

ever, when only single, broadcast applications are made, heavy rainfall may erode soil and wash away fertilizer granules, especially in newly bedded groves without adequate sod cover. Incorporating or burying fertilizer in the root zone may preclude these problems.

In future studies, controlled-release fertilizers, especially single applications of high analysis materials, should be further compared with standard fertilizer practices for trees under low volume irrigation. Controlled-release materials should also be thoroughly tested in reset situations and for growth enhancement during winter months. All experiments reported in this paper were conducted for only 1 yr. Longer term experiments with controlled-release fertilizers may further confirm the value of these materials

in fertilization programs for both young trees and bearing groves.

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MARKETING PROBLEMS AND POTENTIALS CONFRONTING THE FLORIDA FRESH CITRUS INDUSTRY

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Abstract. As a result of freeze-reduced crops and strong export demand for Florida citrus, fresh fruit utilization has become relatively more important during the past decade. In addition, the wholesale value of Florida fresh citrus has reached record high levels. However, questions remain as to the strength of the fresh citrus market. While U.S. per capita consumption declines can be partially explained by the higher prices associated with smaller crops, increased competition from other fresh produce has contributed to this situation. This paper explores production and marketing trends for fresh grapefruit, oranges and specialty fruit and delineates both market problems and potentials.

As the Florida citrus industry recovers from the freezes of the early and mid 1980's, the fresh fruit sector of the industry is emerging with new vigor. Total shipments of Florida fresh citrus reached 71.434 million 4/5 bushel cartons in the 1987-88 season, the second-highest total in the past decade (Table 1). The 1987-88 shipments represented an 8.3% increase from the previous season and nearly a 50% increase (47.9%) from the freeze-impacted 1984-85 season. During the past decade, fresh shipments of Florida citrus have fluctuated from a high of 71.937 million cartons during 1979-80 to a low of 48.292 million cartons during the 1984-85 season. These variations in shipment levels are primarily related to the series of freezes in the 1980-81, 1981-82, 1983-84 and 1984-85 seasons.

In the 1987-88 season, fresh citrus shipments accounted for 17.6% of Florida citrus production. The FOB value of Florida's fresh citrus reached a record \$490.6 million in the 1987-88 season, an increase of 15.5% from the previous season (Table 2). Of this total, grapefruit accounted for \$284.8 million. Specialty citrus including navels and Temples, represented FOB sales of \$111.1 million and oranges accounted for \$94.7 million.

Fresh grapefruit shipments accounted for 63.3% of all fresh shipments in 1987-88, with pink grapefruit at 41.4%

Table 1. Total Florida fresh citrus shipments, 1978-79 through 1987-88 seasons.²

Variety	Fresh Citrus shipments per season ¹ (million 4/5 bushel cartons)									
	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88
Grapefruit	37.8	36.5	32.3	31.7	34.6	30.5	29.6	38.7	41.2	45.2
Oranges	20.7	19.8	14.5	12.9	18.4	13.1	12.1	17.5	17.4	18.2
Temples	3.8	5.1	1.9	1.5	2.9	1.3	1.2	1.7	2.0	2.4
Tangelos	3.1	3.2	3.8	3.2	3.4	2.9	2.8	2.6	2.5	2.6
Honey										
tangerines	1.9	2.8	0.5	0.6	1.2	0.8	0.5	0.9	1.2	1.5
Tangerines	3.6	4.5	3.7	2.9	2.8	2.6	1.6	1.4	1.6	1.6
Total*	70.9	71.9	56.7	52.8	63.3	51.2	48.3	62.8	65.9	71.4

²Source: Economic Research Department, Florida Department of Citrus.

¹78-79 through 83-84 seasons are July 1 through June 30; 84-85 through 87-88 seasons are August 1 through July 31.

*Summation differences due to rounding.

Table 2. FOB value of Florida fresh citrus.^z

Season	Million Dollars			Total
	Oranges	Grapefruit	Specialty ^y	
1979-80	71.9	159.6	108.1	339.6
1980-81	58.5	158.7	87.1	304.3
1981-82	57.8	143.6	78.0	279.4
1982-83	82.0	151.3	103.8	337.1
1983-84	64.5	152.8	82.2	299.5
1984-85	81.6	167.5	85.8	334.9
1985-86	74.1	213.1	92.5	379.7
1986-87	77.8	250.5	96.6	424.9
1987-88	94.7	284.8	111.1	490.6

^zSource: Economic Research Department, Florida Department of Citrus.^yIncludes navels and Temples.

and white grapefruit at 21.9%. Fresh oranges represented 25% of all fresh shipments, led by early and midseason oranges at 10.1%, 'Valencia' oranges at 9.5% and navels at 5.4%. Specialty citrus varieties, including tangelos, 'Temples', 'Honey' tangerines, tangerines and 'K-earlies', accounted for the remaining 11.8% of fresh shipments in the 1987-88 season. The recent growth in fresh citrus shipments has been led by grapefruit, with a 53% increase in shipments between 1984-85 and 1987-88 from 29.6 to 45.2 million 4/5 bushel cartons. Fresh orange shipments increased 42% during the same period from 12.8 million to 18.2 million cartons.

The Export Market

While most of the above noted increase in fresh orange shipments is accounted for by the domestic U.S. market, all of the increase in fresh grapefruit shipments comes from the export market. Fresh grapefruit exports nearly tripled between 1983-84 and 1987-88, increasing from 8.3 million to 23.9 million 4/5 bushel cartons. Excluding Canada, offshore fresh grapefruit exports nearly quadrupled during the same period, increasing from 5.7 million to 20.7 million cartons.

Grapefruit dominates Florida's fresh citrus exports, accounting for 93% of total fresh citrus exports in 1987-88. In the 1987-88 season, exports of Florida fresh grapefruit exceeded domestic shipments for the first time in history, accounting for 52.9% of total fresh grapefruit shipments (Table 3). The leading fresh grapefruit export market area is the Far East or Pacific Rim with 51.2% of Florida's export shipments of grapefruit in the 1987-88 season. Japan dominates Far East grapefruit shipments, accounting for 89.5% of shipments to the region in 1987-88. During the same season, Taiwan represented an additional 8.8% of Far East grapefruit shipments. The second largest fresh grapefruit export market is Europe with 35.4% of total 1987-88 export shipments. Canada accounts for an additional 13.4% of fresh grapefruit exports. In the 1987-88 season, three countries (Japan, France and Canada) accounted for 73% of Florida fresh grapefruit export.

Grapefruit

Grapefruit dominates the fresh sector of the Florida citrus industry. During the 1987-88 season, a record 22.6 million 1 3/5 bushel boxes of grapefruit were shipped fresh, accounting for 41.9% of Florida grapefruit produc-

Table 3. Florida fresh grapefruit shipments, 1983-84 through 1987-88 seasons.^z

Destination	Fresh grapefruit shipments per season ^y (million 4/5 bushel cartons)				
	83-84	84-85	85-86	86-87	87-88
Domestic	18.2	21.3	24.5	22.8	21.3
Export	12.3	8.3	14.2	18.4	23.9
Canada	2.6	2.6	3.1	2.9	3.2
Europe	3.5	3.1	4.9	6.2	8.4
Far East	6.2	2.6	6.2	9.2	12.2

^zSource: Economic Research Department, Florida Department of Citrus.^y83-84 season is July 1 through June 30; 84-85 through 87-88 seasons are August 1 through July 31.

tion. Over the past decade, fresh grapefruit shipments have increased from 16.7 million 1 3/5 bushel boxes in the 1977-78 season to the current record level. Recently, fresh grapefruit shipments have been enhanced by strong export demand. During the 1985-86 through 1987-88 period, an increased amount of fresh fruit has been diverted from domestic to export markets. The decline in the value of the dollar against foreign currencies and increased marketing efforts have been major influences in stimulating export demand. As exports have expanded so has the value of the fresh grapefruit export market. The FOB value of Florida fresh grapefruit exports has increased from approximately \$31 million in the 1984-85 season to \$93.4 million in 1986-87 and further to an estimated \$132.4 million in the 1987-88 season. Export demand for Florida grapefruit in the next decade will depend on a favorable exchange rate environment, industry marketing efforts and trade liberalization efforts.

As noted, export shipments of Florida fresh grapefruit exceeded domestic shipments in 1987-88 for the first time in history. The domestic market has declined in importance as the export market has grown. Domestic consumption of fresh grapefruit has declined primarily in response to record high prices associated with freeze-reduced supplies and strong export demand. During the 1970's, the average U.S. per capita consumption of grapefruit was 8.3 pounds. By 1985, average per capita consumption had declined to 7.1 pounds. In 1986, U.S. consumption further declined to 6.6 pounds per person.

The trends in shipments of fresh grapefruit coincide with the increased availability of the colored (pink) variety relative to the white variety. Since 1977-78, production of colored grapefruit has increased from 14.2 million 1 3/5 bushel boxes to 21.9 million boxes in 1987-88. In contrast, white grapefruit production has declined somewhat from 31.1 million boxes in 1979-80 to 29.2 million boxes in 1987-88. By 1998-99, Florida grapefruit production is estimated to increase by about 24% to 67 million boxes. Almost all of this increase will come from colored varieties. Utilization of Florida grapefruit differs by variety. Between 1982-83 and 1986-87, average fresh utilization of pink seedless grapefruit was 67.9% compared to 29.4% for white seedless grapefruit.

Oranges and Specialty Citrus

Although the volume of Florida orange and specialty fruit movement into fresh market channels may not be as great as grapefruit, oranges and specialty fruit play an im-

portant role in Florida's fresh fruit industry. During the 1987- 88 season, shipments of fresh Florida oranges accounted for 25% of total Florida fresh fruit shipments. Specialty fruit shipments during the 1987-88 season represented 12.5% of total fresh fruit shipments. During the past 10 years, shipments of fresh oranges and specialty fruit have fluctuated in response to freeze-induced changes in the size of the crop.

Per capita consumption of fresh oranges in the U.S. has remained relatively stable since 1970. In 1986, the average U.S. resident consumed 14.6 pounds of fresh oranges, about the same as during the 1970's (14.4 pounds). It is estimated that Florida oranges account for about 20% of domestic orange consumption. It is interesting to note that over 60% of U.S. fresh orange purchasers perceive the origin of fresh oranges to be Florida (3).

Per capita consumption of specialty fruit has declined over the past decade. Through the 1970's, per capita tangerine and tangelo consumption averaged 2.6 pounds, but by 1986 per capita consumption had fallen to 1.5 pounds. The principle reason behind these declining per capita consumption levels has been a short supply situation largely caused by freezes which have reduced Florida specialty fruit production.

Expectations and Challenges

Continued growth in the fresh sector of the industry will depend upon how it deals with future competitive challenges. While continued export market growth will depend upon industry marketing efforts, the exchange rate environment, and trade liberalization efforts, the domestic market faces a different set of challenges. One such challenge is the recovery of the Texas grapefruit industry. In the early 1980's, Texas supplied a little more than one-quarter of fresh grapefruit available domestically. During the 1983-84 season, a severe freeze virtually destroyed grapefruit production capacity in Texas. No citrus was produced in 1984-85. However, the industry in Texas is rebounding; grapefruit production is currently forecast to reach 4.5 million boxes during the 1988-89 season, about 70% of which can be expected to be sold through fresh market channels. It is estimated that annual Texas grapefruit production could increase to the 10 million box level within 10 years (2).

Florida oranges and specialty fruit compete with a variety of citrus and non-citrus fruit. Among citrus fruit, California navels and 'Valencia' oranges dominate the domestic market with more than two-thirds of domestic requirements. California orange production is not expected to grow substantially in the near future.

During the past decade, imports of fruits such as grapes, peaches and plums from South America have had a considerable impact on availability of fruit varieties in grocery store produce departments. Prior to these imports, fresh citrus and bananas were the primary fruits available to American consumers during the winter months. Consequently, fresh Florida citrus is facing growing competition.

Domestic marketers of fresh Florida citrus face some significant challenges ahead. To support the industry's marketing effort, a strategy study was conducted by the Florida Department of Citrus to provide direction for future advertising and promotional programs. Several fac-

tors seem to be influencing and changing fruit shopping behavior. The variety of different fruits available continues to grow. The produce section in the supermarket is growing to accommodate the increasing varieties. In-store promotional activities such as sampling, recipe cards and signs proliferate. Fruits that are regarded as year-round staples are oranges, apples and bananas. These top three fruits accounted for 61% of all fresh fruit consumed in the U.S. in 1986. All fresh citrus varieties accounted for 27% of total fresh fruit consumption (1).

Oranges are very popular with most consumers. They are eaten throughout the day, at a variety of locations, in a variety of ways, year round. Children like them and they are perceived to be fairly economical. Oranges tend overall to be very positively perceived, with advantages far outweighing disadvantages. However, consumers often complain that they have difficulty telling a good orange from a bad one. An orange is described as bad if the fruit is too dry. Since oranges as a category are so integrated into consumer diets and lifestyles, they appear to be at a relatively mature stage of their product lifecycle. Thus, one way to promote Florida oranges might lie through a campaign that educates consumers about the particular attributes and seasonality of the Florida varieties (1).

There is high awareness of specialty fruit such as tangerines and tangelos. They tend to be closely associated with the winter holiday season and are regarded as a treat, popular with children and easy to eat. They may be purchased as a substitute for oranges, but more often are purchased in addition. These fruit are regarded as expensive and of inconsistent quality. Since they have such a short season, consumers need to be reminded of their availability each year.

Grapefruit is viewed primarily as a breakfast or diet food and is strongly associated with weight reduction among users and non-users. Grapefruit is almost always eaten halved and sectioned. As the number of working women increases, demand for more convenience from food stuffs has increased also, especially at breakfast. Many consumers limit grapefruit consumption due to the perception of lengthy preparation time. In terms of their usage and consumption of grapefruit, consumers fall into one of four segments; enthusiasts, amnesiacs, uninformed, and avoiders. Enthusiasts like the taste of grapefruit and use it in the largest variety of ways. They may eat it at breakfast, as an appetizer or dessert, peeled or halved. Grapefruit is a staple fruit for these consumers and is very positively perceived. Amnesiacs like the taste of grapefruit, enjoy eating it, but forget about it when it is not immediately in front of them. Uninformed have no negative taste perceptions of grapefruit but are not aware of the different types (colors) and ways to eat grapefruit, and, in fact, rarely eat it. Avoiders do not like the taste of grapefruit and are very negatively disposed toward it. Dieters are a floating group. These are individuals who may be in any of the four segments. When on a diet, they eat substantial quantities of grapefruit. However, when the diet is over, they may not eat grapefruit for several months. Amnesiacs and uninformed tend to think grapefruit is cumbersome to prepare and limit its consumption to traditional sit-down breakfasts or diets, halved and sectioned (1).

It appears that the dearth of past advertising for grapefruit has weakened its status among fruit in general.

Grapefruit seems to suffer from a lack of image or identity. The study suggest that long-term consumer demand for grapefruit can best be built by demonstrating how grapefruit can become a more mainstream fruit. Three strategic components were identified as key to achieving this. These are: (1) Reposition and build an identity for grapefruit by showing its versatility; (2) Make grapefruit "user friendly" and contemporize its image; (3) Target efforts to those groups most open to new messages: amnesiacs and uninformed. The study recommends down-playing the diet aspect of grapefruit since that is a given with the consumer; instead, play up its health benefits (1).

Concluding Comment

The strength of the fresh citrus market has been affected by consumption declines resulting from a combina-

tion of higher prices and increased competition. Export market growth for Florida fresh citrus will depend on industry marketing efforts, currency exchange rate environment and trade liberalization. Domestic market growth will be a function of price and competition from Texas grapefruit, California oranges and non-citrus fruit imports.

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EFFECTS OF HUMATE AMENDED SOILS ON THE GROWTH OF CITRUS

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Abstract. Field experiments were conducted to determine the influence of humates on 1) citrus trees determined to be under stress and 2) new citrus plantings. Twenty-three-year-old 'Honey' tangerines (*Citrus reticulata* Blanco hybrid) were treated in April 1986 and 1987 with 5 humate combinations. Tree flush and productivity when compared to the controls increased when measured after a 2-yr period. Water uptake data was taken on 23-yr-old declining 'Valencia' (*C. sinensis* (L.) Osb.)/rough lemon (*C. limon* (L.) Burm. f.) trees treated with either 6, 4, or 2 lb. humate or 2 lb. activated carbon (plus a control). Trees treated with all humate levels exhibited higher water uptake 1 yr later, were greener, and produced more vigorous growth flushes. Two new plantings of 'Hamlin' (*C. sinensis* (L.) Osb.)/'Cleopatra' mandarin (*C. reticulata* Blanco) and 'Ruby Red' grapefruit (*C. paradisi* Macf.)/'Swingle' citrumelo (*Poncirus trifoliata* (L.) Raf. x *C. paradisi* Macf.) were treated with 0.5, 1, 2, and 4 lb. of humate at planting. Both plantings indicated the 1 lb. rate of humate produced a large increase in the cross-sectioned stem area of young trees. Studies are continuing to determine what long-term effects may occur.

Humic substances are widely distributed organic carbon materials found in soils, fresh water, and oceans (7, 10). These substances are formed from biological and chemical degradation of animal and plant life and constitute approximately 75% of the organic matter in most inorganic soils (7). Organic substances play a direct role in the

production of fertile soils because they are a source of inorganic nutrients that are held by exchange matrices. Also, organic matter has a fundamental effect on the water-holding capacity as well as the exchange and buffering properties of the soil (9).

Although the term "humic acid" implies that these substances are acids and form true salt compounds, they actually are colloidal and may behave like clays in the soil (9). When hydrogen ions fill the cation exchange sites on the humic acid molecule, the product is considered to be acidic although this molecule is almost insoluble in water. When hydrogen is not the predominant cation, this product is called "humate" (9). Humates have a large exchange capacity and greatly affect the availability of nutrients to plant roots (8).

Many researchers have investigated the effect of humates on plant growth with varying results. Kononova and Alexandrova (5) reported beneficial effects of humates on soil fertility and plant growth. Bryan (1) reported an increase in yield and size of tomatoes. Conover and Poole (3) found that low levels of humates added to potting media increased ornamental plant growth. Other researchers have experienced varying degrees of success with humates on different crops (4, 6, 8).

The objectives of this study were: 1) to determine if humates affected growth and production in citrus and 2) to investigate the effects on citrus trees under stress. The humates used in this study are a commercially available humate product mined in north Florida.

Materials and Methods

Study 1. Twenty-three-year-old 'Honey' tangerine on 'Cleo' rootstock near LaBelle, Florida were selected which exhibited symptoms of growth stress; i.e., no fruit, thinning canopy, and limb breakage. These symptoms were typical of trees exhibiting citrus blight (11). Water uptake readings were taken in March 1986 using a modified Cohen (2) procedure. Initial readings were stratified across all treatments from preselected values that indicated