BULLETIN

OF THE

Agricultural Experiment Station

OF THE

UNIVERSITY OF TENNESSEE



ALSIKE CLOVER PLANT

VOL. XVIII DECEMBER 1905 No.

I. ALSIKE CLOVER

II. ILL EFFECTS SOMETIMES PRODUCED ON HORSES AND MULES PASTURED EXCLUSIVELY UPON ALSIKE

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The Agricultural Experiment Station

OF THE UNIVERSITY OF TENNESSEE

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Packages by express, to receive attention, should be prepaid.

All communications should be addressed to the

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☞The Experiment Station building, containing the offices and laboratories, and the plant house and part of the Horticultural Department, are located on the University campus, 15 minutes walk from the Custom House in Knoxville. The experiment farm, the barns, stables, dairy building, etc., are located one mile west of the University, on the Kingston pike. The fruit farm is adjacent to the Industrial School and is easily reached by the Lonsdale car line. Farmers are cordially invited to visit the buildings and experimental grounds.

Bulletins of this Station will be sent, upon application, free of charge, to any farmer in the State.

I. ALSIKE CLOVER

Failure of red clover

The serious effect and general distribution of a disease of red clover commonly called "clover sickness," within and beyond the bounds of Tennessee, have materially affected well established rotation systems, stock raising interests, and the general agricultural welfare.

During the early part of 1905 the Experiment Station, through its correspondents, inquired with some detail into the general status of red clover diseases. Many letters were received from all parts of the State indicating that red clover had been a failure for some time and that during recent years much time and money had been wasted in efforts to grow this important crop. Mr. Otey Walker, an extensive farmer and stock raiser of Franklin, Tenn., wrote as follows, under date of Mar. 13, 1905:

"For eight years I have sown from 100 to 125 acres to red clover. During the years 1896, 1897, 1898, and 1899 I experienced total failures. In 1900 the crop in some parts of my field was pretty fair, but in other parts partial and even total failures resulted. The crop of 1901 was a complete failure. In 1902 one field of 50 acres was fairly good, but another 50-acre field was a total failure. The crop of 1903 was as complete a failure as that of 1901. In 1904 my experience was similar to that of 1902. In all these years clover seed was sown in March on wheat that was sown after corn. In each year the stand was perfect and continued so until the month of August, when it began to sicken and die, and by the latter part of September it was all gone or as described above. Each year the weeds were mown once or twice. My farm is in the valley of the Big Harpeth, and possesses a fine soil with a red clay subsoil. I have been feeding mules, using wheat and oat straw for bedding. Consequently I have each year a large lot of good manure, but where this was spread on the land the clover died first and more completely than elsewhere."

In the following paragraph, taken from an address delivered by Prof. S. M. Bain, botanist of the Agricultural Experiment Station of the University of Tennessee, before the West Tennessee Division Farmers' Institute, the red clover situation is briefly stated:

"There is perhaps not a more serious difficulty at present confronting Tennessee agriculture than the failure of red clover, due to what is popularly termed, in a vague sort of way, 'clover sickness'. It appears that the trouble has been most severe in the very best agricultural section of the State. The disease has existed a number of years and has been gradually increasing in severity. The writer recalls that twenty or twenty-five years ago he saw magnificent clover fields in Rutherford and adjoining counties in Middle Tennessee where now such sights are almost a curiosity. It was then a rather common custom to sow on the snow in middle or late winter, and no difficulty was experienced in getting a crop. The best farmers of Tennessee have found red clover to be almost indispensable as a soil renovator in a rational system of rotation, to say nothing of its value as a hay and pasture crop."

Through the Botanical Department of the Experiment Station, and the active cooperation of the farmers of the State, a careful study of this

so-called clover sickness was made during the past season, and what appears to be a specific cause, a fungous disease, has been discovered. The life history and habits of the disease are now being investigated and experiments are being outlined with a view of developing some remedial relief.

Alsike as a substitute for red clover

On account of the repeated failures of red clover, and prior to the discovery of the specific cause of the failure, the present Commissioner of Agriculture of Tennessee, Mr. W. W. Ogilvie, and other farmers in the middle division of the State, tried alsike clover as a substitute. It was soon observed that alsike, though naturally slightly less vigorous than the red, was, on account of its immunity to the prevailing sickness, a decided success. Largely through the suggestion and advice of Commissioner Ogilvie, alsike has been grown on many farms in Middle Tennessee, and from present indications it gives fair promise of successfully taking the place of red clover, at least until some effective means have been found of controlling the red clover disease now prevalent.

GENERAL DISCUSSION OF ALSIKE

History

Alsike clover (*Trifolium hybridum*) has long been known to the agricultural public of this and other countries. It was named by Linnaeus, and for a long time was regarded as a hybrid resulting from a cross between red and white clover, but the plants since produced by artificial hybridization of these two clovers indicate that alsike did not originate in this way. Although found in Europe, Asia and Africa, alsike is regarded as indigenous to southern Europe. The name "Alsike" or "Alsyke" is derived from the village of Syke in Sweden, where this plant was first placed under serious cultivation. From Sweden it was introduced into America, where, meeting with the superior competition of red clover, it has not been so commonly used, as it has been thought less valuable than red clover in the prevailing crop rotations.

Alsike has been grown in limited areas for many years in Tennessee. The Experiment Station has grown it for a number of seasons. Col. J. B. Killebrew, in his bulletin on "Grasses and Forage Plants," published by the Experiment Station in 1898, discusses liberally the merits of alsike clover and gives general information as to its habits of growth, methods of culture, and possibilities. Its general acceptance into the rotation systems was not warranted, however, so long as red clover, a legume which was widely adaptable and generally more productive, remained free from disease. Alsike has always, however, been favorably regarded for meadow areas not well drained, and has been more or less limited to creek bottoms, where it has been well combined with Timothy and red-top.

By the forced substitution of alsike for red clover, the wide range of adaptability and usefulness of this plant has been greatly emphasized, so that there is promised a much wider range of growth and production than was first expected.

Messrs. J. W. Howard & Co., of Columbia, Maury County, Tennessee, wrote, under recent date:

"We take pleasure in giving our experience with alsike clover. We have grown this plant for three seasons, and being so well pleased with it have planted no other clover for two years. Two years ago we seeded 180 acres, last year 115 more, and this year we are planting 200 acres (a total of 495 acres). We like it for pasture and for hay and it is very easy to get good stands. It bears heavy pasturing and drouth. We have discarded all other clovers, as alsike makes better pasture and more and better hay."

Mr. W. W. Ogilvie, Commissioner of Agriculture, who was one of the first to use alsike exclusively in place of red clover, and who has been growing it for a few years, has the following to say of it:

"There is no estimating the loss sustained by the farmers on account of the failure of red clover, the most valuable of all legumes both as food for stock and as a soil restorer. Since this failure in the red clover crop, the farmers, in endeavoring to find a substitute have experimented with the cowpea, but with rather unsatisfactory results.

"Until within the last four or five years alsike clover was practically unknown to the Tennessee farmer, but during that time it has been grown extensively with favorable results on land where the red had utterly failed. So far only one objection has been found to this variety of clover; namely, this, in some sections horses and mules have been affected while grazing on it, with a peculiar swelling of the head and limbs followed by sores on the body. However, this is not the case when they have access to grass, and in no instance have cattle, sheep, or hogs been affected in a like manner. A most excellent hay is made from this clover, which is relished by all kinds of stock, and a chemical analysis shows it to be richer in digestible nutrients than the red clover. The only perceptible difference in these two varieties of clover is that the yield of the alsike is not so large as that of the red clover, and it is not inclined to grow so erect, but nearer the ground. So it is advisable to sow with it such grasses as orchard grass or tall meadow oat grass, which mature about the same time. The seed of the alsike is considerably smaller than that of the red clover, thus taking a smaller quantity to the acre, while the price is practically the same. It has been generally believed that alsike clover is best adapted to bottom lands, but my experience and observation is that it can be grown advantageously on uplands also. Consequently, where the red clover has failed I do not hesitate to recommend alsike."

Seeding alsike

While alsike will do its best on moist lands, and will stand more water than red clover, even admitting of submergence for a time, it has proved very successful upon uplands. In communities, however, where alsike has not been grown, limited areas should at first be sown until some acquaintance with the plant has been obtained. The seed is smaller than the seed of red clover, so that 7 or 8 pounds of the former is about equal to 10 or 12 of the latter. It may be sown alone or, as is more frequently the case, may be mixed with grasses. A favorite mixture, and one in general practice in Middle Ten-

nessee, is, 5 pounds orchard grass, 5 pounds tall meadow oat grass, 4 pounds red-top, and 4 pounds alsike.

Alsike hay

The procumbent growth of alsike is often misleading as to the amount of hay a field will produce. The yields on the Experiment Station farm have not averaged so high as those of red clover, but have been very satisfactory. Some of our correspondents consider alsike as prolific as red clover at its best. All classes of live stock relish the hay, the feeding value of which exceeds that of red clover, due to the leafier and finer-stemmed growth. It combines with Timothy and red-top even better than red clover, owing to its being less hasty in maturing.

Alsike pasture

Alsike pastures have grown in favor. Some complaints, however, have reached the Station of a form of dermatitis, or skin eruption, upon horses and mules which have been pastured exclusively upon alsike. Messrs. J. W. Howard & Co., large producers of alsike, whose pasturing has been extensive, say, "We have heard some complaints from sore feet caused by pasturing alsike, but we know of several cases where stock ran on grass and had no alsike, and we think the trouble was from some other cause."

It is a perennial plant, and hence maintains itself longer and is better adapted to permanent pastures than red clover. It is hardy and furnishes early pasture in the spring. After the first crop is removed for hay the second crop shoots up quickly and furnishes excellent pasturage.

Dr. Jacob, veterinarian of the Experiment Station, went last year to Marshall County to examine some mules affected with skin eruptions supposed to be due to exclusive alsike pasturing. He discusses this trouble in the second part of this bulletin. From the evidence thus far obtained it seems advisable when alsike is to be pastured that it be mixed with orchard grass, tall meadow oat grass, Timothy, or other grasses, or that animals (mules and horses) have the run of grass pastures as well as the alsike. Animals other than horses and mules are not affected.

II. ILL EFFECTS SOMETIMES PRODUCED ON HORSES AND MULES PASTURED EXCLUSIVELY UPON ALSIKE

As the result of complaints coming from certain sections of this State, especially Middle Tennessee, that horses and mules pastured exclusively upon alsike clover were affected with a peculiar disease, and at the suggestion of the Commissioner of Agriculture, it was decided to make an investigation. Through the cooperation of several citizens of Marshall County some definite information concerning this condition was obtained. Since we have been unable to find any literature on similar outbreaks in the United States, it is assumed that the ill effects from alsike clover pasturage have been comparatively rare in this country. But European authors of veterinary medical literature describe a condition resulting from pasturing exclusively upon alsike, and refer to it as clover disease (*Trifoliosis*). They describe very plainly the cases which came under observation in this State.

In order that more definite information might be obtained concerning the experience of farmers with the pasturing of alsike clover, a circular letter was sent out containing the following questions:

1. Are you pasturing horses, mules, cattle, or sheep on alsike clover?
2. Is the pasture pure alsike, or is it mixed?
3. Has any of your live stock become diseased this summer?
4. If so, what was the nature of the disease?
5. How many animals were affected with this disease?
6. Did they become sick while being pastured on alsike?
7. Did your stock come into contact with any other stock that was so diseased?
8. Were your animals healthy before being pastured on alsike?
9. Did they improve when removed from alsike pasturage?
10. Did any of your stock become sick that was not pastured on alsike?
11. Have you had any trouble of this nature previous to this year?
12. Any further remarks.

By this means it was possible to obtain a clear history of a great many cases of this disease, and the following facts were established:

1. Horses and mules are the only farm animals susceptible to this disease.
2. The disease occurs especially in animals pastured exclusively upon alsike.
3. The diseased animals will usually begin to improve as soon as removed from the alsike pasture.

As has already been intimated the alsike clover is probably the only species that is associated with the occurrence of such a disease. One foreign authority describes a somewhat similar condition as having occur-

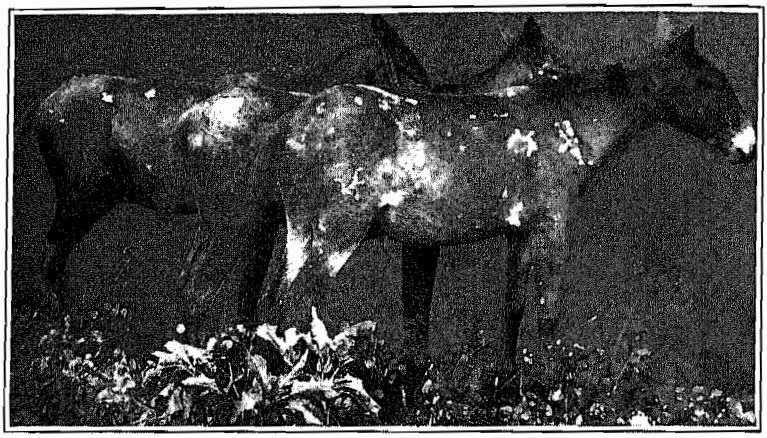
red in colts pastured on a red clover field, but he attributes it to some abnormal condition of the clover.

Cause

The cause of this trouble among horses and mules is not positively understood. Whether the toxic effect is due to the plant itself, which possibly undergoes some change within the digestive tract and subsequently liberates a poison, or whether it is due to the presence of a mold in connection with alsike clover, is still undetermined. The mold has been strongly suspected. To determine this point will require further investigation. It is known, however, that the principal lesions are produced on the skin and mucous membranes.

Symptoms

The symptoms of this disease vary to some extent, depending upon the location of the lesions and the length of time the animal remains on the alsike pasture after the symptoms begin to develop. The cases which came under observation



MULES DISEASED FROM PASTURING ON ALSIKE

in Marshall County showed a marked similarity of symptoms, involving principally the skin, the mucous membranes of the mouth, and the eyes.

The prevailing symptoms of this disease are as follows:

On the skin are inflamed areas, appearing at first as more or less rounded vesicular swellings, varying from one-half inch to five or six inches, or more, in diameter. The hair over the affected areas stands erect, and has a dull appearance, indicating loss of vitality. Later the skin becomes hard and puffed out, as the result of the formation of puss underneath. Finally, the deadened skin is cast off, leaving a deep, raw, angry-looking ulcer, which eventually heals, with the formation of a conspicuous scar, covered with more or less white hair. These changes in the skin may occur on any part of the animal, but especially on the limbs, body and croup. The eye symptoms consist of a marked conjunctivitis, with swelling of the eyelids, sensitiveness to light, and a watery

discharge from one or both eyes. The mucous membranes of the mouth become inflamed (stomatitis), ulcers form, and the animal slobbers and refuses to eat. The advanced cases are frequently accompanied by emaciation. The tongue is usually affected, and the inflammation may extend throughout the entire digestive tract. The functions of the liver may be disturbed, and a yellowish (jaundice) coloration of the tissues follows. In such cases symptoms of colic are not uncommon, and the respiratory tract may become involved and pneumonia develop. Some observers in other countries have noticed marked nervous symptoms, such as excitement, convulsive movements, staggering gait, and paralysis of the throat, with inability to swallow, the paralysis at times becoming generalized, the animal getting down and being unable to rise. In the cases observed in this State, the nervous symptoms, except the general depression, were not very noticeable.

Prognosis

The outcome of the disease depends upon the location and extent of the lesions upon the horse or mule affected. If they are situated on the exterior the animal will readily recover as soon as removed from the alsike pasture. If the vital organs are involved, such as the brain, lungs and liver, the disease may readily produce death. Among those cases occurring in this State, not a single fatality has been heard of at the Station. But even though the death rate is small where the ordinary precautions are taken, the disease has considerable economic importance, since it leaves the animal more or less disfigured by the formation of scars, which materially depreciate his market value. These scars are shown in the accompanying cut, which was made from a photograph of mules belonging to Mr. R. S. Walker, of Lewisburg, Tenn.

Treatment

The treatment is comparatively simple. As soon as the disease is recognized the animal should be removed from the alsike clover pasture and the wounds subjected to ordinary antiseptic treatment, such as frequent washing with 5 per cent solutions of carbolic acid or creolin, and the application to the ulcers on the skin of drying powders, consisting of boric and tannic acids in equal amounts.