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Dusting Cotton With Calcium Arsenate for Boll Weevil Control

(SECOND PROGRESS REPORT)

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COTTON dusting tests with calcium arsenate for the control of the boll weevil were made in 1924 and 1925 on three distinct types of soil,—namely, Norfolk sandy loam at Auburn, Cecil clay in Lee County, and Houston clay in Montgomery County. Detailed data of these tests were published in Circular 51. The tests were continued in 1926, 1927, and 1928 on the plots previously used, with one exeception. This exception occurred in 1926 on the Houston clay soil, when the tests were conducted on plots in a different part of the same field.

This report includes the detailed cotton dusting data on the three soil types for the years 1926, 1927, and 1928. It also includes the average infestation and the seed cotton yield for the five-year period from 1924 to 1928, inclusive.

EXPERIMENTAL METHOD

THE METHOD used in determining the infestation consisted of first definitely locating three to six stations in each of the dusted and undusted plots. Each station was marked by a stake five feet long. The infestation was determined by examining one hundred squares at each station. All the squares on a plant were counted and the number of punctured squares in one hundred was used as the per cent of infestation at a given station. When the average infestation of the plot reached 10 per cent, three applicaitons of calcium arsenate were made at intervals of four to six days.

Further infestation counts were made at intervals of four to seven days following the third application of dust. When the infestation approached 20 per cent, the cotton was again dusted to protect the newly-formed squares and the young bolls. This method of determining the time to dust the cotton was continued throughout the growing season or until the weevil migration caused complete infestation (75 per cent or above).

The applications of calcium arsenate were made at different times of the day, varying from early morning to late evening, but at a time when the air was relatively calm. The condition of foliage varied from wet to dry. Applications of dust were repeated when there was a heavy rainfall within 24 hours following the regular dustings.

The amount of calcium arsenate used in dusting an acre of cotton varied from six to seven pounds per application, with an average of 6.7 pounds. The number of applications of dust each season varied from three to eleven, depending upon the infestation.

All applications of calcium arsenate dust were made with a one-mule, two-row, power dust gun. The power gun was set to make a thin cloud of dust which settled over the entire plant, affording a thorough and even distribution of the dust particles.

NORFOLK SANDY LOAM PLOTS, 1926-1928

THESE PLOTS were located at Auburn on the Agricultural Experiment Station farm. The soil had been in cultivation for many years. There were two series of seven one-tenth acre plots. Three of the plots of each series were not fertilized, —namely, 1, 4, and 7. The other four plots, 2, 3, 5, and 6 were treated respectively with 500, 1000, 1500, and 2000 pounds of fertilizer. One series of plots was not dusted, and the other series was dusted with calcium arsenate after the infestation reached 10 per cent. The dusted series of plots was alternated with the undusted series from year to year. The two series of plots were separated by a thirty-foot alley way, which was dusted but not fertilized.

Infestation and Dusting

The infestation and dusting records for the Norfolk sandy loam plots in 1926, 1927, and 1928 are recorded in Table 1.

The infestation in 1926 did not reach 10 per cent until August 27 (Table 1). Three applications of calcium arsenate dust were then made at intervals of five to six days. The infestation on the dusted plots varied from 12 to 20 per cent from August 27, to September 14, while the infestation on the undusted plots gradually advanced from 15 to 57 per cent, during the same period. The low infestation on the dusted plots contrasted with the relatively high infestation on the undusted plots indicated a decided control of boll weevil.

The early high infestation in 1927 continued throughout the growing season and was in striking contrast to the late infestation in 1926 (Table 1). The continued high infestation in 1927 was apparently due to the twenty-eight days of June that were either cloudy or partly cloudy. The cloudy weather protected the pupae of the first generation so that a high percentage of them emerged as adults. On June 13 the infestation on the dusted plots was 11 per cent. Three dustings were made at intervals of three to five days, which resulted in the infestation dropping to 1 per cent July 1. In the meantime the infestation on the undusted plots had advanced to 28 per cent. The infestation was 15 per cent on the dusted plots July 15, while the infestation

Table 1.—Infestation and Dusting Dates on Norfolk Sandy Loam Plots, Auburn, 1926, 1927, and 1928.

1926				1927				1928			
Average Percent Infestation			Dusting Dates	Average Percent Infestation			Dusting Dates	Average Percent Infestation			Dusting Dates
Date	Un-dusted	Dusted		Date	Un-dusted	Dusted		Date	Un-dusted	Dusted	
July 6	1.0	0.0		June 9	7.1	0.0		July 11	.60	1.00	
July 13	0.0	0.0		June 13	4.0	11.7	June 16	July 17	3.70	2.20	
July 21	0.0	0.5		June 20	5.4	8.8	June 21*	July 20	2.20	.40	
July 28	0.0	0.0		June 28	15.0	4.2	June 22*	July 24	.50	.50	
Aug. 5	0.0	0.0		July 1	28.7	1.2	June 23	July 27	.70	.50	
Aug. 12	0.0	0.0		July 5	25.2	2.2	June 27	July 31	.25	4.00	
Aug. 23	4.0	4.0		July 8	35.2	2.2		Aug. 3	.75	3.25	
Aug. 27	15.3	13.0	Aug. 28	July 12	47.2	5.1		Aug. 7	1.25	3.00	
Aug. 31	27.8	12.3		July 15	36.2	15.4	July 15	Aug. 10	2.80	10.50	Aug. 11
Sept. 3	59.1	17.7	Sept. 3	July 19	39.2	14.5	July 19	Aug. 14	3.30	6.70	Aug. 16*
Sept. 14	57.7	20.3	Sept. 8	July 22	55.1	11.7		Aug. 18	1.71	3.10	Aug. 18
				July 26	74.1	8.7	July 27	Aug. 20	4.00	1.70	
				July 29	83.1	14.5	July 30	Aug. 27	22.60	2.40	
				Aug. 2	89.5	19.1	Aug. 3	Aug. 31	64.30	4.40	
				Aug. 6	88.0	83.8	Aug. 8	Sept. 7	70.00	20.60	
				Aug. 9	95.5	80.5					
				Aug. 12	92.2	87.7					
				Aug. 16	93.1	92.0					
Average Infestation	14.9	6.1		Average Infestation	56.2	25.7		Average Infestation	11.90	4.28	

*Rained within 24 hours.

on the undusted plots was 36 per cent. Applications of dust were made July 15 and 19, which resulted in the infestation dropping to 8 per cent by July 26. Meanwhile the infestation on the undusted plots had advanced to 74 per cent. Applications of dust were made July 27 and 30, and August 3. This series of dustings kept the infestation below 20 per cent until August 2, and protected the newly-formed squares and young bolls. The infestation on the undusted plots gradually advanced to 89 per cent, during the same period. An enormous number of adult weevils spread into the dusted plots practically equalizing the infestation on the dusted and undusted plots by August 6. The eleventh and last dusting was made August 8, for the purpose of protecting the half-grown bolls. The per cent of infestation, however, was not materially changed due to the reduced rate of squaring and to the migration of weevils from the undusted plots. The infestation was complete (above 75 per cent) during the remainder of the season. The infestation count on the dusted plots from June 20 to August 2 indicated that the infestation had been sufficiently reduced (kept below 20 per cent) to protect a large number of squares and young bolls.

The infestation in 1928 did not reach 10 per cent until August 10 (Table 1). Three applications of dust were made at intervals of two to five days. These dustings kept the infestation below 20 per cent until September 7. The infestation on the undusted plots advanced from 2.8 to 70 per cent over the same twenty-eight-day period.

Yields

The contrast in seed cotton yields for 1926 (Table 2) on the dusted and undusted plots, show the effect of controlling the boll weevil when the infestation goes above 10 per cent. The gain from dusting varied from 190 pounds of seed cotton, where there was a 500-pound treatment of fertilizer, to a gain of 480 pounds of seed cotton per acre, where there was a 2000-pound treatment of fertilizer. The average gain for dusting on all fertilized plots was 359 pounds of seed cotton per acre.

The greatest contrast in favor of dusting, however, was obtained in the 1927 season (Fig. 2). This contrast was due, mainly, to a high infestation in early June which continued throughout the season, and the control obtained from dusting. There was a conspicuous contrast between the dusted and undusted plots. Where no fertilizer was used the gain was 224 pounds of seed cotton on the dusted plots. The gain from dusting on the plots treated with different rates of fertilizer varied from 562 pounds of seed cotton, where the fertilizer treatment was 500 pounds, to a gain of 931 pounds of seed cotton per acre, where the fertilizer treatment was 2000 pounds. The average gain per acre from dusting on all fertilized plots for 1927 was 773 pounds of seed cotton (Table 2).

The contrast for dusting in 1928 varied from 142 pounds of

Table 2.—Five-Year Average Infestation and Seed Cotton Yield Per Acre on Norfolk Sandy Loam Plots, Auburn, Alabama. 1924-1928

Fertilizer Per Acre. Lbs.	Treatment	Average Percent Infestation						Seed Cotton Yield in Pounds Per Acre						
		1924	1925	1926	1927	1928	Ave. Inf.	1924	1925	1926	1927	1928	Ave. Yield	Ave. Gain
0	Undusted	0	7	13	40	4	9	107	285	148	74	68	136.0	
	Dusted	0	1	6	25	2	7	101	251	128	298	39	163.4	27
500	Undusted	35	7	17	60	11	26	456	509	484	282	256	397.5	
	Dusted	20	1	8	27	2	12	678	535	674	844	451	636.4	239
1000	Undusted	38	9	13	59	11	26	758	695	888	473	570	667.4	
	Dusted	25	1	8	22	4	12	1050	770	1244	1212	1064	1068.0	392
1500	Undusted	37	21	13	57	13	28	1146	770	1212	606	710	888.8	
	Dusted	23	4	5	26	5	13	1352	813	1622	1468	1050	1261.0	372
2000	Undusted	37	20	13	58	15	30	1304	899	1374	565	1165	1061.6	
	Dusted	28	7	5	29	6	15	1402	887	1854	1496	1308	1349.4	288

seed cotton per acre, where the amount of fertilizer was 2000 pounds, to a gain of 494 pounds of seed cotton per acre, where the rate of fertilizer was 1000 pounds (Table 2). The average gain per acre for dusting on all fertilized plots was 292 pounds of seed cotton.

CECIL CLAY PLOTS, 1926-1928

THE CECIL clay plots were located on the E. H. James farm, five miles west of Loachapoka, in Lee County. In 1926 the soil was treated with 450 pounds of home-mixed fertilizer per acre, in 1927 with 400 pounds, and in 1928 with 600 pounds.

Infestation and Dusting

The infestation in 1926 approached 10 per cent July 26 (Table 3). An application of dust was made July 27. There was a heavy rainfall within twenty-four hours. In fact there was a heavy daily rainfall for eight consecutive days from July 27 to August 3 making it impossible to apply further dust until August 5. Three applications of dust were then made at four-day intervals. The infestation on the dusted plots remained below 10 per cent until August 26, when it advanced to 23 per cent. On the undusted plots, the infestation gradually advanced from 13 to 50 per cent, during the same period.

The infestation on the dusted plots in 1927 was 40 per cent June 14 (Table 3). The first dust was applied June 14, but was washed off within an hour. Five dustings were made from June 14 to 23 inclusive, all of which were affected by rain within twenty-four hours. The infestation on the dusted plots, however, decreased from 40 per cent June 14, to 11 per cent July 5, while on the undusted plots the infestation advanced from 29 to 46 per cent. The dustings on June 25, July 6, 11, and 28, and August 2, and 5, were not affected by rains. The infestation remained below 20 per cent on the dusted plots from June 20 to August 5, except July 29, when the infestation was 42 per cent. The infestation on the undusted plots gradually advanced to 87 per cent during the same period. The infestation advanced to 80 per cent on the dusted plot and 96 per cent on the undusted plot by August 10. All applications of dust were made during the day. The condition of the foliage at the time of dusting varied from wet to dry. There was no appreciable difference in the control under either condition.

The infestation in 1928 was above 10 per cent June 27 (Table 3). The cotton was dusted the same day and at intervals of four to six days until three applications of dust were made. The infestation advanced to 14 per cent July 30, and two applications of dust, July 31 and August 4, kept the infestation below 20 per cent until August 25.

Table 3.—Infestation and Dusting Dates on Cecil Clay Plots, Lee County, 1926, 1927, and 1928.

1926				1927				1928			
Average Percent Infestation			Dusting Dates	Average Percent Infestation			Dusting Dates	Average Percent Infestation			Dusting Dates
Date	Un-dusted	Dusted		Date	Un-dusted	Dusted		Date	Un-dusted	Dusted	
June 15	0.0	0.0		June 14	29.0	40.0	June 14*	June 22	8.0	9.3	
June 24	.2	.5		June 20	31.0	7.0	June 17*	June 27	14.0	20.0	June 27
June 28	1.6	1.0		June 25	44.5	8.0	June 18*	July 3	38.0	17.0	July 3
July 3	.8	.3		June 29	32.5	5.5	June 21*	July 7	7.0	4.0	July 7
July 10	2.0	1.5		July 5	46.5	11.5	June 23*	July 14	4.5	2.0	July 9*
July 16	.8	.6		July 9	49.5	16.5	June 25	July 18	8.0	1.3	
July 21	5.6	4.7		July 15	52.0	13.0	July 6	July 21	13.5	1.0	
July 26	9.6	8.7		July 21	54.0	10.0	July 11	July 27	11.0	10.6	
July 31	13.3	14.5	July 27	July 29	52.0	42.0	July 28	July 30	10.0	14.6	July 31
Aug. 6	13.2	6.1	Aug. 5	Aug. 2	74.0	19.0	Aug. 2	Aug. 3	9.5	16.0	Aug. 4
Aug. 10	8.2	4.3	Aug. 9	Aug. 5	87.0	25.0	Aug. 5	Aug. 7	12.0	8.3	
Aug. 14	12.4	2.6	Aug. 13	Aug. 10	96.0	80.0		Aug. 11	13.0	1.0	
Aug. 19	26.5	4.0	Aug. 17					Aug. 16	16.0	3.6	
Aug. 26	50.4	23.3						Aug. 20	22.0	13.0	
								Aug. 25	38.0	28.0	
								Aug. 28	44.0	20.0	
Average Infestation	11.27	5.7		Average Infestation	53.8	23.1		Average Infestation	16.8	9.9	

*Rained within 24 hours.

Yields

A definite correlation between seed cotton yield and infestation occurred in 1926, 1927, and 1928 (Table 4). The infestation was low in 1926, and the increase in yield of 150 pounds of seed cotton per acre on the dusted plot was correspondingly low; while the infestation in 1927 was high, and the increase in yield of 597 pounds of seed cotton per acre was correspondingly high. The correlation was not quite so pronounced in 1928. The average infestation was low when contrasted with the 490 pounds per acre increase in seed cotton yield on the dusted plot. A careful study of Table 3, however, reveals the fact that the infestation was high several times during the period squares were being set. The large increase in yield resulted, even though the average infestation for the year was comparatively low (Table 4).

Table 4.—Five-Year Average Infestation and Seed Cotton Yield Per Acre on Cecil Clay Plots, Lee County, 1924-1928.

Year	Average Infestation		Seed Cotton Per Acre		
	Undusted	Dusted	Undusted	Dusted	Gain
1924	12	6	755	670	—85
1925	37	14	480	740	260
1926	11	5	1200	1350	150
1927	53	23	535	1132	597
1928	17	10	765	1255	490
Five Year Average	26	11	747	1029	282

HOUSTON CLAY PLOTS, 1926-1928

THE BOLL WEEVIL control on Houston clay was continued on the Joe Phillips farm, three miles east of Pike Road, in Montgomery County. The soil, which had been under cultivation for twenty years, was not treated with fertilizer in 1926, 1927, or 1928. Different parts of the same field were used for the tests during the three-year period.

Infestation and Dusting

The infestation in 1926 was 11 per cent June 25 (Table 5). Three applications of dust were made at intervals of three to five days. The infestation dropped from 11 to 4 per cent, while the infestation on the undusted plots dropped from 8 to 4 per cent and then advanced to 14 per cent for the same period. A five-day period of rainfall, following July 26, prevented the further application of calcium arsenate at a time when it was needed to protect the newly-formed squares and young bolls. Three applications of dust, beginning August 11, reduced the in-

Table 5.—Infestation and Dusting Dates on Houston Clay Plots, Montgomery County, 1926, 1927, and 1928.

1926				1927				1928			
Average Percent Infestation			Dusting Dates	Average Percent Infestation			Dusting Dates	Average Percent Infestation			Dusting Dates
Date	Un-dusted	Dusted		Date	Un-dusted	Dusted		Date	Un-dusted	Dusted	
June 25	8.8	11.0	June 25	June 4	8.0	19.0	June 6*	June 19	4.0	16.0	
June 29	4.8	4.6	June 30	June 10	4.0	11.0	June 11	June 21	5.3	18.3	June 21
July 2	9.0	4.7	July 3	June 15	7.0	.25		June 26	2.6	6.0	
July 9	14.0	4.0		June 22	6.0	2.0		June 30	5.3	2.6	June 30
July 15	20.0	12.6	July 16	June 27	12.0	14.0	June 30	July 4	1.3	0.0	July 4
July 19	24.0	16.0	July 20	July 2	34.5	44.8		July 12	3.3	0.6	
July 23	29.0	12.6		July 8	28.5	11.25	July 4	July 19	6.6	3.0	
Aug. 3	31.3	10.0	July 26*	July 16	28.5	8.0	July 11	July 26	23.0	7.3	
Aug. 9	42.2	30.0	Aug. 11*	July 22	68.5	61.5		July 31	30.0	15.0	July 31
Aug. 13	50.5	42.8	Aug. 13*	July 26	76.0	70.0	July 26	Aug. 4	31.8	15.6	Aug. 4
Aug. 18	43.3	29.6	Aug. 17	July 30	72.0	57.5		Aug. 8	26.3	6.0	
				Aug. 4	88.0	72.5		Aug. 17	50.0	26.0	
								Aug. 21	49.0	40.0	Aug. 24
								Aug. 25	67.3	48.0	Aug. 27
								Sept. 1	55.3	46.0	Aug. 29
Average Infestation	25.17	16.17		Average Infestation	36.08	30.73		Average Infestation	24.0	16.7	

*Rained within 24 hours.

festation from 42 to 29 per cent by August 18. All applications of dust were made in the day time, while the foliage was dry.

The infestation in 1927 was 19 per cent on the dusted plot June 4 (Table 5). Two applications of dust were made at five-day intervals beginning June 5, which was nineteen days earlier than the first dusting in 1926. The third application of dust was not made June 16, on account of the infestation dropping to .2 per cent. A large number of adult weevils, however, had emerged by June 27, and the infestation had advanced to 14 per cent. An application of dust was made June 30. The infestation had advanced to 44 per cent on the dusted plots July 2, which was a gain of 30 per cent infestation in five days. The applications of dust June 30, July 4, and July 11, reduced the infestation to 8 per cent on the dusted plot, while the infestation on the undusted plot advanced from 12 to 28 per cent. The infestation July 26 was practically the same on all plots due to weevil migration. All applications of calcium arsenate were made in the day time, with the foliage dry.

The infestation in 1928 was 16 per cent on the dusted plot June 19 (Table 5). Three applications of dust at intervals of four to nine days kept the infestation below 15 per cent until July 31. Two dustings, July 31 and August 4, and three dustings August 24, 27, and 29, protected the cotton. Weather conditions prevented the application of dust August 17 and 21 at which times the infestation was above 20 per cent.

Yields

The increase in yield from dusting was less in both 1926 and 1927 than in 1928, although the infestation was as great or greater in each of the former years (Table 6). This condition was brought about largely by a failure to make one or two needed applications of dust at crucial periods in the development of the cotton in 1926 and 1927. The type of soil was such that the excessive rainfall which occurred during these periods prevented the operation of the dusting machine. The increase in yield from dusting in 1926, 1927, and 1928 was respectively, 170, 160, and 372 pounds of seed cotton per acre.

WHEN TO DUST AND WHEN NOT TO DUST COTTON AS SHOWN BY THE INFESTATION IN 1926 AND 1927

THE question of when to dust and when not to dust cotton to control the boll weevil profitably is quite clearly shown by the infestation and yield records of 1926 and 1927, on the rate of fertilizer plots (Tables 1 and 2). The late and low infestation during the 1926 growing season is in striking contrast to the early and high infestation in 1927, which continued throughout the growing season.

The infestation in 1926 did not reach 10 per cent until August 27. Three applications of dust were made which resulted in keep-

Table 6.—Five-Year Average Infestation and Seed Cotton Yield Per Acre on Houston Clay Plots, Montgomery County, 1924-1928.

Year	Average Infestation		Seed Cotton Per Acre		
	Undusted	Dusted	Undusted	Dusted	Gain
1924	30	12	235	405	170
1925	22	13	670	1090	420
1926	25	16	690	860	170
1927	36	30	657	817	160
1928	24	16	388	760	372
Five Year Average	27	17	528	786	258

ing the infestation below 20 per cent until September 14. The infestation in 1927, however, was 11 per cent June 13 (Table 1). Three series of dustings were necessary throughout the season, the first beginning June 16 and extending to June 27. Three applications of dust were made at intervals of four and five days. Rain, June 21 and 22, necessitated the repetition of dustings. The second series began July 15, when the infestation reached 15 per cent. Following the second application of dust, July 19, the infestation was reduced to such an extent that further dustings were unnecessary until July 27. The third series was applied July 27, 30, and August 3, respectively. The infestation was complete (above 75 per cent) on all plots by August 6.

These data show that the infestation determines the time to begin dusting and whether or not dusting is necessary. These data also show that no reliable date can be set on which dust should be applied.

FIVE-YEAR AVERAGE YIELD OF SEED COTTON PER ACRE ON THREE SOIL TYPES

THE five-year average gain of seed cotton per acre from dusting with calcium arsenate for boll weevil control was quite uniform on the three soil types. The comparable plots had been treated with approximately 500 pounds of fertilizer per acre, except that on the Houston clay, no fertilizer was used in 1926, 1927, and 1928. The approximate seed cotton yield per acre on the dusted plots of the three soil types was as follows: Norfolk sandy loam, 600 pounds; Houston clay, 800 pounds; and Cecil clay, 1000 pounds (Fig. 1).

The range of gain or loss from dusting cotton on each soil type was quite variable throughout the five-year period. On the Norfolk sandy loam plots the range was from 74 pounds of seed cotton in 1926 to 562 pounds gain in 1927 (Table 2), with a five year average gain of 239 pounds of seed cotton per acre (Fig. 1). The greatest range of gain or loss from dusting cotton for the

Undusted—565 Pounds Seed Cotton

Dusted—1495 Pounds Seed Cotton

Fig. 2.—Cotton on Norfolk Sandy Loam soil treated with 2000 pounds of fertilizer per acre, 1927.

control of boll weevil was on the Cecil clay plots, the range varying from 85 pound loss on the dusted plots in 1924 to a 597 pound gain in 1927 (Table 4), with a five-year average gain of 282 pounds of seed cotton per acre (Fig. 1). The range of gain on the Houston clay plots was from 160 pounds in 1927 to 420 pounds gain in 1925 (Table 6), with a five-year average gain of 258 pounds of seed cotton per acre (Fig. 1).

SUMMARY

EXPERIMENTS on boll weevil control with calcium arsenate dust were conducted on three soil types. Calcium arsenate dust was applied when the infestation reached 10 per cent, since other work had shown this to be the best time to begin dusting.

All applications of dust were made with a power dust gun.

The increase in yield from dusting on sandy loam soil in 1924, 1925, 1926, 1927, and 1928 was respectively, 205, 27, 359, 773, and 288 pounds of seed cotton per acre, the average being 312 pounds.

The increase in yield from dusting on Cecil clay soil in 1924, 1925, 1926, 1927, and 1928 was respectively, 85 (loss), 260, 150, 597, and 490 pounds of seed cotton per acre, the average being 282 pounds.

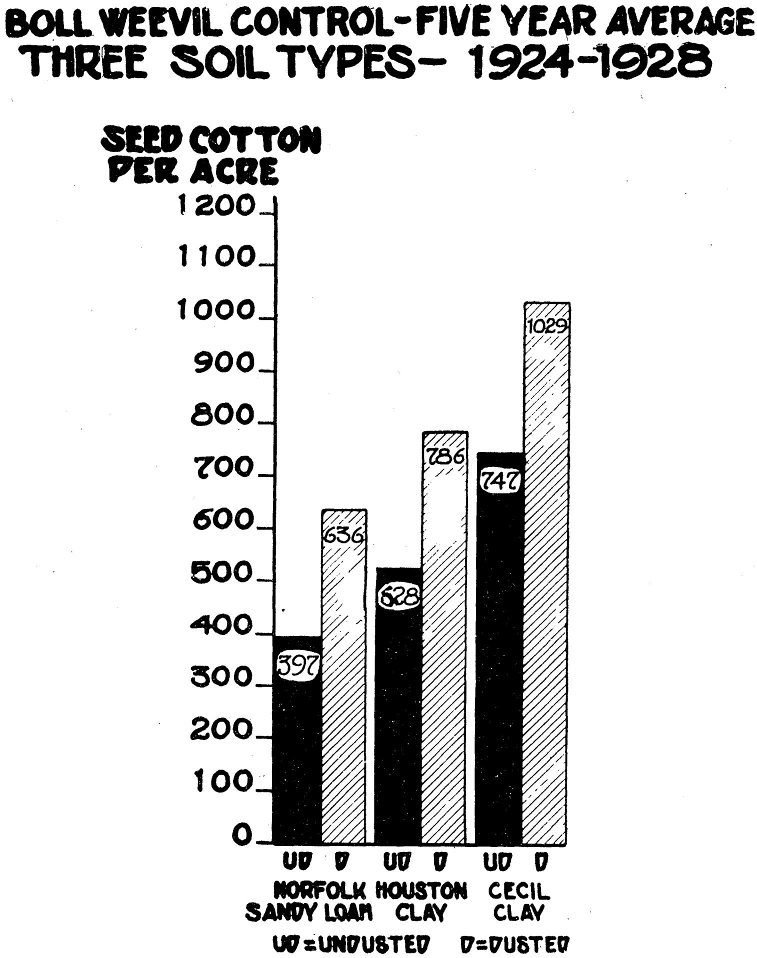

Fig. 1.—Five-Year Average Yields on Three Soil Types, 1924-1928.

The increase in yield from dusting on Houston clay soil in 1924, 1925, 1926, 1927, and 1928 was respectively, 170, 420, 170, 160, and 372 pounds of seed cotton per acre, the average being 258 pounds.

Forty pounds of calcium arsenate dust was the average amount needed for each acre per season.

The average annual cost of the dusting operation was approximately $7.25 per acre.

Calcium arsenate dust reduced the infestation when applied to either wet or dry foliage.

Boll weevil control is profitable only when the infestation exceeds 10 per cent, and when the potential yield is one-half bale or more per acre.