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## Alfalfa Inoculation Tests

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BULLETIN NO. 136.

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ALFALFA INOCULATION TESTS.

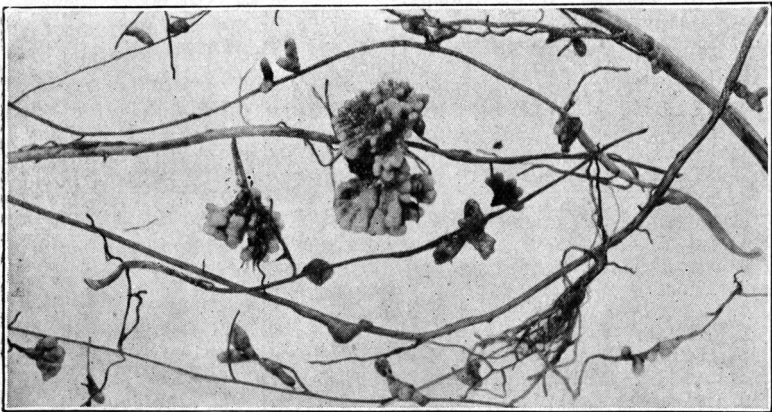
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By C. W. PUGSLEY.

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LINCOLN, NEBRASKA  
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\* Resigned, to take effect February 1, 1913.

# ALFALFA INOCULATION TESTS.

BY C. W. PUGSLEY.

During the winter of 1909-10 an effort was made to secure cooperators among the farmers of Nebraska to test the value of inoculating newly seeded alfalfa fields. This investigation was suggested by reports received from correspondents during 1909. The names of farmers willing to cooperate were secured by correspondence and by conferences at the various Short Courses held during that year.

In the spring of 1910 about thirty-five farmers, located largely near Broken Bow, Cambridge, Franklin, and Blair, agreed to test the effect of cultures sent by the United States Department of Agriculture, soil from well-established alfalfa fields, and farm manure in securing stands of alfalfa and on the subsequent growth.

The weather conditions were very unfavorable and it was thought advisable to repeat the tests in the spring of 1911. If anything, the conditions were more severe the second year. The difficulty experienced was because of extremely dry weather and a large number of grasshoppers. Many of the farmers applied the soil and used the culture but reported in July and August of each year that the crop was entirely dead.

From the thirty-five cooperators we have only twelve reports to indicate the effect of these treatments. The tests should by all means be continued for a number of years, and should cover all sections of the state. The reports in this bulletin cover seedings of 1910 and 1911 and observations during the year 1912.

The method of conducting the tests was as follows: The co-operators were asked to sign a statement promising to carry out the instructions given by the Station and to keep a record of all the field operations. Instructions were sent them as to seeding, measurement of the ground, application of culture, soil and manure, and such other details as were necessary. Wherever it was thought advisable, a man was sent from the Experiment Station to assist in locating the plots and in applying the various treatments. The plots were located in such a manner that there would be no wash from inoculated to uninoculated plots and in such a position that the soil would be as uniform as possible.

*Alfalfa Inoculation Tests*

To assist in the proper interpretation of the results, the following questions were asked each cooperator:

How was ground prepared on which the alfalfa was seeded?

What crops were grown on the ground for the five years preceding?

Was it ever seeded to alfalfa before? If so, when?

Ordinarily is there trouble getting a stand in the neighborhood?

Was culture used? On how large an area?

Was soil from an old alfalfa field used? On how large an area? How much?

Was soil from a sweet clover patch used? On how large an area? How much?

Was barnyard manure used? On how large an area? How much?

How was alfalfa seeded? How much seed per acre? When was it seeded?

The answers to these questions were received about the first of August of each year. Many of them read: "Grasshoppers killed the alfalfa," "Dry weather killed the alfalfa," "So poor a stand that I plowed up the patch, due to the dry weather."

The cooperators were visited in the summer of 1910 and the late summer of 1911, by representatives of the Station. Each field man carried a notebook in which he collected data concerning the soil, preparation of plots, and seeding.

The following table shows results secured by twelve cooperators, as recorded in letters from the cooperators and in notes taken in the field:

Name	County	Year	Results
W. E. Cobb .....	Custer .....	1910	Culture and soil gave good results.
L. S. Crawford ..	Franklin .....	1910	Treatment good, especially top dressing with manure.
J. L. Will . . . . .	Franklin .....	1910	Manure beneficial.
Edgar Grahām ..	Custer .....	1910-11	Manure beneficial.
Winchell Marisch	Boone .....	1910-11	No results from culture.
F. F. Martin ....	Washington..	1910-11	No results from culture. Manure valuable.
R. M. Lemons...	Holt .....	1910-11	Treatment good, especially manure.
F. A. Hangman...	Furnas .....	1910-11	No difference.
R. Barrett .....	Custer .....	1910-11	No difference.
J. D. Ream ....	Custer .....	1910-11	Manure of great benefit.
C. S. Martin ....	Custer .....	1910-11-12	Soil treatment best. Culture of benefit.
J. T. Cole .....	Custer .....	1910-11-12	Soil treatment best. Culture of benefit.

From the notes which were brought in by the field men, and from the blanks which were filled in by the cooperators, it was

apparent that the best stands were secured on the fields which had received in previous years farm manure and careful cultivation, or where a leguminous crop had been previously grown. Better results were often secured from fields to which farm manure had been applied at the time of seeding, or during some previous year, than from fields where farm manure had never been applied. This, of course, does not mean that a heavy application of coarse manure plowed under, in the western part of the state during dry years, would give any advantage for that season at least.

From the notes taken June 21, 1911, on the farm of Mr. J. T. Cole in Custer County, the following is quoted: "Alfalfa much

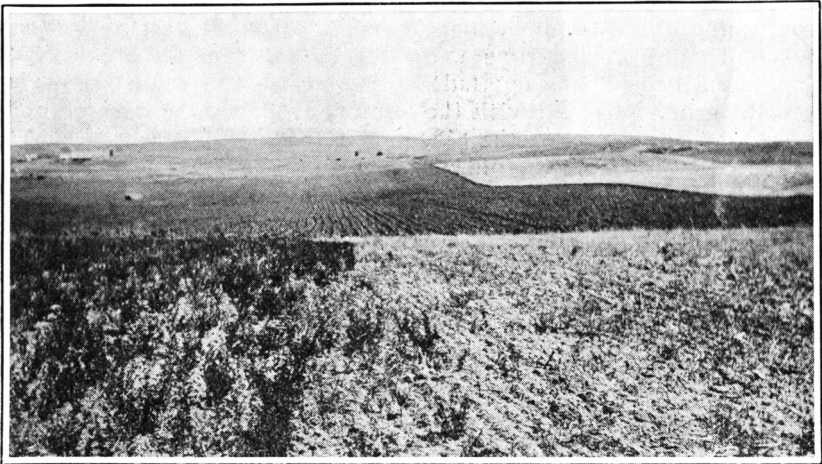


Fig. 1. Inoculated portion of the field to the left. Uninoculated portion to the right. Farm of C. S. Martin, Custer County.

better where inoculated, especially where soil was used. Could see the difference all spring. Made one-half more hay than ground not inoculated."

The following letter, dated July, 1912, from Mr. W. E. Cole of Custer County is of interest.

"I can see little difference in the three plots [liquid treated, soil treated, and no treatment] at the present time, but I do think that either the liquid culture or dirt from an old alfalfa field is a great help in securing a stand, especially in a dry time. It seems to have more vigor and will stand more abuse. I think the soil from an old alfalfa field is as good as anything."

From the notebook of one of the field men, dated June 22, 1911, we find the following in reference to the field of Mr. C. S. Martin in Custer County: "Where dirt from the old field was spread, there is a good stand. Where the Government material was used, the stand is just fair, and in places none. No stand where no treatment was given. Very favorably impressed with the use of inoculated soil."

Figure 1 is of the plots from the farm of C. S. Martin of Custer County. The portion to the left is the edge of the area that was inoculated with soil from a well-established field of alfalfa. The portion to the right is the plot that was not inoculated.

A letter from C. S. Martin dated July, 1912, contains the following: "From the test I got with the liquid inoculation, I do not think there is much to be expected from it. I tried some ground at the same time with soil taken from an old alfalfa field, and I feel that the results were much better than they were on the ground treated with the liquid. I did not get a very good stand on either one of the places, but it was much better where I used the soil from the old alfalfa field."

All seed was tested both years for per cent of germination and purity. If either were low the farmer was notified and new seed secured. The average of all samples used showed a germination test of 76.8 per cent and a purity test of 93.12 per cent.

Figure No. 2 shows alfalfa nodules of different sizes. If alfalfa does not make good growth, appears light in color, and lacks general thriftiness, an examination of the roots should be made. Carefully dig up a plant with considerable soil adhering to the roots. Wash the soil from the roots by gently pouring on water, or by immersing in a pail of water and allowing the soil to soften and fall from the roots. If nodules are present, the trouble is not from lack of inoculation. It is sometimes impossible to find nodules in the surface soil in the winter or during a dry period, even tho the field may be thoroly inoculated.

The following quotation from Bulletin No. 120, on "Alfalfa Management," published by this Station bears on the matter of inoculation and may well be repeated in this connection:

\* "The results of cooperative tests during the past two years with cultures of bacteria have shown that in most instances artificial inoculation is not necessary to the production of a good crop of alfalfa in Nebraska. In localities where alfalfa has been successfully grown for a number of years, such inoculation is probably a useless expense.

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\* The data for 1909 were lost in the transfers of men in charge of the department.

“There are two general ways of inoculating the soil. The best is by spreading soil from an old, well-established and vigorous alfalfa field, or from a sweet clover patch. If a few hundred pounds of this soil is scattered on land which has been properly prepared and manured, and if the soil has not been exposed to

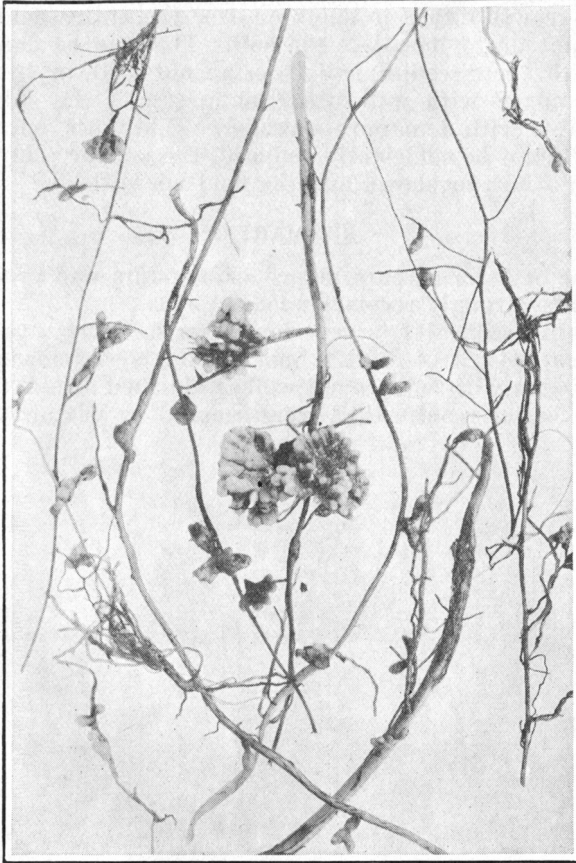


Fig. 2. Alfalfa nodules.

the sun or allowed to dry out, good results will usually follow. The other method is by the use of cultures. There are now a number of reliable companies manufacturing the culture. It comes in bottles and is used on the seed. The ordinary cost of a sufficient amount to treat the seed for one acre is about \$2.00. The United States Government also furnishes the culture in



limited quantities. Complete directions always accompany the culture. Soil inoculation is more certain and not as expensive as the cultures where there is an old and vigorous alfalfa field near.

"If alfalfa has never been grown in the community, or on the farm, or if it is not successful, it is usually advisable to inoculate. Wherever alfalfa is showing, during the first year, a weak, yellowish growth either in spots or over the entire field, it may be of advantage to inoculate the soil. This can be done by applying to the new seeding soil from an old field, or by treating some soil mixed with well-rotted manure with the culture and applying this with a manure spreader. Where the speed of the spreader cannot be sufficiently reduced, the mixture may be scattered with a fork or shovel and the field harrowed."

#### SUMMARY.

The use of farm manure in proper amounts and properly applied is to be strongly recommended.

Where any difficulty is experienced in securing a good stand or vigorous growth of alfalfa, inoculation is recommended.

Inoculation with soil from a well-established alfalfa field gave uniformly better results than were secured by use of liquid cultures.