$426,000 for hiring 1,072 illegal aliens in 1983.

The Immigration and Naturalization Service can remove illegal aliens from a work place, but only the Department of Labor levies fines on contractors who knowingly hire undocumented workers. This two-agency enforcement mechanism has not prevented contractors from hiring undocumented workers; indeed, their activity with such workers appears to be expanding, according to a 1983 survey by the University of California and the California Employee Development Department. This experience with employer sanctions indicates that, without greatly expanded enforcement, federal sanctions will make little difference in the number of undocumented workers hired.

Conclusions

Farm labor contractors have been important in California for over a century. Today, they provide about one-fifth of agricultural employment in California, and contract employment is increasing faster than the employment rate of workers hired directly by growers. Three-quarters of California's farm labor contractors and contract workers are employed in the San Joaquin Valley.

Average contract wages are lower than average agricultural wages in every region in California. The South Coast region pays the highest contract wages at $8,400 per job slot — 65 percent higher than the southern California average of $5,100.

Contractors have been subject to federal regulation since 1964. Progressively stricter regulation was expected to diminish contractor activity. It has been expanding, however, despite enforcement efforts indicating that more than half of all contractors investigated are violating at least one provision of the most recent (1983) federal act.

Since 1965, farm labor contractors have been prohibited from knowingly hiring undocumented workers. Despite criminal fines of up to $10,000 and three-year prison terms and civil fines of $1,000 per undocumented worker, estimates indicate that many contract crews are 30 to 60 percent illegal alien workers. However, the Department of Labor cited an average of only 21 contractors for hiring an average of 15 illegal alien workers each in California, Arizona, and Nevada in the early 1980s. It appears that, without greatly increased enforcement, employer sanctions laws would make little difference in the hiring of undocumented workers.

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Counting populations of the tiny citrus red mite and predator mite on orange trees to determine if control treatments are needed can be a time-consuming task.

Presence-absence sampling of citrus red mite

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The speed and simplicity of the system make it highly practical

Relating pest abundance to changes in productivity or quality is a basic element of the grower's decision-making process. Where reliable decision rules have been applied in a pest management system, the result is often a reduction in pesticide use and less risk of damage. Control action thresholds are an integral part of a pest management system, but using them requires monitoring of pest abundance. The lack of an efficient and reliable monitoring scheme is often the limiting factor in a grower's ability to use research that has been developed on pest management.

One method that has proved acceptable to California growers and pest management consultants is presence-absence sampling. This technique is possible because of the ecological relationship between the proportion of sampling units containing a pest or natural enemy and the numbers of the organism per sampling unit. Presence-absence sampling is especially useful where the organism being recorded is small, abundant, and difficult to count. We have found a significant reduction in the time it takes to reliably sample the abundance of such organisms as mites, aphids, and their predators. The following is an application of presence-absence sampling for the citrus red mite, *Panonychus citri*, and a predatory mite, *Euseius tularensis*, on San Joaquin Valley orange trees, a situation that heretofore required exhaustive counts of both mite species for use of UC-recommended decision rules.

We collected the initial data for this study every two weeks at Lindcove in Tulare County for an eight-year period. During the 1968-69 through 1971-72 seasons, we selected eight leaves from two groups of four trees each. One leaf was selected from the upper and lower portions of the tree at each compass direction. During 1972-73 through 1975-76, we selected 16 leaves from each of two groups of four trees each, taking two leaves from the

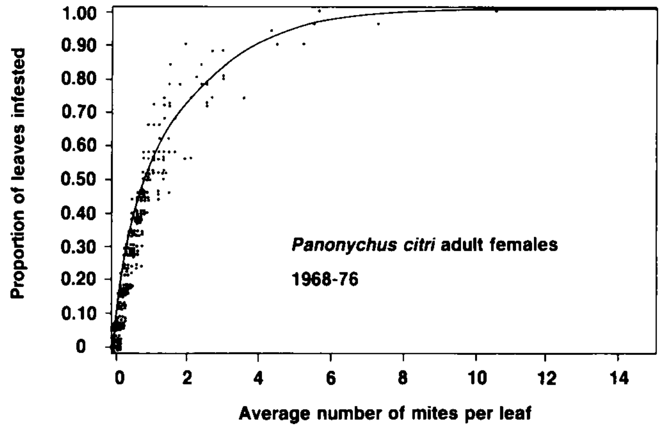

Fig. 1. Proportion of leaves infested with citrus red mite adult females in relation to density.

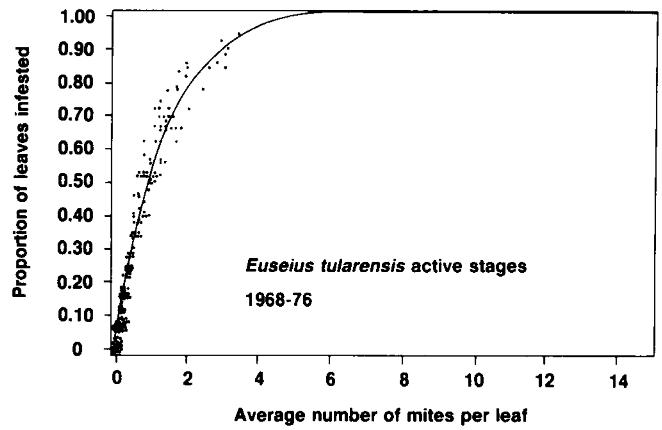

Fig. 2. Proportion of leaves containing the predator *Euseius tularensis* in relation to density.

portions of the trees as previously. We sampled two different groups of four trees in 1973-74 and 1974-75. Leaves sampled each season were those resulting from the spring flush of growth. Each leaf was examined individually for the numbers of citrus red mite adult females and active stages of the predatory mite.

Mite abundance for each location within the four trees was statistically compared on each sampling date (by one way analysis of variance). We determined the proportion of leaves infested with mites in relation to the average number of mites per leaf after combining the eight leaves per tree and four trees (32 leaves total) on each sampling date from the 1968-69 through 1971-72 seasons, and the 16 leaves per tree and two of the trees (32 leaves total) on each sampling date from the 1972-73 through 1975-76 seasons. The clumping pattern per leaf for each species and/or age class was expressed as the relationship between the proportion of leaves infested with mites, the mean number of mites per leaf, and the variance of mites per leaf.

A 1983 validation of the 1968-76 citrus red mite adult female data was conducted in 10 orchards representing all citrus-growing areas of Tulare County. We took 20 leaves from the perimeter of each tree on each week from March 15 to July 21, sampling four to six trees per orchard, and counting the number of citrus red mite adult females on each leaf. Statistical analysis of the clumping pattern per leaf was by the same method as in 1968-76.

Within-tree distribution

We found no statistical difference ($P > 0.05$) between sampling locations on the tree or between samples from the various compass directions for citrus red mite adult females and active stages or for *E. tularensis* active stages. On some of the sampling dates, however, there was a slightly greater density of each species on the north and east quadrants.

The lack of significant difference between sampling locations in a tree is important, because it then becomes possible to select leaves randomly from around the perimeter of a tree without biasing the estimate of densities.

The relationship between the proportion of leaves infested with citrus red mite adult females and the average number of mites per leaf (fig. 1) was similar to that derived from the 1983 validation study. The adult female mites showed very little variation in distribution between the eight years or between the 10 sampling sites in the study. Such stability is important in developing a robust sampling strategy.

The distribution of active stages of the predator mite was slightly less clumped than that of citrus red mite adult females (fig 2.). This pattern is expected of predatory mites, which have higher searching and dispersal rates than their prey.

Monitoring program

Feeding by citrus red mite causes stippling on upper leaf surfaces and stippling or silvering of fruit. Tree health, water management, and weather conditions all influence the tree's tolerance to mite infestations.

Two thresholds have been proposed for citrus red mite on oranges in University of California Publication 3303, *Integrated Pest Management for Citrus.* One threshold is two adult females per leaf in the spring. Below the threshold, no treatment would be recommended if the ratio of citrus red mite to *E. tularensis* were 0.2 or less. Above the threshold, the ratio would have to be much greater. The proportion of leaves infested equivalent to two citrus red mite adult females per leaf is 0.73 (from fig. 1). It is also possible to determine a ratio of the number of citrus red mite adult females to the number of *E. tularensis* from a presence-absence sample by estimating the densities per leaf from figures 1 and 2. The resulting ratio can then be used in the decision-making process.

A second control action threshold for citrus red mite is three or four adult females per leaf in the spring. In this case, the recommended pest mite: predator mite ratio is 1.0 or higher. The proportion-infested equivalent of 3.5 citrus red mite adult females per leaf is 0.85. Again, a density-per-leaf ratio can be estimated from figures 1 and 2.

Conclusion

The distribution of citrus red mite females appears to remain fairly constant between years and between orchards, and it is more clumped than active stages of the predatory mite *E. tularensis,* which may also be present on orange trees. The rapidity of presence-absence sampling and the significant relationship between proportion of leaves infested and mean number of mites per leaf for both species makes this method highly practical.

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