Florida Citrus Production Trends 2003-04 Through 2012-13

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Executive Summary

- The *2002 Commercial Citrus Inventory* indicates that Florida's orange tree population decreased to 85.8 million, down 1.7% from the 2000 level, while the grapefruit tree population decreased to 11.3 million, down 25.1% from the record level in 1996. Florida citrus tree densities are continuing to trend upward, with the average number of orange trees per acre increasing from 93 in 1986 to 132 in 2002, and the average number of grapefruit trees per acre increasing from 82 to 107 over the same period.

- The production estimates in this report are for potential production, as opposed to utilized production. The potential production estimates assume no fruit abandonment.

- Potential production in upcoming years was estimated by applying average historical yields per acre to projected acres, by age.

- The citrus tristeza virus and the brown citrus aphid, which is an efficient vector in spreading this disease, are present in Florida. This situation may result in a sharp increase in tree losses in upcoming years. Trees on sour orange rootstock are vulnerable to tristeza, and, in upcoming years, tristeza may kill most of the trees on this rootstock. An estimated 14% of Florida's orange trees and 42% of the grapefruit trees were on sour orange rootstock in 1999-00.

- Potential production estimates for oranges, grapefruit and specialty are summarized below.

Item/ Season	Planting Assumption	Assumed Tree Losses To Tristeza			
		No Losses	Losses Phased in Over Next 6 Years	Losses Phased in Over Next 10 Years	Losses Phased in Over Next 14 Years
		million boxes			
Oranges					
2003-04		240	220	224	227
2006-07	Average	252	225	226	227
2012-13		266	245	245	245
Grapefruit					
2003-04		48	38	42	44
2006-07	Replacement	47	34	33	35
2012-13		46	45	44	43
Specialty			(Repl.)	(Avg.)	
2003-04	Replacement Average	–	9.7	9.7	–
2006-07		–	9.7	9.4	–
2012-13		–	10.3	9.0	–

- At its height, tristeza could reduce orange production by roughly 25 to 27 million boxes. Based on a six-year phase-in of tristeza, potential orange production is projected to be relatively flat at around 220 million boxes in the next several seasons, and then increase to 225 million boxes in 2006-07 and 245 million boxes in 2012-13.

- Likewise, at its height tristeza could reduce grapefruit production by roughly 14 million boxes. Based on a ten-year phase-in of tristeza, potential grapefruit production would decrease from 42 million boxes in 2003-04 to 33 million boxes in 2006-07, and then increase to 44 million boxes in 2012-13.

- Potential specialty citrus production is projected to be relatively flat at 9 to 10 million boxes over the next ten years.

- The production projections are based on average yields during the last decade and variation from these averages could be relatively large. For example, if 1998-99 yields are used to project 2003-04 orange production, an estimate of 176 million boxes is obtained, while if 1999-00 yields are used, an estimate of 246 million boxes is obtained (a range of 70 million boxes).

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Florida Citrus Production Trends 2003-04 Through 2012-13*

Introduction

This report presents production estimates for Florida round oranges, grapefruit and specialty citrus for the 2003-04 through 2012-13 seasons. The estimates are based on the Florida Agricultural Statistics Service (FASS) biennial commercial citrus inventory for 2002. The biennial inventory reports numbers of trees and acres by age for different varieties of citrus. These data are combined with FASS yield data on boxes of fruit per tree by age to estimate yields per acre, and future production is estimated by applying these estimated yields to projected acreage, by age.[1]

The production estimates in this report are estimates of potential production, as opposed to utilized production reported by FASS. Potential production is the fruit that could be utilized assuming favorable citrus prices, while utilized production is the amount of fruit actually entering certified fresh and processing channels, as well as noncertified channels. Some fruit may be abandoned rather than utilized when grower prices are below harvest and post-harvest costs.[2]

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[1] This method has been referred to as the acre method in past reports. Another method to project production is the tree method which applies average boxes of fruit per tree to projected trees, by age. The acre method was selected over the tree method because recently observed yields per acre, used in projecting production, were expected to more accurately reflect potential future yields than recently observed yields per tree. Increasing tree densities may negatively impact tree yields in upcoming years, making estimation of these yields and tree-based production projections problematic. Yields per acre were assumed to more fully reflect the impact of increasing tree densities. High tree densities have occurred in some of the younger age categories, and the observed acre yields for these age categories reflect the change in this factor. Older-age-category acre yields are assumed to be constrained by limited space and availability of sunshine, water and nutrients in the soil; historical yields are assumed to reflect these yields.

[2] FASS reported abandonment of 3 million, 6 million, 6 million and 2 million boxes of grapefruit in 1995-96, 1996-97, 1997-98 and 2000-01, respectively.

Overview of the 2002 Commercial Citrus Inventory

The *2002 Commercial Citrus Inventory* shows Florida's total citrus acreage declined from 832.3 thousand acres in 2000 to 797.3 thousand acres in 2002, a 4.2% decrease, due in part to diseases such as tristeza, citrus canker and the citrus root weevil (Table 1). Similarly, the number of citrus trees decreased by 3.3% from 106.7 million in 2000 to 103.2 million in 2002. The trend toward denser plantings continued with the average trees per acre at 129.4 in 2002. Since 1996, the number of citrus acres and trees have declined by 7.0% and 3.6%, respectively. Acreage and tree inventory data for individual varieties of citrus—round oranges, grapefruit and specialty citrus—are shown in Tables 2, 3 and 4, respectively.

The FASS commercial citrus inventory indicates that the population of bearing and nonbearing round-orange trees decreased to 85.8 million in 2002, down 1.7% from the previous inventory. As indicated in Table 5, the orange tree population continues to mature, with 72.6% of the round-orange trees being greater than eight years old in 2002.

The total number of bearing and nonbearing grapefruit trees decreased 10.6% from 12.7 million in 2000 to 11.3 million in 2002. The grapefruit tree population has decreased by 25.1% since its high point of 15.1 million in 1996, reflecting disease problems and low returns grapefruit growers have experienced. The grapefruit tree population also continues to age with 81.5% of the trees being greater than eight years old in 2002, versus 47.1% in 1996 (Table 6). The age distribution for grapefruit trees by variety and by Indian River versus Interior regions is shown in Table 7.

The 2002 inventory indicates that the number of specialty citrus (Temples, tangelos and tangerines) acres and trees decreased by 12.2% and 11.0%, respectively, over the last two years. This is the third

census in a row that specialty acreage and tree levels have declined. Like oranges and grapefruit, the specialty tree population has matured with 70.4% of the trees being greater than eight years old in 2002 (Table 8).

Methodology

The production estimates discussed in this report are based on projecting the acreage in 25 tree-age categories in the upcoming ten seasons. Separate projections were made for early and midseason oranges, late oranges, white seedless grapefruit,[3] red and pink seedless grapefruit, Temples, tangelos and tangerines.

The Florida production projections for oranges and grapefruit were based on projections for four regions to take into account variation across regions in potential acreage loss and planting rates, as well as yields. In particular, acreage losses due to the citrus tristeza virus are expected to vary by region. The four regions used in modeling production were the South, West, Indian River, and the North & Central.[4] These regions are roughly the same as those for which FASS reports yields per tree.

Planting Assumptions

The projections are dependent on assumed future acreage-planting rates. Average planting levels based on the 2000 and 2002 commercial citrus inventories are shown in Table 9. Orange and grapefruit

[3] A small amount of seedy grapefruit is included with white seedless grapefruit.

[4] The regions included the following counties—South: Charlotte, Collier, Glades, Hendry, Lee and Okeechobee; West: DeSoto, Hardee, Hillsborough, Manatee, and Sarasota; Indian River: Indian River, St. Lucie, Martin, Palm Beach, Brevard, Volusia, and Flagler (parts of some counties are not included, as defined by FASS); North & Central: all other counties.

planting levels have been relatively flat, while specialty planting levels are down (the trends in orange and grapefruit planting levels are reflected by the percentages of trees that are less than two years old in Tables 5 and 6). Over the projection period, several planting assumptions are considered—recent season-average levels, twice and half-the-average levels, and replacement levels.[5] For the replacement planting assumption, acreage planting levels in the upcoming years are assumed to equal corresponding losses.

Tree/Acre Loss Assumptions

The citrus tristeza virus and the brown citrus aphid, which is an efficient vector in spreading this disease, are present in Florida. This situation has contributed to the recent acreage and tree losses and is expected to continue to result in above normal acreage and tree attrition rates in upcoming years. Trees on sour orange rootstock are vulnerable to tristeza, and, in upcoming years, tristeza has the potential to kill most of the trees on this rootstock. Based on data from the Bureau of Citrus Budwood Registration and a survey of grapefruit in the Indian River Region,[6] an estimated 14% of the orange trees or about 12 million trees, and an estimated 42% of the grapefruit trees or about 5.3 million trees were on sour orange rootstock in 1999-00. Most of the trees on sour orange rootstock were planted in the 1980's and earlier, so that the surviving trees on this rootstock are in the most productive stage of their lives, and loss of these trees to tristeza would be expected to have a significant impact on total production. Although data on the incidence of tristeza are not available for 2002, production projections in this report are based on the

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[5] Planting levels are dependent on market conditions that are difficult to predict—expected citrus prices and grower returns in upcoming years, which depend on future supplies and demands for Florida and competitive citrus products; hence, the consideration of alternative planting scenarios to roughly account for different future market conditions.

[6] The survey was conducted by Ed Stover, assistant professor, Indian River Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida.

guesstimates[7] that from 1999 to 2002, 4.1 million orange trees and 1.5 million grapefruit tree were lost to tristeza, leaving 7.9 million orange trees and 3.8 million grapefruit tree for phasing out.

Three scenarios were assumed in losing acreage to tristeza—nearly all acreage with trees on sour orange rootstock are lost during (1) the next six years, (2) the next ten years, and (3) the next fourteen years.[8] The initial incidence of tristeza was assumed to be highest in the South and West, followed by those in the Indian River and the North & Central regions.

Other factors in addition to tristeza are also expected to result in acreage losses. Non-tristeza, acreage-loss rates were assumed based on loss rates implied by the commercial tree censuses (Table 10). The non-tristeza, loss rates used in projecting production are assumed to follow those loss rates occurring in the mid 1990's, prior to the occurrence of relatively large tristeza losses. The historical acreage-loss rates tend to increase with the age of the trees on the acreage, and this tendency is assumed to continue over the projection period, i.e., the orange and grapefruit projections are based on non-tristeza acreage-loss rates which increase with age.

For oranges and grapefruit, the assumed loss rates vary by region. For the specialty citrus production projections, which were made at the State level, the loss rates were assumed to be flat across the age of the acreage. Over the projection period, the specialty citrus loss rates were initially set at relatively high levels consistent with recent losses and then were phased down to normal levels occurring in the 1990's.

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[7] The guesstimates were based on comparing recent high loss rates to lower normal historical attrition rates.

[8] A logistic function was used to model the loss rate for trees on sour orange rootstock. This function allows the loss rate for this rootstock to increase relatively quickly in the first years when tristeza is spreading; then the loss rate levels off as the disease spreads to most of the trees on the rootstock.

Yield Assumptions: Projection Methodologies Based on Trees Versus Acres

Production estimates were made for each of the four regions defined above, and State estimates were obtained by summing the region estimates. For each region, the production estimates were made by multiplying the projected number of acres in each specific age category by the yield or number of boxes per acre for that age category and summing the results across age categories. Average yields per acre by age were used in making these estimates. The averages were based on yield data reported by FASS for 1993-94 through 2001-02 (Tables 11 and 12). The FASS reports tree yields, as opposed to acre yields. The acre yields used in this report were obtained by multiplying the tree yields (boxes per tree) by the tree densities (trees per acre), by age.

In this study, yields per acre were assumed to more fully reflect the impact of increasing tree densities than yields per tree. The estimated acre yields for the younger age categories capture, to an extent, the impact of increasing tree densities, as these age categories have experienced increasing densities over the years underlying the estimates. Older-age-category acre yields are assumed to be constrained by the limited space in which trees must compete for sunshine, water and nutrients in the soil. Historical acre yields for the older age categories are assumed to reflect the yield potential for these age categories in upcoming years.

It should also be noted that abandonment of grapefruit in 1995-96, 1996-97, 1997-98 and 2000-01 negatively impacted grapefruit boxes of fruit per tree reported by FASS for those seasons. For each age category, FASS boxes of fruit per tree were calculated as that age category's utilized production divided by the number of trees in that age category, including trees that yielded abandoned fruit. Hence, estimates of grapefruit production based on mean FASS yields for recent years may understate potential

production. To correct for this problem, reported grapefruit yields for the four seasons when abandonment occurred were adjusted upward by multiplying the reported yields times the ratio of potential production (utilized production plus reported abandonment by FASS) to utilized production. Separate adjustments were made for white and colored seedless grapefruit yields.

Round-Orange and Grapefruit Production Estimates

Potential production estimates for oranges and grapefruit were made based on a number of different loss and planting assumptions, with an emphasis on the potential impact of tristeza. Table 13 shows estimates of potential orange production for four tristeza assumptions—(1) no losses due to tristeza occur, (2) tristeza kills virtually all trees on sour orange rootstock over the next six years, (3) tristeza kills virtually all trees on sour orange rootstock over the next ten years, and (4) tristeza kills virtually all trees on sour orange rootstock over the next fourteen years.[9]

Assuming tristeza is phased in over the next six years, potential orange production is estimated to be flat at around 219 to 221 million boxes from 2003-04 to 2005-06; afterwards, production would increase reaching 245 million boxes in 2012-13, assuming average planting levels (Table 13). Comparing this projection to the projection assuming no tristeza, indicates that tristeza could reduce potential orange production by 20 to 27 million boxes. If tristeza is phased in over the next ten (fourteen) years, the low point in orange production is estimated to occur in 2004-05 and 2005-06 at 223 (225) million boxes. The production projections for the six-, ten- and fourteen-year tristeza phase-in assumptions are relatively

[9] These assumptions are a continuation of the tristeza phase-in assumptions made in our last report —Economic and Market Research Department, Florida Department of Citrus, "Florida Citrus Production Trends, 2001-02 Through 2010-11," January, 2000. As in the last report, we focus on the six-year phase-in assumption for oranges and the ten-year phase-in assumption for grapefruit, although data on the exact spread of tristeza across Florida are not available.

similar because each scenario begins with a relatively high incidence of tristeza based on estimates of recent occurrences of this disease.

Confidence intervals for these estimates indicate potentially large variation in production. For example, the 95% confidence interval for the orange production estimates under the six-year tristeza phase-in assumption ranged from ±21% to ±22% of the reported projections, based on yield variation alone. If 1998-99 yields are used to project 2003-04 orange production, an estimate of 176 million boxes is obtained, while if 1999-00 yields are used an estimate of 246 million boxes results.

Potential grapefruit production is estimated to decrease from 42 million boxes in 2003-04 to 33 million boxes in 2006-07; afterwards, production would increase reaching 44 million boxes in 2012-13, assuming tristeza is phased in over the next ten years and replacement planting levels occur (Table 14). Comparing this projection to the projection assuming no tristeza, indicates that from 2003-04 to 2006-07 tristeza could reduce potential grapefruit production by 6 million boxes to 14 million boxes; thereafter the difference closes. If tristeza is phased in over the next six (fourteen) years, the low point in grapefruit production is estimated to occur in 2005-06 (2006-07 and 2007-08) at 31 (35) million boxes.

The 95% confidence interval for the grapefruit production estimates under the ten-year tristeza phase-in assumption ranged from ±13% to ±16% of the reported projections, based on yield variation alone.

Sensitivity of the orange and grapefruit production projections to planting assumptions is shown in Table 15. This analysis is based on the assumptions that tristeza is phased in over the next six years for oranges and the next ten years for grapefruit. For oranges, replacement planting levels are not greatly different from average planting levels, and the production estimates for these two planting assumptions are somewhat similar. If the average planting level were doubled (cut in half), the production estimate in

2012-13 increases (decreases) by 40 (20) million boxes. In contrast to the orange situation, the average and twice-the-average planting levels for grapefruit are much lower than the replacement levels, so that unless growers plant more than they have in recent years, grapefruit production could decline by even more than previously noted (Tables 14).

Orange and Grapefruit Production Estimates by Variety

Oranges

Based on tristeza losses being phased in over the next six years, potential early and midseason orange production is projected to be relatively flat at 121 to 122 million boxes from 2003-04 through 2005-06, and then increase to 128 million boxes in 2012-13 (Table 16). Potential late-orange production is projected to increase from 98 million boxes to 117 million boxes over the ten-year projection period. In 2003-04, early and midseason oranges and late oranges are estimated to account for 55% and 45% of round-orange production, respectively; by 2012-13, these shares are estimated to change to 52% for early and midseason oranges and 48% for late oranges.

Grapefruit

Based on tristeza losses being phased in over the next ten years and replacement planting levels, potential white seedless grapefruit production is projected to decrease from 17 million boxes in 2003-04 to 12 million boxes in 2006-07, and then increase to 18 million boxes in 2012-13 (Table 16). Potential red seedless grapefruit production is projected to decrease from 25 million boxes in 2003-04 to 21 million boxes per year from 2005-06 through 2007-08, and then increase to 26 million boxes in 2012-13.

Grapefruit production projections for the Indian River versus Interior regions are provided in Table 17. Indian River grapefruit production is projected to decline greater than Interior production over the next five years, based on our estimates of trees on sour orange rootstock by region.

Specialty Citrus Production Estimates

Specialty citrus production was projected using estimated equations which relate historical production to acres, by age. Potential specialty citrus production is estimated to be relatively flat at 9 to 10 million boxes over the ten-year projection period. Production would increase (decrease) slightly assuming replacement (average) planting levels (Table 18).

Potential tangerine production is estimated to increase slightly from 6.0 to 6.5 million boxes over the next ten years, assuming replacement planting levels; production is estimated to decrease slightly from 6.0 to 5.6 million boxes over this period if the average planting level were to occur. Temple production over the projection period is estimated to decrease slightly from 1.4 million boxes to 1.1 or 1.3 million boxes depending on planting assumption, while tangelo production is estimated to be relatively flat at 2.3 to 2.5 million boxes.

Concluding Comments

In our last analysis in 2000, the assumed tree losses due to tristeza were consistent with subsequent actual tree losses based on the *2002 Commercial Citrus Inventory*. Hence, the scenarios in the present study are a continuation of those made in 2000. These scenarios continue to suggest that in upcoming years, tristeza could have a significant impact on Florida citrus production. The results of this study indicate potential orange production could be relatively flat at around 220 million boxes in the next several years,

assuming average yields and tristeza is phased in over the next six years. Potential grapefruit production could decrease from 42 million boxes in 2003-04 to 33 million boxes in 2006-07, assuming tristeza is phased in over ten years. The extent that orange and grapefruit production might decline depends on the rate at which tristeza spreads—if tristeza spreads slower the decreases in production will be smaller and occur further out in time. Potential specialty production is estimated to be relatively flat at 9 to 10 million boxes.

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TABLES

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Table 1. Florida citrus acreage and tree numbers by commercial inventory.

Year of Inventory	Number of Acres	Percent Change from Previous Acre Inventory	Number of Trees	Percent Change from Previous Tree Inventory	Tree Density
	- thousand -	- % -	- million -	- % -	- trees/acre -
1966	858.1	--	66.4	--	77.4
1968	931.2	8.5	74.4	12.0	79.9
1970	941.5	1.1	76.7	3.1	81.5
1972	878.0	-6.7	72.1	-6.0	82.1
1974	864.1	-1.6	71.3	-1.1	82.5
1976	852.4	-1.4	70.5	-1.1	82.7
1978	831.2	-2.5	69.1	-2.0	83.1
1980	845.3	1.7	70.7	2.3	83.6
1982	847.9	8.5	71.6	1.3	84.4
1984	761.4	-10.2	66.0	-7.8	86.7
1986	624.5	-18.0	57.5	-12.9	92.1
1988	697.9	11.8	69.3	20.5	99.3
1990	732.8	5.0	78.9	13.9	107.7
1992	791.3	8.0	92.0	16.6	116.3
1994	853.7	7.9	103.7	12.7	121.5
1996	857.7	.5	107.1	3.2	124.9
1998	845.3	-1.4	107.1	NC	126.7
2000	832.3	-1.5	106.7	-.4	128.2
2002	797.3	-4.2	103.2	-3.3	129.4

SOURCE: Florida Agricultural Statistics Service, *Commercial Citrus Inventory*, various issues.

Table 2. Florida round-orange acreage and tree numbers by commercial inventory.

Year of Inventory	Number of Acres	Percent Change from Previous Acre Inventory	Number of Trees	Percent Change from Previous Tree Inventory	Tree Density
	- thousand -	- % -	- million -	- % -	- trees/acre -
1966	695.8	--	53.8	--	77.3
1968	713.4	2.5	56.6	5.2	79.3
1970	715.8	.3	57.8	2.1	80.7
1972	659.4	-7.9	53.7	-7.0	81.4
1974	642.4	-2.6	52.5	-2.3	81.7
1976	628.6	-2.1	51.6	-1.8	82.1
1978	616.0	-2.0	50.8	-1.5	82.5
1980	627.2	1.8	52.0	2.2	82.9
1982	636.9	1.5	53.5	2.9	84.0
1984	574.0	-9.9	49.9	-6.8	86.9
1986	466.3	-18.8	43.5	-12.9	93.3
1988	536.7	15.1	54.5	25.5	101.5
1990	564.8	5.2	62.6	14.9	110.8
1992	608.6	7.8	72.8	16.3	119.6
1994	653.4	7.4	81.6	12.1	124.9
1996	656.6	.5	84.2	3.1	128.2
1998	658.4	.3	85.4	1.5	129.8
2000	665.5	1.1	87.2	2.1	131.0
2002	648.8	-2.5	85.8	-1.7	132.2

SOURCE: Florida Agricultural Statistics Service, *Commercial Citrus Inventory*, various issues.

Table 3. Florida grapefruit acreage and tree numbers by commercial inventory.

Year of Inventory	Number of Acres	Percent Change from Previous Acre Inventory	Number of Trees	Percent Change from Previous Tree Inventory	Tree Density
	- thousand -	- % -	- million -	- % -	- trees/acre -
1966	103.2	--	7.10	--	68.8
1968	119.9	16.2	8.50	19.7	70.9
1970	124.1	3.5	8.92	4.9	71.9
1972	124.1	NC	9.01	.9	72.6
1974	130.3	5.0	9.65	7.0	74.1
1976	137.9	5.8	10.40	7.8	75.4
1978	136.3	-1.2	10.41	1.3	76.4
1980	139.9	2.6	10.77	3.4	77.0
1982	139.9	NC	10.83	.6	77.4
1984	134.7	-3.7	10.58	-2.3	78.5
1986	117.8	-12.5	9.62	-9.1	81.7
1988	119.6	1.5	10.08	4.7	84.3
1990	125.3	4.8	11.19	11.0	89.3
1992	135.2	7.9	13.12	17.2	97.0
1994	146.9	8.7	15.00	14.3	102.1
1996	144.4	-1.7	15.12	.8	104.7
1998	132.8	-8.0	14.08	-6.9	106.0
1999	121.3	-8.7	12.96	-7.9	106.9
2000	118.1	-2.6	12.67	-2.3	107.2
2002	105.5	-10.7	11.33	-10.6	107.4

SOURCE: Florida Agricultural Statistics Service, *Commercial Citrus Inventory*, various issues.

Table 4. Florida specialty citrus[a] acreage and tree numbers by commercial inventory.

Year of Inventory	Number of Acres	Percent Change from Previous Acre Inventory	Number of Trees	Percent Change from Previous Tree Inventory	Tree Density
	- acres -	- % -	- million -	- % -	- trees/acre -
1970	82,767	--	7.6	--	91.48
1972	77,042	-6.9	7.1	-5.8	92.60
1974	74,446	-3.4	7.0	-2.1	93.84
1976	67,485	-9.4	6.2	-10.9	92.24
1978	62,723	-7.1	5.8	-7.1	92.23
1980	60,360	-3.8	5.6	-3.9	92.07
1982	55,163	-8.6	5.1	-8.8	91.88
1984	34,619	-37.2	3.2	-37.7	91.17
1986	30,155	-12.9	2.9	-7.7	96.60
1988	30,284	.4	3.0	4.1	100.09
1990	33,347	10.1	3.7	21.1	110.04
1992	37,507	12.5	4.6	24.0	121.36
1994	45,768	22.0	5.9	30.4	129.69
1996	50,950	11.3	7.0	17.1	136.40
1998	48,556	-4.7	6.7	-3.1	138.70
2000	45,355	-6.6	6.3	-6.4	139.00
2002	39,844	-12.2	5.6	-11.0	140.80

[a]Temples, tangelos and tangerines; fallglo tangerines not included prior to 1996.

SOURCE: Florida Agricultural Statistics Service, *Commercial Citrus Inventory*, various issues.

Table 5. Age distribution of Florida round-orange trees by year of inventory.

Year of Inventory	Tree Age						Total Trees	Bearing Trees
	≤2	3-5	6-8	9-13	14-23	≥24		
	- % -						- - - - thousand - - - -	
1970	9.1	20.6	17.6	14.8	13.4	24.4	57,801.5	49,404.2
1972	5.5	11.1	20.2	22.0	14.1	27.0	53,731.1	49,786.5
1974	4.0	5.9	16.9	27.8	16.9	28.4	52,521.7	49,466.9
1976	4.0	4.8	7.5	29.7	24.1	29.8	51,595.3	48,373.8
1978	5.2	4.5	4.7	23.4	31.5	30.6	50,843.2	47,454.5
1980	7.2	4.7	3.8	13.0	39.1	32.2	51,977.8	47,366.3
1982	12.0	5.1	3.7	7.2	40.2	31.8	53,504.7	46,078.5
1984	17.5	7.1	4.5	5.8	35.2	29.9	49,884.7	39,777.7
1986	20.0	12.4	6.1	7.1	28.7	25.7	43,461.4	32,708.0
1988	30.7	13.9	7.8	5.7	17.7	24.1	54,536.6	35,537.3
1990	35.1	14.3	10.7	6.7	10.0	23.3	62,613.4	40,666.0
1992	31.9	23.4	9.9	8.4	6.7	19.7	72,826.3	49,577.1
1994	24.4	24.6	16.7	11.0	6.5	16.9	81,614.4	61,707.7
1996	10.5	26.9	24.0	14.7	8.2	15.7	84,155.4	75,286.6
1998	8.0	15.5	26.7	23.0	11.5	15.3	85,430.6	78,586.5
2000	9.7	7.2	21.4	33.7	13.6	14.4	87,200.1	78,721.0
2002	9.5	8.6	9.3	37.0	22.5	13.1	85,751.1	77,595.9

SOURCE: Florida Agricultural Statistics Service, *Commercial Citrus Inventory*, various issues.

Table 6. Age distribution of Florida grapefruit trees by year of inventory.

Year of Inventory	Tree Age						Total Trees	Bearing Trees
	≤2	3-5	6-8	9-13	14-23	≥24		
	- % -						- - - - - thousand - - - - -	
1970	15.1	21.7	4.2	3.9	14.1	41.1	8,925.4	6,746.5
1972	6.9	21.9	14.0	5.5	10.6	41.1	9,012.7	8,032.1
1974	11.5	8.2	25.1	7.6	8.1	39.4	9,647.2	8,362.6
1976	13.9	7.9	13.3	20.8	6.8	37.2	10,398.1	8,598.9
1978	8.5	13.8	6.8	28.9	7.1	34.9	10,412.5	8,969.7
1980	8.9	10.5	10.7	21.6	15.8	32.5	10,768.7	9,586.2
1982	7.5	7.4	12.8	12.6	29.1	30.6	10,833.2	9,753.9
1984	11.4	6.7	7.5	15.7	32.1	26.7	10,582.9	9,192.8
1986	9.7	7.8	7.9	17.0	35.7	22.0	9,624.0	8,367.7
1988	11.0	9.7	6.5	13.8	38.3	20.7	10,081.2	8,654.7
1990	21.8	6.2	8.0	9.1	31.4	23.5	11,193.2	8,748.5
1992	27.2	14.0	5.5	8.6	19.1	25.6	13,119.2	9,556.9
1994	23.3	21.3	7.6	8.3	16.0	23.5	15,004.0	11,514.1
1996	9.8	25.3	17.8	8.2	15.3	23.6	15,116.9	13,632.8
1998	4.3	16.7	24.6	13.8	14.8	25.8	14,079.1	13,469.6
2000	3.7	6.2	22.7	27.2	13.6	26.7	12,668.6	12,204.1
2002	4.1	4.7	9.7	38.3	16.7	26.5	11,329.2	10,869.7

SOURCE: Florida Agricultural Statistics Service, *Commercial Citrus Inventory*, various issues.

Table 7. Age distribution of Florida grapefruit trees by marketing district and variety, 2002 inventory.

District/Variety	Tree Age						Total Trees
	≤2	3-5	6-8	9-13	14-23	≥24	
	- - - - - - - - - - - - - - - - - - - %[a] - - - - - - - - - - - - - - - - -						- thousand -
Indian River							
White Seedless[b]	5.1	7.7	9.9	32.5	4.9	39.8	3,095
Red & Pink Seedless	4.1	3.6	9.5	33.2	27.0	22.5	4,927
TOTAL	**4.5**	**5.2**	**9.7**	**33.0**	**18.5**	**29.2**	**8,022**
Interior							
White Seedless[b]	1.7	2.9	9.7	35.1	10.9	39.7	1,225
Red & Pink Seedless	3.7	3.6	10.1	60.8	13.6	8.1	2,082
TOTAL	**3.0**	**3.3**	**10.0**	**51.3**	**12.6**	**19.8**	**3,307**

[a]Percentages may not total 100 due to rounding.

[b]Includes seedy grapefruit.

SOURCE: Florida Agricultural Statistics Service, *2002 Commercial Citrus Inventory*.

Table 8. Age distribution of Florida specialty citrus trees by variety, 2002 inventory.

Variety	Tree Age						Total Trees
	≤2	3-5	6-8	9-13	14-23	≥24	
	- % -						- thousand -
Temples	3.0	8.2	11.8	14.2	10.8	52.0	568.9
Tangelos	2.4	6.6	9.5	43.8	15.5	22.1	1,240.8
Tangerines	4.3	8.1	21.9	49.8	11.0	4.9	3,801.6
TOTAL	**3.7**	**7.8**	**18.1**	**44.9**	**12.0**	**13.5**	**5,611.3**

SOURCE: Florida Agricultural Statistics Service, *2002 Commercial Citrus Inventory*.

Table 9. Average annual citrus plantings, by variety, 1997 through 2001.

Variety[a]	2000 Inventory[b]		2002 Inventory[b]	
	Trees	Acres	Trees	Acres
	- thousand -	- acres -	- thousand -	- acres -
Oranges				
Early & Midseason	1,044	7,846	1,195	9,029
Late	1,771	13,194	1,518	11,578
TOTAL	**2,815**	**21,040**	**2,713**	**20,607**
Grapefruit				
Indian River				
White Seedless[c]	56	525	53	496
Red & Pink Seedless	52	464	68	579
Interior				
White Seedless[c]	8	86	7	78
Red & Pink Seedless	39	276	26	231
TOTAL	**155**	**1,351**	**154**	**1,384**
Specialty				
Temples	16	111	6	45
Tangelos	17	136	10	79
Tangerines	84	565	55	372
TOTAL	**110**	**757**	**71**	**496**

[a]Orange trees and acres listed as "unidentified" by the FASS were allocated between early and midseason oranges, late orange, Temples and tangelos in the same proportions as the identified proportions in calculating the averages. Grapefruit trees and acres listed as "unidentified" by the FASS were allocated between grapefruit varieties in the same proportions as the identified proportions in calculating the averages.

[b] Calculated as bearing trees or acres divided by 3 (years set for 2000: 1997, 1998 and 1999; years set for 2002: 1999, 2000 and 2001).

[c] Includes seedy.

Table 10. Historical citrus tree- and acreage-loss rates, by variety.[a]

Variety	Annual Loss Rate[b]							
	Trees				Acres			
	94-96	96-98	98-00	00-02	94-96	96-98	98-00	00-02
	%							
Oranges[c]								
Early & Midseason	1.2	1.9	2.3	3.8	2.2	2.3	2.7	4.2
Late	1.2	1.9	2.3	3.8	2.2	2.3	2.7	4.2
Grapefruit[d]								
Indian River								
White Seedless[e]	1.5	3.0	4.8	5.8	2.4	3.5	5.5	6.1
Red & Pink Seedless	1.5	3.0	4.8	5.8	2.4	3.5	5.5	6.1
Interior								
White Seedless[e]	2.3	7.4	9.3	9.4	2.8	7.9	9.6	8.8
Red & Pink Seedless	2.3	7.4	9.3	9.4	2.8	7.9	9.6	8.8
Specialty[f]								
Temples	3.2	4.9	4.8	10.8	3.9	5.7	5.3	12.2
Tangelos	4.3	5.2	5.6	8.3	4.7	5.6	5.6	9.2
Tangerines	2.1	4.1	5.6	6.6	3.0	4.5	5.5	6.7

[a]Losses are due to both tristeza and normal attrition. In 1999-2000, an estimated 12 million orange trees and 5 million grapefruit trees were on sour orange rootstock. From 1999 to 2002, an estimated 4.1 million orange trees and 1.5 million grapefruit trees were lost to tristeza, leaving an estimated 7.9 million orange trees and 3.8 million grapefruit trees for phasing out in the scenarios in this report.

[b]Based on 1994, 1996, 1998, 2000 and 2002 *Commercial Citrus Inventories*.

[c]One loss rate for round oranges (early and midseason and late oranges) was estimated due to the unidentified (by variety) young round-orange trees.

[d]One loss rate for seedless grapefruit was estimated due to the unidentified (by variety) young grapefruit trees.

[e]Includes seedy for the 1998 to 2002 period.

[f]Loss rates based on bearing trees or acres due to unidentified nonbearing specialty citrus.

Table 11. Average orange yields by age for 1993-94 through 2001-02 seasons.

Tree Age	Southern		West		Indian River		Central	
	Early & Mids	Valencia	Early & Mids	Valencia	Early & Mids	Valencia	Early & Mids	Valencia
	estimated 1-3/5 bushel boxes per acre[a]							
24	491	437	563	429	303	254	606	560
23	543	465	641	470	334	283	665	581
22	520	451	614	445	338	283	663	577
21	521	433	597	418	333	281	642	557
20	509	411	574	398	329	273	644	542
19	501	392	565	396	320	269	642	524
18	487	376	552	389	319	265	634	510
17	483	364	544	384	318	262	628	481
16	483	348	533	379	311	266	602	468
15	481	342	521	378	302	267	577	443
14	481	337	509	377	301	269	549	419
13	485	332	497	380	297	267	518	388
12	489	332	490	383	292	266	494	367
11	494	329	478	384	285	278	459	335
10	477	325	452	376	275	266	426	318
9	441	320	423	372	259	243	396	299
8	400	306	396	363	246	212	368	286
7	368	296	367	350	228	193	333	267
6	308	251	304	300	189	160	279	226
5	242	209	233	242	148	129	220	179
4	172	156	163	179	105	98	158	129
3	85	77	81	90	52	49	79	64

[a]Estimated as average trees per acre, based on data reported by FASS in various *Commercial Citrus Inventories*, times average boxes per tree, based on data reported by FASS in various *Citrus Summaries* (boxes per tree by age were obtained by linear interpolation of FASS yields for broad-age categories).

Table 12. Average grapefruit yields by age for 1993-94 through 2001-02 seasons.

Tree Age	Southern		West		Indian River		Central	
	White Seedless	Red & Pink Seedless	White Seedless	Red & Pink Seedless	White Seedless	Red & Pink Seedless	White Seedless	Red & Pink Seedless
	estimated 1-3/5 bushel boxes per acre[a]							
24	557	502	603	587	468	441	987	733
23	595	541	633	605	532	478	944	767
22	611	583	620	537	542	475	942	736
21	664	589	576	460	556	475	935	722
20	659	588	549	388	578	472	927	735
19	635	584	558	303	568	471	889	741
18	634	584	545	264	550	467	866	733
17	611	586	556	286	521	466	814	707
16	596	577	547	322	504	469	759	686
15	559	578	535	345	488	464	711	674
14	521	569	522	395	463	462	664	658
13	475	581	575	440	443	457	622	647
12	462	581	594	477	432	454	575	631
11	447	579	563	518	416	449	535	596
10	452	583	468	515	409	427	489	564
9	475	570	480	491	400	400	454	511
8	466	551	551	461	388	373	418	452
7	441	498	543	418	373	347	368	400
6	378	451	552	374	320	308	297	328
5	326	400	561	302	256	268	229	252
4	285	324	473	237	187	223	151	184
3	154	179	241	120	95	112	76	85

[a]Estimated as average trees per acre, based on data reported by FASS in various *Commercial Citrus Inventories*, times average boxes per tree, based on data reported by FASS in various *Citrus Summaries* (boxes per tree by age were obtained by linear interpolation of FASS yields for broad-age categories).

Table 13. Orange production estimates.[a]

Season	With No Additional Losses Due to Tristeza		With Tristeza Losses Phased in Over Next 6 Years		With Tristeza Losses Phased in Over Next 10 Years		With Tristeza Losses Phased in Over Next 14 Years	
	Production	Acre Loss Rate[b]	Production	Acre Loss Rate[b]	Production	Acre Loss Rate[b]	Production	Acre Loss Rate[b]
	mil. boxes	- % -	mil. boxes	- % -	mil. boxes	- % -	mil. boxes	- % -
2003-04	240	-2.3	220	-5.4	224	-4.9	227	-4.5
2004-05	244	-2.3	219	-4.1	223	-4.4	225	-4.2
2005-06	248	-2.4	221	-3.0	223	-3.6	225	-3.7
2006-07	252	-2.4	225	-2.5	226	-2.9	227	-3.2
2007-08	255	-2.5	229	-2.4	229	-2.6	229	-2.8
2008-09	258	-2.5	233	-2.4	233	-2.5	233	-2.6
2009-10	261	-2.6	237	-2.5	237	-2.5	237	-2.5
2010-11	264	-2.6	240	-2.5	240	-2.5	240	-2.5
2011-12	265	-2.7	243	-2.6	243	-2.6	243	-2.6
2012-13	266	-2.7	245	-2.6	245	-2.6	245	-2.6

[a]Average yields and average plantings assumed.

[b] Loss rate due to normal attrition and tristeza.

Table 14. Grapefruit production estimates.[a]

Season	With No Additional Losses Due to Tristeza		With Tristeza Losses Phased in Over Next 6 Years		With Tristeza Losses Phased in Over Next 10 Years		With Tristeza Losses Phased in Over Next 14 Years	
	Production	Acre Loss Rate[b]	Production	Acre Loss Rate[b]	Production	Acre Loss Rate[b]	Production	Acre Loss Rate[b]
	mil. boxes	- % -	mil. boxes	- % -	mil. boxes	- % -	mil. boxes	- % -
2003-04	48	-2.6	38	-14.2	42	-9.1	44	-7.9
2004-05	47	-2.6	33	-13.0	38	-10.7	40	-8.4
2005-06	47	-2.7	31	-5.9	34	-9.7	37	-8.6
2006-07	47	-2.7	34	-2.3	33	-6.4	35	-7.6
2007-08	47	-2.7	37	-1.8	35	-3.4	35	-5.7
2008-09	47	-2.7	40	-1.9	37	-2.2	36	-3.7
2009-10	47	-2.7	42	-2.0	40	-2.0	39	-2.5
2010-11	46	-2.7	43	-2.1	42	-2.0	41	-2.1
2011-12	46	-2.8	44	-2.2	43	-2.1	42	-2.1
2012-13	46	-2.7	45	-2.3	44	-2.2	43	-2.2

[a]Average yields and replacement plantings assumed.

[b] Loss rate due to normal attrition and tristeza.

Table 15. Orange and grapefruit production projections for alternative planting assumptions.

Season	Planting Scenario							
	Orange[a]				Grapefruit[b]			
	Replace-ment	Average	Twice the Average	Half the Average	Replace-ment	Average	Twice the Average	Half the Average
	million boxes							
2003-04	220	220	220	220	42	42	42	42
2007-08	235	229	237	224	35	30	31	30
2012-13	253	245	285	225	44	30	33	28

[a]Assumes average yields and tristeza is phased in over next six years.

[b]Assumes average yields and tristeza is phased in over next ten years.

Table 16. Estimated round-orange and grapefruit production by variety.

Season	Oranges[a]			Grapefruit[b]		
	Early & Midseason	Late	Total	White Seedless[c]	Red & Pink Seedless	Total
	million boxes					
2003-04	122	98	220	17	25	42
2004-05	121	98	219	15	23	38
2005-06	121	100	221	13	21	34
2006-07	123	102	225	12	21	33
2007-08	124	105	229	14	21	35
2008-09	125	108	233	14	23	37
2009-10	127	110	237	16	24	40
2010-11	127	113	240	17	25	42
2011-12	128	115	243	17	26	43
2012-13	128	117	245	18	26	44

[a] Assumes average yields, average plantings and tristeza losses phased in over six years.

[b] Assumes average yields, replacement plantings and tristeza losses phased in over 10 years.

[c] Includes seedy grapefruit.

Table 17. Indian River versus Interior estimated grapefruit production, with tristeza losses phased in over next 10 years.[a]

Season	Indian River			Interior		
	White[b]	Red	Total	White[b]	Red	Total
	million boxes					
2003-04	10.4	16.1	26.5	6.5	9.2	15.7
2004-05	8.9	14.1	23.0	5.9	8.8	14.8
2005-06	7.8	12.5	20.3	5.5	8.6	14.1
2006-07	7.6	12.1	19.6	5.4	8.5	13.8
2007-08	8.2	12.7	21.0	5.4	8.6	13.9
2008-09	9.2	14.0	23.2	5.5	8.7	14.3
2009-10	10.3	15.2	25.5	5.7	8.9	14.6
2010-11	11.1	16.1	27.2	5.8	9.0	14.8
2011-12	11.6	16.8	28.4	5.9	9.1	15.0
2012-13	11.9	17.3	29.2	5.9	9.2	15.1

[a]Average yields and replacement plantings assumed.

[b]Includes seedy grapefruit.

Table 18. Estimated specialty citrus production by variety.[a]

Season	Planting Assumptions							
	Replacement[b]				Average[c]			
	Temples	Tangelos	Tangerines	Total	Temples	Tangelos	Tangerines	Total
	million boxes							
2003-04	1.4	2.3	6.0	9.7	1.4	2.3	6.0	9.7
2004-05	1.3	2.3	6.0	9.6	1.3	2.3	6.0	9.6
2005-06	1.3	2.3	6.0	9.6	1.3	2.3	5.9	9.5
2006-07	1.3	2.3	6.1	9.7	1.2	2.3	5.9	9.4
2007-08	1.3	2.3	6.2	9.8	1.2	2.3	5.9	9.4
2008-09	1.3	2.4	6.3	10.0	1.2	2.3	5.8	9.3
2009-10	1.3	2.4	6.3	10.0	1.1	2.3	5.8	9.2
2010-11	1.3	2.5	6.4	10.2	1.1	2.3	5.7	9.1
2011-12	1.3	2.5	6.5	10.3	1.1	2.3	5.7	9.1
2012-13	1.3	2.5	6.5	10.3	1.1	2.3	5.6	9.0

[a]Acre-loss rates for Temples and Tangelos are assumed to be 8%, 7%, 6%, 5%, and 4% in 2002-03, 2003-04, 2004-05, 2005-06, 2006-07 and thereafter, respectively. Acre-loss rates for tangerines are assumed to be 6%, 5.5%, 5%, 4.5%, and 4% in 2002-03, 2003-04, 2004-05, 2005-06, 2006-07 and thereafter, respectively.

[b]Acre plantings are assumed to be equal to acre losses.

[c]Average acres planted from 1999 to 2001.