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The Corn Ear Worm on Tomatoes

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AGRICULTURAL EXPERIMENT STATION
Knoxville

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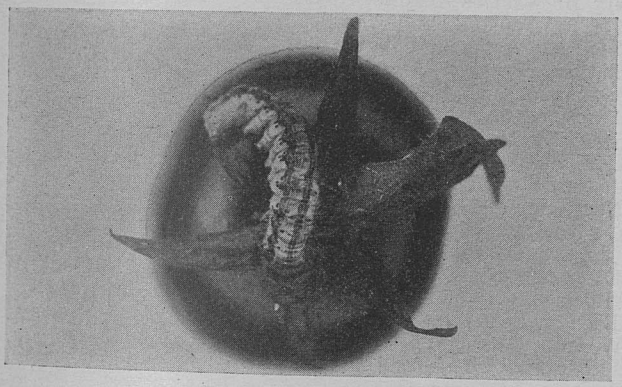
BY

S. MARCOVITCH AND S. A. ROBERT



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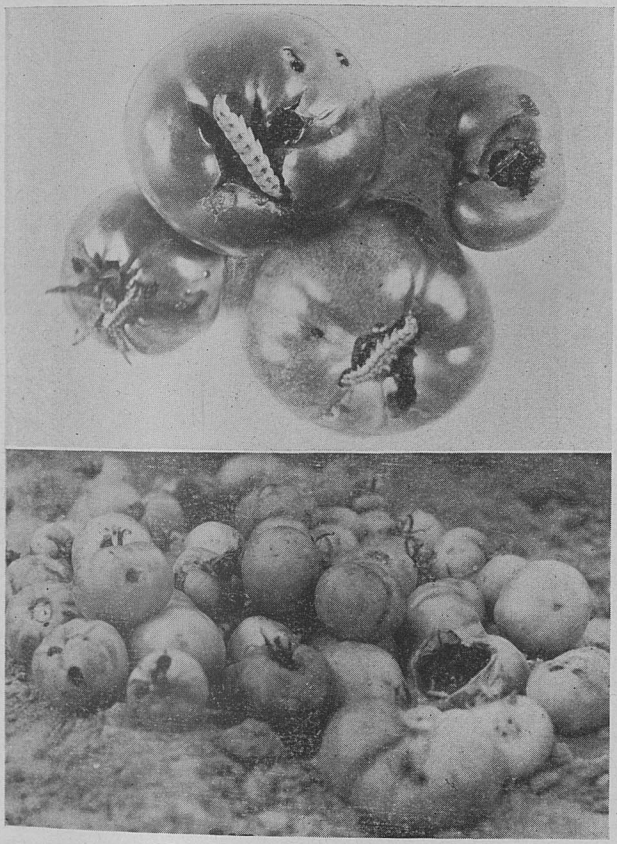
THE CORN EAR WORM ON TOMATO

By
S. Marcovitch and S. A. Robert

INTRODUCTORY

The corn ear worm is the worst tomato pest in Tennessee. Crosby and Leonard, in their Manual of Vegetable Garden Insects, recommend spraying and the use of corn as a trap crop for control measures. A careful search of the literature revealed few data as to just how useful

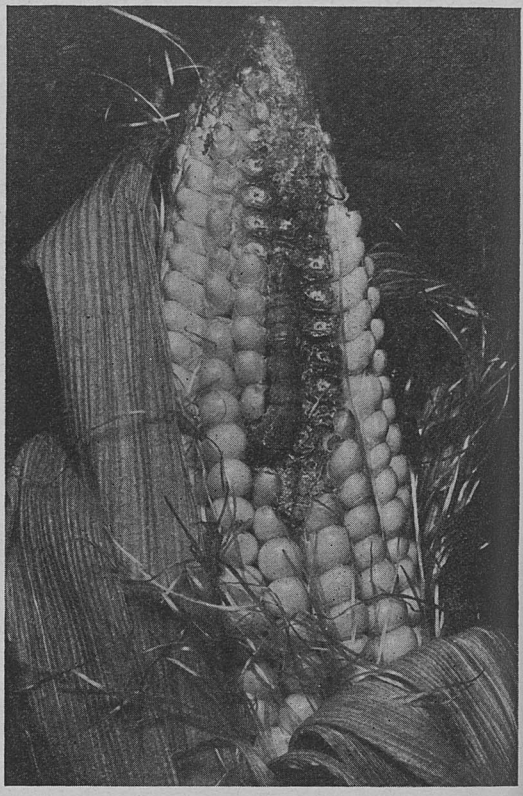


Feeding habits of the worms
Tomatoes spoiled by the corn ear worm

corn might be in trapping the worm. In the hope that a trap crop wo be worth while, extensive experiments were begun in 1923 with vari systems of interplanting. Much to our surprise, those plots where co was planted among the tomatoes showed most injury. Good protecti however, was obtained by spraying with lead arsenate at the rate 1 pound to 50 gallons of water.

HISTORICAL

Mally[1], in 1891, observed that where corn had been planted in skips in cotton fields there was less injury from the boll worm. therefore recommended 3 plantings of 4 or 5 rows of corn for every



A corn ear infested by the corn ear worm

or 50 rows of cotton, during the first few days of June, July, and A gust, respectively. Acting on Mally's suggestion, S. B. Mullen[2], a co

[1]Mally, F. W. The Boll Worm of Cotton. Bul. U. S. D. A. Div. Ent. 24. 1891.
[2]Mullen, S. B. Corn as a Trap Crop for the Boll Worm. Insect Life, 5:48. 189

respondent of the Bureau of Entomology, stated, in 1892, that tomatoes also could be protected by planting corn as a trap crop. He urged that poisons be abandoned and that corn as a trap crop be used to protect the cotton.

On the basis of Mullen's observations, the recommendation of corn as a trap for the tomato worm has continued up to the present time. In 1893[3] Rolfs reported 50 per cent damage to the tomato crop in Florida and advised the planting of corn as a trap crop, in every fifth hill of every fifth row. Quaintance[4], in 1896, made the same recommendation for Florida. In 1904 he also advised corn as a trap for the boll worm on cotton.[5] Bishopp and Jones[6], in 1907, advised corn in cotton, and observed in August that an average of 414 eggs were deposited on each corn plant. In 1912 Watson[7] recommended, for Florida, the planting of two rows of sweet corn to every 25 rows of tomatoes. In 1914 he observed that tomatoes planted next to sweet corn did not show the presence of worms, while a field a quarter of a mile away averaged 20 per cent infested fruit. In the 1914 Report of the Florida Station[8] a table is given showing that, according to observations made in one of the tomato-growing sections, sweet corn if planted near a tomato field will protect the adjacent tomatoes, provided the corn is in silk when the fruit begins to set. These observations indicated that corn 5 rods away offered protection to the tomato crop. In Bulletin 151 he continues, however, to recommend strips of corn within the tomato patch, presumably to afford perfect protection.

In our work at the Jackson Station we have found that, as regards the effect on the moth, it may make a vast difference whether the corn is planted a short distance from the tomatoes or among them.

In a few cases the advisability of planting corn in cotton or tomatoes is questioned. As early as 1879, Riley[9] stated that the planting of corn around a cotton field doubtless helps to increase the injury from the boll worm. Sanderson and Peairs[10] mentioned the fact that no experiments seem to have been conducted which show the practicability of using corn as a trap crop for the protection of tomatoes. On the west coast of Mexico, Morrill[11] observed that corn and tomatoes were seriously damaged, but that the worm showed practically no interest in cotton. This would indicate that cotton is much less attractive to the worm than either corn or tomatoes.

EXPERIMENTAL WORK WITH CORN AS A TRAP CROP

A suitable early variety appeared to be the first requisite for corn as a trap crop. Several varieties were tried out, among them being Pickaninny, from Canada; Assiniboine, from North Dakota; and Minnesota 13 and 23. Seed planted April 3, 1923, germinated April 15, and the

[3]Rolfs, P. H. The Tomato and Some of Its Diseases. Bul. Fla. Agr. Exp. Sta. 21. 1893.

[4]Quaintance, A. L. Insect Enemies of Truck and Garden Crops. Bul. Fla. Agr. Exp. Sta. 34. 1896.

[5]Quaintance, A. L. The Cotton Boll Worm. Farmers' Bul. 191. 1904.

[6]Bishopp, F. C., and Jones, C. R. The Cotton Boll Worm. Farmers' Bul. 290. 1907.

[7]Watson, J. R. Tomato Insects. Bul. Fla. Agr. Exp. Sta. 112.

[8]An. Rep. Fla. Agr. Exp. Sta. p. 53. 1914.

[9]Riley, C. V. The Cotton Worm in the United States. Bul. U. S. Ent. Comm. 48. 1879.

[10]Sanderson, E D., and Peairs, L. M. Insect Pests of Farm, Garden and Orchard. 1921.

[11]Morrill, A. W. Commercial Entomology on the West Coast of Mexico. Jour. Econ. Ent. 18: 712. 1925.

plants were in silk by May 27. All of these appeared to be early enough for they silked within about five or six weeks from the time of germination when planted in the spring. Minnesota 23 was selected in the later tests because it combined earliness with a good-sized ear.

SEASON OF 1923

In the spring of 1923, 15 rows of tomatoes, containing 20 hills to the row, were planted together, with 3 adjacent parallel rows of corn on each side. A count made June 23 revealed an average of 6 wormy tomatoes to the row. The sprayed plot had an average of 1.5, and the check plot 9. Each corn ear was infested with one or more worms. From this test the value of spraying is evident, but the value of the corn is not striking. We therefore decided to continue the work on a much more extensive scale in 1924.

SEASON OF 1924

Will corn as a trap crop prove of greatest value if planted adjacent to the tomatoes, or within the tomato patch? In order to test this point thoroughly we tried out several arrangements, ranging from a hill of corn alternating with a hill of tomatoes, to 1 row of corn for every 6 rows of tomatoes. Six plots were planted, consisting of 5 or more rows to each plot. Separate plots were used as checks and others were sprayed. The plants were set in the field April 15. The corn was planted April 11, and heavily fertilized so as to bring it into silk as early as possible.

Part of experimental plots at Jackson, showing tomatoes interplanted with corn as a trap crop for the corn ear worm

On June 21 a count was made of the number of wormy tomatoes. On Plot 1, where corn alternated with tomatoes within the row, there were an average of 66 wormy tomatoes to the row; on Plot 2, corn alternating with tomatoes, there were 67 wormy tomatoes. A glance at Table 1 shows that, in general, the plots with less corn had fewer wormy tomatoes. The sprayed plot had an average of 5.8 wormy tomatoes, while the check had 19. We had anticipated that Plot 1, with an abundance of

TABLE 1—*Counts of wormy tomatoes*

Plot	Treatment	Average No. of wormy tomatoes to row June 21, 1924	Average No. of wormy tomatoes to row June 24, 1925
1	Corn alternating with tomatoes in row	66	30
2	Tomatoes and corn in alternate rows	67	31
3	Two rows tomatoes to one row corn	39	24
4	Three rows tomatoes to one row corn	51	28
5	Five rows tomatoes to one row corn		29
6	Eight rows tomatoes to one row corn	46	26
	Sprayed	5.8	12
	Check	19	8

corn present, would not show any worms, or at least very few, but the reverse condition prevailed. The moths evidently did not stay on or confine themselves to the corn. The tomatoes had enough eggs on them to cause serious doubt as to the value of corn as a trap crop.

SPRAYING EXPERIMENTS

Experiments for the control of the worm by spraying have been carried out at the Jackson Station for the past three years. In 1924, the

Power sprayer used in spraying tomatoes with lead arsenate—1 pound to 50 gallons of water

tomato field was divided into 3 ranges. Range 1, consisting of 54 rows of tomatoes, with 20 hills to the row, was sprayed. Range 2, containing the corn, was placed opposite Range 1, 16 feet away. Range 3, the check plot, was located 600 feet away from Range 2. In 1925, practically the same arrangement was followed.

The land was manured in the winter, and fertilized with 540 pounds of acid phosphate, 180 pounds of nitrate of soda, and 90 pounds of muriate of potash to the acre. The plants were set in the field April 22.

SPRAY MATERIALS

Powdered arsenate of lead was used at the rate of 1 pound to 5 gallons of water, with the addition of ½ pound of Kayso to aid in spreading and sticking. The spray materials were applied with an orchard power sprayer, delivering 200-pounds pressure, and equipped with a spray rod, as shown in the illustration. In 1924, three applications were made—May 9, June 3, and June 13. In 1925 only two applications were made—May 30 and June 5.

RESULTS OF SPRAYING EXPERIMENTS

On June 21, 1924, a count was made of the number of wormy tomatoes in several rows of each range. As previously indicated, the sprayed range averaged only 5.8 wormy tomatoes to the row, whereas the check range averaged 19. The photographs on page 9 show the wormy tomatoes taken at the ends of their respective rows. They show in a striking manner the value of spraying, compared with no spray-

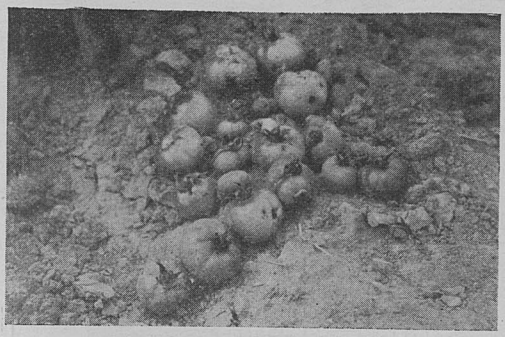
TABLE 2—*Tomato experiments for control of worms*—1924

Plot	Row	Treatment	Acre yield
		RANGE 1	Tons
1	5	Sprayed	10.92
2	5	"	9.86
3	6	"	8.30
4	6	"	8.31
5	5	"	8.30
6	5	"	9.51
7	8	"	10.30
8	8	"	10.12
9	6	"	10.41
		RANGE 2	
1	5	Corn alternating with tomatoes in row	3.83
2	5	Tomatoes and corn in alternate rows	6.18
3	6	Two rows tomatoes to one row corn	6.80
4	6	Three rows tomatoes to one row corn	6.80
5	5	Five rows tomatoes to one row corn	7.20
6	5	Same as above plot	7.50
7	8	Eight rows tomatoes to one row corn	7.42
8	8	Same as above plot	7.50
9	6	Check	4.34

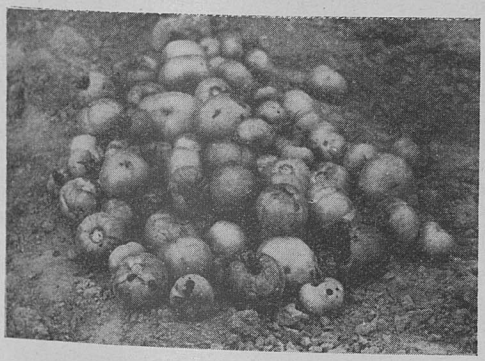
ing, as on the check plot, or with the use of corn as a trap. The yields of each range were also found by weighing the marketable and the wormy tomatoes. Table 2 is a summarized statement of the results. The sprayed range yielded 8.30 to 10.92 tons per acre; the check plots an average of 4.34 tons; and the corn plots 3.83 to 7.5 tons. The low yields of the check plots were in part due to poor soil conditions, accentuating the effect of dry weather.

The counts of wormy tomatoes and the yields both appear to show the superiority of spraying tomatoes against the worm, as compared with no spraying or the use of corn as a trap crop.

5 wormy tomatoes at end of one sprayed row



19 wormy tomatoes at end of one check row



66 wormy tomatoes at end of one row where corn alternated with tomatoes

In 1925, the yields were considerably reduced by the dry weather, but again the value of spraying is evident. The counts made June 24 showed 28 wormy tomatoes to the row in the corn range, 12 in the sprayed range,and 8 in the check. The yields are summarized in Table 3.

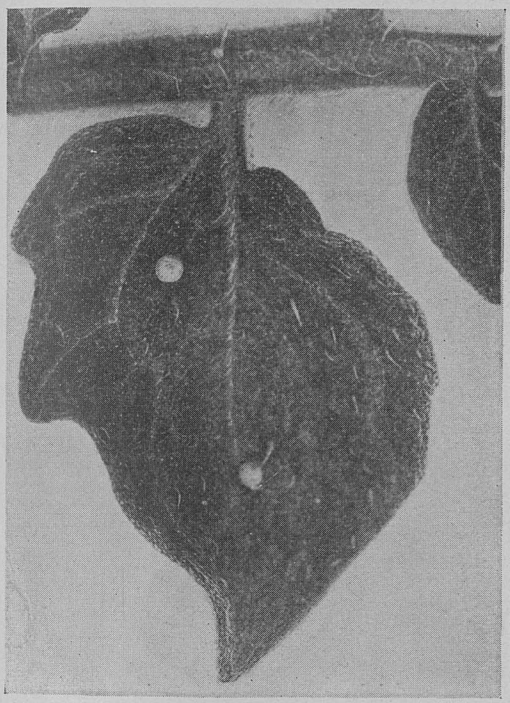
TABLE 3—*Tomato experiments for control of worms*—1925

Plot	Row	Treatment	Acre yield
		RANGE 1	
			Tons
1	1- 2	Sprayed	5.70
2	3- 4	"	5.15
3	5- 6	"	5.10
4	7- 9	"	4.74
5	10-11	"	5.10
6	12-13	"	4.50
7	14-15	"	5.34
8	16-17	"	5.40
9	18-19	"	5.82
10	20-23	"	5.76
11	24-27	"	5.34
12	28-31	"	5.28
		RANGE 2	
1	1- 2	One hill tomatoes, one hill corn	1.74
	3	Corn	
2	4- 5	Tomatoes	2.28
	6	Corn	
3	7- 8	Tomatoes	2.34
	9-10	Corn	
4	11-13	Tomatoes	2.46
	14	Corn	
5	15-16	Tomatoes	2.79
6	17-19	Tomatoes	2.40
	20	Corn	
7	21-22	Tomatoes	2.16
8	23-24	Tomatoes	2.64
9	25-26	Tomatoes	3.90
	27	Corn	
10	28-31	Tomatoes	2.10
11	32-35	Tomatoes	.81
	36	Corn	
12	37-40	Tomatoes	.93
		RANGE 3	
1	8	Check	3.29

LIFE-HISTORY AND HABITS

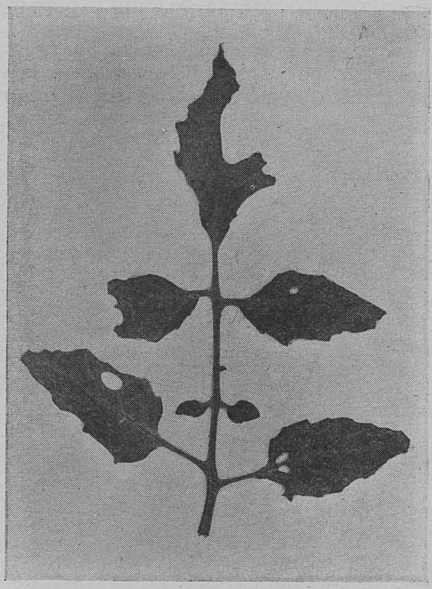
FEEDING HABITS OF THE LARVA

There is a prevailing impression among growers that the eggs are deposited within or on the fruit. As the larva is generally found within the fruit, the belief exists that the worms cannot be



Eggs of corn ear worm on tomato leaf

poisoned. Close observation shows that the eggs are deposited mainly on the leaves. Upon hatching, the young larva does not seek a fruit, but begins to feed upon the leaf upon which the egg was laid. Considerable portions of the leaves may be eaten. Somewhat later the worm starts wandering from leaf to leaf, and may come across a fruit, into which it will burrow. Often, however, fruit is not encountered, and one may find nearly full-grown larvae feeding on the leaves or boring into the stems. Due to the wandering habits of the larva, several fruits may be injured by one worm. After a tomato is attacked it becomes unmarketable because of the presence of holes, which vary in size from that of a pinhead to ¾ of an inch in diameter. Decay usually sets in, and the fruit often becomes badly rotted and falls to the ground. It is fortunate that the worms feed on the leaves as well as the fruit, for this makes it possible to poison successfully. It was also



Young tomato leaves after being attacked by the corn ear worm

observed that the majority of worms enter the tomato at the stem or calyx, end—and the calyx, being leaf-like in character, probably retains more poison than the smooth part of the tomato. Laboratory experiments showed that the worms could be poisoned by lead arsenate placed on the calyx only.

FOOD PLANTS

Corn appears to be the favorite food plant; the injury being so severe on sweet corn as to make its profitable growth in the South almost impossible. Tomatoes are attacked more often early in the season but also late in the fall. The worm is sometimes common in cotton where it is known as the bollworm. When corn is not available, beans and peas are attacked. Many other plants are eaten, among them vetch, alfalfa, cucumber, squash and melons.

LOSSES

Damage to tomatoes occurs every year. Under some conditions one-half or more of the crop may be destroyed. In 1921, Gibson County suffered almost a total loss of the tomato crop, the damage being estimated at over $250,000 in this one county. During the past three years, observations and experiments have indicated a loss of from 10 to 50 per cent in many tomato fields. Shipped tomatoes which appeared sound when packed have in some cases contained worms which caused decay to develop in transit, with considerable loss.

SEASONAL HISTORY

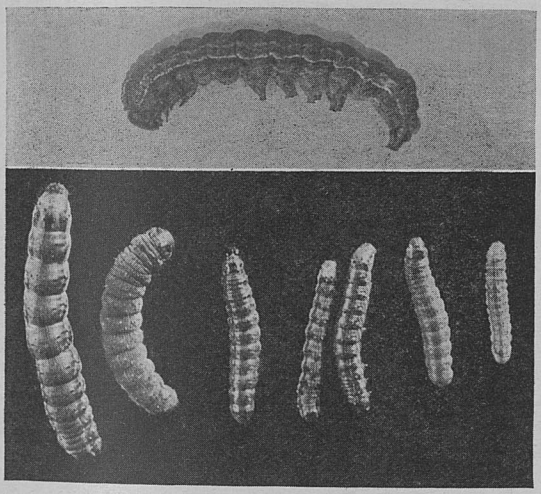
Upon becoming full-grown the worms enter the ground, where they transform to shining reddish-brown pupae 4/5 of an inch in length. In this stage they pass the winter in the ground. The moths emerge early in the spring and begin to deposit eggs. If the corn is not in silk the eggs are placed on the leaves or tassels. Often the worms may be found tunneling the terminal portion of the corn stalk early in the spring. Each female is capable of laying from 500 to 2,500 eggs. These hatch within from 3 to 14 days, depending on the temperature. The worms become full-grown within from 11 to 30 days. The pupal period occupies about two weeks. For an egg to become a moth requires about three or four weeks, under average conditions, making it possible for four or five generations to be produced in a single season.

EGG

The egg is rather small, measuring about 1/50 of an inch in diameter. It is white, globular, and can be easily seen on the green leaves or silk of corn.

LARVA

The larva when full-grown measures from 1½ to 2 inches in length. The coloration is variable, ranging from light green to brown. There are several distinct longitudinal stripes, a dark middle stripe being somewhat prominent. Upon hatching, the small worm is whitish, the head black, and the body covered with numerous small black tubercles.



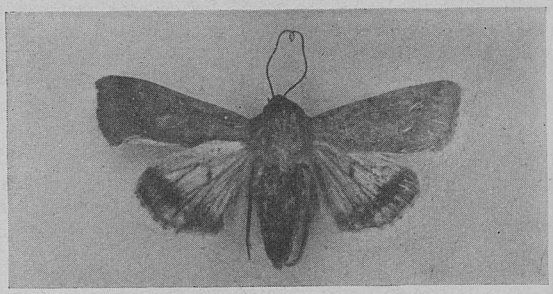
Side view of corn ear worm
Variations in size and color

PUPA

The pupa is smooth, brownish, and measures ¾ to 1 inch in length.

ADULT MOTH

The moth is rather stout, and variable in color, ranging from straw-color to a dark brown. The front wings usually have a dark spot in the middle. The hind wings are whitish, with a black border. Sometimes there is a dark spot near the middle of each hind wing. The moth has an expanse of about 1½ inches.



Moth of corn ear worm

RECOMMENDATIONS FOR CONTROL

The best control of the corn ear worm in tomatoes may be had by spraying. Lead arsenate should be used at the rate of 1 pound to 50 gallons of water. One-half pound of Kayso or 2 pounds of hydrated lime added will aid in sticking the spray material to the foliage. If dusting is preferred, calcium arsenate should be used at the rate of 10 pounds to the acre.

The first application should be given soon after the fruit begins to set, usually after the middle of May. For good protection three or four applications will be necessary, at intervals of from 12 to 14 days.

For areas of an acre or less a compressed-air sprayer may be used. For larger areas a barrel sprayer will be more efficient. A rotary dust gun is satisfactory for dusting.

SUMMARY

1. In 3 years' trials, corn as a trap crop planted among tomatoes did not give adequate protection against the corn ear worm.

2. On June 21, 1924, a count showed 66 wormy tomatoes in the plot where corn alternated with tomatoes; 19 in the check plot; and 8 in the sprayed plot.

3. Good protection was obtained by spraying with lead arsenate.