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Agricultural Experiment Station

BULLETIN No. 174

AN EFFICIENT AND PRACTICABLE METHOD
FOR CONTROLLING MELON LICE

By C. E. DURST



URBANA, ILLINOIS, JULY, 1914

SUMMARY OF BULLETIN No. 174

1. Melon lice are very difficult to combat successfully because of the fact that they live mainly on the undersurfaces of the leaves, and that, in order to destroy them, their bodies must be hit with a material that kills by contact.

Page 322

2. An attack by melon lice commonly begins on a single hill, or on a few hills scattered over a patch. By timely treatment of the first infested hills, combined with the work of predaceous insects, the lice may often be controlled. However, in seasons favorable for rapid multiplication, the lice eventually spread over the entire patch in spite of such treatment.

Page 322

3. The lice suck the juices from the plant and cause the leaves to curl. The plants are weakened, and the crop is reduced, both in quality and quantity. In the case of severe attacks, the vines are often killed outright.

Page 322

4. Severe attacks of melon lice can be controlled by spraying with a commercial preparation of nicotine sulphate known as "Black Leaf 40." The applications may be made effectively with a barrel pump, equipped with lead of hose, bamboo rod, and nozzle with bent shank and fine cap.

Page 324

5. A solution of "Black Leaf 40" as strong as one part to 250 of water will not injure melon foliage, but a 1-to-500 solution is as effective against the lice and is recommended when particularly quick results are desired. A 1-to-1000 solution is practically as efficient and is recommended for use in commercial operations.

Page 326

6. With proper equipment and thoro application, it is possible to kill practically every melon louse on the vines. The material appears to be so destructive to the lice that the finest mist, coming in contact with their bodies, is capable of killing them.

Page 328

7. When the vines are of medium size, about 200 gallons of solution are required for spraying an acre of "rowed" melons. Allowing a 1-to-1000 solution, the "Black Leaf 40" for this amount would cost \$2.50.

Page 330

8. Whale-oil soap and tobacco decoction are fairly efficient for controlling melon lice if applied repeatedly, but do not compare with "Black Leaf 40" in effectiveness or in the ease with which they may be prepared.

Page 331

9. In the tests at this station, fumigation with carbon bisulphide did not prove to be an efficient or practicable method for controlling attacks of melon lice.

Page 332

10. Kerosene emulsion cannot be used with safety for spraying muskmelons and cucumbers.

Page 332

11. Home-made lime sulfur solution injures melon foliage when used as weak as 1 part to 40 of water, and does not control the lice when used as strong as 1 part to 20 of water.

Page 333

12. RECOMMENDATIONS.

Page 334

AN EFFICIENT AND PRACTICABLE METHOD FOR CONTROLLING MELON LICE

By C. E. DURST, ASSOCIATE IN OLERICULTURE

INTRODUCTION

Muskmelons have occupied a prominent place in the vegetable tests of the Illinois Agricultural Experiment Station for the last twelve years. During that time considerable experience has been gained in combating the melon louse (*Aphis Gossypii* Glover), an insect which is often extremely destructive to this crop, as well as to cucumbers and watermelons and, in a lesser degree, to other cucurbitaceae.¹ The principal materials and methods formerly recommended for the control of this insect have been employed from time to time, but none of them has proved satisfactory in the case of a severe attack. Besides being unsatisfactory, some of them were found to be impracticable for use under certain conditions of vine growth.

During the season of 1910, a commercial preparation of nicotine sulphate, known as "Black Leaf 40,"² was tested at the experimental plantation at Anna, Union county, Illinois, and gave promising results. Subsequent tests have shown it to be far more efficient for combating melon lice than any other material with which this station has had experience. It has further been found that a barrel pump, properly equipped, may be successfully used for the application of this material under any field conditions which may arise, thus rendering laborious hand methods unnecessary and reducing the treatment for serious attacks of this insect to a practicable basis.

The details of these tests, together with a resumé of several other methods and materials tested on various occasions, are presented in the following pages.

¹ Other plants infested by this aphid (Chittenden, F. H., U. S. Bur. Ent. Cir. 80, November, 1906) are cotton, okra, orange and other citrus fruits, strawberry, purslane, clover, bean, beet, spinach, tomato, hop, pear, and a number of ornamental plants and common weeds.

² "Black Leaf 40" is a concentrated solution of nicotine sulphate containing 40 percent of nicotine, manufactured by the Kentucky Tobacco Product Company, Louisville, Kentucky.

HABITS AND NATURE OF ATTACK OF THE MELON LOUSE

The melon louse obtains its subsistence by sucking the juices from the host plant, drawing them out by means of its beak, which it inserts in the tissues. It has a tender body and cannot withstand exposure to direct sunlight; hence it lives mainly on the undersurfaces of the leaves. The insect may, however, attack the upper surfaces with equal severity when those parts are shaded.

An attack of melon lice commonly begins on a single hill, or on a few hills scattered over a patch. Occasionally, infestation is more or less general from the start. Sometimes the attack begins while the plants are yet small, but more often about the time the weather is becoming warm and the vines have begun to run. Occasionally, however, the attack does not become severe until comparatively late in the season; for instance, in 1912 the lice did not become abundant in Union county until the latter part of August, when the picking season was drawing to a close.

The extraction of vital juices from the plants weakens them, and the crop is reduced both in quantity and quality. The first visible effect is a curling downward of the edges of the leaves. When an attack is allowed to proceed unchecked, a condition is soon reached like that shown in Fig. 1. The insects multiply with great rapidity under favorable weather conditions, and often within a week or ten days after the first notice of infestation they have spread over a large area and caused irreparable damage. In the case of a severe attack, especially in dry weather, the plants may be killed outright.

Because of its habit of obtaining food by sucking the juices of the plant, the melon louse is not affected in the least by the poisonous substances that would be quickly fatal to chewing insects. The most practicable method of combating it is to bring into touch with its body some material that is capable of killing by contact. The tender body of the insect renders it readily susceptible to such treatment. The material used, besides being capable of destroying the insect, must be one that will not injure the foliage. These circumstances, combined with the fact that the insect lives chiefly on the undersurfaces of the leaves, which are not easily reached with a spray, make it a most difficult matter to combat a severe attack successfully.

It is a practice of many growers to watch closely for the first infested hills, and to treat the lice there as soon as discovered. The chief methods of doing this are by burying the infested vines, by burning straw over the hills, by spraying thoroly with a contact insecticide, or by dusting the plants with fine tobacco powder or pyrethrum. These practices, coupled with the work of the ladybird beetles (Coc-



FIG. 1.—MELON HILL SHOWING AN ADVANCED STAGE OF ATTACK BY MELON LICE

cinellidæ),¹ which are the chief predaceous insect enemies of the melon louse, often suffice to control an attack and are certainly to be recommended. However, it is a matter of experience reported by practical growers, and it has been observed at this station, that in a season favorable for rapid multiplication of the lice, they eventually spread over the patch in spite of all precautionary single-hill treatments and the work of the ladybird beetles combined.

SPRAYING WITH "BLACK LEAF 40"

TESTS IN 1910 AND 1911

"Black Leaf 40" was tested by this station for the first time at Anna, Union county, in 1910. Other methods of combating the lice on individual hills having been employed with indifferent success, solutions of this material were applied to infested plants by means of an atomizer. As is usual in handling this apparatus, it was necessary for one person to turn the vines while another directed the spray. Two strengths of material were used: 1 part in 250 parts of water, and 1 part in 500 of water. Both solutions were noticeably effective against the lice and did not injure the foliage. Altho this treatment served to hold the insects in check, it was impossible, on account of the inadequacy of the equipment used, to exterminate them as thoroly as was desired. The material gave such satisfactory results, however, that it was decided to give it further trial another season.

In 1911 the lice appeared at Anna early in the season on a number of hills scattered at intervals over the patch. Such hills, as soon as discovered, were buried if found badly infested, and if only moderately so, were sprayed with "Black Leaf 40," 1 part to 250 parts of water. An atomizer was again used for making the application. These methods, combined with the work of the ladybird beetles, which were fairly abundant, sufficed to hold the lice in control for a time. However, on July 10 they were found scattered over the entire melon plantation. The weather was warm and the soil was fairly moist.² The vines were growing rapidly and were full of sap. Under these conditions the lice multiplied very rapidly, and it was apparent that

¹ There are several species of this family, nearly all of which eat melon lice.

² From July 1 to 10 the maximum and minimum temperatures were as follows:

	Max.	Min.		Max.	Min.
July 1.....	102.5	66	July 6.....	95	75
July 2.....	102	68	July 7.....	98	72
July 3.....	106	74	July 8.....	92	73.5
July 4.....	106.5	76	July 9.....	94	74
July 5.....	99	76	July 10.....	98	74

There was a rain of 0.38 inch June 24 and a light shower July 4.

more heroic and practicable methods than the single-hill treatments would have to be employed if the melons were to be saved. Accordingly, on July 13 a barrel pump was rigged out with a lead of hose, bamboo rod, and single vermorel nozzle with bent shank and fine cap; and the entire plantation was sprayed with "Black Leaf 40," 1 part to 300 of water.¹ The spraying outfit was drawn thru the patch on a stone boat. In applying the spray, high pressure was used and the nozzle was worked under and between the leaves so as to cover the vines as thoroly as possible. The vines had been "rowed"² for cul-



FIG. 2.—MELON VINES WHICH HAVE BEEN "ROWED" FOR CULTIVATION ARE MORE EASILY TREATED FOR LICE

tivation, as shown in Fig. 2, so that it was not so difficult to do this as would have been the case if no training had been done.³

The day after the spraying, scarcely a live louse could be found. Even on the leaves so situated that it seemed unreasonable to suppose that the spray had reached the lice, a diligent search was required to find any surviving insects. Coincident with the death of the lice, the large black ants which had accompanied them also disappeared.

¹ The preparation of this solution is very simple, it being only necessary to measure out the desired amount of the material and mix it with the water.

² "Rowing" consists simply in turning the vines during the growing season, so that they will run in the direction of the rows. Two or three trainings are necessary during a season to keep the vines within bounds.

³ At the time the spraying was done, the vines from adjacent hills had become well entangled and the first fruits were ripening.

The spray proved so effective against the lice that it was decided to submit it to further tests as soon as opportunity afforded, and among other things, to determine the most desirable strength to use; but the lice did not appear again at Anna during the season in sufficient numbers to permit such tests.

At Urbana in 1911, the same results were secured as at Anna. The lice became very abundant during the latter part of August, at which time some of the melons were ripening. The area devoted to melons was not large enough to test adequately different strengths of the material; so all the vines were sprayed with a solution containing 1 part of "Black Leaf 40" in 300 of water, the applications being made in the same way as at Anna. Examination two days after spraying showed practically all the lice to be dead, and the insects did not reappear in sufficient numbers to be of any consequence.

TESTS IN 1912

At Anna in 1912 lice appeared during early July on a number of hills scattered over the area devoted to melons, but disappeared for the time being.¹ A period of cool weather began July 17 and continued almost unbroken until August 15. It appeared that this cool weather prevented the lice from multiplying rapidly, so that the ladybird beetles, which were fairly numerous, were able to take care of them. With the return of warm weather, however, the lice reappeared and soon were found to be very abundant.

At this time the picking season was nearing its close, and while it was unnecessary to treat the lice so far as the crop was concerned, it was decided to take advantage of the opportunity to make a test of various strengths of "Black Leaf 40." In fact, it seemed an ideal time for putting the material to a rigid test, for the vines had attained their full growth, and the leaves were more or less worn with age. These circumstances combined to make the foliage, especially near the middle of the rows, less accessible to a spray than is ordinarily the case at the time treatment for lice is necessary. As a whole, the vines and foliage were yet in very excellent condition, considering their age.

On August 21 plats of equal size were sprayed with different strengths of "Black Leaf 40," as follows:

- 1 part in 300 of water
- 1 part in 500 of water
- 1 part in 600 of water
- 1 part in 800 of water
- 1 part in 1000 of water

The applications were made between 1 and 3 p. m., with the same equipment and in the same manner as in 1911. During the night

¹ No attempt had been made to combat the lice on individual hills.

following the application, there was a dashing rain amounting to 0.8 inch.

Examination on August 23, two days after the spraying, showed the following results: The 1-to-300, 1-to-500, and 1-to-600 solutions of "Black Leaf 40" appeared to be equally effective in destroying the lice. None of these strengths injured the foliage, and all of them killed practically every insect on the plants, even on the leaves so curled or so situated in the centers of the hills that the lice on them were apparently out of reach of the spray. The 1-to-700 and weaker solutions seemed to have left more lice on the foliage not well exposed, varying with the weakness of the solution. In no case, however, did it appear that enough of the insects had escaped to cause a serious infestation within a reasonable length of time. On well-exposed leaves, the lice were as effectually destroyed by the weaker solutions as by any.

Further examination of the sprayed plats on August 27 and 30 showed that the weaker solutions had controlled the insects much better than was apparent at the time of the first examination. Not enough lice could be found, even on the plat sprayed with 1 part "Black Leaf 40" in 1000 parts of water, to be of any practical significance. No harm had resulted to the foliage from the use of even the strongest solutions. Examinations of unsprayed plants at the same time showed a great number of lice present and many leaves curled as a result.

In order to make further tests of the strength of "Black Leaf 40" required, another set of plats, which had not been treated before, was sprayed on August 27. The applications were made between 1 and 3 p. m. The day was bright and warm. Many melon leaves were much curled at this time from the effects of the lice. The strengths of "Black Leaf 40" used were as follows:

- 1 part in 400 of water
- 1 part in 600 of water
- 1 part in 800 of water
- 1 part in 1000 of water
- 1 part in 1200 of water

Examination on the following day showed that practically all the lice were dead on the plat sprayed with the 1-to-400 solution. There seemed to be a few more lice left by each succeeding weaker solution, but the differences were so slight as to be scarcely recognizable on contiguous plats; it was necessary to go from one of the weaker to one of the stronger solutions to observe a noticeable difference. The 1-to-1000 strength of "Black Leaf 40" had killed nearly all the insects, and gave every indication of being sufficiently strong to control the situation well enough to warrant recommending its use in commercial practice. The 1-to-1200 solution at this time appeared to have left too many of the insects, especially on leaves not well ex-

posed, to warrant advising its use. Further examination on August 30 showed very few lice on any of the plats. Apparently, many of the insects which were alive at the time of the previous examination had succumbed during the three-day interval. So few lice were found at this time on the plat sprayed with the 1-to-1200 solution that this strength appeared capable of controlling them. As in the previous test, no foliage injury had resulted from the use of any of the solutions. On unsprayed plants, the lice continued to be abundant and had caused serious damage.

SUMMARY OF TESTS WITH "BLACK LEAF 40"

To summarize the results of the tests with various strengths of "Black Leaf 40," it may be stated that a solution as strong as 1 part of the material to 250 of water may be used without injury to melon foliage. One part to 500 or 600 of water is as effective against the lice and is recommended for use when particularly quick results are desired. A solution containing 1 part of the material to 1000 of water is somewhat slower in action, but from a practical viewpoint will prove as effective as a stronger solution. In the tests from which these conclusions are drawn, a 1-to-1000 solution destroyed practically all the lice each time it was used, and gave every indication of being capable of controlling serious attacks of the insects well enough to warrant recommending its use in commercial practice. In view of only the one test made with a solution weaker than 1 part to 1000 of water, even tho apparently successful, it is not considered feasible to advise a weaker solution. It is possible, however, that further tests may prove a weaker solution to be capable of controlling the lice satisfactorily.

METHOD OF APPLICATION

While the material itself and its proper dilution are highly important matters in successfully combating melon lice, they are not more important than the method of application.

In the first place, the "Black Leaf 40" solution must come into direct contact with the insects if they are to be destroyed. When this material was first applied with the barrel outfit in 1911, it was thought, in view of the extremely satisfactory results obtained, that possibly it killed by its fumes, or in some other way than by coming into direct contact with the insects at the time of application. It was not supposed that the spray had reached the undersurfaces of many of the leaves lying close to the ground or near the center of the hills, yet the lice were killed on practically every leaf of the plants. To make a test of this point, a plat was sprayed in 1912, at Anna, merely over the tops of the vines with a 1-to-300 solution of "Black Leaf 40."

This treatment did not kill the lice, except on well-exposed leaves, while on other plants sprayed under the leaves at the same time, they were killed. Evidently this material must come into direct contact with the insects if it is to destroy them.

The above circumstance suggests that the spray, when properly applied, reaches more of the vine than would ordinarily be supposed.



FIG. 3.—NEAR VIEW OF THE UNDERSURFACE OF A MELON LEAF BADLY INFESTED WITH LICE

In 1912 the plants were closely examined on several occasions after applying the spray, and it was found that the material had actually reached the undersurfaces of practically every leaf, tho in many cases it was present only in very fine particles scattered over the surface, such as would be deposited from a mist. When the method of appli-

cation is taken into account, it is not difficult to understand why this should be the case. The vermorel nozzle, which was used in these tests, throws an especially fine spray near the nozzle opening. With the very fine cap, the bent shank, the high pressure, and the care taken in applying the material, it may be readily understood why it was possible to reach the undersurfaces of practically every leaf on the plants.

Many melon growers have been of the opinion that it is not feasible to control a serious attack of lice because of the impracticability of reaching the insects with the spray, but in view of the results obtained at this station with "Black Leaf 40," it appears that the difficulty had been due to ineffectiveness on the part of the materials used rather than to the impossibility of thoro application. With the proper equipment and the exercise of care in applying the spray, it is possible, without very much trouble, to reach practically every part of the plants. "Black Leaf 40" is apparently so destructive to the lice that the finest mist made by the nozzle, coming in contact with their bodies, is capable of killing them.

AMOUNT OF MATERIAL REQUIRED

In order to determine how much "Black Leaf 40" would be required to spray a given area, an observation was made at Anna on August 27, 1912, regarding the amount of liquid needed to spray an area amounting to one-eleventh of an acre. The application was made with the same equipment and in the same manner as that previously described. Eighteen gallons of solution were required to cover the vines properly. This is at the rate of 198, or practically 200, gallons per acre.¹

The vines sprayed in this test had attained only a moderate size during the season, and more material would undoubtedly be required when growth is heavy. Also, on account of the vines being "rowed," less material was necessary than would otherwise have been the case. On the other hand, it should be remembered that these vines had attained their full seasonal growth, and that for spraying early in the season, when the vines are not fully developed, less material would be required.

COST OF SPRAYING WITH "BLACK LEAF 40"

"Black Leaf 40" is sold in cans of various sizes, at the prices indicated below:

10½ pounds	\$12.50
2½ pounds	3.25
½ pound.....	.85

The material has a specific gravity of 1.20 to 1.24, varying some-

¹ Incidentally, it may be said that a 1-to-500 solution was used, and that the lice were effectually destroyed.

what with the amount of inert substances present. A gallon usually weighs a little more than ten pounds. Thus, it will be seen that the 10½-pound can contains approximately one gallon of material. Therefore, allowing for a 1-to-1000 solution and using 200 gallons per acre, the material required for spraying an acre of melons for melon lice would cost \$2.50. The expense will vary from this, of course, with the size of the vines and the method of training, but it is safe to regard this amount as being somewhere near the correct figure.

TEST OF OTHER MATERIALS

As stated in the introduction, other materials besides "Black Leaf 40" have been tested from time to time. Whale-oil soap was employed on various occasions previous to the season of 1909. Fumigation with carbon bisulphide was given a thoro trial in 1909. Lime-sulfur solution was tested in 1912. Kerosene emulsion and tobacco decoction, while not used by the Station for combating melon lice, have been used by the author in commercial work. A brief account of the facts revealed in the tests with these materials is presented in the following pages.

WHALE-OIL SOAP SOLUTION

Whale-oil soap has been employed on a number of occasions at this station for combating melon lice, dating back to 1901, but it has never proved more than partially effective in controlling them. Two strengths of solution have been used; 1 pound of the soap to 8 gallons of water, and 1 pound to 6 gallons of water. The former strength has been found only fairly satisfactory. It was always necessary when there was a severe attack of the lice to apply the spray repeatedly to hold them in check. The stronger solution was found somewhat more effective, but injured melon and cucumber foliage under some weather conditions.

In addition to being only fairly efficient, whale-oil soap solution is not easily prepared. The quickest way to make the solution is to cut the soap into thin slices and dissolve it in boiling water, at the rate of about a pound to a gallon of water. This is what is called a stock solution, and may be prepared in advance. When it is desired to make the application, this stock solution is diluted with the quantity of water necessary to make a solution of the desired strength. Thus, it will be seen that the preparation of whale-oil soap solution is not a small task. Incidentally, it is also a somewhat disagreeable task, at least to some persons, on account of the unpleasant odor of the soap. Compared with "Black Leaf 40," whale-oil soap is not only much less easily prepared, but it is far less effective in controlling the lice.

FUMIGATION WITH CARBON BISULPHIDE

Considerable has been written during recent years in regard to fumigating individual plants for lice with poisonous gases. The materials commonly suggested for this purpose are carbon bisulphide, hydrocyanic acid gas, and various tobacco preparations.

Tests with carbon bisulphide for the control of melon lice were conducted at Anna during the season of 1909. The literature on the subject was first reviewed fully, and in making the tests the recommended amounts, and also larger and smaller amounts, were used. Each amount was used for the recommended length of time and also for longer and shorter periods. For covering the plants, butter tubs were used. In all cases where any appreciable number of the lice were killed, the plants were more or less injured. In every case where the plants survived the treatment, many of the insects also survived.

Besides proving inefficient, several practical difficulties were encountered during the course of the tests which showed fumigation methods to be impracticable for use under some conditions which present themselves in a melon patch. The plants may be covered readily while small, but after they have begun to spread, the vines must be handled more or less roughly to bring them within the limits of the covers, which operation is always attended with more or less damage. Furthermore, it is often found necessary to treat melon and cucumber vines for lice after they have reached full size. Covering under such conditions is altogether impracticable. In addition to this difficulty, fumigation was found to be a slow and tedious process in the field. Another minor objection is that the fumes of carbon bisulphide are somewhat poisonous and very inflammable. The operator must not smoke while using carbon bisulphide. From the tests made, it was concluded that fumigation with carbon bisulphide is not an efficient or practicable method for controlling melon lice.¹

TOBACCO DECOCTION AND KEROSENE EMULSION

These two materials, while not tested by the Experiment Station for controlling lice on melons or cucumbers, have been used by the writer in commercial work. Tobacco decoction, made by boiling vari-

¹ Hydrocyanic acid gas, while not used by this station for combating melon lice, would undoubtedly meet with the same practical disadvantages, and in addition would be particularly objectionable because of its extremely deadly nature. Fumigation tests with various tobacco extracts, prepared papers, and tobacco smoke have been reported from several sources as giving satisfaction. While these materials may undoubtedly be employed with greater personal safety and less danger of injury to foliage than carbon bisulphide or hydrocyanic acid gas, their use is without a doubt beset by the same practical disadvantages.

ous tobacco materials in water, was found to be fairly effective, but it had to be applied repeatedly in order to hold the lice in check. It appeared to be somewhat more efficient than whale-oil soap solution for controlling the insects, but the results obtained from its use have no comparison with those derived at this station from the use of "Black Leaf 40." Besides being incapable of holding severe attacks of the lice in check without repeated application, tobacco decoction is inconvenient to make, and its strength is always more or less uncertain because of the variation in the strength of tobacco materials used in its preparation.

Kerosene emulsion was used on several occasions, but at no time did it prove satisfactory for treating melon lice. It invariably produced serious injury to the foliage, even when prepared with the most extreme care and according to the most approved directions. In fact, it seems impossible, under practical conditions, to so make this material that it will not injure melon foliage. In the opinion of the author, kerosene emulsion is altogether unsuited for spraying tender-foliaged plants like muskmelons and cucumbers, and should be omitted from the many spray calendars where it now occurs recommended for that purpose.

LIME-SULFUR SOLUTION

Lime-sulfur solution has given such universal satisfaction as a contact insecticide in combating scale insects that it was thought that possibly a weak solution of the material, such as is used for the summer spraying of fruits, might be used with effect in controlling melon lice. In order to make a test of its qualities for this purpose, several plats of muskmelons were sprayed at Anna, in 1912, with different strengths of solution. Home-made lime sulfur was used, each gallon of concentrated material containing $1\frac{1}{2}$ pounds of sulfur. On August 26 plats of equal size were sprayed with the following strengths of solution:

- 1 part in 20 parts of water
- 1 part in 25 parts of water
- 1 part in 30 parts of water
- 1 part in 35 parts of water
- 1 part in 40 parts of water

The same equipment and the same method of application were employed as are described in connection with the tests with "Black Leaf 40." The applications were made between 1 and 3 p. m., and the day was bright and warm, as was the case with most of the tests with the above material.

Examination on August 27, the day following the applications, showed that fully one-third of the lice were still alive on the plat sprayed with the 1-to-20 solution, and that on all the plats the foliage had been badly injured, the stronger solutions causing the greatest

damage. In view of these tests, it was concluded that lime-sulfur solution, at least in the strengths used, cannot be employed with safety for spraying muskmelons, and that even tho it could, it would not be an efficient material for controlling melon lice.

RECOMMENDATIONS

This experiment station has had more or less experience in combating melon lice for the past twelve years. During that time a number of the more important materials recommended for the control of this insect have been used, but none of them has given as satisfactory results as a commercial preparation of nicotine sulphate, known as "Black Leaf 40," which has been thoroly tested for three seasons.

This material will not injure the melon foliage when used as strong as 1 part to 250 of water. One part to 500 or 600 of water is to all appearances as effective, and should be used when particularly quick results are desired. One part to 1000 of water will prove practically as effective, and is recommended for use in commercial practice.

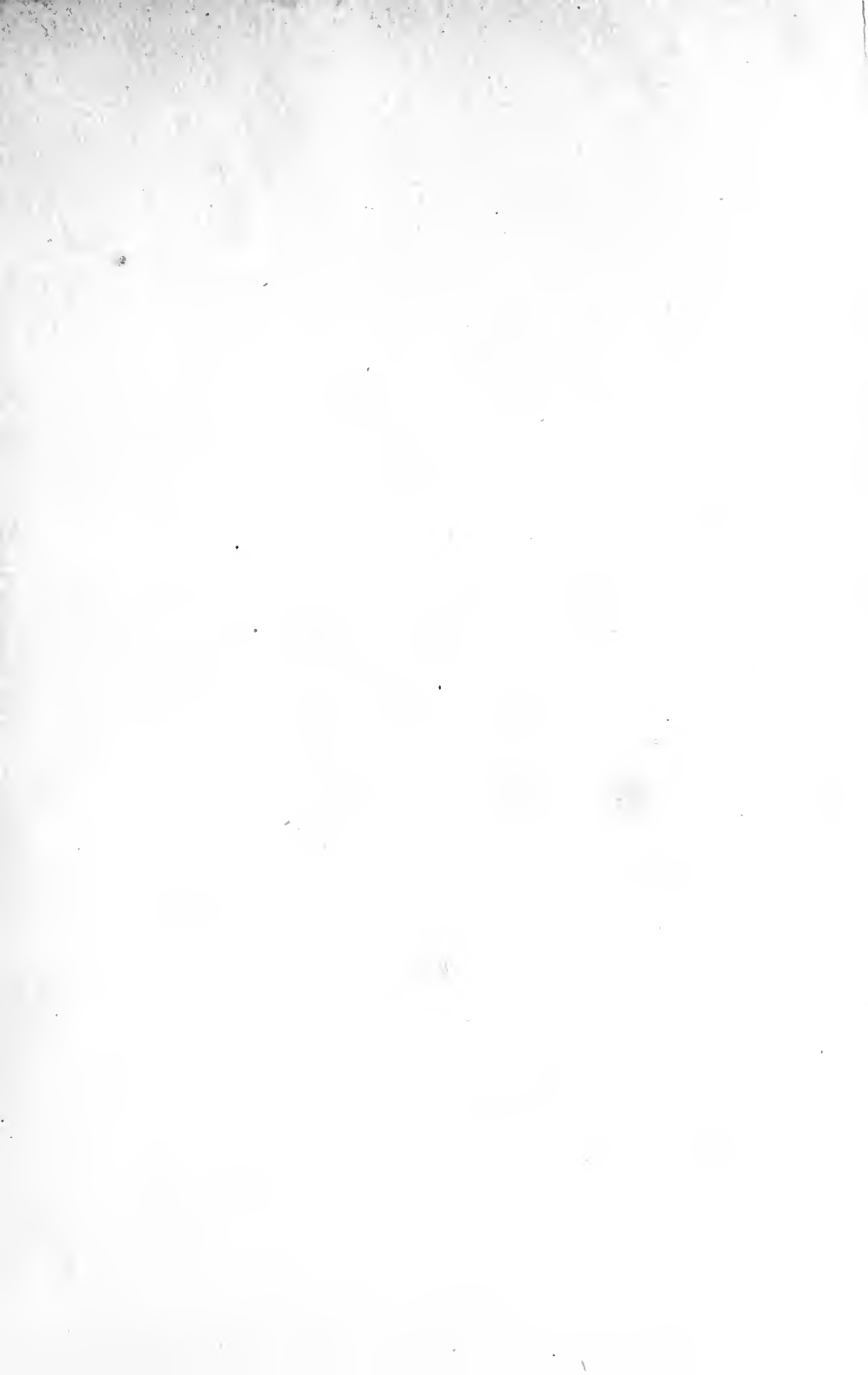
In the tests from which these conclusions are drawn, a barrel pump, equipped with lead of hose, bamboo rod, and nozzle with bent shank and fine cap was successfully used for making the applications. Any outfit capable of throwing a fine spray with reasonable force may be used with equal success.

The type of nozzle used is an important matter in treating melon lice. It should have a bent shank so that the undersurfaces of the leaves may be reached; and it should have a fine cap in order that the material may be distributed as a very fine mist. A single vermored nozzle will be found better adapted to this purpose than some other nozzles for the reason that it throws a finer mist near the opening.

In applying the spray, high pressure should be used and the nozzle should be carefully moved about under and between the leaves. With due care in handling the nozzle, it is possible to reach the undersurfaces of practically every leaf on the plants. "Black Leaf 40" solution is apparently so destructive to the lice that the finest mist, coming in contact with their bodies, is capable of killing them.

It will be found easiest to apply the spray to melon and cucumber vines that have been "rowed." This operation consists simply in turning the shoots during the growing season so that they will run in the direction of the rows, and, as described in a previous publication¹ of this station, is highly advisable for purposes of weed killing and moisture retention. It is feasible, however, to treat melon vines for lice that have not been "rowed," tho more time and material would be required.

¹ Circular No. 139.









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