

BULLETIN No. 156.

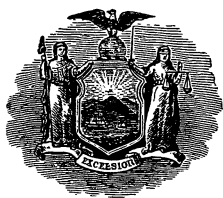
DECEMBER, 1898.

New York Agricultural Experiment Station.

GENEVA, N. Y.

SPRAYING CUCUMBERS IN THE SEASON OF 1898.

F. A. SIRRINE AND F. C. STEWART.



PUBLISHED BY THE STATION.

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*Connected with Fertilizer Control.

† Connected with Second Judicial Department Branch Station.

NEW YORK AGRICULTURAL EXPERIMENT STATION,

GENEVA, N. Y., December 31, 1898.

HON. CHARLES A. WIETING, *Commissioner of Agriculture*,

ALBANY, N. Y.

Sir: I have the honor to submit for publication under the Laws of 1897, Chapter 767, the results of experiments having for their object the control of a disease of cucumbers known as the downy mildew. These experiments have had a most gratifying result. They leave little doubt but that this fungous disease may be controlled by spraying in accordance with the directions given in this and previous bulletins. It is but just to claim, moreover, that this work, which has been carried on during the past three seasons, has saved from destruction an important Long Island industry.

W. H. JORDAN,
Director.

SPRAYING CUCUMBERS IN THE SEASON
OF 1898.

SUMMARY.

Downy mildew is the chief cause of the recent poor crops of late cucumbers in south-eastern New York. Anthracnose has also been destructive in some seasons.

In 1896 the Station made an experiment which showed that the greater part of the damage from downy mildew can be prevented by spraying seven times with Bordeaux mixture.

An experiment made in 1897 showed that when an entire field is sprayed the downy mildew can be wholly prevented. In this experiment a yield of 101,960 merchantable pickles per acre was obtained.

In a second experiment in 1897, on early cucumbers, the yield was increased at the rate of 30,450 fruits per acre, having a weight of 12,405 pounds.

During the season of 1898 cooperative spraying experiments on late cucumbers were conducted in four different localities on Long Island; viz., at Greenlawn, Deer Park, Smithtown Branch and Mattituck. In each case an entire field was sprayed. At Greenlawn the sprayed field contained 1.5 acres sprayed seven times with Bordeaux mixture (1-to-8 formula); at Deer Park, 2 acres sprayed eight times; at Smithtown Branch, 2.15 acres sprayed seven times; and at Mattituck, 2 acres sprayed five times.

Owing to late planting and lack of fertility the crop at Mattituck was a failure. At the other three places the yields of the sprayed fields over unsprayed fields

in the same localities were as follows: At Greenlawn, 80,917 per acre, at Deer Park, 40,675 and at Smithtown Branch 43,226. At Greenlawn the total yield of merchantable pickles per acre was 120,917.

The cost of spraying per acre for each application was as follows: At Greenlawn, \$3.39; Deer Park, \$2.76; Mattituck, \$3.20; and Smithtown Branch, \$2.43.

The value per acre of the increased yield above the cost of spraying was as follows: At Greenlawn, \$73.74; Deer Park, \$22.51; Smithtown Branch, \$37.00.

The crop on these three experiment fields was profitable; that is, after deducting the total cost of growing, gathering and spraying from the value of the crop there was left, in each case, a net profit. At Greenlawn the net profit was \$67.13 per acre; at Deer Park, \$13.35 per acre; and at Smithtown Branch, \$6.74 per acre.

At \$1.25 per thousand, pickles can probably be profitably grown on Long Island if spraying is practiced and the crop given proper care.

In practice, the cost of spraying can be made considerably smaller than it was in these experiments--it can probably be reduced one-half.

According to our estimate, the average yield of unsprayed fields of late cucumbers on Long Island in 1898 did not exceed 34,000 per acre.

On Long Island, cucumbers should be sprayed as follows: Commencing some time between July 15 and August 1, spray thoroughly with Bordeaux mixture (1-to-8 formula) once every eight or ten days until frost.

INTRODUCTION.

During the past six or seven years late cucumbers in south-eastern New York have suffered severely from disease. On Long Island and in Westchester Co. where cucumbers are grown extensively for pickling the losses from "blight" have been so great as to cause many growers to abandon the crop. Anthracnose and the bacterial or wilt disease have been responsible for a part of the damage but the greater part of it has been caused by the downy mildew, *Plasmopara cubensis* (B. & C.) Humph. The latter fungus made its first appearance¹ in the United States in 1889 since which time it has spread so rapidly that it has become one of the most destructive diseases of late cucumbers. It now occurs quite generally throughout the north-eastern United States as far west as Ohio, where it has been very destructive,² and appears to be spreading westward. No special effort has been made to determine its distribution in New York but reports indicate that it is in nearly all parts of the State, although there are still a few localities where it is unknown. Besides the previously mentioned localities in south-eastern New York we have, during the past season, personally observed it at Albany and Geneva where it was destructive. There are no indications of its abatement; on the contrary it seems to be steadily advancing. In localities where it has previously occurred it may be expected to reappear to a destructive extent the coming season; and localities in which it has not yet occurred cannot reasonably expect to remain much longer exempt from its ravages. However, the amount of damage which it does depends very largely upon the temperature between July 15 and August 15. A high temperature and frequent light rains during this period furnish ideal conditions for the propagation of the fungus.

¹ Halsted, B. D. Some Notes upon Economic Peronosporæ for 1889, in New Jersey. Journal of Mycology, 5: 201.

² Selby, A. D. Prevalent Diseases of Cucumbers, Melons and Tomatoes. Ohio Agr. Exp. Sta. Bul. 89, D. 1897.

PREVIOUS EXPERIMENTS.

In 1896.—In 1896 the Station made an experiment³ in which it was shown that this downy mildew can be prevented by spraying the plants with Bordeaux mixture.

A field of late cucumbers containing one and three-fourths acres was divided into five plats, three of which were sprayed and the other two unsprayed, the sprayed plats alternating with the unsprayed. Spraying was commenced when the plants were quite small and repeated at intervals of from six to eleven days until frost. In all, seven applications were made.

The plants on the unsprayed plats were so violently attacked by downy mildew that they ceased to produce any merchantable fruit after August 21. The sprayed plants produced, after this date, cucumbers which were sold for \$260, which is at the rate of \$173 per acre. There was, however, toward the close of the season, considerable disease on the sprayed plats, enough to materially reduce the yield. This was due to the proximity of the diseased plants on the unsprayed plats. It was believed that if no unsprayed plants had been left to furnish a breeding place for the fungus the sprayed plants might have been kept practically free from disease up to the close of the season.

In 1897.—In order to determine what may be accomplished when no unsprayed plants are left, another spraying experiment⁴ on late cucumbers was made in 1897.

An exact acre of late cucumbers was sprayed eight times. There were no unsprayed plants in the immediate vicinity, the nearest source of infection being an unsprayed muskmelon patch about thirty rods distant. When frost came the plants were entirely free from downy mildew and anthracnose although both of these diseases were abundant in most of the cucumber fields in the vicinity. The acre yielded 101,960 merchantable cucum-

³ The details of this experiment are reported in Bulletin 119. The Downy Mildew of the Cucumber: What It Is and How to Prevent It.

⁴ Reported in Bul. 138: 641-643.

bers while the average yield of unsprayed fields was probably less than 20,000 per acre.

A second experiment⁵ was made in 1897. Two hundred hills were planted in May. One-half of these were thoroughly sprayed throughout the season,—in all, fourteen times. The other half were not sprayed.

The yield⁶ per acre for the sprayed plants was at the rate of 71,000 fruits weighing 25,265 pounds; for the unsprayed plants at the rate of 40,650 fruits weighing 12,860 pounds. Hence, the increase in the number of fruits per acre due to spraying was 30,450 and the increase in weight 12,405 pounds. The sprayed plants suffered considerably from anthracnose but not at all from downy mildew.

EXPERIMENTS IN 1898.

INTRODUCTORY.

During the season of 1898 cooperative spraying experiments on late cucumbers were conducted in four different localities on Long Island; viz.: at Greenlawn, Deer Park, Mattituck and at Smithtown Branch. In each case an entire field was sprayed. At Greenlawn the sprayed field contained one and one-half acres, sprayed seven times; at Deer Park, two acres, sprayed eight times; at Mattituck, two acres, sprayed five times; and at Smithtown Branch, 2.15 acres, sprayed seven times.

THE TERMS OF COÖPERATION.

The Station bore all expense of spraying and directed how and when it should be done. The owners of the fields experimented upon performed all of the operations connected with growing, gathering and marketing the crop according to their own judgment and at their own expense; and carried out the spraying under the direction of a representative of the Station.

Therefore, the Station is responsible for the spraying only, and does not commit itself to the recommendation of any of the cultural methods employed on these experiment fields.

⁵ Reported in Bul. 138: 636-639.

⁶ These yields are not comparable with the yields in the preceding experiment because the fruits were allowed to attain greater size.

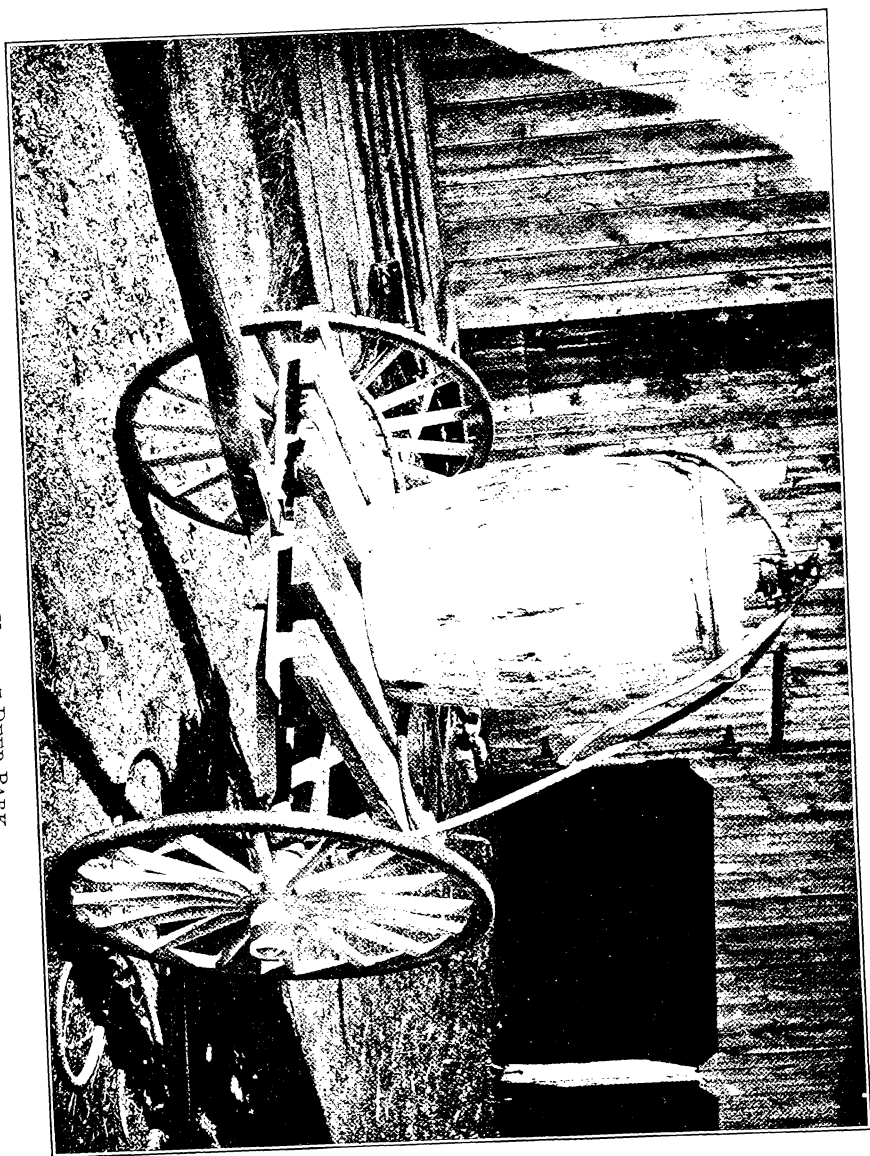


PLATE I.—THE OUTFIT USED AT DEER PARK.

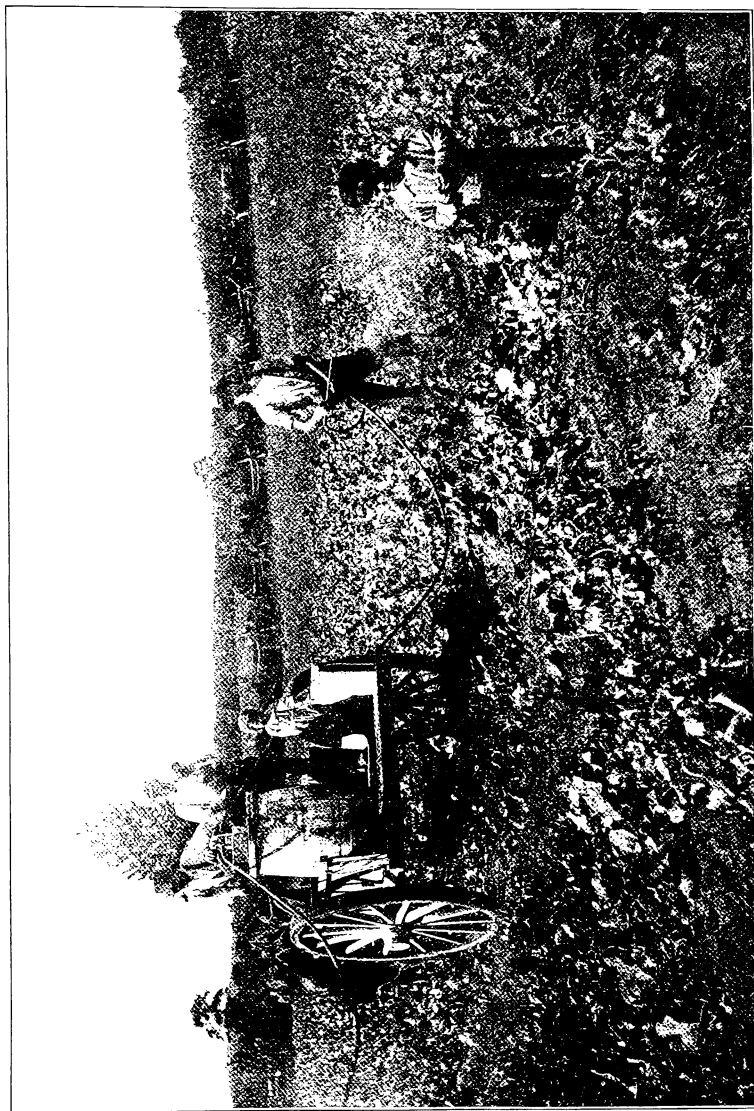


PLATE II.—THE OUTFIT USED AT GREENLAWN.

THE SPRAYING OUTFIT.

The spraying outfit used consisted essentially of a two-wheeled cart which carried a spray pump mounted in a 50-gallon barrel and fitted with two leads of hose twenty feet long. Three men were required to operate the outfit, one to drive and pump and and two others to manage the nozzles. An idea of the general style of the outfit may be obtained from Plates I and II.

The outfits used at the different places differed only in the character of the cart. The pump, barrel and fittings were the same in each case and cost \$27.46. The items are as follows :

1 "Eclipse" spray pump ⁷	\$ 10.00
40 ft. "Maltese Cross" hose.....	10.00
2 stop-cocks	1.50
Freightage on spray pump.....	0.65
4 nozzles	2.40
1 barrel	0.65
4.5 ft. brass tubing.....	0.56
3 strap-irons and bolts.....	0.45
Lumber	0.50
Labor	0.75
Total.....	\$ 27.46

The pump was fastened into the barrel by means of a detachable head⁸ which was secured to the barrel by three strap bolts. This method of attaching the pump has been found not only more convenient but stronger than simply fastening it to the head which comes with the barrel.

The hose used was what is known to the trade as "Maltese Cross," warranted not to rot and to stand a pressure of 600 pounds of steam to the square inch. A three-foot one-fourth-inch brass tube, furnished with a stop cock and bent at one end was used to connect the hose with the nozzles.

At the end of each lead of hose a single nozzle was used in the first two sprayings but when the vines covered the ground two nozzles were used. The two nozzles were attached to the three-foot brass tube by means of a short brass T. The bend in the three-foot tube was made at an angle of from 35 to 40 degrees. Each arm of the T was about nine inches long and bent at about

⁷Manufactured by Morrill & Morley, Benton Harbor, Mich.

⁸Described and illustrated by W. P[addock]. Rural New Yorker, 57 : 299. 23 Apr., 1898.

the same angle as the main tube, the object being to bring the orifices of the two nozzles about eighteen inches apart. "Deming Vermorel" nozzles were used and found very satisfactory for such work.

The twenty feet of heavy half-inch hose was somewhat unwieldy and awkward to handle. In fact, it was impossible to prevent dragging the vines unless the workman took a half twist of the hose around his body and over his shoulder. Hence we would recommend the use of a lighter hose because it would be more easily handled and also cheaper.

THE EXPERIMENT AT GREENLAWN.

(1) *Preparation and planting*.—The field, which contained one and one-half acres, scant, was plowed twice about six inches deep, after which one-half ton of "Great Eastern" fertilizer was applied broadcast and the field harrowed. The seed (Early Cluster) was planted June 20 in raised hills four feet apart each way. Eight loads⁹ of well rotted stable manure were applied in the hills.

(2) *Cultivation and spraying*.—The field was cultivated twice each way with an ordinary mold-board plow, a hoe being used around the hills. The vines were sprayed seven times with Bordeaux mixture¹⁰ as follows: July 20 and 30; August 9, 18 and 21; and September 2 and 13.

(3) *Yield and value of the crop*.—The first picking was made August 6. The total yield of first-class pickles¹¹ from the one and one half acres was 179,375, or 119,583 per acre; there were also sold from the field 2,000 nubs¹² which brings the total yield¹³ of merchantable pickles up to 120,917 per acre.

⁹A load is usually estimated as a ton.

¹⁰In all of the experiments in 1898 the Bordeaux mixture was made according to the 1-to-8 formula.

¹¹The small cucumbers used for pickling are universally called "pickles."

¹²Deformed fruits are called "nubs" or "crooks."

¹³There were thrown away 9000 culls and it was estimated that 21,000 nubs and spoiled pickles were left on the field. The excessively hot weather at the close of August caused pickles to turn yellow very rapidly. Such pickles were pulled from the vines and left on the field. Dry weather in September favored the growth of nubs.

Of the first-class pickles, 13,400 were sold at \$.75 per M., and the balance at \$1.25 per M. The nubs brought \$.50 per M. The total value of the crop was \$218.51 or \$145.67 per acre.

Unsprayed fields in the vicinity of Greenlawn did not average more than 40,000 per acre. Therefore, the increase in yield due to spraying was 80,917 per acre.

YIELD OF CUCUMBERS ON THE SPRAYED FIELD AT GREENLAWN.
(One and one-half acres.)

Date.	Number picked.	Total.	Price received.
August 6..	2,100	16,300	Sold in N. Y. City at \$1.25 (net) per M.....\$20.37.
" 8..	5,800		
" 10..	8,400		
" 13..	6,425		
" 15..	5,375		
" 17..	7,125		
" 19..	10,625		
" 20..	7,700		
" 22..	9,200		
" 23..	9,050		
" 25..	10,300		
" 26..	9,650		
" 27..	2,700		
" 29..	13,225		
" 31..	9,375		
Sept. 3..	16,850	149,675	Sold at salting house at \$1.25 per M.....\$187.09.
" 5..	8,200		
" 7..	7,500		
" 10..	10,000		
" 13..	6,375	13,400	Sold in N. Y. City at \$.75 (net) per M.....\$10.05.
" 16..	9,100		
" 19..	4,300	2,000	Nubs sold at \$.50 per M....\$1.00.
	Total	181,375	Total value of crop, \$218.51.
		Yield per acre, 120,917. Value of crop per acre, \$145.67.	

(4) *Cost of spraying one and one-half acres at Greenlawn.*

(a) Cost of materials for spraying	\$ 5.90
Copper sulphate.....	\$ 3.60
One barrel lime.....	1.50
Expressage.....	0.80
(b) Labor ¹⁴	27.25
(c) Allowance for wear of spraying outfit.	2.46
Total.....	<u>\$35.61</u>
Cost per acre.....	23.74

(5) *Cost¹⁵ of growing and gathering one and one-half acres at Greenlawn.*

Eight loads of stable manure	\$18.00
One thousand pounds of fertilizer.....	16.00
Preparation of land.....	5.00
Seed.....	1.20
Planting.....	2.00
Cultivation	7.00
Rent of land.....	6.00
Gathering crop.....	<u>36.00</u>
	\$91.20
Credit to value of stable manure for the following crop	9.00
Net cost.....	<u>\$82.20</u>
Cost per acre	54.80

(6) *Profit.*

Total value of crop on one and one-half acres...	\$218.51
Cost of spraying one and one half acres.....	\$35.61
Cost of growing and gathering one and one-half acres	82.20
Cost of growing, gathering and spraying one and one-half acres.....	<u>\$117.81</u>
Net profit on one and one-half acres.....	\$100.70
Net profit per acre.....	67.13

(7) *Notes on experiment at Greenlawn.*—The experiment field was situated on the farm of David R. Smith. It was triangular in shape and contained nearly one and one-half acres. For a time the stand was perfect and the plants healthy, but later in the season the bacterial or wilt disease caused some unevenness. This is shown in the photograph of the field (Plate III). After September 13 the yield was light and the pickles had a tendency to be "nubby." This was apparently due to exhaustion of the

¹⁴Labor is estimated at \$1.50 per day for a man and \$3.00 per day for a team. One-half day allowed for each spraying.

¹⁵Estimated by D. R. Smith, the owner.

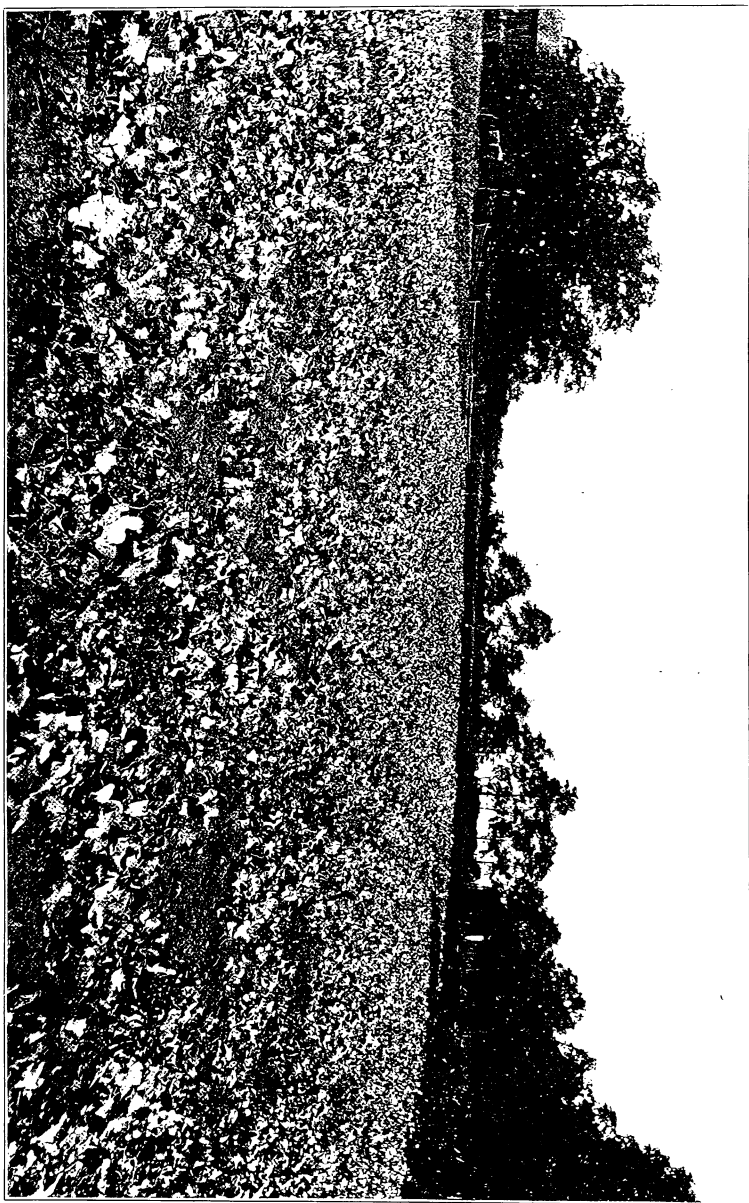


PLATE III.—THE SPRAYED FIELD AT GREENLAWN.
Photographed September 13.

vines and dry weather. There was very little downy mildew. On September 29 the owner pulled the vines in order to prepare the land for winter wheat. The vines were at that time still green, free from disease and bearing a few pickles. A few "withy" pickles were found where the vines were injured by the wilt disease, but no gummy pickles were found during the entire season.

THE EXPERIMENT AT DEER PARK.

(1) *Preparation and planting.*—The field, which contained two acres, was plowed once, then thirty-one tons of well rotted stable manure applied broadcast, after which the field was plowed twice more, each plowing being from five to six inches deep. The ground was thoroughly harrowed just before planting.

At the time of planting, 400 pounds of fertilizer were applied in the hills. The seed¹⁶ (Early Prolific) was planted July 1 in level hills four feet apart in the row, the rows being four feet six inches apart.

(2) *Cultivation and spraying.*—The field was cultivated with a cultivator, three times each way, and hoed once around the hills. The vines were sprayed eight times with Bordeaux mixture on the following dates: July 22 and 29; August 8, 17 and 22; and September 1, 9 and 19.

(3) *Yield and value of the crop.*—The first picking was made August 19. The total yield¹⁷ of first-class pickles from the two acres was 151,350, or 75,675 per acre.

The crop, not being grown under contract, was sold at prices varying from \$1 to \$1.50 per thousand, the total receipts being \$166.48 or \$83.24 per acre. The average yield of three typical unsprayed fields in the vicinity of Deer Park was 35,000 per acre. The increase in yield due to spraying was, therefore, 40,675 per acre.

¹⁶The seed was purchased in Iowa for Early Prolific, but on account of the rank growth of vines and large size of the fruits the owner is of the opinion that the seed was not true to name and that the variety was in reality Long Green, or some similar variety. It is possible, however, that the rank growth of vines and fruit was due to an excess of fertility.

¹⁷In addition to the yield given, it is estimated that 25,000 nubs and yellow pickles were either culled out or left on the field.

YIELD OF CUCUMBERS ON THE SPRAYED FIELD AT DEER PARK.

(Two acres.)

Date.	Number picked.	
August 19..	2,150	
" 23..	4,950	
" 24..	5,800	
" 25..	5,050	
" 27..	7,750	
Sept. 1..	8,050	
" 2..	14,400	
" 5..	14,800	
" 6..	3,600	
" 7..	5,350	
" 8..	3,600	
" 9..	3,300	
" 10..	5,850	
" 12..	6,800	
" 14..	3,000	
" 15..	11,100	
" 16..	5,600	
" 19..	6,600	
" 20..	5,400	
" 23..	8,500	
" 27..	6,500	
" 29..	5,500	
October 5..	4,500	
" 12..	3,000	
" 17..	200	
Total.....	151,350	First-class pickles sold for \$166.48.
		Yield per acre, 75,675. Value of crop per acre, \$83.24.

(4) Cost of spraying two acres at Deer Park.

(a) Cost of materials for spraying.....	\$11.75
Copper sulphate.....	\$ 8.75
Lime	2.50
Freightage	0.50
(b) Labor (same rates as at Greenlawn).....	30.00
(c) Allowance for wear of spraying outfit.....	2.46
Total	\$ 44.21
Cost per acre.....	\$ 22.10

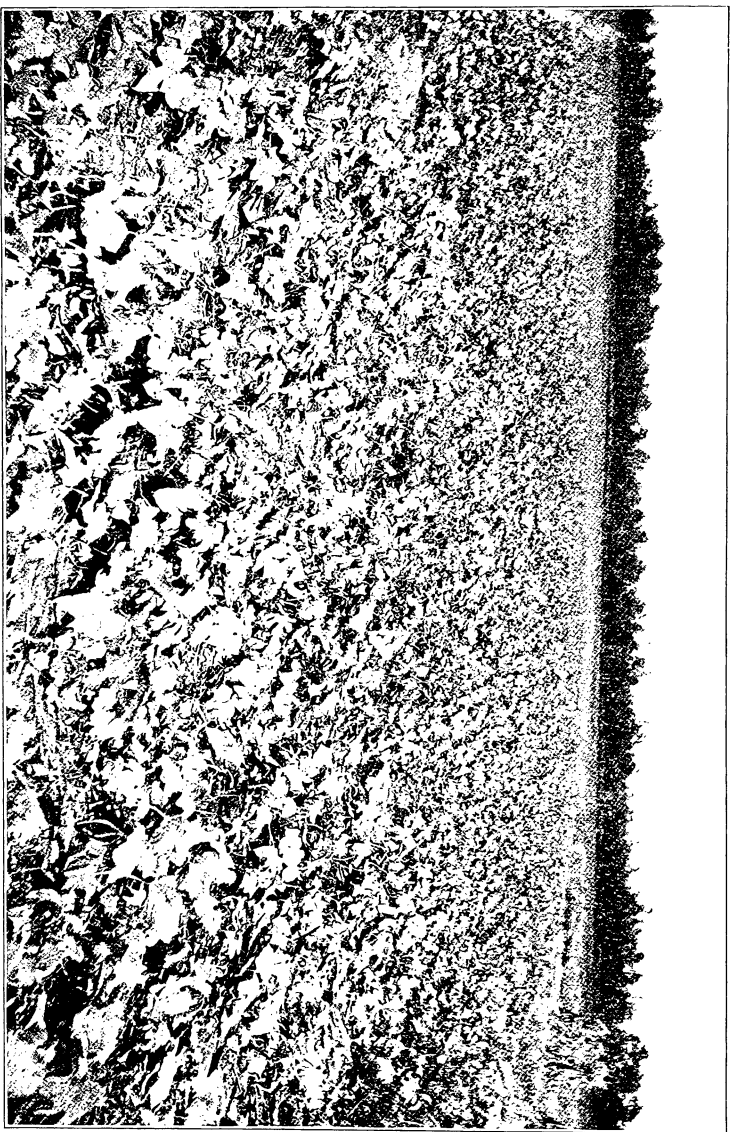


PLATE IV.—THE SPRAYED FIELD AT DEER PARK.
Photographed September 28.

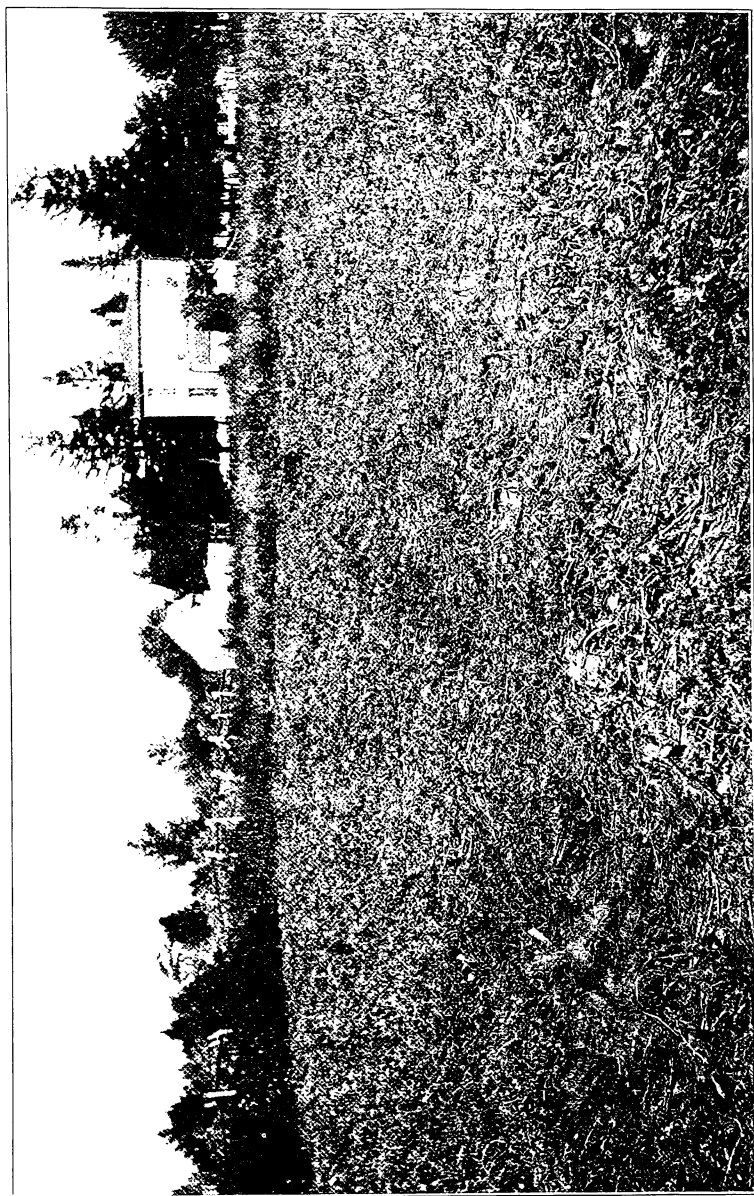


PLATE V.—AN UNSPRAYED FIELD AT DEER PARK.
Photographed September 28.

(5) *Cost¹⁸ of growing and gathering two acres at Deer Park.*

31 tons stable manure.....	\$46.50
400 lbs. fertilizer.....	7.00
Rent.....	5 00
Plowing three times.....	9.00
Preparing and planting.....	6 00
Cultivating and hoeing.....	6.00
Seed.....	2.00
Gathering crop at \$0.25 per M.....	37.33
	<hr/>
	\$118.83
Credit to value of stable manure for the following crop.....	23.25
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Net cost.....	\$ 95 58
Cost per acre.....	\$ 47.79

(6) *Profit.*

Total value of crop on two acres.....	\$166.48
Cost of spraying two acres.....	\$44.21
Cost of growing and gathering two acres.....	95 58
	<hr/>
Cost of growing, gathering and spraying two acres	\$139.79
	<hr/>
Net profit on two acres.....	\$ 26.69
Net profit per acre.....	\$ 13.35

(7) *Notes on experiment at Deer Park.*—The experiment field at Deer Park was on C. W. Conklin's farm. It was nearly square in form and contained two acres. No disease of any kind affected the vines and none of the pickles were gummy or withy. It was rumored that Mr. Conklin intended to pick pickles all winter. The vines were slightly injured by a light frost which occurred September 29, but were not finally killed by frost until October 17.

THE EXPERIMENT AT MATTITUCK.

(1) *Preparation and planting.*—This field, which contained two acres, scant, was on clover sod plowed June 9. On June 23 it was harrowed twice with a spading harrow and once more with a smoothing harrow just before planting.

The seed (Early Cluster) was planted July 8 in level hills four feet apart in the row, the rows being five feet apart. A good many hills failed to come up. These were replanted July 16.

¹⁸ Estimated by C. W. Conklin, the owner.

One-half ton of fertilizer was applied in the hills at the time of planting.

(2) *Cultivation and spraying.*—The field was cultivated three times each way with an ordinary cultivator. The vines were sprayed five times with Bordeaux mixture as follows: July 22, August 1, 9 and 17, and September 1.

(3) *Yield and value of the crop.*—The first picking was made August 26. The yield from the two acres was 41,875 large pickles, 7,080 small ones and 8,525 nubs, making a total yield of 57,480 merchantable pickles,¹⁹ which is at the rate of 28,470 per acre. The large ones were sold under contract at \$1.25 per M. the smaller ones at \$0.60 per M. and the nubs at \$0.50 per barrel (775 nubs made a barrel). The total value of the crop was \$60.44.

The foreman of the salting house at Mattituck estimated that the average yield of unsprayed fields in that section was 40,000 per acre. Hence, the sprayed field yielded 11,260 per acre less than unsprayed fields in the same locality.

YIELD OF CUCUMBERS ON THE SPRAYED FIELD AT MATTITUCK.

(Two acres.)

Date.		Large.	Small.	Nubs.
August	26.....	3,925	225	
"	27.....	3,900	410	
"	29.....	2,550	350	
September	1.....	5,950	1,100	
"	3.....	7,300		775
"	5.....	3,200	300	2,325
"	7.....	2,300	250	775
"	10.....	3,350	800	
"	12.....	2,100	650	775
"	15.....	2,225	900	1,550
"	17.....	2,100	600	1,550
"	19.....	1,100	650	775
"	22.....	950	530	
"	26.....	925	315	
Total.....		41,875	7,080	8,525

¹⁹ Besides 35,000 (estimated) nubs and yellow pickles left on the field.

VALUE OF CROP.

40,000 large, sold at salting house at \$1.25 per M.....	\$50.00
6,235 small, sold at salting house at \$0.60 per M.....	3.74
8,525 nubs (11 bbls.) sold at salting house at \$0.50 per bbl.	5.50
1,875 large, } sold in New York City.....	1.20
845 small, }	
Total value of crop	\$60.44
Yield per acre.....	28,740
Value of crop per acre.....	\$30.22
(4) <i>Cost of spraying two acres at Mattituck.</i>	
(a) Cost of materials for spraying.....	\$5.45
Copper sulphate.....	\$3.60
One barrel lime.....	1.50
Expressage.....	0.25
(b) Labor (same rates as at Greenlawn.)	23.40
(c) Allowance for wear of spraying outfit.....	2.46
Total	\$31.21
Cost per acre.....	\$15.60
(5) <i>Cost²⁰ of growing and gathering two acres at Mattituck.</i>	
1000 pounds fertilizer.....	\$12.42
Rent of land	10.00
Gathering crop.....	15.00
Seed.....	.75
Preparation, planting and cultivation.....	20.50
Total	\$58.67
Cost per acre.....	29.33
(6) <i>Loss.</i>	
Total value of crop on two acres.....	\$60.44
Cost of spraying two acres.....	\$31.21
Cost of growing and gathering two acres.....	58.67
Cost of growing, gathering and spraying two acres	\$89.88
Total loss on two acres.....	\$29.44
Total loss per acre.....	\$14.72

(7) *Notes on the experiment at Mattituck.*—The field at Mattituck was on the farm of A. L. Downs. It was rectangular and contained nearly two acres. At the time of the first spraying (July 23) the stand was very uneven. Many of the hills were not yet up.

The small yield of this field was not due to disease. Downy mildew appeared only in traces and there was very little wilt disease. No gummy pickles were observed. Probably, the causes of the small yield were: Late planting, poor stand and lack of

²⁰ Estimated by A. L. Downs, the owner.

fertility. As late as September 9 the plants did not cover the ground.

THE EXPERIMENT AT SMITHTOWN BRANCH.

(1) *Preparation and planting.*—The field, which contained 2.15 acres, was prepared as follows: First, a heavy coating of manure was plowed under; then the ground was harrowed four times with an "Acme" harrow, after which one-half ton of fertilizer (Quinnipiac Market Garden) per acre was applied broadcast.

The seed (Early Prolific) was planted June 23 in level hills four feet apart each way. Missing hills were replanted June 29.

(2) *Cultivation and spraying.*—After the plants were well started they were thinned to three in a hill. The field was cultivated three times each way and hoed once.

The vines were sprayed seven times as follows: July 20 and 28; August 5, 13, 20 and 27; and September 9.

(3) *Yield and value of the crop.*—The first picking was made August 11. The total yield²⁰ of first-class pickles from the 2.15 acres was 143,600 or 66,790 per acre. These pickles were put into a coöperative pickle house; hence the price will depend upon the selling price of the pickled goods. Estimating their value at \$1.25 per M., the price paid at other salting houses, the value of the crop would be \$179.50 or \$83.49 per acre.

The average yield of unsprayed fields in the vicinity of Smithtown Branch was 23,564 per acre, this being the average yield of the only four unsprayed fields the product of which was delivered at the Smithtown salting house.

Therefore, the increase in yield due to spraying was 43,226 per acre.

²⁰During the hot weather about September 1, 4000 pickles turned yellow and had to be thrown away. It was estimated that 10,000 yellow pickles and nubs were left on the field.

YIELD OF CUCUMBERS ON THE SPRAYED FIELD AT SMITHTOWN BRANCH.
(TWO AND FIFTEEN ONE-HUNDREDTHS ACRES.)

Date.	Number picked.	
August II..	240	
" 13..	600	
" 16..	2,300	
" 17..	2,000	
" 19..	6,875	
" 20..	8,765	
" 22..	8,675	
" 24..	1,000	
" 25..	7,350	
" 26..	8,885	
" 27..	7,145	
" 29..	4,625	
" 30..	7,550	
" 31..	4,950	
Sept. 1..	7,350	
" 3..	14,995	
" 5..	2,750	
" 7..	5,535	
" 8..	4,725	
" 9..	4,035	
" 12..	8,000	
" 13..	4,050	
" 16..	10,350	
" 19..	6,250	
" 26..	4,600	
Total	143,600	First-class pickles. Value, at \$1.25 per M., \$179.50
		Yield per acre, 66,790. Value of crop per acre, \$83.49.

(4) *Cost of spraying 2.15 acres at Smithtown Branch.*

(a)	Cost of materials for spraying.....	\$ 7.90
	Copper sulphate.....	\$5.70
	One barrel of lime.....	1.50
	Freightage70
(b)	Labor (same rate as at Greenlawn).....	26.25
(c)	Allowance for wear of spraying outfit.....	2.46
Total		\$36.61
Cost per acre.....		17.03

(5) *Cost²¹ of growing and gathering 2.15 acres at Smithtown Branch.*

Thirty loads of stable manure.....	\$45.00
One ton of fertilizer.....	32.00
Preparing and planting.....	11.00
Cultivation.....	9.00
Three pounds of seed.....	.90
Gathering and marketing.....	43.00
Rent of land.....	10.00
	<hr/>
	\$150.90
Credit to value of stable manure for the following crop.....	22.50
	<hr/>
Net cost.....	\$128.40
Cost per acre.....	59.72

(6) *Profit.*

Total value of crop on 2.15 acres.....	\$179.50
Cost of spraying 2.15 acres.....	\$36.61
Cost of growing and gathering 2.15 acres.....	128.40
	<hr/>
Cost of growing, gathering and spraying 2.15 acres	\$165.01
	<hr/>
Net profit on 2.15 acres.....	\$ 14.49
Net profit per acre.....	6.74

(7) *Notes on the experiment at Smithtown Branch.*—The field at Smithtown Branch was on the farm of G. W. Hallock and Son and contained 2.15 acres. Over most of the field the vines covered the ground. A little injury resulted from the wilt disease and consequently there were a few withy pickles. No gummy pickles were found. On September 7 it was discovered that downy mildew had become established in a few spots ; it did not, however, cause more than a slight amount of damage. About this time a good many pickles turned yellow on account of the excessively hot weather.

THE PROFIT FROM SPRAYING.

In three of the above experiments—at Greenlawn, Deer Park and Smithtown Branch, spraying was certainly profitable ; that is, the value of the extra yield due to spraying was considerably greater than the cost of spraying. At Greenlawn, the owner of the sprayed field received \$97.48 per acre more than his neighbors who did not spray. To get this \$97.48 per acre it cost only \$23.74,

²¹ Estimated by G. W. Hallock, the owner.

leaving a balance of \$73.74 per acre which is net²² profit from spraying. At Deer Park the net profit was \$22.51 per acre and at Smithtown Branch \$37.00 per acre. The experiment at Mattituck should be left out of consideration because it is perfectly plain that the crop was not properly managed. Spraying cannot supply fertility nor counteract the ill effects of late planting.

From the accompanying table it will be seen that the yield per acre at Greenlawn was nearly twice as great as at Smithtown Branch²³ although the two fields were treated practically alike so far as spraying is concerned, each being sprayed seven times. We will not attempt an explanation of this, because it is partly a question of cultural methods, which is a subject foreign to the present discussion, but we mention it to impress the idea that spraying does not *produce* pickles; its purpose is to protect the vines from disease, thereby giving them a chance to produce all of the pickles of which they are capable under the conditions furnished by the farmer. With this fact in mind, it is plain that the farmer, himself, is an important factor in determining the amount of profit to be derived from spraying. In other words, the farmer who gives his crop the best care will get the most profit from spraying.

Another factor is the cost of spraying. The lower the cost of spraying the greater will be the profit, assuming, of course, that the spraying is properly done. The cost of spraying in these experiments is undoubtedly greater than it would be on larger fields in ordinary farm practice. The cost of spraying also depends to a large extent upon the way it is managed.

Still another factor is the severity of the diseases, downy mildew and anthracnose. When the diseases do not appear until the latter part of August and are mild in their attacks the profit from spraying will not be nearly so great as when the diseases appear during the first week in August and are very virulent. However, so far as Long Island is concerned, it is safe to say that the diseases will be sufficiently destructive in any season to justify the expense of spraying.

²² This does not take into consideration the expense of gathering the increase.

²³ Probably due in part to difference in variety grown.

TABLE SHOWING THE INCREASE IN YIELD AND THE PROFIT FROM SPRAYING CUCUMBERS.

Location of experiment.	Yield per acre.		Increase in yield due to spraying.	Value of the increase per acre.	Cost of spraying per acre.	Profit per acre from spraying.
	Sprayed.	Un-sprayed.				
Greenlawn	120,917	40,000	80,917	\$97.48	\$23.74	\$73.74
Deer Park.....	75,675	35,000	40,675	\$44.61	\$22.10	\$22.51
Mattituck	28,740	40,000	—11,260		\$15.60	
Smithtown Branch.	66,790	23,564	43,226	\$54.03	\$17.03	\$ 37.00

THE PROFIT IN GROWING PICKLES.

Since the yield of the late cucumbers has become so discouragingly small a great many farmers have been in doubt as to whether the crop is any longer a profitable one on Long Island. The very small crops in 1896 and 1897 caused a good many to give up pickle growing. There were many others who decided to try one more season. These have been somewhat encouraged, because the crop of 1898 was considerably better than those of the preceding two years. Our estimate of the average yield of unsprayed fields on Long Island in 1898 is 34,000 per acre. The weather conditions in 1898 were fairly good for pickles, especially the months of July and August, and since the downy mildew did not appear until about August 20, early planted fields produced a fair yield before the vines were killed by disease. It is probable that there were a good many unsprayed fields which paid expenses and some which returned a small profit. However, it is our belief that a majority of the unsprayed fields failed to pay expenses.

In this connection it is interesting to observe how the sprayed fields came out financially. The following table shows the cost of growing and gathering, cost of spraying, value of crop and the net profit on the four experiment fields :

THE COST OF GROWING, GATHERING AND SPRAYING AND THE PROFIT
ON THE EXPERIMENT FIELDS.

Location of experiment.	Cost per acre of growing and gathering.	Cost per acre of spraying.	Total cost per acre growing, gathering and spraying.	Value of crop per acre.	Net profit per acre.
Greenlawn	\$54.80	\$23.74	\$78.54	\$145.67	\$67.13
Deer Park.....	\$47.79	\$22.10	\$69.89	\$ 83.24	\$13.35
Mattituck	\$29.33	\$15.60	\$44.93	\$ 30.22	Loss \$14.71
Smithtown Branch.	\$59.72	\$17.03	\$76.75	\$ 83.49	\$6.74

In each case, except on the field at Mattituck (which does not count), there was a profit over and above all expense of growing, gathering and spraying.

From observations made on cucumber spraying experiments during the past three years we believe we are safe in saying that there is considerable profit in growing pickles on Long Island at \$1.25 per thousand provided spraying is practiced and the crop is given proper care.

COMMENTS ON THE COST OF SPRAYING.

Although the spraying outfits used in the four experiments were essentially identical and the fields sprayed of approximately the same size the cost of spraying varied considerably, as may be seen from the following table :

TABLE SHOWING COST OF SPRAYING CUCUMBERS.

Location of experiment.	Area sprayed.	Cost of spraying per acre.	Number of applications.	Cost per acre for each application.
	<i>Acres.</i>			
Greenlawn	1.5	\$23.74	7	\$3.39
Deer Park.....	2	\$22.10	8	\$2.76
Mattituck.....	2	\$15.60	5	\$3.20
Smithtown Branch	2.15	\$17.03	7	\$2.43

The differences may be due in part to variation in thoroughness of spraying. The more thorough the spraying the greater the amount of labor. The facilities for obtaining water also have a bearing on the cost of spraying.

Spraying was most expensive at Greenlawn where each application cost \$3.39 per acre, and least expensive at Smithtown Branch where it cost \$2.43 per acre. The greater expense at Greenlawn is explained in part by the following : Both at Greenlawn and Smithtown Branch each application spoiled a half-day, and consequently a half day's labor was charged, although the

acreage at Smithtown Branch was more than one-fourth greater than at Greenlawn.

In all of these experiments one-half day was allowed for each spraying, while in no case was a full half day required to do the work. Sometimes the work was completed within two hours. Consequently, the actual cost of spraying was less than it is given in the table.

The cost might also have been lessened if the fields had been planted in such a way that a one-horse cart could have been used to haul the outfit. Such an outfit can be easily handled by one horse provided the field is not hilly, but there is a difficulty to overcome—either the cart must have a tread of sufficient width to cover two rows (which requires the wheels to be nine or ten feet apart) or else special roadways must be prepared for the passage of the cart. In a former bulletin²⁴ we suggested that the cucumbers be planted in strips of about seven rows each, leaving between the strips open spaces twelve feet in width. In the center of each open space two rows of some low growing plant, like late cabbage or cauliflower could be planted. In fields so planted, a one-horse cart could be used without injury to the cucumber vines.

The figures given in the above table represent the maximum cost of spraying. In practice, they can probably be reduced one-half, and, on large fields, perhaps more. For small fields of from one to two acres, knapsack sprayers do very well, but it is hard disagreeable work to operate them.

BRIEF DIRECTIONS FOR SPRAYING CUCUMBERS ON LONG ISLAND.

Commencing sometime between July 15 and August 1st, spray thoroughly with Bordeaux mixture (1-to-8 formula) once every eight or ten days until frost. When heavy rains occur it may be necessary to spray oftener. The leaves should be kept constantly covered with Bordeaux mixture.

²⁴N. Y. Agrl. Expt. Sta. Bul. 119:180.

²⁵Regardless of the age of the plants.