and *atropalpus* in San Antonio—289 traps operated from May 1 to August 31, and 127 from September 1 to October 31. Fort Worth, Texas, had 77 premises with *aegypti* larvae in 1965, 42 in 1966, 16 in 1967, and no positives in 1968. The weekly percent positive ovitraps in the consolidated areas of Fort Worth is indicated in Figure 3. Of 9,663 ovitraps exposed weekly, *Aedes* spp. were recovered but no *aegypti* were collected in Fort Worth in 1968.

SUMMARY. In an evaluation of ovitrap visibility, placement under objects, and location of the site in relation to the direction of the sun, no association with positivity could be demonstrated. No changes are indicated in the present instructions for placement.

The weekly monitoring of the ovitrap was more effective and economical than larval inspections in detecting *aegypti* populations in consolidated areas in Florida, South Carolina, and Texas in 1968.

It is evident from experience measuring *aegypti* populations that the ovitrap is a reliable tool for studying container-breeding *Aedes* populations.

ACKNOWLEDGMENTS. The assistance of many personnel in Area, Project, and Program Offices of the Aedes aegypti Eradication Program for collecting much of these data is gratefully acknowledged.

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A TECHNIQUE FOR ULV INSECTICIDE APPLICATION FROM HIGH ALTITUDES

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The advantages of ultra low volume application are well known, but operations conducted from low altitudes (100–150 feet) present a safety problem even for multi-engine aircraft. Therefore, in June, 1968 a preliminary pre-dawn test was conducted to determine the feasibility of ULV insecticide application from high altitude. A Piper Pawnee aircraft applied insecticide at ULV rate from an altitude of 1,000 feet. Recovery of spray droplets indicated that the target area could be treated from such an altitude. With this in mind, it was decided to attempt control of adult *Aedes sollicitans* (Walker) on two large tracts of land in Orleans Parish, Louisiana, using ULV application from high altitude.

A series of four tests was conducted with a DC-3 aircraft equipped to apply Dibrom at ULV rates (Machado, 1969). Treatments were made between the hours of 2 a.m. and 4 a.m. for the first three tests, and at sunset for the fourth test. There are several advantages gained by night flying. Stable air conditions are often encountered at this time, and lighted streets, towers, etc., provide excellent landmarks for swath placement in urban areas. Rural areas are easily "flagged" by using a flashing light mounted atop a vehicle.

Methods and Materials. Since the aircraft is loaded with insecticide well in advance of spray time (sometimes as much as several weeks prior to use), the corrosive nature of Dibrom must be considered. By filling all available air space of the spray tanks with oil-pumped nitrogen, the problem of metal oxidation and Dibrom crystal formation was greatly reduced. Figure 1 illustrates the small amount of Dibrom crystals collected by an in-line 100-mesh strainer following 90 days' storage of 50 gallons of Dibrom in a 100-gallon system of unlined 10-gallon stainless steel beverage tanks under nitrogen atmosphere.

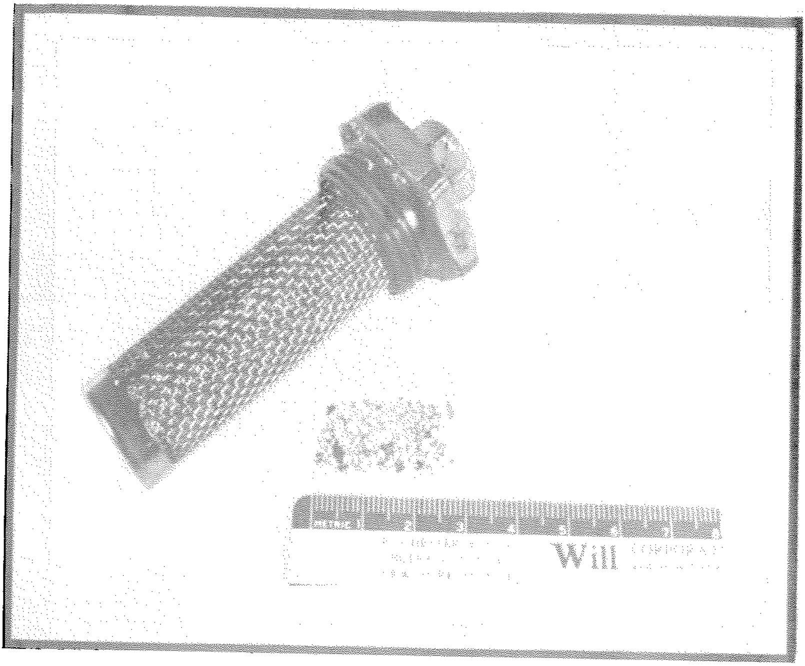

Fig. 1.—Dibrom crystals filtered from 50 gallons Dibrom following 90 days storage in a 100 gal. system of unlined 10 gal. stainless steel beverage tanks under a nitrogen atmosphere.

Tests 1, 2 and 3. Prior to test flights, the spray system was calibrated to deliver Dibrom at a rate of 0.5 to 1.0 ounce per acre in 1,000-foot swaths, using six D-6 disc-type orifices without cores, arranged in a trailing position. Air pressure at the compressor was maintained at 80–100 psi. This yielded an average pressure of 45 psi on the insecticide as it entered the wing boom. Application was made from an altitude of 1,000 feet, at a speed of approximately 150 m.p.h. Temperatures at time of application ranged from 70° to 76° F. Surface winds were at 0 knots, however, smokestacks near the test area indicated a north-northwest drift.

Spray deposition was monitored with Dibrom sensitive dye cards (Koundakjain, 1965). Dye cards, 2.5″ x 5″, were placed at ground level in both horizontal and vertical positions across the test areas perpendicular to the line of flight.

Adult mosquito density was determined by landing rate counts, each count being taken for a 2½-minute interval. Pre- and posttreatment counts were begun at dusk and continued thereafter for approximately 2 hours during each testing period.

The areas treated, known as Little

Woods and Algiers, comprise approximately 8,000 and 7,000 acres, respectively, and are separated by an average of 7 miles. Each area has sections of urban as well as heavily wooded undeveloped land. The Algiers area was sprayed on the nights of July 17 and 19, 1968 (Tests 1 and 3); the Little Woods area on the nights of July 18, 1968, (Test 2) and October 30, 1968 (Test 4).

TEST 4. Test 4 was conducted on October 30, 1968, in Little Woods. At that time of year, daytime temperatures are warm, but nights are quite cool, and mosquito activity is limited to a short period at or near sunset. Therefore, early morning treatment was abandoned in favor of application at sunset.

The spray system was recalibrated to deliver 1.0 oz. per acre in 1,000-foot swaths by increasing air pressure to yield an average of 50 psi at the wing boom. The same nozzle orifices were used in Test 4 as in the previous tests; however, the arrangement was altered so that nozzles were angled 45° from horizontal into the line of flight. This change was made in an attempt to produce smaller droplets. Temperature at time of application was approximately 72° F. Surface winds were recorded at 8–10 m.p.h. Because of these relatively high winds, it was decided to make application from an altitude of 500 feet.

Spray deposition was again monitored with dye cards. Dye card stations were located at 250-foot intervals along two transects in the test area perpendicular to the line of flight.

Mosquito landing rate counts were taken approximately one hour prior to treatment and again 24 hours posttreatment in both the test area and in an untreated control area. Counts within the test area were made in urban as well as wooded sites. Those taken in the untreated control area were made at wooded sites only.

RESULTS. Dye cards used during the July 17 treatment of Algiers (Test 1) were located at 100-foot intervals. There were 124 card stations with a vertical card at each, and with a horizontal card at every fifth station. Figure 2 shows the average number of particles impinging on cards

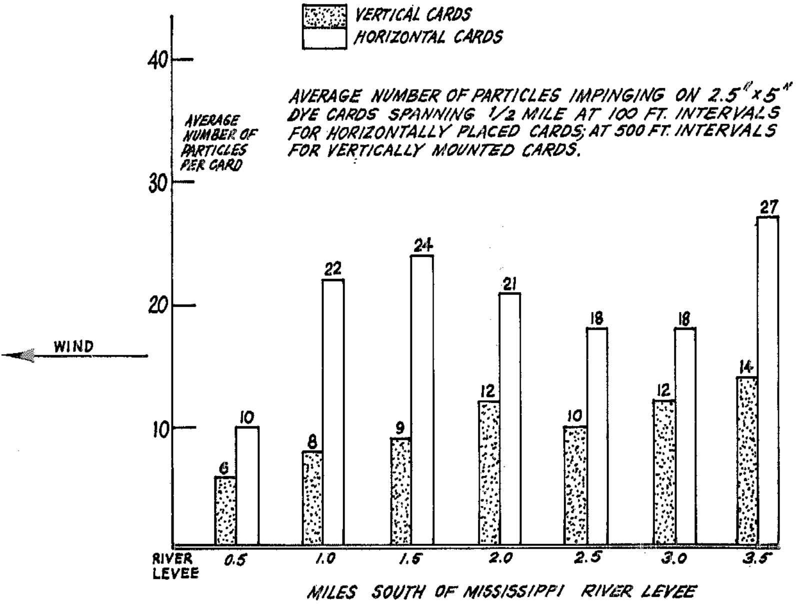

FIG. 2.

at one-half mile intervals for both horizontal and vertical positions: the Mississippi River levee marked the northernmost (downwind) card location (See sketch map, Figure 3). Horizonally placed cards averaged 23 droplets per card, while vertical cards showed an average of only 11 droplets per card. The distribution of particles throughout the entire area was rather uniform, as indicated by cards in both positions.

Two nights later (July 19, Test 3), when

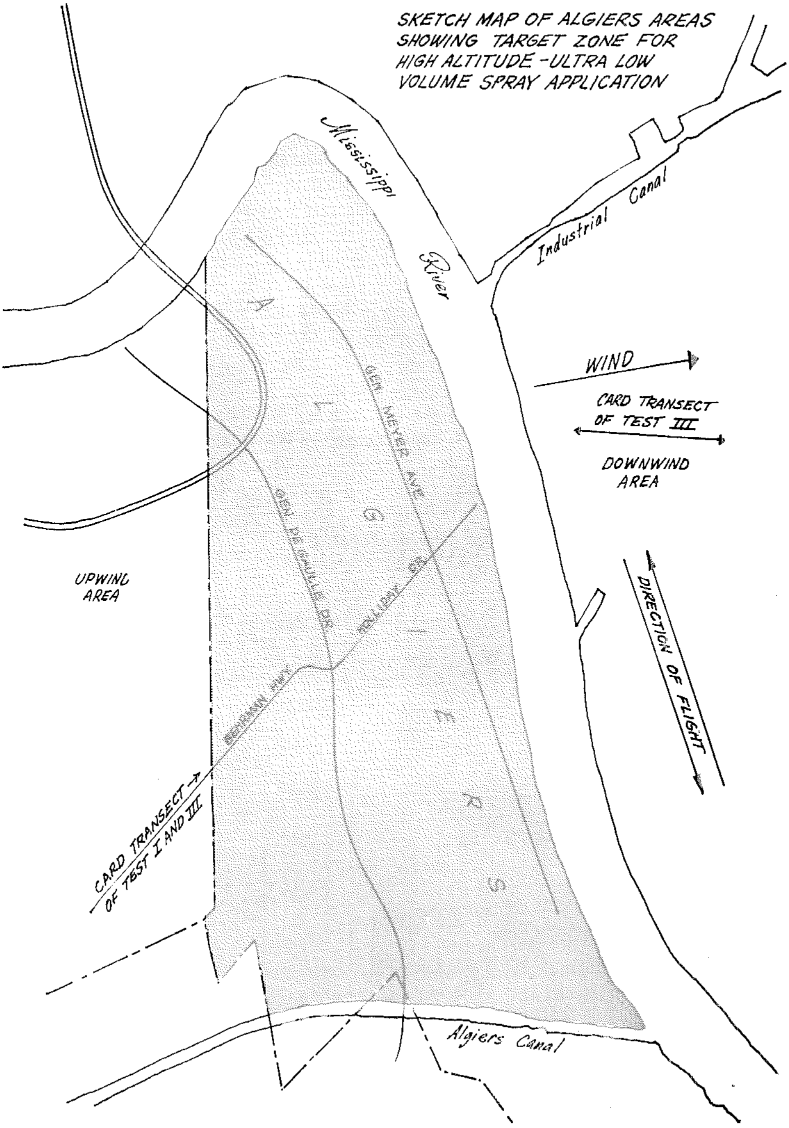

Fig. 3.

Algiers was again treated, cards were placed at 0.1 mile intervals in a horizontal position only. Cards were located as far as 1.1 miles south (upwind) of the target area and continued north (downwind) across the Mississippi River for 0.6 mile (the river at this point is approximately 0.5 mile wide—Figure 3). Figure 4 illustrates the average number of particles re-lets, indicating that drift continued beyond this point. The river is approximately one-half mile wide in this area; it is possible that rising air currents from the water facilitated drift.

No measurement of particle size was taken; however, those droplets recovered upwind of the target area were quite large, at least three times the size recovered

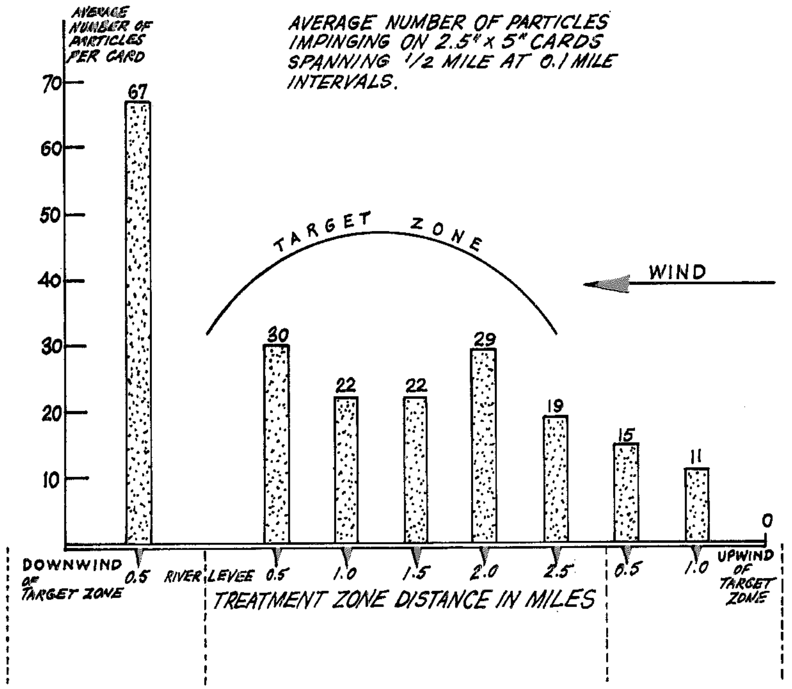

FIG. 4.

covered at card stations within one-half mile intervals. Recovery within the target zone indicated a uniform application. Several swaths were applied upwind of the target zone to allow for drift. Cards within this 1.1 mile upwind area averaged 13 particles per card, as compared to an average of 24 per card for those within the target zone. Dye cards located downwind of the target zone across the Mississippi River showed an average of 67 droplets per card. The card farthest downwind in this series had an impingement of 49 drop-within the target zone. Particles recovered across the river (downwind) were less than half the size of those in the target zone.

Treatment of the Little Woods area on July 18 (Test 2) was monitored at 42 dye card stations established at approximately 250-foot intervals. Each station consisted of one horizontally and one vertically placed card. Cards in a horizontal position averaged 35 droplets, whereas those in a vertical position averaged only 11 droplets as indicated in Figure 5.

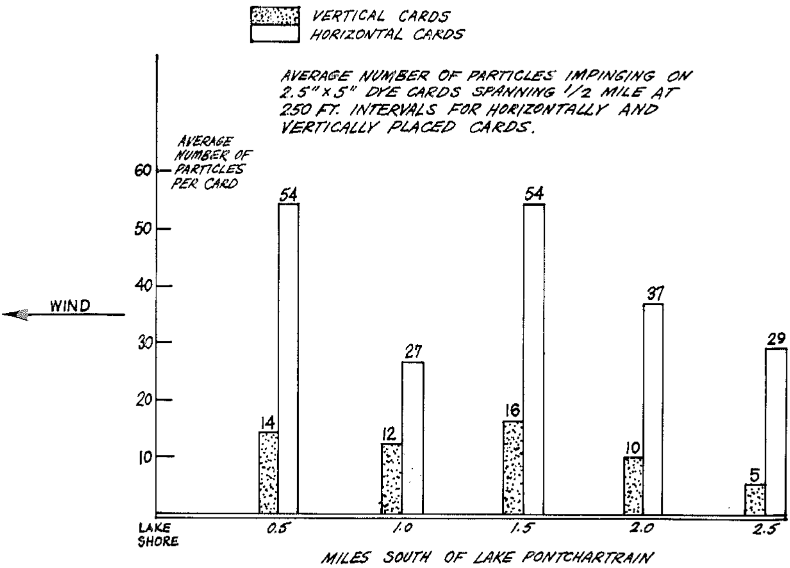

FIG. 5.

When Little Woods was treated on October 30 (Test 4) dye cards were located along two transects. One transect had cards positioned both horizontally and vertically at each station, the former being at ground level and the latter at 3- and 6-foot levels. The second transect, parallel to the first but separated by approximately 3 miles, had cards positioned horizontally at ground level only. Figures 6 and 7 illustrate the average number of droplets recovered at the various card stations. The transect having cards at three levels shows an average of 7 droplets per square inch at ground level (horizontal) and an average of 5 and 6 per square inch at the 3- and 6-foot levels, respectively (vertical). Cards along the second transect (horizontal at ground level) had an average of 6 droplets per square inch. These data indicate that, while impingement was far less than in the previous test, coverage was quite consistent.

Effectiveness of the application made in the Algiers area is shown in Table 1. Zone I is comprised of urban dwellings,

TABLE 1.—Landing rate counts of *Aedes sollicitans* pre & post aerial treatment with Dibrom 14 applied in ULV from an altitude of 1000 feet. (Tests 1 & 3).

	Landing rate counts [a]			
	Pretreatment	Post 1st treatment		Post 2nd treament
	8 hrs.	16 hrs.	40 hrs.	10 hrs.
Zone I [b]	3	1	7	1
Zone II [c]	14	7	11	4
Untreated control	9	10	..	..

[a] Avg. no. of mosquitoes landing on one person in 2½ minutes at 8 individual stations in Zone I, 4 in Zone II, and 6 in the untreated control.

[b] Urban area.

[c] Densely wooded with heavy underbrush.

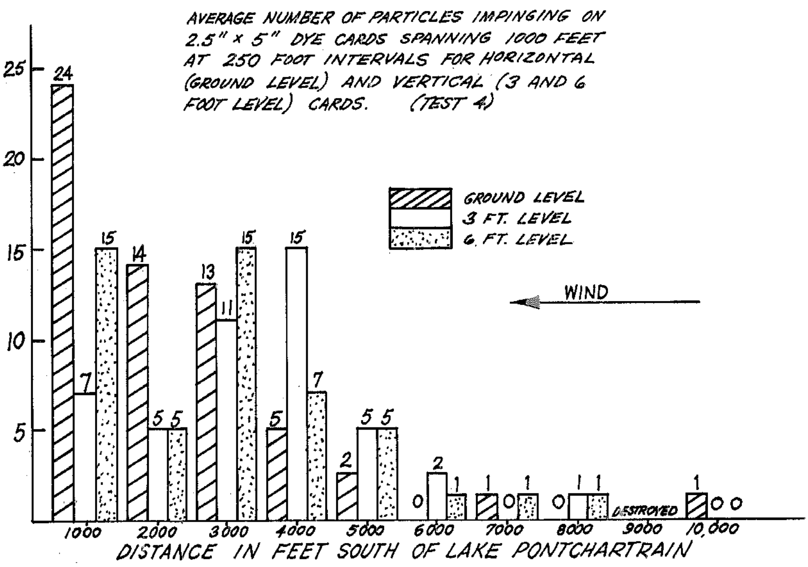
AVERAGE NUMBER OF PARTICLES IMPINGING ON 2.5" x 5" DYE CARDS SPANNING 1000 FEET AT 250 FOOT INTERVALS FOR HORIZONTAL (GROUND LEVEL) AND VERTICAL (3 AND 6 FOOT LEVEL) CARDS. (TEST 4)
GROUND LEVEL
3 FT. LEVEL
6 FT. LEVEL
WIND
DESTROYED
DISTANCE IN FEET SOUTH OF LAKE PONTCHARTRAIN

FIG. 6.

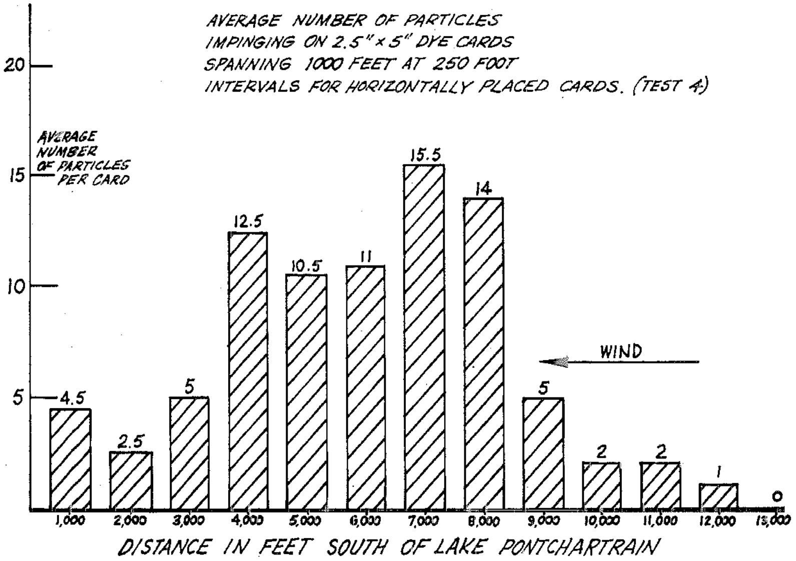
AVERAGE NUMBER OF PARTICLES IMPINGING ON 2.5" x 5" DYE CARDS SPANNING 1000 FEET AT 250 FOOT INTERVALS FOR HORIZONTALLY PLACED CARDS. (TEST 4)
AVERAGE NUMBER OF PARTICLES PER CARD
WIND
DISTANCE IN FEET SOUTH OF LAKE PONTCHARTRAIN

FIG. 7.

while Zone II is a densely wooded area with heavy underbrush, therefore landing rates taken in these areas were viewed separately. Initial treatment (July 17, Test 1) in Zone I yielded a 69 percent reduction in the adult mosquito population within 16 hours; however, the area was reinfested within 24 hours. A reduction of 58 percent was noted in Zone II, followed by a similar reinfestation. The second treatment (July 19, Test 2) of these zones produced a 90 percent and 65 percent mortality, respectively.

Application made in the Little Woods area (July 18, Test 2) produced 71 percent control, and was not followed by reinfestation (Table 2). Landing rate stations in this area were located at sites similar to those found in Zone II of Algiers, but the data indicate a better percentage of control. Although insecticide pressure as it entered the wing booms averaged 45 psi for all three spray applications, a pressure of 50 psi or more was encountered on many of the spray passes made over Little Woods. Since volume of chemical applied is a function of spray pressure, it is logical to assume that a volume of 1.0 oz. per acre was approached during this treatment of Little Woods.

TABLE 2.—Landing rate counts[a] of *Aedes sollicitans* pre & post aerial treatment with Dibron 14 applied in ULV from an altitude of 1000 feet. (Test 2).

	Landing rate counts		
	Pretreatment	Posttreatment	
	8 hrs.	16 hrs.	40 hrs.
Treated area	24	7	6
Untreated control	23	19	..

[a] Average number of mosquitoes landing on one person in 2½ minutes at 10 individual stations in each area.

The second treatment of Little Woods (October 30, Test 4) yielded a reduction in the adult mosquito population of 95 percent in the urban zone and 77 percent in the heavily wooded zone of the test area as is indicated in Table 3.

TABLE 3.—Landing rate counts of *Aedes sollicitans* pre & post treatment with Dibrom 14 applied in ULV from an altitude of 500 feet. (Test 4).

	Landing rate counts[a]	
	1 hr. pretreatment	24 hrs. posttreatment
Zone I[b]	18	1
Zone II[c]	29	7
Untreated control	27	26

[a] Avg. no. of mosquitoes landing on one person in 2½ minutes at 9 individual stations in Zone I, 10 in Zone II, and 5 in untreated control.
[b] Urban area.
[c] Densely wooded with heavy underbrush.

DISCUSSION. In Tests 1, 2 and 3 the problem of insecticide drift was a major concern. For this reason spray nozzles were arranged in a trailing position to minimize shearing action. However, control achieved was less than that desirable. At this point it was thought that possibly drift might be used to an advantage, rather than trying to avoid or compensate for it. It was thought that perhaps the most effective use of ULV spray might be obtained when the material is allowed to drift laterally near ground level, much in the way that thermal fog operates, drifting around objects rather than impinging on them. If this is true, then particles collected on dye cards represent material that has, for the most part, been lost as far as availability to the mosquito is concerned. Therefore, in Test 4 nozzles were angled 45° into the line of flight to produce smaller spray droplets. Data obtained indicate fewer particles per square inch of dye cards, yet a higher percentage of control was achieved even in areas of dense woods with heavy underbrush.

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