A PROGRESS REPORT . . .

Weed Control in Toma

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TOMATOES ARE GROWN on more acreage in California than any other vegetable crop. Weed control costs amounted to $4.24 million, with additional losses from weeds estimated at $10.28 million —for a total cost of $14.5 million annually to tomato growers in California, according to the 1964 report of the Statewide Weed Control Committee of the State Chamber of Commerce. Current costs of weeding tomatoes are estimated at $27 per acre. These costs may increase: (1) if mechanical harvesting requires a longer period of weed control; and (2) if the labor for hand weeding becomes more scarce with the end of the bracero program.

Fortunately, tomato growers have had a number of good herbicides for chemical weed control including carrot oil, CDEC (Vegadex) and PBEC (Tillam). Carrot oil has been applied at a rate of 20 to 40 gallons per acre for anual weed control just prior to emergence of the tomato plants. CDEC has been used at 4 to 6 lbs per acre in preplant applications incorporated 2 inches into the soil, preferably with a power driven rotary tiller. PBEC may also be used at 4 lbs per acre, preplant, soil incorporated—again preferably with a power driven rotary tiller, or with cross disking if a rotary tiller is not available. These herbicides do an excellent job of selective control of most annual weeds, particularly for the first 30 to 45 days.

Early field testing with a new herbicide, diphenamid (N,N-dimethyl-2,2-diphenylacetamide), done without soil incorporation, produced variable results. During the 1964 season, diphenamid was incorporated by various means, including disks, rotary hoes and sprinkler irrigation. When the rotary hoe and sprinkler methods of incorporating diphenamid were used, good weed control generally resulted.

Nine tests

A summary of nine separate experiments, conducted at different locations in the state, indicated that diphenamid at 4 to 6 pounds per acre gave as good weed control as Tillam or Vegadex (see graphs and tables). A summary of the toxicity ratings recorded at various intervals after crop emergence showed no toxicity

TABLE 1. AVERAGES OF NINE TRIALS TESTING SEVERAL HERBICIDES FOR WEED CONTROL IN TOMATOES (1962–64)*

Herbicide	lb/A	% weed control†	Toxicity rating (0–10)	Yield of fruit			
				Plant/ft	% of untreated check		
					green	ripe	total
Tillam	4	68	0.7	‡	110	112	113
Vegadex	4	50	0.8	‡	107	102	110
Tillam + Veg.	2 + 2	56	0.1	‡	92	115	114
Diphenamid	4	72	1.0	100	96	149	122
Diphenamid	6	82	0.1	95	103	89	103
Diphenamid	8	94	0.2	117	104	128	116
Diphenamid	16	‡	2.4	49	‡	‡	‡
Dacthal	8	36	4.4	42	‡	‡	‡
Dacthal	10	50	3.0	33	104	76	99
Dacthal	12	‡	6.8	‡	‡	‡	‡
Dacthal	32	75	6.8	22	‡	‡	‡

* Average of parts of 9 separate experiments. Not all data was taken in every trial, so averages represent averages of 2 to 9 figures.

† Weed control averages based on the untreated check (counts) and weed control ratings for the first 100 days.

‡ Not included in more than one trial or no data collected.

The yield data from two trials was analyzed statistically. In these trials there were no significant differences in number or weight of fruit from any plot. The coefficient of variation for fruit number ranged from 25 to 30%, whereas the coefficient of variation for fruit weight ranged from 7.8 to 11.7%.

Clean tomato row to right of center in large photo below shows excellent deg either side. These tests in San Joaquin County were applied with a sprayer chemical into the soil. Small close-up photo to left shows some stunting of t acre rate in trials at the South Coast Field Station.

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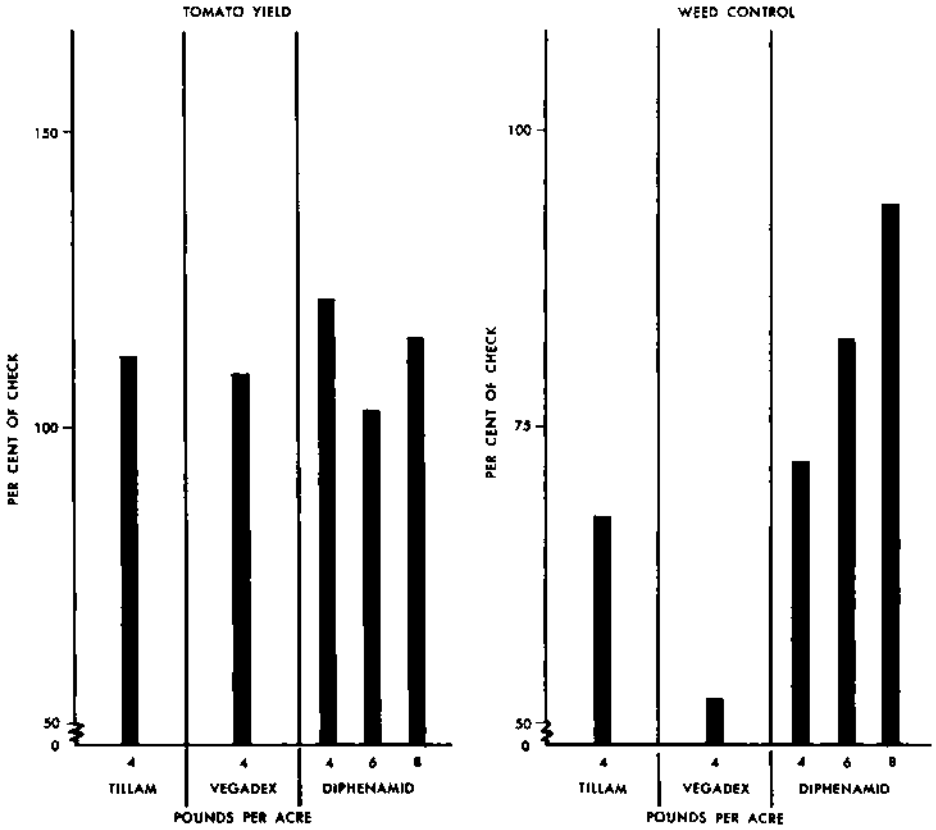
Comparative tomato yield summary, left, from weed control trials in San Benito and Tulare counties using Tillam, Vegadex and diphenamid, 1963–64. Weed control summary for the trials is shown in graph to right.



until a rate of 16 lbs per acre was used. The toxicity, appearing as a stand reduction with early stunting, occurred in only two out of three trials. Weeds and other crops in the plots were essentially eliminated at a rate of 16 lbs per acre—indicating an excellent selective advantage for tomatoes. While there was a reduction in stand of about 50% at this extremely high rate, there was no reduction in yield up to 8 lbs per acre. The weed control was generally good for more than two months as shown in the chart.

DCPA (Dacthal) was included in some of the earlier tests (1963); however, it was excluded from later tests as it did not give adequate weed control up to 10 lbs per acre—in addition, it showed considerable toxicity (table 1) to direct seeded tomato seedlings even at 8 lbs per acre. Stand reduction and stunting were both apparent. A swelling of the hypocotyl just below the soil surface was particularly noticeable on seedlings. Although 10 lbs of DCPA per acre did not affect yields, there was a suggestion of phytotoxicity expressed by considerable delay in maturity—as noted in the small number of ripe fruits compared to the number of green fruits.

Although the number of trials in which

of weed control possible with diphenamid as compared with untreated rows to
i lbs per acre of diphenamid. A 10-inch rototiller was used to incorporate the
ito seedlings with soil incorporated applications of diphenamid at the 16 lb per

TABLE 2, CONTROL* OF WEED SPECIES GROWING IN TOMATO TRIALS BY SEVERAL HERBICIDES AND RATES

Herbicide	lb/A	Pigweed	Lambsquarter	Watergrass	Sow thistle	Wire weed	Bur clover	Nightshade	Purslane	S. clover	Chickweed	Poa annua	Henbit	Groundsel	Cheeseweed	Shepherds purse
Tillam	2		+	–						–						
	4	–	–	+		–	–	–	+	–				+		+
	6	+	+					+	+					+		+
	8															
Vegadex	4	–	–	+	–		–	–	+	–						
	6	+	+					–	–					+		–
	8	+	+					–	+					+		+
Tillam + Vegadex	2 + 2		–	+			–	–	+	–						
Diphenamid	4	–			+	–		–	–	–	±	–	–	+	–	–
	6		+	–					–	–						
	8	±	–	+		+	+	–	+	–						
	16								–		+	+	–	+	+	+
Dacthal	4									–	–	–	–	+	–	+
	8								–	+						
	10	+		+				–	+	+				±		–
	12	+	+					–	–	+				+		+
	32								+		+	+	+	+	+	–

* A plus sign (+) indicates satisfactory control of the species in question whereas a minus (–) sign indicates presence of the species in the plots or unsatisfactory control. No sign indicates inconclusive results. (Data summarized from five experiments).

weed control was evaluated by species was small, the data summarized for 15 weed species pointed out some weaknesses of diphenamid in controlling some of the broadleaf weeds such as nightshade, sour clover, henbit, cheeseweed, and shepherds purse. It may also prove to be weak on purslane. While diphenamid does not generally prevent the germination and growth it appears to stunt purslane seedlings so that they do not compete with tomato plants. Diphenamid at low rates has frequently been observed to severely stunt certain susceptible plants such as purslane and barley and fail to kill the plants as the seeds germinated.

Soil incorporation

Some of the indicated lack of weed control reported with Tillam and Vegadex in the tables can be attributed to insufficient soil incorporation under sprinkler irrigation (in two of the tests in which weed species were evaluated). If the Tillam and Vegadex had been properly incorporated, adequate weed control of the species in these tests might have resulted. On the other hand, Dacthal (not used in these sprinkler-incorporated tests), appeared to be weak in controlling nightshade, and possibly purslane, when incorporated in the soil.

No residues have been found in fruit analyzed for diphenamid from plots treated with up to 12 lbs per acre. As a result of cooperative residue and performance work reported here, diphenamid is being recommended this year by the University of California at 4 to 6 lbs per acre preplant, incorporated, for direct-seeded tomatoes. A precaution has been added concerning sensitive crops following use of diphenamid for weed control in tomatoes. Crops thus far showing sensitivity to diphenamid are the small seeded grains, milo, and sugar beets. Crops having shown some tolerance were beans, alfalfa, and cotton. Further research on crop tolerance and soil residues will be reported at a later date.

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CABBAGE LOOPER

a principal pest of agricultural crops in California

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THE CABBAGE LOOPER, *Trichoplusia ni*, is the larva of a noctuid moth. The name is apt to be misleading, because the adults lay eggs and the caterpillars feed on the leaves of a great variety of plant species in addition to cabbage.

Although its economic importance varies in different areas, the cabbage looper is distributed throughout the continental United States. In southern California, it is regarded as one of the most important insects attacking agricultural crops. The cabbage looper has been long recognized as a serious pest of cole crops (cabbage, cauliflower, broccoli, brussels sprouts) and of leafy vegetables such as lettuce, celery, spinach, and beet greens. It causes damage to these crops mainly by feeding on leaves. This may lead to direct economic loss by weakening or causing the death of plants, or the market value of the crop may be reduced because of the unsightliness of feeding holes and ragged leaf edges. An associated marketing problem may result from excrement lodged among the leaves.

Losses increased

During recent years, losses caused by the cabbage looper to many other plant species appear to have increased or to have been more accurately observed and reported. These plants include potatoes, tomatoes, citrus, melons, cotton, and a variety of annual and perennial ornamentals. The large numbers of larvae found feeding on tomato foliage in San Diego County have sometimes made insecticide treatments necessary. Cabbage looper densities often increase to high levels during the summer on cotton and have been very difficult to control with conventional insecticides. However, large numbers of larvae, in conjunction with hot summer temperatures, favor the spread of a polyhedrosis virus disease. In late summer, looper populations on cotton are often decimated by this disease in a few days.

Melon problem

A serious problem has resulted in some areas from cabbage loopers feeding on the rind of melons. Typical injury on watermelons appears as a tan or white, roughly crescent-shaped or circular area from which the surface of the rind has been devoured. When this scar is circular, a smaller intact circular portion of rind often remains in its center. The typical shape of the scar is caused by the insect's feeding behavior. The caterpillar secures the posterior part of its body to the rind with its abdominal prolegs and feeds on all other portions of rind that it can reach from its location, while swinging the anterior part of its body in an arc. No known reduction in fruit quality is caused by this superficial feeding. However, because the appearance of the melon is affected, economic losses may occur. Following a heavy cabbage looper infestation, essentially all watermelons in a given field may have one or more feeding scars.

Many studies are being conducted on the cabbage looper by federal and state