements in Plant Nutrition."* British Association, Report of Bristol Meeting, 1930, pp. 401-402.

https://doi.org/10.23637/ERADOC-1-63