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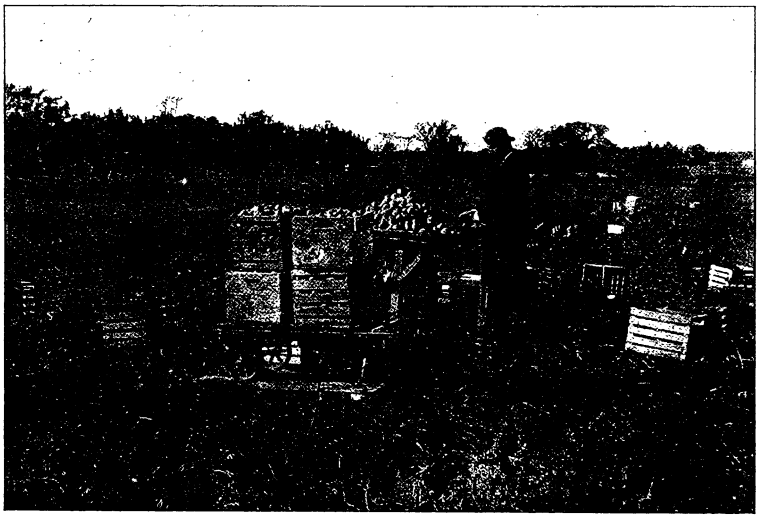

FIVE YEARS OF POTATO SPRAYING.

SUMMARIZED BY

F. H. HALL

FROM BULLETIN BY

F. C. STEWART, H. J. EUSTACE, G. T. FRENCH AND F. A. SIRRINE.

PUBLISHED BY THE STATION.

POPULAR EDITION*

OF

BULLETIN NO. 290.

FIVE YEARS OF POTATO SPRAYING.

F. H. HALL.

Spraying continuously successful.

For five consecutive years of testing, potato spraying has proven, each year, a useful and profitable practice. The past season, that of 1906, was in most parts of the State the least favorable of any of the five for the development of the principal potato disease, late blight and rot; yet in nearly all of the eighty tests reported spraying gave good returns for the money expended and labor applied.

Early blight was somewhat more destructive than usual and a few fields suffered quite severely from this disease; but this trouble rarely causes such havoc as is often wrought by late blight and the rot that follows it. Against early blight, however, spraying is not considered a specific, as it is against late blight; but in fields where this blight prevailed and where sprayed and unsprayed rows both showed signs of infection, its severity was decreased by spraying; so that digging time showed distinct gains from the application of bordeaux mixture.

Another unknown trouble was also a cause of injury in several localities. While the cause of this brown, curled appearance of

*This is a brief review of Bulletin No. 290 of this station, on Potato Spraying Experiments in 1906, by F. C. Stewart, H. J. Eustace, G. T. French 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.

the leaf margin was not determined, it much resembles tip-burn. Though probably a physiological trouble due to the hot, dry weather in August, it was to some extent controlled by spraying since treated rows showed less signs of injury from this cause than those unsprayed.

Flea beetles were present in many of the fields; and these were quite well controlled by the bordeaux and poison. In one or two instances a larger flea beetle threatened damage but was held in check by the spraying.

Late blight began its attacks early,—in late June on Long Island and about the middle of July up the State. It seemed liable to be very destructive; but a period of hot, dry weather in August checked its inroads; so that, as already stated, the damage from this blight was less than at any time during the five years of the tests. Consequent upon this checking of the blight there appeared to be a greatly lessened power to produce rot, for very little of this trouble appeared, even where the later weather conditions were favorable. There were very few rotten potatoes anywhere in the State.

Though the season as a whole was, therefore, a poor one for showing the advantage of spraying in its strongest point, protection against late blight, it did bring out the advisability of spraying to control other troubles; for only two out of the eighty tests failed to show increased yields and only four or five failed to show financial profit.

Station ten-year tests.

The ten-year tests were continued by the Station, as in 1902, 1903, 1904 and 1905, 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 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 but, for reasons already given, only moderate gains were secured from the spraying. At Geneva, the "unsprayed" rows (sprayed with poison, only, to protect from "bugs") yielded at the rate of 195⅔ bu. of marketable potatoes per acre; those sprayed with bordeaux mixture three times during the season, at the rate of 227½ bu.; and those sprayed five times, at the rate of 258⅔ bu. That is, three sprayings with bordeaux mixture gave a gain of 32 bu. per acre and five sprayings a gain of 63 bu. The two additional sprayings, which practically doubled the gain, were equivalent to one double spraying, since the bordeaux applied August 20 was washed off by a heavy rain before it dried and a second application was made the next day.

At Riverhead the unsprayed rows yielded at the rate of 150½ bu. per acre, those sprayed three times 172 bu., and those sprayed five times 203¾ bu. It will be noticed here, also, that the two additional sprayings were of decided advantage, since three sprayings gave a gain of only 21½ bu., while five sprayings more than doubled this gain,—53¼ bu. per acre. There was no rot either at Geneva or Riverhead.

The following table shows the results obtained in the ten-year experiments during the first five years:

TABLE I.—SUMMARY OF THE TEN-YEAR EXPERIMENTS FOR FIVE YEARS.

	AT GENEVA.		AT RIVERHEAD.	
Year	Gain per A. due to spraying every two weeks.	Gain per A. due to spraying three times.	Gain per A. due to spraying every two weeks.	Gain per A. due to spraying three times.
	Bu.	*Bu.*	*Bu.*	*Bu.*
1902.....	123½	98½	45	27⅔
1903.....	118	88	56	39½
1904.....	233	191	96	56½
1905.....	119	107	82	31½
1906.....	63	32	53	21½
Average...	132	103⅓	66⅓	35⅓

Farmers' business experiments.

The farmers' business experiments carried out in 1903, 1904 and 1905 and reported in Bulletins Nos. 241, 264 and 279 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 1906. 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. 290 of which this is a summary.

The profit in each case, in this table and the next one, 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, 5 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; but the smaller average gain, 42½ bu. per acre, and the increased cost of spraying both tend to lessen the profit. Yet in every case there was some gain.

TABLE II.—SHOWING RESULTS OF BUSINESS EXPERIMENTS IN 1906.

Experiment.	Area sprayed.	Number of times sprayed.	Increase in yield per acre.	Total cost of spraying per acre.	Cost per acre for each spraying.	Net profit per acre.
	A.		*Bu.*			
Chafee	10.4	5	49.8	$4.70	$0.94	$15.23
Silver Springs	22	6	80.1	5.67	.94	22.35
Batavia	18	6	19.6	5.52	.92	3.28
Avoca	13	5	29.1	4.74	.95	6.92
Odessa	7.5	5–6	47.5	6.90	1.15	12.10
Nichols	17	9	60	8.47	.94	18.51
Cortland	8	5	18.3	5.10	1.02	4.05
Memphis	9.5	4	19.4	2.85	.71	4.92
Ogdensburg	6.5	5	41.7	6.00	1.20	14.87
Chateaugay	25	4	42.3	3.24	.81	13.68
Peru	9	4–5	31.5	3.34	.73	9.26
Hebron	5	3	75.6	4.24	1.41	26.02
Woodbury	8.7	3	36.3	3.84	1.28	19.76
Riverhead	45	4–5	7.5	3.44	.82	.66
Sagaponack	21	10	80.8	9.62	.96	36.87

Total area sprayed in fifteen experiments, 225.6 *acres.*
Average increase in yield per acre, 42.6 *bushels.*
Average total cost of spraying per acre, $5.18.
Average cost per acre for each spraying, 98.5 *cents.*
Average net profit per acre, $13.89.

The following table shows the results of the farmers' business experiments for four years, 1903 to 1906 inclusive.

TABLE III.—SHOWING RESULTS OF BUSINESS EXPERIMENTS, 1903–1906.

Year.	Number of experiments.	Total area sprayed.	Average increase in yield per acre.	Average total cost of spraying per acre.	Average cost per acre for each spraying.	Average net profit per acre.
		A.	*Bu.*			
1903	6	61.2	57	$4.98	$1.07	$23.47
1904	14	180	62.2	4.98	.93	24.86
1905	13	160.7	46.5	4.25	.98	20.04
1906	15	225.6	42.6	5.18	.985	13.89

Average net profit for four years, $20.51 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; and 50 made in 1905, in Bulletin 279.

It was hoped that in 1906 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. Considerable effort was made to secure figures from these tests; and the number reporting is gradually increasing. Yet the returns indicate that the practice of spraying is not extending as fast as its merits warrant.

The highly favorable results obtained in the numerous experiments made by the Station and by New York farmers during the past five 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 1907. The work of the Station along this line is to be continued at least five years longer and it is hoped that we may continue to have the hearty coöperation of potato growers throughout the State. All who spray potatoes with bordeaux mixture are requested to leave a few rows unsprayed in order that it may be determined how much the yield is increased by spraying. The product of unsprayed and sprayed rows adjacent should be *weighed or measured* and the length of the rows measured so that the yields may be accurately determined. We can not use experiments in which the yields have been only estimated. Neither can we use experiments in which the application of poison to the unsprayed rows has been neglected.

The leading features of the 62 volunteer experiments are shown in the following table:

TABLE IV.—SHOWING RESULTS OF VOLUNTEER EXPERIMENTS IN 1906.

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	Gainesville	C. M. Dennis	13	5	287	51	155	14	132	37	$1.05	40	2-horse, home-made, 6-row (2 nozzles per row).
2	West Rush	T. E. Martin	18	15	401	5	273	36	127	29	.80	40	1-horse, home-made, 6-row geared.
3	Cutchogue	Edward Burns	20	9	360	—	240	—	120	—	.59	60	Hudson, 1-horse, 4-row.
4	Plattsburgh	Pardy Bros	9.5	6	235	12	122	41	112	31	.95	50	Aroostook, 2-horse, 6-row.
5	Constableville	G. P. Bernholz	1	4	244	20	140	29	103	51	2.30	40	5-gallon, compressed air.
6	Riverhead	W. L. McDermott	35	6	241	31	140	14	101	17	.....	55	Iron Age, 1-horse, 4-row (2 nozzles per row).
7	Lisbon	S. Miller	1	3	254	44	154	—	100	44	.76	.....	1-horse, home-made.
8	Cherubusco	J. La Clair	4	5	317	43	219	58	97	45	.....	45–47	Watson, 1-horse, 4-row.
9	Phelps	N. L. Rockefeller	13	7	275	31	179	39	95	52	.....	40	E. C. Brown Co., 2-horse, 6-row.
10	Cutchogue	R. W. Sterling	7.5	7	293	20	205	20	88	—	.....	50–60	Hudson, 1-horse, 4-row.
11	Dewittville	G. A. Kirkland	5	6	246	7	158	7	88	—	1.27	50	Spramotor, 1-horse, 4-row (3 nozzles per row).
12	Cassville	P. S. Doolittle	13	6	256	31	169	24	87	7	.87	45	Aspinwall, 1-horse, 4-row.
13	Avoca	C. Sager	16	7	269	45	186	8	83	37	.81	40	Watson, 2-horse, 4-row.
14	Bridgehampton	E. E. Halsey	32	7	189	6	105	44	83	22	.....	55	E. C. Brown Co., 2-horse, 5-row.
15	Bridgehampton	F. C. Howell	15	9	226	35	144	44	81	51	.....	60	Peppler, 1-horse, 6-row (2 nozzles per row).
16	Canandaigua	H. Van Voorhis	14	4	185	17	111	56	73	21	.90	40	Home-made, 2-horse 6-row geared.
17	Schuyler Lake	D. C. Williams	3	4	240	33	168	15	72	18	1.32	40	5-gallon knapsack.
18	Constableville	C. H. Zimmer	1.5	6	306	—	235	—	71	—	1.77	40	4-gallon, compressed air, auto-spray No. 1.

19	Andover	E. R. Crandall	6	6	198	19	129	37	68	42	$0.67	40	1-horse, 4-row.
20	Berkshire	G. W. Brown	4	6	150	47	85	15	65	32	1.00	40	Watson, 1-horse, 4-row.
21	Jordan	F. O. Chamberlin	4.2	7	235	8	175	6	60	2	.....	40	Home-made, 1-horse, 4-row.
22	Riverhead	D. H. Hudson	30	6	228	49	170	13	58	36	.80	50–60	Hudson, 1-horse, 4-row (2 nozzles per row).
23	Atlanta	T. S. Darling	3	4	161	6	104	10	56	56	.92	40	Watson, 1-horse, 4-row.
24	Elba	C. W. Driggs	4	7	214	40	158	—	56	40	1.05	40	2-horse, Aroostook sprayer, rigged for 4 rows.
25	Chateaugay	W. J. Barry	7	5	401	48	347	11	54	37	.75	32	Iron Age, 1-horse, 4-row.
26	Glen Head	T. Powell	10	7	300	—	246	—	54	—	1.00	60	Shangle, 1-horse, 6-row.
27	Clay	C. N. Breman	2.5	4	196	29	144	47	51	42	.....	50	Home-made, 1-horse, 4-row
28	Peru	M. L. Roberts	5	3	143	29	92	18	51	11	.....	45	Iron Age, 1-horse, 4-row.
29	Berkshire	G. W. Belden	2.5	5	215	47	167	53	47	54	.....	40	Watson, 1-horse, 4-row.
30	Cutchogue	F. Tuthill	10	5	309	24	261	40	47	44	.....	60	New Hudson, 1-horse, 4-row.
31	Phelps	D. E. Lyon	18	5	185	3	137	37	47	26	.55	40	1-horse, 4-row sprayer.
32	Hardys	L. H. Taylor	8.5	5	235	38	189	27	46	11	.53	35	1-horse, 4-row, pumped by hand.
33	Interlaken	Bradley Bros	8	5	235	28	189	47	45	47	.95	40	Watson, 2-horse, 4-row.
34	West Rush	D. S. Norris	6	7	191	48	149	3	42	45	.48	40	1-horse, 4-row, home-made power sprayer; E. C. Brown pump.
35	Watermill	C. B. Foster	15	11	248	47	206	35	42	12	.88	50	Shangle, 2-horse, 5-row.
36	Avoca	C. Bellinger	9	5	135	29	94	12	41	17	.....	40–45	Watson, 2-horse, 4-row.
37	Greenfield Center	E. D. Harris	.25	4	178	21	138	1	40	20	.....	75	Hand sprayer.
38	Danville	J. A. Miller	4	4	270	—	230	—	40	—	.56	45	Watson, 2-horse, 4-row.
39	Homer	H. H. Jones	3.5	4	175	—	135	—	40	—	.71	40	
40	Phelps	I. P. Rockefeller	9	6	275	42	237	36	38	6	1.00	40	E. C. Brown Co., 2-horse, 6-row.
41	Memphis	J. A. Klotz	8	3	228	48	193	36	35	12	.75	40	Aspinwall, 1-horse, 4-row.
42	Fulton	V. W. Shattuck	6.5	5	251	3	217	27	33	36	1.59	40	1-horse, 4-row.
43	Cutchogue	W. A. Fleet	12	5	241	44	208	35	33	9	.65	60	Hudson, 1-horse, 4-row.
44	Southampton	Fred Bennett	4.75	8	155	17	124	13	31	4	.78	55	Iron Age, one-horse, 4-row (2 nozzles per row).
45	Macedon	L. F. Allen	7	4	186	13	155	11	31	2	1.00	40	E. C. Brown Co., 2-horse, 6-row.

TABLE IV.—SHOWING RESULTS OF VOLUNTEER EXPERIMENTS IN 1906—*Continued*.

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.*	
46	Avoca	John Fox	5	4	100	55	69	54	31	1	1.07	40	Watson, 2-horse, 4-row.
47	Phelps	L. Salisbury	16	5	132	38	102	1	30	37	.90	40	Aroostook, 2-horse, 6-row (2 nozzles per row).
48	Denmark	H. E. Cook	3	3	448	—	420	—	28	—	1.66	40	Aroostook, 2-horse sprayer, rigged for 4 rows.
49	Coopers	W. L. McConnel	1.75	3	111	8	83	21	27	47	.....	44	Knapsack.
50	Peru	J. Mannix	5	4	227	37	201	11	26	26	.60	40	5-gallon, compressed air.
51	Clifton Springs	P. H. Pettit	13	5	176	55	153	9	23	46	.60	40	E. C. Brown Co., 2-horse, 4-row.
52	Spencerport	F. E. Gott	13	4	200	21	178	14	22	7	.53	40	Aspinwall, 1-horse, 4-row.
53	Malone	T. J. Shields	10	5	154	—	132	—	22	—	.90	38	Aspinwall, 1-horse, 4-row.
54	Glenmore	C. H. Gubbins	1.5	3	189	—	170	6	18	54	.....	40	Knapsack.
55	Syracuse	G. G. Hitchings.	18	7	100	49	82	29	18	20	.71	50	2-horse, 4-row Niagara Gas sprayer.
56	Batavia	G. A. Prole	12	6	208	30	193	15	15	15	.72	42	Home-made, 2-horse pumped by hand, 4 to 5 rows.
57	Phelps	F. A. Salisbury	16	4	146	6	132	11	13	55	.90	40	Aroostook, 2-horse, 6-row (2 nozzles per row).
58	Memphis	W. E. Ward	8	3	188	41	175	15	13	26	1.00	40	Home-made, 1-horse, 4-row.
59	Norwood	W. D. Clark	1	3	252	4	241	59	10	5	.....	50	Rochester hand sprayer.
60	W. Henrietta	Wm. Robert	22	5	222	25	214	2	8	23	.51	35	E. C. Brown Co., 2-horse, 5-row.
61	Ellenburgh	Wm. Brennan	6	5	259	20	259	20	0	0	.....	35	Home-made, 1-horse, 4-row
62	W. Henrietta	C. M. Lyday	7.86	7	271	18	271	18	0	0	.54	42	Peppler's Perfection, 2-horse, 6-row.

The following table shows the results obtained in the volunteer experiments during the past three years,—1904 to 1906 inclusive:

TABLE V.—SHOWING RESULTS OF VOLUNTEER EXPERIMENTS, 1904–1906.

Year.	Number of experiments.	Total area sprayed.	Average gain per acre due to spraying.		Average market price per bushel of potatoes at digging time.
		A.	*Bu.*	*lbs.*	*Cts.*
1904	41	364	58	28	43.5
1905	50	407	59	32	57.0
1906	62	598	53	6	44.5

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 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 four pounds of copper sulphate to each 50 gallons in the first two sprayings and six pounds to 50 gallons in subsequent sprayings. Whenever bugs or flea beetles are plentiful add one to 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.