POPULAR EDITION.

BULLETIN NO. 187.

DECEMBER, 1900.

New York Agricultural Experiment Station.

GENEVA, N. Y.

PROFITABLE POTATO FERTILIZING. III.

F. H. HALL, AND W. H. JORDAN.

PUBLISHED BY THE STATION.
BOARD OF CONTROL.

Governor Theodore Roosevelt, Albany.
Austin C. Chase, Syracuse.
Frank O. Chamberlain, Canandaigua.
Frederick C. Schraub, Lowville.
Nicholas Hallock, Queens.
Lyman P. Haviland, Camden.
Edgar G. Dusenbury, Portville.
Oscar H. Hale, North Stockholm.
Martin L. Allen, Fayette.

OFFICERS OF THE BOARD.

Stephen H. Hammond, President.
William O’Hanlon, Secretary and Treasurer.

EXECUTIVE COMMITTEE.

Stephen H. Hammond,
Martin L. Allen,
Frank O. Chamberlain,
Frederick C. Schraub,
Lyman P. Haviland,
Nicholas Hallock.

STATION STAFF.


George W. Churchill,
Agriculturist and Superintendent of Labor.
William P. Wheeler,
First Assistant (Animal Industry).
Fred C. Stewart, M.S.,
Botanist.
Lucius L. VanSlyke, Ph.D.,
Chemist.
Christian G. Jenter, Ph. C.,
*William H. Andrews, B.S.,
J. Arthur LeClerc, B.S.,
†Amasa D. Cook, Ph. C.,
Frederick D. Fuller, B.S.,
Edwin B. Hart, B.S.,
Charles W. Mudge, B.S.,
Andrew J. Patten, B.S.,
Assistant Chemists.

Harry A. Harding, M.S.,
Dairy Bacteriologist.
Lore A. Rogers, B.S.,
Assistant Bacteriologist.
George A. Smith,
Dairy Expert.
Frank H. Hall, B.S.,
Editor and Librarian.
Victor H. Lowe, M.S.,
†F. Atwood Sirrine, M.S.,
Entomologists.
Percival J. Parrott, A.M.,
Assistant Entomologist.
Spencer A. Beach, M.S.,
Horticulturist.
Heinrich Hasselbring, B.S.A.,
Assistant Horticulturist.
Frank E. Newton,
Jennie Terwilliger,
Clerks and Stenographers.
Adin H. Horton,
Computer.

Address all correspondence, not to individual members of the staff, but to the New York Agricultural Experiment Station, Geneva, N. Y. The Bulletins published by the Station will be sent free to any farmer applying for them.

*Connected with Fertilizer Control.
†At Second Judicial Department Branch Station, Jamaica, N. Y.
‡Absent on leave.
Popular Edition*
ofBulletin No. 187.

Profitable Potato Fertilizing. III.

F. H. Hall.

Series of tests ended. For six years, ending in 1900, experiments with commercial fertilizers on potatoes have been carried on by the Station, on Long Island farms. The results, while quite contradictory to much of the practice in that section, and also, in some points, to general scientific teaching, have been consistent from year to year.

Results. The yields and the financial returns therefrom teach that 1,000 pounds of high-grade complete fertilizer per acre is the greatest amount which should be used if the most profitable crop is desired, not necessarily the largest crop.

They also show that a mixture of chemicals supplying fertilizer ingredients in about the proportions, except for phosphoric acid, in which these ingredients are contained in the potato vines and tubers—7 per ct. of nitrogen, 4 per ct. of phosphoric acid and 10 per ct. of potash—is inferior, on Long Island soils, to the mixture commonly used on the Island, which supplies 4 per ct. of nitrogen, 8 per ct. of phosphoric acid and 10 per ct. of potash.

*This is a brief review of Bulletin No. 187 of this Station, on Commercial Fertilizers for Potatoes, III, by W. H. Jordan. 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 upon 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.
They teach, further, that much more potash has been used by potato growers in the section considered, than is justifiable. Nitrogen and phosphoric acid, not potash, seem to be the ingredients most necessary for the production of good crops.

The experiments of 1895 and 1896 were conducted on only one farm, on 26 plats, using ten different brands of "potato" fertilizers, in quantities varying from 1,000 pounds to 2,000 pounds per acre. The conclusion reached was that the use of over 1,000 pounds was attended with loss, as compared with the results obtained in using 1,000 pounds of fertilizer.

In 1897 a series of tests was begun on four farms in separated localities on the Island, including 20 tenth-acre plats on each farm the first year and 10 additional plats on each for the last three seasons. The tests for quantity of fertilizer included, on each farm, four plats for each amount from 0 to 2,000 pounds, the quantity increasing by 500-pound additions. The summarized results appear in the table below:

**Table I.—Increase of Yield of Potatoes from Different Quantities of Fertilizer, Four Years.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>$6.25</td>
<td>31.6</td>
<td>33.4</td>
<td>9.7</td>
<td>18.5</td>
<td>23.3</td>
<td>23.3</td>
<td>$5.40</td>
</tr>
<tr>
<td>1000</td>
<td>12.50</td>
<td>62.3</td>
<td>60.7</td>
<td>20.3</td>
<td>33.5</td>
<td>44.2</td>
<td>21.9</td>
<td>10.60</td>
</tr>
<tr>
<td>1500</td>
<td>18.75</td>
<td>65.1</td>
<td>84.8</td>
<td>23.3</td>
<td>48.3</td>
<td>55.4</td>
<td>11.2</td>
<td>8.95</td>
</tr>
<tr>
<td>2000</td>
<td>25.00</td>
<td>71.3</td>
<td>89.7</td>
<td>36.0</td>
<td>48.6</td>
<td>61.4</td>
<td>6.0</td>
<td>5.70</td>
</tr>
</tbody>
</table>

*Average of plats on two farms only.

Thus it will be seen that the four years' test supports the conclusion from the two years' test, which was conducted on a different plan, that 1,000 pounds is the most profitable amount of high-grade fertilizer to use.

When we compare the amounts of fertilizing ingredients applied to the soil and removed by the crops grown we find a
great discrepancy, part of which, at least, must be called a loss of fertilizing materials. The following table shows the quantities of nitrogen, phosphoric acid and potash in the increase of the crop grown and in the fertilizer whose application produced that increase:

**Table II.—Fertilizer Elements in Fertilizers and in Crop Increase Produced.**

<table>
<thead>
<tr>
<th>Amount of fertilizer per acre</th>
<th>Nitrogen</th>
<th>Phosphoric acid</th>
<th>Potash</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lbs.</td>
<td>Lbs.</td>
<td>Lbs.</td>
</tr>
<tr>
<td></td>
<td>Increased yield,</td>
<td>Applied in L. I. formula,</td>
<td>Applied in potato formula,</td>
</tr>
<tr>
<td>Lbs.</td>
<td>Lbs.</td>
<td>Lbs.</td>
<td>Lbs.</td>
</tr>
<tr>
<td>500</td>
<td>10.9</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>1000</td>
<td>20.4</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>1500</td>
<td>25.5</td>
<td>60</td>
<td>105</td>
</tr>
<tr>
<td>2000</td>
<td>28.3</td>
<td>80</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>In increased yield,</td>
<td>Applied in L. I. formula,</td>
<td>Applied in potato formula,</td>
</tr>
<tr>
<td></td>
<td>Lbs.</td>
<td>Lbs.</td>
<td>Lbs.</td>
</tr>
<tr>
<td>500</td>
<td>3.4</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>1000</td>
<td>6.4</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>1500</td>
<td>8.1</td>
<td>120</td>
<td>60</td>
</tr>
<tr>
<td>2000</td>
<td>8.9</td>
<td>160</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Lbs.</td>
<td>Lbs.</td>
<td>Lbs.</td>
</tr>
<tr>
<td>500</td>
<td>12.2</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>1000</td>
<td>23.2</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1500</td>
<td>29.1</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>2000</td>
<td>32.7</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>

That is, when more than 1,000 pounds of fertilizer was used per acre, from 2.4 to 5 times as much nitrogen was applied as was returned in the crop increase, from 7.5 to 18 times as much phosphoric acid, and from 5.2 to 6.1 times as much potash.

On each farm the plats were divided into two series, those in one set receiving the "Long Island" formula fertilizer, which contains 4 per ct. of nitrogen, 8 per ct. of phosphoric acid and 10 per ct. of potash; and the other set, a fertilizer based on the apparent needs of the potato crop as determined by chemical analysis of tubers and vines, a mixture made up, like the other, from nitrate of soda, dried blood, acid phosphate and muriate or sulphate of potash, but containing 7 per ct. of nitrogen, 4 per ct. of phosphoric acid and 10 per ct. of potash. The advantage during every year of the four, and for each amount tested, except for 500 pounds in 1899—when the crop throughout was very poor because of drought—was with the "Long Island" formula. The average amount produced by this 4-8-10 mixture was 22.9 bushels greater in 1897 than that
produced by the "potato" formula (the 7-4-10 mixture), 6.3 bushels greater in 1898, 7.4 bushels greater in 1899 and 18.4 bushels greater in 1900.

**Too much potash used.** From three years' tests on 10 plats on each farm, it seems evident that potash is being wasted on Long Island soils. In these tests plats receiving 1,000 pounds per acre of fertilizer containing 40 pounds of nitrogen and 80 pounds of phosphoric acid as a basis, with either no potash, 35 pounds of potash, 70 pounds of potash or 100 pounds of potash, were compared with each other and with plats without any fertilizer. The average gain for the three years from the nitrogen and phosphoric acid alone was 30.9 bushels, from the nitrogen and phosphoric acid with one-third full amount of potash, 38.7 bushels; with two-thirds full potash ration, 40.4 bushels; and with 100 pounds, or 10 per ct. of potash, 39.5 bushels.

It is clear that decreasing the amount of potash in the fertilizer from 10 per ct. to 7 per ct. or even to 3½ per ct. did not correspondingly decrease the yield of potatoes. While further data may be necessary to establish the presumption, indications are that many farmers and even scientists have over-estimated the importance of potash in potato fertilizers.

**Practical lessons.** From the data relating to the fertilizers and the crops, and from study of the conditions outside of those directly introduced into the tests, the following points seem worthy of special emphasis:

Unless soil conditions are right and weather favorable the best planned scheme of fertilizing cannot give maximum crops. Thorough culture must be given to insure proper warmth and airing of the soil and humus must be provided to aid in forming a suitable soil texture. Unless these conditions are secured fertilizers will be wasted; and even under the best of conditions, there is a limit to the amount of fertilizing ingredients which can profitably be used. The largest crop is not always the most profitable one; for a smaller crop produced at a moderate cost per bushel benefits the pocket book more than a large one produced at a disproportionately greater cost.
Then when the quantity of fertilizer to be used is approximately decided the special needs of each crop on each soil must be studied, lest an extravagant excess of some ingredient be applied and simply thrown away.