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Report for 1923-1924 With the Supplement to the Guide to the Experimental Plots Containing the Yields per Acre Etc.



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Control

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The quantitative measurements give a much clearer picture than was hitherto possible of the character of the soil population. The average numbers obtained in the high activity period of spring and the low activity period of the winter are as follows :—

			Numbers per gram of soil.	Approx. weight. lbs. per acre.
Bacteria	High Activity	...	45,000,000	50
	Low	„	22,500,000	25
Amoebae	High Activity	...	280,000	320
	Low	„	150,000	170
Flagellates	High Activity	...	770,000	190
	Low	„	350,000	85
Ciliates	High Activity	...	1,000	—
	Low	„	100	—

The weight (also the volume) of the protozoa in the soil considerably exceeds that of the bacteria in spite of the high numbers of the latter.

It is more difficult to ascertain whether the production of plant food fluctuates in the same way as the numbers of organisms. There are undoubted fluctuations, but more data are required before the proof becomes as rigid as it is for bacteria.

There is definite evidence that crops obtain only part of the possible food supply, much of the rest being taken by soil organisms and thus rendered unavailable. One cannot as yet say which are the worst offenders in this respect; at present suspicion attaches to the algae, and the laborious task of clearing up the problem is being carried out by Dr. Bristol Roach.

CONTROL OF THE SOIL ORGANISMS.

The knowledge of the soil organisms gained in our laboratories is allowing of a steadily increasing degree of control. There are at present four directions in which large scale tests are carried out.

1. Inoculation of lucerne by the appropriate micro-organisms.
2. Conversion of straw into a useful manure by the cellulose decomposing organisms.
3. Control of the plant food production process by partial sterilisation methods.
4. Control of plant disease organisms by similar methods.

Of these, inoculation has already been discussed on p.

Artificial Farmyard Manure.—The production of manure direct from straw is now being carried out on the large scale. In the past season no less than 3,000 tons of straw and like material were treated in Britain alone in addition to much larger quantities treated abroad.

The method of making artificial farmyard manure is based on the facts that the necessary organisms are already present and need only suitable conditions to call forth their

activities. Food stuffs (especially nitrogen compounds and phosphates) are supplied, along with calcium carbonate to obviate acidity, and decomposition then proceeds rapidly, converting waste useless straw and other materials into valuable manure.

The large scale development is carried out by the non-profit making "Adco" syndicate, of which Lord Elveden is Chairman, thus relieving the Station of much exploitation work for which it is not suited. The numerous scientific problems constantly arising out of the field experience are studied by Messrs. E. H. Richards and R. L. Amooore in these laboratories.

The organisms are naturally present in the straw or in the dust and they need not be deliberately added. It is, however, important to discover exactly what they use, how they do their work, and what conditions are necessary to their efficiency. These problems are studied in the Bacteriological Department. A new organism has recently been found by Mr. P. H. H. Gray, which not only decomposes cellulose rapidly, but unlike the *Spirochæta Cytophaga* previously isolated in the laboratory, acts in presence of sugar and is indeed stimulated by small quantities of xylose and lignin such as occur in straw. It seems probable that this new organism plays a considerable part in the decomposition of straw in practice, in the making of farmyard manure and other important changes.

PARTIAL STERILISATION AND CONTROL OF SOIL. PESTS AND DISEASE ORGANISMS.

These are conveniently dealt with together. The methods first tested in these laboratories 17 years ago involved either heating the soil or treatment with volatile antiseptics such as toluene and carbon disulphide. The first applications were made in glass houses, and the method first used in practice was heat. This is effective but costly, and it cannot be much cheapened. Chemicals offer much better prospects and search is being made in Mr. Tattersfield's Department for agents which will effect the same purpose as heat at less cost. The obvious method of utilising industrial waste products is less useful than might be expected owing to their variable composition: the first investigation is, therefore, directed to the discovery of the organisms to be put out of action and the testing of chemical compounds in a definite systematic manner, so as to obtain information as to the relationships between chemical constitution and effectiveness. The proper quantity and the suitable time and method of application have all to be determined by direct trial, while laboratory experiments are made to discover more particularly the precise actions going on. The most interesting result thus far obtained is that organic substances, such as the cresols, phenol and cresol derivatives, and the chlornitro derivatives, such as chlorpicrin and chlordinitrobenzene, can, when applied to soil in proper quantity, determine substantial crop increases, though it is not yet known how far the effect is due to removal of disease organisms, and how far to improvement in nitrate production or to direct stimulation of the plant. Under this treatment tomatoes