Experiment 2. Plots were sprayed March 18, 1970, at which time the weevil population in the check plots averaged 91 larvae per 10 sweeps. The alfalfa (Caliverde 65) was about 8 in. tall when sprayed and was 2 weeks from first cutting. Sweep counts were taken 3, 7, and 14 days after spraying to evaluate weevil control.

Experiment 3. Application of the insecticides was on March 2, 1972, at which time the alfalfa was about 8 in. tall and the population of weevils in the unsprayed check plots averaged 205 larvae per 10 sweeps. The interval from treatment to first harvest was about 3 weeks in this field of Joaquin 11.

The insecticides and rates evaluated in the experiments conducted in 1970 are summarized in tables 1 and 2. Counts of weevil larvae were significantly lower for all insecticide treated plots compared with the unsprayed checks.

Data from experiment 3 are summarized in counts taken 7, 14, and 21 days after treatment as shown in table 3. These data indicate that all treatments differed significantly from the unsprayed checks at each sampling interval. The Furadan, Imidan, Zolone, and Vydate treatments were very effective in controlling weevil larvae for 21 days. These insecticides caused a marked improvement in growth, visibly evident in contrast to the untreated check plots.

In experiment 3, the pea aphid, *Acyrthosiphon pisum*, was also found in the plots when sampling for weevil larvae, allowing evaluation of the insecticides on control of this additional pest of alfalfa. Furadan, Zolone, and Vydate effectively controlled the pea aphid for 21 days when final insect counts were taken. These insecticides are not registered on alfalfa at this time.

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Leafhoppers on Silage Corn

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Since leafhopper populations on silage corn increase rapidly late in the season, early plantings are able to escape serious damage. Chemical control measures are available for areas where late plantings are necessary or desirable. Leafhoppers have not been a pest every year.

Dalbulus maidis (DeLong and Wolcott), a leafhopper, occasionally can be a serious pest of silage corn in local areas of the southern San Joaquin Valley of California. A section of northern Kings County extending southeasterly into Tulare County is the only known area of California where damage has occurred. This leafhopper also occurs throughout the southern United States and in most of South America. Specimens were collected from Kern, Los Angeles, and Riverside counties more than 20 years ago, but no damage to corn was reported.

Damage occurs when nymphs and adults feed on the leaves in large numbers and secrete large amounts of honeydew. Damage is compounded by the honeydew which supports the growth of black sooty mold organisms that reduce the amount of light received by the leaves. Sooty mold is known to affect the palatability of dry alfalfa hay; its effect on wet silage, however, is unknown. Poor cultural practices, especially excessive irrigation, can contribute to yield losses from leafhopper damage.

Silage corn in this area is most often grown as a second crop following the June-July harvest of wheat or barley. At times, and usually in association with dairy operations, two summer silage crops are grown. The first crop is planted from March to May, and the second is planted late July-August, as soon as the ground can be made ready after harvest of the first crop. The most serious losses have occurred when leafhoppers attack young plants of the second summer crop of silage corn. Early planted corn has never been reported to be damaged.

Corn stunt, a mycoplasma disease carried by this leafhopper in other areas of the country, is not known to be present in California. Distorted leaves, small or deformed ears, and rosetting of plants are symptoms of this disease.

Leafhoppers are not a problem every year and it is suspected that biological or other natural control agents exert a cyclical regulating effect upon their populations. Pirate bugs, assassin bugs, lady-bird beetles, lacewings, and hymenopterous egg parasites can be found in infested fields. Their regulating effect on leafhopper population levels remains unknown. Chemicals are the only short term solution to the problem. The long term effects of chemical applications are not known and cannot be predicted; the past history of leafhopper infestations indicates they will not have to be used every year.

Experiments designed to provide growers with a means to control this pest were carried out in Kings County during 1969 and 1970. Plots were established in a second-crop field (Funk 5758, planted August 12, 1969) which contained large numbers of leafhoppers. In early September, this field had sustained enough damage that reduced growth was noticed. On September 23 (when plants were about 2 ft. high), phorate 10 G, diazinon 4 EC, disulfoton 6 EC and 15 G, all at 1.0 pounds active ingredient per acre (AI/a) were applied to replicated plots. These pesticides were selected because they were registered for other uses on silage corn and this leafhopper could be added to the label if the manufacturer chose to do so. Sprays were applied with a CO_2 powdered sprayer (2 nozzle wand). Granules were broadcast over the leaves and into whorls with an Ortho Whirlybird spreader to simulate aerial application.

Leafhopper nymphs were counted on randomly selected plants by cutting 10 lower leaves which showed no more than 20 percent yellowing of the leaves from excessive feeding by leafhoppers. The leaves were cut, put into an aphid shaker, and an irritating chemical (methyl ethyl ketone) added. The nymphs were shaken from the leaves into jars, alcohol was added, and the samples were taken to the laboratory for counting. Yields were taken from an area 5 rows wide by 20 feet long in the center of each replicate. Cut plants were weighed on canvas hung from a suspended dial scale. The percentage of dry matter was determined from 5 plants selected at random from those cut for yield.

The second trial was established August 25 on a late planting (July 11, 1970) of Funk 5757 silage corn. In addition to the treatments listed for trial one, malathion 8 EC and phorate 10 G were included in this experiment.

The third experiment in this series was established in a large commercial field of silage corn with plants about 5 feet tall. Large blocks were treated with phorate granules on August 27, 1970, and alternated with untreated sections to give 3 replicates of each.

Results

All treatments in the 1969 trials depressed the populations of nymphs for 2 to 3 weeks (table 1) when compared to the untreated check. Numbers of nymphs were lowest in the phorate granule treatment. The bright green color of the plants and the absence of honeydew on even the lower leaves allowed easy visual identification of the plots treated with phorate. Yields of green and dry matter (table 2) from phorate-, diazinon-, and disulfoton-treated plots were significantly better than all other plots.

The duration of control after the application of treatments in 1970 was about the same as observed in 1969. After approximately 1 month, and for the remainder of the season, the treated plots resembled the untreated plots. It was impossible to distinguish between treated and untreated plots when ratings of the amount of sooty mold present on the plants were made in November (data not shown). All of the plots had nearly 100 percent of the leaves and stems covered by sooty mold. Yields of green silage from individual replicates were variable and average green yields did not differ statistically even though mean yield values differed by as much as 2 tons per acre. During 1970 there was also a wide and unexplainable range observed in the percentage of dry matter at harvest. Primarily because of the high percentages of dry matter deposited, disulfoton 6 EC (28.46%), phorate 10 G (23.38%), and malathion 8 EC (22.18%) gave the best yields. The 6 EC formulation of phorate and the 15 G of disulfoton did not yield as high as their companion formulations.

Applications of phorate 10 G in a commercial field reduced populations of nymphs only for about 1 week. Relative to other fields, leafhopper populations in this field remained at low levels, sooty mold never developed, and no differences were obtained in silage yield, percent dry matter, or dry matter yield.

D. maidis was shown to be capable of causing serious losses of yield and perhaps quality to silage corn grown in the Kings-Tulare County area of the San Joaquin Valley. Damage is most severe when large numbers of nymphs build up early in the fall on young, second-crop silage corn (<24"). The presence of large amounts of honeydew on these young plants followed by the rapid development of sooty mold fungi signals that yield losses may occur. Controls applied at this time will allow some yield recovery, but normal yields will not be obtained if leafhoppers have stopped or slowed plant growth. When plants become more mature they are able to withstand higher leafhopper populations without loss of yield.

The risks of planting double-drop silage corn are well known to most growers. Small acreages of late silage corn increase the risks that serious damage may occur when leafhoppers move in from surrounding fields of drying dent corn. Poor cultural practices will increase the severity of damage from leafhoppers on this late crop.

TABLE 1. NUMBERS OF LEAFHOPPER NYMPHS COLLECTED ON LEAF SAMPLES OF SILAGE CORN TREATED WITH INSECTICIDES, KINGS COUNTY, CALIFORNIA, 1969.

Treatment		lbs./acre	No. nymphs per leaf				
			9/23[1]	10/1	10/7	10/15	10/23
Phorate	10 G	1.0	209	27a[2]	206	126a	65a
Diazinon	4 EC	1.0	157	86ab	216	325 b	135a
Disulfoton	6 EC	1.0	195	157 b	226	264ab	98a
Disulfoton	15 G	1.0	182	105 b	257	293ab	127a
Check	--	--	187	305 c	406	595 c	213ab
Check	--	--	173	294 c	527	646 c	343 b

[1] Pretreatment counts. Materials were applied on this date immediately after pretreatment counts were made. No significant differences were found among counts made on 9/23 and 10/7.

[2] Numbers followed by the same letter are not significantly different from each other at the 5% level, Duncan's Multiple Range Test.

TABLE 2. YIELD OF SILAGE FROM INSECTICIDE TREATMENTS TO CONTROL LEAFHOPPERS ON SILAGE CORN, KINGS COUNTY, CALIFORNIA, 1969.

Treatment		Active ingredient lbs./acre	Silage yield tons/acre	% dry matter	Weight of[1] dry matter tons/acre
Check	--	--	5.34a[2]	22.40	1.20a
Check	--	--	6.40ab	21.30	1.35ab
Disulfoton	10 G	1.0	7.54 bc	17.77	1.42abc
Disulfoton	6 EC	1.0	8.24 bcd	20.03	1.65 bcd
Diazinon	4 EC	1.0	9.14 cd	19.32	1.77 cd
Phorate	10 G	1.0	9.67 d	20.10	1.94 d

[1] Numbers followed by the same letter are not significantly different from each other at the 5% level, Duncan's Multiple Range Test.

[2] Calculated for each replicate and averaged.

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