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The Texas Citrus Budwood Certification Program

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ABSTRACT. The high incidence of psorosis disease prompted the Texas citrus industry to initiate a voluntary virus-free program in 1948, but by the 1960s it was no longer operating. A similar program in the 1980s was short-lived, but the discovery of *Citrus tristeza virus* in nursery trees in 1992, the continued dominance of sour orange rootstock, and the presence of viroids and viruses which affect alternative rootstocks were catalysts for a mandatory virus-free budwood program. Selected trees of the commercially important varieties of grapefruit and sweet orange were indexed for several viruses and viroids, subjected to shoot tip grafting and re-indexed. These plants provided the start of a foundation block of trees to which other varieties imported from the California Citrus Clonal Protection Program have been added. There are now over 80 varieties in the foundation block and nearly 280,000 buds have been supplied to nurseries since 1998. Since there is no current expansion or replanting of commercial citrus in the Rio Grande Valley of south Texas, a growing proportion of budwood is for the homeowner market, especially in east Texas.

A survey for citrus psorosis in Texas by Fawcett (4) in the 1940s showed that the disease was widespread, with an incidence of up to 80% in some grapefruit orchards. A plan for a psorosis-free budwood certification program, based on the California program, was then drawn by the Rio Grande Valley Nurserymen's Association, the Texas Nursery Inspection Service, the Texas Department of Agriculture, and the Texas Agricultural Experiment Station (14). Trees were biologically tested for psorosis and those determined to be free of the disease were certified. The program was voluntary, but even so, nearly 600 trees were certified. By 1959 these budwood sources produced 1.6 million trees, or 23% of the total, although only 200,000 were tagged and sold as registered trees. By the early 1960s, over 90% of new citrus trees were from psorosis-free sources. In addition to this program, three severe freezes also helped reduce the number of infected trees (2). Unfortunately, the program gradually became ineffective and was abandoned.

Biological indexing during the 1950s also showed that the agents causing exocortis, cachexia and tristeza were present in Texas (7, 8, 9). The widespread use of sour orange rootstock meant that the first two diseases were not apparent in the orchards and tristeza was limited in extent and with no observed symptoms of decline. *Citrus tristeza virus* (CTV) was later confirmed in dooryard trees, but not in commercial groves (3). Because infected dooryard trees could pose a threat to the industry, another program to produce pathogen free planting material was started in the 1980s (2). This program was also voluntary and although budwood source selections were made, and some shoot tip grafting was attempted, the program did not release any material.

The discovery of CTV in nursery material in 1992 (10) prompted the industry to support a mandatory virus-free program. Additional findings during the 1990s also illustrated the need for such a program. A statewide CTV survey showed a 1% incidence of CTV in the Lower Rio Grande Valley, but an 18% incidence in east Texas (15). There was a high level of viroid infections (6) and citrus tatterleaf virus (CTLV) was detected in several citrus vari-

TABLE 1
SALE AND DISTRIBUTION OF CITRUS BUDWOOD CUTTINGS FROM TEXAS BUDWOOD PROGRAM 1998-2004

Variety		Total buds/cuttings sold
Grapefruits		
	Rio Red	49,180
	Henderson	2,125
	Other varieties (4)	640
Sweet Oranges		
	N-33 navel	23,725
	Everhard navel	10,370
	Other navels (10)	9,540
	Standard Valencia	24,500
	Other Valencias (5)	6,100
	Marrs	13,270
	Pineapple	3,040
	Blood Oranges (7)	7,370
	Other varieties (10)	1,870
Mandarins and hybrids		
	Satsumas (6)	24,925
	Other mandarins	17,845
	Minneola tangelo	3,615
	Tangors (5)	890
Lemons and Limes		
	Meyer lemon	26,325
	Mexican lime	22,885
	Other lemons (2)	1,690
	Other limes (4)	3,685
Other citrus		
	Pummelos (3)	3,585
	Kumquat (2)	5,550
	Calamondin	365
	Others (5)	18,970
	Total	282,060

eties (5), and its apparent spread to neighboring trees also prompted concern (1). With the threat from CTV, future plantings will have to be on alternatives to sour orange rootstock. However, those with trifoliate parentage are sensitive to exocortis and CTLV. Moreover, trifoliate orange rootstocks are not well-suited for the soil conditions of south Texas.

Locally selected budwood sources of the commercially important Rio Red and Star Ruby grapefruits and navel, Marrs and Valencia sweet orange varieties were subjected to biological indexing for CTV, viroids, *Citrus psorosis virus* (CPsV), concave gum and CTLV. Serological testing by enzyme-linked immunosorbent assay (ELISA) for CTV was conducted, followed by shoot-tip grafting of budwood sources (12). The resulting plants were again indexed, and then planted out in a foundation block (FB). Budwood from these trees now is used to produce increase block (IB) trees that supply budwood to nurseries. All trees in the FB and IB are tested for CTV by ELISA annually and testing for other pathogens occurs every 4-5 yr. The program is enforced now by Texas state law (13). In addition to the production of virus-free varieties locally, other virus-free varieties are imported from the University of California Riverside's Citrus Clonal Protection Program

(CCPP), or from the Florida Department of Consumer Services' Bureau of Citrus Budwood Registration.

Fruit characters of the commercial varieties in the FB are evaluated annually, and when sufficient budwood from true-to-type trees is available, the state mandated requirements will come into force. This is expected to occur in 2006, but beginning in 2004 all citrus trees produced for sale in Texas have to be tagged as "Produced in Texas", with an accompanying reference number. The program has been widely publicized, and the first budwood was sold in 1998. The variety collection now has over 80 accessions and since 1998, approximately 282,000 buds have been sold (Table 1). The numbers of buds cut from different varieties over the past 6 yr are shown in Table 1. A significant proportion of these trees are propagated for planting in east Texas. This could help reduce the high incidence of CTV in that area, but the probable arrival of the brown citrus aphid, *Toxoptera citricida*, into Texas in the near future could increase CTV incidence.

There is currently no new major plantings of commercial citrus in Texas, but there is an expanding homeowner market. The varieties sold to this market include the major commercial varieties, but also include lemons, limes, kumquats, satsumas and other mandarins.

South Texas has on several occasions in the past experienced tree-killing freezes (11). The FB trees are protected by a system of micro sprinklers which would be activated in the event of a freeze. In addition, frame structures are being constructed over the IB trees which in winter are covered with plastic to trap heat. During summer, shade cloth reduces heat stress on the young trees, allowing them to grow faster. They could also be used in the future to protect trees from viruliferous aphids by covering them with insect screen.

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