Tomato Insect Survey

studies indicate direct field seeding increases early season problem

— A. E. Michelbacher, W. W. Middlekauff and E. E. Stevenson

The insect situation in tomato plantings during the early season of 1950 was more serious than during the past several years.

The ever-increasing acreage of direct field seeded tomatoes was responsible—in part—for the seriousness of the situation. This change in cultural procedure has complicated the insect control problem as compared to that which exists where plants are raised in beds and then transplanted into the field. With direct seeding the entire field must be watched carefully from the start.

Control Essentials

To reduce the danger of serious damage, the first essential is to obtain a good germination stand as the most critical period is from the time the plants appear above the ground until they are two to three inches tall. During this period a relatively small population of insects may do considerable damage. If a grower is not alert a portion or even an entire field may be destroyed before he becomes aware of the situation.

Among the tomato insects that caused most concern in the early season of 1950 were darkling ground beetles, flea beetles, aphids and thrips. Others that were less abundant included grasshoppers, crickets and caterpillars of the beet armyworm.

Beet Leafhopper

Another insect that was troublesome in the San Joaquin and Salinas valleys was the beet leafhopper which is the vector of the serious virus disease of tomato known as curly top or western yellow tomato blight.

The dusting of tomato fields to control this insect and thus reduce the amount of disease did not result in checking the disease. However, where fields were weedy and the leafhopper was concentrated on the weeds, some benefit may have resulted from treating the field to control the leafhoppers before the weeds were destroyed by cultivation and hoeing. The reason for this was to kill infective leafhoppers before they had an opportunity to move over to the tomato plants and transmit the disease.

A great deal of good resulted where thinning was delayed to the latest possible date. This allowed the grower to leave the maximum number of healthy plants.

Darkling Ground Beetle

Darkling ground beetles caused some damage, although injury due to other causes was frequently attributed to these beetles.

A large number of growers attempted to control the pest by applying poison baits with a fertilizer attachment as a side dressing at the time of planting. Usually the bait was applied at the rate of about 20 pounds to the acre. Although no experimental tests were conducted, it appeared that this method should have resulted in the control of beetles present. In most cases direct seeded tomatoes are irrigated immediately after planting. This practice results in a moistening of the bait, which should make it attractive to the beetles.

Most growers were pleased with the results and in principal the method is sound in that the pest is eliminated before the plants show above the ground. However, it is difficult to measure the exact benefits accomplished, because of the spotted nature of the darkling ground beetle infestation.

Where plants are heavily dusted with hydrated lime, highly satisfactory control of the beetles is obtained. A 5% DDT dust applied with a ground duster at the rate of eight pounds to the acre is also an effective treatment.

Flea Beetles

Flea beetles were destructive to the seedling stands. This was particularly true in many fields in the San Joaquin Valley. If control measures had not been applied, the stand in many fields would have been destroyed. This pest was adequately controlled with timely applications of 40% or 50% cryolite dust applied with a ground duster at the rate of 12 to 15 pounds per acre.

Excellent control was also obtained with a 5% DDT dust applied with a ground machine at the rate of eight pounds per acre. This latter treatment also resulted in the control of darkling ground beetles.

Airplane applications of 5% DDT at the rate of 20 pounds per acre controlled flea beetles but the results obtained were not as good as where the material was applied by ground dusters at the rate of eight pounds per acre. Serious infestations of flea beetles were not adequately controlled with 5% DDD dust applied with a ground machine.

Aphids

Aphids were abundant on practically all the direct seeded tomatoes.

The most common species was the green peach aphid *Myzus persicae* (Sulz.). This aphid migrated into tomato fields in great numbers. Some breeding occurred within the fields and it was not uncommon to find the very young tomato plants nearly covered with the pest.

Numerous insecticides were applied to control the aphid, but little good resulted because of the constant influx of migrating individuals.

The insecticide that showed the most promise was a benzene hexachloride dust, but it is not a recommended material because of the danger of its imparting an off flavor to the tomatoes. Furthermore, observations were made which indicated that the tomato plants in untreated fields did as well as those in treated fields. The aphid population in all fields largely disappeared, probably due to the fact that tomato is not a favorable host for the aphid, and also due to natural enemies of the pest which were very abundant.

It is questionable whether insecticide treatments for green peach aphid control is ever justified on field-grown tomatoes.

Other Pests

Thrips were sometimes present in rather large numbers. In some cases injury was noticeable, but in all fields under observation the plants outgrew the damage. In some fields application of DDT for the control of flea beetles or darkling ground beetles may have resulted in a marked reduction in the thrips population.

Caterpillars of the beet armyworm were encountered in numerous fields. They never reached a destructive level, and in many fields the population was eliminated by treatments applied for the control of flea beetles and darkling ground beetles.

Grasshoppers and crickets caused some damage. Injury by these insects was not general, and little opportunity was afforded to conduct insecticidal tests against them. It is possible that poison baits used for the control of darkling ground beetles reduced the population of these pests. Where damage occurred, it was checked with chlordane applied as a dust or spray.

In some young stands many plants were

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GOPHERS

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To locate runways, the probe is thrust repeatedly into the ground near fresh gopher mounds until it hits a tunnel. The operator can easily tell when this happens because then the probe drops suddenly due to changed resistance as its point passes from the soil into the open tunnel.

After locating an open runway, the small probe hole is enlarged for placing the bait by inserting the handle end of the probe. The bait is then dropped into the runway, and the probe hole closed with a clod or pressed shut with the heel.

It is more effective to place baits at two or three sites in each burrow system rather than to drop them all down a single hole.

In heavily infested fields it is often difficult to tell where one burrow system ends and another begins. In that event, baits may be placed arbitrarily every 20 feet or so.

An intensive, persistent campaign against gophers is strongly recommended. Treatment should be repeated until survivors have been eradicated or reduced to a negligible minimum.

A rough check on the effectiveness of the treatment may be had by kicking off the tops of mounds during the operation and revisiting the area several days later to look for new work. Another method is to return to the field after irrigation to check on new mounds.

For the final elimination of survivors, traps or a different poison bait formula should be used since the last survivors may be wise to the original treatment.

Once cleared of gophers, fields should be surveyed periodically for reinvaders. These are apt to migrate overland from nearby untreated lands and to dig in around the edges of the field.

Cost of Poisoning

Cost of poisoning will vary greatly with density of the gopher population, degree of control desired, price of material, labor cost, and operating conditions.

A rough idea of the expense may be had by considering how much it would cost to eradicate or reduce to a negligible minimum 100 gophers in a five-acre alfalfa field—heavy infestation of 20 per acre.

Labor is the principal item. Given abundant fresh mounds and low vegetation so that gopher systems can readily be seen, and moist soil for easy and efficient probing, an experienced operator can thoroughly treat at least 25 systems an hour. To this must be added an hour for preparing baits and the time required for a second treatment to reduce survivors. Assuming an 80% kill, it would take about another hour to re-treat the 20 surviving gophers—killing presumably another 80%, or 16 of them. Thus, to obtain a 96% kill would take two treatments, requiring approximately six man-hours. With labor at $1.00 an hour, this would amount to a little more than six cents a gopher, or about $1.20 per acre.

Cost of materials would be nominal. With strychnine alkaloid at $28.96 per pound it would take only 40¢ worth of this poison to kill nearly 100 gophers, about four tenths of a cent per gopher. With strychnine sulfate at $22.24 per pound, 35¢ worth would be needed.

For bait, about four pounds of cut root vegetables would be required for 100 gophers using strychnine alkaloid—slightly more with strychnine sulfate.

The cheapest available bait material can be used—culled or unmarketable vegetables are satisfactory. At 5¢ a pound, the bait for 100 gophers would only cost about 20¢, or two tenths of a cent per gopher. The cost of poisons and baits together at most would add about six tenths of a cent per gopher to the total cost.

Poisoning is cheaper and obtains better kills than either gassing or trapping.

Trapping may be desired for final eradication or may be preferable in small areas or for small numbers of gophers, but poisoning with the proper poisons, baits and dosages is the most effective and economical method for eradicating pocket gophers.

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COTTON

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Careful operation of the harvester itself is extremely important. Growers cite the necessity for keeping picker drums clean of dirt, grease and soiled cotton, using a minimum of moisture on the spindles and not picking when weather conditions are very unfavorable—high humidity.

Growers also reported successful machine-picking in very rank, high-yielding cotton.

Grades of machine-picked cotton varied widely among the gins. Some gins in each area had grades comparable with hand-picked cotton.

Economic Advantage

The economic advantage of machine-picking must be evaluated on more than just the costs of machine versus hand-picking.

In this study, machine-picked grades were lower than those for hand-picked cotton. Money returns from the crop, therefore, were lower for machine-picked than for hand-picked cotton. The difference averaged, for the season, slightly less than one full grade.

An indication of the effect of grades on money returns is the government loan value. The loan value of hand-picked cotton at 35 gins averaged $142.84 per bale, and of machine bales $132.52, a difference of $10.32 per bale. The $10.32 difference in loan value is a market cost to be charged to mechanical harvest.

The net economic advantage of machine-picking is found by adding together harvesting costs, value of field waste, and value of grade-loss, and comparing the total with the cost of hand-picking.

These figures are summarized in terms of the average grower in 1949:

	Hand picking	Machine picking
Picking cost	$45.00	$14.65
Field waste		1.20
Grade-loss		10.32
Total harvesting cost	$45.00	$26.17
Difference in favor of machine-picking		$18.83

A practical economic question facing the grower is at what yield of seed cotton per acre he can afford machine-picking. In 1949 a grower's total cost would have been $6.47 per hundredweight of seed cotton worth $7.70 above ginning costs—assuming second picking cotton with lint at 20¢ a pound and cottonseed at $45.00 a ton.

A grower who considered only the direct costs of operating a mechanical harvester—exclusive of overhead—could operate when the yield was only 75 pounds. His direct costs would be $6.25 per hundredweight.

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cut off. Although insects were suspected, in many cases, careful examinations revealed that the damage was out of proportion to the insect population present. Observations were made that indicated that birds were responsible for the loss. Of these, horned larks were the most important offenders.

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