THESIS

Effect of Bacteria on Bonemeal

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T H E S I S

THE EFFECT OF BACTERIA ON BONEMEAL.

(A Partial Verification of Work Done by Professor Stoklasa in Germany.)

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The aim of this thesis has been the investigation and possible verification of some valuable results regarding the effect of bacteria on bonemeal recently published by Professor Stoklasa of Germany. The subject is one of agricultural interest and worthy of careful consideration. His work was published in Scientific and Agricultural Journals in Europe.

It has not been possible to take up the work as extensively as that carried on by the German Professor. As his work could be readily divided into two experiments, one a verification in a horticultural way of the other, we chose to duplicate that part most intimately connected with the Science of Bacteriology. Furthermore the time allotted did not permit of satisfactory repetition of the entire experiment.

Before giving the details of our own work it will be necessary to present a few facts regarding the Professor's work, which were given in German Scientific papers. He used six different bacteria, first in solutions, and, later, in soils. We are interested in the results he has published as to their effect in solution, and our aim has been to verify his work along that line. It was his opinion that the discovery of micro organisms capable of reducing bonemeal to the elements would, by the liberation of Nitrogen and Phosphoric Acid, favor the growth of plants. With this end in view he conducted his investigations as to the effect

of the six micro organisms in solution as follows: Ten grams of bonemeal, (analysis indicated the presence of 5.86 per cent of nitrogen and 19.8 per cent of phosphoric acid), were put into 900 c.c. of sterile water, and iron sulphate, potassium sulphate, and magnesium chloride were added in small quantities. Equal quantities were then put into seven flasks, one of these being retained as a control. After inoculation the flasks were kept at a temperature favorable for germ growth. After 33 days had elapsed, they were analyzed, with the following results:

	Nitrogen.	Phosphoric Acid.
Control flask- - - - - - - - -	3.69%	0.76 %
Hogaterium- - - - - - - - - -	4.98%	4.27 %
Fluoresc. liquef.- - - - - -	5.00%	1.82 %
Proteus Vulgaris- - - - - - -	4.59%	2.93 %
Butyric Huppe- - - - - - - -	5.06%	3.08 %
Mycoides - - - - - - - - - -	5.10%	4.56 %
Mesenthericus Vulgatis- - -	4.78%	4.08 %

An examination of these tabulated results shows us: That the effect on Phosphoric Acid was greater than on Nitrogen; the per cent of Nitrogen very far less than those of Phosphoric Acid; and that in all cases the germs have increased the amount of both elements.

In our work, fresh ground bone was not available, so old meal was used. This meal contained lime in small quantities, which fact probably accounts for the small changes that occurred.

To understand the work thoroughly, many of the details must be given. March 12, 1902, seven 500 c.c. Erlmeyer flasks, each containing 1 1/2 grams of the bonemeal, 188 c.c.m. of sterile water, a little potassium sulphate, Magnesium chloride and iron sulphate, were prepared. The following day bacteria were introduced into five of them, two being reserved as controls. They were placed in the incubator room, where a uniform temperature of 25 C. is maintained. After the expiration of 33 days these were removed and Nitrogen and Phosphoric Acid determinations made as rapidly as possible. The Kjeldahl method was used for determining the total amount of Nitrogen, and the Uranium titrating method for the Phosphoric Acid. Duplicate tests were, in all cases, made of the contents of each flask, and in two instances a disagreement made it necessary to repeat, making in all four tests for a single determination. The Megaterium flask and one of the controls contained a mold when samples for the determinations were taken.

The results of our tests are given below.

	Nitrogen.	Phosphoric Acid.
Control flasks- - - - - - - - - -	.035 %	0.80%
Mesentericus Vulgatis - - - -	.014	1.85
Proteus Vulgaris- - - - - - - - -	.01405	1.55
Fluoresc. Liquefier- - - - - - - -	.0154	1.70
Megaterium- - - - - - - - - - -	.0182	1.10
Butyricus - - - - - - - - - - -	.0238	0.80

An examination of this table shows a decrease in the Nitrogen and an increase in the Phosphoric Acid. The Butyricus is an exception to this, but this may be accounted for by the apparent feebleness of the germ as indicated by cultures made from the flask. Our germs have decreased rather than increased the amount of Nitrogen, but have increased the amount of Phosphoric Acid to more than double the original amount in two of the flasks. The small changes as indicated by the tests are probably due to a great extent to the absence of organic matter upon which the germs could thrive. The Germ, Mycoides, was not available at the time of inoculation.

It would not be just to make the statement that Professor Stoklasa's results are not possible and even probable. In comparing the figures given in the two tables it must be constantly borne in mind that the soil which we used was old and liny, and, to say the least, unfavorable for the action of germs. Our results in the Phosphoric Acid column parallel those of the Professor's as closely as could be expected, when we consider the media the germs had to work upon. We regret that green bone was not available, so that all the conditions of his work could have been duplicated.