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Table 1.—Life cycles, percentages of mortality of fall armyworm larvae and pupae, and pupal weights ($\bar{x} \pm S_{\bar{x}}$ of 3 successive generations) confined to feed on 2 bermudagrass plant lines.

		Mortality (%, $\bar{x} \pm S_{\bar{x}}$) of population of:				
		Larvae at indicated days:				
Plant line	Life cycle (days)	3–6	8	10	Pupae	Pupal weights (g)
Coastal bermudagrass	28.3±0.33	2.5±1.4	5.0± 2.9	5.3± 2.9	22.5±5.8	0.168±0.006
Tifton accession no. 239	26.3± .33	18.5±4.8	28.7±10.7	31.2±10.5	37.1±8.4	.149± .046

1970, Leuck and Skinner 1971). It probably exists among others. It would appear that the factors of resistance in bermudagrass foliage shown to exist in bermudagrass no. 239 are factors that could be combined in this crop in future breeding programs to exert, in part with other resistant crops, a constant portion of environmental resistance to fall armyworm populations.

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Pesticide Drift IV. On-Target Deposits from Aerial Application of Insecticides[1]

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With the increasing public concern of air pollution, which occasionally incriminates insecticides, the question is asked: what percentage of the insecticide from an aerial application actually reaches the target crop?

It is generally conceded that dusts result in greater drift, or nontarget deposits, than do sprays, and that aerially applied sprays likewise result in greater nontarget deposits than do ground sprays (Ware et al. 1969, Ware and Apple 1969, Dean 1962, Argauer et al. 1968).

Fraser (1958) indicated that low-volume spraying requires that the drops be small because the area covered by a given volume of liquid increases as the drop size decreases. However, small drops result in drift and low dynamic catch on sprayed crops.

Coutts and Yates (1968) found that the droplet-size spectrum in the spray cloud produced by a low-flying spray plane depends on nozzle design, nozzle orientation, nozzle emission velocity, and physical properties of the sprayed liquid.

Fraser (1958) showed that outdoor spray transit losses from ground equipment at a target distance of 12 in. varied from 48% with a fan spray to 73% with swirl nozzles, both at 25 psi.

Akesson and Awady[3] reported that a significant part of spray loss is attributable to the application system, which may deposit from as little as 30% up to 95% on target plants, and permits the remainder to become contaminant in the soil, water, and air environment.

This Department has conducted research on pesticide drift for several years, accumulating considerable information peripheral to its original objectives, concerning the on-target deposits of aerial applications. It is the purpose of this paper to present this information.

MATERIALS AND METHODS.—Table 1 presents the parameters of aerial applications of insecticides made in central Arizona to either irrigated alfalfa or cotton, with the objectives of determining the amount and distance of drift off-target. In each study on-target deposits were measured after collecting the insecticide on the treated alfalfa (Table 1, items 1, 2), on 10×25-cm glass plates placed through the application area, or on 18×24-in. aluminum foil sheets (Table 1, items 15, 16).

The percent of insecticide theoretically deposited is followed by the adjusted or corrected percent value. The factors involved in correction were laboratory recovery rates and actual amount of toxicant in the spray mixture as measured in the laboratory.

RESULTS AND DISCUSSION.—Table 1 shows the average corrected deposit on-target as 53.3%. This covers all of the summer months in Arizona plus December which gave the exceptionally high results of 100%. Excluding December, the corrected average is reduced to 46.?% for the summer applications.

We recognize that a leafy crop, such as alfalfa or cotton, having multiple surfaces on which small droplets impinge, is superior to glass plates or sheets of aluminum foil

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[3] N. B. Akesson and M. N. Awady. 1967. Air transport of small particles as applied to air-carrier spraying. Amer. Soc. Agr. Engr. Winter Meeting, Detroit, Mich. Dec. 12–15.

Table 1.—Deposit of aerial spray applications on alfalfa and cotton during insecticide drift studies.

No.	Date & time	Insecticide AI/acre	Gal spray /acre	Thickener	Temp (F°)	RH (%)	Wind (mph)	Sample	Sample height (in.)	Actual % deposited	Corrected % deposited
1	5/2/61, 6:10 PM	toxaphene 4.0	15% Dust	....	61	55	3–4	alfalfa	..	14.0	14.0
2	5/2/61, 6:10 PM	toxaphene 4.0	5.7	....	61	55	3–4	alfalfa	..	47.7	47.7
3	6/26/64, 9:20 AM	methoxychlor 1.75	8	carboxymethylcellulose	93	..	4.9	GP in[a] alfalfa	18	34.4	39.3
4	6/26/64, 9:20 AM	methoxychlor 1.75	8	....	93	..	4.9	GP in alfalfa	18	38.3	43.8
5	12/16/64, 8:15 AM	methoxychlor 1.75	7	....	36	..	1.4–2.6	GP in alfalfa	10	69.5	96.5
6	12/16/64, 8:15 AM	methoxychlor 1.75	7	carboxymethylcellulose	36	..	1.4–2.6	GP in alfalfa	10	73.0	107.0
7	8/24/65, 5:54 AM	methoxychlor 1.72	7	....	60–70	..	1–2.5	GP in alfalfa	18	28.0	35.4
8	8/25/65, 4:00 PM	methoxychlor 1.72	7	....	95–100	..	2–3.5	GP in alfalfa	18	44.0	53.7
9	8/21/67, 8:20 PM	methoxychlor 2.0	8	....	83–86	..	<1.0	GP in cotton	ground	33.7	35.4
9	8/21/67, 8:20 PM	methoxychlor 2.0	8	....	83–86	..	<1.0	GP in cotton	24	69.2	72.8
10	7/9/68, 6:15 PM	methoxychlor 2.0	5	Dacagin 0.8% (w/w)	90–94	35	4.5–5.5	GP in alfalfa	12	40.4	40.4
11	7/9/68, 7:00 PM	methoxychlor 2.0	5	....	87–93	45	1.8–2.0	GP in alfalfa	12	38.4	39.7
12	7/10/68, 5:30 PM	methoxychlor 2.0	5	....	98–103	44	2.9–3.7	GP in alfalfa	12	72.0	72.0
13	8/29/68, 4:50 PM	methoxychlor 2.0	5	molasses (24% V/V)	100–105	19	5–5.6	GP in alfalfa	12	61.3	61.3
14	8/29/68, 5:50 PM	methoxychlor 2.0	5	Cab-O-Sil (3.5% w/w)	99–103	25	2–3	GP in alfalfa	12	28.0	28.0
15	8/4/69, 3:00 PM	methoxychlor 2.0	5	....	103–105	28	1.8–2.7	GP in alfalfa	12	32.8	44.2
16	8/4/69, 3:00 PM	methoxychlor 2.0	5	....	103–105	28	1.8–2.7	GP in alfalfa	12	35.8	36.0
								Avg		46.7	53.3

[a] GP = 10 × 25-cm glass plates.

However, the 1 alfalfa sample (Table 1, item 2) which was collected on a square-footage basis captured no more than the average, 47.7% vs. 46.4%.

The distance from target to plane also determines the efficiency of deposit. In Table 1, item 9, the amount deposited on plates resting on the ground between cotton rows was 35.4%, while those at 24 in., the height of the crop, collected 72.8%. This was probably a matter of spray penetration of the foliage canopy, although Fraser (1958) pointed out that distance from nozzle to target also is a factor in deposit efficiency.

In examining the deposit based on spray gallonage per acre the 8-gal rate deposited 47.8%, 7-gal deposited 44.5% (excluding December applications), and 5-gal deposited 46.2%. Essentially, from this small sample size, there is no difference in the gallonage range reported. The 3 morning applications deposited 39.5%, while the 11 late afternoon applications deposited 48.3%. Again sample distribution prevents any equitable comparison.

Within the range of summer temperatures involved in these studies there appears to be no correlation between temperature and deposit. Quite naturally, however, the higher the temperature the greater the evaporation rate, resulting in reduced on-target deposit.

In conclusion, aerially applied insecticides in Arizona apparently deposit less than 50% on-target during the normal insecticide-use growing season.

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