

Corn Earworm Control

**DDT leads list of effective
of application as dust or**



Corn earworm on tip of sweet corn ear and typical injury caused by the pest.

Effective control of earworms on sweet corn was obtained in extensive experiments during the past five seasons.

DDT leads the list as being the most effective and economical of the recently developed insecticides.

The corn earworm—*Heliothis armigera* (Hbn.)—is the most important pest of the 15,000 to 20,000 acres of sweet corn grown each year in California and worth five to seven million dollars to the growers.

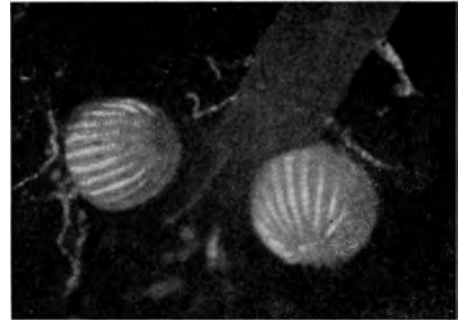
This pest is usually more abundant in the warmer interior corn-producing areas and if not controlled it can cause a great loss in quality and value of the crop.

The female moth lays its eggs at dusk usually on the freshly emerged silks of the ear. Within a few days the eggs hatch into tiny larvae—worms—which feed down the silk channel and onto the grains of corn. There they rapidly grow to maturity, and severely damage the tip of the ear in the process.

Dust Treatments

DDT dust treatments applied by aircraft equipment have been effective only when earworm populations were low—not over 50% of the ears infested. Under these conditions at least four applications of a 5% to 10% DDT dust should be made at 30 to 40 pounds per acre at two- to four-day intervals, beginning just before the appearance of the first silks.

Where the earworm population is mod-



Corn earworm eggs on thread of the corn silk. Greatly magnified.

erate to heavy—at least one worm per ear—aircraft dust applications are ineffective. Ground power dusters give somewhat better control but are also relatively ineffective under heavy earworm population levels.

Individual ear treatments with 5% DDT dust are economically effective, even when the earworm population is heavy. This method of treatment may be done either with a puff duster or with a stencil-type paint brush.

Treatment must be made as soon as the silks appear and repeated—at not more than three-day intervals—until three or four treatments have been applied. Even though considerable dust residue is visible on a given silk mass, the silk should be re-treated every three days. From 35 to 40 pounds of dust per acre should be used in each application.

For the paint-brush method a suitable container—such as a wide-mouth one-gallon tin can—with 5 to 10 pounds of dust in it, is strapped around the operator's waist. At first the operator should try to treat only one ear with one dipping of the brush into the dust. With experience two to three ears may be treated with one brushful of dust. One experienced operator may treat as many as two acres of corn a day, depending on the number of ears ready for treatment.

This treatment does not impair pollination but does result in a crop with from 80% to 95% of the ears worm-free, even under heavy earworm populations.

Several thousand acres of California sweet corn were treated successfully by the brush method during the past two seasons.

The main objections to the individual



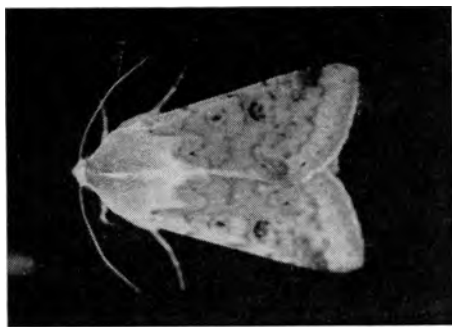
Individual treatment with puff duster—above—are economically more effective on heavy population than ground power duster—shown in operation below.



Control on Sweet Corn

Insecticides with methods spray important factors

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Moth of the corn earworm, with wings folded. Slightly enlarged.

treatment method are that it is tedious, time-consuming work and is expensive. Neither is the visible dust residue remaining on the outside of the ear desirable. The advantages are good control, ease of supervising inexperienced labor, simple and inexpensive equipment, and lack of interference with irrigation schedules.

Spray Treatments

Aircraft spray applications during the tests were no more effective than aircraft dust treatments. However, properly timed applications of the correct spray mixture with fixed nozzle boom, power ground equipment did give promising earworm control under certain conditions.

Individual ear spray treatments were very effective in earworm control even with high worm population levels.

For the fixed nozzle boom or the individual ear spray treatments it is desirable to have the conventional sprayer equipment mounted on a high-clearance rig that is especially adapted for operation in corn. Many corn growers have fabricated such rigs in their own shops.

Fixed Nozzle Boom Spray

For field treatment with a fixed nozzle boom spray the boom should be fitted with four-spray nozzles per row, two for each side. The nozzles should be adjusted to give complete coverage to the 18" to 24" area of the plant at ear height.

For this type of spray equipment $\frac{1}{4}$ " swivel-type nozzles—using number two, four or six hollow-cone tips—are satisfactory. The size of the tips will vary with the liquid pressure, speed of application

equipment, and amount of spray to be applied per acre.

When fall armyworms or other pests are attacking different parts of the plant, additional nozzles can be added to give complete coverage of the plant.

Each application for earworm control should consist of 30 to 50 gallons of 0.75% DDT and 10% mineral oil emulsion spray mixture per acre. Even when 50 gallons per acre are used the earworm control may not be good where earworm populations are high.

Formulation of the spray mixture requires six quarts of 25% DDT emulsifiable concentrate plus five gallons of U.S.P. grade mineral oil—70 to 90 seconds Saybolt viscosity—plus water to make 50 gallons of spray. These materials should be mixed in the order given and the mixture should be thoroughly agitated while being applied.

As with the individual dust treatment, it is necessary to apply the first spray by the fixed nozzle boom method when the silks appear. Repeat applications at not more than three-day intervals should be made for at least three or four treatments. Sometimes it may help to begin treating just before the first silks appear.

Depending on the size and speed of the equipment used, from a few to 50 or more acres may be treated per day by this method.

No injury to pollination has been observed by this method of treatment. How-

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Brush method of individual treatment. Note dust container at waist of operator.



Above, modified paint spray gun in use for individual spray treatment. Below, fixed boom spray rig with lead hoses and spray guns for individual spray treatment.



CORN

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ever, some yellowing of the foliage frequently results from this oil spray treatment, particularly in plants grown on soils of low fertility. Proper timing of applications is difficult to synchronize with proper irrigation schedules, especially on corn planted in heavy soils.

The most desirable features of this method of treatment are speed of application and minimum labor requirements. The disadvantages are inconsistent earworm control, elaborate and expensive equipment, frequency of applications, and interference with the irrigation schedules.

Individual Corn-ear Spray

Individual ear spray treatments may be made with the same equipment used for fixed nozzle boom spray applications, except that 10- to 20-foot lead hoses—one per row—instead of fixed nozzles are attached to the boom. A modified painter's spray gun is attached to the end of each lead hose and one man operates each gun. These trigger guns are operated at 60 to 90 pounds pressure and are adjusted to apply approximately 1.5 cc— $\frac{1}{3}$ teaspoonful—of spray per ear per application.

Each application requires three to eight gallons of material per acre, with the actual amount depending on the number of ears to be treated. The first application is made within three to four days

after the appearance of the silk and a second application about five days later. A third application may be necessary when the ears are silking over a long period of time.

The formulation used is the same as that for the fixed nozzle boom spray except that the amount of mineral oil is reduced to 5%.

The individual corn-ear spray has the advantages of giving the best earworm control, with the fewest number of applications and at the lowest cost. It does have the disadvantage of requiring better technically trained operators as the spray mixture may cause injury to the husk if the ears are overdosed. Also, this method usually requires fairly heavy equipment which may interfere with proper timing of applications in relation to irrigation practices.

Injection Treatments

The standard injection treatment is not so efficient as individual ear spray or dust treatments and few growers in California are using this method.

DDT has replaced the pyrethrum in the mineral oil used for ear injection, and the amount used has been reduced from 1 to 0.6–0.7 cc per ear. Improper timing and overdosing by this method may severely injure the corn ear.

Insecticide Residues

When properly applied, none of these treatments leaves harmful DDT residues



Sprayer in operation.

on the edible part of the corn ear used for human consumption.

Many residue analyses have shown that the individual ear spray treatment leaves the least amount of residue, but that all of these treatment methods leave large amounts of DDT residue—20 to 200 ppm—on the fodder and other plant refuse. DDT-treated corn plants or the unmarketable ears should never be fed to dairy animals nor fed to meat animals within 60 days of slaughter.

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Left: Close-up of experimental fixed nozzle boom spray rig showing construction and placement of nozzles. Right: Commercial fixed nozzle boom spray in operation.

