

Economic Impact of Agriculture and Agribusiness in Dade County, Florida

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PREFACE

This study was conducted at the request of numerous individuals in Dade County representing agricultural and business interests and local government. It was conducted with the financial support of the Dade County Farm Bureau.

The conclusions and opinions expressed in this report are those of the authors and do not necessarily represent those of the grantors.

ABSTRACT

This study evaluates the importance of agricultural production and related activities to Dade County's economy. Data for analyses were based on published and unpublished data and interviews with growers, shippers, extension personnel and others familiar with Dade County agriculture. Input-output analysis was used to determine the economic impact of agricultural subsectors, i.e., fruit, vegetable and nursery subsectors, on the Dade County economy and economic interrelationships with other sectors of the county's economy. Input-output analysis showed sales of agricultural products contributed \$834 million to Dade County output and almost \$200 million to the county's income. The nursery industry contributed the most in terms of dollars, followed by the vegetable industry and then the fruit industry. Descriptions of selected commodities produced in the county and a historical view of agriculture in the county are also reported.

Keywords: Agriculture, Economic Impact, Input-Output Analysis, Fruits, Vegetables, Ornamental Horticulture.

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EXECUTIVE SUMMARY

- # Due to the non-traditional nature of Dade County agriculture, there is reason to believe that estimates of the economic value of agriculture in the county are sometimes under-reported. This study provides an updated, in-depth understanding of the importance of agriculture to the Dade County economy. The research methodology employed was similar to that used in the 1989-90 study conducted by the University of Florida to facilitate comparison.
- # The study focused on row crops including traditional and tropical vegetables, tree crops, i.e. tropical fruit production, and commercial ornamental horticulture.
- # The aggregate economic impact of Dade County's agricultural sector and its interrelationships with other sectors of the county's economy were estimated with Input-Output analysis. Economic data required for the Input-Output analysis were obtained from published sources and personal interviews.
- # Gross sales to destinations outside Dade County (termed "exports") are used to calculate the economic impact of agriculture on the county. These sales bring "new" dollars into the county thereby stimulating local economic activity. The effect of this economic activity is measured in terms of output and earnings. "Output" is a measure of gross economic activity generated among all sectors of the Dade County economy resulting from sales of agricultural products. Sales outside of Dade County bring in "new" dollars that create a multiplier effect as they are spent and respent within the county. Sales of agricultural products within the county do not create a multiplier effect, but they are added to total output. Similarly "earnings" reflect total household earnings or income generated among all sectors of the county's economy resulting from sales of agricultural products outside the county. As these "new" dollars are spent and respent within the county, they also cause a multiplier effect on total earnings. However, earnings estimates do not include sales of agricultural products made within the county.
 - ❖ Agriculture's total output impact on Dade County in 1996 was \$834 million. Of this output impact, nurseries contributed 46.5 percent or \$387.6 million; vegetables were 41.2 percent or \$344 million, and fruits constituted 12.3 percent or \$102.6 million.
 - ❖ The total earnings impact of agriculture on Dade County in 1996 was almost \$200 million. Nurseries constituted nearly 45 percent or \$87 million; vegetables contributed 42 percent of county income impact, or \$82 million; and fruits represented 13 percent, almost \$26 million.
- # There are approximately 1.25 million acres of land area in Dade County, with almost three quarters of this under water, in water conservation areas, or considered submarginal for

urban or agricultural uses.

According to the 1992 U.S. Department of Commerce Census of Agriculture:

- ❖ Since the 1970s, physical land area devoted to agricultural production has remained relatively constant at approximately 6.7 percent of total county acreage.
- ❖ Between census years 1974 and 1992, farmland acreage in Dade County increased by nearly 10 percent. During the same period, the number of farms more than doubled, from 872 to 1,891. However, the average farm size decreased from 88 acres to 44 acres.
- ❖ In 1992, nearly 60 percent of all Dade County farms were nine acres or less in size. Only 13 percent were 50 acres or larger.
- ❖ Between 1987 and 1992, there was a 12 percent decline in harvested vegetable acreage in the county. However, the real value of vegetable production increased by 85 percent in the five year period between 1987 and 1992.
- ❖ Acreage devoted to fruit production steadily increased, by over 65 percent, between census years 1974 and 1987, but declined slightly from 1987 to 1992. The Agricultural Census reports 16,507 acres of fruit crops in 1992, but a comprehensive, post hurricane survey by the University of Florida estimated acreage at just over 13,000 acres. The value of fruits produced in Dade County decreased by about 40 percent between 1987 and 1992, reflecting crop losses caused by Hurricane Andrew.
- ❖ Commercial ornamental horticulture acreage increased by nearly 40 percent between 1987 and 1992. The value of nursery production during the same time period increased by nearly 20 percent.
- ❖ Census data showed that field crops continued a steep decline in terms of acreage. Total field crop acreage dropped from 6,739 acres in 1987 to 1,487 acres in 1992.

For the economic impact analysis, official 1995-96 season or calendar year 1996 estimates of individual commodity production values were used when available. Unofficial sources, including growers, shippers and packers, were consulted to estimate acreages and values for those commodities for which there were no official estimates and the proportion of all commodities shipped out of the county.

- ❖ There were at least 18 different traditional vegetables commercially grown in Dade County. During 1996, the estimated value of these traditional vegetables was 174 million of which approximately 98 percent was shipped out of the county. With respect to value, the top four traditional vegetable commodities were tomatoes, green beans (bush and pole), potatoes, and squash.

- ❖ The value of traditional vegetable crops declined by about 35 percent between the 1988-89 and 1995-96 seasons, reflecting lower acreages and perhaps lower prices. This decline is likely due to increased competition from Mexico and other off-shore sources of winter vegetables.
- ❖ More than a dozen tropical and specialty vegetables, as well as a variety of herbs and spices are grown. The estimated value of tropical vegetables, herbs and spices sold during 1996 was about \$25 million, down from \$26 million in 1988-89. About 90 percent of sales are made outside Dade County. Malanga, boniato, and calabaza constituted most of the tropical vegetable production, but significant quantities of Asian vegetables and spices were produced as well.
- ❖ Of approximately 19 commercially grown tropical fruits, the highest value crops are carambola, avocados and limes. Tropical fruit sales for 1995-96 were estimated at \$56 million, down from \$74 million in 1988-89. Most of the decline is due to acreage losses caused by Hurricane Andrew, reduced yields of groves severely damaged by the storm and to low yields of immature groves planted after the hurricane. Approximately 90 percent of all tropical fruits are shipped out of the county.
- ❖ A survey of nurseries in Dade County showed dramatic growth of the industry from 1989 to 1996. Acreage increased by 42 percent, from about 6,100 to 8,668 acres.
- ❖ The value of nursery sales per acre across all production systems increased by over 9 percent, from about \$28,000 to \$30,650.
- ❖ Nursery sales in 1996 totaled \$265.6 million, up from \$171 million in 1988-89, a 55 percent increase. About 74 percent of sales, \$196.6 million, are made outside of Dade County.

INTRODUCTION

Despite the fact that Dade County is the most populous urban center in Florida, it is also a major producer of agricultural products. According to the most recent official agricultural census, Dade County ranked second in the state in terms of the size of its agricultural industry with products valued at \$357 million in 1992. Even though this figure is impressive, there is reason to believe that published estimates significantly underreport the economic value of agriculture in Dade County due to the non-traditional nature of Dade County agriculture. As a result, estimates of agricultural activity that attempt to quantify the economic importance of agriculturally related activities in the county (e.g. input supply, transportation, marketing, etc.) may be significantly underestimated as well.

OBJECTIVES

This study was undertaken to provide a more complete understanding of agriculture and agribusiness and their economic importance to Dade County. Information obtained may be used by policy makers and industry officials to consider a broad range of policies affecting the interests of agricultural producers, agribusiness firms, and citizens of the county.

Specific objectives were to: (1) identify the major elements of agricultural production and agribusiness, (2) assemble available published and unpublished data for the major agricultural and agribusiness elements, (3) identify potential sources of primary economic data to supplement secondary data as necessary, (4) determine the aggregate economic impact of the agricultural sector and estimate economic interrelationships with other sectors of the county's economy, and (5) prepare descriptive profiles and specific estimates of economic impacts for individual sectors as resources permitted.

PROCEDURES

The elements of the agricultural and agribusiness industry were identified through personal interviews of individuals familiar with Dade County agriculture. Field work was conducted in Dade County in cooperation with the Dade County extension staff and faculty of the University of Florida's Tropical Research and Education Center (TREC) in Homestead. The major focus was on row crops (including traditional and tropical vegetables), tree crops, and ornamental horticulture. Interviews were conducted with members of the agricultural community and officials of the Cooperative Extension Service, the Florida Department of Agriculture and Consumer Services, Federal agricultural agencies, trade associations, and other local business and government sources. Interviews provided leads for obtaining published and unpublished data.

Objectives 2 and 3 were met through personal interviews described above. Published data were evaluated for accuracy and refined to meet the requirements of input-output analysis. For example, published estimates of farm values of various crops were adjusted to reflect values at the shipping point. Data for making such adjustments were obtained from trade associations or shippers as required.

Objective 4 was largely achieved through the use of macroeconomic analytical techniques, primarily input-output analysis. This technique allowed economic interrelationships existing between agriculture and other sectors of the economy to be estimated. Analysis employed an existing input-output model of the Dade County economy estimated by the U.S. Department of Commerce (23).

The remainder of this report is organized into two major sections: "Economic Impact of Agriculture Upon Dade County's Economy" and "An Overview of Agricultural Production in Dade County." The first and most important section discusses the analysis of the agricultural sector's impact on Dade County's economy. The second section provides a brief physical description of the county as it pertains to the agricultural sector, and supporting production and value data for selected commodities produced in the county.

ECONOMIC IMPACT OF AGRICULTURE UPON DADE COUNTY'S ECONOMY

Overview of Input/Output Analysis

The purpose of economic impact analysis is to help planners, analysts, and interested individuals estimate the total economic effect that a particular sector or industry has upon a region's economy, and to aid in understanding how a particular sector relates to other sectors of the local economy. The agricultural sector of Dade County's economy "exports" commodities to locations outside of the county. These "exports," in turn, affect the county's economy by stimulating additional local economic activity, as dollars generated from sources outside Dade are used for purchases within the county.

When Dade's agricultural commodities are sold outside the county, the agricultural industry directly affects the region's economic activity by bringing new dollars into the county. These direct effects then produce indirect impacts or effects on the regional economy as dollars generated by external sales are used for local purchases. For example, farmers spend money for wage payments in all phases of agricultural production from land preparation, planting and harvesting to transporting produce to warehouse facilities for storage and subsequent packaging and processing for export out of the county. Indirect impacts include goods and services provided by local businesses to the agricultural sector, such as business services, sale of inputs, and sale of parts and repair services. These indirect effects represent additional economic activity and result in additional jobs and income for local residents, generated from external sales by the agricultural industry.

In addition to direct and indirect effects, there are also induced effects or impacts associated with the production of agricultural commodities. Induced effects represent the spending activities of employees who earn income in jobs provided by the businesses involved, either directly or indirectly, in the production of regional (agricultural) exports. This induced effect is income that is spent by consumers on the local purchase of goods and services.

The total economic impact that agriculture has upon Dade County's economy is the combined direct, indirect, and induced effects. For example, if for some reason agricultural "export" sales increase and local production expands, then the increase in sales represents new direct economic activity and increased local expenditures for labor and other agricultural inputs.

This increased activity then triggers a chain of increased local spending by service and input supply industries as they increase their output and local purchases in order to supply increased demands of the agricultural sector. This expansion, in turn, leads to increased output and local purchases by firms supplying the input and service businesses. For example, a local tire business might experience increased sales (indirect effect) because it supplies the local transport company that provides freight services for agricultural producers. At the same time, tire sales personnel spend income for a variety of local goods and services, one example could be purchases of health services (induced effect). Thus, each dollar in additional sales, when spent locally, triggers a chain reaction of additional indirect and induced spending activities.

Total economic repercussions associated with an additional dollar of external sales is referred to as the multiplier effect. The multiplier for a particular industry is the total economic activity (direct, indirect, and induced) associated with an additional dollar of external sales by the industry in question. As illustrated earlier, an increase in export sales has repercussions via additional economic activity within the region. On the other hand, the converse is also true. A decrease in agricultural export sales will have economic repercussions in the form of decreases in regional economic activity. The multiplier therefore measures the impact of either an increase or a decrease in export sales activities.

Additional economic activity is not infinite in its ripple effect through the economy. Some dollars earned in the direct activity are not spent locally. A part of direct sales dollars are used for such things as taxes and fees paid to state and federal agencies, payments to landowners who reside outside the county, and as payment for goods and services which are imported into Dade County (seed purchased from mid-west companies, externally located computer consultants servicing equipment, etc). The size of the multiplier associated with increased/decreased regional export sales varies with the size of the region and with the industry in question. In general, the larger and more diverse the economy of the region and the more complex the industry in terms of its linkages to other local industries, the larger the multiplier effect.

The means of estimating the economic impact that the agricultural sector has upon the county is through use of multipliers based on regional input-output (I-O) models. The foundation

of the I-O model is a transactions table structured like a mileage chart on a road map. Each industry (or sector) in the region is listed as a selling industry in a row and as a purchasing industry in a column of the table. Entries in the table indicate the distribution of sales and the pattern of purchases for each sector of the regional economy. For example, agricultural products and services is treated as one sector, real estate as a sector, wholesale trade as a sector, etc. until the entire local economy is divided into economic sectors producing similar products. Households are considered a separate sector which purchases goods and services and sells labor. In effect, the transactions table provides a picture of interactions between local sectors and allows the flow of dollars to be traced through the economy. Multipliers are calculated based on the information generated from the transactions table.

Because they are dollar multiples of the initial dollar spent for the output (sales) of the industry, total changes in output are referred to as output multipliers. Earnings multipliers for the agricultural industry in Dade County show the total earnings (direct, indirect, and induced) by households in Dade County in order for the agricultural sector to deliver a dollar of sales outside the county (Table 1).

Table 1. Multipliers used to estimate the economic impact of Dade County's agricultural sector.

Impact area	Agricultural Subsectors		
	Fruits	Vegetables	Nurseries
	(- - - - -Multipliers- - - - -)		
Output multipliers	1.9200	1.7481	1.6202
Earnings multipliers	0.5078	0.4253	0.4446

In addition to output and earnings impacts, changes in agricultural sales also have multiplier

effects on employment in other sectors of the local economy. However, as will be noted later, data problems prevent the estimation of employment impacts as a part of this study. For this study, Dade County's agricultural sector consists of three subsectors: (1) vegetable production, (2) fruit production, and (3) commercial ornamental horticulture. Multipliers for subsectors of Dade County's agricultural sector (Table 1) were estimated by the Bureau of Economic Analysis of the U.S. Department of Commerce using their Regional Input-Output Modeling System (RIMS II) (23).

In order to estimate the impact that agricultural production had upon Dade County's economy during the 1995-96 production season, (calendar 1996 for nursery crops) total gross sales were estimated for each subsector, i.e., vegetables, fruits, and commercial ornamental horticulture. For the purpose of describing the agricultural industry, vegetable production was disaggregated to include itemization of traditional vegetable and tropical vegetable production. However, for the impact analysis, vegetable production is aggregated into one subsector.

Since economic impact analysis estimates an industry's affect upon regional economic activity when products or commodities are exported from the region (county), it is the dollar amounts of total gross sales (for each subsector: vegetables, fruits, and commercial ornamental horticulture) shipped out of Dade County that are used (Table 2, Figures 1-5).

The amount of total gross sales of each subsector that remains in Dade County (dollars generated from local, in-county sales) is added back into the output impact calculation to show the total output impact of the sector. That is to say, local sales do not generate new activity or rather do not bring in new dollars into the county. They do represent local economic activity and are simply added, without a multiplier effect, back into the estimated output impact calculation from the I/O model.

Figure 1. A comparison of values of traditional vegetable production, 1988-89 and 1995-96.

Figure 2. A comparison of the values of tropical vegetable production, 1988-89 and 1995-96.

Figure 3. A comparison of the value of tropical fruit production, 1988-89 and 1995-96.

Figure 4. A comparison of nursery crop production, 1988-89 and 1995-96.

Figure 5. Total value of production by agricultural subsector, Dade County, 1995-96, million dollars.

Table 2. Total value of production by agricultural subsector, Dade County, 1995-96.

Subsector	Value of crop sold outside of Dade	Value of crop sold within Dade	Total crop value
	(- - - - - Thousand Dollars ^a - - - - -)		
Traditional vegetables	171,128.6	3,092.8	174,221.4
Tropical vegetables	22,375.7	2,669.3	25,045.0
Subtotal	193,504.3	5,762.1	199,266.4
Tropical fruits	50,548.9	5,587.0	56,135.5
Nursery crops	196,590.2	69,072.2	265,662.5
Totals	440,643.4	80,421.3	521,064.7

^aTotals may not sum due to rounding.

Table 3. Subsector contribution and economic impacts of agriculture on Dade County, 1996.

	Agricultural Subsectors			Total
	Fruits	Vegetables	Nurseries	
Total sales outside region	\$50,548,600	\$193,504,300	\$196,590,200	\$440,643,100
Percentage of total ^a	11.47%	43.91%	44.61%	
<u>Output</u>				
Multiplier	1.92	1.7481	1.6202	
Output impact	\$97,053,312	\$338,264,867	\$318,515,442	\$753,833,621
Percentage of total ^a	12.87%	44.87%	42.25%	
<u>Earnings</u>				
Multiplier	0.5078	0.4253	0.4446	
Earnings impact	\$25,668,579	\$82,297,379	\$87,404,003	\$195,369,961
Percentage of total	13.14%	42.12%	44.74%	
Sales within Dade County	\$5,587,000	\$5,762,100	\$69,072,200	\$80,421,300
Total output impact	\$102,640,312	\$344,026,967	\$387,587,642	\$834,254,921
Percentage of total	12.30%	41.24%	46.46%	

^aPercentages do not sum to 100.0 due to rounding.

Results of Economic Impact Analysis

Table 3 summarizes the impacts of agricultural subsectors on the Dade County economy and includes respective subsector multipliers. Impacts for output and earnings are reported separately for each agricultural subsector and for the agricultural industry in total.

Output Impact

Output multipliers in Table 3 (from Table 1) estimate the total changes in output that occur in all Dade County industries for each additional dollar of output that the agricultural subsectors deliver outside Dade County. Vegetable production exported (sold) outside Dade County during 1995-96 totaled \$193,504,300. The output multiplier for vegetables is 1.7481 indicating that each dollar in vegetable sales outside Dade County has a local impact of \$1.75. Thus, multiplying gross export sales (output) of vegetables times the output multiplier results in vegetable production during 1995-96 having an estimated economic impact of \$338,264,867. Similarly, export fruit production estimated at \$50,548,600 times the output multiplier for fruits (1.92) equals an estimated economic impact of \$97,053,312 during the 1995-96 season; nursery export sales estimated at \$196,590,200, times the nursery output multiplier of 1.6202 equals an estimated economic impact of \$318,515,442 for the 1995-96 production season.

To obtain the total output impact for each subsector, the amount of output that remains within the county is added back to the (I/O model) output impact estimates. For fruits, there is a total economic impact of \$102,640,312 during the 1995-96 production season. Similarly, for vegetables, the total output impact for 1995-96 was \$344,026,967 of, and for nursery and greenhouse production, the total output impact for 1995-96 was \$387,587,642. The combined total output impacts from fruits, vegetables and nursery production indicate that the agricultural sector of Dade County had a total output impact of \$834,254,921 during the 1995-96 production season.

Earnings Impact

Earnings multipliers for a particular subsector provide an estimate of the earnings generated in all Dade County industries in order for each agricultural subsector to deliver a dollar of output to final demand. Or stated differently, earnings multipliers for each subsector can be viewed as estimates of the total (direct, indirect, and induced) dollar changes in earnings that

occur in Dade County households for each additional dollar of output (sales) the agricultural subsectors deliver outside the county. To illustrate, for the nursery and greenhouse subsector, the earnings multiplier is 0.4446 (Table 3) which is interpreted as follows: for each additional dollar of export sales the nursery subsector delivers, \$0.44 in earnings is generated in all Dade County industries. Similarly, for each additional dollar of export sales delivered by the vegetable industry and the fruit industry, there is approximately \$0.43 and \$0.51, respectively, in earnings generated in Dade County industries.

The total impact (generated from external sales) that the agricultural sector had upon Dade County earnings during 1995-96 was \$195,369,961. A summation of earnings or income impacts in 1995-96 are as follows: (a) nurseries \$87,404,003, (b) vegetables \$82,297,379, and (c) fruits \$25,668,579. Estimates do not include earnings generated by sales made within Dade County.

Employment Impacts

As noted earlier, employment impacts are not estimated in this study due to data problems. Between the time of this study and that of the 1990 Dade County economic impact study, the methodology for estimating employment effects was changed. As a result, the use of RIMSII employment multipliers here would yield estimates that are inconsistent with estimates from earlier studies.

Further, there are equally severe problems with agricultural employment data from other sources. Data reflecting employment covered by unemployment compensation are reported at the county level for a sector which combines agriculture, forestry and fisheries. However, these data likely understate agricultural employment, due to the seasonal and part-time nature of much agriculture employment. There also may be problems with the classification of employees by sector where one firm conducts economic activities that could be classified in more than one sector.

Problems with employment data were recognized in an earlier study of agricultural impacts in southwest Florida (19). That study is now being supplemented with a detailed study of agricultural labor in the same area being conducted by University of Florida researchers in the Department of Food and Resource Economics and the Southwest Research and Education

Center. Results should provide more insight into the accuracy and comparability of agricultural data.

Economic Interrelationships

In addition to total impacts noted above, Tables 4-5 illustrate the interrelationships between the three agricultural subsectors and each of 37 other sectors of the Dade County economy for output and earnings. Sectors are listed on the left of each table and the three agricultural subsectors are listed across the top. The final row of each table reflects the total impacts for each agricultural subsector, and the final column reflects the total agricultural impact on other sectors of the local economy. Numbers in the tables reflect that part of the total agricultural impact which occurs in the sector listed for a particular row. Each table (Tables 4-5) shows the disaggregated multiplier value for each agricultural sector and dollar impacts for each sector. Disaggregated impacts are reported only for external sales.

The greatest amount of economic activity generated by agriculture in the county occurs within the agricultural sector itself. For example, of the \$97 million economic impact generated by fruit production export sales, about \$60 million occurs within the agricultural sector. With respect to interrelationships with other sectors of Dade County's economy, the real estate sector is the second most important sector affected by agricultural output. For example, of the \$1.75 of total economic activity generated by a dollar of export sales from vegetable production approximately \$0.12 of this is economic activity which occurs within the real estate sector. Stated differently, this indicates that for every dollar of export sales produced by the vegetable industry in Dade County, approximately \$0.12 of economic activity is generated in the real estate sector. Similarly, for every dollar of export sales from nursery production, approximately \$0.09 of economic activity is generated in the real estate sector and fruit sales generates \$0.12 in the real estate sector. The household sector row of each table sums the impact on Dade County households of the output and earnings impacts reflected in sectors 1 through 37.

In a manner similar to that for output above, Table 5 desegregates the earnings impact across 38 sectors of the Dade economy. To illustrate the economic interrelationships with other sectors of Dade County's economy, for each additional dollar of sales outside the county that fruit

production delivers, there is an estimated \$0.02 of earnings generated in retail trade industries by the fruit sector. Similarly, for each dollar of external sales that nurseries deliver, there is an estimated \$0.02 of earnings in the wholesale trade sector. In each case estimates include direct, indirect, and induced activity.

Table 4. Agricultural sector's impact on output by industry, Dade County, 1996.

	Agricultural Subsector						Total (Dollars)
	Fruits (Dollars)		Vegetables (Dollars)		Nursery (Dollars)		
Total sales outside region	\$50,548,600		\$193,504,300		\$196,590,200		\$440,643,100
Industry aggregation	Multiplier	Impact *	Multiplier	Impact *	Multiplier	Impact *	(Dollars)
		(Dollars)		(Dollars)		(Dollars)	
1 Farm products & Ag, Forestry & Fishery Services	1.1867	\$59,986,024	1.144	\$221,368,919	1.0882	\$213,929,456	\$495,284,398
2 Forestry and fishing products	0	\$0	0	\$0	0	\$0	\$0
3 Coal mining	0	\$0	0	\$0	0	\$0	\$0
4 Oil and gas extraction	0	\$0	0	\$0	0	\$0	\$0
5 Metal mining and nonmetallic minerals	0.0011	\$55,603	0.0011	\$212,855	0.0006	\$117,954	\$386,412
6 Construction	0.0182	\$919,985	0.0162	\$3,134,770	0.0124	\$2,437,718	\$6,492,473
7 Food and kindred products and tobacco prod.	0.0129	\$652,077	0.0108	\$2,089,846	0.0111	\$2,182,151	\$4,924,075
8 Textile mill products	0.0033	\$166,810	0.0028	\$541,812	0.002	\$393,180	\$1,101,803
9 Apparel and other textile products	0.0138	\$697,571	0.0123	\$2,380,103	0.0073	\$1,435,108	\$4,512,782
10 Paper and allied products	0.0113	\$571,199	0.0124	\$2,399,453	0.0018	\$353,862	\$3,324,515
11 Printing and publishing	0.0125	\$631,858	0.0101	\$1,954,393	0.0091	\$1,788,971	\$4,375,222
12 Chemical and allied products; petroleum and coal products	0.0092	\$465,047	0.0067	\$1,296,479	0.0049	\$963,292	\$2,724,818
13 Rubber; misc plastic; leather and leather products	0.0032	\$161,756	0.0034	\$657,915	0.0032	\$629,089	\$1,448,759
14 Lumber and wood products; furniture and fixtures	0.0035	\$176,920	0.0016	\$309,607	0.0016	\$314,544	\$801,071
15 Stone, clay and glass products	0.0009	\$45,494	0.0008	\$154,803	0.0006	\$117,954	\$318,251
16 Primary metal industries	0.0001	\$5,055	0.0001	\$19,350	0.0001	\$19,659	\$44,064
17 Fabricated metal products	0.0014	\$70,768	0.0011	\$212,855	0.0009	\$176,931	\$460,554
18 Industrial machinery and equipment	0.0012	\$60,658	0.0011	\$212,855	0.0007	\$137,613	\$411,126
19 Electronic and other electric equipment	0.0007	\$35,384	0.0006	\$116,103	0.0005	\$98,295	\$249,782
20 Motor vehicles and equipment	0.0003	\$15,165	0.0002	\$38,701	0.0002	\$39,318	\$93,183
21 Other transportation equipment	0.0013	\$65,713	0.001	\$193,504	0.0012	\$235,908	\$495,126
22 Instruments and related products	0.0010	\$50,549	0.0008	\$154,803	0.0008	\$157,272	\$362,624
23 Miscellaneous manufacturing industries	0.0013	\$65,713	0.0011	\$212,855	0.001	\$196,590	\$475,158

Table 4. Agricultural sector's impact on output by industry, Dade County, 1996 (continued).

	Agricultural Subsector						Total (Dollars)
	Fruits (Dollars)		Vegetables (Dollars)		Nursery (Dollars)		
Total sales outside region	\$50,548,600		\$193,504,30		\$196,590,200		\$440,643,100
Industry aggregation	Multiplier	Impact * (Dollars)	Multiplier	Impact * (Dollars)	Multiplier	Impact * (Dollars)	(Dollars)
24 Transportation	0.0390	\$1,971,395	0.0328	\$6,346,941	0.0333	\$6,546,454	\$14,864,790
25 Communications	0.0254	\$1,283,934	0.0214	\$4,140,992	0.0209	\$4,108,735	\$9,533,662
26 Electric, gas and sanitary services	0.0210	\$1,061,521	0.0167	\$3,231,522	0.0274	\$5,386,571	\$9,679,614
27 Wholesale trade	0.0949	\$4,797,062	0.0576	\$11,145,848	0.057	\$11,205,641	\$27,148,551
28 Retail trade	0.0565	\$2,855,996	0.0473	\$9,152,753	0.0485	\$9,534,625	\$21,543,374
34 Business services	0.0519	\$2,623,472	0.0434	\$8,398,087	0.0342	\$6,723,385	\$17,744,944
35 Eating and drinking places	0.0304	\$1,536,677	0.0252	\$4,876,308	0.0253	\$4,973,732	\$11,386,718
36 Health services	0.0504	\$2,547,649	0.0422	\$8,165,881	0.0441	\$8,669,628	\$19,383,159
37 Miscellaneous services	0.0395	\$1,996,670	0.0331	\$6,404,992	0.029	\$5,701,116	\$14,102,778
38 Private households **	0.5078	\$25,668,579	0.4253	\$82,297,379	0.4446	\$87,404,003	\$195,369,961
Totals		\$97,053,312		\$338,264,867		\$318,515,442	\$753,833,621

* Impact equals sales outside the county times the multiplier value.

**Totals in the impact columns do not include the household sector.

Table 5. Agricultural sector's impact on earnings by industry, Dade County, 1996.

	Agricultural Subsector						Total (Dollars)
	Fruits (Dollars)		Vegetables (Dollars)		Nursery (Dollars)		
Total sales outside region	\$50,548,600		\$193,504,300		\$196,590,200		\$440,643,100
Industry aggregation	Multiplier	Impact * (Dollars)	Multiplier	Impact * (Dollars)	Multiplier	Impact * (Dollars)	(Dollars)
1 Farm products & Ag, Forestry & Fishery Services	0.3144	\$15,892,480	0.2708	\$52,400,964	0.3031	\$59,586,490	\$127,879,934
2 Forestry and fishing products	0	\$0	0	\$0	0	\$0	\$0
3 Coal mining	0	\$0	0	\$0	0	\$0	\$0
4 Oil and gas extraction	0	\$0	0	\$0	0	\$0	\$0
5 Metal mining and nonmetallic minerals	0.0002	\$10,110	0.0003	\$58,051	0.0001	\$19,659	\$87,820
6 Construction	0.0049	\$247,688	0.0044	\$851,419	0.0033	\$648,748	\$1,747,855
7 Food and kindred products and tobacco prod.	0.0016	\$80,878	0.0013	\$251,556	0.0013	\$255,567	\$588,001
8 Textile mill products	0.0006	\$30,329	0.0005	\$96,752	0.0004	\$78,636	\$205,717
9 Apparel and other textile products	0.0029	\$146,591	0.0026	\$503,111	0.0014	\$275,226	\$924,928
10 Paper and allied products	0.0020	\$101,097	0.0022	\$425,709	0.0003	\$58,977	\$585,784
11 Printing and publishing	0.0030	\$151,646	0.0024	\$464,410	0.0022	\$432,498	\$1,048,555
12 Chemical and allied products; petroleum and coal products	0.0015	\$75,823	0.0011	\$212,855	0.0008	\$157,272	\$445,950
13 Rubber; misc plastic; leather and leather products	0.0006	\$30,329	0.0007	\$135,453	0.0006	\$117,954	\$283,736
14 Lumber and wood products; furniture and fixtures	0.0009	\$45,494	0.0004	\$77,402	0.0004	\$78,636	\$201,532
15 Stone, clay and glass products	0.0002	\$10,110	0.0002	\$38,701	0.0001	\$19,659	\$68,470
16 Primary metal industries	0	\$0	0	\$0	0	\$0	\$0
17 Fabricated metal products	0.0003	\$15,165	0.0003	\$58,051	0.0002	\$39,318	\$112,534
18 Industrial machinery and equipment	0.0003	\$15,165	0.0003	\$58,051	0.0002	\$39,318	\$112,534
19 Electronic and other electric equipment	0.0002	\$10,110	0.0001	\$19,350	0.0001	\$19,659	\$49,119
20 Motor vehicles and equipment	0	\$0	0	\$0	0	\$0	\$0
21 Other transportation equipment	0.0003	\$15,165	0.0002	\$38,701	0.0003	\$58,977	\$112,843
22 Instruments and related products	0.0002	\$10,110	0.0002	\$38,701	0.0002	\$39,318	\$88,129
23 Miscellaneous manufacturing industries	0.0003	\$15,165	0.0002	\$38,701	0.0002	\$39,318	\$93,183
24 Transportation	0.0126	\$636,912	0.0106	\$2,051,146	0.0104	\$2,044,538	\$4,732,596
25 Communications	0.0048	\$242,633	0.004	\$774,017	0.0039	\$766,702	\$1,783,352

Table 5. Agricultural sector's impact on earnings by industry, Dade County, 1996 (continued).

	Agricultural Subsector						Total (Dollars)
	Fruits (Dollars)		Vegetables (Dollars)		Nursery (Dollars)		
Total sales outside region	\$50,548,600		\$193,504,300		\$196,590,200		\$440,643,100
Industry aggregation	Multiplier	Impact * (Dollars)	Multiplier	Impact * (Dollars)	Multiplier	Impact * (Dollars)	(Dollars)
26 Electric, gas and sanitary services	0.0032	\$161,756	0.0025	\$483,761	0.0035	\$688,066	\$1,333,582
27 Wholesale trade	0.0296	\$1,496,239	0.018	\$3,483,077	0.0178	\$3,499,306	\$8,478,622
28 Retail trade	0.0221	\$1,117,124	0.0185	\$3,579,830	0.019	\$3,735,214	\$8,432,167
29 Depository & nondepository institutions; securities brokers	0.0126	\$636,912	0.0106	\$2,051,146	0.0091	\$1,788,971	\$4,477,029
30 Insurance	0.0095	\$480,212	0.0068	\$1,315,829	0.0051	\$1,002,610	\$2,798,651
31 Real estate	0.0028	\$141,536	0.0029	\$561,162	0.0017	\$334,203	\$1,036,902
32 Hotels & lodging; amusements; recreation services	0.0050	\$252,743	0.004	\$774,017	0.0033	\$648,748	\$1,675,508
33 Personal services	0.0049	\$247,688	0.0039	\$754,667	0.0032	\$629,089	\$1,631,444
34 Business services	0.0224	\$1,132,289	0.0186	\$3,599,180	0.0152	\$2,988,171	\$7,719,640
35 Eating and drinking places	0.0089	\$449,883	0.0073	\$1,412,581	0.0074	\$1,454,767	\$3,317,231
36 Health services	0.0236	\$1,192,947	0.0198	\$3,831,385	0.0207	\$4,069,417	\$9,093,749
37 Miscellaneous services	0.0108	\$545,925	0.0089	\$1,722,188	0.0084	\$1,651,358	\$3,919,471
38 Private households **	0.0009	\$45,494	0.0007	\$135,453	0.0008	\$157,272	\$338,219
Totals		\$25,638,250		\$82,161,926		\$87,266,390	\$195,066,565

* Impact equals sales outside the county times the multiplier value.

**Totals in the impact columns do not include the household sector.

Summary of Economic Impact Analysis & Comparison to 1990 Study

Of the total \$834 million economic impact on Dade County output, in 1995-96, the fruit industry contributed 12.3 percent or \$102.6 million (Table 3), the vegetable industry contributed 41.2 percent or \$344 million, and the nursery industry contributed 46.5 percent or \$387.6 million of the total output. This pattern of subsector contribution is similar for earnings impacts. Agriculture's impact on Dade County earnings totaled \$195 million in 1995-96. Approximately 13.1 percent of the earnings impact was generated by the fruit subsector (\$25.7 million), 42.1 percent or \$82.3 million by the vegetable industry, and 44.7 percent or \$87.4 million by nursery production.

Table 6 provides a comparison between estimates presented here and those for 1988-89 presented in a 1990 study of agricultural impacts in Dade County. The earlier study reported a total output impact of \$910.1 million compared to \$834.3 million reported here, a decline of more than eight percent. Similarly, the current study provides a lower estimate of earnings impact, \$195.4 million compared to \$297.2 million in the earlier study, a decline of approximately 34 percent.

Also, the mix of impacts between the three agricultural subsectors changed between 1988-89 and 1995-96. Vegetables provided 56 percent of output impacts and 61 percent of earnings impacts in 1988-89. By 1995-96 these percentages had declined to 41 percent for output impacts and 42 percent for earnings. The fruit sector declined slightly in terms of absolute impacts on output and earnings between the time of the two studies but remained relatively constant at around 13 percent of total impacts. The nursery sector's impact increased in both relative and absolute terms. In 1995-96 the nursery sector accounted for 46 percent of total agricultural impacts and 44 percent of total earnings impacts.

Table 6. A summary of agriculture's impact on Dade County's economy by agricultural sector, 1988-89 and 1995-96.

Sector	Total Output				Earnings			
	1988-89		1995-96		1988-89		1995-96	
	Percent	Million Dollars	Percent	Million Dollars	Percent	Million Dollars	Percent	Million Dollars
Fruit	14.0	127.5	12.3	102.6	13.3	39.6	13.1	25.7
Vegetable	56.2	511.4	41.2	344.0	61.0	181.2	42.1	82.3
Nursery	<u>29.8</u>	<u>271.2</u>	<u>46.5</u>	<u>387.6</u>	<u>25.7</u>	<u>76.4</u>	<u>44.7</u>	<u>87.4</u>
Totals ^a	100.0	910.1	100.0	834.3	100.0	297.2	100.0	195.4

^aTotals may not sum to 100 due to rounding.

Examination of the F.O.B. sales data for each of the major agricultural subsectors reveals where major changes have occurred in Dade County's agricultural economy since the 1988-89 economic impact study (Figures 1-4, Table 7). The declines in total economic impact (output) and earnings impact are directly attributable to drastically reduced value of production in the vegetable and fruit subsectors. Traditional vegetables showed the largest decline in total value of production, going from \$267.3 million in 1988-89 to \$174.2 million in 1995-96, a drop of over \$93 million, or approximately 35 percent (Table 7). The crops showing the greatest declines were tomatoes (\$42.8 million) snap beans (\$19.0 million) squash (\$10.3 million) and potatoes (\$6.2 million) and cukes (\$2.8 million). Only sweet corn and eggplant increased in total value of production, by \$1.7 and 0.7 million, respectively. The reason for the lower values of production vary from crop to crop, but most stem from lower acreage and prices. Although determining the reasons for lower acreages and prices was outside the scope of this study, these effects are likely due to increased competition from imports.

The total value of tropical vegetable production dropped slightly from 1988-89 to 1995-96, from \$26 million to \$25 million. Boniato was the only one of the four tropical vegetable crops to show a gain, however. While the value of the boniato crop doubled due to price increases, the value of malanga, calabaza and cassava dropped by 18, 78 and 85 percent, respectively. These crops have also been negatively impacted by import competition in recent years.

The value of tropical fruit production dropped from \$74 million in 1988-89 to \$56.1 million in 1995-96. Most of this decrease is directly attributed to Hurricane Andrew; nearly 40 percent of the county's tropical fruit acreage was lost to the storm, and during the 1995-96 season total grove acreage was still 34 percent below pre-hurricane levels. Further, yields were lower than normal because many trees that had been replanted following the hurricane had not reached maturity, and older trees damaged by the storm had not fully recovered.

Fortunately, the nursery subsector showed very large gains, largely offsetting the lower values for vegetable and fruit crops. Total nursery sales increased by over \$94 million from 1989 to 1996, a 55 percent increase and over \$75 million in sales were made outside Dade County (Table 7).

Additional details on major, specific crops within each of the agricultural subsectors are found in the following section "Descriptive Overview of Agriculture in Dade County."

Table 7. F.O.B. sales by major agricultural subsector, Dade County, 1988-89 and 1995-96 seasons.

Agricultural subsector	Season 88-89	Season 95-96	Change, 1988-89 to 1995-96	
	(----Million Dollars----		(Million)	(Percent)
<u>Fruit</u>				
Sales Outside Dade County	64.9	50.5	-14.4	-22.2
Sales Within Dade County	<u>9.1</u>	<u>5.6</u>	<u>-3.5</u>	<u>- 38.5</u>
Totals	74.0	56.1	-17.9	-24.2
<u>Traditional vegetable</u>				
Sales Outside Dade County	262.5	171.1	-91.4	-34.6
Sales Within Dade County	<u>4.8</u>	<u>3.1</u>	<u>-1.7</u>	<u>35.4</u>
Totals	267.3	174.2	-93.1	-34.8
<u>Tropical vegetables</u>				
Sales Outside Dade County	18.2	22.4	4.2	+23.1
Sales Within Dade County	<u>7.8</u>	<u>2.7</u>	<u>-5.1</u>	<u>-65.4</u>
Totals	26.0	25.0	-1.0	-3.8
<u>Total vegetables</u>				
Sales Outside Dade County	280.7	193.5	87.2	-31.1
Sales Within Dade County	<u>12.6</u>	<u>5.8</u>	<u>-6.8</u>	<u>-54.0</u>
Totals	293.3	199.3	-94.0	-32.0
<u>Nursery</u>				
Sales Outside Dade County	120.9	196.6	+75.7	62.6
Sales Within Dade County	<u>50.6</u>	<u>69.1</u>	<u>+18.5</u>	<u>36.6</u>
Totals	171.4	265.7	+94.3	55.0

^aSome totals may not sum to values shown because of rounding.

DESCRIPTIVE OVERVIEW OF AGRICULTURE IN DADE COUNTY

In order to fully appreciate the environment in which agriculture exists in Dade County, it is helpful to first look at physical characteristics which contribute to the uniqueness of Dade County agriculture, and then review agriculture in the county from a historical perspective. The remainder of this report is devoted to describing Dade County agriculture by looking at its physical characteristics, its history and selected commodities which are currently produced in the county.

Physical Characteristics

Land Area and Population

Dade County covers 2,429.6 square miles or over one and one half million acres. However, about three-fourths of the land area in the county is either covered by water, in water conservation areas, in national parks, or is submarginal; i.e., unsuitable for urban or agricultural use (reference). There were approximately 83,700 acres of farm land in the county in 1992, an increase of about 600 acres over the 1987 Census of Agriculture (22). Nearly 22 percent of Dade County farmland is foreign-owned (1).

With 4 percent of the state's population, Dade county ranks first in state population, estimated to be over 2.0 million in 1996 (21). Dade County's populated area is located along the coastal ridge. With respect to number of persons per square mile, Dade is the fourth most densely populated county in the state, and Miami is the second most populous city in Florida with 376,000 inhabitants (1).

Soils

There are primarily two soil types on which Dade's fruits, vegetables, and nursery crops are grown: Miami oolite, a solid rockland soil and Perrine marl, both basically calcium carbonate. The marl and rockland farming soils are extremely low in organic matter and nutrients. Even with the use of summer cover crops, organic buildup in these soils is slow and requires good management year round. Both soil types are alkaline with pH of 7.5 to 8.5. Crops raised on either type of soil depend on commercial fertilizer applications for nutrients. The consistency of rockland and marl soils are quite different. The rock soil is hard but very porous and requires frequent irrigation. On the other hand, flooding can be a problem for the marl land because marl

is a dense soil and percolation is slow (18).

Most of Dade's winter vegetables are grown on rock soil. Rock soils are located inland on elevations ranging from eight to fourteen feet above sea level. Preparation of rock soils for cultivation is unique and expensive. The rock soils must be broken up with track-type tractors (D8 or D9 Caterpillars), with specially designed plows to scarify the solid rock into small particles. Tractor clearing of rockland started in 1920 in the area of Coral Gables. Until that time, rockland vegetable farming was impractical, but since 1947, vegetable acreage on the rockland has increased steadily. Prior to 1925, rockland vegetable farming in the South Dade pinelands was confined to "pot hole" areas in the pines. Farmers confined winter vegetable growing to the marl areas of the East Glade and the inland finger glades. Some growers followed these practices through 1935 and even later (3).

Perrine marl land must be contoured and shaped to allow appropriate runoff and drainage of excess water. Marl land used for cultivation ranges from elevations of one to two feet along the coastline to elevations up to seven and eight feet near the rock ridge and in the inland glades. As long as flooding is controlled, almost anything will grow on the marl. Potatoes, other root crops such as malanga and boniato, and large tree nurseries are currently found on marl lands.

Salt intrusion from hurricane storm surge can severely pollute the East Glade marl vegetable lands and tree farms. Due to the very slow leachability of marl soil, salt pollution may prevent land use for several years afterward. During the 1970s, a hurricane dike was built to deter salt intrusion, hoping to protect farmland and residences located near the coastline. Salt intrusion may also occur during severe droughts when the fresh water table declines.

Climate

Dade County, Florida is located on the lower east coast of the state at the bottom of a 400 mile long peninsula that is no more than 100 miles wide at its widest point. The Tropic of Cancer, 23.4 degrees North latitude, is approximately 140 miles south of Homestead. The county has a subtropical climate, wet and hot in the summer (May to November) and cool and dry through the winter (December to April). Average temperatures range from 67° F in January, steadily increasing to an average of 83° F in July and August, then again decreasing to the mid to low 70s during the fall. For Miami the average annual high temperature is 82.6° F and the

average annual low is 68.7° F, with the highest temperature of record (at the Miami International airport) being 98° F and the lowest temperature of record being 30° F (1). However, in the farming areas around Homestead, temperatures of 25° F and lower have been reported. Subfreezing temperatures may occur about every two years with moderate to severe damage to agricultural commodities. Frosts are recorded almost every winter. Droughts have influenced production practices and affect the area every few years. There is occasional flooding during the wet season, which lasts from June through October. The greatest amount of rainfall generally occurs in September and October. Average annual rainfall is approximately 58 inches (38), with as much as 100 inches reported in the Homestead area in the early 1970s (18).

Irrigation

Low rainfall during the dry season combined with the porous nature of the rock soils necessitates the use of irrigation. Irrigation systems, therefore, play an important role in agricultural production in Dade County. Encased wells for portable overhead high-pressure volume gun irrigation rigs are used primarily for winter vegetable production. Permanent solid set sprinkler irrigation is used in the production of fruits and nursery crops. Permanent and portable solid set sprinklers also provide frost and freeze protection for many crops. Trickle and drip low-volume irrigation systems are also used by farmers in Dade County. Farmers and researchers are converting irrigation systems to low-volume systems due to recent droughts, water restrictions, and increased urban water use.

Natural disasters

Although Dade County enjoys a highly productive sub-tropical growing environment, the area is also susceptible to a wide range of potentially devastating natural disasters, such as hurricanes, floods, droughts and freezing temperatures.

Hurricanes--Hurricanes have had devastating effects on Dade County and on the agricultural sector in particular. Hurricane Andrew, which struck the Homestead area on August 24, 1992 was the most destructive hurricane to ever hit the U.S. Andrew caused an estimated \$25 billion in damage, and effects are still evident in some tropical fruit groves even though five years have elapsed. Grove crops and ornamental plant nurseries were particularly hard hit by Andrew. Approximately 57 percent of the lime acreage was destroyed, as was about one-third of the

mango and avocado acreage. Many other types of tropical fruit groves were heavily damaged as well (5). Nurseries also sustained heavy losses of shade houses, greenhouses and plant material.

Andrew was particularly shocking to many south Florida residents, including agricultural producers, because there had not been any serious hurricane damage in the area since the 1960s. Until Andrew, the last hurricanes to cause damage were Donna in 1960, Betsy in 1965 and Inez in 1966. Hurricane Donna was the most damaging of storms to hit in the 1960's. In October, 1994, tropical storm Gordon inflicted considerable damage to Dade County. High winds gusted to over 50 miles per hour, and excessive rainfall caused extensive flooding. Crop losses for most traditional winter vegetables and tropical vegetables ranged from 85 to 100 percent. Tree crops such as limes, carambola, and bananas sustained from 50 to 80 percent losses.

Freezes.--Freezes in Dade County are not unique occurrences. A freeze in 1958 caused "financial loss to Dade County's agriculture (that) was the greatest of any on record (as of 1958)... The official low temperature for the morning of February 5, 1958, near Homestead was 25 degrees" (4). More recently, freezes occurred during 1960, 1962, 1967, 1977, 1983, 1985, and 1989. Of these freezes, the 1958, 1977, and 1989 caused the most extensive crop damage. The "Christmas Freeze of 1989" was an extremely damaging freeze. High winds caused wind burn and plant desiccation. High winds exacerbated the freeze because most types of irrigation normally used for freeze protection became ineffective when the winds reached 15 mph and higher. Long duration of record low temperatures in the Homestead area (25° F) and frost occurring for two consecutive nights also contributed to the severity of damage. This freeze was preceded by temperatures in the upper 70s and some low 80s. Plants had not had any low temperatures to become "winterized" in preparation for more severe conditions. Therefore, any one of the factors listed above (wind, duration, record low temperature, and frost) can severely damage trees and plants, but the combination of all four destroyed a large portion of the winter vegetables, with nursery and grove damages continuing to appear as late as the summer of 1990 (18).

Historical View of Dade County Agriculture

Many aspects of Dade County agriculture have changed over time. The number of farms, size of farms, types of farms, value of farm production, and geographic location of farms in the

county have all changed.

Acreage in Farms

Census of Agriculture data gives some perspective of the changes Dade County agriculture has undergone in the 1970s and 80s and early 90s. In 1974, there were 872 farms in Dade County; by 1987, there were reportedly 1,623 and by 1992 there were 1,891 (Table 8). Thus the number of farms in the county increased by 117 percent between 1974 and 1992. Farms with less than ten acres almost tripled in number, the largest increase of any size category. In 1974, there were 437 farms that were one to nine acres in size, and by 1992 there were 1,129 farms in this size category. This smallest size category, nine acres or less, had grown to represent 60 percent of all farms in the county by 1992. Eighty-seven percent of Dade farms (1,644 farms) were of 49 acres or less in size in 1992.

Dade County's average per acre value of land and buildings is nearly five times higher than the state average (Table 8). This is probably the result of substantially higher per acre land values for the county.

Between 1974 and 1992 there was an 117 percent increase in the number of farms in Dade County, but there was only a 9.6 percent increase in the amount of farmland acreage (76,318 acres in 1974 up to 83,681 acres reported in 1992). Larger parcels were being subdivided into smaller units during this time period (Table 9). By 1992, the average farm size was only half as large as in 1974, declining from 88 to 44 acres. From 1974 to 1992, harvested cropland, "all other land" (land other than cropland or woodland), and irrigated land all showed substantial increases in the number of farms but much smaller increases in the amount of acreage. The "all other land " category captures increases in the number of farms for smaller orchards, groves, and nurseries. Harvested cropland from 1974 to 1992 increased from 771 farms to 1,716 farms, representing a 123 percent increase; whereas, the amount of

Table 8. Number of farms categorized by acreage, value and size, for Dade County and the State of Florida.

	Year									
	1974		1978		1982		1987		1992	
	Dade	Florida	Dade	Florida	Dade	Florida	Dade	Florida	Dade	Florida
Total number of farms	872	32,466	1,354	44,068	1,483	36,352	1,623	36,556	1,891	35,204
Approximate land area (Acres)	1,306,816	34,618,304	1,251,200	34,620,800	1,251,366	34,657,843	1,251,366	34,657,843	1,244,480.0	34,558,261.0
Proportion in farms	5.6	38.1	7.5	38.4	7.0	37.0	6.6	32.3	6.7	31.2
Value of land and buildings (\$1,000)	281,682	8,896,000	533,476	15,444,000	683,663	20,066,304	555,066	19,849,908	736,911,354	21,800,605,060
Average value/farm (Dollars)	323,030	274,010	394,000	350,458	461,000	552,000	342,513	543,000	389,694	619,265
Average value/acre (Dollars)	3,691	685	4,965	1,149	7,835	1,576	6,853	1,790	9,794	2,037
Number of farms with:										
1 to 9 acres	437	7,090	665	10,997	544	2,449	877	7,300	1,129	7,664
10 to 49 acres	262	9,802	411	10,771	334	3,489	499	13,346	515	12,692
50 to 179 acres	73	4,645	150	5,255	103	2,083	142	8,379	143	7,738
180 to 499 acres	64	1,338	79	1,702	69	1,204	68	4,255	68	4,011
500 to 999 acres	19	419	31	537	15	602	23	1,598	23	1,451
1,000 acres and over	17	326	18	381	13	723	14	1,678	13	1,648

Source: Census of Agriculture 1974, 1978, 1982, 1987, and 1992, Florida Edition, U.S. Department of Commerce, Bureau of Census.

Table 9. Farms and agricultural land use in Dade County and the State of Florida.

	Year									
	1974		1978		1982		1987		1992	
	Dade	Florida	Dade	Florida	Dade	Florida	Dade	Florida	Dade	Florida
Number of farms	872	32,466	1,354	44,068	1,483	36,352	1,623	36,556	1,891	35,204
Acreage in farms	76,318	13,199,365	98,574	13,306,231	87,420	12,814,216	83,061	11,194,090	83,681	10,766,077
Average farm size (Acres)	88	407	73	302	59	353	51	306	44	306
<u>Land in farms according to use:</u>										
Total cropland										
farms	812	28,658	1,246	38,240	1,378	30,565	1,464	29,386	1,779	28,702
acreage	62,096	3,721,831	74,506	4,497,004	72,784	4,093,583	66,313	3,790,599	68,795	3,841,505
Harvested cropland										
farms	771	23,620	1,198	29,643	1,336	24,396	1,420	22,677	1,716	22,556
acreage	55,730	2,304,043	64,084	2,761,473	58,940	2,643,147	61,997	2,240,831	61,342	2,400,704
Cropland used only for pasture or grazing										
farms	55	12,034	72	16,691	71	11,766	55	11,460	61	10,916
acreage	2,064	1,086,074	4,313	1,299,766	9,240	1,072,069	1,340	1,004,426	2,590	972,995
All other cropland										
farms	66	4,315	163	7,502	121	5,132	135	6,264	211	5,538
acreage	4,302	331,714	6,109	435,765	4,604	378,367	2,976	545,342	4,863	467,806
Total woodland including pasture										
farms	43	9,943	102	12,184	84	10,157	71	9,457	69	9,185
acreage	2,176	2,932,880	5,785	2,978,291	4,832	2,875,028	3,014	2,213,679	1,892	1,922,035
All other land										
farms	328	19,877	601	27,812	642	23,479	696	23,779	706	21,224
acreage	12,046	6,544,654	18,283	5,830,936	9,804	5,845,605	13,734	5,189,812	12,994	5,002,537
Irrigated land										
farms	503	7,749	885	11,657	1,078	10,550	1,195	11,981	1,418	13,500
acreage	44,469	1,558,735	48,930	1,991,068	47,819	1,585,080	53,158	1,622,750	52,363	1,782,680

Source: Census of Agriculture 1974, 1978, 1982, 1987, and 1992, Florida Edition, U.S. Department of Commerce, Bureau of Census.

harvested cropland acreage over this time period increased by only 10 percent (from 55,730 acres in 1974 to 61,342 acres in 1992). The number of farms considered "all other land" more than doubled between 1974 and 1987, from 328 farms to 706 farms, representing a 115 percent increase. At the same time however, acreage for this "all other land" category increased by only 8 percent, from 12,046 acres in 1974 to 12,994 in 1992. The number of irrigated farms almost tripled between 1974 and 1992, a 182 percent increase from 503 farms to 1,418 farms. Irrigated acreage also increased during this time frame by almost 18 percent, from 44,469 acres to 52,363 acres. However, irrigated acreage declined by nearly 800 acres (1.5 percent) from 1987 to 1992.

Over the 1974-92 period, Dade County experienced large percentage increases in numbers of orchards and grove acreage compared to generally declining numbers statewide (Table 10). The number of Dade County farms in fruit production in 1974 totaled 448 and steadily rose to 1,092 by 1987, more than doubling the county's number of groves. However, after years of sustained increases, grove acreage in Dade County declined slightly (5.4 percent) from 1987 to 1992. This decline is likely due to Hurricane Andrew.

Value of Production

Census of Agriculture (22) data also provide information on the value of agricultural production in Dade County. Table 11 and Figure 1 show published farm gate values for agricultural production from the census. Dollar values for all years are reported in current (1996) dollars, constant dollars adjusted for inflation. Gross production values for vegetables and commercial ornamental horticulture generally show upward trends over the reported census years 1974 through 1987, but the value of fruit crops declined precipitously from 1987 to 1992, from \$35.0 million to \$20.6 million. This drop is attributable to the widespread destruction caused by Hurricane Andrew. The farm value of vegetables rose by 85 percent from 1987 to 1992. Commercial ornamental horticulture also showed a substantial gain in gross sales; in 1987, gross sales were \$151.5 million to \$179.6 million in 1992, an increase of about 19 percent. Since the 1974 census, the value of gross sales of ornamental horticulture production more than quadrupled. On the negative side, Agricultural Census statistics show a persistent, long-term decline in field crop production; in 1992 field crop acreage was only 8 percent of what it had been in 1974, and the Census did not estimate the relatively small value of production (Table 11).

Despite the long-run decline in field crop production, some field corn, sorghum and soybeans are grown for seed production every year, and on occasion, fairly large acreages are produced. When growing seasons in other parts of the United States or other seed producing countries result in shortages of these crops, acreage in Dade County increases. For example, seed corn production in the county increased dramatically during the 1988-89 season to compensate for drought and subsequent crop failure in the mid-west. In 1988-89, there were an estimated 9,000 acres of seed corn planted for seed production, whereas during a normal season there are approximately 700 to 800 acres planted.

Table 10. Total land in orchards (groves) for fruits and nuts, Dade County and the State of Florida.

Year	Dade County		State of Florida	
	No. of Farms	Acres	No. of Farms	Acres
1974	448	10,557	11,079	912,079
1978	721	14,920	13,441	938,036
1982	822	15,644	11,214	938,527
1987	902	17,452	9,965	762,066
1992	1,092	16,507	10,258	914,642
% change 1974-1992	143.8%	56.4%	-7.4%	0.3%
% change 1987-1992	21.1%	-5.4%	2.9%	20.0%

Source: Census of Agriculture, 1974, 1978, 1982, 1987, 1992, Florida Edition. U.S. Department of Commerce, Bureau of Census.

Table 11. Acreage and gross sales by agricultural production subsector, Dade County, 1974, 1978, 1982, 1987 and 1992.

Year	Subsectors ^a							
	Fruits ^b		Vegetables ^c		Field Crops ^c		Commercial Ornamental Horticulture	
	(Acres)	(\$1,000)	(Acres)	(\$1,000)	(Acres)	(\$1,000)	(Acres)	(\$1,000)
1974	10,612	n.a.	26,423	n.a.	19,099	n.a.	1,205	43,420
1978	14,970	30,080	29,498	75,117	18,535	20,119	2,269	79,085
1982	15,644	24,231	29,068	89,955	11,173	17,890	3,144	80,023
1987	17,452	35,006	42,356	107,773	6,739	16,502	5,107	151,483
1992	16,507	20,632	37,170	199,605	1,487	n.a.	7,084	179,565

^a Dollar values are real. Base year=1996.

^b Fruit acres represent planted acreage.

^c Vegetable and field Crop acreage represents harvested acres.

Geographic Shifts in Production Areas

Over the past three decades escalating environmental concerns have spawned changes in policies and adoption of regulations that have adversely affected agriculture and forced geographic relocation of much agricultural production in Dade County. For over sixty years, there was continuous farming in Everglades National Park's Hole-in-the Donut on approximately 6,200 acres. In 1975, farming activities in the Donut ceased and tomato and other vegetable growers were forced to find other acreage (6). With new technology, land previously believed to be submarginal was converted to agricultural use. During the late 1980s, the East Everglades, also known as "the other side of the dike", was farmed without severe flood damage. Tree row trenches were back-filled and "bedded up", affording some protection from flooding.

In 1988, land adjacent to the eastern boundary of Everglades National Park was purchased for vegetable production by six farming enterprises. This area, known as "the Frog Pond", was the largest contiguous area of farmland in Dade County, comprising eight and one half square miles or approximately 5,400 acres when acquired by the farmers. In recent years however, the South Florida Water Management District (SFWMD) has acquired 5,200 acres of the entire Frog

Pond area as part of the Everglades Restoration Program. According to SFWMD, personnel half of the Frog Pond acreage has been leased back to private citizens for agricultural purposes. The SFWMD is also attempting to purchase 5,400 acres of farmland in the Rocky Glades area. To date the SFWMD has bought 1,723 acres, 922 acres of which has been leased back to agricultural producers. Thus, approximately 9,600 acres of farmland has been taken out of production in these three environmentally sensitive areas since 1975, and even more agricultural land will be taken out of production when SFWMD achieves its land acquisition goal in the Rocky Glades area.

Production of Selected Agricultural Commodities

Dade County's diversified commercial agricultural industry can be categorized into four major subsectors: ornamental horticulture, traditional vegetables, tropical vegetables and tropical fruits. The discussion which follows addresses each of the subsectors, identifying principle commodities, production trends for selected commodities, and estimates of 1995-96 production and F.O.B. value of production.

Descriptive discussions of the various agricultural commodities produced in Dade County which appeared in the Florida Agricultural Market Research Center's 1990 benchmark study, Economic Impact of Agriculture and Agribusiness in Dade County, Florida are not repeated here for the sake of brevity. Readers interested in basic attributes of the various crops and general cultural practices are referred to the original study (18).

It should be noted that the total economic impact of agriculture was essentially based upon new dollars that are generated by sales of production and embodied services sold outside of Dade County. Thus, it was necessary to estimate sales of all commodities within and outside of the county. In addition, the vast agricultural service industry which includes landscaping, lawn care, tree surgeons, etc, in Dade County was not included in this study because most of these services are performed within the county and thus do not generate "new" dollars.

Commercial Ornamental Horticulture

The very nature of Dade County's sub-tropical environment encourages a diverse,

complex horticultural industry. The nursery industry in Dade County has grown from 492 nurseries and flower growers in 1957-58 (4) to about 761 nurseries registered with Florida's Department of Plant Inspection (DPI) in 1996 (13). Considering that some of these nurseries have multiple locations, it is currently estimated that there are between 1,000 and 1,200 nursery sites in Dade County. This represents an increase of about 55 percent in the number of nurseries in the county in four decades. The number of nurseries is only up about 1.5 percent since 1989 when DPI registered 750 nurseries in the county, but dollar volume of sales has increased by 55 percent.

In addition to plant nurseries, the commercial ornamental horticulture sector also includes landscape and interiorscape maintenance services, landscape contractors and architects, suppliers of nursery equipment and materials, a cut flower industry with nearly 100 importers, some of which are multi-million dollar import-export establishments, and a vast array of businesses such as golf courses, condominium complexes, cemeteries, parks, etc. that employ various types of horticultural experts .

Types of nursery operations

There are basically three types of nurseries in Dade County. They are "field", "container", and "greenhouse". A number of Dade nursery owners having varied acreage combinations of the three. Field nurseries are always grown on marl soil because it is prohibitively expensive to harvest trees grown on rockland soils. They generally range in size from one to two acres to several hundred acres depending on the type of production. Field nurseries usually have trees in the ground from a minimum of 1.5 years to 4 years and planting densities between 500 and 1,000 trees per acre depending upon the type of tree.

Field nurseries in Dade County supply trees to malls and various indoor establishments throughout the U.S. and Canada. Since these trees have been grown in full sun, nurseries must, depending on the final destination point, transfer the trees to large shade houses for a period of time appropriate for acclimation. Similarly, shade houses are also used in container nurseries. Landscape plants destined for South Florida can be grown in full sun; however, for those plants shipped to other destinations or grown for interiorscape purposes, shade houses are used to reduce the amount of sunlight under which the plant is grown, thereby adapting plants to a variety of conditions.

In addition to field nurseries and container nurseries, there are also nurseries that specialize in liners, starter plants grown from tissue culture or seed, and supplied to growers in South Florida from growers located within the county as well as other parts of the U.S., Europe, the Caribbean, and Central America. Some larger nursery businesses have their own off-shore operations that supply liners and smaller plant material to their Dade County operation.

Survey Analyses

It is important to stress that the survey, analyses, and conclusions provided as part of this study do not include the service sector of the ornamental horticultural industry. This service sector includes landscape maintenance firms, landscape architects, lawn equipment dealers, and so forth. Restricted by time, resources, and the industry's diversity and complexity, this study only surveyed the Dade County nurseries registered with the Florida Department of Agriculture's Division of Plant Inspection (DPI), and this survey determined the aggregate economic impact of plant nurseries. Data on nurseries' production practices, acreages, sales volumes and location of sales activity (in-county vs. out-of-county) were obtained through a mail survey with an intensive telephone follow-up effort to interview non-respondents to the mail survey.

The mail survey, requesting nursery information for calendar year 1996, was conducted during the spring of 1997. DPI provided its most current computer listing of all registered Dade County nurseries (13). However, services that were provided by the DPI inspected nurseries that were incidental to their plant production operations are included. The DPI mailing list included a total of 761 nurseries. As completed questionnaires were returned to FARMC, research assistant conducted follow-up calls to clarify information if necessary. Non-respondents were contacted by telephone to obtain data. At least five attempts were made to reach each number on the DPI list. Searches of Internet phone directories were made to find telephone numbers that had changed. In total, the survey effort yielded information on 390 DPI listings. Of the 390 cooperating respondents, 314 provided usable economic information, while the remaining 76 were hobbyists, recently established firms with no sales activities during the 1996 period, or firms that had gone out of business. Attempts were made to interview the other 371 firms on the DPI list, but many were unreachable, some telephone numbers were unlisted, and others refused to cooperate. The 390 cooperating nurseries represent a 51 percent response rate to the survey effort. The 314 questionnaires providing usable economic data represent a 41 percent usable response rate for the economic portion of the survey. It is not unusual for agricultural mail

surveys of this type to have only a 10 to 15 percent response rate.

Information obtained from the 390 cooperating businesses was used to estimate the economic activity among the 371 unreachable or uncooperative nurseries. The 371 were distributed as the 390 across categories of active nurseries, out of business, hobbyists, or recently started with no 1996 sales activity. All subsequent discussion of the economic data refers to 592 commercial nurseries estimated to be active in Dade County that had sales in 1996. This number excludes 72 nurseries estimated to be small-scale hobbyists, 88 operations that have been acquired by or merged with other Dade County nurseries, and 9 recently established nurseries that had no sales during calendar 1996.

Container acreage was estimated to be about 2,661 (30.7 percent), field acreage was 5,547 (64.0 percent) and greenhouse acreage was 459 (5.3 percent) (Figure 6). According to DPI records, nursery acreage in Dade County totaled 8,700.3 acres in 1996. This figure was adjusted to remove non-commercial and startup acreage, resulting in a commercial acreage estimate of 8,667 acres.

With respect to production systems, 31.5 percent specialized solely in container production, 7.6 percent were solely in field production, and 6.4 percent only used greenhouses (Figure 7). The remaining 54.5 percent had some combination of container, greenhouse, and/or field operations. Almost 100 percent of all gross sales were from the wholesale trade (Figure 8), 96.7 percent of gross sales were from plant sales and 3.3 percent from sales of related services (Figure 9). Foliage sales accounted for 34.4 percent of the total value of production, followed by woody ornamentals with 29.4 percent. Flowering plants generated 25.9 percent of total value, followed by fruit and nut trees with 9.0 percent and bedding plants with 1.3 percent (Figure 10). Seventy-four percent of gross sales were made to buyers outside Dade County (Figure 11).

Figure 6. Major nursery production systems and acreages.

Figure 7. Production system specialization.

Figure 8. Percentages of wholesale and retail nursery sales.

Figure 9. Percentages of gross sales comprised of plants and related services.

Figure 10. Percentages of sales of various types of nursery crops grown in Dade County.

Figure 11. Percentages of gross sales inside and outside Dade County.

Gross sales per acre.—Generally, field nurseries show the lowest overall gross income per acre, then container, and the greatest income per acre from greenhouses. Survey results indicated that the average gross income over all types of operations was \$30,649 per acre. Therefore, it is estimated that the total value of Dade County's nursery production was \$265.7 million in 1996 (Table 2, Figure 4).

Traditional Vegetables

Dade County is known for its winter vegetable production due to the commodities grown in winter months, when much of the U.S. vegetable production is dormant. Traditional vegetables produced in Dade County include tomatoes, potatoes, yellow squash, zucchini, pole beans, bush beans, sweet corn, seed corn, and soybeans, strawberries, cucumbers, pickles, okra, eggplant, peppers, cabbage, southern field peas, and turnips. Corn and soybeans grown for seed are technically agronomic crops, but are included in this section for lack of a more appropriate classification within the report. This list represents those vegetables grown in Dade County for which there were published data (11), official but unpublished data (10), data collected from local growers, or data that could be estimated by using local information on acreage and yield and using published prices. Therefore, this list is not considered exhaustive; there may be other vegetables grown in Dade but are not itemized here because production is either very small or is unreported.

During the 1995-96 season, traditional vegetables grown in Dade County accounted for approximately one-third of the value of all agricultural production. Traditional vegetables were estimated to have an aggregate total gross production value of \$174.2 million of which 98 percent or \$171.1 million were sales outside the county (Table 12). The distinction made between the proportions of commodity sales within the county vs. sales outside of Dade County is necessary for economic impact analysis and is explained in greater detail in the first major section of this report. Tomatoes, bush beans, potatoes, squash and peppers accounted for about 90 percent of the total value of traditional vegetable crops in the 1995-96 season.

Table 12. Estimated value of traditional vegetables sold outside of and within Dade County, 1995-96.

Commodity	Value of crop sold outside Dade	Value of crop sold within Dade	Total crop value
(- - - - -Dollars- - - - -)			
Tomatoes	68,197,140	688,860	68,886,000
Bush and pole beans	40,974,888	413,888	41,388,776
Potatoes	23,525,964	237,636	23,763,600
Squash, yellow and zucchini	12,818,047	261,593	13,079,640
Sweet corn	9,704,683	98,027	9,802,710
Seed, corn & soybeans	2,904,000	0	2,904,000
Peppers, bell	2,057,652	228,628	2,286,280
Strawberries	762,080	762,080	1,524,160
Eggplant	1,443,314	14,579	1,457,893
Cucumbers (slicers)	860,740	87,212	947,952
Other ^a	7,880,048	300,323	8,256,960
Total	171,128,556	3,092,825	174,297,971

^a Other includes estimated data for cabbage, pickling cucumbers, okra, and Southern field peas.

Source: Published, unpublished and estimated data. All itemized listings are public information estimates. Confidential data have been aggregated.

Tomatoes accounted for about 40 percent of the total value of traditional vegetables. Dade County tomato producers fared quite well compared to growers in other parts of the state in 1995-96 with respect to prices. The average F.O.B. price per 25 pound box was \$11.56, compared with only \$7.28 for all other districts covered by the Federal Market Order (14). Although Dade County growers did well in the 1995-96 season, the situation has not been as favorable in recent seasons. Economic changes in Mexico, stimulated by the North American Free Trade Agreement (NAFTA) and the major devaluation of the peso, resulted in a flood of Mexican tomatoes to U.S. markets, seriously reducing prices. Low tomato prices and the uncertainties of Mexican competition have greatly impacted the entire Florida tomato industry. From the 1992-93 season to the 1995-96 season, statewide harvested tomato acreage has declined by 12 percent and Dade County acreage has dropped by nearly 36 percent (Table 13). Statewide shipments under the tomato marketing order declined by 25 percent during this period, and shipments from Dade County dropped 19 percent. Despite favorable yields and prices in 1995-96, the F.O.B. value of Dade county's tomato production was far less than it was during the late 1980s and early 1990s (Table 14).

Snap beans

During the 1995-96 season, estimated total gross sales for bush and pole beans produced in Dade County were over \$41 million. Bush and pole beans were the second most important traditional vegetable crop in terms of total revenues (Table 12).

Over the past 10 seasons, snap bean acreage in Dade County has been erratic, ranging from a low of 12,000 acres in 1989-90 to a high of 20,800 acres in the 1992-93 season. Over the past four years, however, acreage has trended downward, reaching 14,300 acres in the 1995-96 season, the smallest acreage since the 10 year low in 1989-90. Production for the state as a whole has been variable as well, showing no discernable trends during the past decade (Table 15). Dade County typically accounts for a substantial portion of the state's total snap bean acreage. Over the 1986-87 through 1995-96 seasons, Dade County's proportion of the state's snap bean acreage ranged from over 76 percent in 1992-93 to a low of 54 percent in 1994-95. It amounted to about 56 percent of the state's total in 1995-96 (Table 15).

Table 13. Tomato acreage, Dade County and the State of Florida, 1980-81 to 1995-96.

Season	Dade County	Florida ^a	Dade Acreage as a proportion of total Florida acreage
	(Acres)	(Acres)	(Percent)
1980-81	13,403	44,801	29.9
1981-82	10,898	39,095	27.9
1982-83	12,892	43,386	29.7
1983-84	12,787	45,400	28.2
1984-85	11,180	44,729	25.0
1985-86	11,602	45,530	25.5
1986-87	11,113	50,908	21.8
1987-88	9,135	53,939	16.9
1988-89	8,015	57,663	13.9
1989-90	5,742	49,306	11.6
1990-91	5,580	45,597	12.2
1991-92	5,048	46,255	10.9
1992-93	5,690	44,477	12.8
1993-94	5,030	45,189	11.1
1994-95	4,345	43,735	9.9
1995-96	3,650	39,144	9.3

^a Lost or abandoned acreage from each district removed.

Source: Florida Tomato Committee Annual Reports, 1980 to 1996.

Table 14. Tomato prices, production and total sales, Dade County, 1982-83 through 1995-96.

Season	Price	Production ^a	Total Sales	1996 Dollars
	(Dollars)	(1,000 cartons)	(\$1,000)	
1982-83	8.15	9,194	74,931	89,493
1983-84	9.24	10,665	98,545	114,237
1984-85	9.15	9,618	88,005	113,175
1985-86	7.77	8,025	62,354	82,087
1986-87	7.02	8,650	60,723	77,764
1987-88	7.46	11,294	84,253	98,229
1988-89	9.86	11,333	111,743	123,230
1989-90	11.98	4,816	57,696	62,889
1990-91	9.25	7,950	73,538	85,086
1991-92	13.92	10,390	144,629	170,735
1992-93	7.55	7,395	55,832	63,756
1993-94	7.06	6,762	47,740	54,925
1994-95	8.27	5,889	48,702	55,459
1995-96	11.56	5,959	68,886	68,886

^a One carton weighs 25 pounds.

Source: Florida Tomato Committee Annual Report, 1982-1996.

Potatoes

The Pre dominant type of potatoes grown for winter harvest in south Florida are the "red-skinned" varieties, with most of the winter crop sold for table stock. During the 1995-96 season, Dade County's potato crop was estimated to have total gross sales of about \$23.8 million, down from \$30 million recorded in 1988-89. Over the past decade, potato acreage in Dade County trended slightly lower, from just over 5,000 acres in the late 1980s to slightly under 5,000 acres in the early 1990s. After a significant dip to only 3,100 acres in the 1994-95 season, acreage rebounded to 4,600 acres in 1995-96. Although prices remained relatively low, good yields and larger plantings boosted total crop value to \$23.8 million (Tables 12 and 15).

Squash

Squash production in Dade County includes both yellow crookneck and zucchini, although zucchini is grown on a much smaller scale. Total acreage of both types for 1995-96 for Dade County was approximately 4,600 acres. Total estimated gross sales for the 1995-96 season were approximately \$13.1 million (Table 12).

Over the 10 year period from 1986-87 through 1995-96, squash acreage in Dade County has fluctuated between 5,250 and 3,400 acres. Acreage in 1995-96 was 4,600 acres. Squash acreage in Dade County has been quite variable over the last decade, there have been no discernable trends, but statewide, squash acreage has been trending downward. In the 1980s, Dade County typically accounted for about one-fourth to one-third of the state's acreage. However, over the past few seasons, Dade has accounted for about 40 percent of the total, and in 1995-96 Dade's acreage was nearly half of the state's.

Sweet corn

In 1995-96, gross sales of sweet corn were estimated at \$9.8 million, up from about \$8.0 million in 1988-89. Acreage in 1990-91 was only 1,030 acres, but there was an upward trend in acreage during the early to mid 1990s. By 1995-96, sweet corn acreage had increased to 4,500 acres. This represented an increase of nearly 17 percent over the acreage reported in 1988-89 (Table 18).

Seed corn, sorghum and soybeans

Dade County seed production during the 1995-96 crop year was slightly higher than normal production years, with an estimated combined acreage of 1,320 for corn, sorghum and soybeans. Seed production acreage in Dade County is extremely variable, depending on growing conditions in other parts of the U.S. and other countries where seed production occurs. As many as 50 different companies and research institutions involved in plant breeding and seed production maintain a presence in Dade County as insurance against unfavorable growing conditions in the U.S. and abroad. As recently as 1988-89, acreage in Dade County seed corn acreage was 9,000 acres, the result of a severe drought in the mid-west. Most Dade County seed production is used as foundation stock for breeding purposes rather than for crop production.

Table 15. Bush and pole bean acreage, Dade County and Florida, 1976-77 to 1993-94.

Season	Dade County	Florida	Dade Acreage as a proportion of total Florida acreage
	(Acres)	(Acres)	(Percent)
1976-77	5,530	40,000	13.8
1977-78	7,250	51,000	14.2
1978-79	7,400	54,100	13.7
1979-80	9,750	54,300	18.0
1980-81	12,500	42,600	29.3
1981-82	16,300	48,300	33.7
1982-83	20,000	46,400	43.1
1983-84	21,100	44,000	48.0
1984-85	21,800	45,700	47.7
1985-86	23,000	37,900	60.7
1986-87	20,950	34,000	61.6
1987-88	20,200	29,400	68.7
1988-89	18,500	25,900	71.4
1989-90	12,000	19,700	60.9
1990-91	14,600	20,950	69.7
1991-92	18,500	29,450	62.8
1992-93	20,800	27,200	76.5
1993-94	17,700	25,500	69.4
1994-95	17,200	31,600	54.4
1995-96	14,300	25,300	56.5

Source: Florida Agricultural Statistics, Vegetable Summary, (1977-96).

Table 16. Harvested acres of potatoes, Dade County and Florida 1976-77 to 1995-96

Season	Dade County	Florida	Dade Acreage as a proportion of total Florida acreage
	(Acres)	(Acres)	(Percent)
1976-77	6,950	30,100	23.1
1977-78	7,350	32,300	22.8
1978-79	6,000	28,000	21.4
1979-80	6,750	27,300	24.7
1980-81	6,400	29,900	21.4
1981-82	5,200	31,900	16.3
1982-83	5,100	31,300	16.3
1983-84	5,400	33,600	16.1
1984-85	5,500	35,100	15.7
1985-86	5,000	32,600	15.3
1986-87	5,000	35,700	14.0
1987-88	5,200	36,100	14.4
1988-89	5,100	42,600	12.0
1989-90	4,800	44,700	10.7
1990-91	4,800	43,000	11.2
1991-92	4,900	40,100	12.2
1992-93	4,700	41,900	11.2
1993-94	4,300	46,400	9.3
1994-95	3,100	42,900	7.2
1995-96	4,600	44,300	10.4

Source: Florida Agricultural Statistics, Vegetable Summary, (1977-96).

Table 17. Harvested acres of squash, Dade County and the State of Florida, 1972-73 to 1995-96.

Season	Dade County	Florida	Dade Acreage as a proportion of total Florida acreage
	(Acres)	(Acres)	(Percent)
1972-73	2,970	9,800	30.3
1973-74	3,730	10,100	36.9
1974-75	3,000	11,200	26.8
1975-76	3,400	11,400	29.8
1976-77	3,500	12,000	29.2
1977-78	3,600	11,850	30.4
1978-79	3,400	13,350	25.5
1979-80	3,600	13,500	26.7
1980-81	3,900	14,800	26.4
1981-82	4,550	16,600	27.4
1982-83	4,550	16,100	28.3
1983-84	5,600	16,800	33.3
1984-85	5,300	16,500	32.1
1985-86	4,800	15,800	30.4
1986-87	5,000	15,200	32.9
1987-88	5,250	14,000	37.5
1988-89	4,018	13,650	29.4
1989-90	3,400	11,700	29.1
1990-91	4,600	11,800	39.0
1991-92	5,400	13,300	40.6
1992-93	3,700	10,500	35.2
1993-94	5,300	13,300	39.9
1994-95	5,150	11,900	43.3
1995-96	4,600	9,600	47.9

Source: Florida Agricultural Statistics, Vegetable Summary, (1977-96).

Bell peppers

Bell peppers generated about \$2.3 million in sales in 1995-96. For most of the 1990s, bell pepper acreage in Dade County could not be reported because of confidentiality restrictions, so recent trends cannot be analyzed. However, in 1995-96, there were 250 acres of bell peppers, down slightly from the 300 acres recorded in the 1994-95 season. Even so, the 1995-96 acreage is almost five times greater than that recorded in the 1988-89 season, and two to three times greater than reported in most seasons of the 1980s (Tables 12 and 18).

Strawberries

Strawberries are a relatively minor crop in Dade County, accounting for only 80 acres of production in the 1995 season. Yet, strawberries generated a total value of over \$1.5 million. Acreage has slowly, but steadily increased during the 1990s (Table 18). Most strawberry producers have relatively small acreages, and many of the berries are sold directly to consumers through u-pick operations or roadside stands.

Eggplant

Eggplant sales for the 1995-96 season were almost \$1.5 million, about double the value in the 1988-89 season (Table 12). Acreage in 1995-96 was estimated at 280 acres, up considerably from the 124 acres reported in 1988-89. For the past few seasons, eggplant acreage has been in the 275-300 acre range (Table 18).

Cucumbers (Fresh market)

The value of cuke sales was approximately \$948,000 in the 1995-96 season, compared with \$3.7 million in the 1988-89 season. Lower prices and considerably lower acreage contributed to this drop in value. Acreage of fresh market cukes was 400 acres in 1988-89, but only 200 acres in 1995-96. During the early 1990s, fresh market acreage ranged from 500 to 900 acres (acreage for 1992-93 and 1994-95 could not be reported due to confidentiality restrictions). The 1995-96 fresh market acreage was the lowest reported since the 1985-86 and 1986-87 seasons (Table 18). Meanwhile, acreage of pickling cucumbers remained relatively strong. Because of confidentiality restrictions, acreage and market value of pickling cucumbers is not published here, however their value is included in the "Other" category.

Table 18. Published acreage estimates of selected traditional vegetables, Dade County, 1979-80 to 1995-96.

Season	Okra	Fresh Market		Bell peppers		Sweet corn	Strawberries
		Cucumbers	Eggplant		Cabbage		
1979-80	190	a	120	100	200	3900	100
1980-81	1000	a	100	75	200	1700	100
1981-82	700	a	100	55	275	1100	35
1982-83	875	a	120	75	180	2570	50
1983-84	875	a		90	80	1400	50
1984-85	900	a		110	120	2900	a
1985-86	950	200		110	90	2900	a
1986-87	900	200	150	230	530	3400	a
1987-88	a	a	a	a	a	a	a
1988-89	800	400	124	53	400	3859	a
1989-90	a	a	a	a	a	a	a
1990-91	a	650	0	0	0	1030	34
1991-92	a	900	0	a	305	2460	56
1992-93	471	a	275	a	360	2400	61
1993-94	a	500	290	a	180	3360	67
1994-95	a	a	305	300	a	3640	78
1995-96	a	200	280	250	a	4500	80

^a No published estimates not available.

Sources: Dade-IFAS Cooperative Extension Service, Homestead, Florida, 1970-80 to 1988-89, Florida Agricultural Statistics Service, 1990-1996.

Other traditional vegetables

This category includes cabbage, pickling cucumbers, okra and southern field peas, cherry tomatoes and plum tomatoes. Some of these crops represent substantial acreage and sales, however they cannot be reported separately because of confidentiality restrictions. In total, the "Other" category included approximately 3,500 acres (unofficial estimates) for these crops, with a combined F.O.B. market value of about \$8.3 million in the 1995-96 season (Table 12).

Tropical Vegetables

Vegetables included in this section are those that are generally grown in the tropics but grown in Dade County due to favorable tropical growing conditions. Scientific names are indicated below for these vegetable crops because of the confusion sometimes associated with identifying them.

Based upon grower interviews, Dade County tropical vegetables were estimated to have aggregate gross sales of approximately \$25.0 million during the 1995-96 season, about \$1.0 million below sales in 1988-89. Boniato, malanga, calabaza and cassava are the most widely planted tropical vegetables in Dade County. In the 1995-96 season, these four "Cuban" vegetables accounted for over 96 percent of the tropical vegetable acreage. The Miami and Tampa Bay areas are the main points of consumption within Florida, and out-of-state shipments are primarily destined for New York City and Philadelphia markets (11). Growers and shippers estimate that 90 percent of the Cuban vegetables are shipped outside of Dade County. Boniato and malanza were by far the most important in 1995-96, accounting for about 92 percent of the total harvested acreage of about 8,800 acres. Calabaza and cassava accounted for just over four percent of the tropical vegetable acreage. "Asian" vegetables, various herbs and spices accounted for just under 4 percent of total harvested acreage.

Boniato

Ipomoea batatas is the scientific name for boniato, which is also known as the tropical sweet potato. Acreage in 1995-96 was estimated at 4,200, down 30 percent from the 6,000 acres reported in 1988-89. Despite the decline from the 1988-89 levels, the 1995-96 acreage reflects a significant increase over most seasons in the early 1990s when intense competition from imports drastically reduced Dade County acreage. In the 1991-92 season, acreage dipped to only 1,925,

and gradually increased in the 1992-93 through 1994-95 seasons (Table 20). The total value of boniato in the 1995-96 season was estimated at approximately \$11.8 million, 90 percent of which was sold outside of Dade County (Table 19).

Malanga

There are two types of malanga grown in Dade County: (1) malanga (blanca and amarilla) scientifically known as *Xanthosoma sp.* and commonly called tannier, yautia, or cocoyam and (2) malanga isleña with a scientific name of *Colocasia esculenta Schott* commonly known as taro, dasheen, tannier, eddoe, or cocoyam (18). Malanga blanca is a starchy tuber with a shaggy brown skin and a beige colored flesh. Malanga isleña or taro has been grown as a specialty crop in Florida since the early 1900s and has been a basic food plant in the Orient for over 2,000 years. Taro is a brown, barrel-shaped shaggy tuber with varying flesh colors of white, beige, and light grey. Malanga can be used as a potato substitute (18).

In the 1995 season, harvested malanga acreage in Dade county was approximately 3,900 acres. While this acreage is nearly 25 percent lower than the 5,100 acres reported in the 1988-89 benchmark study, it represents acreages nearly double those reported in the early 1990s (Table 20). The total value of malanga production was estimated at \$11.7 million, with \$10.5 million shipped outside of Dade County (Table 19).

Calabaza

The scientific name for calabaza is *Cucurbita moschata*, and it is commonly known as the Cuban pumpkin, tropical pumpkin, or simply as "pumpkin". The calabaza is thought to have been cultivated by the Mayan and Aztec Indians when the first explorers stepped ashore in the New World. It is frequently round, more commonly pear shaped, and varies in color from solid green to traditional orange to a striped variation of the two (18).

Table 19. Estimated value of tropical vegetables sold outside of and within Dade County, 1995-96.

Commodity	Value of crop sold outside Dade	Value of crop sold within Dade	Total crop value
(- - - - -Dollars- - - - -)			
Boniato	10,584,000	1,176,000	11,760,000
Malanga	10,530,000	1,170,000	11,700,000
Calabaza	242,000	198,000	440,000
Thai & Chinese eggplant	244,530	12,870	257,400
Cassava	126,016	84,011	210,026
Tindora	80,750	4,250	85,000
Bitter melon	76,995	777	77,773
Long beans	75,058	758	75,816
Other ^a	416,325	22,671	438,996
Total	22,375,674	2,669,337	25,045,011

^aOther includes winged beans, luffa, bela melon, lemongrass, Thai spice, basil, Chinese okra, long squash, mint, dill and chives.

Source: Published, unpublished and estimated data. All itemized listings are public information and estimates. Confidential data have been aggregated.

Table 20. Acreage for selected tropical vegetables, Dade County.

Season	Malanga	Boniato	Calabaza	Cassava
	(- - - - - Acres - - - - -)			
1979-80	4,100	5,500	1,100	200
1980-81	4,000	5,500	900	200
1981-82	2,500	6,000	400	300
1982-83	1,690	3,375	975	560
1983-84	2,155	3,600	900	750
1984-85	2,400	4,000	1,000	850
1985-86	2,500	5,000	1,200	1,900
1986-87	2,500	2,000	800	1,000
1987-88	a	a	a	a
1988-89	5,100	6,000	1,000	1,000
1989-90	a	a	a	a
1990-91	2,310	2,750	100	50
1991-92	1,620	1,925	100	35
1992-93	2,080	2,475	100	45
1993-94	2,310	2,750	100	50
1994-95	2,500	5,000	20	25
1995-96	3,900	4,200	220	150

^a Estimates were not available for these years.

Source: Dade County Agriculture Statistical Report, 1979-80 to 1988-89, Dade/IFAS Cooperative Extension Service, Homestead, Florida, and interviews with growers, processors and extension service personnel.

Acreage of calabaza in 1995-96 was estimated by growers at 220 acres, down from 1,000 in 1988-89. As with boniato and malanga, calabaza acreage has suffered major reductions because of import competition. Through most of early 1990s calabaza production was only 100 acres per season (Table 20). Although acreage rebounded in the 1995-96 season, it is too early to tell if further increases will follow. The calabaza sales were estimated at \$440,000 for 1995-96, compared with \$2 million in 1988-89. Slightly over half, 55 percent, was estimated to have been shipped outside of Dade County (Table 19).

Cassava

Manihot esculanta is the scientific name for cassava or yuca. Cassava is a bark covered root vegetable with a white flesh and is grown only in tropical climates. Its foliage forms a green lacy canopy about six feet over its roots. Its high starch content makes it useful as a thickener and it is also the source of tapioca. The outer bark and underskin of the root must be peeled before using. In addition to the root, the cassava foliage is consumed as a legume in some Third World countries where cassava is a food staple (18).

Cassava production in Dade County has followed the same general patterns as boniato, malanga and calabaza: from peak acreage in the late 1980s, acreage plummeted in the early 1990s due to import competition. In 1988-89, cassava acreage was estimated at 1,000 and the value of production was approximately \$1.4 million. However, in the 1990-91 season acreage dropped to 50 acres, and by 1994-95 only 25 acres of cassava were grown in Dade County. In 1995-96, acreage rebounded to an estimated 150 acres, with a value of about \$210,000 (Tables 19 and 20).

Other specialty vegetables

In addition to the four "Cuban" vegetables discussed above, there are at least 16 other specialty vegetables, herbs and spices grown in Dade County. Of these, only Thai and Chinese eggplant, tindora, bitter melon and long beans are reported separately because of confidentiality restrictions. Winged beans, luffa, bela melon, lemongrass, Thai spice, basil, Chinese okra, long squash, mint, dill and chives are all included in the "other" category to avoid disclosure of confidential data.

These specialty vegetables are grown on a much smaller scale than the tropical vegetables

listed above and are destined primarily for New York and Chicago but some are also shipped to other major U.S. cities. Grower acreage of any one crop is usually quite small. It is estimated that 90 to nearly 100 percent of these vegetables are shipped out of Dade County.

Thai and Chinese eggplant.--These eggplant are similar to the varieties normally available in the supermarket but differ in size and shape. Thai eggplant (*Solanum macrocarpon*) is quite small and round while Chinese eggplant (*Solanum melongena*) is long and cylindrical and is purplish in coloration. Thai eggplant is purple, white, green, or white with green netting (18).

Acreage of Thai and Chinese eggplant increased from an estimated 44 acres in 1988-89 to 60 acres in 1995-96. The total value of production was approximately \$145,000 in 1988-89, but over \$257,000 in 1995-96 (Table 19).

Tindora.--Tindora (*Coccinia cordifolia*) looks like a tiny cucumber but is grown as a perennial vine, like grapes. It is planted in February and harvested from May through October. Yields average about 8,500 pounds per acre. Approximately 95 percent of production is shipped out of Dade County to major metropolitan areas, particularly New York and Chicago. During the 1988-89 season tindora gross sales for the county totaled an estimated \$59,500. Total sales increased to about \$85,000 in 1995-96, and about 95 percent was shipped out of Dade County (Table 19). From 1988-89 to 1995-96, acreage increased from about 7 acres to 10.

Bitter melon.--There are several varieties of bitter melon; the one grown in Dade County (*Momordica charantia*) is a mild, Indian variety with a smooth exterior. These are shaped like a long, slightly curved zucchini; some varieties are much more bitter than others. Bitter melon can be grown on a trellis or can be left to crawl along the ground (18). Yields are generally about 3,000 pounds per acre, but they were slightly lower in 1995-96. There were an estimated 18 harvested acres of bitter melon in the county during 1988-89 and 40 acres in 1995-96. For the 1995-96 season, gross sales of bitter melon for the county were estimated at approximately \$78,000, up from \$40,000 in 1988-89 (Table 19).

Long beans. --Long beans, *Vigna unguiculata subsp. sesquipedalis*, are also referred to as yardlong beans or asparagus beans. These are similar to black-eyed peas in taste, cuisine preparation, and appearance except that they grow to be two to three feet in length, hence the name yardlong beans. There are two types of long beans, pole long beans and bush long beans;

the former requires support by trellis or fence (18). About 90 percent of production is shipped to major out-of-state markets such as New Orleans, New York, and Chicago.

During 1988-89, there were 54 acres of long beans grown in Dade county, but acreage dropped to about 25 acres in 1995-96. Yields also decreased, from 4,200 pounds per acre to 3,800 pounds while the price remained the same. As a result, the value of production declined from about \$181,000 in 1988-89 to approximately \$76,000 in 1995-96 (Table 19).

Other specialty vegetable crops.--The "other" category includes winged beans, luffa, bela melon, lemongrass, Thai spice, basil, Chinese okra, long squash, mint, dill and chives. Inclusion in this category does not mean they are inconsequential, because some acreages are relatively large; they are included here because of confidentiality restrictions.

Total acreage in the other category was estimated at 202 acres in 1995-96, and the value of production was about \$439,000 (Table 19). Approximately 95 percent of the production was shipped to destinations outside Dade County.

Tropical Fruit

Dade County's climate encourages tropical fruit experimentation and production. As a result, over 35 different tropical fruits are grown in the county, 20 on a commercial scale. Total tropical fruit acreage in 1996 was estimated at 13,291 acres, about 6,800 acres less than reported for the 1990 economic impact study (Table 21). Hurricane Andrew was the major factor responsible for this drastic acreage loss. Although recent tree censuses have shown steady increases in acreage of most major tropical fruits the rate of increase has been relatively slow. Competitive pressures from Mexico, particularly from limes and mangos, have adversely affected replanting of these crops.

In addition to the very large total losses in fruit crop acreages caused by Hurricane Andrew, lingering effects of the storm continued to affect productivity of many tree crops during the 1995-96 season. Many avocado and mango trees were blown over, requiring resetting. Severe pruning was also required on reset trees and on those with significant damage to major branches and limbs. These "hat-racked" trees had not regained full productivity by 1995-96. This reduced productivity resulted in a 25 percent drop in the total value of production compared with the 1988-89 season, the focus of the previous economic impact study. Total fruit crop sales

declined from \$74 million in 1988-89 to \$56.1 million in 1995-96 (Figure 3).

In terms of acreage, avocados, Persian (Tahiti) limes, mangos, carambola, lychee, papaya, longan, mamey sapote, specialty banana (including plantain) and guava are the most important, accounting for 98 percent of total acreage in 1996 (Table 21). Acreage trends and estimates of the value of production of these and other imported tropical fruit crops appear below.

Avocados

Avocados have been cultivated in tropical America since pre-Columbian times; they arrived in Florida in 1833 (16). Currently, there are 58 varieties of avocados grown and marketed commercially in Florida (12). In 1996, Dade County had 6,305 acres of avocados, nearly 90 percent of the state's total (8). Within Dade County, avocados constitute slightly over 47 percent of the total tropical fruit acreage (Table 21).

Examination of long-term acreage trends for avocados in Dade County shows rapid expansion in the late 1970s and early 1980s when acreage increased from nearly 7,300 acres in 1976 to nearly 11,000 acres in 1984 (Table 22, Figure 12). After several years of modest declines, avocado acreage was approximately 9,000 acres in 1990. The tropical fruit census in March, 1993 showed that avocado acreage had dropped to less than 6,000 in the aftermath of Hurricane Andrew. The 1996 census confirmed a modest rebound in avocado acreage. Nevertheless, 1996 avocado acreage was still about 2,700 acres (nearly 30 percent) below that reported in the 1990 economic impact study (18). Despite the reduced acreage, recovering yields and reasonably good prices resulted in a total avocado crop value (F.O.B. basis) of about \$15.5 million in 1995-96, of which an estimated 95 percent (\$15.2 million) was sold outside Dade County (Table 23).

Figure 12. Dade County acreage of avocados, Persian limes and mangos, 1976-1996.

Persian (Tahiti) Limes

Persian limes, as differentiated from key limes or Spanish limes, have long been one of the leading tropical fruit crops in Dade County. Throughout the following discussions "limes" will refer to Persian (also called "Tahiti") limes. Long term trends for lime production in Dade County tend to parallel those for avocados. Lime acreage generally increased in the late 1970s and early 1980s, reaching a peak in 1982 with 6,783 acres (Table 22, Figure 11). From 1982 to 1990, acreage gradually declined by about 700 acres. However, limes were particularly hard hit by Hurricane Andrew, and the March 1993 tropical fruit census indicated that only 1,668 acres of limes remained (15). Subsequent acreage estimates show that limes have rebounded to nearly 2,800 acres. Even so, this is 3,279 acres (54 percent) below the 1990 acreage (Table 21). Despite the lower figure, limes still constitute 21 percent of all tropical fruit crop acreage in Dade County and just over 88 percent of the state's lime acreage.

During the 1995-96 season, Dade County's lime production was still very limited because of the effects of Hurricane Andrew. Reduced total acreage and limited production from trees set after the storm resulted in a total crop that was only about 20 percent as large as that recorded prior to Andrew. As a result, the total F.O.B. value of lime production in Dade County was only \$4.48 million, of which approximately \$4.3 million was shipped to markets outside Dade County (Table 23).

Mangos

For several decades, mangos have been one of Dade County's most important tropical fruit crops, consistently ranking third in acreage and value of production behind avocados and limes. Mangos currently comprise about 11 percent of the tropical fruit acreage in Dade County, maintaining its relative importance despite the losses caused by Hurricane Andrew (Table 21).

Table 21. Dade County tropical fruit acreage, 1990 and 1996.

Fruit	1990		1996		Change, 1990 to 1996	
	(acres)	(percent)	(acres)	(percent)	(acres)	(percent)
Avocados	8,987	44.6	6,305	47.4	-2,682	-29.8
Persian limes	6,071	30.2	2,792	21.0	-3,279	-54.0
Mangos	2,424	12.0	1,505	11.3	-919	-37.9
Carambola	600	3.0	532	4.0	-68	-11.3
Lychee	200	1.0	511	3.8	311	155.5
Papaya	375	1.9	250	1.9	125	-33.3
Longan	72	0.4	310	2.3	238	330.6
Mamey sapote	267	1.3	308	2.3	41	15.4
Banana (all types)	580	2.9	302	2.3	-278	-47.9
Guava	77	0.4	199	1.5	122	158.4
Pummelo	20	0.1	45	0.3	25	125.0
Passion fruit	100	0.5	15	0.1	-85	-85.0
Kumquat	25	0.1	26	0.2	1	4.0
Sugar apple	75	0.4	25	0.2	-50	-66.7
Atemoya	120	0.6	15	0.1	-105	-87.5
Miscellaneous ^a	138	0.7	151	1.1	13	9.4
Totals ^b	20,131	100.0	13,291	100.0	-6,840	-34.0

^aThe miscellaneous category includes sapodilla, Barbados cherries, wax jambu, jackfruit, key lime, canistel, black sapote, persimmons, white sapote, coconuts, assorted citrus fruits other than Persian limes and pummelos, tamarind, wampee, ambarella, jaboticaba, loquat, macadamia, monstera, Spanish lime and star apple. The acreages of these fruits are combined to prevent disclosure of individual firms' operations. Acreage estimates for these fruits were not available for 1990, so estimates from 1992 (pre-hurricane) were used.

^bTotal percentages may not sum to 100.0 due to rounding.

Sources: Avocado, Persian lime and mango acreage estimates were obtained from "Tropical Fruit: Acres and Trees," Florida Agricultural Statistics Service, 1996. Other acreage estimates are based upon survey data collected by the Florida Agricultural Market Research Center and consultations with Dr. Carlos Balerdi, Dade County Extension agent, and Dr. Jonathan Crane, Professor, Tropical Research and Education Center, University of Florida, Homestead.

Table 22. Dade County acreages of avocados, Persian limes and mangos, 1976-1996.

Census years	Avocados	Limes	Mangos
	(-----acres-----)		
1976	7,286	4,346	1,534
1978	8,239	4,277	1,376
1980	9,338	5,641	1,449
1982	10,554	6,783	1,937
1984	10,986	6,592	2,273
1986	10,598	6,577	2,394
1988	10,076	6,290	2,527
1990	8,987	6,071	2,424
1993 ^a	5,965	1,668	1,398
1994	6,040	2,618	1,550
1996	6,305	2,792	1,505

^aThe October 1992 census was delayed until March 1993 to capture the effects of Hurricane Andrew in August, 1992.

Source: Florida Agricultural Statistics Service, "Tropical Fruit: Acres and Trees," various issues.

Table 23. Estimated value of tropical fruits sold within and outside of Dade County, 1995-96.

Commodity	Value of crop sold outside Dade	Value of crop sold within Dade	Total crop value
(-----1,000 Dollars-----)			
Carambola	17,089.1	348.8	17,437.9
Avocados	15,178.3	326.5	15,504.8
Limes	4,338.5	141.5	4,480.0
Mamey Sapote	2,879.9	720.0	3,599.9
Longan	2,732.0	482.1	3,214.1
Guava	2,398.9	599.7	2,998.6
Banana	1,279.0	1,279.0	2,558.0
Mangos	1,379.3	344.8	1,724.1
Papaya	796.9	796.9	1,593.8
Lychee	623.4	32.8	656.2
Passion Fruit	447.8	9.1	456.9
Pummelo	413.2	21.8	435.0
Kumquat	254.9	28.3	283.2
Atemoya	194.6	10.2	204.8
Sugar Apple	5.4	48.6	54.0
Miscellaneous ^a	537.4	396.9	934.3
Total	50,548.6	5,587.0	56,135.6

^aThe miscellaneous category includes sapodilla, wax jambu, jackfruit, key lime, canistel, black sapote, persimmon, white sapote, Barbados cherries, coconuts, ambarella, jaboticaba, loquat, macadamia monstera, Spanish lime, star apple, tamarind, wampee and assorted citrus fruits other than Persian limes and pummelos. The value of these fruits are combined to prevent disclosure of individual firms' sales.

Source: Published, unpublished, and estimated data. All itemized listings are public information and estimates. Confidential data have been aggregated.

Acreage trends over the past 20 years have generally followed the same patterns as those of avocados and limes. Plantings and total acreage steadily increased from the late 1970s through most of the 1980s, going from 1,376 in 1978 to a maximum of 2,527 acres in 1988 (Table 22, Figure 11). The tropical tree census of 1990, the last before the hurricane, showed a slight decline in total acreage. The 1993 census, however, showed a post-hurricane acreage of only 1,398 acres, a loss of more than a thousand acres from 1990. The 1996 tropical fruit inventory showed a slight increase in acreage to 1,505. However, this acreage was still about 38 percent below pre-hurricane levels (Tables 21 and 22). Despite the sizeable decrease in mango acreage, Dade County still accounts for over 82 percent of the state's total mango acreage (8).

Dade County's mango production in 1995 was still far below pre-hurricane levels, amounting to less than 30 percent of the 1991 crop. Limited production was not only due to smaller total bearing acreage, but also the result of poor tree recovery from hurricane damage, bloom problems, and disease (9). Further, low prices prevailed during much of the 1995 season, and as a consequence, the total F.O.B. value of the Dade County mango crop was only \$1.7 million. An estimated 80 percent of total sales, about \$1.3 million, were made outside of Dade County (Table 23).

Carambola

Carambola, also called star fruit, is one of Dade County's most successful tropical fruits of the 1980s and 1990s. Native to tropical Asia, carambola were first grown in Florida over 100 years ago. However, until the 1970s, the fruit was grown primarily as a dooryard curiosity because of its tart, sour taste (7, 18). Improved, sweeter varieties developed in the 1970s by USDA, private breeders, and University of Florida horticulturists at the Tropical Research and Education Center in Homestead stimulated interest in carambolas as a commercial crop. Aggressive marketing programs by J. R. Brooks and Sons, Inc. and other shippers helped foster rapid expansion of carambola production. In the early 1980s, carambola acreage stood at 40 acres, but by the end of the decade, acreage had increased to 600 acres (Table 24). A significant portion of this acreage was severely damaged or destroyed, but by 1996, Dade County's total acreage was estimated at 532 acres. This represents about 80 percent of the state's total carambola plantings.

In the 1995-96 season, yields of nearly 40,000 pounds per acre, packouts of about 60 percent and season average F.O.B. prices approaching \$1.40 per pound resulted in F.O.B. revenues of about \$17.4 million. Total revenues for carambola were greater than any of the other tropical fruit crops grown in Dade County (Table 23). An estimated 98 percent of all carambola shipments go to destinations outside of the county.

Mamey Sapote

Mamey sapote, originating in the Mexican and Central American lowlands, is a football shaped fruit that can measure up to nine inches in length and usually weighs from one to three pounds, although it can weigh up to eight pounds. The main mamey sapote crop matures from May through September in Florida, but fruit can be found any time of the year. Trees may have flowers, immature fruits, and mature fruits on their branches all at the same time. Depending on the weather, an individual fruit can require up to two years to mature in Florida (18).

Mamey sapote acreage steadily increased from 200 to 350 acres in the early 1980s, then dropped to 226 acres in the 1986-87 and 1987-88 seasons. By the 1988-89 season, acreage had increased to 267 acres (Table 24). By the time Hurricane Andrew hit, mamey sapote acreage had once again increased to about 300 acres, and in the ensuing seasons, increased ever-so-slightly to 308 acres. Although the total acreage of mamey sapotes had recovered, many trees still had not reached their full production potential during the 1995-96 season due to young trees and older trees that were still recovering from storm damage. As a result, average yields were estimated at 4,870 pounds per acre. Despite the relatively low yields, favorable prices (\$2.40 per pound, F.O.B.) resulted in a total value of nearly \$3.6 million. Approximately 80 percent of mamey sapote sales went to destinations outside Dade County (Table 23).

Table 24. Acreage of selected tropical fruits in Dade County 1982-83 to 1995-96.^a

Year	Carambola	Lychee	Papaya	Mamey sapote	Banana	Longan	Guava	Pummelo	Passion fruit	Kumquat	Sugar apple	Atemoya
(- - - - - Acres - - - - -)												
1982-83	40	150	350	200	350	30	90	n.a.	n.a.	n.a.	70	n.a.
1983-84	40	200	350	300	350	40	35	n.a.	n.a.	n.a.	50	20
1984-85	40	200	350	300	350	30	40	n.a.	n.a.	n.a.	50	20
1985-86	140	170	350	350	350	40	40	n.a.	n.a.	n.a.	50	20
1986-87	411	145	350	226	275	64	37	n.a.	22	n.a.	59	44
1987-88	411	145	350	226	275	64	37	n.a.	22	n.a.	59	44
1988-89	475	195	350	267	300	72	77	n.a.	n.a.	n.a.	49	52
1989-90	600	200	375	267	580	72	77	20	100	25	75	120
1990-91	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1991-92	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1992-93	400	100	n.a.	300	600	100	80	40	10	25	25	75
1994 ^b	532	511	394	307	300	294	197	35	62	26	23	41
1994-95	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1995-96 ^c	532	511	250	308	302	310	199	45	15	26	25	15
1995-96 ^d	532	200	250	308	302	124	149	45	10	26	20	10

^a In addition to the fruits listed in this table and in Table 21, sapodilla, Barbados cherries, wax jambu, jackfruit, key limes, canistel, black sapote, persimmons, white sapote, coconuts, ambarella, jaboticaba, loquat, macadamia, monstera, Spanish lime, star apple, tamarind, wampee and assorted citrus other than Persian limes, pummelo and kumquats are produced in Dade County. Combined acreage was approximately 151 acres in 1996. Time series data for this group of tree crops are not available.

^b These estimates do not correspond with a production "season", but reflect acreage as of December 31, 1994. Also, these estimates are based upon growers' statements as to actual planted acreage and planting intentions; some of the intended plantings may not have occurred.

^c The first estimates for 1995-96 reflect total acreage.

^d The second set of estimates for 1995-96 show bearing acreage.

Sources: Marketing Florida Tropical Fruits and Vegetables, Federal-State Market News Service, Winter Park, FL Annual summary 1982-83-1992-93. Estimates for 1994 were made on the basis of a grower survey conducted by the Florida Agricultural Market Research Center, and estimates for 1995-96 were made by IFAS horticulturists in Homestead.

Longan

The longan, also known as "Dragon's eye", is native of India (20). It is a close relative to the lychee but the longan fruit has a milder flavor than the lychee. These two crops bear about a month apart in South Florida. One of the problems of both the longan and lychee is their tendency towards alternate or erratic seasonal production. However, the longan is a tougher (withstands slightly lower temperatures) and is a less fussy crop than the lychee (2, 18).

The longan has several additional advantages over the lychee. Unlike the lychee, the longan, growing in clusters of 3 to 20 or more fruits, can be sold in picked clumps rather than individually packed fruits. The longan can also remain a saleable item for a longer time because the naturally brown longan does not suffer from color change (2). In Dade County the longan is generally harvested from mid July through mid August.

After slowly increasing from about 30 acres in the early 1980s to 72 acres in the late 1980s, longan acreage in Dade County increased rapidly after Hurricane Andrew. By 1995-96, total longan plantings were estimated at 310 acres, of which 124 were bearing (Table 24) average yields were estimated at 8,000 pounds per acre, well below anticipated yields for fully mature groves. Packout was estimated to be 90 percent. F.O.B. prices in the 1995-96 season were very favorable, averaging about \$3.60 per pound. Thus, despite relatively low yields, the total value of the crop was estimated to be over \$3.2 million. Approximately 85 percent of the longan crop was shipped to destinations outside of Dade County (Table 23).

Guava

Guava is primarily used for jelly-making or other culinary purposes. Native to tropical America, it is said to have been introduced into Florida from Cuba in 1847. A heavy fruit bearer, the guava tree ripens its fruit practically all year round, although the bulk of Florida production occurs during the summer months (17, 18). Throughout most of the 1980s, guava acreage in Dade County fluctuated from 35 to 40 acres. However, in the late 1980s and early 1990s, acreage increased to approximately 80 acres. Interest in guava production escalated after the hurricane, and by the end of 1994 acreage was estimated to be 197 acres.

During the 1995-96 season, total planted acreage approached 200 acres, of which about

three-fourths was of bearing age (Table 24). For this season, yields were estimated at 25,000 pounds per acre, packout at 70 percent, and F.O.B. prices at \$1.15 per pound, resulting in a total crop value of nearly \$3 million (Table 23).

Plantain and banana

Plantains and bananas grown in Dade County are *Musa spp.* which are tropical specialty bananas. Compared to the dessert banana generally found in the supermarket, plantains are much larger, less sweet, more starchy, and are cooked before eating. Other bananas grown in Dade County tend to be smaller and thicker than dessert bananas but are sweet tasting (18).

Throughout the early 1980s, banana acreage in Dade County was fairly stable at 350 acres. After dropping down to about 275 to 300 acres in the late 1980s, acreage rebounded to about 600 acres in the late 1980s and early 1990s. Following the hurricane, growers have experienced disease problems, and acreage has not regained pre-hurricane levels. As a result, acreage has remained at about 300 acres and yields have been about 12,000 pounds per acre. Demand has remained strong, however, and in 1995-96, season average F.O.B. prices were conservatively estimated at 70 cents per pound. Thus, the total F.O.B. value of banana production was slightly over \$2.5 million in 1995-96, with half of the sales made outside of Dade County.

Papaya

Papaya acreage in Dade County remained constant at 350 acres throughout most of the 1980s. However, in the 1989-90 season, acreage increased to 375 acres. After Hurricane Andrew, interest in papayas increased, and by the end of 1994, acreage was estimated to be nearly 400 acres (Table 24). However, total acreage during the 1995-96 production season was estimated to be down to 250 acres. Average yields during the 1995-96 season were about 25,000 pounds per acre, packout about 85 percent, and the season average F.O.B. price 30 cents per pound. Thus, the total value of papaya production was estimated at \$1.6 million, with half the sales outside the county (Table 23).

Lychee

The lychee or litchi originated in southern China. It has been introduced widely in the

tropical and subtropical world, but has proved to be well-adapted in relatively few places. There is commercial production in the U.S. (Florida and Hawaii), southern China, Taiwan, India, South Africa, and Australia. In southern Asia, lychee cultivation dates back at least two thousand years. While the lychee is believed to have been planted in Florida as early as 1886, it was not until 1916 that the first fruits were produced (2).

The greatest constraint to commercial production of lychee in Florida has been its erratic flowering and fruiting. However, in recent years, improved cultural practices have helped to overcome these problems. These advances, coupled with favorable prices, have stimulated greater plantings in Dade County. Throughout the 1980s, lychee acreage ranged between 145 and 200 acres. Hurricane Andrew reduced lychee acreage to about half of pre-storm levels. However, significant plantings have been made in the post-hurricane period. Total lychee acreage in 1995-96 was estimated at 511 acres, of which only 200 were bearing (Table 24). Of the bearing acreage, about 100 acres were mature, yielding about 8,750 pounds per acre and 100 acres were young trees bearing about 1,000 pounds per acre. With an average packout of 70 percent and extremely favorable prices (estimated at \$3.75 per pound), the F.O.B. value of the Dade County lychee crop was over \$650,000 in 1995-96, approximately 95 percent of which was shipped out of the county (Table 23).

Passion fruit

Passion fruit originated in the American tropics. It is now grown in most tropical and subtropical parts of the world, but is particularly important commercially in Australia, Hawaii, South Africa, and Brazil (24). In Dade County, passion fruit acreage increased rapidly in the late 1980s, going from 22 acres in the 1987-88 season to 100 acres in 1989-90. Official acreage estimates after the hurricane reported only 10 acres of passion fruit (Table 24). In the 1995-96 season, bearing acreage of passion fruit was 10 acres, and yields were estimated at 21,500 pounds per acre. With a packout rate of 85 percent and a season average F.O.B. price of \$2.50 per pound, the total value of production was nearly \$457,000 (Table 23).

Pummelo

Pummelo, also called Chinese grapefruit, represents a small, but growing segment of the

tropical fruit industry in Dade County. In the 1989-90 season, there were 20 acres of pummelo, and by the 1992-93 season there were 40 acres. Although acreage declined slightly as a result of Hurricane Andrew, by 1995-96 there were an estimated 45 acres in production (Table 24). Of these, approximately 20 acres are older, mature trees yielding about 25,000 pounds per acre, and 25 acres are younger, producing about 10,000 pounds per acre. In the 1995-96 season, the season average F.O.B. price was nearly 60 cents per pound, resulting in a total crop value of \$435,000, of which 95 percent was sold outside of the county (Table 23).

Kumquat

Kumquats originated in China and were introduced into the U.S. in the last century (18). A specialty citrus item, the tart fruit is frequently included in gift packs, and is in high demand during major holiday seasons in the fall and winter. Dade County kumquat acreage has been very stable at about 25 acres over the past few years, before and after the hurricane (Table 24). In the 1995-96 season, yields averaged about 8,300 pounds per acre, and packout was estimated at 95 percent. Estimates of season average prices ranged between \$1.25 and \$1.50 per pound, resulting in a total crop value of about \$283,000.

Atemoya

The atemoya's scientific name is *Annona cherimola* x *A. squamosa* indicating that it is a cross of the cherimoya and the sugar-apple. Other common names for the atemoya are custard apple and anon. In Florida, the atemoya is best adapted to frost-free areas (18). Virtually all of the state's commercial production is in Dade County. Atemoya acreage steadily increased throughout the 1980s, going from 20 acres in 1982-83 to 120 acres in 1989-90. Following the hurricane, acreage dropped precipitously, and by the 1995-96 season, there were only 10 acres in production (Table 24). The estimated yield was 6,400 pounds per acre, and the packout was about 80 percent. Although the quantity shipped was just over 51,000 pounds, the F.O.B. price of \$4.00 per pound generated nearly \$205,000 in sales, of which 95 percent were made outside of Dade County (Table 23).

Sugar apple

The sugar apple is a type of annona, and it is also called sweetsop. Throughout the 1980s,

sugar apple acreage fluctuated from about 50 to 75 acres (Table 24). Since the hurricane, however, acreage has been estimated to be 25 acres or lower. In the 1995-96 season, bearing acreage was only 20 acres, and yield 1,000 pounds per acre. Given a packout of 90 percent and a reported season average F.O.B. price of \$3.00 per pound, the total crop value was \$54,000. Because of the fragile nature of the sugar apple, it does not ship very well; it was estimated that only 10 percent of the crop is shipped out of the county (Table 23).

Miscellaneous Tropical Fruit

Approximately 20 tropical fruits have been combined into the miscellaneous category to maintain the confidentiality of data obtained from individual firms. Fruits included are sapodilla, Barbados cherries, wax jambu, jackfruit, key limes, canistel, black sapote, persimmons, white sapote, coconuts, ambarella, jaboticaba, loquat, macadamia, monstera, Spanish lime, star apple, tamarind, wampee, assorted citrus such as oranges, tangerines and grapefruit. Acreage of these fruits ranged from about one acre to about 30 acres; the combined total acreage for the 1995-96 season was 151 acres, up from 138 acres in 1989-90 (Table 21). Yields and prices for these fruits vary considerably, but most of the "exotics" typically sold for \$1.50 to \$2.50 per pound F.O.B. Homestead in the 1995-96 season, although more common types of fruit sold for considerably less. Overall, the market value of the fruits in the miscellaneous category totaled over \$934,000. Because of limited quantities of some items and heavy local demand, slightly over 40 percent of the "miscellaneous" sales were made within Dade County (Table 23). According to growers and professional horticulturists, a number of the fruits in their category have the potential for much greater economic importance.

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