with careful breeding and systematic selection will do. The system of feeding, followed, is simple, and can be easily adopted by any farmer. All feeds are fed dry, and the water and buttermilk are fed separately. By this method, the labor of mixing up mashes is avoided. Regularity in feeding, plenty of light and exercise, cleanliness and good wholesome food, such as can be grown on every farm, are some of the main factors emphasized in the care of this flock.

Great care is exercised in selecting the birds to remain in the flock. Small, slow-maturing and off-type birds are disposed of, when young, and only well matured typical birds are kept for laying. These hens are mated with males from the best bred-to-lay flocks obtainable. The best of the hens from last year's flock of pullets are being used for breeding stock this year. As far as possible, no bird is kept after two years old.

A glance at the foregoing report reveals a net profit of nearly $5.50 per bird. This perhaps would not be practicable with a large flock, owing to the difficulty in caring for the young stock. A further study of the report shows a net profit of $1.85 per hen for eggs alone, even when sold at ordinary market prices. This is a very satisfactory profit per hen, and there is no reason why equal profits should not be obtained with much larger flocks.

Ontario Co., Ont. R. M. TIPPER.

HORTICULTURE.

The Scab Disease of Apples.

Editor "The Farmer's Advocate":

A bibliography by Prof. Errett Wallace was published at the Agricultural Experiment Station of Cornell University last summer on the "Scab Disease of Apples." This little book covers the subject in a most exhaustive manner, and a magazine article on the principal points brought out should be of interest to the readers of "The Farmer's Advocate" who have not had the most perfect results in their endeavor to grow clean fruit. The experiments cited refer more particularly to the State of New York, but their conditions are so like our own that the conclusions arrived at should apply with equal force to either Ontario or Nova Scotia.

In 1904 a study was made of 564 orchards containing 4,881 acres. The average net gain from spraying three times was $40.23 an acre. Another count was made including only those orchards that were otherwise well cared for; the net profit in this case was $74.23 an acre. This is what should be expected, since trees properly cared for are better able to produce a larger quantity of fruit than those not well cared for. Ordinarily the reduction in quality of scabby apples is considered to be the main cause of loss, but this, however, is only one of several factors. Early scab infection, if not controlled in some years, almost entirely prevents the setting of fruit, and also reduces the size of individual apples. It was noticed in two epidemic years of scab that apples from unsprayed trees were uniformly smaller than those from sprayed trees. Another important factor is in the keeping quality of the fruit, and in the devitalizing effect on the tree after a case of severe leaf infection; this prevents the formation of fruit buds for the following year, and hinders the normal wood growth, which is the basis for future crops.

Apple growers have believed for years that cold, wet weather during the blossoming period, is the cause of failure of fruit to set; there is ample evidence to prove, however, that in some years (as in 1913) the scab occurs on the blossom stems, and causes the blossoms or young fruit to fall. It is even claimed by one authority that cold rains at blossoming time are not a factor in the setting of fruit. In a bulletin published in 1895 Prof. Bailey says, "The immediate cause of most of our apple failures the last few years, is undoubtedly the apple scab fungus. And again, "The best proof that the apple scab fungus is the immediate cause of the greater part of the apple failures of Western New York, is afforded by the fact that thorough spraying with Bordeaux Mixture is usually followed by a great increase in the productiveness of the orchard." While Prof. Bailey does not say just how the disease so greatly injured the crop, there is no doubt the decrease was brought about by the occurrence of scab on the stems of the blossoms or young fruit at an early stage, causing them to fall.

Another authority, Selby in 1910, states that scab often causes the young fruit to fall, and that often this falling or failure of the fruit to set, which is attributed to frost injury or poor pollination, is really due to scab.

The spores that carry the disease over the winter exist in little sacs in the dead leaves on the ground, and only begin to mature at or about the time the apple blossoms are ready to open. Mature spores were first found at Cornell on May 4th, in 1908, and in 1910 on May 1st, the blossoms were about to open in each case. These spores do not all mature at one time, as the ripening process may continue for about a month. The description given by Prof. Wallace of the method of studying this spore discharge is most interesting; glue-coated slides were placed in an inverted position over moistened leaves containing the spore sacs. A study was made as to how many would be discharged in a given time from a given area of leaf surface; how soon after wetting the leaves the discharge would begin; how long it would continue, and how long a single sac would continue to discharge spores. The most spores were caught on the slides placed only one half a centimetre, or about one-sixth of an inch above the leaf. From a fragment of leaf one centimetre square 5,630 spores were discharged in forty-five minutes. From this it is estimated that if the surface of the ground beneath trees set 40 by 40 feet apart were covered with old leaves, there might be 8,107,000,000 spores discharged for each tree in three-quarters of an hour of wet weather. This ought to be enough to account for any early infection. The discharge of spores began within five minutes of the time the trees were wet, showing that spore shooting begins almost as soon as rain begins, and if kept continually wet it was found that a single leaf would continue to throw off spores for about ten days. It is probable that in nature some leaves would be found that would continue even longer than this, and the fact that from some leaves operations would begin earlier than from others would lengthen the period still more.

Prof. Wallace artificially inoculated leaves to see if he could learn the time of development. On leaves inoculated May 16th scab first appeared on May 24th, on May 23rd no scab was visible. On May 28th many infections showed on each leaf, while only a few spots could be found on any uninoculated leaf. From the inoculation on May 26th scab first showed on June 12th. The period of inoculation would then be from eight to fifteen days. At Cornell in 1908 the first natural infection appeared on May 22nd; as the mature spores were found on May 4th, they assume that some infection occured during the rains of May 7th, 8th and 9th, since these furnished the most favorable conditions for infection after the spores had matured. This gives a period of thirteen to fifteen days. Favorable weather for infection also occurred on May 13th and 14th; in this case the period would be from eight to nine days, which corresponds with experiments made earlier in the season. At Sodus in 1910 spores began to mature about May 1st. Rain fell on April 29th, and on May 2nd and 3rd there was three-quarters of an inch of rain, with good condition for scab infection. Scab first showed on the leaves on May 12th, giving a possible incubation period of from nine to thirteen days. There were weather conditions that would permit infection earlier than this date, but there are two reasons why the experimenter does not believe that any occurred before May 1st. First, no spores were mature before May 1st, and second, no scab appeared on foliage sprayed on April 29th.

As the first spot showed on May 12th, secondary infection could take place at the first favorable time after this. On May 24th rain fell heavily followed on the twenty-fifth by cloudy, misty weather; scab appeared abundantly on June 7th, showing an incubation period of about thirteen days duration. The amount of rainfall is not necessarily the important item in determining whether or not a certain rain permits infection; a more important factor is the length of time the trees remain wet. The ideal condition for infection is a gentle continued rain, followed by cloudy, calm weather and a saturated atmosphere, in which case the spores are kept wet for a long time while in one position. Any condition, such as poor air drainage, or dense foliage that prevents prompt drying out of the trees after rain has ceased, is most favorable to scab development.

The following table should be carefully studied to understand at what stage of the development of the buds scab infection is likely to occur:

Correlation of the first appearance of scab due to primary infection and the date on which the infection probably occured, with the development of spores and of fruit buds.

Year	Date of first appearance of scab.	Condition of buds at date of first appearance of scab.	Probable date of infection. Wet weather.	Condition of buds at probable date of infection.	Date when mature spores were first found.
1908	May 22nd	Petals falling	May 7th to 9th	Almost opening	May 4th.
1910	May 12th	Mostly in bloom.	May 2nd to 3rd.	Ready to open	May 1st.

Prof. Wallace believes that leaves and buds are susceptible to infection as soon as they are exposed, but that infection does not occur until the spores have matured, or until the first appearance of weather conditions favorable for infection following the maturity of the spores. According to his experience, from three year's observation, the spores do not reach maturity until the blossoms are either opening or just ready to open, and, therefore, that there is little danger of infection before this time. In Nova Scotia this last season, infection took place much earlier than this, as proved by the experiments of the Government Horticultural Station at Kentville. Spraying on May 8th just as the leaf buds were unfolding giving practically perfect results, while where the application was deferred until May 20th, just before the blossoms opened, twenty per cent. of the apples were spotted. As everyone knows this was a most exceptional season, for on account of cold, backward weather, the time between the opening of leaf buds and blossom buds was nearly twice as long as the average.

Many have noticed that the leaves of blossom buds become scabbed earlier than the leaves of leaf buds. These leaves are the first to open in the spring; they are exposed to the earliest infection, while those from leaf buds do not appear until later (ten days) and thus escape it. The leaves from fruit buds are exposed to both first and secondary infection, while those from leaf buds are for the most part subject only to the secondary attack. The first spore infection, however, is often not severe in itself, but it is the original source of the secondary infection which is usually much more abundant, and which causes most of the scabby fruit as well as the greatest leaf infection.

From his experiments Prof. Wallace came to the following conclusions: Early infection is caused entirely by the wintering spores on the dead leaves, and may appear during the first period of weather favorable to infection occuring after the spores have matured; usually not until blossoming time or a little before. There is little danger that infection will occur much earlier, not because the leaves are not susceptible, but rather because the spores are not ripe.

The period of incubation may vary from eight to fifteen days, and after this period has elapsed a second crop of spores is produced, which may cause infection again eight to fifteen days after weather conditions favorable to their development; this generation may in time produce another and so on throughout the season. However, the various infections do not always occur in successive jumps at intervals of eight to fifteen days as might be inferred from the foregoing. The first crop of spores do not all mature and discharge at the same time; they begin to ripen at about the time indicated above, and furnish a constant source of infection for a month or more. Thus individual infections belonging to the first generation may be started at several different dates, and produce their first crop of spores at different times."

After finishing the study of the life history of the scab, Prof. Wallace takes up the most important subject of control. He says,—"While there will always be enough fallen leaves exposed to permit infection, still if the orchard is plowed late in the fall or early in the spring, it is probable there will be much less danger from the early infection occurring about blossom time.

A striking demonstration is cited bearing on this point. Two McIntosh orchards were under observation for several years; both were seriously effected with scab each year, and the loss from this cause was about the same in each; both orchards were in sod. About the middle of April a fire started from a sugar camp, swept over the entire area of one of these orchards. Not a scab spot could be found in this orchard the following summer, while the disease was quite common in the other orchard.

Pruning is also an important factor in controlling scab; the denser the foliage of the tree the more slowly it dries out after a rain, the better is the opportunity for the spores to germinate and cause infection. But it is certain that notwithstanding all the precautions that can be taken, by destroying dead leaves, correct pruning, etc., clean fruit cannot be grown unless the trees are properly sprayed. The problem is to find the best fungicide, and to learn how and when it should be applied. The best authorities now agree that to control scab, lime-sulphur and Bordeaux are equally efficient, but lime-sulphur has the advantage in other ways, as it does not russet the fruit and is more easily prepared. When to spray is now the most important question, and to know when infection occurs is to know when to spray, for the fungicide must be applied first in order to prevent it. As we have shown, infection usually occurs when the blossoms are about to open, so spraying to be effective must commence a little before this, or when the buds are first beginning to show pink. Two applications, one immediately after the petals fall, and another two or three weeks later are necessary to prevent attacks from the secondary infection. The grower should watch, not only