$$L = \frac{(5.80)\,(80)}{100}$$

$$L = 4.6 \text{ bushels per acre}$$

The regression indicates that economic injury levels are rather low. Two considerations enter into this possibility, (1) that these data were collected under extreme drought conditions and (2) the likelihood that corn has very little tolerance for defoliation.

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MONITORING FALL ARMYWORM FOR SUSCEPTIBILITY/RESISTANCE TO METHOMYL

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ABSTRACT

DuPont has monitored the fall armyworm, *Spodoptera frugiperda* (J. E. Smith), for methomyl susceptibility/resistance since 1976. This effort has not documented resistance in any populations of fall armyworm to methomyl.

RESUMEN

DuPont ha observado la susceptibilidad/resistencia del gusano cogollero, *Spodoptera frugiperda* (J. E. Smith), desde 1976. Este esfuerzo no ha documentado la resistencia a "methomyl" de ninguna población del gusano cogollero.

Fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith), populations from throughout the US, have been monitored for susceptibility/resistance to insecticides since 1976. This has been done as a part of the Insecticide Resistance Management Program in the DuPont Company. The purpose of this paper is to report the monitoring data for technical Lannate® insecticide (97% methomyl).

TABLE 1. BREAKOUT OF STATES AND CROPS WHERE FALL ARMYWORM CULTURES WERE OBTAINED (1981-1983).

		STATE						
		AL	CA	DE	FL	GA	LA	TX
CROP	Corn (field)	-	A	-	-	-	-	-
	Corn (sweet)	-	B	C	ABC	B	-	-
	Cotton	-	-	-	-	-	C	B
	Peanuts	A	-	-	-	AC	-	-
	Sorgum	-	-	-	-	-	B	-
	Soybean	-	-	-	-	B	-	-
	Sudangrass	-	-	-	-	-	B	-

A = 1981 B = 1982 C = 1983

METHODS AND MATERIALS

FAW larvae were collected in 7 states from 7 crops (Table 1). They were placed, individually, in 1 oz. capped cups containing soy flour/wheat germ diet and shipped to the DuPont Experimental Station, Wilmington, DE. Thirty-one cultures were established on diet and maintained in a room at 26.7°C, 50% RH on a 16L:8D cycle.

Deposit-on-glass (DOG) tests were conducted on established cultures. The inner surfaces of 100 mm x 15 mm glass petri dishes were treated with 1 ml acetone containing predetermined concentrations of 97% methomyl. The solutions were swirled around the dish. This coated the inner surfaces with methomyl as the acetone evaporated. There were at least 4 replicates, of 5 larvae each, per treatment rate. In some instances, rates were tested more than once.

Topical application (TOP) tests, using an Isco Mode M Microapplicator, have been conducted on FAW cultures since 1981. One μl of an acetone solution containing known concentrations of 97% methomyl were applied to the dorsal prothorax of test larvae. At least 20 larvae were treated per rate. Treated larvae were held, individually, in 1 oz. capped cups containing diet.

Third instar larvae, weighing 20 $\pm$ 5 mg, were used in all tests. Mortality was recorded after 1, 3, 4 and 18 to 24 h exposure for the DOG tests and 24 and 48 h after treatment for the TOP tests. The 4 h DOG and 48 h TOP test data were used for this report.

Larvae were considered dead if they did not move when probed or if they could not right themselves in 15 seconds when placed on their backs (moribund = dead).

RESULTS AND DISCUSSION

DOG test results, expressed in the lowest concentration required to obtain $\geq$ 90% mortality after 4 h exposure (effective concentration = EC), are presented in Fig. 1. The highest EC value obtained was 12 μg per petri dish, recorded on the Georgia culture in 1979. Since then, the highest EC values have been 6 μg per petri dish.

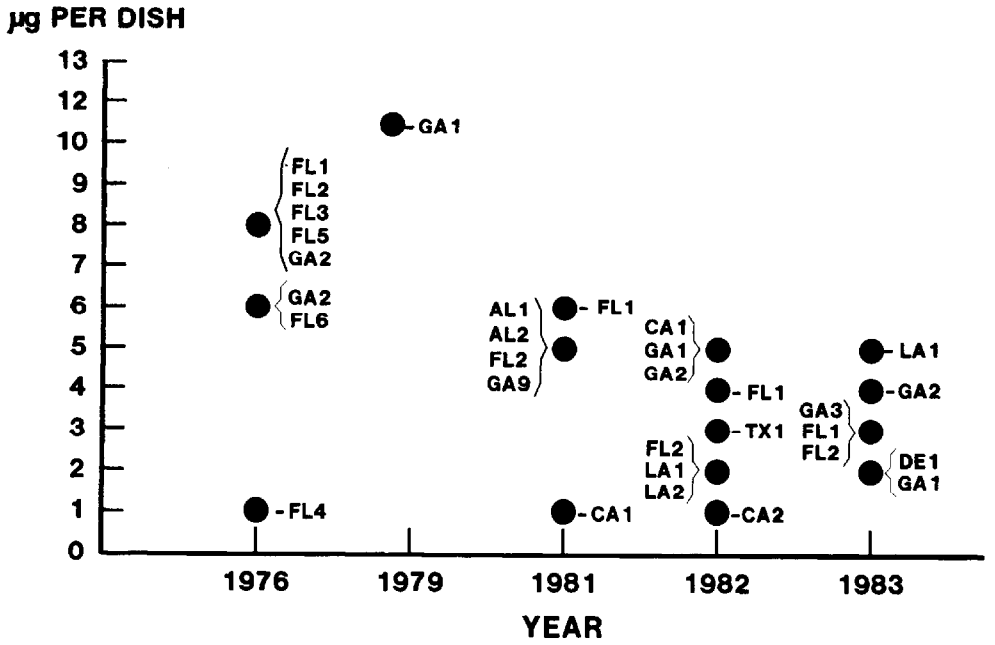

Fig. 1. Deposit-on-glass test 4 h data lowest concentration required to obtain 90%, or greater, mortality.

Through experience, we have learned that field use rates for Lannate® insecticide are equivalent to the 50 to 100 µg per petri dish rates for 97% methomyl (Leeper and Langille 1982). Ninety percent control, or better, of an insect population within that range would be considered acceptable. Based on the EC values obtained through DOG testing, the FAW remains highly susceptible to methomyl throughout its range in the U.S.

TOP test results have not been related to field control. Through probit analysis they can provide a more precise value for the amount of material required to kill a given proportion of a population. It is also the most widely accepted monitoring method. For these reasons, DuPont has conducted TOP tests on FAW cultures established since 1981 (Fig. 2).

Note that the data for the FL1 culture for 1982 were not suitable for probit analysis. The culture died prior to completion of testing. Also note that each culture represents an independent culture. For example, the FL1 cultures for 1981, 1982 and 1983 were independent collections and cultures.

What should be considered a population? The LD50 values show the variability in susceptibility between cultures. These cultures were usually collected during the latter half of the growing season. Each culture expresses susceptibility/resistance characteristics based on its exposure to insecticides. Based on these data, the insecticide use patterns within the field in which the culture was collected had the greatest influence on the susceptibility/resistance characteristics of that field population. Each field can, therefore, develop and maintain its own FAW population.

Susceptibility to permethrin within the 2 FAW cultures collected in California in 1982 illustrates this point. They were both collected from sweet corn on the same day. The CA1 culture was collected on a large corporate farm using primarily Ambush® insecticide. The CA2 culture was collected on a small farm under minimal insecticide use, about a mile from the

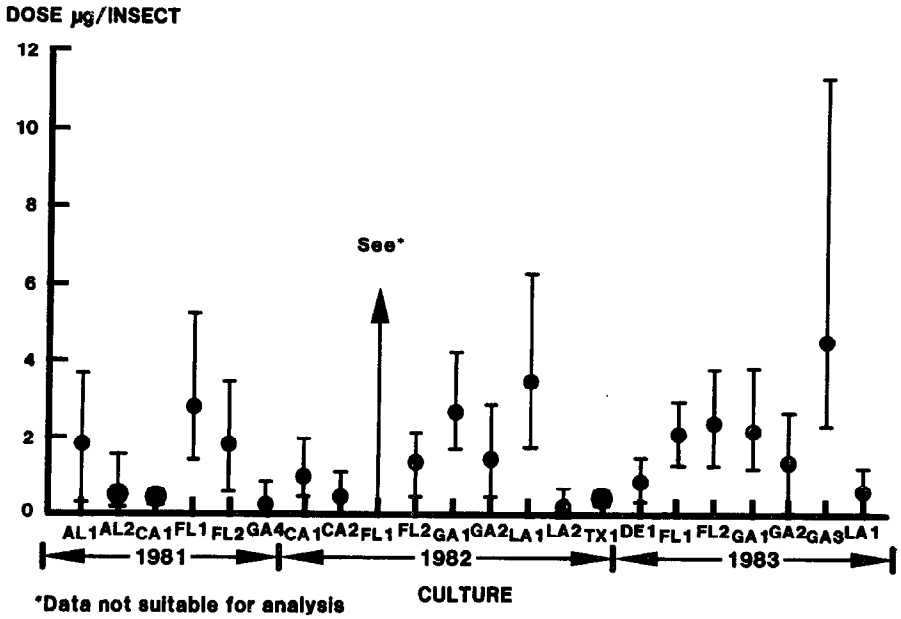

Fig. 2. LD50 values with 95% upper and lower confidence values for fall armyworm topical application test results 1981-1983.

CA1 collection site. There was over a 10 fold difference in susceptibility to permethrin between the cultures. This indicates that the cultures were distinctly different populations and that movement between the populations was minimal at best. This is probably the case for most established field populations where suitable food remains. Susceptibility/resistance characteristics of immigrants have little or no effect on the susceptibility/resistance characteristics of an established field population.

The 3 Georgia cultures for 1983 were collected from peanuts around Albany, GA. Based on LD50 values for methomyl: the GA1 and GA2 cultures came from very similar populations; the GA2 and GA3 cultures appear to be from distinctly different populations; and, it is not possible to speculate on the similarities or differences between the GA1 and GA3 populations. The large confidence interval for the LD50 value of the GA3 culture was due to a plateau in data. Four data points between 2 and 10 µg per larvae provided 50 to 55% mortality. This may indicate an incipient problem. This could not be followed further in the field. FAW do not overwinter in the Albany, GA area and must be reestablished, by migrants from south Florida, each spring (Snow and Copeland 1969). This implies that methomyl use patterns in Florida for FAW control could influence methomyl susceptibility throughout the southeastern U.S. However, neither DOG nor TOP tests have indicated methomyl resistance in any Florida culture.

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