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OF

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DOES IT PAY TO SPRAY POTATOES?

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*Connected with Second Judicial Department Branch Station.

†Connected with Fertilizer Control.

POPULAR EDITION*

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BULLETIN No. 123.

DOES IT PAY TO SPRAY POTATOES?

F. H. HALL.

Prevention of late blight.

Could the large growers of potatoes know that late blight or rot (*Phytophthora infestans*) would appear in their fields in any given season each one would probably use Bordeaux mixture freely. The power of this fungicide in the prevention of this disease has been too thoroughly shown to admit of doubt. The potato raisers know that an added expense of two or three dollars per acre for spraying will prevent serious loss, while a failure thus to protect may be followed by complete destruction of the crop.

A matter of insurance.

But fortunately the late blight does not come every year, perhaps only once in four or five years, and many growers seem to think that spraying every year is paying too high a rate of insurance, and that it would be cheaper to suffer the occasional loss of a crop. For fungicides are not remedies, but preventives: it does little good to apply them after the disease appears, but the spraying must be done before it can be known whether or not an outbreak will occur. If then the blight does not appear the money spent for spraying seems to be thrown away.

How spraying protects.

Recent experiments conducted by the Station indicate that, for Long Island at least, this is not true, but that spraying is profitable whether the late blight prevails or not. The early blight (*Macrosporium solani*) is almost certain to appear unless prevented; and its

*This is a brief review of Bulletin No. 123 of this Station, on Spraying Potatoes on Long Island in the Season of 1896, by F. C. Stewart. Any one specially interested in the detailed account of the investigations will be furnished, on application, with a copy of the complete Bulletin.

damage, not so noticeable in any one season as that of the late blight, yet fully as great in the aggregate, may be almost wholly avoided by spraying. This disease causes the brown, dead spots on the leaves, which are marked by concentric rings, and which sometimes affect so much of the leaf surface that the nutrition of the plant is seriously checked. For this disease, as for the late blight, Bordeaux mixture is an almost perfect preventive. Its protective power would probably be complete could each leaf be entirely coated with a thin layer of the deposited lime and copper sulphate, for the spores of the disease could then find no vulnerable point. The nearer this complete coating is obtained the more perfect will be the protection, and it can only be obtained by spraying carefully with a nozzle which makes a very fine mist.

The Bordeaux mixture is not poisonous to insects but it is very distasteful to them; and Paris green combined with it will be distributed by the sprayer more evenly than it can be in any other way. The lime will cause the poison to adhere to the leaves so that its protective influence is strengthened and the time of its efficiency prolonged. Flea beetles, as well as the ordinary potato beetles, will find it very difficult to attack the leaves without being poisoned, although they are very cautious insects and seem to avoid the Paris green quite successfully when it is applied in the usual way. The Paris green is fatal to them if they eat it, notwithstanding the common opinion to the contrary. Applied with the Bordeaux mixture Paris green will not "burn" the foliage as it frequently does when applied as a powder. It is believed by many authorities that the Bordeaux mixture itself exerts a favorable influence upon potato foliage not due to its effect upon diseases or insects. These reasons, each slight in itself, all favor spraying potatoes; and, in the experiments, made the application of Bordeaux mixture and Paris green profitable even in a season when fungous diseases were scarcely noticeable.

During the season of 1895 one plot of one
Floral Park and one-half acres of potatoes at Floral
experiment. Park, Long Island, was sprayed five times
 with Bordeaux mixture, a similar plot in
 the same field was treated three times, and another plot of like

size was left unsprayed. Paris green was used with the Bordeaux mixture in the first two applications, and an equal amount in water was applied to the unsprayed rows. Some flea beetles appeared and considerable early blight; but no late blight. The effect of the spraying against these enemies was quite noticeable, as the plot sprayed three times produced 52 bushels more per acre of merchantable potatoes than did the unsprayed plot, and that sprayed five times 62 bushels more.

**Expense and
profit of
spraying.**

In order to get a correct idea of the expense and profit of applying Bordeaux mixture as it would need to be done by practical potato raisers an experiment upon a large scale was carried out by the Station in 1896. The use of a potato field of nearly ten acres was obtained from Mr. R. H. Robbins of East Williston, Long Island. Four varieties of potatoes had been planted—Victor Rose, White Elephant, Green Mountain and Defender—each variety being in a block by itself. The main part of the block was sprayed, but from five to ten rows of each variety were left as checks. The Bordeaux mixture was made up by the 1-to-8 formula (one pound of copper sulphate to eight gallons of water), the ingredients being bought at wholesale and mixed and applied by an ordinary farm laborer. The apparatus used consisted of an Eclipse No. 2 spray pump mounted in a 70-gallon barrel, which was put on a cart with wide tread and drawn by one horse. The pump was connected through a short piece of hose to a $\frac{3}{4}$ -inch cast-iron pipe attached to the rear of the cart and extending over four rows of potatoes. Each row received the spray from two adjustable Deming-Vermorel nozzles attached to the pipe. Paris green was added to the Bordeaux mixture when thought necessary at the rate of three-quarters of a pound to 50 gallons, and on the unsprayed rows was applied with a Leggett powder gun. Careful account was taken of all expense, and liberal allowance made for the time of man and horse and the wear of the machinery. Five applications of the Bordeaux mixture were given; the first June 4, when the plants were about six inches high, and the others at intervals of two weeks until the end of July. Paris green was used on the check plots but twice,

air slaked lime being used as a diluent and to prevent burning the foliage. The amount of Bordeaux mixture required was 1,975 gallons, or about 46 gallons per acre at each spraying; and the total expense, making, applying and wear of machinery, was \$4.00 per acre, or 80 cents per acre for each spraying. The season was not well adapted to show great profits from the spraying, for almost no fungous diseases appeared; the sprayed and unsprayed plots looked about alike, and most persons would have said the spraying was a needless and unprofitable expense. Yet upon weighing the tubers from the treated and untreated parts there was found to be a gain of $4\frac{3}{4}$ bushels per acre of merchantable potatoes from the sprayed Victor Rose, 16 bushels from Defender, $60\frac{1}{2}$ bushels from White Elephant, and 62 bushels from Green Mountain. Counting the potatoes as worth 25 cents a bushel, and deducting from the gain the cost of spraying (\$4.00 per acre), we find a small loss (\$2.81 per acre) from Victor Rose; but a net profit from each of the other varieties—two cents from Defender, \$11.14 from White Elephant, and \$11.52 from Green Mountain. In reality there should be added to each of these gains the amount which it would have cost to apply the Paris green by means of the powder gun (\$1.51 per acre), for protection against the insects was a necessity. In another experiment in which 1-to-11 Bordeaux mixture and Paris green was applied five times upon the variety Late Blush the yield was increased 28 bushels per acre.

Different fungicides. In an experiment at East Williston, on a farm managed by C. Burkard, two patented fungicides were tested. The first of these commercial remedies is "Fungicoid," a so-called "dry" Bordeaux mixture made and sold by Leggett & Brother, 301 Pearl street, New York. This can be easily applied by means of the Leggett powder gun, either alone or mixed with Paris green, and so would be very convenient if an efficient fungicide. Another compound is the "Lion Brand" Bordeaux mixture, patented and sold by James A. Blanchard, 4 and 6 Gold street, New York. It is a concentrated form of the mixture, sold in gallon tin cans, and to be diluted to 50 gallons with water and applied in the usual way. Each of these fungicides with Paris green, Bordeaux

mixture of varied strength alone and with Paris green, and Paris green and lime water were applied on two long, separated rows of Late Blush potatoes. Owing to loss of the can of "Lion Brand" Bordeaux mixture the first application on the rows devoted to this fungicide was of Paris green in lime water only, and the last application of one 1-to-7 Bordeaux and Paris green combination was omitted, otherwise all seven sets of rows were sprayed five times. No late blight appeared even upon the rows sprayed with Paris green only, and but little early blight, the chief enemy being the abundant Colorado potato beetles.

Neither of the patented fungicides was very effective, both being excelled by all of the regular Bordeaux applications; the "Fungiroid" and dry Paris green was below the Paris green and lime water, even, in influencing the yield of potatoes; while the "Lion Brand" Bordeaux increased the merchantable crop only $3\frac{1}{2}$ bushels per acre.

The 1-to-11 Bordeaux mixture proved superior to the 1-to-7 strength—a rather surprising result and one which would probably have been different if fungous diseases had been troublesome. It is possible also that the "Lion Brand" and "Fungiroid" would have given better results had there been more disease; but they would be less efficient under any conditions than the freshly made Bordeaux mixture of good strength, as they are not sufficiently adhesive to make a good coating upon the leaves. This opinion relative to "Fungiroid" is supported by experiments of other Stations and by the testimony of authorities upon plant diseases. The "Lion Brand" also proved difficult to remove from the cans.

It was found necessary to make more than three applications of Bordeaux mixture and Paris green; for the Colorado potato beetles would have wrought injury had any one of the earlier treatments been omitted, and the last application was required to insure against the late blight.

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| <p>Heavy or light spraying.</p> | <p>Seven rows of White Elephant potatoes grown after corn on the farm of Mr. H. L. Hallock, near Jamesport, N.Y., were used in an experiment to determine whether heavy applications of Bordeaux mixture were more effective than light ones. By turning short with</p> |
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the power sprayer which treats four rows at once the middle row received an application at each trip of the sprayer and so was given a double quantity (100 gallons per acre) of the Bordeaux mixture. All the rows were sprayed five times and at harvest there was a difference in yield of $15\frac{1}{2}$ bushels per acre in favor of the doubly sprayed row. In a similar experiment on potatoes planted on clover sod the double treatment increased the yield 27 bushels per acre.

**A power
sprayer.**

A horse-power sprayer which has several commendable features was tested throughout the season of 1896 upon seven acres of potatoes near Jamesport. It worked very satisfactorily, the eight nozzles attached to the light tube in front of the wheels being adjustable so that the plants in each of the four rows, no matter what their size, may receive the spray from two nozzles. The agitation of the mixture is very thorough, and there was little clogging, although the suction pipe leads from the lower side of the barrel. The machine is well balanced whether the rider is on or off, and with full or empty barrel. The barrel can easily be filled and the rotary pump is strong and durable. The apparatus is the Hudson Sprayer, and it is made by the Riverhead Agricultural Works, Riverhead, N. Y.

**Concise
directions.**

If, then, the potato grower desires to combine in one profitable line of treatment a preventive of early and late blight and insect injuries he should spray every season with Bordeaux mixture made by the 1-to-8 formula. Use a sprayer by which the spray from two, or, better, three nozzles can be given each row, making the first application when the plants are six or eight inches high, and repeat every two weeks, or oftener if heavy rains occur. Add Paris green (three-quarters of a pound to 50 gallons of the mixture) when beetles are abundant; and use especial care and heavy applications late in the season.