



A statewide survey conducted in 1983 queried processing tomato growers on their current pest control practices, sources of pest management information, and primary pest problems as they perceived them. The purpose was to establish baseline data against which the University of California Statewide Integrated Pest Management (IPM) Project could measure adoption and impact of IPM programs in the future.

The confidential survey was mailed with the assistance of the California Tomato Growers' Association. Usable responses were received from 175 growers, representing 37 percent of California's processing tomato acreage. The responses were divided into the five major growing regions in California. Percentage of respondents from each area closely approximated the percentage of the state's processing tomato crop grown in each area.

Problems and practices

Growers ranked weeds as their number one pest problem; diseases and insects tied for second place (table 1). Regional differences in these rankings were significant. For instance, although more than half of the growers in the Central Valley and the central coast area ranked weeds as number one, none from the southern coast or southern desert listed them as their most serious problem. Diseases were identified as the biggest problem along the coast and insects the most serious concern in the southern desert.

The key components of any pest management program are proper identification of the pest species causing damage, field monitoring to determine when control actions are needed to prevent damage, and choice of suitable control methods. All of the growers surveyed reported checking for pests or having their fields checked by a pest control advisor during the growing season, and most recognized the need to carry out these procedures

Pest management practices in processing tomatoes

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frequently. Almost half of the growers had fields checked twice a week, and an additional 19 percent checked more often. Roughly a third reported checking their fields for pests once a week, and only 2 percent checked less than once a week. Growers in the Sacramento and San Joaquin valleys tended to check their fields more often than growers along the coast or in the southern desert.

The most common methods used to control pests in processing tomatoes are applying pesticides, cultivating (table 2), planting resistant varieties, and rotating crops.

Weeds

Nightshades were overwhelmingly listed as the most important weed problem statewide (70 percent of the growers). A little over 10 percent ranked barnyardgrass as their number one weed problem, but only growers in the San Joaquin and Sacramento valleys mentioned it. Nutsedge was considered almost equal to barnyardgrass as a problem. Along the central coast, cheeseweed was listed as the second most important weed in tomatoes, after nightshades. The importance placed on nightshades and nutsedge may be linked to the difficulty growers have controlling them with herbicides currently available for use in tomatoes.

Despite the importance of weed problems, about half of the growers surveyed did not keep written weed records for their fields, and about one-fourth said they sometimes kept written records. Only slightly more than a quarter of the growers reported records kept every year. Cross-tabulation of survey results showed that written weed records are not kept more often by growers who consider weeds their number one pest problem or by those who own their own land than by other growers.

Herbicide application and cultivation were the primary means of weed control. Of the respondents, 94 percent made a preplant herbicide treatment, 78 percent made applications after thinning or transplanting, and 19 percent made post-plant applications before weed emergence. Growers who cultivated more often were able to reduce the number of herbicide applications. Ninety-seven percent of the growers reported rotating regularly to another crop. The most fre-

quent reason given for rotating was weed control (80 percent of the growers).

Diseases and nematodes

Statewide, growers applied pesticides for black mold more often than for any other disease; 81 percent said they treated for this disease. Bacterial speck ranked second with 46 percent of growers treating for the disease, although late blight was treated more often in the central and southern coastal areas. Applications for powdery mildew were slightly more common (29 percent of responding growers) than for late blight (26 percent), and gray mold was a close fifth (21 percent). The number of fungicide and bactericide applications varied significantly among regions (table 2).

Over half of the growers (56 percent) reported rotating for disease control. Rotation is an important method for controlling pathogens that are soil transients and need a host to survive. Growers may also be rotating to tomatoes to manage diseases of other crops for which tomatoes are not a host.

Of the surveyed growers, 44 percent reported having nematode problems on their processing tomato acreage, but only a few listed nematodes as an important problem. Most growers used more than one method of controlling nematodes: 89 percent used soil fumigation, 50 percent used crop rotation, and 35 percent used resistant varieties.

Caterpillars

The most important insect pests in processing tomatoes are lepidopterous caterpillars, primarily the tomato fruitworm, that feed on the fruit. Insecticide treatments are the principal means of control.

Growers were asked how many times they made insecticide applications for caterpillars in a typical year and in 1982, which was a "light year" for these pests. Half reported no difference in the number of applications between 1982 and a typical year. About a third were able to eliminate one spray, and a few eliminated two applications. A few growers put on more sprays in 1982 than in a normal year. Although responses to an earlier question indicated that fields were being checked frequently for pests, growers may have used this information only for timing sprays and still made treatments

when worm pressure was low. About 60 percent of the growers said they used one of the recommended methods for sampling damaged fruit.

A key part of an integrated pest management program is the use of a population or damage threshold to determine when treatment is required based on sampling results. A little over half, or 52 percent, of the surveyed growers said they used such thresholds for fruitworms and armyworms. When growers who used thresholds were asked to describe them, most used a very general rule of thumb rather than a quantifiable threshold. Common responses were "when you see damage," "own experience," "percentage damage," or "pest control advisor recommendation." A few listed "1 percent of sampled tomatoes with worm damage," and one suggested "5 percent damage on 200 random-pick samples." The most important source of this threshold information was the growers' own experience; pest control advisors were also an important source. Development of quantitative treatment thresholds for fruitworms was among the most frequent suggestions for what UC Cooperative Extension could do to help improve IPM in processing tomatoes.

Aphids

Aphids are only minor pests on tomatoes; natural enemies and environmental factors usually keep them under control in many growing regions. Occasionally they build up in sufficient numbers to damage seedlings or to cause leaf distortion or blossom drop on older plants of susceptible varieties.

The regions with the highest number of aphid applications (the southern coast and southern desert) also had the highest number of worm applications (table 2). This trend may reflect the fact that aphid infestations can occur as secondary outbreaks when insecticide treatments for other pests kill off their natural enemies. The central coast, which ranked third, may have a more serious problem with aphids than the Central Valley because of the mild summer climate; summer heat often limits aphid populations in other areas.

Information sources

Growers were asked to rank their most important sources of pest control information. More than 56 percent of the respondents listed pesticide company representatives first; 23 percent ranked consultants first; and 13 percent considered their farm advisor to be their best source of information. Rankings of sources of information varied by the number of years the respondents had grown tomatoes. The longer growers had

TABLE 1. Ranking of pest problems in five California regions

Problem	Percentage of growers*					Total statewide (169)
	Sacramento Valley (101)	San Joaquin Valley (40)	Central coast (16)	Southern coast (9)	Southern desert (3)	
Weeds	61	76	56	0	0	60
Insects	21	10	6	44	100	19
Diseases	15	15	38	56	0	19
Nematodes	4	0	0	0	0	2

* Number of respondents per region in parentheses.

TABLE 2. Annual number of pest control treatments made by processing tomato growers in California regions

Treatment	Average number of treatments (and range)					Statewide
	Sacramento Valley	San Joaquin Valley	Central coast	Southern coast	Southern desert	
Insecticides						
Worms (avg. yr.)	1.9 (1-5)	1.1 (0-5)	1.6 (0-3)	2.3 (1-3)	4.7 (4-6)	1.8 (0-6)
Worms (1982)	1.4 (0-4)	0.6 (0-3)	1.3 (0-5)	1.9 (1-3)	4.3 (3-6)	1.3 (0-4)
Aphids	0.4 (0-2)	0.3 (0-2)	0.7 (0-3)	1.0 (0-2)	1.0 (0-2)	0.4 (0-3)
Fungicides and bactericides	1.7 (0-4)	1.2 (0-5)	2.4 (1-5)	2.5 (0-6)	1.7 (1-3)	1.7 (0-6)
Herbicides	2.1 (1-4)	1.9 (1-3)	1.6 (1-3)	1.5 (1-3)	3.0 (2-4)	2.0 (1-4)
Cultivations (for weed control)	3.4 (1-8)	2.7 (1-6)	4.5 (2-6)	4.0 (3-5)	1.5 (1-2)	3.2 (1-8)

been producing tomatoes the more likely they were to rely on a pesticide company representative and the less likely to rely on a farm advisor or private consultant. Put another way, the new growers relied more on private consultants and farm advisors. Source of information did not vary by farm size or region.

Conclusions

California tomato growers face a variety of pest problems every year. The survey showed that weeds were considered the most significant problem statewide, although pest problems varied by region. Growers demonstrated a working knowledge of the weeds occurring in their fields, and yet three-quarters of them did not keep annual weed records.

Virtually all reported at least weekly field checks for pests. Central Valley growers tended to check their fields more often than those along the coast or in the southern desert. Since growers in the southern desert and coastal areas also treated more often for insects and diseases, less frequent field checking does not seem warranted.

Although most growers demonstrated a willingness to devote resources to monitoring their fields, many were not able to reduce insecticide treatments in a year with low caterpillar populations. This may indicate that fields were checked

primarily to time the sprays rather than to decide whether treatments were needed. Despite a general awareness of IPM methods, almost 40 percent of the growers used no quantitative method for determining when to treat for fruitworms and armyworms. Growers based their treatment threshold decisions on their own experience, but many mentioned that they would like the University to develop treatment thresholds for caterpillars. The UC IPM Project will release such thresholds for the 1985 growing season in some areas.

Tomato growers' sources of IPM information did not vary by region or size of operation. Over half of the growers relied primarily on pesticide company representatives, who may or may not depend on the University of California for IPM information. The fact that newer growers tended to confer more with private consultants and farm advisors may indicate an increasing reliance on Cooperative Extension for IPM information in the future as new growers enter the industry.

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