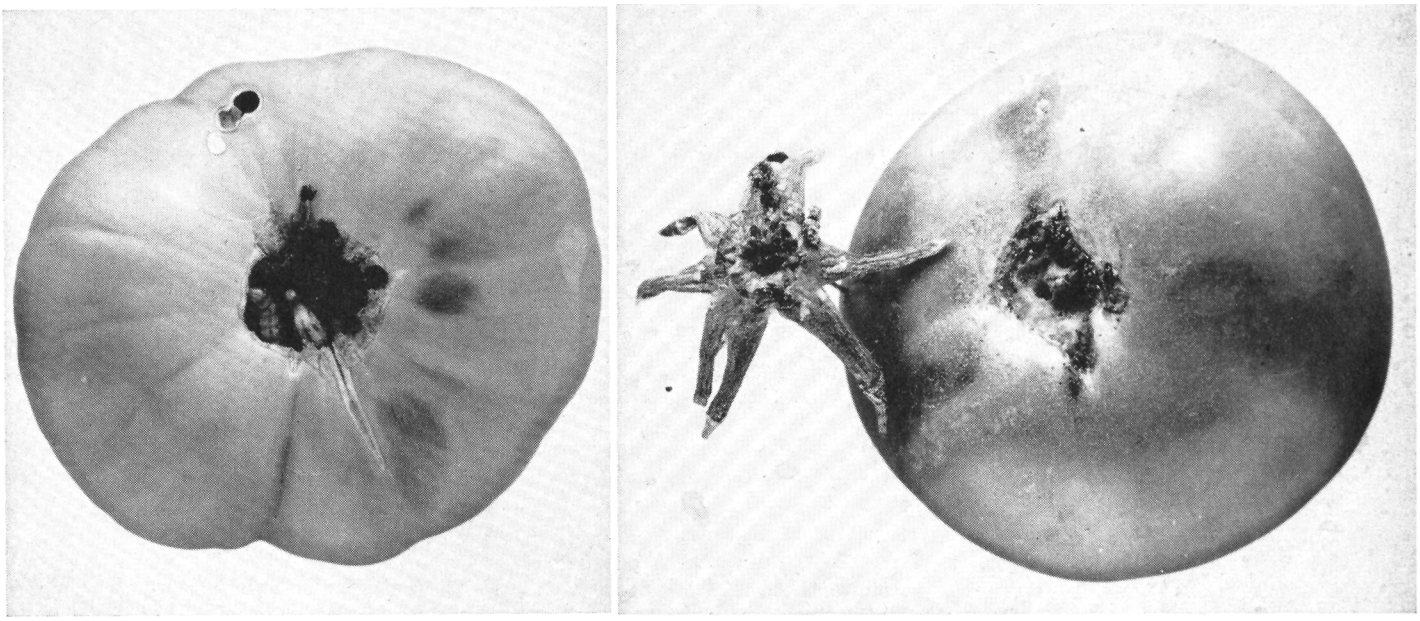

Left: **Tomato infested by the corn earworm, one of the most important caterpillars attacking tomato.** ***Right:*** **Tomato infested with larvae of the potato tuber moth, a pest which sometimes is very destructive to tomato where this crop is grown in regions largely devoted to potato culture.**

Tomato Insect Control Program

all-season program outlined for northern California as protection against the most important tomato pests

A. E. Michelbacher, O. G. Bacon, and W. W. Middlekauff

The tomato plant is subject to attack by insects from the time it is planted until the crop is harvested.

Where direct seeding is practiced, the seedling plants are frequently injured seriously as soon as they show above the ground, by flea beetles, darkling ground beetles or other pests. These insects can be controlled effectively by applying a 5% DDT dust at the rate of eight pounds per acre with a ground machine, or at least 20 pounds per acre by air. The DDT should not be used in combination with sulfur at this time because of danger that sulfur will injure the small plants. DDD should not be substituted for DDT because it is less effective against flea beetles. Where flea beetles are the principal pest, satisfactory control can be obtained by applying a 40% or 50% cryolite dust at the rate of 12 pounds per acre with ground equipment.

Control for Seedlings

Seedling stands as well as transplants are sometimes heavily infested with aphids. Treatment is not necessary, as this infestation usually disappears of its own accord without causing any real injury. The most important aphid is the green peach aphid for which the tomato apparently is a poor host.

Thrips sometimes occur in large numbers. Direct control is seldom necessary, as the plants will outgrow the damage in most cases. Thrips as well as armyworms—such as the beet armyworm—usually are effectively controlled by the dusts used against flea beetles or darkling ground beetles.

Grasshoppers or crickets can be controlled with chlordane dust or spray.

The beet leafhopper—vector of curly top or western yellow tomato blight—is sometimes very troublesome in the San Joaquin and Salinas valleys. Treating tomato fields to control this insect is of little or no value. In outbreak years, where fields are weedy and the leafhoppers concentrated on the weeds, some benefit may result from treating a field with DDT to control the leafhoppers before the weeds are destroyed by cultivation and hoeing. The purpose of this treatment is to kill infective leafhoppers before they have had an opportunity to move to the tomato plants and transmit the disease. Much may be gained by delaying thinning until the latest possible date, and leaving the maximum number of healthy plants.

To eliminate the danger of a serious spring invasion, by the leafhoppers, of tomato and other susceptible crops the Bureau of Entomology of the State Department of Agriculture each year conducts an extensive control program. As many as possible of the overwintering leafhoppers are killed in their native breeding areas—principally along the western foothills of the San Joaquin Valley.

Often insects are suspected of cutting off young seedling plants when actually birds are responsible for the damage. Of these, horned larks are the most important offenders.

Advanced Season Control

Once tomato plants are well established there usually is a period when little control is needed. However, with the advance of the season a number of destructive pests make their appearance. Important among them are the tomato mite, tomato and tobacco hornworms, beet armyworm, western yellow-striped armyworm, corn

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SPRAY

Text continued from page 11

6. Spray chemical. Fumigant types such as TEPP and parathion may require less gallonage per acre in aphid control. Oil emulsions and lime sulphur must be applied at lower concentrations and gallonage to avoid excess deposits.

7. Condition of bark at time of application. Dry bark absorbs more spray liquid and requires a higher gallonage.

8. Atmospheric conditions. Warm, dry air increases evaporation and requires larger gallonages to wet the trees adequately.

9. Amount of wind. An increased gallonage is generally required even if a light wind is blowing.

10. Insects to be controlled. Bark infestations of scale insects are more satisfactorily controlled by bulk sprays or increased applied gallonage.

In general, the applied gallonage per acre required for fruit trees with the semiconcentrate and concentrate methods of application may be expressed as the following fractions of what is required in the bulk application method:

	Concentration (in multiples of standard dosage 1X)	Gallonage required (in fractions of requirements by the bulk application method)
Semiconcentrate applications	1X	4/5
	2X	2/5
	3X	3/10
	4X	1/5
Concentrate applications	6X	1/8
	8X	1/10
	10X	1/12

The table on page 12 gives the gallonage and amount of material to be applied per acre with the various concentrations of spray chemicals, as used in bulk, semiconcentrate and concentrate methods of application.

The gallonage as applied by the bulk method—being most familiar to growers—is used as a base in determining the data.

The variance in planting and number of trees per acre is covered in column one.

The variance in tree size is indicated in column two by the number of applied gallons per tree in the bulk method.

The variance in concentration of the three methods is indicated in columns three to 10 by the multiples of 1X, the standard dosage.

The reduction in the amount of material applied per acre by the semiconcentrate and concentrate methods of application does not exceed 20% of that as applied by the bulk method.

The amounts of material applied by the semiconcentrate and concentrate methods of application are comparable or equal.

Arthur D. Borden is Lecturer in Entomology, University of California College of Agriculture, Berkeley.

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TOMATO

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earworm, tomato pinworm, and the larvae of the potato tuber moth. In Central California it is seldom necessary to initiate control against these pests before early July. In the warmer portions of the San Joaquin Valley, it may be necessary to start treatments in May or June.

Sulfur is the principal material used to control the tomato mite, while DDD and DDT are the chief insecticides used against the several species of caterpillars. Sulfur for the control of the tomato mite can be used in combination with the insecticide selected for the control of caterpillars. In such cases the concentration of sulfur should not be less than 50% and—for the first application—best control of the mite will be insured if the sulfur content is 75%. In most cases, where it appears that there is poor control, it is because applications were made too late; poor coverage was obtained especially in the vicinity of aerial obstructions such as buildings, trees, or power lines; insufficient material; or faulty equipment. To the present time there has been no positive indications that a strain of mite resistant to sulfur is being selected from the population.

In general if the control of the mites has been satisfactory and no evidence of them can be found by the first part of September, sulfur can be omitted from later applications of insecticides intended for caterpillar control.

DDT is not nearly so effective as DDD for the control of the tomato hornworm, *Protoparce sexta*. Therefore, in the warmer interior valleys where this caterpillar is likely to be present in destructive numbers, DDD is the recommended insecticide for the first two applications. However, DDD is not effective against flea beetles. A switch to DDT for a final application is frequently desirable as flea beetles may appear in destructive numbers in tomato fields in late summer and early fall. By this time hornworms no longer present a problem, and the important caterpillars likely to be present include the corn earworm, beet armyworm, tomato pinworm and the potato tuber moth. Against these pests both DDT and DDD are highly effective.

For an effective control of the tomato mite and the several species of caterpillars, usually two to three applications of insecticides are necessary, applied at intervals of from four to six weeks. The concentration of DDD or DDT in the dust should be 5% and the dusts applied at the rate of from 30 to 35 pounds per acre per application. Best results are assured where the dusts are evenly and thoroughly applied. Where obstacles—such as trees, buildings, power lines, oil derricks—interfere with airplane applications, supplemental measures should be used to treat any areas missed, If this is not done, the harvested crop may contain annoying amounts of infested fruit, particularly in the late shipping crop from the southern San Joaquin Valley. Failure to obtain highly satisfactory control should not be blamed at present upon the insecticide but upon the application.

In recent years a leafminer occasionally has caused serious defoliation of tomato plants. At first, some of the newer insecticides—such as DDD and DDT—were held responsible for an increase in the population of the leafminer. After investigation it appears that serious infestations by the leafminer are more dependent upon natural surroundings and conditions than upon insecticides used.

The insecticides used in the tomato insect control program will not result in a residue problem if used as recommended and if the fruit is washed or wiped carefully before being marketed.

A. E. Michelbacher is Associate Professor of Entomology, University of California College of Agriculture, Berkeley.

O. G. Bacon is Assistant Professor of Entomology, University of California College of Agriculture, Berkeley.

W. W. Middlekauff is Associate Professor of Entomology, University of California College of Agriculture, Berkeley.

SCALE

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after the application but such populations did not persist so long as in the previous two years.

Multiple applications of parathion in 1951 were no more serious in this respect than single treatments were in 1949 and 1950. One possible explanation is that the increased populations of this scale in 1948 and 1949 because of parathion treatments followed unusually cold winters which may have reduced the number of parasites to much lower levels than the milder winter in 1950–51.

H. S. Elmer is Assistant Specialist in Entomology, University of California College of Agriculture, Riverside.

W. H. Ewart is Assistant Entomologist, University of California College of Agriculture, Riverside.

G. E. Carman is Associate Entomologist, University of California College of Agriculture, Riverside.

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