The Tristeza Suppression and Eradication Program in California

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TRISTEZA FIRST attracted attention in 1939, in the San Gabriel Valley of California, and was given the name "quick decline" (5, 6). It is widespread in parts of Los Angeles, Orange, Riverside, and San Bernardino counties—which comprise the Los Angeles basin—and in the Santa Clara River Valley of Ventura County. More than half the present citrus industry is, however, in areas other than these, and the trend is toward increased plantings outside the generally infested area.

The California Department of Agriculture conducts a vigorous program of tristeza suppression and eradication to protect the present and future citrus industry in areas where tristeza is not prevalent. The program is carried out in cooperation with the University of California Agricultural Experiment Station and Agricultural Extension Service, the U.S. Department of Agriculture, the Agricultural Commissioners of counties involved, and organizations of citrus growers and nurserymen.

The program includes quarantine regulations to prevent movement of infected stock from infested areas and the requirement that only tristeza-free propagating materials be used in protected areas. In the eradication areas, infected trees identified in surveys and by indexing are destroyed. Suppression and eradication are effective because the only known insect vector of tristeza virus in California—*Aphis gossypii* Glover—is inefficient (3); the number of tristeza source trees in the

protected areas is small; and the program has the support of the citrus industry. Not only are the older orchards on sour orange rootstock being protected, but also those on rootstocks generally considered to be tristeza-tolerant—such as Troyer citrange, which has been found to decline under some conditions when infected with tristeza virus (1, 2, 7).

Evidence for the low rate of spread of tristeza virus in the lightly infested areas was obtained in two studies made in Tulare County, in the San Joaquin Valley. In 1964–65, 4,551 orange trees within ¼ mile of an orchard in which about 2,000 tristeza-virus-infected trees had grown for 4 years were indexed on Mexican lime seedlings; only 40 were infected. Of 3,640 trees indexed that were more than ¼ mile from the infected trees, none was infected. When 1,800 sweet orange trees on sweet orange rootstock surrounding 34 tristeza-virus-infected trees that had been in place for 8 years were indexed in 1968–69, only 2 were found to be infected. As reported elsewhere in these Proceedings (2), the rate of spread is higher where infected trees are more numerous.

The tristeza quarantine regulations are found in California Administrative Code, Section 3407. Five types of areas are defined in the regulations.

Meyer lemon-free districts.—These are eradication areas. In these, growing Meyer lemon trees is prohibited because of the high incidence of tristeza virus in this clone. All tristeza-virus-infected trees are destroyed and only tristeza-free propagating materials may be used. Meyer lemon–free districts include the major citrus areas of Sacramento Valley (Glenn County), San Joaquin Valley (Madera, Fresno, Tulare, Kern counties), and Coachella Valley (Riverside County).

Protected suppressive areas.—These include most of the rest of the state where citrus is grown and tristeza is not prevalent. Tristeza-virus-infected plants, including Meyer lemon, are not eradicated, but only tristeza-free propagating materials may be used.

Infested suppressive areas.—These are those in which tristeza is more prevalent but in which only tristeza-virus-free propagating material may be used. This category includes Ventura County and parts of San Diego and Santa Barbara counties. Citrus budwood, cuttings, and trees may not be moved to any other area except the infested ones.

Infested areas.—These include the heavily infested parts of Los Angeles, Orange, San Bernardino, and western Riverside counties. There is no restriction on use of propagating material. Citrus budwood, cuttings, and trees may not be moved to other areas.

Nonregulated areas.—These include the rest of the state, in which there are no commercial citrus orchards, and there is no restriction on propagating materials.

The Citrus Nursery Stock Registration and Certification Program conducted by the California Depart-

ment of Agriculture Nursery Service (4) is an essential part of the program, because trees in this program are used as the source of tristeza-free propagating materials that are required in the protected areas. In addition to prohibiting the movement of citrus propagating materials from infested areas—and requiring that propagating materials moving into or within suppression and eradication districts be from sources tested and found free of tristeza virus—the program uses visual surveys and statistical indexing to locate tristeza-virus-infected trees in the eradication areas (Meyer lemon–free districts). These trees are removed as soon as possible after verification of infection.

The principal eradication effort is in the San Joaquin Valley. Visual surveys have been conducted annually since 1945. Meyer lemon trees were removed in 1956 and subsequently. All known Satsuma trees were indexed; those found to be infected were removed, as were orange trees found to be infected by tracing sources of infected budwood. In 1961 it was discovered that over 10,000 tristeza-virus-infected orange trees had been propagated from infected budwood and shipped from a nursery in another area into the San Joaquin Valley. The Central California Pest Control Agency (now the Central California Tristeza Control Agency) assumed the responsibility of locating the infected young trees. (This organization is grower controlled and supported by a per acre tax on citrus orchards.) All suspect trees were indexed in Mexican lime seedlings. Infected trees were removed, affected growers being compensated.

The agency continues to participate actively in the eradication program. In 1968, 42,681 trees were indexed in the state–county-agency joint program. Of these, 1,143 were found to be infected and were destroyed. In addition to a program of indexing trees in and around orchards known to have contained infected trees, a program of indexing all citrus orchards in the district is now in progress. A statistical grid sample of budwood from 100 trees is taken from each orchard, giving a confidence level of 95 per cent that infection of 3 per cent of the trees will be detected. When 1 or more infected trees are found, all trees in the orchard are indexed.

The indexing program is supplemented by surveying for visible symptoms. In 1968, 63,023 acres of orange trees were surveyed by persons walking through the orchards, and a similar acreage was aerially surveyed. It is the goal of this program to eradicate tristeza virus from the San Joaquin Valley and to keep the area free from the disease by continued surveillance.

Another important eradication program is in the Coachella Valley. The area contains several large citrus nurseries that supply trees to other parts of California as well as other countries. In 1965, a random sample of 5,000 trees of all varieties was indexed. A few Algerian (Clementine) tangerine trees were found

to be infected with the tristeza virus.

A state-county-industry program was established, with industry contributing through the Coachella Valley Citrus Nurserymen's Association. The program, now nearly completed, required sampling all Algerian tangerine orchards not originating from sources known to be free of tristeza virus. In 1968, 7,503 trees were indexed and 58 were found to be infected. All known infected trees are destroyed when identified.

When all the Algerian trees have been indexed, the orange orchards in the valley will be sampled statistically, and dooryard trees of miscellaneous varieties will be indexed. There is little or no natural spread of tristeza virus in the Coachella Valley, so the nurseries are protected by the eradication program.

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