to 500 ppm. These higher concentrations also caused some killing of small shoots, particularly in the tops of trees. However, little leaf drop was observed in these tests. Some fruit on treated trees began to darken and shrivel within about ten days after ethephon application.

Additional studies conducted in 1973 and 1974 indicated that 250 ppm was the maximum concentration that could be used on Royal Ann cherries in California because of gumming from treated trees. Even at this concentration, however, serious gumming can occur in some seasons. A concentration of 125 ppm has not produced serious gumming but loosening at 125 ppm has been inconsistent. Hence, there appears to be seasonal variability in the response of sweet cherry trees and fruit to this material.

Limited trials with ethephon were conducted on the fresh shipping varieties, Bing and Van, during the 1972, 1973, and 1974 seasons. Ethephon at 250 ppm gave adequate loosening with no adverse effects on fruit color, soluble solids or weight. In the tests with Bing and Van, no serious phytotoxic effects were noted.

While ethephon can greatly aid in fruit removal, the potential phytotoxic effects of this material on sweet cherry trees in California appear to outweigh its fruit loosening advantage. The use of ethephon on cherries is not recommended by the University of California and because of its phytotoxic effects, this material is not labeled for use on sweet cherries in California.

W. C. Micke is Extension Pomologist, U. C. Davis; W. R. Schreader is University of California Farm Advisor, San Joaquin County; and J. T. Yeager and E. J. Roncoroni are Extension Staff Research Associates, U. C. Davis. *The authors gratefully acknowledge Amchem Products, Inc., for supplying the ethephon used in this study and for the technical assistance of its representatives Ken Dunster and Sheron Christensen. The following growers also assisted in these studies: Mario Podesta, Caminata and Podesta, Lagomarsino Bros., and Robert Russell.*

Control of the Corn Earworm on Sweet Corn in Southern California

G. G. Kennedy • H. N. Nakakihara • E. R. Oatman

Larva of corn earworm feeding on kernels of sweet corn.

THE CORN EARWORM, *Heliothis zea (Boddie)*, also known as the tomato fruitworm and cotton bollworm, is a serious pest on sweet corn, tomato, cotton, and several other row crops grown commercially in California. Sweet corn, however, is the preferred host and, although the larvae also feed on the tassel in the whorl, the most significant damage results from feeding on kernels in the developing ear.

In the past, corn earworm infestations in southern California were so severe that virtually all ears not treated with insecticide were damaged by this pest. For example, in the absence of insecticides, an average of 99.1 per cent of harvested ears from successive plantings in Orange County during 1963, 1964, and 1965 were injured by the corn earworm. In the Coachella Valley of Riverside County, between 1966 and 1968, an average of 99.0 percent of all untreated ears harvested during June were injured by the corn earworm. More recently, however, earworm damage has been considerably less severe in the Coachella Valley. Between 1969 and 1972, for example, only 9 percent of the untreated ears harvested during June were infested by the corn earworm. This reduced level of infestation has apparently continued through 1974. Similarly, a reduction in the level of tomato fruitworm (= corn earworm) infestations in processing tomatoes occurred in Orange County in recent years. There, the level of fruitworm-infested tomatoes in untreated plots averaged 5.3 percent between 1969 and 1972 whereas, between 1973 and 1974, it averaged only 0.7 percent. Under conditions of low earworm infestations, satisfactory control may be obtained by insecticides that do not provide acceptable control under the pressures of a severe infestation.

During 1974, four commercially available insecticides and three experimental compounds were evaluated for control of the corn earworm on sweet corn in Riverside, where late-season corn earworm infestations continue to reach high levels. The commercial materials were also evaluated for effectiveness in controlling the aphid *Rhopalosiphum padi (L.)*. This aphid is usually not a serious problem on sweet corn, but it occasionally develops high populations which are capable of devitalizing their host plant. Additionally, it produces copious quantities of sticky honeydew which foster the growth of a black sooty mold which interferes with normal photosynthesis and discolors the husk of the ears.

All insecticides tested were applied to 'Golden Cross Bantam' (t strain) sweet corn planted June 17, 1974, at the University of California's Citrus Research Center and Agricultural Experiment Station. Applications were made with a high-clearance ground sprayer, equipped with four D-4 hollow-cone nozzles per row. Fifty gallons of spray mix per acre were applied at 90 to 100 psi. All treatments were replicated four times in a randomized complete-block design.

The commercially available compounds, lorsban (not presently approved for control of corn earworm on sweet corn), Lannate, Sevimol and Gardona were applied to plots

235 ft. x 4 rows (40-inch spacing) at the rates shown in table 1. Presilk applications were made on August 2 and 5; remaining applications on August 7, 9, 11, 13, 15, 17, 19, and 21. On August 27 and 28, fifty ears were harvested per plot (200 per treatment) and individually examined for corn earworm damage and the presence of aphids.

Lannate, Lorsban, and Gardona provided effective control of the corn earworm in the presence of an infestation that produced 78 percent worm-infested ears in the untreated plots (table 1). In the presence of this moderate level of infestation, Sevimol at 3 lbs. actual toxicant per acre did not provide acceptable control. The use of Sevimol (or Sevin and molasses) for control of corn earworm is presently widespread among sweet corn growers in southern California. However, the results indicate that this material may not provide adequate protection when earworm populations are high. Of the compounds tested, only Lorsban provided effective control of both the corn earworm and the aphid.

The experimental compounds, FMC 33297 (a synthetic pyrethroid), RH 218 (an organophosphate), and UC 49035 (a carbamate) were evaluated in a separate test in which the plots were 50 ft. x 3 rows. These materials were applied on August 7, 9, 11, 13, 15, 17, 19, and 21. On August 29-30, twenty-five ears per plot (100 per treatment) were harvested and examined individually for corn earworm damage. The results are presented in table 2.

Although FMC 33297 and RH 218 at 1 lb. appeared to give slightly better control than UC-49035 and RH 218 at 0.5 lb., there were no significant differences between the mean percentages of infested ears in these treatments. All treatments had significantly fewer ears than the untreated plots.

Table 1. Evaluation of insecticides for control of corn earworm and *R. padi* on sweet corn in Riverside, Ca.—1974

Treatment	Lb. actual toxicant per acre	Percent earworm-infested ears	Percent aphid-infested ears
Lorsban	1.0	3.5 a	2.5 a
Lannate	0.45	3.0 a	56.0 b
Gardona	1.5	4.5 a	86.5 c
Sevimol	3.0	20.0 b	49.5 b
Untreated		78.0 c	96.0 c

Means in column followed by same letter not significantly different — Duncan's multiple range test $P \leq 0.05$

The present studies indicate that under conditions of a moderate corn earworm infestation, Lannate, Gardona, and Lorsban provide effective earworm control, while Sevimol does not. The experimental compounds tested showed sufficient promise to warrant additional testing.

G. G. Kennedy is Assistant Professor and Assistant Entomologist; H. N. Nakakihara is Staff Research Associate IV; and E. R. Oatman is Professor and Entomologist, Department of Entomology, University of California, Riverside.

Table 2. Evaluation of insecticides for control of corn earworm on sweet corn in Riverside, Ca. — 1974

Treatment	Lb. actual toxicant per acre	Percent earworm-infested ears
FMC 33297	0.1	5 a
RH 218	0.5	15 a
RH 218	1.0	8 a
UC 49035	1.0	12 a
Untreated		75 b

Means in columns followed by same letter not significantly different — Duncan's multiple range test $P \leq 0.05$

Research Briefs for CALIFORNIA AGRICULTURE

HIGH-ENERGY RATIONS

Results of three studies to date in a continuing project aimed at determining the effects of dietary treatment on body composition and performance of beef cattle indicate that maximum performance on a high-energy ration is achieved by cattle grown to 500 lbs. before being given the high-energy ration. To obtain data for determining what procedure should be used to grow calves to 500 lbs., various energy levels were compared. In general, the rate of growth was dependent on energy concentration in the ration. Considering the growth and efficiency to 500 lbs. on the growing ration and the performance on the high energy ration from 500 lbs. to finish, a growing ration containing 72 percent concentrates appeared to be optimum. Costs, obviously, would determine the levels chosen. — *G. P. Lofgreen, Department of Animal Science, Davis, Imperial Valley Field Station.*

CATTLE WASTE NITRATE DISPOSAL

A recent Imperial Valley Field Station study of an unlined, liquid-cattle-waste digestion pond showed that soil sealing occurred in 3 weeks and that the order of magnitude of nitrate addition to the ground water was 0.27 lbs. per steer per year. The study was conducted as part of a current project at the station which is aimed at improving irrigation management and salinity control in the Imperial Valley. — *F. E. Robinson, Department of Water Science and Engineering, Davis.*

HEAT-TREATED, VIRUS-FREE MEYER LEMON CLONES

Two heat-treated, virus-free Meyer lemon clones developed through the Citrus Variety Improvement Program are being compared with four old-line, virus-infected clones on three rootstocks and as own-rooted seedlings in a study at the South Coast Field Station. So far, evaluation of the heat-treated, virus-free clones for production and fruit quality in this planting give every indication that they can successfully replace virus-infected Meyer lemons.— *W. Reuther and E. C. Calavan, Department of Plant Science, Riverside.*