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## Report for 1929

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## Lucerne

### Rothamsted Research

Rothamsted Research (1930) *Lucerne* ; Report For 1929, pp 26 - 27 - DOI:  
<https://doi.org/10.23637/ERADOC-1-111>

In this country the Bessemer process of steel manufacture is not at present used, and Bessemer slags on the British market are entirely of foreign origin. So far as solubility is concerned, the slags fall into two groups only, few if any samples having solubility between 45% and 75%.

In practically all our experiments the high soluble slag has given the better results and there is no question that it is of greater value to the farmer. It acts more quickly and gives larger increases than the low soluble slag. Recent changes in steel making have tended to increase the output of this high soluble material, which is all to the good: and, further, the manufacturers are now prepared to offer slag of less than 45% solubility in the old official citric acid test at lower unit price than they ask for slag of 75% or higher solubility.

While the low soluble slags are inferior to those of high solubility as a source of phosphate, nevertheless they have value in certain humid conditions; fortunately these occur near the works where the slags are obtainable cheaply.

A further result of the investigation has been to show the limits of value of the old citric acid test which had fallen into some disrepute. The grading of the slags into two classes is almost entirely satisfactory, and the analysis is sufficiently easy and rapid.

The method is not, however, of a high order of accuracy, and it fails to place slags in their proper order within each class: a slag of 90% solubility may be less effective as a fertiliser than one of 75%. Occasionally it appears even to class a slag wrongly: it puts into the low soluble group a new type of slag which is said to have high agricultural value, and which is now being tested by the Rothamsted staff. A method has been worked out by Mr. R. G. Warren at Rothamsted (extraction with sodium chloride solution) which places the slags within each class more in accordance with their agricultural value; it is, however, less convenient than the citric acid method and is better suited to an experimental station than to an analysts' laboratory.

#### LUCERNE.

The inoculation process developed in the Bacteriological Department has proved very successful: in 1929 the issue of cultures to farmers again exceeded the previous records, and sufficed to sow 1,300 acres. The demand rose above our power to supply, and accordingly some of the leading biochemical firms were invited to tender for the taking over of the business. Arrangements were finally made with Messrs. Allen & Hanbury, of Bethnal Green, London, E. 2, to prepare cultures under Rothamsted tests and to supply them to farmers at the rate of 3/- for one acre of land. These arrangements have been in force for some months and are working satisfactorily: the demand has been greater than ever. Dr. Thornton has also devised a method for transmitting the cultures over great distances: cultures sent to Western Australia arrived in good condition and successfully increased yields of lucerne there.



The relationship of the nodule organisms to the plant has been further studied; Dr. Thornton has shown that they do not normally enter the plant until the true leaves begin to form: then there is extruded from the root a substance which facilitates or even determines their entry. The nature of this substance is not yet determined, but it does not appear to be made in the leaf. When the organisms are in the root they increase greatly in number, and they stimulate the plant cells to multiply, forming the well-known nodules. Around the colony of bacteria a network of conducting vessels develops as an offshoot from the main circulating system of the plant, and, this close connection being established, the bacteria take sugar from the plant, causing an increase in growth. If the supply of sugar is cut off by keeping the plants in the dark, or by stopping the development of the conducting vessels (which can be done by withholding the trace of boron needed for this purpose) the bacteria turn to the root tissue for food and begin to consume it: they thus change from being beneficial into harmful parasites. If the supply of air is restricted the bacteria fix less nitrogen, but they do not become parasitic.

POTATOES.

The potato experiments were conducted on much the same general lines as last year. The yields, however, were low, as the result of the very dry March and April: the plants were not able to start growing till May.

The increases given by fertilisers were, in cwt. per acre :—\*

	1929			Average 1925-28 †		
	0	1.5	3	0	2	4
Sulphate of Ammonia cwt. per acre						
Sulphate of Potash } cwt. per acre	0	12	15	—	20	24
"    "    "    1	7	15	18			
"    "    "    2	2	16	21	15	49	71
"    "    "    4				16	55	75
	Basal crop 4.52 tons per acre.			Average Basal crop 6.62 tons per acre.		

\* In all years except 1925 farmyard manure was also applied.

† In 1928, the weights of fertilisers used were as in 1929.

The increases are thus less than usual, nevertheless they cost less than £2 per ton. Taking the four years 1925-28, the expenditure in pence on manure per cwt. of additional crop has been :—

	1925-28		
	0	2	4
Sulphate of Ammonia .. ..	0	2	4
Sulphate of Potash .. .. 0	0	13	21
"    "    "    "    2	21	12	12
"    "    "    "    4	39	16	15