The Nitro-Culture Method and Results Obtained.

"Is it necessary to inoculate for clove rand alfalfa, and if so, how is it done?" is a question frequently asked when a clover discussion arises. A large number of experiments have been conducted, but as yet uniformity of opinion is lacking.

On the roots of alfalfa and clover may be noticed small excrescences or nodules, the size of a pinhead and larger. These contain immense numbers of microscopic organisms, called bacteria, which have the faculty of extracting nitrogen gas from the air, and after having used it pass it on to the plant, which builds it up into its tissues. Plants other than legumes have to derive their supplies of nitrogen from the soil, where it exists in sparing quantities, chemically combined with such elements as potassium, sodium, etc. Except through the agencies of legumes the nitrogen supply of the soil cannot be increased appreciably without the use of manures and fertilizers. Barnyard manure contains a considerable amount of nitrogen, but if commercial fertilizers are bought something like 15 or 20 cents a pound is charged for all the available nitrogen contained in the fertilizer, whereas for a pound of potash and phosphoric acid contained, only about 5 or 6 cents is charged; hence the great economy of growing crops like alfalfa, clover and peas, which draw largely upon the air for their nitrogen requirements. Each of the legumes has a special variety of bacteria which especially favor it. They become very abundant in soil where that crop grows, and seem to persist quite a time—a year or more—after the crop has been plowed up. They also come in contact with the seed, and when this is sown and the young plants strike out roots, the few bacteria present begin to multiply rapidly, and their presence causes the development of the nodules referred to above.

Scientists are able to grow these bacteria in their laboratories on specially-prepared food, and then send them out in the form of "cultures" of one kind or other. The first "culture," we believe, was called nitragin, handled by a German firm of manufacturing chemists, but after a few years' trial the sale of this culture was discontinued. About 1902 the Laboratory of Plant Physiology of the United States Department of Agriculture began to study the subject, and they developed a method of their own, by which these organisms could be sent out to farmers. They sent the bacteria out in dried form upon absorbent cotton. Experiments by the New York Experiment Station revealed that many packages contained no live bacteria at all. The idea seemed all right, but their method of preparing the cultures proved defective. This system would not keep the bacteria alive and vigorous for a long enough time to entitle it to be called a practical success.

During the spring of 1905 the Bacteriological Department of the Ontario Agricultural College sent out a number of samples of the nodule-forming bacteria for experimental purposes. These samples were sent out in a small bottle in such condition that all a farmer had to do was to mix the contents of the bottle with a measured quantity of water, and then apply it to his seed. This method was very simple, and did away with the building up process advocated by the U. S. Department of Agriculture, in which the package of treated cotton containing dried bacteria had to be put into the solution of chemicals and the bacteria allowed to develop a day or two before the culture was applied to the seeds. The Ontario culture was tried all over Canada, from Prince Edward Island to British Columbia, and the reports were thus summarized in Bulletin 148, on "Co-operative Experiments with Nodule-forming Bacteria," published in 1906:

CROP.	Total No. of reports received.	Inoculation successful, with increased growth of crop.	Organisms already present in the soil.	No advantages from inoculation.
Lucerne or alfalfa...	59	43	1	15
Red clover	47	31	1	15
Peas	12	7	1	4
Beans	9	5		4
Alsike.....	2	1		1
White clover	1	1		
Vetch.....	3	2		1
Soy bean	1	1		
	134	91	3	40

Western experimenters report as follows:—

Emerson, Man.—On some plants treated the nodules were quite numerous. Those having nodules were very vigorous, but the others have made but small growth. (Red clover.)

Edmonton, Alta.—Numerous nodules on plants from treated seed and very healthy stand. With the untreated seed the plants were sickly, with a few healthy stalks. (Red clover.)

Rapid City, Man.—Plants from treated seed strong, numerous nodules; from untreated seed plants only about half as big. (Alsike clover.)

Colquitz, B. C.—I find that in the portion of ground where this culture was used, plants seem to be thriving and have the nodules on the roots, while, at the same time, on ground seeded to alfalfa close by, on which the culture was not used, the plants are sickly looking and have no nodules upon the roots. (Alfalfa.)

Harding, Man.—There was quite a marked difference between what was treated and what was not treated, and I consider the result was very good. (Alfalfa.)

Colquitz, B. C.—I am not a believer in nitro-culture, or, at least, was very sceptical as to the treatment being of any value whatever. I have been unable however, to shut my eyes to the fact as shown by my own land. The land had been well subsoiled in preparation to a depth of from 16 to 18 inches, and the portion upon which the nitro-culture was not used was treated in every way as well as the other. The plants from the treated seed were very strong, and sown with nurse crop are now about 8 inches high. From untreated seed the plants are weak in appearance and only about 3 inches high. (Alfalfa.)

Treesbank, Man.—Nodules are plentiful on the part sowed with the treated seed, but I have not been able to find any on the other strip seeded with untreated seed. Furthermore, the second growth on the untreated strip is now sickly looking, and much shorter than the rest. (Alfalfa.)

In 1906 the experiments were repeated, and will be again in 1907, but a charge of 25 cents per bottle is now made to cover actual expenses.

Failure of plants to form nodules, even when the seed is inoculated, may result if:

1. The soil is too acid or too alkaline. Lime should be first applied to the soil if too acid.
2. If some fertilizer with a caustic action is brought into contact with the treated seed.

Little benefit may result from inoculation:

1. If the soil does not contain sufficient of the other necessary plant foods, especially potash and phosphoric acid.
2. If the soil is too rich in nitrogen; in this case it is better ot plant crops that are nitrogen feeders rather than nitrogen accumulators.
3. If the soil is not perfectly cultivated and freed from weeds.
4. If the soil is already thoroughly inoculated with the nitrogen-fixing bacteria peculiar to the particular plant for which the culture is applied.

METHODS OF INOCULATING.

There are three methods of inoculating the crop:

1. By transfer of soil.
2. By treating the soil.
3. By treating the seed.

In the first case soil which is known to contain the nodule-producing organisms is scattered over the land where it is desired to grow a crop of legumes. In other words, the land is top-dressed with soil from an infected field. This method has given good results. but is expensive when the soil has to be brought any distance, and in certain sections of the country such a practice is fraught with danger, as weed seeds and certain diseases are apt to be transferred from one field to another by this means.

In the second method, a quantity of soil is moistened with large quantities of culture, and this is mixed with more dry soil and then used as a top-dressing on the land that is to be planted.

Two years ago the offer was made in these columns by Supt. Sharpe, Experimental Farm, Agassiz, B. C., to send a certain quantity of inoculated soil to people on the prairie who were prepared to experiment and pay the transportation charges, but we are unable to state whether many inoculations were thus made.

The third method, seed treatment, consists in moistening the seed with a culture or growth of the desirable bacteria, allowing the seed to dry for a short time and immediately sowing it. The O. A. C. cultures are recommended for seed inoculation.

DIRECTIONS FOR THE USE OF NITRO-CULTURES SUPPLIED BY THE BACTERIOLOGICAL DEPARTMENT OF THE ONTARIO AGRICULTURAL COLLEGE.

The culture is sent you with the understanding that it is to be used for experimental purposes, and that you will use it as directed and report to us your success or failure.

1. For every 60 pounds of seed to be treated, take one and one-half pints of clean cool water in a small pail.
2. Pour some of the water into the bottle; shake the bottle and pour back the water into the pail. Repeat this until the culture is all rinsed from the bottle into the pail, and the water in the pail is clouded. The jelly-like substance in the bottle is agar; it will not dissolve, but may be broken up and stirred in the water.
3. Pour the water from the pail over the seed and mix thoroughly.
4. Spread out the seed to dry in a clean place out of the sunshine.
5. The seed will dry in an hour, and may be planted in the usual manner as soon as it is dry.
6. Do not add water to the culture in the bottle until you are ready to plant your seed.
7. Some untreated seed should be planted for comparison, and it is well to plant this first.
8. After the seedlings are one month old look for nodules on the roots. During the season note number and the size of nodules, and vigor of plant growth from treated and untreated seed.

Nitro-culture is not recommended for land where the particular crop to be grown has been grown well a year or two before, nor on land which has been accidentally inoculated by applications of manure made by animals feeding upon fodder of that crop. On a farm where alfalfa or clover is abundantly grown and fed the whole farm becomes inoculated. Artificial inoculation is advisable, however, when a legume is to be grown on land where it has never grown before, or where, though grown, the characteristic nodules or tubercles have failed to form upon the roots. Let it be remembered that the bacteria which work on red clover may not be depended on to adapt themselves to alfalfa. The bacteria which work on sweet clover (*Melilotus alba*,) however, seem to be practically identical with those of alfalfa; hence land where sweet clover has been growing will furnish alfalfa with all the bacteria it needs.

As pointed out in the bulletin, the simplest way to inoculate a new field to be seeded to alfalfa or clover as the case may be, is to scatter over it a load of surface soil from an established field of that particular crop, but where the soil has to be hauled too great a distance this method becomes expensive, and for such cases the nitro-culture treatment is worth a trial Remember that nitro-culture is of no use to crops except legumes—for instance, alfalfa, clovers, beans peas, vetches, or, as they are sometimes called, the pod-bearing plants.

Clover and alfalfa are such valuable crops for the Western farmer that a little time spent in studying the reasons for previous failures with a view to overcoming such will be well expended.

Alberta Fair Dates Fixed.

The annual meeting of the Alberta Fair Association held last night fixed the following schedule of dates for provincial fairs this season: Edmonton, July 1, 2, 3, 4; Innisfail, July 4, 5; Calgary, July 9, 10, 11, 12; Okotoks, July 16,17; High River, July 18,19. Red Deer, July 22,23; Strathcona, July 24; Fort Saskatchewan, July 26; Macleod, July 31, August 1, 2; Lethbridge, August 6, 7, 8; Leduc, August 8, 9. Vermilion, September 10, 11; Vegreville, September 11, 12; Didsbury, September 13; Olds, September 16, 17; Magrath, September 19, 20; Raymond, September 24, 25; Cardston, September 26, 27; Medicine Hat, October 1, 2; Lacombe, October 3, 4; Ponoka, October 7, 8; Wetaskiwin, October 9, 10; Innisfail, October 11, Nanton, October 15; Pincher Creek, October 16 The election of officers for the ensuing year was held and resulted as follows: President, H. H. Jenkins, Pincher Creek; vice-president, R. A. Wallace, High River; executive committee, T. Daly, Edmonton; Palmer, Lacombe; G. Rands, Olds; W. H. Fairfield, Lethbridge; E. L. Richardson, Calgary; George H Budd, Raymond.

Demonstration Farms.

The North Dakota Agricultural College has under its control six demonstration farms, each twenty acres in extent in different parts of that state. The director of the experimental farm at Fargo says:

"The purpose of establishing these demonstration farms is to put into practice, in different sections of the state, the principles worked out at and recommended by the experimental farm and the sub stations. The main idea, so far, has been to work out the best and most profitable crop rotation, one that will demonstrate whether or not clover can be successfully grown in the dryer sections of the state. the value of barnyard manure when properly applied advantages of a cultivated crop grown at regular intervals, and to demonstrate the value of good, thorough tillage. These demonstrations admit of considerable variation, and can be made highly educational. One should be established in each of about twenty-four counties of the state. No similar expenditure of such a small sum of money would return to the state such large and permanent returns."

Two railroads, G. N. R. and N. P. R., are bearing the expense of operating the six farms, each of which is divided into five fields of four acres each. The land is leased under a five year lease in each case.

Considers Coal Oil (Kerosene) Too High in Price.

EDITOR FARMER'S ADVOCATE:

Reading your ADVOCATE through each week I notice you are always "taking up the cudgels" for the welfare of the poor farmer; I say poor farmer from experience. It would be a boon and blessing to mankind in the Great West if you could see your way to start an agitation for the reduction in price of coal oil. The Members of Parliament for the provincial and Dominion Governments do not need to study the price of coal oil because they (most of them) dwell where light is, that is in towns. Now whatever the Governments may say or think, the mainstay of Canada is the farmer. The manufacturers all need bolstering with protection and the poor farmer is the nether millstone. The other side of the border, sixty miles south, coal oil can be purchased at about twelve cents or even lower at times, whilst we have to pay thirty-five and get poor stuff at that Oh that the farmers could combine for a year in the same way as the manufacturers of the East! They could gain every point they demanded; in fact, they could rule Canada instead of as now, being the slaves for the Egyptians.

F. W. NEALE.

Green Vitriol for Mustard.

Sulphate of iron (ferrous sulphate) or green vitriol is being experimented with for spraying weeds, and so far seems to promise good results. The Agronomist of the Wisconsin Experiment Station has been carrying on work for some time with this chemical and we understand with encouraging results, other weeds also being destroyed or arrested in their growth.