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# New York Agricultural Experiment Station.

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## UNPROFITABLE ORCHARD FERTILIZING

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SUMMARIZED BY  
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FROM BULLETIN BY  
U. P. HEDRICK

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POPULAR EDITION\*

OF

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## UNPROFITABLE ORCHARD FERTILIZING.

F. H. HALL

**Feeding  
apple trees  
a complex  
problem.**

With the common farm crops a single-season test will give valuable indications of the needs of soil and crop. In the orchard, though, the effect of fertilizers applied during the first years of its growth is apparent only in factors whose exact relation to fruit production no one can calculate. Who can say, for instance, how many bushels of fruit will be added to the product of a tree by one foot increase in its height or by an inch added to the diameter of its trunk? Or how can the orchardist know that a fertilizer which produces luxuriant foliage upon his growing trees is either increasing or decreasing the quantity of fruit in the first or succeeding crops, or is improving or lowering the quality of that fruit? Even when the orchard is in full bearing, apple crops are irregular, varying from nothing to an overload, not only in different years, but also with different varieties and even with different trees of the same variety in the same year; so that some accidental or ordinarily negligible factor may obscure for several seasons the effect of the most careful fertilizing.

Any test with fertilizers in an orchard, therefore, especially in an old orchard whose tree-growth is practically complete, must continue for years if we are to secure reliable data concerning the effect of fertilizers.

**Station test  
with ashes  
and  
phosphate.**

Such a test of the effect of annual applications of potash and phosphoric acid in the form of wood ashes and acid phosphate has been continued in one of the Station orchards for 12 years. Though the results are not striking except in a negative way, they should be valuable; for the orchard is a type of many in the State, half-a-century old, on heavy, clay loam soil similar to that of hundreds of orchards in western New York; the fertilizers used are among those most

\*This is a brief review of Bulletin No. 289 of this Station, on The Effect of Wood Ashes and Acid Phosphate on the Yield and Color of Apples, by U. P. Hedrick. Anyone specially interested in the detailed account of the investigations will be furnished, on application, with a copy of the complete bulletin. The names of those who so request will be placed on the Station mailing list to receive future bulletins, popular or complete as desired. Bulletins are issued at irregular intervals, as investigations are completed, not monthly.

often recommended and most commonly applied; the varieties under test are those generally grown in commercial orchards; and the years of the test have been markedly fruitful ones, so that fair crops have been secured in eleven of the twelve seasons; and these crops have been most carefully harvested, sorted, examined, weighed and recorded.

**Details of fertilizing.** Previous to 1893, when the test began, the orchard was in sod, but from that time has received clean culture except that cover crops of clover, barley, oats and peas, or rye were grown during fall and spring on both check plats and test plats. Consequent upon the tilling and use of cover crops there has been a notable increase in yields of fruit from the orchard, independent of the effect of the chemical fertilizers.

The orchard soil is a heavy, clay loam, not well adapted to apples, since the crops seldom color well and the fruits average much smaller in size than those grown on lighter, warmer soils. Yet the orchard, in soil, location and treatment, is typical of thousands in Ontario and adjoining counties.

In 1893 the trees were 43 years old. Those under test and of such uniformity as to justify considering them in the experiment included from 8 to 30 trees of each of the varieties Roxbury, Fall Pippin, Baldwin, Rhode Island *Greening* and Northern Spy, an approximately equal number of each variety being treated and untreated. For the first five years of the test, wood ashes alone were used in a study of the effect of the potash upon apple scab; but since the ashes also contain phosphoric acid the experiment was really a test of the effect of potash and phosphoric acid on both yield and quality of fruit. The ashes also contain sufficient lime to give liberal applications of this element, amounting to about three-fourths of a ton to the acre annually; but since the soil is well enough supplied with lime to grow heavy crops of legumes without liming, the additional supply given in the ashes can not be considered a predominant factor. During the last seven years, additional phosphoric acid was added in the form of acid phosphate, so that for the entire period of 12 years the applications averaged 169 lbs. per acre annually of potash; and about 72 lbs. of phosphoric acid annually from the ashes, with 57 lbs. annually for the last seven years from the acid phosphate. These applications, both of potash and phosphoric acid, are larger than those usually recommended for orchards. The fertilizers were worked into the ground around each tree over a space about equal to that covered by the branches of the tree.

**Effect  
on  
yield.**

In only one season, 1903, was there a total failure of the crop, and in three of the years there were heavy yields on all varieties. The annual averages per tree ranged from 5½ bu. on the untreated Northern Spy plats to 11½ bu. on the treated Roxbury plats. In every season the sum of the average yields of fertilized trees was greater than the sum of the average yields on the unfertilized trees; as is shown by the following table:

TABLE I.—SUM OF THE AVERAGE YIELDS OF APPLES WITH AND WITHOUT APPLICATIONS OF POTASH AND PHOSPHORIC ACID.

	1893	1894	1895	1896	1897	1898
Treated, bushels.....	10.21	23.80	33.98	115.77	28.59	32.22
Untreated, bushels.....	5.37	16.28	33.17	102.42	23.47	24.70

TABLE I.—(Continued).

	1899	1900	1901	1902	1903	1904
Treated, bushels.....	24.14	70.54	9.14	75.16	.....	98.74
Untreated, bushels.....	17.74	59.96	6.18	70.90	.....	87.18

When we study the varieties separately, however, the figures show much uncertainty as to the effect produced by the fertilizers. Only two of the five varieties, Roxbury and Northern Spy, showed increases great enough to be considered outside the range of variation; and the average annual gain per tree of the varieties taken collectively, 1¼ bu., is not great enough to be of practical importance.

From a financial standpoint, the gain in fruit—first, seconds and culls—at \$1 a barrel, would give us less than \$20 an acre greater returns from the treated trees, while the value of the fertilizers applied is almost \$15 an acre. This leaves only \$5 an acre for the work of handling, applying and working in the fertilizers.

We can only conclude that in practice, at least, if not strictly in fact, the results from the fertilizers have been negative so far as yields are concerned.

**Effect on color.** As already stated, fruit in this orchard rarely colors well, so that any application or method that would improve the color and thus increase the market value might be profitable even if it did not increase the yield greatly.

Potash is generally recommended in liberal quantity in orchard fertilizers as having marked beneficial effect on fruit color; and phosphoric acid is also supposed to have some favorable effect in the same direction. With the quantities used in this test and under conditions where great improvement was possible, it was hoped that the fertilized trees would show much brighter fruit than the untreated trees. Here, again, the results are disappointing. Careful observations were made each year relative to color both while the fruit was on the tree and while sorting and handling it; but variations in color were not uniform. In a few years, like 1893 and 1902, when the climatic conditions were unfavorable to color development, there appeared to be a slight improvement in color on the treated trees; but in other years, like 1896, 1900 and 1904, the coloring was just as good upon the untreated as on the treated trees. Occasionally, with some varieties, the color seemed better on the untreated plats.

It can only be said that the effects varied so much, not only from season to season, but between different trees of the same variety similarly treated in the same season, that it is impossible to ascribe to the fertilizers applied any definite effect upon color of the fruit.

**Application of results.**

The returns obtained in this twelve-year experiment are negative from a practical standpoint. The data show that it is not profitable to apply potash, phosphoric acid or lime to the soil of the Station orchard. Fifty-seven years of orchard cropping has not reduced this soil to the condition where it needs a "complete" fertilizer, yet the leguminous cover crops plowed under in the orchard have usually produced beneficial effects the same or the next season. This seems to show that the orchard is having a one-sided wear. It needs nitrogen, or humus, or the physical condition to be obtained by plowing under organic matter. It would be an assumption to say whether it is the food, or the condition of the soil brought about by the organic matter, or both, that has proved beneficial when cover crops were plowed under.

"Potash for fruits" has been the cry for so long that many fruit growers are misled as to its use. It is true that the "out-go" of potash from the soil is relatively great, as shown by analyses, and if the soil lacks this ingredient, trees are not fruitful. But

it is becoming more and more apparent that in many orchard soils potash is more abundant, or more available, or is less needed by the trees, than was formerly thought. Orchard practice, as well as the present experiment, has demonstrated that the plea for potash in orchards may not always be founded on a real need.

It must not be concluded, because the effects from the fertilizers applied were scarcely apparent in the Station orchard, that they would be ineffectual in all orchards, or necessarily for all time in this orchard. Plants require food, and the fact that certain nutrients added to this soil gave no results must mean that this particular soil contained an abundance of the elements added when the experiment was begun. Since, however, the soil of the Station orchard is an average piece of land for western New York—no better, no worse—there must be many other orchards in the State that do not need these fertilizers. In view of the fact that fertilizers are now very generally used in growing apples, it may be that considerable sums of money are wasted in buying and applying fertilizers which are not needed.

The practical application of the information obtained by this experiment is, that the apple grower should not apply manures in quantity until he has obtained some evidence as to what food elements, if any, are needed in his soil. Good evidence in this direction is furnished by the trees themselves. So long as trees are growing well, adding a fair amount of new wood each year, and producing good crops of well-colored fruit, it may be taken for granted that they need no additional food from fertilizers. Should the growth and behavior of the trees be otherwise, it may be suspected that they need more, or other foods, and experiments should be set on foot to determine what and how much.

Such a test can easily be made by every orchardist, with but little additional outlay in time or money. The plan should be worked out, trees selected and fertilizers made ready for application during the winter season when regular work is not pressing; for if left until spring, the other demands will crowd aside this necessary and valuable work;—valuable not only from a financial standpoint, but also as a simple introduction to the spirit and method of scientific investigation by which alone the fruit grower can hope to keep himself master of the complexities of successful modern orcharding. Such a test should include six plats (seven, if thought best to include lime), each of at least five uniform bearing trees.

On plat 1, use about 400 lbs. per tree of well-rotted stable manure; on plat 2, about 13 lbs. per tree of 14 per ct. acid phosphate or its equivalent; on plat 3, about 8 lbs. per tree of 50 per

**Plan for  
home test of  
fertilizers.**

ct. muriate of potash; on plat 4 combine fertilizers as given for plats 2 and 3; on plat 5, a "complete" fertilizer, made up, for example, of stable manure as on plat 1 with phosphate and potash as in plat 4 or use in place of the manure 13 lbs. of dried blood and  $3\frac{3}{4}$  lbs. of nitrate of soda per tree. On plat 6, if lime is to be tested, repeat plat 5 adding 25 lbs. per tree of good stone lime. Plat 7 (or 6, if lime is not considered) leave as a check. The fruit from these trees should be carefully weighed or measured, including culls and windfalls.

**Summary.** The most important lessons taught by the experiment here recorded are: That an orchard soil may not need potash, phosphoric acid, nor lime, even though the soil may have been cropped a half century; that in a soil which produces apples of poor color potash and phosphoric acid may not improve the color; and that the apple does not seem to be as exhaustive of soil fertility as farm crops. The experiment suggests, as well, that to assume without definite knowledge that a tree needs this or that plant food often leads to the waste of fertilizing material; and that in the matter of fertilizing an orchard a fruit grower should experiment for himself, since an orchard's need of fertilizer can be determined only by the behavior of the trees when supplied with the several plant foods.