ROTHAMSTED RESEARCH

Report for 1930

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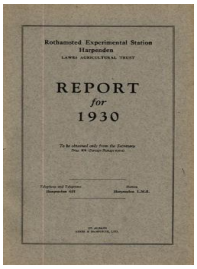

Soil Micro-organisms

Rothamsted Research

Rothamsted Research (1931) *Soil Micro-organisms ;* Report For 1930, pp 50 - 52 **- DOI: https://doi.org/10.23637/ERADOC-1-63**

Woburn.

	Potatoes.	Sugar Beet. Roots.	Sugar Beet. Tops.
Latin Squares—			
Average 1926–1930	5.1	9.1	11.0
1930	4.7 7.0	8.6	9.4
Randomised Blocks—			
Average 1926–1930	8.7	12.5	19.1
1930	—	—	—

Outside Centres.

Potatoes.

	Wisbech	Tunstall. Ipswich.	Bourne.	Biggleswade.	Ownby	Midland College.	Welshpool.	Burford	Nateby.	Great Nash.	Hull.
Latin Squares—											
Average 1927–30 ..	3.9*	—	—	—	4.5*	5.6†	—	—	—	—	—
1930 ..	5.0	—	—	4.2 4.8	2.8	—	—	12.0	5.7	4.7	8.2
Randomised Blocks—	No previous experiments in many of these cases.										
Average 1927–30 ..	—	—	—	—	—	—	—	—	—	—	—
1930 ..	—	8.2	11.3	4.3	—	9.0	5.8	—	—	—	—

	Sugar Beet. Colchester. Roots	Sugar Beet. Colchester. Tops	Sugar Beet. Welshpool.		Sugar Beet. Wye.		Sugar Beet. Moulton.		Sugar Beet. Leeds.		Barley ‡ Wye. Grain	Barley ‡ Wye. Straw
Latin Squares—												
Average 1927–30	7.2	5.3†	—	—	5.2	—	—	—	—	—	—	—
1930	—	—	—	—	3.1 2.1	5.2 —	8.5	12.2	5.0	4.1	7.8	8.3
Randomised Blocks—												
Average 1927–30	10.1*	—	5.3	6.9								
1930 ..	12.8	12.2	2.2	2 8								

* Mean of 2.
† Single figure.
‡ Expts. harvested by sampling method excluded.

SOIL MICRO-ORGANISMS

Lucerne. The arrangements for supplying farmers with cultures of the necessary organisms are working smoothly and Messrs. Allen and Hanburys report that the demand during 1930 was more than three times that of the previous year, enough cultures being distributed to inoculate between 4,000 and 4,500 acres. The Ministry's return show that the acreage of lucerne in the country increased by over 4,000 acres in spite of the fall in acreage of arable land. Experiments are in hand to see whether seedsmen can inoculate the seed before sale; this will save much trouble both in distribution and on the farm.

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Meanwhile, scientific work has continued on the relation between the organism and the plant. It was shown in a previous Report that nodules do not appear on the roots of the young plant till the first leaf appears; as soon as that opens a substance is extruded from the root which enables the bacteria to attack and enter. The first visible sign of attack is the curling of the root hairs, this also is determined in part by a root excretion and, like the entry of the bacteria, it can be brought about before the true leaf appears if the seedling is growing among rather older plants on which the leaves have opened. Thus it appears that the excretion from one plant can serve for others as well as for itself. The curling, however, is also determined by an excretion from the bacteria, though the relations between the excretions from the plants and the bacteria cannot yet be stated. The bacterial excretion is effective on plants other than those which the bacteria can enter, *e.g.*, lucerne bacteriaocan curl the root hairs of peas but they cannot enter. The varius leguminous bacteria do not live at peace with each other in the soil; lucerne bacteria reduce the number of nodules formed on clover roots by clover bacteria though they cannot themselves enter the clover root. Something happens to the organisms in the soil after the soil has been cropped with the leguminous plant for a time; clover growing on a soil that had carried clover every fourth year had fewer nodules than clover growing on adjacent soil where no clover had been grown for 80 years, and this held true whether there was inoculation or not.

Purification of Sugar Beet Effluent. The microbiological process developed at Rothamsted has now been so far perfected that it gives a purification of 95 per cent when working at the rate of 50 gallons of liquid per cubic yard of filter per day. This is satisfactory in practise and accordingly the factory work at Colwich has been temporarily discontinued in favour of further laboratory investigation of the various outstanding microbiological difficulties which sooner or later will give trouble unless they are definitely dealt with at the outset. The chemical and microbiological changes are being studied in detail.

The Decomposition of Straw by Micro-organisms. Dr. Norman finds that the most striking change is the rapid decomposition of the cellulose; this accounts for most of the total loss. At first some of the hemicelluloses (unfortunately named since they are entirely different from cellulose) decompose rapidly, but some of them remain with the lignin as the undecomposed residue. The decomposition is brought about mainly by fungi, not, however, by one organism alone but by many acting together. Much heat is evolved during the process but this is associated with the decomposition of hemicellulose especially its pentose units and possibly the uronic units, rather than of cellulose. A supply of easily available nitrogen is essential to the nutrition and the functioning of the organisms; usually there is insufficient in the straw so that a further supply is necessary and this becomes immobilised in the tissues of the organisms. The actual quantity immobilised depends on the reaction, being greater in alkaline than in neutral or acid conditions. Microbial protein is apparently a suitable source of nitrogen.

The Production of Ammonia from Peptone in Culture Soluiont

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and its Oxidation by Bacteria. The production of ammonia from peptone did not increase as the bacterial numbers increased, but beyond a certain point fell off. Introduction of a protozoan Hartmanella lowered the bacterial numbers but seemed to increase the rate of ammonia production.

During the work on sugar beet effluent a number of organisms were discovered which oxidise ammonia to nitrite ; critical examinations have already revealed 42 distinct strains of these organisms in addition to the nitrosomonas and nitrococcus previously known. Four distinct species have been isolated from the Rothamsted soil which, while agreeing physiologically with some of those from the filters, are morphologically different.

CULTIVATION OF THE SOIL

Cultivation is one of the costliest items in the arable farmer's programme ; its high cost, indeed, is sending many of them into grass farming. It is not yet reduced to a science and consequently cannot be treated by advisors with the same confidence as manuring.

The Physics Department at Rothamsted is endeavouring to work out a science of cultivation, and it is proceeding in two ways. Experiments are made in the field to try and discover by dynamometer and other tests what cultivation does to the soil, and to see what other methods have the same effect. Other studies are made in the laboratory to explain the field measurements and observations, and to work out the physical properties of the soil, especially those related to cultivation such as stickiness, friction, plasticity and permeability ; to discover also what is meant by tilth and crumb structure. The physical properties under investigation for the purpose of explaining tilth and crumb structure include the plasticity of the soil, the electrical conductivity and dielectric constants of soil suspensions, the specific gravity in the crumb and finely powdered states before and after pumping out all air. Cultivation with a rotary implement, the Simar, which makes a seed bed in one operation, has for the past five years been compared with the normal cultivation which requires two or three processes to do the same thing.

The Simar has consistently given a better seed bed, so that there has always been better germination and early growth ; more plants, and on wheat more tillers. This, however, has applied to the weeds as well as the sown crop, and the " Simared " plots have always been the more weedy. The final yields have been much the same as with the ordinary cultivation, the advantage of the early growth not having been maintained—perhaps the result of the weed growth.

The Simar appears to be admirable for inducing germination of weeds and cleaning land.

The effect of sheep folding on light land has been studied at Woburn. The compacting of light soil obtained by sheep is different from that given by implements ; it extends to a greater depth and it lasts longer ; the top three inches of the soil is mainly affected. It gives also a coarser tilth. In this year's tests it did not increase the water holding power of the soil, on the contrary the trodden part was, if anything, somewhat the drier ; but a fuller investigation is being made.

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