

TEXAS AGRICULTURAL EXPERIMENT STATION.

BULLETIN NO. 22.

SEPTEMBER 1892.

ALFALFA ROOT ROT.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

All Bulletins of this Station are issued free. Any one interested in any branch of agriculture may have his name placed on our permanent mailing list, and secure future numbers, by application to
GEO. W. CURTIS, DIRECTOR,
College Station, Brazos Co., Tex.

In requesting Bulletins, write name and address plainly.



BRYAN, TEXAS:
COX, "THE NEAT PRINTER."
1892.

TEXAS AGRICULTURAL EXPERIMENT STATION

OFFICERS AND STAFF.

GOVERNING BOARD.

BOARD OF DIRECTORS A. AND M. COLLEGE.

MAJ. A. J. ROSE, President.....	Salado.
HON. JNO. E. HOLLINGSWORTH, State Com. Agr.....	Austin.
HON. W. R. CAVITT.....	Bryan.
DR. J. D. FIELDS.....	Manor.
HON. JNO. ADRIANCE.....	Columbia.

TREASURER.

PRESIDENT L. S. ROSS,.....	College Station.
----------------------------	------------------

STATION STAFF.

GEO. W. CURTIS, M. S. A.....	Agriculturist, Director.
H. H. HARRINGTON, M. Sc.	Chemist.
M. FRANCIS, D. V. M.....	Veterinarian.
R. H. PRICE, B. S.....	Horticulturist.
D. ADRIANCE, M.S.....	Meteorologist, Associate Chemist.
J. W. CARSON,.....	Assistant to Director.
J. M. CARSON,.....	Assistant Agriculturist.
P. S. TILSON, M. S.....	Assistant in Chemistry.

Texas Agricultural Experiment Station.

ALFALFA ROOT ROT.

(GEO. W. CURTIS, M. S. A.)

A comparatively new trouble which occurs in growing alfalfa is the tendency to die in spots which has been reported from various sections of the state. By many this has been thought due to the presence of an "alkali" in the soil, but its continued growth on the same land, showing widening circles of disease with each succeeding year, would indicate at once a fungus trouble.

Mr. W. H. Farley, whose letters we select, as fairly expressing the experience of all who have tried to grow alfalfa under similar conditions, is one of Williamson county's most progressive and energetic farmers, and one who has taken a great interest in alfalfa. He writes as follows from Hutto, Texas, under date May 9, 1892:

" * * My alfalfa is doing well this season and none dying yet, and will not likely do so before June. As soon as it shall commence I will send some of the dead and dying and some contiguous, together with some of the soil. I had four acres in alfalfa—two acres six years old when the dying showed itself; two acres three years old, which has as yet showed no signs of disease except one small place that joined my old patch, and one of these circles of diseased alfalfa spread out into it a few feet. * * *"

Another letter from Mr. Farley dated May 24, 1892 contains this statement:

" * * I notice a few stalks of dead alfalfa now, but will advise you later in June or July, and think it will be a benefit to the state for you to visit this section and get various samples of our soil. *"

June 16, 1892, Mr. Farley again wrote:

" * * In reply to yours of the 14th inst. I have only noticed a few stalks alfalfa dying this spring but think by last of this, or first of next month it will show up; when it does I will advise you and will be happy to meet you at the depot with buggy, and hope you will be able to spend several days in this neighborhood. * * *"

Again on June 4, 1892, Mr. Farley wrote:

" * * You will please come to see my alfalfa at your earliest convenience. It has commenced dying by extending the last year's circles. The peculiarity about it is, that during the warm weather, in summer, it dies in almost perfect circles, and when cool weather sets in it stops dying until the latter part of June the following year when it commences again on the circumference of the same circle and extends it. * * *"

Pressure of business at the station prevented my complying with his request at once, and it was not until July 16, that I was able to leave. On the 16th and 17th, July, in order to ascertain the exact nature of the trouble I made a personal investigation of Mr. Farley's alfalfa meadow and procured specimens of the diseased and contiguous—apparently healthy—plants which I afterwards forwarded to Prof. Geo. F. Atkinson, Biologist of the Ala. Exp't Station, at Auburn Ala.

My examination of Mr. Farley's field as above stated was on July 16th and 17th, and after a prolonged period of drouth. The balance of the alfalfa field—not affected by the spot dying—was peculiar in that a large strip through the lowest portion of the field which had been mowed somewhat later than the rest, seemed dry and dead, and apparently had never grown at all after mowing. This was undoubtedly due to the excessively dry condition of the soil and extreme heat before and after cutting. Indeed, Mr. Farley writes me that since the August rains this portion of the field is as bright and vigorous as the rest. The dead spots were examined closely, and by persistent questioning some important facts observed by Mr. Farley during previous years were brought out. From him it was learned that the disease had spread but slowly—not more than fifty or sixty feet additional in diameter of the diseased circles yearly, and that plowing up and around the dead spots even at several feet beyond the edge had entirely failed to check its spreading. This would show that the fungus must attack the healthy plants for some time before there are any visible signs of disease and for an area much larger than the small circle seemingly affected—or that the disease is not at all checked by plowing. As a matter of fact both these propositions are true. On personal inspection I saw that the plants near the edge of the dead circle were in different degrees of vigor as to growth, and that the vitality decreased centripetally—from without, in. On digging up the roots I observed that the disease affected first the crown, and mainly the upper portion of the root—generally about six to ten inches—so that in pulling up plants which showed the disease but slightly it was almost impossible to prevent breaking off the root at the lower point of this diseased portion. By great care, however, I succeeded in digging up several roots to a depth of 16 to 18 inches, and on examination found them at this point almost entirely free from the fungus. Specimens of the dead roots, and of apparently healthy ones, growing at some little distance from the edge of the dead circle, with a number taken from intervening points, were carefully dug, packed and shipped by express to Prof. Atkinson at Auburn, as already noted. In reference to this shipment Prof. Atkinson wrote July 20, 1892, as follows:

“Geo. W. Curtis,
College Station, Tex.,

Dear Sir:—The alfalfa roots were received today. The disease is the same as that which causes “root rot” of cotton in Texas. The fungus was determined for Pammel as *Ozonium auricomum*, but I have my doubts about that being proper determination, and I think also that Pammel has. I have been exceedingly anxious to obtain some good cultures of this fungus so that I might determine if possible, its true nature and development. I will undertake to get such from these alfalfa roots, but they may be too dry, in which case I should be glad to call on you for roots sent in a moist condition.

Truly,
GEO. F. ATKINSON.”

July 27, 1892, Prof. Atkinson again wrote:

“ * * I find the fungus I wish to develop from the alfalfa roots does not grow because of the great preponderance of another fungus in the roots. It may be that this is because the roots were in so dry a condition when they reached me. I would be pleased to have a half dozen more roots from plants that have just wilted. * * Would be glad if you could also send me some cotton in the same condition which is just wilting from the “root rot.” * * ”

On August 6, 1892, I wrote to Prof. Atkinson as follows:

“Geo. F. Atkinson,
Auburn, Ala.,

My Dear Sir:—Are you sure that the fungus you observed in the alfalfa roots is *Ozonium auricomum*? Do not make the statement unless you are absolutely certain for I expect to use it on your authority. The disease does not work like root rot in cotton although quite similar to it. * * I direct by to-day’s mail Mr. W. H. Farley of Hutto, Texas, to forward you by express a number of roots from plants just beginning to die in his alfalfa field, and instruct him to pack in accordance with suggestions in your letter of above date to me. I will also try to have sent you some cotton roots affected with the root rot. * *

Very truly yours,
GEO. W. CURTIS,
Prof. Agr. & Director.”

Replying to this Prof. Atkinson under date of August 9, 1892, says:

“ * * In replying to your letter of August 6, 1892, I will say that I am absolutely certain that one of the fungi which I find in the alfalfa roots you sent me recently is identical with the *Ozonium auricomum* as determined by Prof. L. H. Pammel, and described by him in the Annual Report of Texas Agricultural Experiment Station for 1889. [See also bulletin number 7, Texas Agricultural Experiment Station.] I have also found the same thing on roots of cotton sent me from Texas by Mr. R. D. Blackshear of Navasota. I do not find the *Ozonium* so abundant in the alfalfa roots as I have been accus-

tomed to find it in cotton roots, but on two of the roots of alfalfa it was quite abundant. Besides the *Ozonium* I found two other fungi in abundance in the alfalfa roots—one a saprophytic *Mucor* which probably plays no part in causing the disease; the other a very active parasite which I have recently separated from young cotton plants which rotted off at the crown. I have a pure culture of this last fungus and can kill young cotton within two to four days from time of inoculation. The alfalfa disease may be a complication of the two and thus account for the difference you have observed between the "work" of the alfalfa root rot and cotton root rot. Some of the alfalfa roots which you sent I placed in a moist chamber on filter paper below which was a layer of moist sand. From one of the roots there was an abundant development of *Ozonium* and also of my "damping off" fungus. In each case fungus threads were developed from the roots, which extended out on the filter paper for several inches. These threads are composed of several fungus threads growing closely parallel to each other and intertwining. To the unaided eye the threads appear to be those of the same fungus, but on microscopic examination the peculiar, short, stout cells of the threads of *Ozonium* with the characteristic branching of the free threads could be plainly detected, while the threads of my "damping off" fungus are composed of much longer and narrower cells, and the free threads have a characteristic branching different from that of *Ozonium*. I have pure cultures of my "damping off" fungus growing in different substances, and I am trying to obtain a pure culture of the *Ozonium*, but I find it much more difficult to transplant with success. * * Please bear in mind I do not say it is the *Ozonium auricomum* of Link., but the *Ozonium auricomum* of Pammel. * * "

After writing this letter the package of alfalfa roots sent under my direction by Mr. Farley was received by Prof. Atkinson as noted by him in the following letter dated August 18, 1892:

" * * The package of alfalfa roots from Mr. W. H. Farley of Hutto, Texas, is received. There can be no mistake about the fungus being the same as Pammel's *Ozonium auricomum*. It is out on these roots in great shape. * * "

From all this we conclude that the alfalfa disease is nothing more or less than the fungus growth described by Prof. Pammel in bulletin number 7, of the Texas Station, as causing "root rot of cotton." This is what I had suspected, and the difference in action which I observed, and which at first led me to doubt the accuracy of my own judgment, is accounted for by Prof. Atkinson's discovery that another fungus is associated with the *Ozonium* in its host plant—the alfalfa. It will be remembered that in bulletin number 7 of the Texas Station, Prof. Pammel recommends rotation of crops as about the only satisfactory way in which to overcome the trouble in cotton. It would seem that since alfalfa is certainly affected by the same disease there may be other crops also affected aside from those suggested

by him in bulletin number 7. On the alfalfa dead spots in Mr. Farley's field we have started an attempt to eradicate the trouble—with what success remains to be seen. Since the disease is undoubtedly a plant growth (fungus), and since there are certain substances well known to act as poisons to plant growth in general, the idea presented itself of applying a poison which should kill not only the alfalfa, but—if applied in a proper manner, and at the proper time—its parasitic occupant, the *Ozonium*. In this way, if successful, the land, while destroyed for crops one or possibly two years, should afterwards be free from trouble and bear whatever crops might be desired.

A still more hopeful view is that by applying just the right quantity of poison at the proper time, it may be possible to kill or check *Ozonium* without serious injury to the alfalfa. As above stated we are experimenting on this line with alfalfa root rot, and if it proves successful for alfalfa we shall have no doubt of its success for cotton. Indeed, our Mr. G. L. Stone in charge of branch station at McGregor, Texas, who has made some tests already under our direction with common salt to prevent "blight" or root rot in cotton, writes as follows under date Sept. 24, 1891:

" * * Where I have sown salt in cotton rows this year I see a very small per cent. of it has died. * * "

Our tests on alfalfa root rot are with common salt and coal oil (kerosene), which together have been found effective in destroying Johnson grass. Both these substances are well known to be poisonous to plant growth if applied in sufficient quantity, and are moreover cheap and easily handled, and without danger to man or beast. The quantity of salt necessary for effective killing we have found to be quite large—enormous, indeed, if computed for an entire acre of any strong growing perennial. The ground must be made thoroughly white in appearance, and the application must be at a time when the plant is young and not too vigorous. Similar conditions must govern the application of coal oil and the surface of the ground must be quite thoroughly drenched in order to be effective.

We shall be very glad if all who are troubled with the disease in question, either in alfalfa or cotton, will make the experiment on a small scale at least, and report results to this station. In this way we may be able to arrive at definite conclusions in much shorter time than would be possible if working on an independent basis and without co-operation.

[A card from Prof. Atkinson, just received, states that his address is now Ithaca, N. Y.]

The following is a list of the names of the persons who have been appointed to the various positions in the office of the Secretary of the State, and who have taken the oath of office and qualification, and who are now acting in their respective offices.

Secretary of the State, [Name]

Assistant Secretary, [Name]

Chief Clerk, [Name]

Deputy Chief Clerk, [Name]

Recorder of Deeds, [Name]

Register of Probate, [Name]

Register of Land, [Name]

Register of Tax, [Name]

Register of Marine, [Name]

Register of Shipping, [Name]

Register of Trade, [Name]

Register of Manufactures, [Name]

Register of Agriculture, [Name]

Register of Commerce, [Name]

Register of Finance, [Name]

Register of Education, [Name]

Register of Health, [Name]

Register of Labor, [Name]

Register of Industry, [Name]

Register of Science, [Name]

Register of Art, [Name]

Register of Music, [Name]

Register of Literature, [Name]

Register of History, [Name]

Register of Geography, [Name]

Register of Natural History, [Name]

Register of Botany, [Name]

Register of Zoology, [Name]

Register of Mineralogy, [Name]

Register of Geology, [Name]

Register of Astronomy, [Name]

Register of Meteorology, [Name]

Register of Oceanography, [Name]

Register of Hydrography, [Name]

Register of Cartography, [Name]

Register of Navigation, [Name]

Register of Shipping, [Name]

Register of Trade, [Name]

Register of Manufactures, [Name]

Register of Agriculture, [Name]

Register of Commerce, [Name]

Register of Finance, [Name]

Register of Education, [Name]

Register of Health, [Name]

Register of Labor, [Name]

Register of Industry, [Name]

Register of Science, [Name]

Register of Art, [Name]

Register of Music, [Name]

Register of Literature, [Name]

Register of History, [Name]

Register of Geography, [Name]

Register of Natural History, [Name]

Register of Botany, [Name]

Register of Zoology, [Name]

Register of Mineralogy, [Name]

Register of Geology, [Name]

Register of Astronomy, [Name]

Register of Meteorology, [Name]

Register of Oceanography, [Name]

Register of Hydrography, [Name]

Register of Cartography, [Name]

Register of Navigation, [Name]