POPULAR EDITION.

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New York Agricultural Experiment Station.

GENEVA, N. Y.

ROTTEN TUBERS ON UNSPRAYED AND SPRAYED ROWS.

GOOD RESULTS FROM SPRAYING POTATOES.

SUMMARIZED BY

F. H. HALL

FROM BULLETIN BY

F. C. STEWART, H. J. EUSTACE AND F. A. SIRRINE.

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*In Second Judicial Department: Riverhead, N. Y.

POPULAR EDITION*

OF

BULLETIN No. 279.

GOOD RESULTS FROM SPRAYING POTATOES.

F. H. HALL.

Confirmatory evidence.

Each year of the Station tests of potato spraying only strengthens the case for advocates of this practice. Twenty tests were carried on by the Station or under its supervision during 1905, and fifty more were reported by volunteer experimenters; and in *every case but one spraying has increased the yield*. One farmer who *sprinkled* his potatoes with bordeaux through an ordinary garden sprinkler, so, properly speaking, did not spray them at all, reports no gain from his two acres. Even the sprinkling might have been some benefit if blight had attacked the crop; but there was no evidence of blight, even on the untreated rows.

In 63 experiments conducted by other farmers, the gain on 573⅔ acres was 31,966½ bushels. The 15 farmers who carried on experiments under Station supervision secured an average net profit of $20.04 an acre. Others, to the number of 29, carried on their tests independently but reported with sufficient accuracy to make a computation of profit or loss possible. These men made an average profit of $29.85 an acre.

Station ten-year tests.

The ten-year tests were continued by the Station, as in 1902, 1903 and 1904, in two localities, Geneva and Riverhead. The same plan was followed, of single-row treatments (not sprayed, sprayed three times and sprayed every two weeks) repeated in series throughout the plat so that the area devoted to each method of treatment was one-tenth of an

*This is a brief review of Bulletin No. 279 of this Station on Potato Spraying Experiments in 1905, by F. C. Stewart, H. J. Eustace and F. A. Sirrine. Any one especially 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.

acre. The spraying was done with a knapsack sprayer, very thoroughly. "Bugs" (Colorado potato beetles) were kept in check by the use of poison with bordeaux mixture on sprayed rows and by poison in lime water on "unsprayed" rows.

The yields were fair at both Geneva and Riverhead and satisfactory gains were secured from the spraying. At Geneva, the "unsprayed" rows (sprayed with poison, only, to protect from "bugs") yielded at the rate of 122 bu. of marketable potatoes per acre; those sprayed with bordeaux mixture three times during the season, at the rate of 229 bu.; and those sprayed five times, at the rate of 241 bu. That is, three sprayings with bordeaux mixture gave a gain of 107 bu. per acre and five sprayings a gain of 119 bu.

The difference due to the two additional sprayings was smaller this year than ever before,—only 12 bu. per acre. The foliage on these two series showed no difference.

There was some slight injury to all the vines by flea beetles before spraying began, and considerable damage to the unsprayed rows by an attack of these insects early in August. But, as usual, most of the gain was due to the prevention of late blight injury. The disease was later than in 1904 in making its appearance, being first noticed on August 12, and was not as severe as in some former years. It was followed, however, by more rot than usual, so that more than one-fourth of the potatoes on the unsprayed rows were rotting when harvested. On the rows sprayed five times the loss from rot averaged 6¼ bu. per acre, on those sprayed three times, 6⅔ bu., and on those not sprayed 47½ bu. In other words, *spraying reduced the loss from rot by 41 bushels per acre.*

At Riverhead the unsprayed rows yielded at the rate of 221⅔ bu. per acre, those sprayed three times, 253 bu., and those sprayed five times 303⅔ bu.

The gains are, as usual, smaller than at Geneva, 31⅓ bu. per acre from three sprayings and 82 bu. from five sprayings. They were mostly due to better protection of the sprayed rows against flea beetles. There was no rot.

The results for four years, of the Station ten-year tests, are summarized below:

FOUR YEARS' RESULTS IN TEN-YEAR POTATO-SPRAYING TESTS.

AT GENEVA.

No. of sprayings.	1902.		1903.		1904.		1905.		Average gain.
	Acre yield.	Gain.	Acre yield.	Gain.	Acre yield.	Gain.	Acre yield.	Gain.	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
0	219		174		153½		122		
3	317½	98½	262	88	344½	191	229	107	121
5-7	342½	123½	292	118	386½	233	241	119	148½

AT RIVERHEAD.

0	267⅔		207		201½		221⅔		
3	295⅓	27⅔	246½	39½	258	56½	253	31⅓	38¾
5-7	312⅔	45	263	56	297¾	96⅓	303⅔	82	70

Farmers' business experiments.

The twenty farmers' business experiments carried out in 1903 and 1904 and reported in Bulletins Nos. 241 and 264 proved very helpful. The good results secured in most of these tests proved, not only to the neighbors of those making the tests, but to hundreds of others who read the reports, that potato-spraying is simple, not requiring the services of an expert but well within the ability of the average farmer, is effective and is likely to be profitable.

It was thought best, therefore, for the Station to arrange for similar tests in 1905. Fifteen growers who were intending to spray co-operated with the Station in such work, and carried out the tests. The growers furnished apparatus and materials and did the work as best suited their own plans. Each experimenter was required to leave a few rows unsprayed in a representative portion of the field. The Station merely gave advice when asked to do so and supervised the harvesting sufficiently to obtain an accurate measure of the effect of the spraying. A row or more in the unsprayed strip was compared with a similar row or rows in the sprayed section. Usually the yield of the

center one of three unsprayed rows was taken as the measure of the yield of unsprayed potatoes; and the average of two sprayed rows (the second sprayed row on each side) as the measure of the yield of sprayed potatoes.

Details of these experiments can not be given here, but may be obtained in Bulletin No. 279 of which this is a summary.

The profit in each case, in this table and that on page 9, is based upon the actual market price of potatoes at digging time in the nearest or customary market of the grower.

As will be seen from the table, these tests were all on a large scale, 6 acres being the smallest area sprayed. The fact that there was an increase in yield from spraying in each experiment shows clearly the widespread occurrence of potato troubles preventable by spraying. The damage can be estimated from the average gain from spraying, which was 46½ bu. per acre.

The method of spraying in the Hebron experiment was one we call the two-hose-and-three-men method. This is an expensive method because of the large amount of man labor employed In the other thirteen experiments the spraying was done with horse sprayers of several different kinds covering three to seven rows at each passage.

Nothing is said in this Bulletin concerning the relative merits of different potato sprayers. It has been our aim to have the leading potato sprayers represented in the experiments, but this is not a comparative test of spraying machinery. The larger gain or larger net profit obtained in some experiments than in others is not necessarily due to a difference in the kind of sprayer used. It is impossible to make close comparisons because the conditions in the different experiments vary greatly.

The Station is obliged to decline to answer the question, Which is the best potato sprayer? We can only say that there are now upon the market several good, practical potato sprayers. The excellent results obtained in the business experiments during the past three years are proof of this.

The principal features of the fourteen business experiments are shown in the table on the next page.

RESULTS OF BUSINESS EXPERIMENTS.

Experiment.	Area sprayed.	No. of times sprayed.	Increase in yield per acre.	Total cost of spraying per acre,	Cost per acre for each spraying.	Net profit per acre.[1]
	A.		*Bu.*			
Gowanda	10	4	46 1/6	$ 3 76	$ 0 94	$ 23 93
Gainesville	16	7	67 1/3	5 41	77 1/3	22 63
Arkport	6	4	34 2/3	3 95	98 1/2	13 39
Atlanta	8	3 to 4	44 1/6	3 50	99 1/2	18 59
Spencerport	10	3	53 1/6	2 44	81 1/3	29 47
Verona Mills	11	5	49 1/4	5 02	1 00	27 01
Cassville	11	5	33 1/2	4 31	86	20 83
Cortland[2]	6	5	173	6 50	1 30	
Chateaugay	17	5 to 7	60 1/4	4 04	77	13 50
Peru	10	4	36 1/2	2 41	65 1/2	17 31
Hebron	6	2	39 2/5	4 02	2 01	11 64
Syosset	21	3	35 5/6	4 09	1 36 1/2	17 41
Mattituck	16 2/3	7 1/2	54 1/5	5 55	74	26 94
Bridgehampton	18	8	49 1/5	6 84	85 1/2	17 76

[1] Based on local market price for potatoes at time of digging the test rows.

[2] In computing the averages following the table, the Cortland experiment has not been included. The gain in this experiment may not have been entirely due to spraying.

Total area sprayed in thirteen experiments, 160 2-3 acres.
Average increase in yield per acre, 46 1-2 bushels.
Average total cost of spraying per acre, $4.25.
Average cost per acre for each spraying, 98 cents.
Average net profit per acre, **$20.04.**

SUMMARY OF BUSINESS EXPERIMENTS IN 1904.

Total area sprayed in fourteen experiments, 180 acres.
Average increase in yield per acre, 62 1-4 bushels.
Average total cost of spraying per acre, $4.98.
Average cost per acre for each spraying, 93 cents.
Average net profit per acre, **$24.86.**

SUMMARY OF BUSINESS EXPERIMENTS IN 1903.

Total area sprayed in six experiments, 61 1-6 acres.
Average increase in yield per acre, 57 bushels.
Average total cost of spraying per acre, $4.98.
Average cost per acre for each spraying, $1.07.
Average net profit per acre, **$23.47.**

Average net profit for three years, $22.79 per acre.

Volunteer experiments.

In 1904 the Station began collecting and recording the results of experiments made by farmers in all parts of the State. As these experiments were carried out entirely by the farmers themselves we call them volunteer experiments. Forty-one such experiments made in 1904 were reported in Bulletin 264.

It was hoped that in 1905 a much larger number of volunteer experiments might be secured for publication in the present bulletin. In the spring many farmers were urged to make volunteer experiments and in the fall they were requested to report results. Although considerable effort was expended in this line only 50 reports were obtained. Evidently, our farmers are not experimenting as much as they should. We have had occasion to mention this before.

The highly favorable results obtained in the numerous experiments made by the Station and by New York farmers during the past four years should stimulate potato growers to give spraying a trial. If it really is as profitable as these experiments indicate they can not afford to neglect spraying. As a matter of fact many are beginning to practice spraying, but only a few are making any attempt to determine how much the yield is increased thereby or whether the spraying is profitable. Let us have more experiments in 1906. It is a very easy matter to make potato spraying experiments like the farmers' business experiments reported in this bulletin. The two important points to be determined are: (1) The increase in yield due to spraying; and (2) the expense of spraying.

The leading features of the 50 volunteer experiments are shown in the following table:

Experiment.	Location.	Name.	Area sprayed.	Times sprayed.	Yield per acre.		Gain per acre due to spraying.		Cost per acre each spraying.	Price of potatoes.	Kind of sprayer.
					Sprayed.	Not sprayed.					
			A.		*Bu. lbs.*	*Bu. lbs.*	*Bu. lbs.*			*Cts.*	
1	Dewittville	G. A. Kirkland	6	6	215 37	140 37	75	—	$1 16	65	One-horse, home-made, 2-row.
2	Dunkirk	C. S. Aldrich	2	3	197 —	173 —	24	—		75	Knapsack.
3	Poland Center	Newel Cheney	3	11	188 41	152 29	36	12	70	60	One-horse, 4-row.
4	Springville	C. E. Safford		4	175 57	97 45	78	12	1 25	50	Knapsack.
5	Fillmore	O. C. Gibbs	8½	4	180 54	130 48	50	6		62	Two-horse, 5-row, home-made.
6	Pike	C. M. Dennis	12½	4	150 —	100 —	50	—		40-60	
7	Hardys	L. H. Taylor	10	5	184 41	128 29	56	12	70	50	One-horse, home-made, 4-row.
8	Castile	L. J. Wilson	10	5	204 35	155 56	48	39	62	40-60	Two-horse, home-made, 4-row.
9	Elba	C. W. Driggs	1½	3	153 49	135 29	18	20	77	60	4-row, horse sprayer.
10	Batavia	G. A. Prole	10½	6	181 48	118 43	63	5	67	52	Two horse, home-made, 5-row.
11	W. Henrietta	C. M. Lyday	6	7	198 —	136 7	61	53	43½	50	Peppler 1-horse, 6-row power sprayer.
12	W. Henrietta	Wm. Robert	15	7	229 41	148 49	80	52		50	Brown power sprayer.
13	West Rush	D. S. Norris	5	5	257 18	166 —	91	18	70	42-45	Home-made, 4-row.
14	West Rush	T. E. Martin	17½	20	352 20	215 40	136	40	40	38	One-horse, home-made, 6-row, geared.
15	Andover	E. R. Crandall	5	4	100 —	55 —	45	—		50	One-horse, 4-row, power sprayer.
16	Nichols	Daniel Dean	14½	3	146 40	93 30	53	10		68-75	Watson, 4-row, 1-horse power sprayer.
17	Coopers Plains	W. L. McConnell	1	3	42 —	221 50	20	10		60	Knapsack.
18	Campbell	E. S. Cole	1	2	100 48	72 36	28	12		50	Hand sprayer.

Experiment.	Location.	Name.	Area sprayed.	Times sprayed.	Yield per acre.		Gain per acre due to spraying.	Cost per acre each spraying.	Price of potatoes.	Kind of sprayer.
					Sprayed.	Not sprayed.				
			A.		*Bu. lbs.*	*Bu. lbs.*	*Bu. lbs.*		*Cts.*	
19	Beaver Dams	A. J. Moore	5	3	165 —	144 —	21 —	$1 16	60	Watson, one-horse, 4-row, power sprayer.
20	Victor	C. E. Green	10	8	230 —	166 34	63 26		60	Home-made, 4-row.
21	Canandaigua	H. Van Voorhis	14	4	191 9	119 28	71 41	1 00	50	Two horse, 6-row, home-made, geared.
22	Clifton Springs	J. F. Curran	6 3/10	5	199 10	127 50	71 20	1 13	60	Aroostook, 6-row, 2-horse power sprayer.
23	Clifton Springs	P. H. Pettit	18	4	147 58	117 45	30 13	68	55	Brown, 4-row, 2-horse power sprayer.
24	Phelps	J. V. Salisbury & Sons	25	5	140 12	58 25	81 47	80	60	Aroostook, 2-horse, 6-row power sprayer.
25	Phelps	M. B. Newman	15	5	300 —	200 —	100 —	90	55	Aroostook, 2-horse, 6-row, power sprayer.
26	Geneva	H. W. Hadlow	1/3	3	194 41	176 31	18 1[illegible]	2 03	50	Knapsack.
27	Ovid	J. M. Bennett	2	3	97 30	53 11	44 19		50-60	
28	Interlaken	M. C. Brokaw	10	5	230 —	145 —	85 —		40	One-horse, home-made, 2-row outfit.
29	Interlaken	F. C. & L. B. Bradley	5	6	187 46	105 4[illegible]	82 —	1 02	50	Two-horse, home-made, 4-row outfit.
30	Trumansburg	F. N. Smith	20	10	252 —	144 —	108 —	50	60	Watson, 2-horse, 4-row power sprayer.
31	Jordan	F. O. Chamberlin	10	6	70 —	58 21	11 39	53	70	Home-made cart with barrel spray pump.
32	Fulton	V. W. Shattuck	6 1/2	4	230 46	176 19	54 27		60	One-horse, home-made 4-row.
33	Clay	C. N. Breman	1 1/4	5	260 48	196 56	63 52	98	45-55	Home-made cart.
34	S. Onondaga	G. G. Hitchings	32	6	117 22	62 7	55 15	50	55	Niagara gas sprayer 2-horse, 2-row.

Experiment.	Location.	Name.	Area sprayed.	Times sprayed.	Yield per acre.		Gain per acre due to spraying.		Cost per acre each spraying.	Price of potatoes.	Kind of sprayer.
					Sprayed.	Not sprayed.					
			A.		*Bu. lbs.*	*Bu. lbs.*	*Bu. lbs.*			*Cts.*	
35	Fayetteville	F. E. Dawley	5	5	220 30	156 30	64 —		$ 98	60	Iron Age, one-horse, 4-row, power sprayer.
36	Schuyler Lake	D. C. Williams	2	4	286 46	145 12	141 34		1 32	60	Knapsack.
37	Constableville	C. H. Zimmer	1	3	326 —	256 —	70 —			50	Comp. air sprayer.
38	Constableville	G. P. Bernholz	1	3	237 58	159 19	78 39		1 58	50	Five-gallon, comp. air sprayer.
39	Malone	T. J. Shields	10	3	132 —	110 —	22 —			50	Aspinwall, 1-horse, 4-row power sprayer.
40	Ellenburgh Depot	Wm. Brennan	10	3	247 30	38 30	209 —			40	Home-made cart, 4-rows.
41	Peru	John Mannix	6	4	158 12	112 —	46 12		75	51	5-gallon, compressed-air sprayer.
42	Westport	J. M. Graeff	5	2	224 —	192 —	32 —			75	Gould, 1-horse, 2-row automatic sprayer.
43	Greenfield C't'r	E. D. Harris	¼	1	121 —	111 —	10 —			45	Hand sprayer.
44	Saratoga Springs	John Gick	2	3	242 —	242 —	0 —			60	Common garden sprinkler.
45	Akin	J. T. Buchanan	7½	5	240 39	179 32	61 7			65	Aspinwall 1-horse, 4-row, power sprayer.
46	W. Sand Lake	J. Jeannin Jr.	½	2	157 56	114 38	43 18		2 21	65	Auto compressed air sprayer.
47	Setauket	W. S. Rowland	11	4	220 —	165 —	55 —			50 60	Aspinwall 1-horse, 4-row power sprayer.
48	Riverhead	D. H. Hudson	4	5	216 20	155 28	60 52		73	50	Hudson, 4-row power sprayer.
49	Riverhead	E. Salmon	20	6	200 —	150 —	50 —			60	Peppler, 2-horse, 6-row power sprayer.
50	Water Mill	C. B. Foster	12	10	251 —	196 50	54 10		81	50	One-horse, Shangle 6 to 7 rows.

SUMMARY OF THE VOLUNTEER EXPERIMENTS IN 1905.

Total area sprayed in 50 experiments, 407 acres.
Average increase in yield per acre, 59 bu. 32 lbs.
Average total cost of spraying per acre (29 experiments), $4.57.
Average cost per acre for each spraying (29 experiments), 92 cents.
Average market price of potatoes at digging time, 57 cts.
Average net profit per acre (29 experiments), **$29.85.**

SUMMARY OF THE VOLUNTEER EXPERIMENTS IN 1904.

Total area sprayed in 41 experiments, 363 3-4 acres.
Average increase in yield per acre, 58 bu. 28 1-2 lbs.
Average total cost of spraying per acre (23 experiments), $3.91.
Average cost per acre for spraying (23 experiments), 90 2-3 cents.
Average market price of potatoes at digging time, 43 1-2 cents per bu.
Average net profit per acre (23 experiments), **$22.01.**

Soda vs. lime for bordeaux.

In 1904 bordeaux mixture made with soda was not equal to the regular lime bordeaux in increasing the yield of potatoes; and the test of 1905 strengthens the conclusion that, for conditions at Geneva at least, there would be no advantage in substituting the soda burdeaux for the lime bordeaux. Five series of rows were included in this test, one row in each series unsprayed, except that paris green in lime water was used to prevent insect injury, one row sprayed five times with lime bordeaux and one row five times with soda bordeaux.

The rows sprayed with the regular bordeaux mixture yielded at the rate of 202 bu. of marketable tubers per acre, those sprayed with soda bordeaux 193 bu., and those not sprayed 82 bu. per acre.

The lime bordeaux gave 9 bu. more potatoes to the acre than the soda bordeaux; and in 1904 the difference was 16 bu. in favor of the lime bordeaux.

Paris green safe with bordeaux.

As in 1904, the test to ascertain the effect of paris green on potato foliage proved this poison perfectly harmless to the plants when used in moderate amounts (one to two pounds per acre), combined with bordeaux mixture. Five rows were sprayed with paris green in lime water, five with bordeaux only and five with bordeaux and paris

green. "Bugs" were picked off the "bordeaux-only" rows once, but it was found unnecessary to continue this method as the later sprayings with bordeaux mixture kept the potato beetles well controlled. The five rows treated with paris green in lime water yielded at the rate of 212¾ bu. of marketable tubers to the acre, those with bordeaux only, 321 bu., and those with bordeaux and paris green, 326 bu. That is, the use of bordeaux instead of lime water as a medium for carrying the paris green increased the yield 112 bu. per acre, while the addition of paris green to bordeaux increased the yield over the rows sprayed with bordeaux alone 5 bu. per acre. The paris green, *with bordeaux*, most certainly was not harmful.

Arsenite of soda.

Arsenite of soda was also tested with bordeaux in a similar way, and found a safe insecticide in this combination. It was only used at the rate of one quart of stock solution to 50 gallons of bordeaux; but it is believed that a larger proportion would not be harmful. This amount is equivalent in poisoning power to eight ounces of paris green.

The arsenite of soda is much cheaper than paris green and remains in suspension better, but must be prepared beforehand by boiling. It is prepared by boiling for 15 minutes in two gallons of water, two pounds of white arsenic and eight pounds of sal soda. This makes the stock solution, which should be kept in tightly stoppered jugs, labelled " Poison".

Cold or warm water for bordeaux.

A very careful test proved it unnecessary to heat water, even from the coldest well, for making bordeaux mixture. There was no apparent difference, or a slight difference in favor of the cold water, when rows were sprayed three times with bordeaux made with water at a temperature of from 70° to 80° F. or at a temperature from 40° to 50°.

Spraying and rot.

Does spraying prevent rot? An unqualified affirmative answer can not truthfully be given to this query, but this can be said emphatically " *Spraying always increases the yield on the sprayed*

rows, if rot is troublesome ''. It *usually* decreases the amount of rot noticeably, it *occasionally* causes little apparent difference in the quantity of rotten tubers on sprayed and unsprayed rows, and it may, *rarely*, lead to an increased amount of rot on treated rows. All these conditions were shown in different experiments of 1905, the variations being due to diverse weather conditions in different localities.

In two of the Farmers' Business Experiments and in one Volunteer Experiment, more rotten tubers were found on sprayed than on unsprayed rows. The explanation is this : Rot is caused by blight spores from the leaves of diseased plants, carried down through the soil to the tubers and caused to germinate and produce rot by moist soil and warm weather. These spores on the leaves or above ground die quickly in dry, bright weather ; and the early death of the badly diseased vines on unsprayed rows results in death of the spores ; so that, even should rain occur later, there are few or no living spores to be carried down upon the tubers. On the sprayed vines, on the other hand, unless the work is done with extreme thoroughness, there will be some disease, which will continue as long as the vines remain alive, ripening spores in succession. Then, should rain and favorable weather come just at the right time these spores, though comparatively few in number, will be borne beneath the soil and cause rot. Under these conditions, harvest time will show many rotten tubers on the sprayed rows and few on those not sprayed. *But*, the protection given the sprayed rows will have so lengthened the life of the vines that the rotten tubers can be discarded and the *resultant crop of marketable tubers on sprayed rows with considerable rot will be larger than on the unsprayed rows with less rot.*

Occassionally, there *appears* to be more rot on sprayed rows when such is not the true condition. The blight on unsprayed rows gains an early foothold, ripens spores and, through a favoring rain, produces rot which by harvest time has caused complete decay of the affected tubers so that they are not in evidence when the hills are turned out on the surface of the ground. On the sprayed rows the blight is held off until late,

then rain washes down some spores and sets a few tubers to rotting well just when harvest is beginning. The number of tubers rotted and out of sight on the unsprayed rows may be greater than those in sight on the sprayed rows. The index of yield will show where the advantage lies. Spraying will be found to have increased the yield, whatever the appearance may be to the eye. Only measured areas and weighed product can be depended upon as evidence in such cases, and almost without exception will show a clear financial gain from spraying.

Directions for spraying. In general, commence spraying when the plants are six to eight inches high and repeat the treatment at intervals of 10 to 14 days in order to keep the plants well covered with bordeaux throughout the season. During the epidemics of blight it may be necessary to spray as often as once a week. Usually six applications will be required. The bordeaux should contain six pounds of copper sulphate to each 50 gallons. Whenever bugs or flea beetles are plentiful add one or two pounds of paris green or two quarts of arsenite of soda stock solution to the quantity of bordeaux required to spray an acre.

Thoroughness of application is to be desired at all times, but is especially important when flea beetles are numerous or the weather favorable to blight. Using the same quantity of bordeaux, frequent light applications are likely to be more effective than heavier applications made at long intervals; e. g., when a horse sprayer carrying but one nozzle per row is used, it is better to go over the plants once a week than to make a double spraying once in two weeks. A good plan is to use one nozzle per row in the early sprayings and two nozzles per row in the later ones.

Those who wish to get along with three sprayings should postpone the first one until there is danger of injury from bugs or flea beetles and then spray thoroughly with bordeaux and poison. The other two sprayings should likewise be thorough and applied at such times as to keep the foliage protected as much as possible during the remainder of the season. Very satisfactory results may be obtained from three thorough sprayings.

A single spraying is better than none and will usually be profitable, but more are better. Spraying may prove highly profitable even though the blight is only partially prevented. It is unsafe to postpone spraying until blight appears. Except, perhaps, on small areas, it does not pay to apply poison alone for bugs. When it is necessary to fight insects use bordeaux mixture and poison together.