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Effects of Molasses, Summer Emulsifiable Oil Concentrate, Crude Cotton Seed Oil, and Glycerin on the Residual Life of Sulprofos on Cotton[1]

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The residual life of many organophosphates is known to be short. Adjuvants have been shown to increase residual life and efficacy of some insecticides. The addition of toxophene to a methyl parathion spray mix extends both the residual life and efficacy of methyl parathion (McGARR & WOLFENBARGER 1969, NEMEC et al. 1968, WARE et al. 1979, WARE et al. 1980). PHILLIPS & LINCOLN (1968) showed that the use of molasses with methyl parathion enhanced the control of bollworm larvae on cotton. LINCOLN et al. (1966) indicated improved efficacy of the prevailing insecticides applied to cotton in combination with 9.35 L of molasses per ha against bollworm larvae and moths.

The objective of this study was to find a readily available and economical material that will increase the residual life and hence, efficacy, of a short-lived organophosphate by at least 24 h.

The four spray additives chosen were molasses, summer emulsifiable oil concentrate, crude cotton seed oil, and glycerin. These were mixed with sulprofos (Bolstar), an organophosphate with a known, short efficacy period of 24 h.

METHODS AND MATERIALS

The test plots were located in a 6.5 ha block of maturing 'Stoneville 825' cotton at the Agricultural Experiment Station, Marana, Arizona. Cotton plant heights averaged 88 cm on the day of insecticide applications, August 4, 1980. Plots consisted of 4 treated rows, with 102 cm spacing, 30.5 m long. Sprays were applied at 122 L/ha, at 4.2 km/h and 276 kPa pressure (13 gal/acre, 2.6 mph, and 40 psi). The manually drawn spray rig treated two rows, using 3 DC 2-13 Spraying Systems nozzles per row. The pressure was maintained from a 6.8 kg CO_2 tank with a two-stage regulator.

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The formulation and rate of active ingredient (AI) per ha of sulprofos for each plot was Bolstar 6 (6 EC) @ 1.1 kg/ha. Four additives were mixed with the sprays, one each to 4 plots: molasses (feed grade) at 9.35 L/ha, 2% (wt/wt) summer emulsifiable oil concentrate (415 Spray Oil, FMC), 2% (wt/wt) glycerin (U.S.P., Mallinckrodt), and 2% (wt/wt) crude cotton seed oil (Casa Grande Oil Mill). The cotton seed oil had been premixed with 4% Triton®B (Rohm and Haas).

Minimum and maximum air temperatures during the test were: Aug. 4, 21.7°-37.8°; Aug. 5, 20.6°-38.9°; Aug. 6, 20.6°-41.1°; Aug. 7, 25°-42.8°; and Aug. 8, 21.7°-42.2°C. There was no rainfall during this study.

Triplicate samples for residue analyses were collected in each treated plot at 0, 24, 48, 72, and 96 h after treatment, with controls collected at 0, 48, and 96 h. Each sample consisted of 100 leaves punched singly and consecutively from the top, middle, and bottom portions of plants in all 4 rows, using 2.54-cm diameter leaf punches.

In the field, each sample was extracted for 1 min with 100 mL redistilled benzene. The extract was then transferred to a labeled sample bottle, the solvent level marked, and the bottle placed on ice until transferred to the laboratory refrigerator.

Sulprofos and its metabolites were analyzed without cleanup on a Micro Tek MT-220 gc equipped with a flame photometric detector in the phosphorus mode. A 104 cm x 4 mm I.D. Pyrex column containing 2% OV-101 on 100/120 mesh Chromosorb W (H.P.) was used. Nitrogen carrier gas flow was 120 mL/min and temperatures were 230°C, 185°C, and 225°C for inlet, column, and detector respectively. Quantitation was by peak height.

RESULTS AND DISCUSSION

The results are shown in Table 1, expressed as micrograms of sulprofos or metabolite per square centimeter of cotton leaf ($\mu g/cm^2$), one surface only.

Molasses and cotton seed oil significantly prolonged the life of sulprofos through 72 h. At 96 h molasses significantly reduced degradation beyond glycerin and summer oil, but not cotton seed oil. Additionally, the cotton seed oil resulted in significantly higher levels of the sulfoxide than the others at 24 through 96 h.

Because of the successful formulation of molasses as a stabilizer with the carbamate insecticide carbaryl (Sevimol®) and the recent use of cotton seed oil as a carrier for the pyrethroids in ULV applications, the addition of either of these two materials to most short-lived insecticides could prove both

TABLE 1

Dislodgable residues of sulprofos, its sulfoxide, and the sulfone expressed as $\mu g/cm^2$ of cotton leaf (one surface only) following application of sulprofos at 1.1 kg/ha. Marana, Arizona, August 4, 1980.

	Sulprofos			Sulprofos + 2% Glycerin			Sulprofos + 2% Summer Oil		
Hours	Sulprofos	Sulfoxide	Sulfone	Sulprofos	Sulfoxide	Sulfone	Sulprofos	Sulfoxide	Sulfone
0	5.1a*	0.37a	<0.045a	4.2a	0.53ab	<0.046a	3.2a	0.36a	<0.023ab
24	2.0a	0.67a	0.12a	1.9a	0.60a	0.11a	1.4b	0.42b	0.077b
48	0.76ab	1.0a	0.52a	0.73ab	0.88ab	0.54a	0.60a	0.66b	0.28b
72	0.31a	0.73ab	0.55a	0.38a	0.86a	0.74b	0.31a	0.61b	0.28c
96	0.23a	0.65a	0.67a	0.20a	0.71a	0.79ab	0.11a	0.48a	0.27c
Controls	<0.0014	<0.010	<0.0047						

	Sulprofos + 2% Crude Cottonseed Oil			Sulprofos + Molasses 1 gal/acre		
Hours	Sulprofos	Sulfoxide	Sulfone	Sulprofos	Sulfoxide	Sulfone
0	3.8a	0.65b	<0.045a	4.6a	0.33a	<0.016b
24	2.3c	1.1c	0.097ab	2.8d	0.88d	0.16c
48	0.99bc	1.6c	0.23b	1.1c	0.96a	0.65c
72	0.58b	1.7c	0.32c	0.69b	0.67ab	0.85b
96	0.27ab	1.4b	0.39c	0.43b	0.66a	0.93b

* Common letters on the same line for the same compound (Sulprofos, Sulfoxide, or Sulfone) indicate no difference in residue at the 0.05 level (Duncan's new multiple range test).

economical and useful. (Cotton seed oil, once purified, costs $0.24/lb or $0.50/quart, while molasses sells for $0.55/gal, roughly the same cost per acre.)

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