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WOOD ASHES NOT AN APPLE SCAB PREVENTIVE.

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*Connected with Second Judicial Department Branch Station.
†Connected with Fertilizer Control.
WOOD ASHES NOT AN APPLE SCAB PREVENTIVE.

F. H. HALL.

The apple scab disease is due to a fungus, scientifically known as *Fusicladium dendriticum*. The spores of this tiny plant germinate and grow in colonies upon the tissues of the apple, forming olive-brown patches upon the leaves and causing them to crumble or to grow ragged from the falling away of the dead tissue; while on the fruit the colonies produce the too familiar mole-like, brown, disfiguring patches, "scabs," and the cracking open and decay of the apples which accompany them.

Dark, wet, cool weather seems favorable to the spread of the fungus; and when a period of this character follows the opening of the buds it is liable to prove very destructive to apples; for the forming fruits are rendered more susceptible by these conditions and the abundant spores of the fungus find congenial germinating places and favorable surroundings for rapid growth.

Like nearly all fungous diseases, the scab may be almost entirely prevented by the use of Bordeaux mixture; but some have believed that, by the use of fertilizers, it might be possible to so increase the vitality of the trees that they would be able to resist the attacks of this and other fungous diseases, and thus to avoid the necessity of spraying. In the meeting of the Western New York Horticultural Society at Rochester in 1893 this idea was advanced.

*This is a brief review of Bulletin No. 140 of this Station on Wood Ashes and Apple Scab, by S. A. Beach. Any one specially interested in the detailed account of the investigations will be furnished, on application, with a copy of the complete Bulletin.*
with the qualification that, as too liberal applications of highly nitrogenous fertilizers, like barnyard manure, by producing luxuriance of foliage and rapid growth tended to make the tissues more susceptible to attack, fertilizers like wood ashes, containing mainly potash and phosphoric acid, should be used.

To test this theory an experiment was begun by the Station in 1893, and this has now continued five years. This length of time has been necessary to prevent misleading conclusions through the varying influences of different seasons. A large number of trees was included in the test to prevent individual characteristics or surroundings from unduly affecting the results.

The orchard in which the experiment was conducted is an old one upon the Station grounds, on fairly good apple soil of heavy clay loam, mostly upland, but containing at one end a section of creek bottom land. It had been in meadow for several years before the commencement of the experiment, was heavily manured with stable manure during the winter preceding the experiment, was plowed in the spring, and subsequently received clean culture in the summer followed by a cover crop, or was devoted to soiling crops. In all there were 153 bearing trees, but for the purpose of securing similar conditions as to variety, age, vigor and location, and approximately uniform distribution of the varieties, only 47 trees on the treated sections and 47 on the untreated sections were considered in determining the results.

The orchard was divided into eight sections, four of which were treated liberally with ashes each year, and four alternate sections were left untreated. Each tree received 100 pounds of ashes annually, equivalent to an application of 200 lbs. per acre of actual potash, about twice as much as would be considered a very liberal application, and 48 pounds of phosphoric acid, a small amount for apple fertilization. No other fertilizer was used, and all sections of the orchard received the same cultivation and care. Insects, except plant lice, were kept well controlled by means of Paris green and London purple.
No record of the effect upon the foliage was made in 1893, but in the spring of 1894 and in the fall of that year and of those succeeding two observers noted carefully the injury caused the foliage by scab and other causes. The fruit was closely examined for scab spots, and careful records kept for each of the five years.

The period immediately following blooming in 1894 was one highly favorable to development of the scab, and examination of the foliage made on June 23 of that year showed from 16 per cent to 56 per cent of injury from all causes to the foliage of the five different varieties considered. Fall Pippin and Rhode Island Greening showed less injury on the treated sections; Northern Spy was the same on both and Baldwin and Roxbury Russet were better on the untreated sections, the average amount of injury on treated and untreated trees, considering all varieties, being practically the same. In the September examination the improvement in the condition of the foliage on the treated sections was very apparent, every variety being in better condition where ashes had been applied except Roxbury Russet, and that was equal instead of being worse where ashes had been used, as it was at the time of the spring examination. The average difference was about 4 per cent in favor of the trees on the treated sections. In succeeding years the condition of the foliage was recorded only in the fall, and the averages showed but slight differences in favor of the treated sections in 1895 and 1897: while the foliage on all varieties was practically perfect in 1896 on both treated and untreated sections.

Fall Pippin and Rhode Island Greening showed improvement every year on the treated sections; Baldwin was better in 1894 and 1897, and about the same in 1895, and Roxbury Russet and Northern Spy were about the same, except in 1894, when the condition on the untreated section was slightly better.

"Taking all years and all varieties into consideration, whenever there was any marked difference in the September
condition of the foliage, it was in favor of the sections which had received the ashes. Since the estimates include the loss or injury from all causes, including not only the effects of the scab but also of other diseases, insect depredation, etc., they do not necessarily show that the improvement in the foliage was due to increased ability to resist the scab as a result of the use of ashes as a fertilizer. The most that can be said is that in many cases there was better foliage where the ashes were used."

**Scab on fruit.** More exact data could be obtained with reference to the fruit than to the foliage, as each fruit was examined and the faintest sign of scab recorded. The ashes proved entirely useless as a preventive of the disease so far as the fruit is concerned, the most important consideration.

Each year, with the exception of Baldwin and Fall Pippin in 1895, Roxbury Russet in 1893 and Rhode Island Greening in 1893 and 1894, all varieties gave smaller percentages of scabbed fruit on the untreated than on the treated sections, although the comparative averages are so nearly alike that it is safe to say the use or the withholding of the ashes made no difference so far as scab is concerned. This ineffectiveness of the application of ashes as compared with the use of Bordeaux mixture is shown by comparison of this orchard in 1894 with an adjoining one which had been sprayed. In the orchard where the ashes were used much of the fruit dropped in June as a result of the loss of the foliage, and the treated plats yielded less perfect fruit than did those receiving no ashes; while the Bordeaux-sprayed orchard held both foliage and fruit and matured a fair crop of good fruit.

**Color of fruit.** The use of ashes, while not perceptibly influencing the amount of scab injury, seemed to have an effect on the fruit in other directions. In years which were not favorable to the perfect development of the fruit the ashes in the soil seemed to aid proper maturing and produced higher-colored apples. This was most noticeable in 1893, for all varieties showed better color on the treated sections. In 1894 Fall Pip-
pines, Tompkins Kings and Rhode Island Greenings were, to a greater or less extent, brighter and smoother on the treated sections; while Baldwins seemed, in some instances, more highly colored on untreated sections than on treated ones. The same lack of uniformity in coloring effect was noticed in 1895, Tompkins Kings and Esopus Spitzenburgs, alone, showing uniform improvement on treated soils. In 1896 and 1897 conditions were favorable to perfect development and any effect of the ashes was obscured by the stronger influence of light, heat, moisture and probably the supply of stored plant food. This last feature is thought to be quite important in the determination of high color, for in 1896, following an autumn in which the trees had been able to store up exceptionally abundant supplies of food materials, the fruit began to show color very early in the season and was exceptionally well colored at maturity.

Keeping quality. The same factors probably influence the keeping quality of apples, for when the season is conducive to perfect maturity at an early period, the ripening processes may be carried so far that decay will also begin early. As to the effect of ashes upon this development and the keeping quality of the fruit, the following facts are of interest: In each season the Roxbury Russets from untreated sections kept longer than those from treated sections, the Northern Spys showed but little difference and Esopus Spitzenburgs from treated sections kept better than from untreated ones. In 1894-5 and 1895-6 the fruit from treated sections generally kept better than that from untreated sections, Roxbury Russet being a marked exception. The season of 1896 was especially favorable to the perfect development of the fruit and that from untreated sections kept the longer.

Thus the ashes seem to hasten perfect development of the fruit. In slow-growing seasons they would be of advantage in promoting proper condition of winter fruit at picking time; but in seasons in which untreated trees would develop their fruit perfectly, the liberal use of ashes apparently causes the ripening processes to be carried farther while the fruit is on
the tree than is the case with untreated trees, and conse-
sequently the treated fruit ripens earlier and decays earlier
than does that from corresponding trees not treated with the
ashes.

The entire orchard seemed to increase in
yield during the continuation of the experi-
ment, due, perhaps, to the breaking up of
the sod and regular cultivation.

The experiment was not designed to show the fertilizer
effect of the ashes nor were all the conditions secured which
are necessary to give decisive results along this line; yet it
may be said that, except with the Baldwins, there was an in-
creased yield each year on the treated plats, with all varieties,
over corresponding untreated plats.

In the course of the experiment the variation
of the different varieties in ability to resist
scab was very noticeable. Fall Pippin suf-
fered severely nearly every year, the aver-
age injury to the fruit being 33.85 per cent;
while Maiden Blush showed great power to resist the attacks
of the disease, the average annual injury to the fruit of this
variety being only 8.15 per cent. Other susceptible varieties
were Vandevere, Reinette Pippin, Esopus Spitzenburg and
Rhode Island Greening; but Tompkins King, Baldwin, Peck
Pleasant, Golden Russet and Roxbury Russet were only
slightly or moderately injured by scab.

Preliminary studies seem to indicate that the degree of
susceptibility varies with structural peculiarities of the skin
of the apple; and it is hoped that, by selection and cultiva-
tion, scab-resistant varieties of the apple may be developed.

It seems conclusively proven that ashes ap-
plied in the soil have no practical value as a
scab preventive, and that only two lines of
defense against the scab are open—the development of resist-
ant varieties and protection by spraying with fungicides.
As the former, if possible, is a very slow process, the best
advice to give now seems to be to spray the apple orchard
thoroughly with Bordeaux mixture.