Florida Citrus Production Trends 1997-98 Through 2006-07

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Prepared by:

ECONOMIC AND MARKET RESEARCH DEPARTMENT
FLORIDA DEPARTMENT OF CITRUS

P.O. Box 110249
Gainesville, Florida 32611-0249
Phone: 352-392-1874
FAX: 352-392-8634
E-Mail: MBROWN@fred.ifas.ufl.edu
Web Site: http://www.fred.ifas.ufl.edu:80/citrus/

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Executive Summary

- The 1996 Florida commercial tree inventory indicates record orange and grapefruit tree populations of 84.2 and 15.1 million, respectively. Both tree populations are relatively young, as a result of freeze-related losses and plantings. Florida citrus tree densities are also trending upward, increasing from 92 trees per acre in 1986 to 125 tree per acre in 1996.

- The production estimates in this report are for potential production, as opposed to utilized production. The potential production estimates assume no fruit abandonment, other than what has occurred historically and has been reflected in historic yields.

- Two basic methods were used to estimate potential production in the upcoming years: (1) a tree-based method which applies average historic yields per tree to projected trees, by age, and (2) an acre-based method which applies average historic yields per acre to projected acres, by age. The tree-based (acre-based) method may overestimate (underestimate) future production as future yields per tree (acre) may be less (more) than the average historic yields per tree (acre), due to increasing tree densities.

- At present, there is insufficient information on how tree and acre yields may trend in the upcoming years with higher tree densities, making the choice between the tree-based and acre-based production estimates problematic. The tree-based and acre-based production estimates can be viewed as upper and lower potential production ranges, respectively.

- To roughly estimate where potential production may fall in the above range, the tree-based and acre-based methods were combined under the assumption that, regardless of tree density, an acre can only produce so many boxes of fruit. The combined method estimates production through the tree-based method with the limitation that yield per acre can not exceed an historic maximum level (see pages 7 and 8).

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

Item	Units	Oranges			Grapefruit		
		1997-98	2001-02	2006-07	1997-98	2001-02	2006-07
Tree-Based Method							
Bearing Trees	(millions)	78.8	79.0	78.1	14.3	14.3	14.3
Yield	(boxes/tree)	3.1	3.5	3.8	4.5	5.1	5.2
Average Bearing Tree Age	(years)	9.4	11.7	14.2	11.5	13.4	15.4
Potential Production	**(million boxes)**	**245**	**279**	**293**	**65**	**72**	**74**
Acre-Based Method							
Bearing Acres	(thousands)	603.2	596.5	589.7	134.1	131.8	131.1
Yield	(boxes/acre)	368.7	392.4	402.6	441.0	461.6	458.9
Average Bearing Acre Age	(years)	10.3	11.8	13.4	12.5	13.4	14.2
Potential Production	**(million boxes)**	**222**	**234**	**237**	**59**	**61**	**60**
Combined Method							
Potential Production	**(million boxes)**	**245**	**275**	**263**	**64**	**69**	**67**

- The tree-based (acre-based) potential production estimates for oranges increase from 245 million boxes (222 million boxes) in 1997-98 to 293 million boxes (237 million boxes) in 2006-07.

- The tree-based (acre-based) potential production estimates for grapefruit increase from 65 million boxes (59 million boxes) in 1997-98 to 74 million boxes (60 million boxes) in 2006-07.

- The combined potential production estimates for oranges (grapefruit) increase from 245 million boxes (64 million boxes) in 1997-98 to 263 million boxes (67 million boxes) in 2006-07.

- The bearing tree and acre populations underlying the above estimates are relatively stable over the projection period. The increases in the production estimates are due to the aging of the trees and acres. The projected average bearing age for trees and acres differ as a result of (1) differences in the tree versus acre age distributions (e.g., in 1996, the percentages of trees and acres in the non-bearing category were 10.5% and 9.4%, respectively) and (2) differences in assumed loss and planting rates (the rates for acres exceeded those for trees).

- Potential specialty citrus production is projected to increase from 12 million boxes in 1997-98 to 14 million boxes in 2006-07.

Florida Citrus Production Trends
1997-98 Through 2006-07*

Introduction

This report presents production estimates for Florida round oranges, grapefruit and specialty citrus for the 1997-98 through 2006-07 seasons. The estimates are based on the Florida Agricultural Statistics Service (FASS) biennial commercial tree inventory for 1996. 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 category to project future production. Two basic methods are used to project production—(1) a tree-based method which directly applies average boxes of fruit per tree to projected trees, by age, and (2) an acre-based method which applies boxes per acre (calculated indirectly using the tree, acreage and tree yield data) to projected acreage, by age. These two methods are also combined to project production through the tree-based method with the limitation that yield per acre cannot exceed an historic maximum level.

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 economic conditions, while utilized production is the amount of fruit actually entering certified fresh and processing channels, as well as noncertified channels. When citrus prices are not high enough to cover harvest and post-harvest (variable) costs, some fruit may be abandoned rather than utilized.[1]

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*Prepared by Mark G. Brown, Research Economist, Florida Department of Citrus, Gainesville, Florida.

[1]Some abandonment of grapefruit occurred in 1995-96 which negatively impacted the 1995-96 grapefruit boxes-per-tree yields reported by FASS. Hence, to some extent abandonment is accounted for by reducing the historic tree yields used in projecting future production; however, if abandonment increases in the upcoming years, the historic yields would not fully account for this problem.

Overview of the 1996 Commercial Tree Inventory

The 1996 commercial tree inventory reflects the continuing growth in Florida's production capacity following the series of severe freezes in the 1980's (Exhibit 1). The inventory shows Florida's total citrus acreage increased from 853.7 thousand acres in 1994 to 857.7 thousand acres in 1996, a .5% increase (Table 1). The citrus tree inventory increased more than proportionately because of the trend toward denser plantings (Exhibit 2). According to the 1996 commercial tree inventory, the number of citrus trees totaled a record 107.1 million, an increase of 3.2% over the 1994 level. Acreage and tree inventory data for round oranges, grapefruit and specialty citrus are shown in Tables 2, 3 and 4, respectively.

The 1996 FASS commercial tree inventory indicates that the population of bearing and nonbearing round-orange trees increased to a record 84.2 million in 1996, up 3.1% over the previous inventory. Approximately 31.5 million round-orange trees, or 37.4% of the total, are five years old or less; an additional 20.2 million trees or 24.0% of the 1996 round-orange tree population are between six and eight years old (Table 5 and Exhibit 3). In total, 61.4% of the round-orange trees are less than nine years old, reflecting the planting activity that has occurred since the freezes of the last decade. A relatively low 23.9% of the tree population is 14 years old or older. The large population of young trees is expected to substantially increase Florida's orange production potential in the upcoming years.

According to the 1996 FASS commercial tree inventory, the total number of bearing and nonbearing grapefruit trees totaled a record 15.1 million, an increase of .8% over the previous inventory level. The age distribution for grapefruit trees in 1996 is similar to that for oranges, except the grapefruit distribution includes a larger percentage of old trees and a somewhat smaller percentage of young trees (Table 6). However, there continues to be a large percentage of young trees, with 5.3 (8.0) million trees

or 35.1% (52.9%) of the tree population being five years old or less (eight years or less), reflecting the post-freeze grapefruit planting activity. The 8 million grapefruit trees under nine years of age represent the highest level on record. The age distribution for grapefruit trees by variety and by Indian River and Interior regions is shown in Table 7. For white seedless and red and pink seedless grapefruit, the tree populations in both regions continue to be relatively young, with the percentages of five-year-old-or-less trees for the white, and red and pink varieties being 29.6% and 30.7%, respectively, in the Indian River region, and 34.2% and 52.8%, respectively, in the Interior region.

The 1996 inventory indicates that the number of specialty-citrus (Temples, tangelos and tangerines) acres and trees increased by 11.3% and 17.1%, respectively, over the last two years. Part of this increase is due to the inclusion of Fallglo tangerines in the tangerine category for the first time in 1996 (prior to 1996 Fallglo tangerines were reported in the "Other Citrus" category). When Fallglo tangerines are removed from the specialty category, the number of specialty-citrus acres and trees still increased by 3.1% and 6.4%, respectively, over the last two years. The tangerine category has experienced a relatively high growth rate in its production base, with 22.6% of its tree population being two years old or less (Table 8), while the Temple and tangelo acreage and tree levels have declined since the last inventory.

Methodology

The production estimates provided in this report are based on projecting the number of trees and acres, or just acres in the case of Temples, tangelos and tangerines, in 25 age categories in the upcoming seasons. Separate projections were made for early and midseason oranges, and late oranges; white seedless, red and pink seedless, and seedy grapefruit; and Temples, tangelos and tangerines.

The relatively young citrus production base as discussed in the previous section, underlies our production projections. Production potential tends to increase with maturation of trees. In the upcoming years, the projected average ages of orange and grapefruit trees increase from 11.2 and 13.4 years in 1996-97 to 16.1 and 17.5 years in 2006-07, respectively; the projected average age of specialty acreage increases from 11.3 to 15 years over this period (Exhibit 4).

Planting Assumptions

The projections are dependent on assumed future tree-planting rates or acreage-growth rates. Planting levels for the period from 1993 through 1995 (Table 9) are down from earlier post-freeze levels, with prices and returns to producing citrus at reduced levels during this period. For example, the 1994 and 1996 tree inventories show the numbers of orange trees planted have decreased from 8.6 million and 7.2 million in 1991 and 1992, respectively, to 4.3 million, 2.1 million and 2.5 million in 1993, 1994 and 1995, respectively. Over the projection period, planting levels are assumed to stabilize at relatively low levels compared to earlier post-freeze levels. Prices and grower returns are major factors that have stimulated past plantings. The future planting assumptions are based on anticipation that these factors will be at levels that do not stimulate additions to the population of trees or acres as in the earlier post-freeze period.

In this report, tree and/or acreage planting levels in the upcoming years are assumed to equal corresponding losses. Thus, this assumption maintains the production base but does not allow growth in the base as occurred since the freezes of the last decade. Sensitivity of the orange and grapefruit production estimates to assumed plantings is examined by considering zero plantings over the projection

period. Also, a reduced planting assumption for Temples was made, with plantings for this variety trending downward in recent years.

Tree/Acre Loss Assumptions

The tree-loss and/or acreage-loss rates used in making the projections are based on recent post-freeze loss rates observed from 1992 to 1996. Average orange loss rates from 1994 to 1996 were somewhat lower than the loss rates that occurred between 1992 to 1994 (Table 10). In part, this may be due to the increasing proportion of young trees over this period. Tree- and acre-loss rates for most citrus varieties are generally lower for young ages, tending to increase with age of tree or acre. Assuming this pattern continues into the future, the projections are based on tree- and acre-loss rates which increase with age; for a few varieties, the loss rates are flat.[2]

Yield Assumptions: Projection Methodologies Based on Trees Versus Acres

The tree-based (acre-based) production estimates are obtained by multiplying the projected number of trees (acres) in each specific age category by the yield or average number of boxes per tree (acre) for that age category and summing the results. The yields per tree used in estimating production by variety and age of tree are based on actual yields reported by FASS for 1991-92 through 1995-96 (Table 11). The FASS data indicate that yields per tree tend to increase with age (Exhibit 5). Also, yields by age category have varied considerably over time, as a result of variations in growing conditions. Thus, actual

[2] For oranges, the assumed loss rate for trees (acres) increased from .2% (.2%) for the one-year-old category to 3.7% (5.5%) for the 24-year-old-and-greater category. For Interior seedless grapefruit, the assumed loss rate for trees (acres) increased from .2% (.2%) for the one-year-old category to 4.2% (5.2%) for the 24-year-old-and-greater category. For Indian River seedless grapefruit, the assumed loss rate for trees was flat at 1.5% for all age categories; the assumed loss rate for acres increased from .2% for the one-year-old category to 4.4% for the 24-year-old-and-greater category. For specialty citrus, the assumed loss rates were flat across the age categories, as shown in Table 21.

production may deviate substantially from estimated production in any given season, due to variations in yields. For example, for the 1997-98 orange (grapefruit) projection, the 95% confidence interval, based on yield variation alone, is roughly ±24% (±29%) of the estimated tree-based production shown in this report.

Yields may also be dependent, in part, on the number of trees per acre or tree density which has been increasing over time, as shown in Tables 1 through 4. Since the mid 1980's, tree densities have noticeably increased. For example, on average, 143 orange trees were planted per acre in the last three years, 1993 through 1995; on the other hand, tree density of the oldest acreage (pre-1952), reported in the 1996 commercial inventory, averages 88 trees per acre.

The 1995-96 tree densities for the 25 age categories used in projecting production in the upcoming years are shown in Table 12 and Exhibit 6. As time goes by, older-age-category tree densities are expected to increase. For example, in 1995-96, the round-orange tree density for the one-year-old category was 146 trees per acre, compared to 119 trees per acre in the twelve-year-old category. One-year-old trees and acres in 1995-96 will become twelve-year-old trees and acres by the end of the projection period in 2006-07. Hence, assuming the average density in this cohort is maintained over time, the density in the twelve-year-old age category would increase from 119 trees per acre in 1995-96 to 146 trees per acre in 2006-07.

For young acreage, increasing tree densities are expected to increase yields per acre. However, since older acreage presently has relatively low tree densities, we do not know how older-age-category yields per acre might be affected as young-high-density acreage matures into old acreage. In terms of tree yields, we do not know how boxes per tree may be affected by dense plantings, as trees mature and

compete for space. As highly dense acres age, some trees may be removed to allow the remaining trees more space to grow, or yields per tree may simply be less than historically observed.

This uncertainty about yields motivated our projections based on yields per acre. For each age category, yields per acre were calculated as the product of yields per tree times trees per acre.

Yield Assumptions: Projection Methodologies Based on Combined Trees and Acres

The projections based on yields per tree, may overestimate future production, since these yield assumptions may overestimate the yield per acre for the older age categories, as tree densities in these age categories increase over the projection period. On the other hand, the projections based on yields per acre may understate future production as these yield assumptions do not allow the maturation of high-density trees to increase yields per acre for the younger age categories.

Given the possibility that the tree-based production estimates and acre-based production estimates overstate and understate future production, respectively, production projections are also made by combining the basic features of the tree- and acre-based projection methods. The combined method is based on the assumption that, regardless of tree density, an acre can only produce so many boxes of fruit. Under this method, production per acre is allowed to increase with age and/or tree density until the maximum historical production per acre (1991-92 through 1995-96) is exceeded; in which case, production per acre is held constant at the historical maximum. The combined method is implemented by limiting the tree-based production estimate for any given age category whenever the yield-per-acre maximum is exceeded. When the yield per acre maximum is exceeded for some age group, the production estimate for the age group becomes the number of projected acres for the group times the yield-per-acre maximum. With this method, the maturation of young, high density acreage to medium age acreage can

result in higher yields per acre than historically observed when densities tended to be lower; but the maturation of young, high density acreage into old, high density acreage is not allowed to result in potentially unrealistic, high yields per acre.

We also note that the production estimates in this report are based on historical yields which may not fully reflect the impact on yields of the new distribution of acreage across the different regions of the State, resulting from the post-freeze recovery. For example, with the major replanting following the freezes, there has been an increase in the proportion of citrus acreage in southern areas of the State, where soil types and drainage may limit yields. The full impact of such changes on yields may not manifest itself until the present tree populations in these regions of the State mature further. Given this possibility, sensitivity of the orange and grapefruit production projections to assumed yields will be considered further in the next section.

Round-Orange, Grapefruit and Specialty-Citrus Production Estimates

For oranges and grapefruit, three sets of potential production estimates are presented—(1) estimates based on projected trees times yields per tree, by age; (2) estimates based on projected acres times yields per acre, by age; and (3) estimates based on the combined method (projected trees times yields per tree, by age, with yield per acre limited to the historic maximum). For oranges, the tree-based estimates show potential production increasing from 245 million boxes in 1997-98 to 293 million boxes in 2006-07 (Table 13). This set of estimates is generally a continuation of our tree-based estimates made two years ago, except for adjustments resulting from changes in the tree census numbers, as well as planting, loss and yield assumptions. Likewise, the acre-based orange estimates are generally a continuation of our acre-based estimates made two years ago. The acre-based estimates are substantially less than the tree-

based estimates, increasing from 222 to 238 million boxes over the ten-year projection period. The combined-method estimates show potential orange production could increase from 245 million boxes in 1997-98 to 276 million boxes in 2002-03 and then decrease to 263 million boxes in 2006-07. The decline in the combined estimates at the end of the projection period is due to the yield per acre limitation imposed in conjunction with projected changes in the distribution of trees over time—when the yield limitation is not imposed, production increases from the older age categories outweigh the production decreases from the younger age categories (the number of trees in the older age categories increases with maturation, while the number of trees in the younger age categories decreases given the planting assumptions of this study), and, hence overall production across all age categories increases; however, when the yield limitation is imposed, the production increases from the older age categories decline and do not outweigh the production decreases from the younger age categories during the latter part of the projection period. Comparing the combined estimates with the tree-based estimates, it can be seen that the per-acre yield limitation has very little impact during the first half of the projection period; however, during the last half of the projection period, the yield limitation results in substantially lower crop estimates (Exhibit 7).

Estimated average yields and tree-age distributions over the projection period are shown in Tables 14, 15 and 16.

As mentioned previously, relatively large variations in yields may occur over time. The above estimates are based on average yields over the five-season period from 1991-92 through 1995-96. When yields for any one of these seasons are assumed in projecting production, the results may differ substantially from the projection based on the average. For example, in the 1997-98 season, application of the tree-based method assuming 1995-96 (1992-93) yields results in an estimate of 228 (277) million boxes of oranges, compared to the average of 245 million boxes (Exhibit 8). Examination of the projections for each

such yield scenario indicates that yields in 1992-93 were noticeably higher than in the other four seasons; when the five seasons prior to 1991-92 are considered, the yields in 1992-93 seem more normal, although still relatively high. Omitting the 1992-93 yields, the combined-method orange projections, based on average yields for the remaining four seasons, decrease by 7 to 10 million boxes over the projection period (Exhibit 9), indicating that even when this season's yields are considered to be outliers, projected production still increases sharply in the upcoming years.

In addition, if the tree and acre yields were to decline by 5% (10%) for ages 12 and greater, the orange crop projections for 2006-07 would decline by roughly 10 to 13 (20 to 26) million boxes, depending on the projection method (Table 17, Exhibit 10).

The orange production projections are also sensitive to tree and acre loss rates and planting rates. For example, if zero orange plantings were assumed over the projection, the previously discussed orange crop projections for 2006-07 would decline by 28 to 42 million boxes, depending on the projection method. Likewise, if the assumed acre and tree loss rates increased by 1%, the orange crop projections for 2006-07 would decline by roughly 12 to 17 million boxes, depending on the projection method.

The three sets of potential grapefruit production estimates (Table 13) follow a similar pattern as the orange estimates, with the tree-based estimates showing a high range of production possibilities and the acre-based estimates showing a low range of production possibilities. The combined-method estimates for grapefruit show potential production increasing from 64 million boxes in 1997-98 to 69 million boxes in 2000-01 through 2002-03 and then decreasing to 67 million boxes in 2006-07. Sensitivity of the grapefruit projections to planting, loss and yield assumptions is shown in Table 18.

Specialty-citrus production was projected using estimated equations which relate historic production to acres, by age (data on specialty tree yields were not available to make the same three sets

of estimates as were made for oranges and grapefruit). Potential specialty citrus production is estimated to increase from 12.2 million boxes in 1997-98 to 13.9 million boxes in 2006-07, a 14% increase. These estimates are generally a continuation of our specialty citrus estimates made two years ago.

Production Estimates by Variety

Oranges

Based on the combined method, potential early-and-midseason-orange production is projected to increase from 145 million boxes in 1997-98 to a maximum 162 million boxes in 2002-03, a 12% increase, while potential late-orange production is projected to increase from 100 million boxes to 114 million boxes, a 14% increase, over the same period (Table 19). In 1997-98, the percentages of total round-orange production accounted for by early and midseason oranges, and late oranges, are estimated to be 59.3% and 40.7%, respectively; by 2006-07, the percentages are estimated to change slightly to 58.2% for early and midseason oranges and 41.8% for late oranges.

Grapefruit

Potential white-seedless-grapefruit production is estimated to be relatively flat over the projection period at 26 to 27 million boxes; while potential red-and-pink-seedless grapefruit production is projected to range from 37 to 40 million boxes (Table 20). As a result of low planting levels in past years and relatively few young trees presently in existence, potential seedy-grapefruit production is estimated to decrease slightly over the ten-year projection period, from 1.8 to 1.5 million boxes.

Specialty Citrus

Potential tangerine production is estimated to increase from 6.4 million boxes in 1997-98 to 8.5 million boxes in 2006-07, a 33% increase (Table 21). Potential tangelo production is estimated to be relatively flat at 3.6 to 3.7 million boxes over the projection period. Potential Temple production is estimated to decline somewhat from 2.2 million boxes to 1.6 million boxes over the upcoming years, following the generally downward trend that this variety has been experiencing.

Summary

Record-high tree population levels with large numbers of young trees indicate Florida citrus production can be expected to increase substantially in the upcoming years. Future production will depend on a number of variables, including tree yields, loss rates and planting rates. Depending on the assumed values of these three variables, projected production varies considerably. Unfortunately, it is not possible to determine, with a high degree of confidence, the values of some of these variables such as tree or acre yields. However, regardless of the assumption, the alternative projections presented in this report point to substantially larger orange crops in the upcoming years.

TABLES

Table 1. Florida citrus acreage and tree numbers by commercial inventory, 1966 to 1996.

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

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

Table 2. Florida round-orange acreage and tree numbers by commercial inventory, 1966 to 1996.

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

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

Table 3. Florida grapefruit acreage and tree numbers by commercial inventory, 1966 to 1996.

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

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

Table 4. Florida specialty-citrus[a] acreage and tree numbers by commercial inventory, 1970 to 1996.

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

[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	Tree Age						Total 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	57,801.50
1972	5.5	11.1	20.2	22.0	14.1	27.0	53,731.10
1974	4.0	5.9	16.9	27.8	16.9	28.4	52,521.70
1976	4.0	4.8	7.5	29.7	24.1	29.8	51,595.30
1978	5.2	4.5	4.7	23.4	31.5	30.6	50,843.22
1980	7.2	4.7	3.8	13.0	39.1	32.2	51,977.80
1982	12.0	5.1	3.7	7.2	40.2	31.8	53,504.70
1984	17.5	7.1	4.5	5.8	35.2	29.9	49,884.70
1986	20.0	12.4	6.1	7.1	28.7	25.7	43,461.40
1988	30.7	13.9	7.8	5.7	17.7	24.1	54,536.60
1990	35.1	14.3	10.7	6.7	10.0	23.3	62,613.40
1992	31.9	23.4	9.9	8.4	6.7	19.7	72,826.30
1994	24.4	24.6	16.7	11.0	6.5	16.9	81,614.40
1996	10.5	26.9	24.0	14.7	8.2	15.7	84,155.40

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

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

Year	Tree Age						Total 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
1972	6.9	21.9	14.0	5.5	10.6	41.1	9,012.7
1974	11.5	8.2	25.1	7.6	8.1	39.4	9,647.2
1976	13.9	7.9	13.3	20.8	6.8	37.2	10,398.1
1978	8.5	13.8	6.8	28.9	7.1	34.9	10,412.5
1980	8.9	10.5	10.7	21.6	15.8	32.5	10,768.7
1982	7.5	7.4	12.8	12.6	29.1	30.6	10,833.2
1984	11.4	6.7	7.5	15.7	32.1	26.7	10,582.9
1986	9.7	7.8	7.9	17.0	35.7	22.0	9,624.0
1988	11.0	9.7	6.5	13.8	38.3	20.7	10,081.2
1990	21.8	6.2	8.0	9.1	31.4	23.5	11,193.2
1992	27.2	14.0	5.5	8.6	19.1	25.6	13,119.2
1994	23.3	21.3	7.6	8.3	16.0	23.5	15,004.0
1996	9.8	25.3	17.8	8.2	15.3	23.6	15,116.9

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

Table 7. Age distribution of Florida grapefruit trees by marketing district and variety, 1996 inventory.

Item	Tree Age						Total Trees
	≤2	3-5	6-8	9-13	14-23	≥24	
	- - - - - - - - - - - - - - - - - - %[a] - - - - - - - - - - - - - - - - -						- thousand -
Indian River							
White Seedless	9.3	20.3	12.5	2.4	11.0	44.5	3,725.3
Red and Pink Seedless	9.7	21.0	18.9	13.7	22.7	14.0	5,946.9
Seedy	.0	1.3	.0	.0	5.7	93.0	22.8
TOTAL	**9.5**	**20.7**	**16.4**	**9.3**	**18.1**	**25.9**	**9,710.7**
Interior							
White Seedless	10.8	23.4	15.2	4.6	12.1	33.9	1,853.9
Red and Pink Seedless	10.8	42.0	24.4	7.0	8.6	7.2	3,192.4
Seedy	3.6	9.4	10.4	6.5	15.8	54.4	359.9
TOTAL	**10.4**	**33.5**	**20.3**	**6.1**	**10.3**	**19.5**	**5,406.2**

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

SOURCE: Florida Agricultural Statistics Service, *1996 Commercial Citrus Inventory*.

Table 8. Age distribution of Florida specialty-citrus trees by variety, 1996 inventory.

Item	Tree Age						Total Trees
	≤2	3-5	6-8	9-13	14-23	≥24	
	- % -						- thousand -
Temples	3.1	8.0	11.5	7.0	4.6	65.8	713.3
Tangelos	8.4	28.1	25.0	7.4	3.1	28.0	1,669.2
Tangerines	22.6	40.2	22.2	5.9	2.3	6.9	4,568.5
TOTAL	**17.2**	**34.0**	**21.7**	**6.4**	**2.7**	**18.0**	**6,951.0**

SOURCE: Florida Agricultural Statistics Service, *1996 Commercial Citrus Inventory*.

Table 9. Average annual citrus plantings, by variety, 1993 through 1995.

Variety[a]	Plantings	
	Trees	Acres
	- thousand -	- acres -
Oranges		
Early and Midseason	1,339	9,504
Late	1,607	11,040
TOTAL	**2,946**	**20,544**
Grapefruit		
Indian River		
White Seedless	116	1,013
Red and Pink Seedless	192	1,348
Seedy	0	0
Interior		
White Seedless	67	540
Red and Pink Seedless	115	911
Seedy	4	47
TOTAL	**494**	**3,859**
Specialty		
Temples	8	81
Tangelos	56	379
Tangerines	344	2,029
TOTAL	**408**	**2,489**

[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.

Table 10. Citrus tree- and acreage-loss rates, by variety.

Variety	Loss Rate[a]			
	1992-94		1994-96	
	Trees	Acres	Trees	Acres
	----------% ----------			
Oranges[b]				
Early and Midseason	1.7	3.0	1.1	2.2
Late	1.7	3.0	1.1	2.2
Grapefruit[c]				
Indian River				
White Seedless	.8	1.9	1.5	2.4
Red and Pink Seedless	.8	1.9	1.5	2.4
Seedy	9.6	8.3	4.2	3.9
Interior				
White Seedless	.9	1.9	2.3	2.8
Red and Pink Seedless	.9	1.9	2.3	2.8
Seedy	3.7	4.4	3.7	5.2
Specialty[d]				
Temples	6.1	6.3	3.2	3.9
Tangelos	2.2	3.1	4.3	4.7
Tangerines	2.2	3.2	2.1	3.0

[a]Based on 1992, 1994 and 1996 commercial citrus inventories.

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

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

[d]Loss rates based on bearing trees or acres due to the large number of unidentified nonbearing specialty citrus.

Table 11. Average yields by age of tree for 1991-92 through 1995-96.[a]

Item	Tree Age				
	3-5	6-8	9-13	14-23	24+
	- - - - - - - - - - 1-3/5 bushel boxes per tree - - - - - - - - - -				
Oranges					
Early and Midseason	1.42	3.10	4.05	4.44	5.16
Valencia	1.23	2.22	2.74	3.54	3.98
Grapefruit					
Indian River					
White Seedless	2.31	3.78	4.68	5.10	5.76
Red and Pink Seedless	2.15	3.54	4.43	4.74	4.74
Interior					
White Seedless	2.37	3.76	5.31	8.71	7.63
Red and Pink Seedless	2.32	4.12	6.68	5.93	6.89

[a]The average yields by age category shown in the table were used to obtain linear interpolation yield estimates for ages, 3, 4, ..., 23, 24+ which were used in estimating the orange and grapefruit crop sizes shown in Table 13.

SOURCE: Florida Agricultural Statistics Service.

Table 12. Estimated 1995-96 round-orange and grapefruit trees per acre, based on the 1996 commercial inventory.

Tree Age	Round Orange[a]	Grapefruit
	trees per acre	
0	142.0	124.4
1	145.9	131.7
2	143.0	128.0
3	140.6	122.1
4	142.7	119.2
5	146.4	118.4
6	147.6	117.5
7	138.2	112.2
8	132.0	114.7
9	132.2	112.5
10	127.9	110.0
11	120.8	111.1
12	119.2	100.9
13	116.9	94.3
14	118.4	99.7
15	117.9	103.7
16	118.9	96.0
17	112.0	96.2
18	110.4	99.1
19	114.1	94.0
20	115.6	96.7
21	119.0	99.1
22	111.6	93.8
23	122.5	94.8
24	99.0	85.2

[a]Orange trees and acres listed as unidentified by the FASS were allocated between round oranges, Temples and tangelos in the same proportion as the identified proportions in calculating the average trees per acre.

Table 13. Estimated production for round oranges, grapefruit and specialty citrus, based on alternative estimation methods.

Season	Oranges			Grapefruit			Specialty[h]
	Method			Method			
	Tree[a,b]	Acre[c,d]	Combined[e]	Tree[a,f]	Acre[c,g]	Combined[e]	
	million boxes						
1997-98	245.35	222.39	245.17	64.79	59.14	64.21	12.17
1998-99	257.67	227.80	257.15	67.39	59.91	66.38	12.52
1999-00	266.99	231.04	265.94	69.50	60.44	67.92	12.81
2000-01	273.83	232.88	271.36	71.15	60.71	68.65	13.06
2001-02	279.11	234.05	274.62	72.39	60.86	68.91	13.25
2002-03	283.35	235.16	275.67	73.25	60.92	68.81	13.43
2003-04	286.47	235.78	274.36	73.68	60.82	68.47	13.56
2004-05	288.94	236.35	271.31	73.81	60.57	67.98	13.68
2005-06	291.12	236.69	267.22	73.84	60.32	67.40	13.79
2006-07	293.11	237.38	262.74	73.86	60.16	66.68	13.88

[a]Projected trees times average yield per tree, by age of tree, with tree plantings equal to tree losses.

[b]Orange tree loss rates increase with age, averaging 2.1% over tree ages, over the projection period.

[c]Projected acres times average yield per acre, by age of acre, with acre plantings equal to acre losses.

[d]Orange acre loss rates increase with age, averaging 3.2% over acre ages, over the projection period.

[e]Projected trees times yield per tree, by age, with yield per acre limited to historic maximum; tree and acre plantings equal to losses.

[f]Grapefruit tree loss rates increase with age, averaging 1.8% over tree ages, over the projection period.

[g]Grapefruit acre loss rates increase with age, averaging 3.0% over acre ages, over the projection period.

[h]Based on regression equations relating production to acres, by age of acre. Acre plantings equal acre losses for tangelos and tangerines; acre plantings are equal to the average that occurred in 1994 and 1995 for Temples. The acre loss rates were 4.5% for Temples and tangelos, and 3.0% for tangerines.

Table 14. Estimated average yields for production estimates for round oranges and grapefruit.

Season	Oranges				Grapefruit			
	Tree Method		Acre Method		Tree Method		Acre Method	
	Bearing Trees	Boxes/ Tree	Bearing Acres	Boxes/ Acre	Bearing Trees	Boxes/ Tree	Bearing Acres	Boxes/ Acre
	million trees	boxes	thousand acres	boxes	million trees	boxes	thousand acres	boxes
1997-98	78.8	3.1	603.2	368.7	14.3	4.5	134.1	441.0
1998-99	79.7	3.2	601.4	378.8	14.4	4.7	132.3	452.8
1999-00	79.5	3.4	599.7	385.3	14.3	4.9	132.2	457.3
2000-01	79.3	3.5	598.1	389.4	14.3	5.0	132.0	460.0
2001-02	79.0	3.5	596.5	392.4	14.3	5.1	131.8	461.6
2002-03	78.8	3.6	595.0	395.3	14.3	5.1	131.7	462.7
2003-04	78.6	3.6	593.5	397.3	14.3	5.2	131.5	462.5
2004-05	78.4	3.7	592.1	399.2	14.3	5.2	131.4	461.1
2005-06	78.2	3.7	590.8	400.6	14.3	5.2	131.2	459.7
2006-07	78.1	3.8	589.7	402.6	14.3	5.2	131.1	458.9

Table 15. Estimated age distribution of Florida round-orange trees.

Season	Tree Age						Total Trees
	≤2	3-5	6-8	9-13	14-23	≥24	
	- % -						- million -
1997-98	6.3	15.9	27.1	23.3	11.7	15.6	84.12
1998-99	5.2	10.3	26.1	29.9	12.9	15.5	84.12
1999-00	5.5	6.9	22.9	34.9	14.3	15.5	84.12
2000-01	5.8	6.2	15.4	39.4	17.8	15.4	84.12
2001-02	6.0	5.2	10.0	39.2	24.2	15.4	84.12
2002-03	6.3	5.4	6.7	37.7	28.5	15.3	84.12
2003-04	6.5	5.7	6.0	31.1	35.0	15.6	84.12
2004-05	6.8	6.0	5.0	26.1	40.3	15.9	84.12
2005-06	7.0	6.2	5.3	18.4	46.5	16.6	84.12
2006-07	7.2	6.4	5.5	12.4	51.1	17.3	84.12

Table 16. Estimated age distribution of Florida grapefruit trees.

Season	Tree Age						Total Trees
	≤2	3-5	6-8	9-13	14-23	≥24	
	- % -						- million -
1997-98	5.2	16.1	23.9	13.8	14.6	26.4	15.12
1998-99	5.1	9.5	24.3	19.3	13.8	28.1	15.12
1999-00	5.2	5.8	21.8	25.7	12.7	28.9	15.12
2000-01	5.3	5.0	15.5	31.8	13.3	29.0	15.12
2001-02	5.4	4.9	9.1	34.9	16.1	29.6	15.12
2002-03	5.5	5.0	5.5	34.7	19.0	30.3	15.12
2003-04	5.5	5.1	4.8	29.4	24.3	30.8	15.12
2004-05	5.6	5.2	4.7	23.8	29.9	30.8	15.12
2005-06	5.7	5.3	4.8	17.3	35.6	31.3	15.12
2006-07	5.8	5.3	4.9	11.3	40.6	32.1	15.12

Table 17. Sensitivity analysis of orange production projections.

Season	Scenario				
	Base	Zero Plantings	1% Higher Loss Rate	5% Lower Yield for Ages 12+	10% Lower Yield for Ages 12+
	million boxes				
Tree Method					
1997-98	245	245	240	240	234
2001-02	279	274	266	270	261
2006-07	293	265	276	280	267
Acre Method					
1997-98	222	222	218	217	212
2001-02	234	225	223	227	219
2006-07	238	196	226	228	218
Combined Method					
1997-98	245	245	240	239	233
2001-02	275	269	261	265	254
2006-07	263	235	248	251	240

Table 18. Sensitivity analysis of grapefruit production projections.

Season	Scenario				
	Base	Zero Plantings	1% Higher Loss Rate	5% Lower Yield for Ages 12+	10% Lower Yield for Ages 12+
	million boxes				
Tree Method					
1997-98	65	65	63	63	61
2001-02	72	71	69	70	68
2006-07	74	67	70	71	67
Acre Method					
1997-98	59	59	58	57	56
2001-02	61	58	58	59	57
2006-07	60	50	57	58	55
Combined Method					
1997-98	64	64	63	62	61
2001-02	69	67	66	67	65
2006-07	67	60	63	64	62

Table 19. Estimated round-orange production by variety.[a]

Season	Early and Midseason	Late	Total
	million boxes		
1997-98	145.44	99.73	245.17
1998-99	152.22	104.93	257.15
1999-00	157.00	108.94	265.94
2000-01	160.04	111.32	271.36
2001-02	161.77	112.85	274.62
2002-03	162.08	113.59	275.67
2003-04	160.85	113.51	274.36
2004-05	158.41	112.90	271.31
2005-06	155.65	111.57	267.22
2006-07	152.80	109.94	262.74

[a]Based on combined method (see Table 13, footnote e).

Table 20. Estimated grapefruit production by variety.[a]

Season	White Seedless	Red and Pink Seedless	Seedy	Total
	- - - - - - - - - - - - - - - - - - million boxes - - - - - - - - - - - - - - - - - -			
1997-98	25.54	36.88	1.79	64.21
1998-99	26.04	38.61	1.73	66.38
1999-00	26.47	39.76	1.69	67.92
2000-01	26.78	40.22	1.65	68.65
2001-02	27.04	40.26	1.61	68.91
2002-03	27.28	39.96	1.57	68.81
2003-04	27.43	39.50	1.54	68.47
2004-05	27.48	38.99	1.51	67.98
2005-06	27.45	38.47	1.48	67.40
2006-07	27.28	37.95	1.45	66.68

[a]Based on combined method (see Table 13, footnote e).

Table 21. Estimated specialty-citrus production by variety.

Season	Temples[a]	Tangelos[b]	Tangerines[c]	Total
	million boxes			
1997-98	2.19	3.63	6.35	12.17
1998-99	2.12	3.63	6.77	12.52
1999-00	2.05	3.64	7.12	12.81
2000-01	1.99	3.66	7.41	13.06
2001-02	1.92	3.67	7.66	13.25
2002-03	1.86	3.69	7.88	13.43
2003-04	1.79	3.70	8.07	13.56
2004-05	1.73	3.71	8.24	13.68
2005-06	1.67	3.73	8.39	13.79
2006-07	1.61	3.74	8.53	13.88

[a] Acre plantings are assumed to be the average that occurred in 1994 and 1995; the acre-loss rate is assumed to be 4.5% per year.

[b] Acre plantings are assumed to be equal to acre losses; the acre-loss rate is assumed to be 4.5% per year.

[c] Acre plantings are assumed to be equal to acre losses; the acre-loss rate is assumed to be 3.0% per year.

EXHIBITS

Exhibit 1. (Not Available)
Florida Citrus Trees & Acreage by Census

Exhibit 2. (Not Available)
Florida Citrus Trees Per Acre by Census

Exhibit 3. (Not Available)
1996 Age Distribution of Florida Citrus

Exhibit 4. (Not Available)
Average Production Tree/Acreage Age

Exhibit 5. (Not Available)
Average Orange Tree Yields by Age, 1991-92 thru 1995-96

Exhibit 6. (Not Available)
Estimated Trees per Acre by Age, 1996

Exhibit 7. (Not Available)
Estimated Orange Production Based on Alternative Estimation Methods

Exhibit 8. (Not Available)
Tree-Based Orange Production Estimates Based on Alternative Yields

Exhibit 9. (Not Available)
Combined Orange Production Estimates Under Alternative Yield Assumptions

Exhibit 10. (Not Available)
Combined Orange Production Estimates Under Alternative Planting, Loss and Yield Assumptions