in either test. Test plots in 1986 and 1987 were not harvested for yield determinations because severe bird depredation and head rot in the seed heads negated any differences in yield that might have occurred as a result of insecticidal treatment.

1986. All treated plots had significantly fewer SFM larvae than the untreated plots. No significant differences occurred among insecticides at the rates tested. Plots treated with Karate at 0.03 lb AI/acre had 1.7 larvae per head. representing a 92% control effectiveness over the untreated plots. Control effectiveness in the other treatments ranged from 69 to 86%. Except for Asana, all treated plots had numerically fewer larvae than plots treated with the methyl parathion standard.

1987. All insecticide treatments provided significant reductions in larval numbers compared to the untreated plots. However, there were no statistically significant differences among insecticides. Plots treated with Karate at 0.03 lb AI/acre had 3.3 larvae per head, representing an 89% control effectiveness over the untreated plots. Control effectiveness in the other treatments ranged form 68 to 88%. Karate at 0.03 lb AI/acre and Supracide at 0.5 lb AI/acre were the only insecticide treatments that had numerically fewer SFM larvae per head than the ethyl parathion standard used in this test. Since adverse weather conditions caused a delay in the initial application until 50% bloom, the potential of some of the insecticides to provide maximum effectiveness may not have been fully realized. This point should be given consideration when interpreting the results.

Conclusions

Results obtained from these experiments indicate that there is much potential for the use of synthetic pyrethroid insecticides (which have long residual activity) in controlling sunflower moth. Statistically, the pyrethroids used in these tests (Karate, Pydrin, Capture, and Asana) were as effective as currently labeled insecticides generally recommended for SFM control. Presently, Pydrin (at the rate of 0.1-0.2 lb AI/acre) is the only synthetic pyrethroid insecticide that has labeled clearance for SFM control on sunflower.

Brand names are used to identify products. No recommendation or endorsement is intended, nor is any criticism implied of similar products not mentioned.

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Insecticides for Control of Sunflower Moth Larvae on Sunflower

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Economic pressures from increased energy costs and dwindling water resources have prompted western producers to seek alternatives for crops that are considered to be high water users. Cultivated sunflower, *Helianthus annuus* L., shows economic potential under western Kansas cropping and climatic conditions. It is perceived to be a drought-tolerant crop and would probably do well under limited irrigation practices. Producers also are interested in the implementation of new crops in double-cropping systems, for which sunflower would be ideally suited.

In Kansas, the sunflower moth (SFM), *Homoeosoma electellum* (Hulst), is one of the most destructive pests of cultivated sunflower (Fig. 1). The larvae feed upon pollen, floral parts, and maturing seed. Thus, at high infestation levels, considerable yield loss may occur. Larval feeding also contributes to secondary infection by *Rhizopis* head rot, a fungal disease. Newly hatched larvae are yellowish but change to a purplish-brown with four creamish longitudinal stripes as they mature. At maturity, larvae are approximately 3/4 inch long. A single larva may destroy up to a dozen developing seeds. After feeding is completed, larvae drop to the ground and pupate (change to the adult stage) in earthen cells about 3-4 inches below the soil surface.

The adult moth is buff to grayish and approximately 3/8 inch long, with a wing span of about 3/4 inch. Depending on the condition of the moth, two small

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dark spots may or may not be present on the forewings. Female moths deposit small, white eggs among the florets of the sunflower head. The eggs hatch within 2-3 days.

Insecticides still remain the principal method for SFM management on sunflower. Current recommendations for insecticide application are an initial treatment at 20% bloom (20% of the plants showing yellow rays), followed by one or two applications at 5-7 day intervals depending on SFM population pressure. This report presents the results of field plot tests conducted in 1986 and 1987 to determine the effectiveness of labeled and nonlabeled insecticides for controlling SFM larval infestations on sunflower.

Procedure

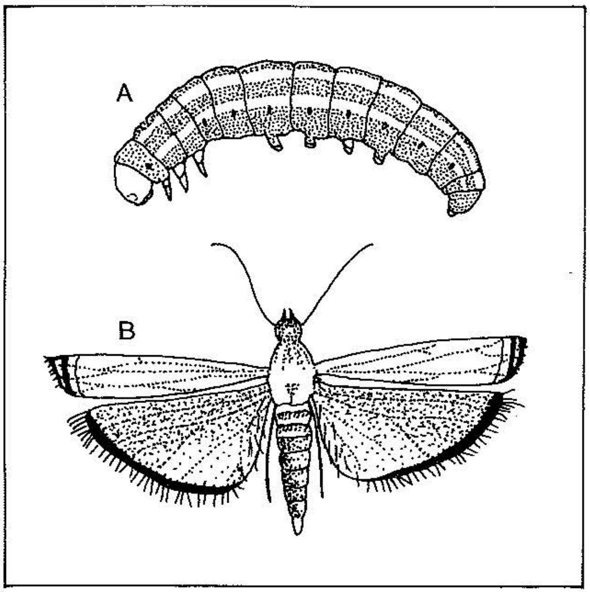
Tests were conducted at the Southwest Kansas Branch Experiment Station, Garden City, Kansas. Experiments were arranged in a randomized block design with four replications. Plots were four rows wide (19 ft) by 40 ft long with 5-foot vacant alleyways separating blocks of plots. Insecticide sprays were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 14.8 gal/acre (1986) and 11.4 gal/acre (1987). Only the two center rows in each plot were sprayed to minimize plot-to-plot contamination from spray drift.

Treatments were assessed 2 weeks after the first application by dissecting and examining six sunflower heads (1986) and five sunflower heads (1987) from each plot and counting the number of live larvae in each head. Data were subjected to analysis of variance for significance, and Duncan's multiple range test was utilized to separate pair comparisons.

1986 Test. Sunflower hybrid DeKalb 'S-37' was planted in an irrigated field on 19 May. Plots were irrigated and cultivated in accordance with good agronomic practices. Two applications of each insecticide (Table 1) were made starting on 20 July, when approximately 30% of the plants had flowered and again 7 days later.

1987 Test. Sunflower hybrid Seed Tec 'Sunwheat' was planted in an irrigated field on 20 May. Plots were irrigated and cultivated in accordance with good agronomic practices. Two applications of each insecticide (Table 1) were made starting on 22 July, when approximately 50% of the plants had flowered and again 5 days later. The initial application was scheduled for 20% bloom, but adverse weather conditions delayed treatments.

Figure 1. Sunflower moth (*Homoeosoma electellum*), A. larva and B. adult.



Results

Effectiveness of the insecticides applied to sunflower, based on the number of larvae per head, is summarized in Table 1. None of the insecticides produced visual phytotoxic symptoms (plant injury) on sunflower

Table 1. Comparative effectiveness of selected insecticides applied to sunflower for sunflower moth larval control, 1986-1987.

Treatment and formulation	Dosage (lb AI/ acre)	Mean no. larvae per head**	Percent reduction
	1986		
Karate 1E*	0.03	1.7a	92
Furadan 4F	0.5	3.0a	86
Pydrin 2.4E	0.1	4.3a	80
Karate 1E*	0.02	4.8a	77
Lorsban 4E	0.5	5.5a	74
M. parathion 4E	1.0	6.1a	71
Asana 1.9E*	0.025	6.6a	69
Untreated check	—	21.1b	—
	1987		
Karate 1E*	0.03	3.3a	89
Supracide 2E	0.5	3.6a	88
E. parathion	1.0	4.0a	87
Lorsban	0.5	4.1a	87
Capture 2E*	0.02	7.0a	77
Karate 1E*	0.02	7.3a	76
Asana 1.9E*	0.025	9.9a	68
Untreated check	—	30.7b	—

*Karate, Capture, and Asana are not currently registered for use on sunflower and CANNOT be applied for sunflower moth control.

**Means followed by the same letter are not significantly different (P=0.05; DMRT).