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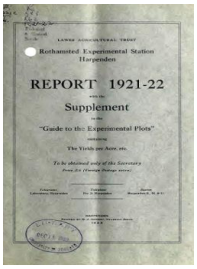
Report 1921-22 With the Supplement to the Guide to the Experimental Plots Containing the Yields per Acre Etc.



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Soil Organisms

Rothamsted Research

Rothamsted Research (1923) *Soil Organisms ;* Report 1921-22 With The Supplement To The Guide To The Experimental Plots Containing The Yields Per Acre Etc., pp 36 - 39 **- DOI: https://doi.org/10.23637/ERADOC-1-110**

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and (ii.) an abnormally low variation ascribable to defective procedure in the preparation of the medium. Application of the same tests to other extensive series of bacterial counts showed that a similar approach to theoretical accuracy, though rare, had been obtained by Breed and Stocking in counts of *B. coli* in milk. It should be emphasised that all cases of departure from the theoretical law of distribution, which have been investigated, are associated with large systematic errors in the counts; for this reason simple tests are presented by which such deviations from the theoretical accuracy of the method can be detected.

ACCURACY OF APHIS COUNTS.

XV. R. A. FISHER. *"Appendix to 'Biological Studies of* APHIS RUMICIS,' *by* J. DAVIDSON." Annals of Applied Biology, 1922. Vol. IX. pp. 142-145.

A special method was developed for determining the accuracy of Dr. Davidson's counts on Aphids; by this means it was possible to show that the 19 varieties of bean tested could be assigned to only six degrees of susceptibility to aphis infestation.

MANURIAL RESPONSE OF POTATO VARIETIES.

XVI. R. A. FISHER and W. A. MACKENZIE. *"The Manurial Response of Potato Varieties."* Journal of Agricultural Science, 1923. Vol. XIII. pp. 311-320.

In an experiment carried out at Rothamsted (1922), twelve potato varieties were each tested with six different manurial treatments, each test being triplicated. Consequently it was possible to test a question upon which very little information has hitherto been available, namely, whether different varieties respond alike to manurial treatment. It is impossible to generalise from a single test of a single species, and it has seemed to the authors of more importance to call attention to (i.) the kind of data required for such an enquiry, and (ii.) the type of statistical treatment needed to elicit an answer, than to emphasise the fact that no significant differences are observable in the manurial response, although the varieties differed much among themselves in yield, and the different treatments also resulted in large differences in yield.

SOIL ORGANISMS.

XVII. E. J. RUSSELL. *"Les Micro-Organismes du Sol dans leurs rapports avec la croissance des plantes. Position actuelle du probléme."* Ann. de la Sci. Agronomique, 1921. pp. 49-67.

A review of the present position of our knowledge on this subject.

ALGÆ.

XVIII. B. MURIEL BRISTOL and HAROLD J. PAGE. *"A Critical Enquiry into the Alleged Fixation of Atmospheric Nitrogen."* Annals of Applied Biology, 1923. Vol. X. pp. 1-30.

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Four species of green algæ were grown in pure culture on six media which had as a common basis a solution of mineral salts devised by Schramm, but differing in that the nitrogen was supplied as ammonium nitrate, calcium nitrate or ammonium sulphate; for each of these sources of nitrogen there were two media, one without added sugar and the other containing 1% glucose. The cultures were aerated daily with sterile air free from combined nitrogen. The initial nitrogen-content of the medium in each flask was ascertained from check analyses of that medium, and the nitrogen-content after six months' growth was determined by chemical analysis of the whole of the contents of the flask.

In practically all cases a good growth of algæ was obtained, and in a large number the growth was luxuriant. Nevertheless the analytical results afforded no evidence whatever that any fixation had occurred. In fact, those cultures the growth of which had been most luxuriant had a final nitrogen-content that was, if anything, slightly lower than that of the medium originally.

This result differs from that obtained by Wann (Amer. Jour. Bot., 1921., Vol. VIII.) Investigation showed, however, that the method by which he estimated nitrogen breaks down in presence of nitrate. The results give the appearance of nitrogen fixation even when none occurred.

The chemical methods used by the present authors were free from these sources of error and, as already stated, no fixation could be detected. While it is quite conceivable that green algæ might under certain conditions, as yet unknown, assimilate atmospheric nitrogen, there is so far no trustworthy evidence that they can do so.

BACTERIA.

XIX. H. G. Thornton. *"On the Development of a Standardised Agar Medium for Counting Soil Bacteria, with especial regard to the Repression of Spreading Colonies."* Annals of Applied Biology, 1922. Vol. IX. pp. 241-274.

For counting bacteria by the plating method it is a first essential to accuracy that the plating medium should give uniform results. The medium should be exactly reproducible, *i.e.*, different batches should give similar results. In the medium here developed, this has been achieved by using pure chemical compounds as food constituents, selecting those compounds that did not alter the reaction of the medium during sterilisation.

Further parallel platings of a suspension of organisms made on a single batch of medium should develop the same number of colonies (within the limits of random sampling variance). This necessitates the independent development of each colony on the plate, which on agar media is frequently prevented by the development of bacteria that form rapidly spreading colonies which interfere with the development of other bacteria.

A special study was therefore made of a common "spreading" organism with a view to limiting its growth. It was found that the organism spreads over the agar surface by active motility and that the factors controlling its spread were (i.) the existence of a

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surface film of water on the agar, and (ii.) the rate of multiplication previous to the drying of this film. In the present medium this rate of multiplication has been much reduced so that spreading colonies are greatly restricted. The medium has the following composition :—K_2HPO_4, 1.0 gram; $MgSO_4$, 7 H_2O, 0.2 grs.; $CaCl_2$, 0.1 gr.; NaCl, 0.1 gr.; $FeCl_3$, .002 grs.; KNO_3, 0.5 grs. Asparagine, 0.5 grs.; mannitol, 1.0 gram; agar, 15.0 grs.; water to 1000 cc. Reaction brought to PH 7.4 before sterilisation.

(For the rigid test of this medium, see Paper XIV., p. 35.)

PROTOZOA.

XX. D. W. CUTLER, LETTICE M. CRUMP, and H. SANDON. *"A Quantitative Investigation of the Bacterial and Protozoan Population of the Soil."* Phil. Trans. Roy. Soc., London, B., 1922. Vol. CCXI. pp. 317-350.

The results of 365 consecutive daily counts of the numbers of bacteria and of six species of protozoa in a normal field soil are given, and the methods of counting bacteria and protozoa are described.

The numbers of both bacteria and protozoa rarely remain the same from one day to the next. The fluctuations are very great, but it has not been found possible to connect them with meteorological or general soil conditions.

Fourteen-day averages of the daily numbers demonstrate that well-marked seasonal changes in the soil population are superimposed on the daily variations in numbers. In general, both bacteria and protozoa are most numerous at the end of November and fewest in February. These changes are not directly influenced by temperature or rainfall, but show a similarity to the seasonal fluctuations recorded for many acquatic organisms.

There is a slight tendency for the various species of flagellates to fluctuate together from day to day, but this is not shown by the two species of amœbæ.

An inverse relationship is found between the numbers of bacteria and active amœbæ in 86% of the total observations.

A two-day periodicity obtains for the active numbers of one species of flagellate (*Oicomonas termo*).

XXI. D. W. CUTLER. *"The Action of Protozoa on Bacteria when Inoculated into Sterile Soil."* Annals of Applied Biology, 1923. Vol. X. pp. 137-141.

Soil sterilized by heat was inoculated with :—

(*a*) Bacteria alone;
(*b*) ,, + one species of amœba;
(*c*) ,, + one species of flagellate.

Daily bacterial counts made on each portion of soil showed that the one containing no protozoa sustained a greater number of bacteria than those containing protozoa. Also the bacteria in the protozoa free soil did not exhibit the fluctuations in numbers characteristic of soil in which protozoa were living.

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XXII. S. M. Nasir. *"Some Preliminary Investigations on the Relationship of Protozoa to Soil Fertility with Special Reference to Nitrogen Fixation."* Annals of Applied Biology, 1923. Vol. X. pp. 122-133.

A perusal of the results shows that the presence of protozoa has no depressing effect on the nitrogen-fixing bacteria, either in the artificial culture media, or in sand cultures. From a total of 36 experiments done in duplicates or triplicates, 31 showed a decided gain, while only 5 gave negative results. The average figure for fixation works out to be 8.5%, which is well above the experimental error.

The highest fixation of 36.04% was recorded in sand cultures in the case of ciliates. All the three types of protozoa gave higher fixation figures. The experiment was repeated six times, and every time concordant results were obtained.

XXIII. D. W. Cutler and Lettice M. Crump. *"The Rate of Reproduction in Artificial Culture of Colpidium Colpoda."* Biochemical Journal, 1923. Vol. XVII. pp. 174-186.

Methods are given by which it has been found possible to obtain comparable results when studying the reproductive rates of certain protozoa in mass cultures.

It is shown that within a relatively short period after inoculation, under certain conditions, a varying proportion of the organisms die; and that this is correlated with the age of the culture from which the inoculation was made.

By means of three hourly counts it was found that death occurs even during the period of maximum reproduction.

Evidence is supplied that in certain strains of Colpidium the rate of reproduction from inoculation to the maximum numbers attained is constant.

XXIV. Madeleine Perey. *"Les Protozoaires du Sol."* Ann. Sci. Agron., 1923. Vol. LXIII. pp. 333-352.

A short review is given of our knowledge of soil protozoa together with an account of the species of protozoa found in certain French soils.

XXV. H. Sandon. *"Some Protozoa from the Soils and Mosses of Spitsbergen."* Journ. Linn. Soc., 1923. Vol. XXXIV.

Samples of soils and mosses brought back from Spitsbergen by the Oxford University expedition of 1921 and 1922 were examined, and an abundant protozoal fauna, practically identical with that found in soils and mosses of temperate lands, was found. Protozoa were found to be considerably more numerous in some of the soil samples than in others, but no close connection could be found between the numbers of species present and the physical or chemical properties of the soils. Descriptions are given of seven previously undescribed flagellates, of which five, however, occur also in Rothamsted soils.