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COLLEGE STATION, BRAZOS COUNTY, TEXAS

BULLETIN NO. 356 APRIL, 1927

DIVISION OF ENTOMOLOGY

CONTROL AND SPRING EMERGENCE OF THE COTTON FLEA HOPPER

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SYNOPSIS

This Bulletin reports the results secured in experiments on control of the cotton flea hopper by the use of insecticides applied as dusts and as sprays under field conditions. Superfine dusting sulphur, flowers of sulphur, Niagara sulphur-naphthalene, and mixtures of sulphur-tobacco dust resulted in an average daily control ranging from 68 to 75 per cent. When applied at the rate of 20 pounds per acre it was found that these dusts remained effective in preventing multiplication of the insects for a period of six or seven days under favorable climatic conditions. The materials used as sprays in three series of preliminary tests did not prove to be as effective as the dusts in controlling the insect.

Data on the spring emergence of the cotton flea hopper are presented. During 1926 emergence from the overwintering eggs extended over a period of more than thirteen weeks beginning March 7; however, 73 per cent of the total emergence occurred between April 5 and April 26, and it was practically completed by May 17. The relation of spring emergence to control measures is pointed out and data are presented to emphasize the importance of destroying winter host plants and spring weeds as a means of preventing early infestations on young cotton plants. An additional list of sixteen food plants is given including principally early spring weeds which were found growing in and adjacent to local fields of young cotton. Winds are mentioned as a possible factor in spreading the insects to uninfested fields early in the season.

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BULLETIN NO. 356 APRIL, 1927

CONTROL AND SPRING EMERGENCE OF THE COTTON FLEA HOPPER

H. J. REINHARD

During the season of 1926 the cotton growers in Texas and other States experienced a striking exemplification of widespread injury to the cotton crop which could be produced by the insect now commonly known as the cotton flea hopper. In the first part of the season when the cotton plants normally should have been laden with fruit, it was a common occurrence to find large areas of cotton plants without any immediate prospects in evidence to make a crop. Much concern over this condition was manifested by growers and numerous belated attempts to control the insect by means of insecticides were made. Many of these endeavors proved unsatisfactory primarily because they were begun too late, and apparently it was due only to the abundance of moisture in the soil and favorable climatic conditions during the middle and latter portions of the growing season that good yields were realized generally throughout the State.

Further studies on the insecticidal control of the cotton flea hopper under field conditions were conducted during 1926 and the results of these experiments are presented in this Bulletin, with the data obtained from cage experiments on hibernation and emergence of the insect during the winter and spring of 1925-26.

METHODS USED IN CONDUCTING CONTROL EXPERIMENTS

To note the insecticidal value of the various materials used in combating the cotton flea hopper it was necessary to confine the control experiments to goatweed or sageweed which was very heavily infested throughout the summer. While cotton in this vicinity was infested generally with the insects, yet the degree of infestation never approached that which was present on goatweed. Since there appears to be no reason why an insecticide applied to goatweed as described below should be any more effective in destroying the insects present than when it is applied directly to cotton, it is believed that the data presented herein are a reliable index to what the grower may accomplish by the proper application of insecticides to protect his cotton from the ravages of this insect.

Each experiment on the control of this insect extended over a period of fourteen days and was made on a series of four one-eighth-acre plats of goatweeds. Three of the plats in each experiment were given two applications of some insecticide at seven-day intervals, and the remaining plat was left untreated to serve as a check on the treated areas. Immediately preceding the first application and daily thereafter for

Table 1.—Dust Series 1

Insecticide	Plat No.	First Application of Dust July 30, 1926								Second Application of Dust August 6, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			July 31	Aug. 1	Aug. 2	Aug. 3	Aug. 4	Aug. 5	Aug. 6		Aug. 7	Aug. 8	Aug. 9	Aug. 10	Aug. 11	Aug. 12	Aug. 13	
Sulphur Superfine....	2	14 lbs.	35.9	.....	17.0	27.9	16.9	29.8	35.7	22 lbs.	5.8	.....	4.4	4.0	10.5	18.3	50.4	21.4
Sulphur Flowers.....	3	10 lbs.	34.6	.....	36.3	32.8	38.2	36.0	49.3	24 lbs.	10.5	.....	1.3	3.6	10.7	6.7	3.8	21.9
Stauf. Sulph.-Naph. 60:20:20	4	10 lbs.	66.9	.....	55.9	41.1	76.7	76.6	74.1	16 lbs.	26.3	.....	54.4	26.9	43.7	30.7	47.5	51.7

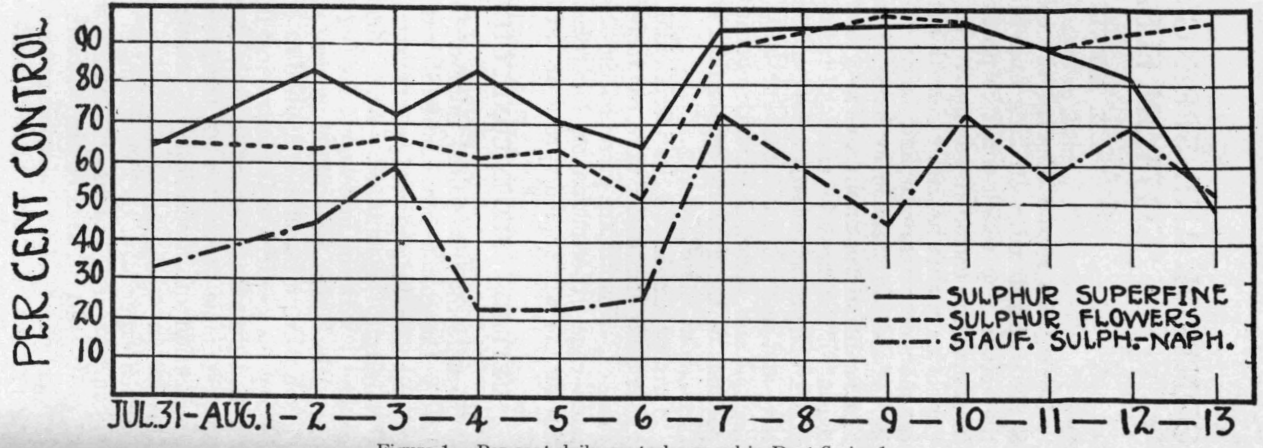

Figure 1.—Per cent daily control secured in Dust Series 1

the entire duration of the experiment, twenty-five or fifty terminal bud clusters were clipped at random from the plants on both the treated and the untreated plats. These samples were placed in separate containers, one for each plat in the test, and taken to the laboratory where the insects present on the bud clusters were counted carefully and a daily record made of the infestation on each plat. The number of insects found on the samples taken from the check or untreated plats was considered to be a 100 per cent infestation and the daily control obtained on the treated plats was calculated on that basis.

All insecticides were applied by hand-operated Niagara dusting machines and for the most part during the afternoon when there was no dew. Every effort was made in applying the material to cover the entire area of each plat treated regardless of the fact that the weeds were not always uniformly distributed over the plat.

EXPERIMENTS ON CONTROL OF THE COTTON FLEA HOPPER

Dust Series 1

In Table 1 are presented the results secured in a series of tests on the control of the cotton flea hopper by the use of superfine dusting sulphur, flowers of sulphur, and a mixture of sulphur, naphthalene, and hydrated lime in the proportion of 60 parts of the sulphur to 20 parts of each of the naphthalene and hydrated lime. Hydrated lime was added in the local laboratory to improve the physical qualities of the dust. The mixture of sulphur and naphthalene was prepared by the Stauffer Chemical Company, Houston, Texas.

The climatic conditions prevailing for the duration of this series of tests were favorable for securing a maximum control. Practically no rainfall occurred to interfere with the tests. The temperatures for the most part were high and the days clear or but partially cloudy.

It will be noted that both grades of sulphur resulted in a good control over a period of six or seven days after each application and that the sulphurs were especially effective in holding the infestation to a small per cent after the rather heavy second applications were made. The Stauffer sulphur-naphthalene did not prove to be as effective as either of the sulphurs in reducing the infestation at any time during the extent of the experiment. In this connection it should be pointed out, however, that the second application of this material was considerably less than in the case of the sulphurs.

In Figure 1 is illustrated graphically the per cent of daily control obtained with each insecticide throughout the duration of this series of tests.

Dust Series 2

The results secured in the control tests with sodium fluosilicate, Electric sulphur, and Super-sulfodust are given in Table 2.

Light showers of rain occurred during the first four days in this series

Table 2.—Dust Series 2

Insecticide	Plat No.	First Application of Dust August 12, 1926								Second Application of Dust August 19, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Aug. 13	Aug. 14	Aug. 15	Aug. 16	Aug. 17	Aug. 18	Aug. 19		Aug. 20	Aug. 21	Aug. 22	Aug. 23	Aug. 24	Aug. 25	Aug. 26	
Sodium Fluosilicate..	2	16 lbs.	40.9	91.2	50.0	31.5	73.3	123.5	83.3	16 lbs.	63.2	102.1	73.1	57.8	43.2	68.2	50.5	67.9
Sulphur Electric.....	3	16 lbs.	55.9	63.8	26.8	46.6	45.1	65.9	70.3	16 lbs.	45.9	34.6	28.8	25.3	44.7	30.1	26.5	43.6
Super-Sulfodust....	4	16 lbs.	37.9	42.4	23.1	34.6	47.4	80.0	134.9	16 lbs.	67.0	64.1	30.8	38.8	48.5	42.4	40.2	52.3

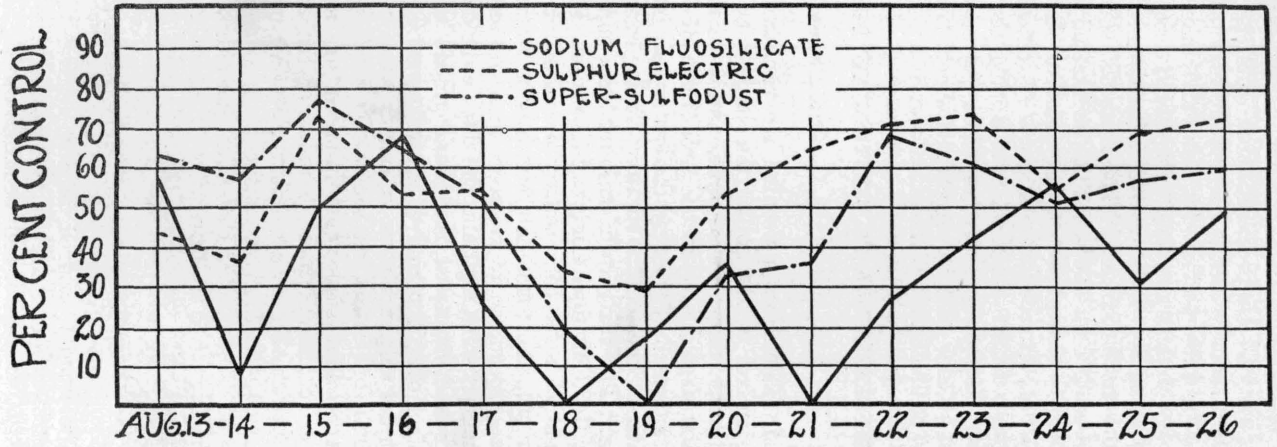

Figure 2.—Per cent daily control secured in Dust Series 2

of tests. The first rain fell on the day following the first application of poison. On August 21, two days after the second application of dusts, another light shower occurred and a heavy precipitation was recorded on the final day of the test.

None of the insecticides used in this experiment proved efficient in reducing the number of insects to a desirable minimum under the prevailing climatic conditions. Undoubtedly the rains were unfavorable to obtain the best results during the first half of the tests; yet it will be noted that the daily infestation on each plat remained consistently high during the latter seven days of the tests, notwithstanding the moderately heavy applications of insecticides which were applied and the more favorable climatic conditions. It is interesting to note in this connection that the materials containing sulphur resulted in a higher per cent of control.

The per cent of daily control obtained with each insecticide in these tests is shown by the curves in Figure 2.

Dust Series 3

In Table 3 are presented the results obtained in another series of tests on the control of the cotton flea hopper by the use of superfine dusting sulphur, flowers of sulphur, and a Stauffer sulphur-naphthalene-lime mixture in the proportions of 60:20:20.

In comparing these data with the results secured by the use of the same insecticides as shown in Table 1, it should be pointed out that two light showers of rain decreased the effectiveness of the first application of dusts to some extent, for the heavier rate at which the dusts were applied resulted in about the same degree of control. On the third, fourth, and fifth days after the second applications were made in this experiment a heavy rainfall occurred, which resulted in a marked increase of infestation on the final two or three days of the test. In this experiment both grades of undiluted sulphur were much more effective in controlling the insect than the Stauffer mixture of sulphur-naphthalene-lime which was applied at the same rate.

The per cent of daily control secured on each treated plat in this experiment is indicated by the graphs in Figure 3.

Dust Series 4

In this series of control tests superfine dusting sulphur and flowers of sulphur were compared with a 60:20:20 mixture of sulphur-naphthalene-lime prepared by the Niagara Sprayer Company. Heavy applications of all dusts were made. The results obtained are given in Table 4.

The weather conditions prevailing during this test were very unfavorable. A heavy precipitation was recorded on the third day after the first application of dusts was made, followed by lighter rains on the two succeeding days. Subsequent to the second application of dusts rains occurred on four separate days accompanied by lower temperatures.

Table 3.—Dust Series 3

Insecticide	Plat No.	First Application of Dust August 16, 1926								Second Application of Dust August 23, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Aug. 17	Aug. 18	Aug. 19	Aug. 20	Aug. 21	Aug. 22	Aug. 23		Aug. 24	Aug. 25	Aug. 26	Aug. 27	Aug. 28	Aug. 29	Aug. 30	
Sulphur Superfine....	2	24 lbs.	26.5	27.7	20.1	18.7	21.7	31.9	30.6	24 lbs.	19.8	13.9	21.2	24.4	34.9	61.4	85.0	31.3
Sulphur Flowers.....	3	24 lbs.	44.5	27.6	23.1	32.1	34.6	50.0	70.4	24 lbs.	16.0	45.9	22.2	19.7	38.4	57.0	92.3	40.9
Stauf. Sulph.-Naph. 60:20:20	4	24 lbs.	67.8	43.3	76.2	80.2	63.3	88.9	95.2	24 lbs.	60.8	24.4	53.2	54.2	87.5	153.2	213.9	83.0

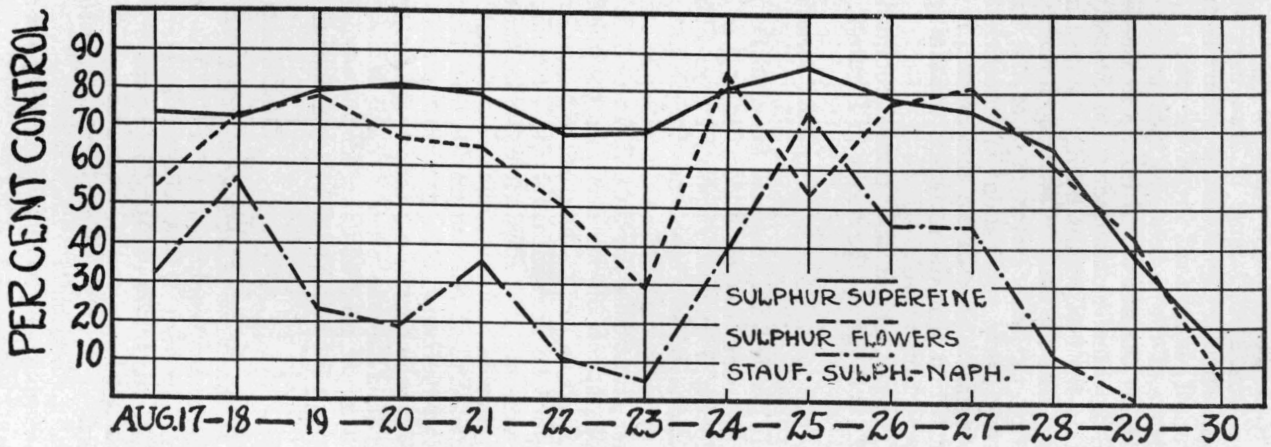

Figure 3.—Per cent daily control secured in Dust Series 3

Table 4.—Dust Series 4

Insecticide	Plat No.	First Application of Dust August 23, 1926								Second Application of Dust August 30, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Aug. 24	Aug. 25	Aug. 26	Aug. 27	Aug. 28	Aug. 29	Aug. 30		Aug. 31	Sept. 1	Sept. 2	Sept. 3	Sept. 4	Sept. 5	Sept. 6	
Sulphur Superfine....	2	32 lbs.	16.5	14.7	6.2	13.0	23.2	45.9	71.2	32 lbs.	23.2	45.8	18.1	24.8	32.0	.....	70.6	31.2
Sulphur Flowers.....	3	32 lbs.	46.2	34.6	23.1	24.4	65.3	73.1	49.3	30 lbs.	22.2	31.8	30.8	35.6	35.5	.....	76.3	42.2
Niag. Sulph.-Naph. 60:20:20	4	32 lbs.	7.4	7.7	7.4	14.1	21.0	41.1	35.7	34 lbs.	17.2	24.7	57.5	28.8	56.8	.....	49.0	28.3

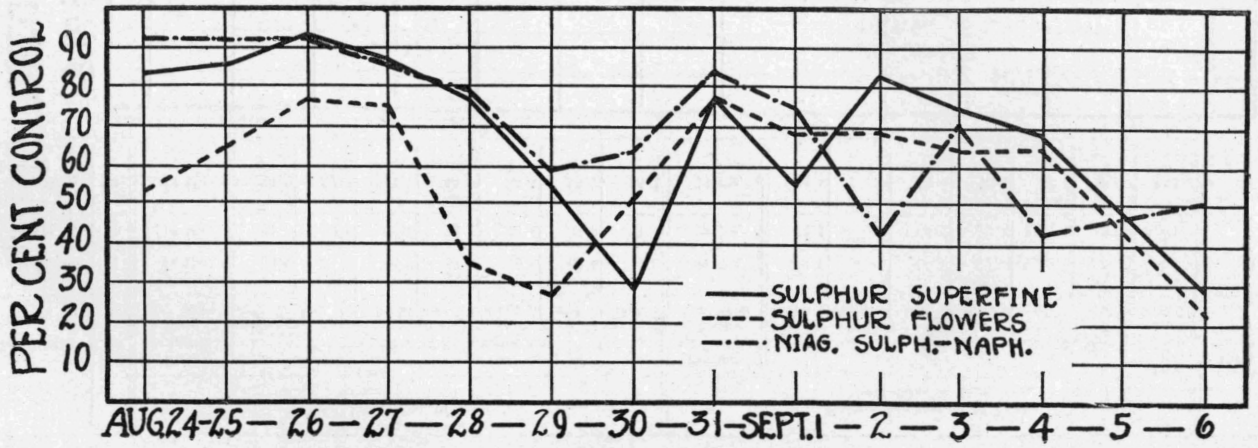

Figure 4.—Per cent daily control secured in Dust Series 4

Table 5.—Dust Series 5

Insecticide	Plat No.	First Application of Dust August 27, 1926								Second Application of Dust September 3, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Aug. 28	Aug. 29	Aug. 30	Aug. 31	Sept. 1	Sept. 2	Sept. 3		Sept. 4	Sept. 5	Sept. 6	Sept. 7	Sept. 8	Sept. 9	Sept. 10	
Sulphur Hydrocarbon	2	14 lbs.	53.2	51.4	74.2	67.8	46.6	69.5	54.3	22 lbs.	53.6	.....	39.3	79.0	52.9	50.3	63.8	58.1
Kolodust....	3	16 lbs.	61.5	33.6	27.6	31.5	42.6	67.0	83.8	22 lbs.	74.1	.....	64.2	70.6	51.6	47.9	84.4	57.0
Niag. Sulph.-Naph. 60:20:20	4	14 lbs.	26.2	37.5	32.3	10.7	35.5	99.2	95.1	14 lbs.	96.9	.....	82.8	73.9	56.9	82.3	106.9	64.3

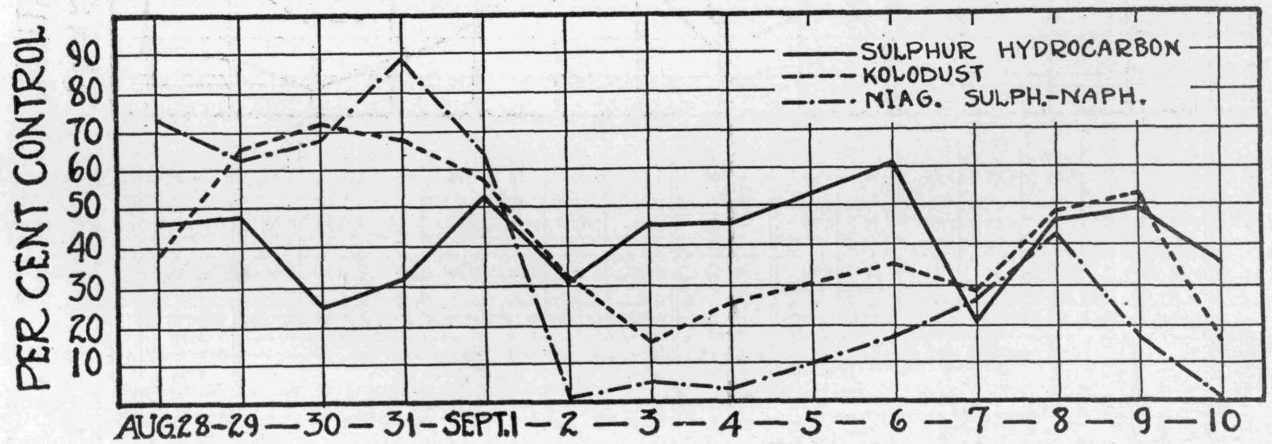

Figure 5.—Per cent daily control secured in Dust Series 5

Under these extremely unfavorable climatic conditions, the per cent of infestation on the treated plats was held to a satisfactory minimum for the first four or five days of the test. The infestation then increased rapidly until the day following the second application of insecticides, when all the treated plats again showed a marked decrease in the number of insects present. As has been noted above, rains interfered on the following days and a high per cent of infestation occurred on all plats on the last day of the test. In comparing the effectiveness of the insecticides used in this experiment it will be observed that the Niagara mixture of sulphur-naphthalene-lime yielded the best average daily control.

The graphs in Figure 4 show the per cent of daily control secured on each treated plat in this experiment.

Dust Series 5

In Table 5 are presented the results obtained in a series of tests on the control of the cotton flea hopper with Hydrocarbon sulphur compound, Kolodust, and a Niagara 60:20:20 mixture of sulphur-naphthalene-lime.

The prevailing weather conditions during the extent of this series of tests were not favorable for securing the best results. Rains decreased the effectiveness of both the first and the second applications to the extent that no satisfactory reduction in per cent of infestation was maintained on any of the treated plats.

This is illustrated graphically in Figure 5, which shows the low per cent of daily control that was obtained on each treated plat in this series of tests.

Dust Series 6

The insecticides used in this series of control tests included a commercial preparation known as DuPont Insecticide No. 44, a Niagara 60:20:20 mixture of sulphur-naphthalene-lime, and a mixture of superfine sulphur and tobacco dust in the proportions of 60 parts of the former to 40 parts of the latter. Heavy applications of all dusts were made. The results obtained by the use of these materials are presented in Table 6.

Clear or partially cloudy days with fairly high temperatures prevailed during the extent of this experiment. Only two light rains were recorded but since these occurred four days after the first and seven days after the second application of dusts was made it is not likely that the results were affected to any appreciable extent.

Since the per cent of infestation on plat 2 remained excessively high, observations were discontinued after the fourth day of the test. It should be pointed out that DuPont Insecticide No. 44 is not a contact poison but was used in this experiment to determine its repellant action on the cotton flea hopper. The infestation on plats 3 and 4 was checked effectively by the insecticides applied. In fact, the number of insects

Table 6.—Dust Series 6

Insecticide	Plat No.	First Application of Dust September 9, 1926								Second Application of Dust September 16, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Sept. 10	Sept. 11	Sept. 12	Sept. 13	Sept. 14	Sept. 15	Sept. 16		Sept. 17	Sept. 18	Sept. 19	Sept. 20	Sept. 21	Sept. 22	Sept. 23	
DuPont Insecticide No. 44.....	2	28 lbs.	113.4	80.0	83.9	77.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	88.6
Niag. Sulph.-Naph. 60:20:20	3	28 lbs.	52.0	30.9	23.8	13.7	11.4	14.1	19.5	26 lbs.	11.4	4.5	5.3	3.7	12.2	6.8	22.1	16.5
Sulphur-Tobacco Dust 60:40	4	24 lbs.	37.6	33.3	35.3	24.2	20.6	24.2	34.8	28 lbs.	14.2	20.7	11.9	14.9	24.0	26.6	27.2	24.9

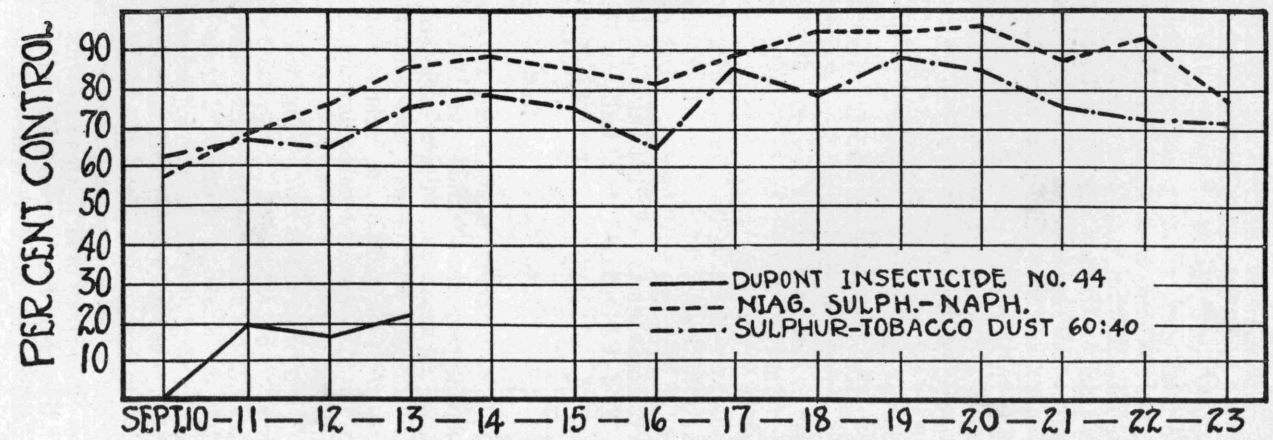

Figure 6.—Per cent daily control secured in Dust Series 6

present on the sixth and seventh days after each application of insecticide was held to a satisfactory minimum.

The excellent control obtained on both of these plats is shown graphically in Figure 6.

Dust Series 7

In this series of control tests on the cotton flea hopper the effectiveness of a new mixture composed of superfine sulphur, ground tobacco dust, and hydrated lime in the proportions of 60:20:20, was compared with a Stauffer and a Niagara 60:20:20 mixture of sulphur-naphthalene-lime. Heavy applications of all insecticides were made. The results secured in this experiment are given in Table 7.

During the first seven days of this series of tests clear or but partially cloudy days with high temperatures prevailed. These conditions were ideal for securing a maximum control. However, the climatic conditions during the final seven days of the experiment were not so favorable. Light and moderately heavy showers of rain occurred on the first, second, and fourth days after the second application of dusts was made, and the days for the most part were cloudy accompanied by lower temperatures.

The infestation on the treated plats was reduced materially on the day following the first application and was held to a satisfactory minimum per cent until the last day of the test. The effectiveness of the sulphur-tobacco dust mixture used in this test deserves emphasis. While it did not prove quite as efficient as the Niagara sulphur-naphthalene in reducing the infestation, yet when considered on the cost per pound basis the cheap sulphur-tobacco dust has a decided advantage over the higher-priced sulphur-naphthalene mixtures. In other words, the difference in effectiveness of these two insecticides is not sufficient to warrant the difference in the cost of these materials.

In Figure 7 is illustrated graphically the per cent of daily control obtained on each treated plat in the test.

Dust Series 8

The two sulphur-tobacco dust insecticides described above, viz., the 60:40 and the 60:20:20 mixtures, were used in conjunction with flowers of sulphur in this series of tests. Heavy applications of all insecticides were made. The results secured are presented in Table 8.

Since this experiment extended over the same period of time as Dust Series 7, the comments on the prevailing climatic conditions given above apply also to this series of tests.

It will be observed that these insecticides were effective in reducing the number of insects and maintaining a low per cent of infestation on each treated plat. It should be pointed out in this connection that unfavorable climatic conditions prevailed during the latter half of this experiment; nevertheless the insecticides remained effective until the final day of the test. In comparing the results secured on the plats

Table 7.—Dust Series 7

Insecticide	Plat No.	First Application of Dust September 16, 1926								Second Application of Dust September 23, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Sept. 17	Sept. 18	Sept. 19	Sept. 20	Sept. 21	Sept. 22	Sept. 23		Sept. 24	Sept. 25	Sept. 26	Sept. 27	Sept. 28	Sept. 29	Sept. 30	
Stauf. Sulph.-Naph. 60:20:20	2	24 lbs.	48.3	22.8	24.7	25.3	30.3	33.6	31.1	32 lbs.	30.1	21.9	.....	23.4	18.2	17.6	53.3	29.3
Niag. Sulph.-Naph. 60:20:20	3	26 lbs.	47.9	23.2	17.2	16.2	5.2	10.8	30.9	24 lbs.	12.4	14.3	.....	13.5	19.0	25.0	21.4	19.8
Sulphur-Tobacco Dust 60:20:20	4	24 lbs.	45.6	32.2	27.8	33.9	25.0	19.5	25.2	24 lbs.	18.7	26.5	.....	26.1	12.9	25.0	50.0	28.3

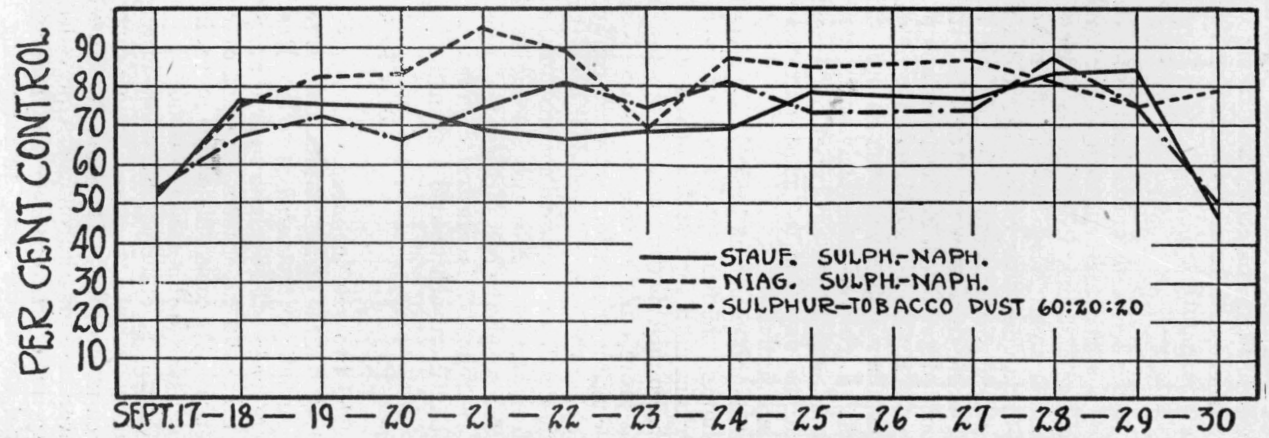

Figure 7.—Per cenr daily control secured in Dust Series 7

Table 8.—Dust Series 8

Insecticide	Plat No.	First Application of Dust September 16, 1926								Second Application of Dust September 23, 1926								Average Daily Infestation
		First Application, Rate Per Acre	Per Cent of Infestation on							Second Application, Rate Per Acre	Per Cent of Infestation on							
			Sept. 17	Sept. 18	Sept. 19	Sept. 20	Sept. 21	Sept. 22	Sept. 23		Sept. 24	Sept. 25	Sept. 26	Sept. 27	Sept. 28	Sept. 29	Sept. 30	
Sulphur-Tobacco Dust 60:20:20	2	26 lbs.	69.3	30.6	16.9	31.0	28.4	29.3	37.8	24 lbs.	16.5	24.0	.....	15.5	5.0	37.5	46.1	29.8
Sulphur-Tobacco Dust 60:40	3	26 lbs.	53.3	28.8	19.7	11.8	12.1	17.7	28.3	24 lbs.	7.0	16.1	.....	18.7	23.5	7.7	45.5	22.3
Sulphur Flowers.....	4	24 lbs.	36.5	17.4	23.5	15.7	17.5	20.0	20.7	22 lbs.	7.7	9.2	.....	10.1	0	31.2	42.8	19.4

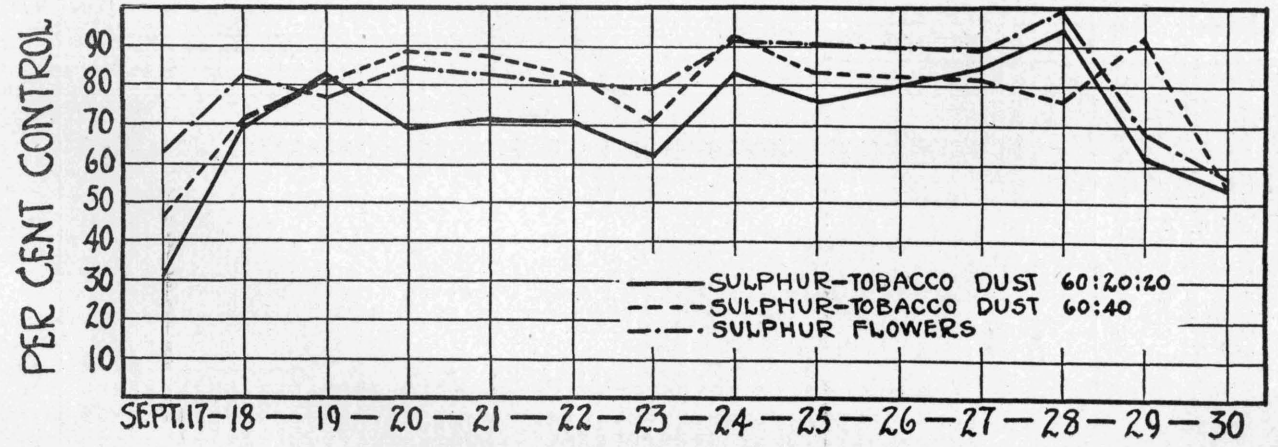

Figure 8.—Per cent daily control secured in Dust Series 8

treated with the sulphur-tobacco dust it will be noted that the material containing 40 parts of ground tobacco dust proved most efficient in controlling the insect.

The high per cent of daily control obtained with each insecticide is illustrated graphically in Figure 8.

Table 9.—Climatological Data Affecting the Control Tests

Date	Temperature		Rainfall, Inches	Prevailing Wind Direction	Character of Day, Sunrise to Sunset
	Maximum	Minimum			
1926					
July 30	98	74		N.	Partly cloudy
July 31	99	74		S. W.	Clear
August 1	97	71	Trace	N. W.	Partly cloudy
August 2	100	75		S. W.	Partly cloudy
August 3	97	74		S.	Partly cloudy
August 4	97	75		S.	Clear
August 5	98	73		W.	Clear
August 6	100	73		S.	Clear
August 7	102	74		S.	Clear
August 8	103	70		N.	Clear
August 9	97	71		E.	Clear
August 10	94	73		S.	Partly cloudy
August 11	96	72	Trace	S.	Partly cloudy
August 12	97	72		S.	Partly cloudy
August 13	98	73	0.03	S.	Partly cloudy
August 14	93	71	0.08	S.	Partly cloudy
August 15	89	73	0.02	S.	Partly cloudy
August 16	97	77	0.01	S.	Partly cloudy
August 17	98	77		S.	Clear
August 18	98	77		S. W.	Partly cloudy
August 19	99	79		S.	Partly cloudy
August 20	99	79		S.	Partly cloudy
August 21	97	74	0.03	S.	Cloudy
August 22	97	74		S.	Partly cloudy
August 23	101	71		S.	Clear
August 24	91	73		N.	Partly cloudy
August 25	89	66		N.	Partly cloudy
August 26	87	65	1.31	N.	Cloudy
August 27	86	71	0.03	S.	Partly cloudy
August 28	92	70	0.43	S.	Partly cloudy
August 29	93	73		S. E.	Cloudy
August 30	93	74		S. E.	Partly cloudy
August 31	91	73		S.	Partly cloudy
September 1	89	73	Trace	S.	Partly cloudy
September 2	95	74	0.05	S.	Partly cloudy
September 3	93	73	0.10	S.	Clear
September 4	92	76		S. W.	Partly cloudy
September 5	93	74	0.16	S.	Partly cloudy
September 6	94	74	0.07	S.	Partly cloudy
September 7	94	73	Trace	S.	Partly cloudy
September 8	94	72		S.	Partly cloudy
September 9	96	73		N.	Partly cloudy
September 10	95	72		S.	Partly cloudy
September 11	96	72		S. E.	Clear
September 12	93	71		S.	Partly cloudy
September 13	95	72		S.	Clear
September 14	93	71	0.03	S. E.	Partly cloudy
September 15	95	72		S. E.	Partly cloudy
September 16	95	71		S. E.	Partly cloudy
September 17	95	72		S. E.	Clear
September 18	96	71		N.	Partly cloudy
September 19	96	76		N. E.	Partly cloudy
September 20	98	72		N. E.	Clear
September 21	99	72		N. E.	Clear
September 22	100	77		N. E.	Clear
September 23	99	77	0.01	S. W.	Partly cloudy

Table 10.—Summary of Control Tests

Insecticide	Per Cent of Control on														Average Per Cent Daily Control	Rank	No. of Tests
	1st Day	2nd Day	3rd Day	4th Day	5th Day	6th Day	7th Day	8th Day	9th Day	10th Day	11th Day	12th Day	13th Day	14th Day			
Sulphur Superfine	73.7	78.8*	85.6	80.1	79.4	64.1	54.2	83.7	70.2*	85.4	82.3	74.2	60.2*	31.3	71.8	2	3
Sulphur Flowers	59.6	73.5†	73.5	73.8	61.1	55.2	52.6	85.9	71.0†	81.9†	82.8	78.9	68.4†	46.2	68.5	4	4
Niag. Sulph.-Naph. 60:20:20	66.6	75.2	79.8	86.3	81.7	58.7	54.7	65.5	85.5†	51.5†	70.0	63.8	61.9†	51.9	68.2	5	4
Stauf. Sulph.-Naph. 60:20:20	39.0	66.9*	47.7	51.1	43.2	33.6	33.2	60.9	76.8*	46.2*	65.2	50.2	50.6	33.1	48.8	6	3
Sulphur-Tobacco Dust 60:20:20	42.6	68.6	77.7	67.6	73.3	75.6	68.5	82.4	74.8	.....	79.2	91.1	68.8	52.0	70.9	3	2
Sulphur-Tobacco Dust 60:40	54.6	69.0	72.5	82.0	83.7	79.1	68.5	89.4	81.6	.....	82.5	76.3	82.9	63.7	75.9	1	2

*Two tests. †Three tests.

Summary of Insecticides Used in Dust Form

A summary of the data secured in the control tests on the cotton flea hopper by the use of the six most effective insecticides, which were applied as dusts in two or more tests, is given in Table 10.

Superfine Dusting Sulphur: This insecticide ranked second in effectiveness in controlling the cotton flea hopper. When properly applied at the rate of 15 to 20 pounds per acre it reduces the infestation very rapidly and under favorable climatic conditions remains effective for six or seven days after it is applied. In Table 10 it will be noted that this grade of sulphur attained its maximum efficiency on the third or fourth day after it was applied.

This is a heavy finely ground sulphur, 95 per cent of which passes through a 200-mesh screen. It can be applied satisfactorily with either hand-operated or traction dusting machines. It is available to practically all Texas growers at a nominal price in commercial quantities.

Flowers of Sulphur: In four separate series of tests flowers of sulphur proved to be a very efficient insecticide in combating the cotton flea hopper. It ranked fourth in effectiveness among the insecticides used. If applied properly at the rate of 15 pounds per acre this material will reduce and hold the infestation of insects to a satisfactory minimum under favorable climatic conditions. The rapidity of the effect produced on the cotton flea hopper appears practically the same as that of the superfine dusting sulphur.

Flowers of sulphur compared with the superfine dusting sulphur is also fine-grained (92 per cent passes through a 200-mesh screen) but is considerably lighter in weight than an equal volume of the latter grade. In other words a larger area of plants may be dusted with the flowers of sulphur than with an equal weight of the superfine dusting sulphur. This in some degree compensates for the difference in cost of these materials. The physical qualities of flowers of sulphur are such that good uniform applications may be made with any good type of dusting machine. It also is available to most of the growers in Texas in commercial quantities.

Niagara Sulphur-Naphthalene: The performance of this insecticide in controlling the cotton flea hopper is considered very good. While it is ranked fifth in effectiveness among the insecticides listed in Table 10, it should be pointed out that unfavorable climatic conditions, especially during the time that Dust Series 5 was conducted, practically counteracted the effects of the insecticide; nevertheless when considered on an average basis of four separate tests it proved about equal to flowers of sulphur in effectiveness and was but little less effectual than superfine dusting sulphur. Under favorable conditions it reduces the infestation very rapidly and reaches its maximum efficiency on the fourth or fifth

day after application. When properly applied at the rate of 15 to 20 pounds per acre it remains effective for a period of six or seven days.

This insecticide is manufactured by the Niagara Sprayer Company, Middleport, New York, and is designated commercially as Special Mixture No. 227. It contains 60 parts of sulphur and 20 parts of naphthalene, with 20 parts of hydrated lime added by the manufacturer to improve the physical qualities of the mixture. It can be applied satisfactorily with either hand-operated or the traction type of dusting machines. At present, however, this material is not readily available on the local market and the high cost prohibits its use in general farm practice.

Stauffer Sulphur-Naphthalene: This insecticide ranked lowest in effectiveness in the experiments on the control of the cotton flea hopper. It was used in three separate series of control tests and in only one of these, Dust Series 7, did it compare favorably with the other insecticides used in the same test. When considered on the basis of the average control secured in all tests as indicated in Table 10, it will be observed that the per cent of daily control was consistently low and averaged less than 50 per cent notwithstanding applications of dust which were made at an average rate of 20 pounds per acre.

This material is manufactured by the Stauffer Chemical Company, Houston, Texas, and contains the same proportions of sulphur, naphthalene, and hydrated lime as the Niagara product, viz., 60 parts of sulphur to 20 parts each of naphthalene and hydrated lime. Its physical qualities are such that it is readily distributed by any good type of dusting machine. However, until this insecticide is perfected its performance as a control for the cotton flea hopper aside from the high cost does not merit a recommendation to the growers for general use in combating the insect.

60:20:20 Sulphur-Tobacco Dust: Among the insecticides listed in Table 10, the 60:20:20 sulphur-tobacco dust mixture ranked third in effectiveness in the control tests on the cotton flea hopper. When applied at a rate of 20 pounds per acre it reduced the infestation rapidly and under favorable climatic conditions remained effective for a period of about seven days. Apparently this insecticide does not reach its maximum efficiency until the fourth or fifth day after it has been applied.

This insecticide was prepared in the local laboratory and consisted of a mixture of 60 parts of superfine dusting sulphur, 20 parts of finely ground tobacco dust, and 20 parts of hydrated lime. The latter material was added to improve the physical qualities of the dust. The mixture is distributed satisfactorily by any good type of hand- or traction-dusting machine. As indicated by two tests, the advantage gained by the addition of the tobacco dust is an increased period during which the insecticide remains effective in controlling the insect and hence necessitates less frequent applications.

60:40 Sulphur-Tobacco Dust: In the control experiments on the cotton flea hopper this insecticide, which was used in two separate series of tests, ranked first in effectiveness. When applied at an average rate of 25 pounds per acre it produced a high average per cent of daily control and remained effective in checking the infestation for seven days after application under favorable climatic conditions. According to the averages of two tests, as is indicated in Table 10, this mixture reached its maximum efficiency on the fourth or fifth day after application and resulted in an exceptionally good average per cent of daily control.

This insecticide was also prepared in the local laboratory and consisted of 60 parts of superfine dusting sulphur and 40 parts of finely ground tobacco dust. This is a heavier mixture than the 60:20:20 mixture described above, and more than the ordinary care must be exercised to secure a uniform application of the dust. It should be stated, however, that in these experiments it was applied without any great difficulty by means of a Niagara hand-operated dust gun.

The addition of ground tobacco dust to sulphur appears to increase the effectiveness as well as prolong the period over which undiluted sulphur serves in controlling the cotton flea hopper. These two features are considered of sufficient importance to merit further experimentation in this connection, since present knowledge concerning the most desirable combination of sulphur and tobacco dust is not sufficient to recommend the two proportions given above as final. However, the present information available on the subject indicates that this mixture of insecticides will prove practical for general farm use since it can be easily prepared and be made available to the growers in Texas at a nominal cost per pound in commercial quantities.

Control Tests with Sprays

A number of control tests on the cotton flea hopper by the use of liquid insecticides were conducted in a manner similar to the experiments described above in which the dust applications were used. That is, each series of tests extended over a period of fourteen days and consisted of four one-eighth-acre plats of goatweeds one of which was left untreated to serve as a check on the results secured. Each of the other three plats received two applications of the spray at seven-day intervals at the rate of 24 gallons per acre. All of the sprays were applied by means of a knapsack type of compressed air sprayer under a pressure sufficient to produce a fine mist.

In the first series of these control tests on the cotton flea hopper the following materials were used: Pyrethol, 1 to 48; Derrisol, 1 to 800; and Insecto-Spray, 1 to 48. The results secured in this test indicate that these sprays are not satisfactory in combating this insect. The daily record of the number of insects present on each treated plat showed very little, if any, reduction from the number present on the check or untreated plat, notwithstanding very favorable climatic conditions throughout the duration of the test.

Sunoco oil 1 to 48, colloidal sulphur 1 to 6, and sweetened poison 1:4:24, were used in the second series of tests. The per cent of daily control produced by these insecticides exceeded 50 per cent throughout the duration of the experiment. However, in this connection it should be pointed out, that the results secured were based upon a comparatively light infestation of insects present on all the plats of goatweeds under observation. Further experimentation with these mixtures is necessary before they can be recommended as satisfactory in combating the cotton flea hopper.

In the third series of tests on the control of the cotton flea hopper by the use of liquid insecticides the following materials were used: Sulfocide 1 to 200, Boll-We-Ex 1 to 6, and Lime-Sulphur 1 to 100. With favorable climatic conditions prevailing for two days after the first application of the sprays all of the treated plats showed a high per cent of infestation. On the third day another application was made on all plats. However, these sprays did not prove to be effective even when applied at three-day intervals, and the experiment was discontinued after the fifth day, when the infestation still exceeded 50 per cent on all treated plats.

The results obtained in the experiments on control of the cotton flea hopper with liquid insecticides, although preliminary in nature, indicate almost without exception that they are less effective than insecticides applied in dust form. This information is presented for the guidance of local growers who are often solicited to purchase high-priced proprietary spray materials which are not effective in controlling this insect.

Recommendations for Applying Insecticides

1. A good type of dusting machine is essential for distributing the insecticide.
2. The first application of dust should be made at the time when cotton plants would normally begin to form squares.
3. Apply the dust at the rate of 15 to 20 pounds per acre.
4. Use superfine dusting sulphur or flowers of sulphur. Mixtures of sulphur and ground tobacco dust have proved more effective than the undiluted sulphurs, but the most desirable proportions of these materials have not been completely determined.
5. Apply dust every seventh day until the cotton plants have set a good crop of fruit.
6. Applications of materials that are washed off by rains within four or five days after they are made should be repeated.
7. Dusts may be applied at any time during the day, but preferably when there is little or practically no air movement.

SPRING EMERGENCE OF THE COTTON FLEA HOPPER DURING 1926

The cotton flea hopper passes through the winter season in the egg stage. The eggs are laid principally in cotton stalks and goatweed wherever it occurs. After September 1, the eggs begin to remain dor-

mant and a smaller number of the insects hatch with the advent of lower temperatures. Subsequent to November 15, very few of the eggs have been observed to hatch and normally by December 1, all of the young and adult insects in the field are killed by cold weather. This leaves the dormant eggs within the host plants as the only source of an infestation in the following spring. Thus a complete knowledge of the spring emergence of the cotton flea hopper from the overwintering eggs is of vital importance to the grower in combating the insect.

During January and February, 1926, two lots of goatweeds, each of which consisted of 250 average-sized plants, were pulled up in a local field and placed in separate cages for observations on hatching of the eggs or emergence of the insects. The type of cage used for this purpose measures 2x2x4 feet, and had the top and sides covered with one thickness of black percale. Two rows of five shell vials (25x100 mm.) were inserted on three sides near the middle and top of the cage to admit light, which attracted the insects into the vials as they hatched from the eggs within the confined weeds. In Figure 9 is illustrated an improved type of emergence cage now in use.

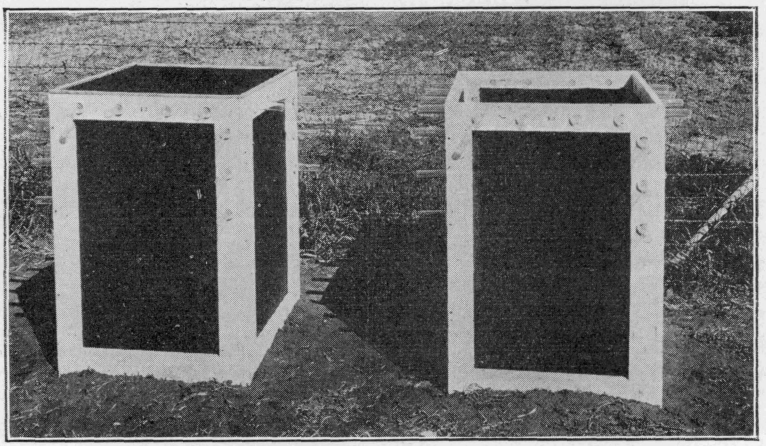

Figure 9.—Type of emergence cage now in use measures 2x2x3 feet and is fitted with 28 vials

Time and Rate of Spring Emergence

The insects began to hatch in these cages on March 8 and continued to emerge until June 10. The numbers hatching during weekly intervals throughout this period are given in Table 11. These data illustrate a very significant fact which should be emphasized in connection with any combative measures undertaken to control the pest. Although the insects hatched from the overwintering eggs over a period of more than thirteen weeks, it will be observed that the maximum emergence of the

Table 11.—Spring Emergence of the Cotton Flea Hopper

Cage	Number of Goatweeds Installed	Number of Insects Emerged												
		March 8–15	March 16–22	March 23–29	March 30-Apr. 5	April 6–12	April 13–19	April 20–26	April 27-May 3	May 4–10	May 11–17	May 18–24	May 25–31	June 1–10
A	250	81	286	487	2662	7700	4978	830	1051	316	85	3	0	1
B	250	47	276	520	2141	6205	9963	2419	2609	1055	539	92	13	4

cotton flea hopper occurred from March 30 to May 3, which includes the time from planting practically to the squaring stage of the cotton plants. Hence, it is imperative to make early applications of insecticides to protect the crop.

The rate of emergence of the cotton flea hopper at College Station during the spring of 1926 is illustrated graphically in Figure 10. The interesting feature in this connection is the rapidity with which emergence occurred. From April 5 to April 26, 73 per cent of the total emergence had been effected and it was practically completed by May 17. The peak of emergence occurred during the week bginning April 12.

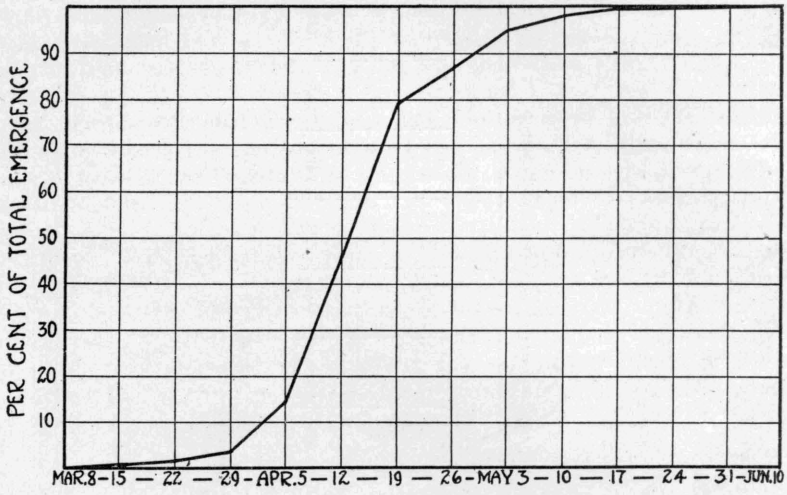

Figure 10.—Rate of spring emergence of cotton flea hopper at College Station during 1926

The Relation of Spring Emergence to Control Measures

A summary of the data secured in the experiments on spring emergence of the cotton flea hopper from the overwintering eggs is presented in Table 12. More than 90 per cent of all the insects emerged during the month of April, which obviously is the time when the young cotton plants that have almost reached the squaring stage should be protected from attack by the application of insecticides. Another very pertinent fact illustrated by these data is the extreme importance of goatweeds as a source of infestation to young cotton plants in the spring. Nearly fifty thousand young insects hatched from the eggs laid the previous fall in five hundred average-size goatweed plants. In other words, each weed of this variety which is not completely destroyed before the insects hatch may prove to be the origin of one hundred young cotton flea hoppers. With this possible degree of infestation it will readily be seen that a comparatively few of these weeds in a field are a menace to the

cotton plants in constituting a source of infestation by the cotton flea hopper and may result in severe losses to the crop.

Table 12.—Summary of Spring Emergence

Cage	Number of Goatweeds Installed	Date of First Emergence	No. of Insects Emerged During				Date of Last Emergence	Total Number Emerged
			March	April	May	June		
A	250	1926 March 8	860	17138	481	1	1926 June 7	18480
B	250	March 9	846	23061	1972	4	June 10	25883

The Destruction of Winter Host Plants as a Means of Reducing the Spring Emergence

It has already been pointed out that the cotton flea hopper passes through the winter only in the egg stage. In the fall the insects lay their eggs in several kinds of weeds but principally in goatweeds and cotton plants. Obviously the destruction of these winter host plants will reduce the number of insects that emerge in the spring. The enormous numbers of cotton flea hopper eggs present, especially in goatweeds during the winter, unquestionably makes this the most favorable time to begin combative measures against the insect.

The data secured in experiments conducted in this connection indicate that only the complete destruction of the infested host plants during the fall or winter prior to March 1, will result in a material reduction of the numbers of insects which emerge the following spring.

Goatweed: Six lots of infested goatweeds each consisting of fifty plants were pulled up in local fields during the fall of 1925 at intervals of two weeks beginning September 1. These weeds were kept under field conditions until February, 1926, when each lot of weeds was placed in a small emergence cage for observations on hatching of the insects. The results obtained in this experiment are presented in Table 13.

Table 13.—The Effect of Killing Goatweeds in the Fall on Spring Emergence of the Cotton Flea Hopper

Cage	Host Plants	Number Plants Installed	Date Pulled Up	First Emergence	Last Emergence	Total Number Emerged
4	Goatweed...	50	1925 Sept. 1.....	1926 April 6.....	1926 April 10.....	8
5	Goatweed...	50	Sept. 15.....	Mar. 12.....	April 29.....	38
6	Goatweed...	50	Oct. 1.....	Mar. 9.....	May 13.....	308
7	Goatweed...	50	Oct. 15.....	Mar. 9.....	May 11.....	920
8	Goatweed...	50	Nov. 1.....	Mar. 13.....	May 18.....	1265
9	Goatweed...	50	Nov. 15.....	Mar. 7.....	May 8.....	1371

These data illustrate the importance of destroying the infested weeds at the time when they are pulled up or cut in the field. It will be observed that eight insects hatched from the eggs contained in fifty goatweed plants which were pulled up as early as September 1, and that the numbers of insects emerging from the weeds pulled up on subsequent dates at intervals of two weeks increased very rapidly up to November 15. In other words, infested weeds which are killed at any time after September 1 and are left in the field remain a likely source of infestation to the next crop.

Cotton and horsenettle: Present knowledge indicates that goatweed or sageweed wherever it is present is the most attractive host plant of the cotton flea hopper. Nevertheless it has been proved by experiment that both cotton stalks and horsenettle, *Solanum elaeagnifolium* Cav., also serve as winter host plants for the insect.

Cotton stalks which were collected during November, 1925, in various sections in the northeastern part of the State and in local fields during February, 1926, were placed in emergence cages to determine their importance as a winter host plant of the cotton flea hopper. First hatching of the eggs in these plants occurred on March 22, and the insects continued to emerge until May 28. On the basis of the total emergence of insects in these cages each cotton plant yielded about ten young cotton flea hoppers.

In another emergence cage twenty-five horsenettle plants were installed for observation on February 24, 1926. A total of fifteen cotton flea hoppers hatched from eggs contained in these plants. The emergence extended from April 2 to May 7.

While these data show that neither cotton nor horsenettle is as important as goatweed as a winter host plant for the cotton flea hopper, yet it is evident that a sufficient number of eggs may be contained in either plant to create a source of infestation in the spring to young cotton plants. Hence these plants like goatweed should also be destroyed during the winter to prevent the insects emerging from the eggs which these plants may contain.

Plowing Under Infested Winter Host Plants to Prevent Spring Emergence

Since it has been demonstrated that the destruction of the winter host plants of the cotton flea hopper at the proper time is a very desirable procedure in combating the pest, the question remains as to the manner in which the host plants shall be destroyed. Ordinarily in general farm practice plowing under weeds is the most common means to dispose of them as well as the most desirable practice from the standpoint of soil fertility.

In order to determine if the eggs of the cotton flea hopper are destroyed when the weeds are plowed under, three lots of goatweeds each containing fifty plants were placed under the soil on December 1, 1925, at depths of four to six inches. During the first week of April, 1926,

the undecayed remnants of these weeds were placed in emergence cages for observation. Hatching in these cages began on April 16 and the insects continued to emerge from the eggs in the undecayed portions of the weeds until June 7. Notwithstanding the fact that all of these buried weeds were largely decayed at the time they were removed from the soil one lot yielded eighty-six young cotton flea hoppers.

Although the results of this experiment show that plowing under the infested winter host plants to an ordinary depth is not completely effective in preventing the insects from emerging from the weeds, since there is always the possibility of bringing undecayed remnants containing eggs to the surface while preparing the seed-bed, yet this operation destroys immense numbers of cotton flea hopper eggs. Aside from being a good farming practice, plowing under infested weeds merits an unqualified recommendation as a means for combating the pest.

Spring Weeds as a Factor in Early Infestation

In some sections of the State the emergence of the cotton flea hopper from the overwintering eggs may begin before either cotton or goatweed is available as a food plant. This proved to be the case at College Station during the spring of 1926. Whenever this situation occurs the young insects feed upon the most attractive spring weeds present in the field until cotton or goatweed plants are available. Spring weeds thus become an important factor which must be considered in any measures that are undertaken to combat an early infestation of insects on young cotton plants. Hence the systematic destruction of all early weed growth by a thorough preparation of the seed-bed and by cultivation after planting is recommended as an additional measure of protecting the crop from injury by this insect.

Observations at College Station during April and May, 1926, showed that the spring weeds which are most frequently infested by the cotton flea hopper include the following, in addition to the thirty-eight food plants previously listed in Texas Experiment Station Bulletin 339.

Scientific Name	Common Name
Callirrhoe involucrata	Poppy Mallow
Castilleja indivisa	Painted-Cup
Cynosciadium pinnatum?	
Filago prolifera	Evax
Gaura sinuata	
Gaura tripetala	
Gnaphalium purpureum	Cudweed, Everlasting
Lepidium medium	Peppergrass
Leptilon Canadense	Horseweed
Modiola Caroliniana	
Monolepis Nuttalliana	
Oenothera laciniata	Evening Primrose
Rumex spp.	Dock, Sorrel

Scientific Name	Common Name
Serinea gracilis	
Torilis nodosa	Hedge-Parsley
Trifolium amphianthum	Purple Clover

Wind as a Factor in the Dispersal of the Cotton Flea Hopper

When the spring emergence of the cotton flea hopper is well under way and the insects are hatching in enormous numbers in the field it appears quite likely that the young insects, which are very small when newly hatched, may be carried for considerable distances by winds. Frequently an infestation of the cotton flea hopper becomes well established in fields remote from any source of infestation before the presence of the insect in the field is suspected. Furthermore, during the season of 1926 the insect caused much concern by its presence on cotton over large areas where it had not previously been reported as injuring the crop. These facts suggest the possibility that winds may prove to be an important factor in the dissemination of the pest, especially, early in the season. This is being made a subject of further investigation and the present reference to the theory is made primarily to direct attention to the fact that any fields of cotton regardless of location may become infested by the insect early in the season through the agency of strong winds.

OUTLOOK FOR THE FUTURE

The past history of the cotton flea hopper in Texas has furnished ample evidence which indicates that growers must learn to produce cotton profitably in the presence of another major insect pest. The experience of Texas growers during the season of 1926 may give encouragement to the thought, that after all, the insect will not prove to be as injurious as the boll weevil, since good crops were obtained after a severe and unprecedented infestation of the cotton flea hopper had occurred in many sections of the State. Climatic conditions proved to be the controlling factor during the past season. The moisture in the soil was sufficient and other conditions were favorable for producing a good crop after July 15. Therefore cotton growers should not assume that good yields will always be secured regardless of the abundance of this insect.

Any forecasts regarding the extent of damage by the cotton flea hopper which may be anticipated in the future must be based upon the depredations caused by the insect in the past. From the time that it first attracted attention as an enemy of cotton the prospects for making inroads on the crop have increased over correspondingly larger areas culminating during the season of 1926, when as late as August 1, large areas of cotton plants in many sections of the State, were without any immediate prospects of making a crop. There is no good reason for assuming that the injury which occurred in the spring and early summer of 1926 is unlikely to occur again when climatic conditions are not favorable, or the moisture in the soil is insufficient, to promote the

growth and development of a crop after the middle of July. In other words, considerable losses in yields may be expected from general cotton flea hopper infestations whenever conditions are not favorable for making a crop in the latter part of the season.

In this connection it should be pointed out that late crops are usually subject to more severe injury by the cotton boll weevil. Hence the relation between these two major cotton pests appears noteworthy in considering prospective losses to the crop. At the time cotton plants first begin to form young squares they are subject to attack by the cotton flea hopper and when the insects are numerous a large proportion of the squares are injured and shed off by the plants. Thus in the early part of the season the boll weevil infestation is held in check when there are comparatively few squares available in which the insects can develop. This situation apparently occurred in many localities in this State as late as July, 1926. When the injury by the cotton flea hopper had subsided the cotton plants formed and retained fruits so rapidly that good crops were made before the boll weevil had increased to the extent of being an important factor. Undoubtedly this condition was unprecedented and growers are cautioned not to anticipate its frequent recurrence. For it appears logical to assume when the cotton flea hopper infestation in the former part of the season is not general or sufficient on cotton to result in a complete shedding of squares, the boll weevil will multiply in the uninjured fruit remaining on the plants and become a menace to the crop after the cotton flea hopper attack has ceased. In other words, under these conditions the boll weevil supplements the injury produced by the cotton flea hopper. This will likely prove to be the more common situation confronting local growers, who should be prepared to combat both pests.

No natural enemies have been found which give promise of aid in checking infestations of the cotton flea hopper and growers must resort to remedial measures in combating the insect.

SUMMARY

In field experiments on control of the cotton flea hopper, superfine dusting sulphur, flowers of sulphur, Niagara sulphur-naphthalene, 60:20:20 sulphur-tobacco dust-lime, and 60:40 sulphur-tobacco dust all proved effective insecticides in controlling the pest. The average daily control secured in the tests ranged from 68.2 to 75.9 per cent. When applied at the rate of 20 pounds per acre these insecticides remained effective in controlling the insects for a period of six or seven days under favorable climatic conditions. In a series of three preliminary tests contact sprays including Derrisol, Insecto-Spray, Pyrethol, Sulfocide, Boll-We-Ex, and Lime-Sulphur did not prove effective in controlling the pest.

During 1926 spring emergence of the cotton flea hopper extended over a period of more than thirteen weeks beginning March 7; however, 73 per cent of the total emergence occurred between April 5 and April

26, and it was practically completed by May 17. The peak of spring emergence occurred during the week beginning April 12. Goatweed is the most important host plant of the cotton flea hopper. During 1925-26 it carried an enormous number of eggs through the winter. Cotton stalks and horsenettle, *Solanum elaeagnifolium,* are also important in this connection but generally are less severely infested than goatweed. Plowing under infested host plants during the winter and the destruction of early spring weed growth by a thorough preparation of the seed-bed and cultivation after planting are recommended as a means of preventing infestations of this insect. A list of sixteen additional food plants is recorded including principally early spring weeds growing in and adjacent to fields of young cotton. There is some evidence which suggests that winds may be an important factor in dispersal of the cotton flea hopper, especially during the early part of the season. No natural enemies have been found which give promise of aid in reducing infestations of the cotton flea hopper and growers must resort to remedial measures in combating the pest.