Comparison of Insecticide Deposits Applied As Dust and Spray by Airplane To Cigar-Wrapper Tobacco[1]

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Insecticidal dust and spray applications from airplanes have become widely accepted for insect control on cigar-wrapper tobacco in the Quincy, Florida, area during the past 15 years because of ease of application and economic feasibility. Some applicators favor spraying over dusting because of a larger profit margin, and have promulged unsubstantiated claims for their products. Guthrie **et al.** (1) found that damp shade-cloth covering cigar-wrapper tobacco fields retained a considerable amount of airplane-applied dust materials; however, dust formulations penetrated dry cloth more easily than sprays.

The objectives of the study reported herein were: (1) to determine the lateral distribution of insecticidial dust and spray in the application swath when applied from an airplane, (2) to compare the amount of insecticide coverage between the upper and lower leaf surfaces, and (3) to determine the degree to which the dust and spray penetrate the shade-cloth covering the tobacco.

Materials and Methods

In 1966, an airplane-applied insecticide study involving two tests, one with dust and the other spray, was conducted at Quincy in a commercial cigar-wrapper tobacco shade. The shade was covered with cotton cloth having a weave of 12 threads per inch in each direction. Insecticidal applications were made with a conventional biplane travelling in the same direction in one swath each for the dust on May 9 and the spray on May 11. Swaths are normally spaced 64 feet apart for dusts and 48 feet apart for sprays. The length of swaths in these tests was 608 feet. Little or no wind movement was observed at the time of either application, and the apparent condition of the cloth was dry. Amounts of actual DDT applied per acre in the dust and spray were 2.67 and 3.35 pounds, respectively.

Immediately prior to each application, a 24.0-cm diameter filter paper soaked in mineral oil was attached with paper clips to both surfaces of each horizontal 25.4-cm diameter galvanized iron trap to simulate the tobacco leaf. The locations and positions of the traps for each of the dust and spray tests are shown in **Figure 1.** Distributions of the traps for each of the tests were as follows: three locations laterally, center, mid-center, and edge of the swath; three position heights in and above the tobacco rows at each location, 1 foot above and below the cloth and 1 foot above the soil level; and two surfaces for each trap, upper and lower. There were three replications for each location spaced 16 feet apart, which totalled 54 trap surfaces for each test. The experimental design was a split plot with locations as main plots and traps as subplots. The distance from the cloth top to soil level was approximately 8 feet, while plant heights averaged 48 to 52 inches at each application. The traps at each location were staggered vertically as illustrated in the top view of **Figure 1,** so that no trap would mask the insecticide deposit from the other. Tobacco leaves in proximity to the upper and lower trap surfaces 1 foot above soil level were cut from the plants to prevent further masking effects.

After application of dust or spray, the filter papers were removed from the traps and immersed in 150 ml of redistilled benzene in 0.5-pint jars. The jars were stored at 35°F until analyses were made by the electron capture gas chromatography method using a Barber-Colman Pesticide Analyzer, Model No. 5360.

Results and Discussion

The means of the three replicates for all data collected is presented in **Table 1.** In general, it may be concluded from these data that (1) more insecticide was deposited on the trap surfaces when applied as a spray than as a dust, (2) the amount of insecticide deposited decreased with distance from the center of the swaths, (3) the amount of insecticide deposited decreased as trap height decreased, (4) the magnitude of difference in deposits between heights was not the same at all locations, becoming more uniform at the edge of the swaths, and (5) there was less of both forms of insecticide deposited on the lower than upper trap surfaces. Average dust deposits collected on both trap surfaces 1 foot below the cloth and 1 foot above soil level were 77% and 64%, respectively, of the

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amount collected 1 foot above the cloth. The corresponding figures for the spray were 41% and 16%, respectively. Apparently penetration of the shade cloth was poor for both forms of insecticide, but adherance of the spray to the traps was better than the dust as indicated by the greater deposits.

The analysis of variance using all data collected is shown in **Table 2**, and except for the location x test interaction, all effects were statistically significant. Since this analysis included the interactions among the variables, it must be concluded that the effects were not independent of each other.

Separate analyses for the upper and lower surfaces are given in **Table 3**. The analysis of the upper surfaces was quite similar to that for the combined data in **Table 2**. Except for the location x test interaction, all factors considered were statistically significant. The results of the analysis for the lower surfaces indicated no statistically significant differences for any of the factors included. Therefore, the lower surfaces received approximately the same amounts of insecticide regardless of their height, location, or formulation used.

The upper surface data for each insecticide were analyzed separately as shown in **Table 4**. No significant differences were found in the dust deposits detected on the upper surfaces regardless of height or location of the traps. The analysis of the spray data indicated a significant difference in the amount of insecticide recovered due to height of the traps, which was dependent on location.

Although penetration of the shade cloth was poor for both formulations of insecticide, the percentage comparison of the amount of penetration showed that the dust passed through the cloth more easily. Apparently a large portion of the dust was deposited uselessly on the soil as indicated by the poor adherence to the traps above and within the shade. Spray deposits above and below the cloth were much greater than the dust, although the total amount released from the airplane was only slightly greater. Therefore, the spray should be more effective for control of foliage feeding insects, particularly on the upper portion of the tobacco plants where the deposits were the greatest as indicated by the trap data. In addition to its su-

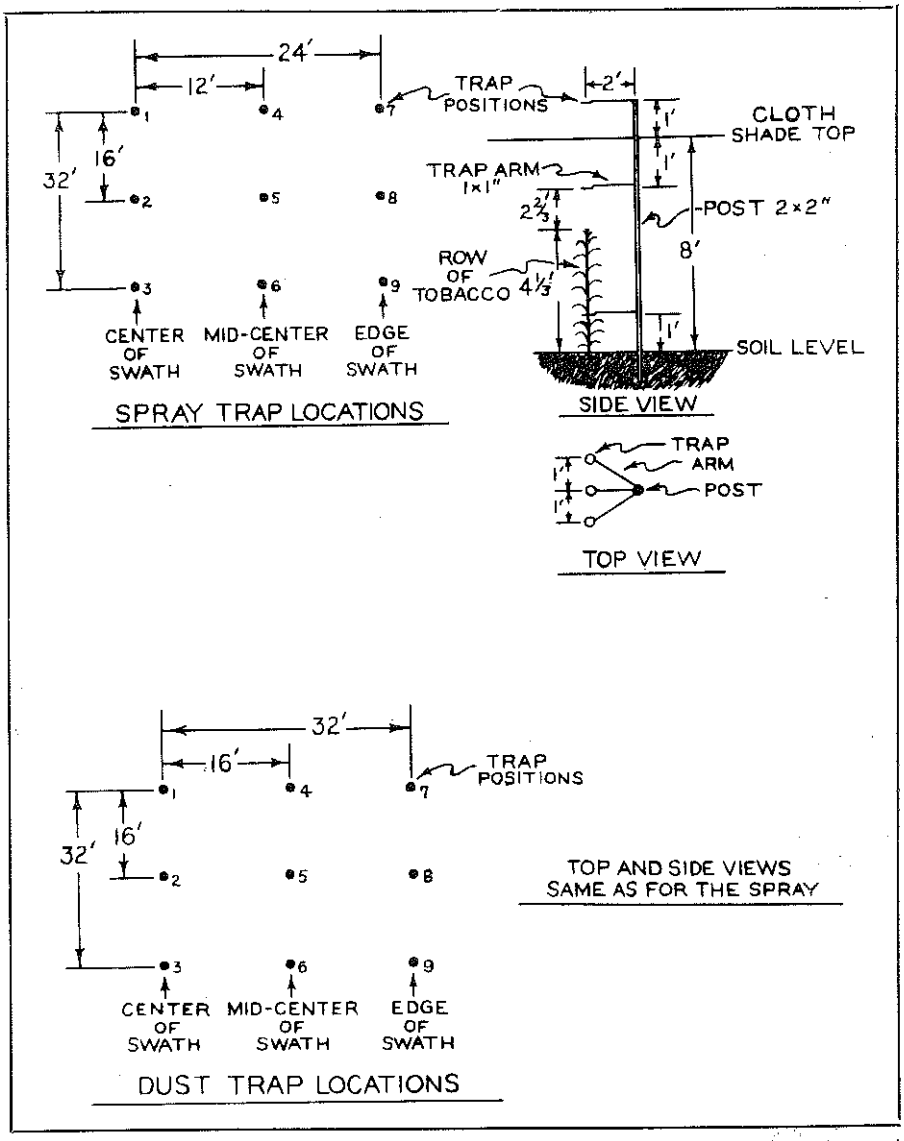

Figure 1. Diagram of locations and position heights of insecticide traps in airplane dust and spray application swaths above and within a cigar-wrapper tobacco shade.

Table 1: Mean deposits in ppm of airplane-applied DDT dust and spray on the upper and lower surfaces of filter paper traps above and within a cigar-wrapper tobacco shade.

Trap Surface	Trap Position Height	Dust Swatch Locations				Spray Swatch Locations			
		Center	Mid-center	Edge	Avg.	Center	Mid-center	Edge	Avg.
Upper	1 ft. above cloth	5.20	0.58	3.49	3.09	49.97	25.27	7.80	27.78
	1 ft. below cloth	4.91	0.94	2.38	2.74	14.72	10.23	8.72	11.22
	1 ft. above soil	3.49	1.07	1.81	2.13	4.44	2.20	5.18	3.94
	Avg.	4.54	0.86	2.56	2.65	23.04	12.67	7.23	14.31
Lower	1 ft. above cloth	0.51	0.38	2.15	1.01	0.88	1.06	0.54	0.83
	1 ft. below cloth	0.32	0.23	0.68	0.41	0.87	0.68	0.37	0.64
	1 ft. above soil	0.29	0.57	0.65	0.50	0.90	0.54	0.64	0.69
	Avg.	0.38	0.40	1.16	0.64	0.88	0.76	0.52	0.72

perior adherence property, the spray is more economical because water is utilized as the carrier in this formulation.

Summary

DDT dust and spray were applied from an airplane to a cloth-covered cigar-wrapper tobacco shade in 1966. Deposits of both formulations of insecticide were recovered on mineral oil-soaked filter paper traps placed above and within the shade. The traps were located in and above the tobacco rows at three position heights at the center, mid-center, and edge of the swaths. Analyses of the deposits were made to determine (1) the lateral distribution of the insecticides in the swaths, (2) the amount of insecticide coverage of the upper and lower trap surfaces, and (3) the degree to which the insecticides penetrated the shade-cloth covering.

The evidence obtained indicated that (1) more spray than dust was deposited on the trap surfaces, (2) the amount of insecticide deposited on the traps decreased with decreasing height of the traps and increasing distance from the center of the swaths, (3) deposits at the various heights were more uniform at the edge of the swaths, and (4) more of both forms of insecticide was deposited on the upper than lower trap surfaces.

Penetration of the shade cloth was poor for both forms of insecticide, but a percentage comparison of the two indicated an advantage for the dust. Spray deposits, however, were greater than the dust on the traps above and below the cloth indicating poor adherence of the dust to the tobacco foliage. The spray apparently would be more effective for insect control, particularly on the upper portion of the tobacco plants where the deposits on the traps were the greatest.

Acknowledgment

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Literature Cited

1. Guthrie, F. E., R. L. Rabb, and C. H. Van Middelem. Control of aphids on cigar-wrapper and flue-cured tobacco. J. Econ. Entomol. 49(5): 602-606. 1956.

Table 2: Analysis of variance of airplane-applied DDT dust and spray deposits on both upper and lower surfaces of filter paper traps above and within a cigar-wrapper tobacco shade.

Source	df	Mean Square	F Value
Test	1	929.7494	16.47*
Replicates/Tests	4	56.4555	
Location	2	192.0710	6.07*
Location x Tests	2	126.6192	4.00
Error (a)	8	31.6355	
Traps			
Surface	1	1,642.8360	115.92**
Height	2	382.7740	27.01**
Surface x Height	2	340.4413	24.02**
Traps x Test			
Surface	1	905.6138	63.90**
Height	2	300.3839	21.20**
Surface x Height	2	322.6462	22.76**
Traps x Location			
Surface	2	203.9239	14.39**
Height	4	93.2529	6.58**
Surface x Height	4	105.3759	7.44**
Traps x Location x Test	10	99.6124	7.03**
Error (b)	60	14.1723	

**, ** Significant at the 5% and 1% levels, respectively.*

Table 3: Analysis of variance of airplane-applied DDT dust and spray deposits on the upper and lower surfaces of filter paper traps above and within a cigar-wrapper tobacco shade.

		Upper Surface		Lower Surface	
Source	df	Mean Squares	F Value	Mean Squares	F Value
Test	1	1,835.2839	16.43*	0.0793	<1.00
Replicates/Tests	4	111.7259		0.3746	
Location	2	395.6575	6.57*	0.3374	<1.00
Location x Tests	2	215.3510	3.58	1.7768	3.48
Error (a)	8	60.1955		0.5102	
Height	2	722.4190	44.68**	0.7963	2.69
Height x Tests	2	622.8000	38.51**	0.2300	<1.00
Height x Location	4	198.3740	12.27**	0.2547	<1.00
Height x Tests x Location	4	203.2470	12.57**	0.5298	1.79
Error (b)	24	16.1705		0.2959	

**, ** Significant at the 5% and 1% levels, respectively.*

Table 4: Analysis of variance of airplane-applied DDT dust and spray deposits on the upper surface of filter paper traps above and within a cigar-wrapper tobacco shade.

		Dust		Spray	
Source	df	Mean Square	F Value	Mean Square	F Value
Replicates	2	6.8646	<1.00	216.5872	1.92
Location	2	30.4000	3.91	580.6084	5.16
Error (a)	4	7.7708		112.6203	
Height	2	2.1418	2.35	1,343.0772	42.73**
Height x Location	4	1.3745	1.51	400.2465	12.73**
Error (b)	12	0.9106		31.4306	

*** Significant at the 1% level.*