Avocados:
An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

Prepared by the Economic Research Service, USDA
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Executive Summary

Avocados are a tropical fruit and commercial production in the United States is limited to California, Hawaii, and Florida. The value of U.S. avocado production between 1989/90 and 1993/94 (five seasons) ranged from $118 million to $251 million, averaging $196 million. Florida and California accounted for 5 and 95 percent, respectively, of the U.S. value of avocado production over that five-season period, while Hawaii accounted for an inconsequential amount.

California markets avocados year round, but the largest volume is shipped between March and August. Florida's marketing season extends from June through March, with about 90 percent of its volume shipped between August and December. Hawaii produces less than 1 percent of the U.S. crop, worth less than $500,000, and has limited out-of-state shipments.

Avocados are grown mostly in California's southern coast region, which includes San Diego, Riverside, Ventura, and Santa Barbara counties. Acreage has been declining in San Diego County since 1990, but has been rising in Ventura County. The higher cost of water in San Diego County than in Ventura County is one reason for this shift in location.

Nearly all of Florida's avocados are grown southwest of Miami, in Dade County. Hastened by tree losses due to high winds from Hurricane Andrew in 1992, Florida's bearing acreage declined from a peak of 11,300 acres in the mid-1980's to 5,800 acres in 1994. Hurricane Andrew eliminated 3,000 acres of avocados, of which only about 350 have been replanted. Because no resurgence of avocado planting is anticipated in Florida, California will likely further dominate U.S. production.

Avocados are primarily used fresh in salads and as the main ingredient in guacamole. Cooking impairs their flavor and appearance, but satisfactory frozen products have been prepared from the pulp. Less than 10 percent of U.S.-grown avocados are used for processing.

U.S. avocado consumption topped 2 pounds per person in 1993, the highest level since 1987, when per capita consumption reached nearly 2.4 pounds. Consumption, up sharply during the 1980's, has trended downward during the early 1990's. The decline is due to the 1990 freeze in California that lowered production for several seasons.

Avocado prices display a definite seasonal pattern, declining from February through May and rising from June through November. Prices are generally highest, and show the greatest variability from year to year, during October and November when the volume of shipments are typically lowest.

Avocado trees grow to heights of 30-65 feet, but are usually pruned to 20 feet or less in commercial orchards. Avocado trees adapt to a number of different types of soils, but will not tolerate flooding or poorly-drained conditions. In California, the trees are frequently planted on hillsides, which enhances drainage.

Avocados have a high water requirement. A mature, 10-year-old tree in California needs about 25 gallons of water a day during the hottest part of the year and about 15 gallons during the coolest days. Even a one year old tree needs 3 gallons of water during the hottest days and 1 gallon during the coolest.

Hass is the most widely-grown commercial variety of avocado, and accounts for more than 85 percent of California's production. Despite its poor cold tolerance and strong alternate-year bearing tendency, it produces high yields of rich fruit with excellent storage and shipping qualities. While some other varieties tolerate wind and frost better and have less marked alternate-bearing tendencies, most have storage and shipping qualities that are much inferior to Hass.

Trees are usually picked at least twice a year. Fruit selection depends on release-date size requirements and anticipation of price changes. The smaller fruit is permitted to remain on the tree after the first harvest to further increase in size. Freeze-damaged fruit is not saleable and, therefore, not harvested. However, fruit that has dropped may still be marketable if it is mature and picked up within a couple of days.

Avocados are hand picked and harvesting is a highly labor intensive operation. Since the fruit is easily bruised and scratched, workers are encouraged to wear cotton gloves and use canvas picking bags. Picked fruit is placed carefully in field boxes that are kept in the shade or covered. Pickers must be able to selectively choose only desirable avocados and to clip the stem as close as possible without injuring the fruit. In addition, pickers must select fruit that meets the minimum size requirements.

Frost and freezing temperatures appear to be the most serious production peril in avocado production. Temperatures below 30 degrees are possible in both the California and Florida avocado-growing areas. Major freezes are anticipated to happen every 7-10 years in the avocado-growing area of Florida and less often in California. When a severe freeze occurs, production can be reduced for 2 or 3 seasons following the freeze. Other perils include hurricanes, phytophthora root rot, and other fungal diseases.

Grower participation in buying insurance for avocados in California is likely to be proportionately similar to participation for citrus. Both are high value crops and both are subject to similar perils. One consideration that may diminish participation, however, is that avocados appear to be a sideline job for a large number of California's growers. Nearly two-thirds of the farm operators reported some off-farm work during 1987, and 80 percent reported less than $25,000 in farm sales. Most have fewer than 20 acres of avocados.

There is likely to be a moderate amount of interest among Florida growers in purchasing insurance because of severe losses in recent years. Florida producers experienced a severe freeze in 1989 that damaged avocados. Further, Hurricane Andrew destroyed a large number of trees in 1992, along with fruit which had not yet been harvested. The overall demand for avocado insurance in Florida is quite limited, however, because of the small amount of acreage--5,800 bearing acres in 1993.

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Introduction

The avocado belongs to the genus *Persea americana* and, as a member of the laurel family, *Lauraceae*, is related to camphor, sassafras,and cinnamon. The fruit is a berry, consisting of a single large seed surrounded by a buttery pulp. It has an oil content of 3 to 30 percent. The fruit skin varies in thickness from thin to thick, in texture from smooth to rough, and from light green to black in color. The fruit can be round or pear-shaped and weigh as little as a few ounces or as much as 5 pounds.

Hass avocados, the dominant variety grown in the United States, have a thick, rough skin that turns from green to black as the fruit matures and ripens. The yellow-green pulp is usually sliced for use in salads or mashed to make guacamole.

Avocados are grown commercially in Florida, Hawaii, and California, as well as in Mexico, Brazil, Chile, Australia, Israel, and Africa. Although cultivated in the American tropics since pre-Columbian times, avocados were first recorded growing in Florida in 1833 and in California in 1856. Commercial production in both states began between 1910 and 1920. California ships avocados year round and provides the bulk of the U.S. supply. Florida supplies the east coast markets from June through March. Hawaiian avocados can not be shipped to any other state except Alaska, because of plant health requirements restricting the importing of fresh avocados from certain areas.

This report examines those aspects of the avocado industry that relate to the demand for crop insurance and the feasibility of developing an avocado policy.

The U.S. Avocado Industry

Avocados are a tropical fruit and commercial production in the United States is limited to California, Hawaii, and Florida. The value of U.S. avocado production between 1989/90 and 1993/94 (five seasons) ranged from $118 million to $251 million, averaging $196 million (Appendix Table 1). Florida and California accounted for 5 and 95 percent, respectively, of the U.S. value of avocado production over that five-season period, while Hawaii accounted for an inconsequential amount.

California markets avocados year round, but the largest volume is shipped between March and August. Florida's marketing season extends from June through March, with about 90 percent of its volume shipped between August and December. Hawaii produces less than 1 percent of the U.S. crop, worth less than $500,000, and has limited out-of-state shipments.

Location

Avocados are grown mostly in California's southern coast region, which includes San Diego, Riverside, Ventura, and Santa Barbara counties (Appendix Table 2). Acreage has been declining in San Diego County since 1990, but has been rising in Ventura County. The higher cost of water in San Diego County than in Ventura County is one reason for this shift in location (Faber).

Nearly all of Florida's avocados are grown southwest of Miami, in Dade County. Hastened by tree losses due to high winds from Hurricane Andrew in 1992, Florida's bearing acreage declined from a peak of 11,300 acres in the mid-1980's to 5,800 acres in 1994. Hurricane Andrew eliminated 3,000 acres of avocados, of which only about 350 have been replanted. Because no resurgence of avocado planting is anticipated in Florida, California will likely further dominate U.S. production.

The Census of Agriculture reported 7,203 farms growing avocados in 1992, nearly 6,000 of which were in California (Appendix Table 3). Florida reported 604 farms and Hawaii, 610 farms.

Farm Characteristics

Although relatively large farms account for a major share of total avocado acreage, most avocado operations are small businesses. Eighty percent of all farms producing avocados reported crop sales of less than $25,000 in 1987, while just 2 percent reported crop sales of $500,000 or more (Table 1).

A 1990 survey of California avocado growers further substantiates that the majority of farms with avocados are small operations, although the bigger operations account for a large share of the production (Table 2). Seventy-nine percent of the growers reported having 10 or fewer acres of avocados, but they accounted for only 18 percent of the total acreage. Two percent of the growers, on the other hand, reported having more than 100 acres of avocados, and accounted for 38 percent of the avocado acreage.

According to 1987 Census data, 82 percent of the farms with avocados are individual- or family-owned operations (Appendix table 4). Only 4 percent of farms with avocados had a corporate-type structure.

Off-farm employment provides a substantial degree of income diversification for farm operators in both California and Florida. Sixty-six percent of the operators in California reported working off the farm at least 1 day during 1987, and 44 percent reported working off the farm 200 days or more (Appendix table 5). In Florida, 63 percent of the operators worked off the farm at least one day, and 40 percent worked off the farm 200 days or more. Wages from off-farm work provide back-up income for farm operators during years of low avocado returns.

While off-farm employment is an important source of income diversification in both Florida and California, receipts from other agricultural product sales

Table 1--Size distribution of farms producing avocados, from the 1987 Census of Agriculture

State	All farms	Total value of crop sales: $500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number	Percent				
California	5,920	2	6	5	7	80
Florida	554	4	6	4	8	78
Other	428	*	2	5	5	88
U.S.	6,902	2	6	5	7	80

*: Less than 0.5 percent.

Source: 1987 Census of Agriculture.

Table 2--Avocado farm sizes and share of acres, California

Farm size	Share of state avocado acreage	Growers	Share of growers
Acres	Percent	Number	Percent
0-10	18	4,961	79
11-25	17	787	13
26-100	27	443	7
101+	38	95	1
Total	100	6,286	100

Source: California Avocado Society. 1990.

are much more important to operators in Florida than in California. An estimated 79 percent of total sales on California farms with avocados in 1987 were from avocados, while in Florida, avocados accounted for only 18 percent of total sales (Table 3).

In California's Ventura County, a typical avocado operation consists of 20 acres or less. The operator can care for this amount of acreage on weekends and work full-time at another job during the week. Similar operations are also common in San Diego County, where most growers have 5-10 acres of avocados. Typically, these small operations specialize in avocados and sell no other crops. The largest 4 or 5 operations in California have 300-400 acres of avocados and are likely to be growing lemons, oranges, and grapefruit as well as avocados (Faber, Bender).

In Florida, 90 percent of the growers have 20 acres of avocados or less. Typically these growers have diversified cropping plans, producing other tropical crops, such as mangoes, limes, and lichees (Wheeling).

The Avocado Market

Supply

U.S. avocado output is highly variable, ranging from 303 million pounds to 605 million pounds annually over the last 10 years. These wide variations have been due to weather-related disasters, combined with the natural tendency of avocados trees to produce abundantly following seasons with low yields. For example, a hard freeze during December 1990 destroyed avocados in Southern California, reducing yields in 1989/90, 1990/91, and to a lesser extent, in 1991/92. Then, in 1992/93, California produced an average 7,800 pounds of avocados per acre. Average yields have exceeded 5,000 pounds per acre in only three of the last ten seasons.

Hurricane Andrew was responsible for the big drop in Florida's yields during the 1992/93 and 1993/94 seasons. Florida's yields have been slow to recover because a number of trees were pruned heavily, reset, or replanted following the storm and have not reached full-bearing potential. Hurricane Andrew had little effect on U.S. average yields because Florida accounts for such a small share of total output.

Although avocados are marketed year-round in California, nearly 65 percent of the fresh-market fruit was shipped between March and August over the 1990/91 to 1994/95 seasons (Appendix table 6). In Florida, commercial production extends from June to the following March. About 90 percent of the crop, however, was shipped between July and December.

Avocado producers extend their season beyond the peak harvest periods by growing varieties that mature at different times. Also, avocados grown at different altitudes and latitudes mature at somewhat different times. In addition, growers can store mature avocados on the tree for long periods, which further extends the marketing season.

Table 3--Market value of sales from farms producing avocados, 1987

State	All products	All crops	Fruit & nuts	Avocados	Avocados, % of all products
	Million dollars				Percent
California	253	245	220	199	79
Florida	49	49	22	9	18
Other	8	7	6	n.r.	n.r.
U.S.	310	301	248	208	67

n.r. = not reported.

Note: The category "other" is computed as the U.S. total minus listed states.

Source: 1987 Census of Agriculture and USDA/NASS.

Imports account for a relatively small share of total U.S. avocado supplies and do little to stabilize volume and prices. About 10 percent of U.S. supplies were imported between 1990 and 1994, up from 2 percent during 1985-89 (Appendix table 7). Chile was the main source of imports until 1993, when low prices associated with a large California crop prompted Chilean growers to find markets in Europe. Chile exports the Hass variety of avocado and ships during the California off-season. The Dominican Republic also exports avocados to the U.S. The avocados imported from the Caribbean Islands are mostly green-skinned varieties.

Although Mexico is the world's leading producer of avocados, the U.S. has prohibited the importing of fresh avocados from Mexico since 1918. Mexico has had problems with several avocado pests (avocado seed weevils and stem borers) in the past and its avocados have been excluded from the U.S. mainland to prevent infestation of domestic orchards. Avocados grown in Hawaii are not allowed into the 48 mainland states because of similar concerns. Starting in 1993, Mexican avocados could be shipped to Alaska, but not to other states.

Although fresh avocados from Mexico are excluded from the lower 48 States, processed avocado pulp can be imported. California avocado growers are concerned that the North American Free-Trade Agreement may eventually give Mexico increased access to the U.S. fresh avocado market and result in lower domestic prices.

Exports account for only a small amount of U.S. avocado production. Although U.S. exports rise and fall as production rises and falls, less than 5 percent of supplies are typically sold to foreign buyers. Canada, Japan, France, and the United Kingdom are the top export markets. The United States competes mainly with Mexico in the Canadian and Japanese avocado markets, and with Chile in Europe.

Demand

Avocados are primarily used fresh in salads and as the main ingredient in guacamole. Cooking impairs their flavor and appearance, but satisfactory frozen products have been prepared from the pulp. Less than 10 percent of U.S.-grown avocados are used for processing.

U.S. avocado consumption topped 2 pounds per person in 1993, the highest level since 1987, when per capita consumption reached nearly 2.4 pounds (Appendix table 7). Consumption, up sharply during the 1980's, has trended downward during the early 1990's. The decline is due to the 1990 freeze in California that lowered production for several seasons.

Per capita consumption has generally risen since 1970. The growth in use is likely due to an increase in the Hispanic population in the U.S and to a rising interest in gourmet and ethnic foods. Avocados are a traditional ingredient in Mexican and Caribbean foods. It remains unclear whether the emphasis on fresh fruits and vegetables for "healthier eating" has contributed to the increase in avocado consumption. Although a good source of potassium

and vitamin A and free of cholesterol, avocados are relatively high in fat and calories.

Prices

Avocado prices display a definite seasonal pattern, declining from February through May and rising from June through November (Table 4). Prices are generally highest, and show the greatest variability from year to year, during October and November when the volume of shipments are typically lowest (Table 4).

Consumers purchase considerably more avocados when prices decline and cut back substantially when prices rise. A statistical estimate of the demand elasticity for California Hass avocados is -1.25 (USDA/ERS). This suggests that a decline (increase) in quantity purchased is associated with a more than proportionate increase (decrease) in price. In other words, each 1 percent change in price would be associated with a 1.25 percent change in the opposite direction in the quantity purchased.

Although they sell in different ethnic and geographic markets than the California Hass variety, prices for the green-skinned avocados grown in Florida usually rise and fall in tandem with prices for California's Hass avocados. Florida supplies east coast markets where the Caribbean- and Central American-immigrant populations, who prefer the green-skin avocados, are largest. California ships nationwide.

Such a small share of total output is used for processing that there is no separate price series for avocados for processing. A major California processor reportedly uses mostly fresh-grade fruit, so prices for avocados for processing may be about the same as for fresh use (McCormac).

Cultivation and Management Practices [1]

Avocado trees grow to heights of 30-65 feet, but are usually pruned to 20 feet or less in commercial orchards. Although classified as evergreens, some varieties drop their leaves just before flowering. Leaves range from 3 to 16 inches in length and are smooth, leathery, and dark green when mature.

Soil and Water Requirements

Avocado trees adapt to a number of different types of soils, but will not tolerate flooding or poorly-drained conditions. In California, the trees are frequently planted on hillsides, which enhances drainage.

Avocados have a high water requirement. A mature, 10-year-old tree in California needs about 25 gallons of water a day during the hottest part of

[1] Information in this section was complied from publications by Crane, et. al.; Lee, et. al.; Pohronezny, et. al.; and Sauls.

Table 4--California avocados: Monthly f.o.b. prices 1/, 1987-94

Month	1987	1988	1989	1990	1991	1992	1993	1994
	Dollars per pound							
January	0.56	0.64	0.95	1.18	1.24	1.15	0.65	1.16
February	0.60	0.87	0.88	1.05	1.09	0.96	0.66	1.22
March	0.50	0.88	0.79	1.09	1.02	0.77	0.37	1.12
April	0.44	0.87	0.76	1.23	0.90	0.59	0.29	1.17
May	0.36	0.85	0.81	1.23	0.79	0.59	0.28	1.18
June	0.33	1.04	0.80	1.53	0.84	0.61	0.25	1.29
July	0.31	1.09	0.86	1.62	0.70	0.90	0.26	1.29
August	0.21	1.25	0.90	1.69	0.67	0.98	0.26	1.21
September	0.21	1.24	1.05	1.89	1.15	1.12	0.43	1.38
October	0.39	1.79	1.40	--	1.24	1.25	0.48	--
November	0.45	1.61	--	--	--	--	0.56	na
December	0.46	0.97	1.28	1.11	1.13	0.70	1.08	na
Average	0.40	1.09	0.87	1.13	0.90	0.80	0.47	na

--: Insufficient data to establish price.

na: Not available.

1/ Hass variety from California's South District in 28-pound cartons, 2-layer tray packs of size 40s.

Source: USDA, Agricultural Marketing Service.

the year and about 15 gallons during the coolest days. Even a one year old tree needs 3 gallons of water during the hottest days and 1 gallon during the coolest.

Varieties

Indigenous to the West Indies and Central and South America, avocados are grown in tropical and subtropical climates worldwide. The botanical classification of avocados, *Persea americana*, is divided into 3 ecological races: Mexican, West Indian, and Guatemalan. The Mexican and Guatemalan races originated in the tropical highlands and are more cold-tolerant than the West Indian race, which originated in the tropical lowlands. A healthy, mature tree of the Mexican race can tolerate temperatures as low as 18° F, while a West Indian tree may be killed at temperatures below 25° F. The most successful varieties in Florida have been the West Indian and Guatemalan races, or hybrids of the two. Most of the avocados grown in California are derived from the Mexican and Guatemalan races.

There are fewer than 10 varieties of avocados currently grown in California. Hass, the most common, accounted for 86 percent of the 1993/94 crop, up from 80 percent in 1988/89; Fuerte accounted for 2 percent, down from 6 percent; and other varieties (including Bacon, Zutano, Pinkerton, Reed, and Gwen) made up 12 percent (California Avocado Society).

Hass was developed from mostly Guatemalan parentage and has a thick, leathery skin that turns from dark green to black as the fruit matures. The Pinkerton, Reed, and Gwen varieties are related to Hass, but remain green to dark green when mature and have somewhat smoother skin. Bacon and Zutano are from Mexican parentage, have much thinner skins, and mature earlier than Hass. Fuerte avocados were derived from the Mexican and Guatemalan races and have smooth green skin and a higher wind tolerance than Hass.

Hass is the most widely-grown commercial variety. Despite its poor cold tolerance and strong alternate-year bearing tendency, it produces high yields of rich fruit with excellent storage and shipping qualities. While some other varieties tolerate wind and frost better and have less marked alternate-bearing tendencies, most have storage and shipping qualities that are much inferior to Hass.

More than 60 varieties are grown in Florida. About half of Florida's avocado production is thought to be comprised of the Simmonds, Booth 8, Choquette, Monroe, Lula, Nadir, and Booth 7 varieties. Simmonds is a West Indian variety and the others are hybrids of West Indian and Guatemalan races. Small quantities of Pinkerton and Reed (patented varieties of California budwood) have been produced in Florida. The Hass tree is less robust in Florida than trees of other varieties, and the fruit is not as popular among ethnic groups accustomed to larger, green skin avocados.

Simmonds and Nadir are early varieties, whose fruit matures in late June and early July. Booth 8, Booth 7, and Choquette are usually ready for harvest in October. Lula and Monroe are among the latest varieties, maturing in November

and December. Simmonds and Nadir have low tolerance to cold, but the other varieties have moderate to high tolerance. Simmonds, Nadir, and Choquette, however, have greater scab resistance than Booth 8, Booth 7, Lula, and Monroe.

The rich, buttery taste of avocados is mainly attributable to the high fat content. California varieties contain from 3 to 30 percent oil, while Florida's varieties seldom contain more than 15 percent. The oil content rises as the fruit becomes more mature. Hass and Fuerte usually reach a higher oil content than other varieties (Bender).

Fruit size varies from season-to-season, but Florida varieties typically weigh from one-half to two and one-half pounds. California avocados are usually smaller, between one-third and one pound.

Propagation and Planting

Named-variety avocado trees are propagated vegetatively. When trees are grown from seed, fruiting is delayed, and the fruit tends to be less abundant and of poorer quality than fruit from the parent tree.

Propagation can be done in several ways. Using one method, a 4-5 inch long section of budwood is selected and grafted to a seedling using veneer-, side-, or cleft-grafting techniques. Four-to-eight-month old, vigorously growing seedlings are used for rootstocks, while the scion material (the bud or shoot that forms the top of the new tree) comes from a desirable named-variety tree.

Topworking, another propagation method, uses established trees instead of seedlings for the rootstock. Scions of the preferred variety may be cleft-grafted to the cut-back trunk or scaffold branches of a vigorous, healthy tree, or veneer-grafted to the new sprouts arising from the stump or branches of an established tree. Top-worked trees begin to produce commercial-size crops after 2-3 years and new plantings after 3-4 years.

In California, orchard establishment consists of land clearing, laying out roads between tree rows, installing an irrigation system, and planting and staking the trees. Recommended initial spacing for the Hass variety is 20 by 15 feet, which translates to 145 trees per acre. Avocado orchards are likely to be established on a hillside in California.

Orchards need to be thinned periodically as the trees grow larger to prevent overcrowding. An 8-to-12 year-old orchard will likely have about 75 trees per acre. Avocado trees usually reach full-bearing potential after 7 years. The anticipated useful life of avocado trees is about 40 years. However, 75-80 year old trees have been reported in California and Florida.

Fertilization

Avocados require regular applications of nitrogen, phosphate, and potassium. In California, nitrogen is frequently applied through drip irrigation, but can be placed directly on the soil. Fertilizer requirements increase with the age of the tree. During the first year after planting, only about 0.1 pound is

recommended for each tree. At maturity (about 7 years after planting), from 1.5 to 2.0 pounds of nitrogen are needed per tree per year.

Because of the relatively nutrient-poor soil and frequent rains which quickly leach nutrients in Florida, higher fertilization rates are recommended than in California. Young trees in Florida are fertilized every 4-6 weeks during the first year. They need from 0.25 to 0.75 pound of nitrogen, phosphorus, and potash during the first year. Mature trees should be fertilized 3-4 times a year and need 2.0 to 2.5 pounds of nitrogen and potash per year (Balerdi).

Irrigation

Almost all avocados are irrigated. In Florida, irrigation prevents drought stress during dry spells and can be used to prevent frost and freeze damage during cold spells (Balerdi). In California, irrigation is required from May through October and may also be needed during the cooler, rainy season (November-April) if rainfall is inadequate.

Typically, a drip-irrigation system is installed when the orchard is laid out. Growers may replace the drip emitters with micro sprinklers (sprinklers that are under the tree, and that do not provide irrigation overhead) when the trees are about three years old because the micro sprinklers provide more water in a shorter time period and may also be used for frost protection. Although less effective than overhead systems, micro sprinklers raise the temperature a few critical degrees during cold spells (Bender).

Pesticides

Avocados generally experience fewer pest problems than other subtropical crops. Growers in California depend heavily on biological controls to manage insect pests. They introduce predators and parasites of avocado pests into the orchards and maintain conditions to foster their populations. Chemical insecticides, as well as dust and ants, can reduce predator populations and interfere with their ability to control damaging insects (Faber).

Insects do not usually limit fruit production in Florida, although fungal infections can lower yields and reduce fruit quality. Chemical controls for insects are recommended only if substantial populations build up, but chemical controls for plant-parasitic fungi are applied on a regular basis.

Marketing Avocados

Harvesting

Although different avocado varieties mature at different times throughout the year, a given variety matures at about the same time each year. In California, Bacon usually matures in November, Hass in April, and Reed in July (Table 5). Weather conditions may shift maturity dates 1 to 3 weeks before or after normal maturity dates.

Table 5--Avocado varieties and harvest dates

State/variety	Color	Usual harvesting dates		
		Begin	Most active	End
California:		November		November
Zutano	Yellow-green		October-February	
Fuerte	Green		November-May	
Bacon	Dark green		November-February	
Pinkerton	Dark green		December-May	
Hass	Black		April-October	
Reed	Green		July-October	
Florida:		June		March
Simmonds	Green		June-September	
Nadir	Green		July-August	
Booth	Green		October-December	
Choquette	Green		November-January	
Lula	Green		November-February	
Monroe	Green		December-February	
Reed	Green		December-March	

Sources: *Harvesting and Marketing Avocado*; Crane, Balerdi, and Campbell.

A California state law set minimum maturity standards, based on the oil content of the fruit. To be legally mature in California, avocados must be 8 percent oil, by weight.

The California Avocado Commission establishes "release dates" for avocados based on maturity testing. A release date for a specific variety and size fruit is established so that at least 80 percent of the fruit can be expected to satisfy the maturity requirement. During the 1994/95 season, for example, December 2, 1994 was the release date for Hass avocados weighing at least 10 ounces, while December 16 was the release date for those weighing at least 8 ounces. After the release date, all avocados that satisfy the variety/size requirements can be harvested and packed, but are still subject to inspection. Avocados can be harvested before the release dates, but must pass maturity tests at the packinghouse before they will be accepted (McCormac).

In Florida, the Florida Avocado Administrative Committee establishes the date each season that avocados of a specific weight and diameter can be considered mature. Fruit is considered mature and ready for harvest when it reaches a minimum size by a specified calendar date. For example, during the 1992/93 season, Simmonds avocados weighing at least 16 ounces and with a diameter of at least 3-and-9/16-inches could be shipped after June 15, 1993. Restrictions declined to 14 ounces and a 3-and-7/16-inch diameter two weeks later, and after July 13, minimums dropped to 12 ounces and a 3-and-1/16-inch diameter. After July 27, any size of Simmonds could be shipped. Testing for oil content was not found to be a satisfactory method to determine maturity of Florida avocados.

Once avocados mature, growers have a great deal of flexibility about when they harvest because avocados can be stored on the tree, up to several weeks or months depending on the variety and conditions. On-tree storage life in California varies from 2 months for Bacon avocados to 8 months for Hass. Florida growers are less inclined to leave mature avocados on the tree because mature fruit has a tendency to drop to the ground, especially in the summer. Later varieties can remain on the tree longer than early varieties, up to 3 months after maturity.

Although avocados must have reached the minimum maturity standard when harvested, they are not ready to eat. The fruit ripens (softens) only after it has been picked. The time needed for ripening depends on the degree of maturity, storage temperature, and variety. Avocados picked early in the season may require 3-4 weeks to ripen, while later-season fruit may require just 3-4 days.

Rain can interfere with winter harvest schedules in California. In Florida, rain can interfere any time during the harvest season. However, since the timing of harvest is not critical, rain may delay harvesting, but it does not usually result in yield losses by preventing harvesting.

Trees are usually picked at least twice a year. Fruit selection depends on release-date size requirements and anticipation of price changes. The smaller fruit is permitted to remain on the tree after the first harvest to further

increase in size. Freeze-damaged fruit is not saleable and, therefore, not harvested. However, fruit that has dropped may still be marketable if it is mature and picked up within a couple of days (McCormac).

Avocados are hand picked and harvesting is a highly labor intensive operation. Since the fruit is easily bruised and scratched, workers are encouraged to wear cotton gloves and use canvas picking bags. Picked fruit is placed carefully in field boxes that are kept in the shade or covered. Pickers must be able to selectively choose only desirable avocados and to clip the stem as close as possible without injuring the fruit. In addition, pickers must select fruit that meets the minimum size requirements. A scarcity of experienced workers can be a problem for avocado growers.

Packing and Shipping

In California, avocados are delivered to packinghouses in 40-pound field boxes or bulk bins. The California Department of Agriculture specifies fruit-size factors and the size of containers to be used for marketing. The size factor for avocados is "the count" or how many avocados of a certain size fill a standard shipping container. From 8 to 18 large-sized avocados, 20 to 30 medium-sized, and 35-48 small avocados fill a 12.5-pound flat. Another basic shipping container is a 25-pound carton, which holds twice as much fruit as a flat.

After packing, each container is weighed to insure it is within the limits established by the state and each lot of fruit must be certified to meet the legal minimum standard for maturity. The variety and fruit size (count) are stamped on the container. Avocados should not be stored below 42^{o} F to avoid chilling injury and loss of flavor. Shippers frequently condition avocados in storage under controlled atmospheric conditions so ripening starts just before shipment and finishes at retail.

Marketing Organizations

A large proportion of California avocado growers use cooperative marketing organizations to market their produce. Calavo, founded in 1924, is the oldest and largest avocado growers' cooperative in California. About 2,100 growers belong to Calavo, which markets nearly half of California's avocados. Calavo owns two packing and ripening plants and a processing plant. It also contracts the use of a third packinghouse. A subsidiary, Calavo Foods, handles the cooperative's processed product line (Wedin).

Another avocado growers' cooperative is Index, which started in San Diego County and has about a 5 percent market share. In addition, there are 30 to 40 independent handlers of California avocados, including Mission Produce, Henry Avocado Company, WestPac, McDaniel, and Del Rey Avocado Company (Bender).

The California Avocado Commission administers the state marketing order. In effect since 1962, the state order authorizes the collection of fees from members for research and promotion. Members include both growers and

handlers, since the commission is a trade organization that represents the entire industry. There is no federal marketing order for avocados in California.

A state inspection and certification program has been in effect since April 1973. The program establishes standards for certified avocado shipments that are based on maturity, variety identification, fruit count, and the approximate weight of a packed carton. The California Department of Food and Agriculture carries out the mandatory inspections and assesses packers a fee for administering the inspection program.

The California Avocado Society is a grower organization that disseminates information about research programs and cultural practices.

In Florida, the Florida Avocado Administrative Committee manages a federal marketing order which provides for minimum grades and standards, but not for promotional activities. Florida growers may pack and sell their own avocados, but smaller operations frequently use the facilities of larger operations. Among the ten largest growers in Florida are several with packinghouses, who ship avocados for their own operations and other growers. Three of these large shippers are Brooks Tropicals, Limeco, and Kendall Foods. There are more than 60 certified packinghouses in Florida, but only about 10 are active. Avocados from several growers are usually pooled to be sold (Wheeling).

Costs of Production

In the southern coast region of California, harvesting costs range from 15 to 26 percent of total production costs, depending on the yield (Table 6). Based on a typical mature-orchard yield of 10,000 pounds per acre, harvesting expenses (picking and hauling) accounted for 20 percent of total costs. The amortized expenses for establishing the orchard were included in the total cost estimates. (For more information, see Appendix table 8.)

Because harvesting costs are a relatively small share of total costs, moral hazard is not likely to be a major issue in offering crop insurance for avocados. Harvesting costs are not likely to play a role in growers' decisions about whether or not to harvest avocados. Unlike crops such as lettuce, broccoli, and cauliflower, where the mature crop is extremely perishable and harvesting costs sometimes exceed market prices, avocado prices are unlikely to fall below harvesting and marketing expenses. In addition, avocados are relatively storable on the tree and can be held off the market during periods of weak prices.

Ad Hoc Disaster Assistance for Avocados

Ad hoc disaster assistance legislation was made available for losses of commercially-grown crops in each of the years 1988-93. Ad hoc payments provide an indication of high-loss areas during that period, and may indicate

Table 6--Costs of producing avocados in the Southern Coast Region of California, 1992

Item	Yield (pounds/acre)						
	7,000	8,000	9,000	10,000	11,000	12,000	14,000
	Dollars/acre						
Cultural cost	1,599	1,599	1,599	1,599	1,599	1,599	1,599
Harvest cost	638	730	821	912	1,003	1,094	1,277
Interest on operating capital	75	76	77	77	78	79	80
Total operating costs	2,312	2,404	2,496	2,588	2,680	2,772	2,956
Cash overhead costs	685	685	685	685	685	685	685
Non-cash overhead costs	1,334	1,334	1,334	1,334	1,334	1,334	1,334
Total costs	4,331	4,423	4,515	4,607	4,699	4,791	4,975
Harvest, percent of total	15	17	18	20	21	23	26

Source: Klonsky, et. al.

states and counties that would face relatively high risk under a potential FCIC avocado policy. Such data provides one indicator of the demand for an avocado crop insurance policy.

Under the 1988-93 legislation, payments were made under the categories of participating program crops, nonparticipating program crops, sugar, tobacco, peanuts, soybeans, sunflowers, nonprogram crops, ornamentals, and at times, aquaculture. Producers without crop insurance--the case for avocados--were eligible for payments when losses exceeded 40 percent of expected production. If a producer had no individual yield data to use in calculating "expected production," county-level or other data were used as a proxy. Payment rates for avocados were based on 65 percent of a 5-year average price, dropping the high and low years.

Disaster assistance payments for avocado losses totalled over $8.7 million during 1988-93 (Table 7). Payments for avocado losses peaked at more than $3.1 million in crop year 1990, and were in the $1.5 to $2.0 million range in 1991, 1992, and 1993. There were no ad hoc disaster payments made for avocado yield losses in 1988 and minimal payments in 1989.

Ad hoc disaster payments for avocado losses were made in 14 counties, encompassing three states. The largest payments occurred following major weather-related disasters: the December 1990 freezes in California and Hurricane Andrew in Dade County, Florida, in August 1992. The largest payments were made to California growers, at $4.5 million over the 6-year period. Florida growers received $4.2 million, while payments to Hawaii and American Samoa were negligible.

In an ordering of counties, Dade County, Florida ranked first in payments, receiving about $4.2 million over the 6-year period ($1.9 million in 1992 and $1.8 million in 1993). Ventura County growers in California received $1.7 million in 1990 and $785,000 in 1991 due largely to freeze losses, while Santa Barbara County growers received about $617,000 in 1990 and about $276,000 in 1991.

Ad hoc disaster data can be used to indicate which avocado-producing areas received large payments relative to their production. California, for example, reported 89 percent of U.S. avocado production between 1988 and 1993, but accounted for only 52 percent of the ad hoc disaster payments (Table 8). Florida, in contrast, accounted for 11 percent of output, but collected nearly half of U.S. ad hoc disaster payments made for avocados.

Disaster payments for California and Florida averaged 0.7 percent of the value of the avocado crop over the 1988-93 period (Table 9). The relatively high 6.7 percent in Florida indicates a higher incidence of weather-related yield losses than in California, where disaster assistance amounted to only 0.4 percent of the avocado crop's value.

Table 7--Disaster assistance payments for avocados by county and state, 1988-93

State/county	Total ad hoc disaster payments for avocados
	--Dollars--
California:	4,525,606
Ventura	2,487,719
Santa Barbara	893,082
San Diego	341,371
San Luis Obispo	335,790
Tulare	328,426
Riverside	54,019
Monterey	22,111
San Bernardino	18,973
Santa Cruz	15,552
Los Angeles	14,662
Fresno	12,857
San Benito	1,044
Florida:	4,202,337
Dade	4,202,337
Hawaii:	6,642
Kaui	6,642
American Samoa:	434
United States: (including American Samoa)	8,735,019

Source: USDA, Agricultural Stabilization and Conservation Service data, compiled by GAO.

Table 8--Disaster assistance payments for avocados, 1988-93

State	Average avocado production, 1988-93 1/	Share of U.S. production	Total avocado disaster payments, 1988-93	Share of U.S. avocado disaster payments
	Short tons	Percent	$1,000	Percent
California	165,500	89.0	4,526.6	51.8
Florida	20,000	10.8	4,202.3	48.1
Hawaii	437	0.2	6.6	0.1
U.S.	185,937	100.0	8,734.6	100.0

1/ Production is in crop years. The crop year begins November 1 and ends November 30 of the following year in California, extends from June 20 to February 28 in Florida, and reflects the calendar year in Hawaii.

Sources: USDA/NASS (production) and USDA/ASCS, compiled GAO.

Table 9--Avocados: Cumulative crop value and disaster assistance in California and Florida, 1988-93

State	Total crop value	Total disaster payments	Disaster payments, percent of crop value
	-----1,000 dollars-----		Percent
California	1,117,780	4,526	0.4
Florida	63,017	4,202	6.7
Two states	1,180,797	8,728	0.7

Sources: USDA/NASS (production) and USDA/ASCS, compiled by GAO.

Production Perils

Frost and Freeze

Freezing temperatures can kill the avocado fruit, the fruit buds, the foliage, and the entire tree, especially if the tree is young. In California, a frequent source of cold damage occurs when the fruit buds are exposed to cold temperatures. The buds located on the tips of the previous year's growth are usually located at the outer edge of the tree's canopy, where temperatures are the lowest.

The extent of cold damage to the fruit depends on the minimum temperature and the length of time the temperature remains below freezing. In addition, some varieties are more resistant to cold damage than others. While the Hass variety is damaged when temperatures fall to 29° F or less for 4 hours, the Fuerte variety can withstand temperatures down to 26° F for up to 4 hours.

Damage from cold temperatures frequently is limited to a portion of the orchard. Since cold air tends to flow to the lowest elevations, avocados planted on slopes, as is frequently the case in California, may escape frost damage while those in low lying areas are more likely to be damaged (Bender).

Growers can provide a degree of protection from cold temperatures by using smudge pots, wind machines, or irrigation. Overhead sprinklers are the main protection used in Florida.

Because avocados are very susceptible to cold damage, they are planted mainly in the coastal areas of Southern California and in the southern tip of Florida where the oceans moderate winter temperatures. Long periods of below-freezing temperatures are least likely to occur in these areas.

Excessive Rain

Excessive rains can create favorable conditions for the development of avocado diseases. The most damaging of avocado diseases, phytophthora root rot, is associated with waterlogged soils.

Excessive rains also promote soil-borne fungal diseases such as Armellaria root rot, which is not normally a problem in drier climates, but tends to flare up in California during extended periods of warm winter rains.

In Florida, cool, wet weather favors the development of scab and Cercospora spot, both fungal infections. Fungicide sprays can provide effective control for these airborne fungal diseases, but may be diluted or washed off by rain. Susceptibility to fungal infection, whether soil- or air-borne, varies by variety.

Excessive rain can cause additional problems for avocados planted in fine-textured (clay) soils or in shallow soils with impervious subsoils. As the soils become saturated, water replaces oxygen in the soil and the tree's small

fibrous roots die from lack of oxygen (asphyxiation). The fibrous roots are those that absorb water.

Symptoms of asphyxiation develop rapidly. The leaves collapse and turn brown, the fruit withers, and the branches die back from the tips. Trees under 3-years old are the most susceptible to asphyxiation. Older trees may recover by sending up new shoots along main branches, but yields are diminished during the recovery period. Good drainage usually avoids damage from asphyxiation.

Excessive Wind

Excessive wind can blow fruit off the tree and contribute to a physiological defect called "carapace-spot." Carapace is a corky growth that forms on the skin of the avocado when the leaves or stems rub against tender young fruit. Although the flesh under the corky spot is undamaged, the blemished fruit grades lower and, therefore, has a lower value.

Excessive wind also damages foliage and branches, and in extreme cases, it may uproot trees. Hurricane-strength winds uprooted a large number of avocado trees in Florida during 1992.

Wind also may inhibit pollination and contribute to the spread of fungal diseases. Even moderate winds disseminate fungus spores that cause Cercospora spot and algal leaf spot in Florida. Timely fungicide applications will control both diseases.

Planting windbreaks has been effective in reducing damage to avocados in some areas of California. Planted windbreaks, however, compete with nearby avocado trees for water, nutrients, and root space. Windbreaks are not considered very effective in Florida, and those destroyed by Hurricane Andrew in 1992 have not been replanted.

Excessive Heat and Sunburn

Excessive heat and temporary water-stress may cause "crick-side" blemishes on fruit in California. The fruit is misshapen due to a depression formed near the stem. In some cases, the depressed area turns black and the fruit drops to the ground.

High temperatures combined with dry wind off the desert can contribute to excessive fruit drop in California. Keeping the trees well-supplied with water helps minimize fruit drop. Although some dropped fruit can be salvaged, it usually grades lower and has diminished value.

Fruit exposed to full sun may be injured by sunburn. The exposed areas on sunburned fruit turns pale yellow and the center of the area may turn brown and wither. Maintaining a good leaf canopy on the trees usually avoids sunburn.

Diseases

Phytophthora root rot is the most serious disease of California avocado trees. Other diseases that afflict California avocado trees include: oak root fungus, sunblotch, and verticillium wilt. In addition to Phytophthora root rot and verticillium wilt, Florida avocados are subject to anthracnose, scab, Cercospora spot, and algal leaf spot.

Phytophthora Root Rot

Phytophthora root rot (also called "avocado root rot") is caused by a soil-borne fungus, *Phytophthora cinnamomi*, for which there is as yet no effective chemical treatment. The leaves of infected trees wilt, branches die back, feeder roots become darkened and decayed, and if damage becomes severe, the tree dies. Once established, phytophthora rot is nearly impossible to eradicate and leads to loss of production and trees. Although many trees in Florida are infected with avocado root rot, the disease only becomes serious under flooding conditions.

Growers are advised to prevent the spread of the virus by washing and disinfecting all equipment and vehicles that enter their avocado orchards and eliminating unnecessary traffic. Recently developed root stock exhibit some resistance to the root rot fungus.

Oak Root Fungus

Avocado trees are generally tolerant of oak root fungus, also known as Armellaria root rot, but it may cause occasional and sometimes severe damage to avocado trees in California. The fungus is usually well-established in tree roots before symptoms appear. Leaves in one area of the tree may turn yellow and droop, or the entire tree may collapse suddenly. Growth of a white, mycelium fungus under the bark may be visible, or mushroom-stage fungus may develop around the base of the tree. The fungus is sensitive to drying. As a result, the tree may be saved if the base of the tree can be opened and exposed to air. Oak root fungus can be treated successfully with chemical soil fumigation under favorable conditions.

Verticillium Wilt

Verticillium wilt is a soil-borne fungal disease. The disease attacks trees of all ages. Damage ranges from the loss of a few twigs to the loss of the entire tree. Usually, damage is not widespread in a single orchard. Controls include the use of healthy budwood, and the avoidance of susceptible crops nearby (including tomatoes, cucumbers, peppers, cotton, and strawberries).

Sunblotch

Sunblotch is a virus-like disease, transmitted through budwood, graftwood, root grafts, and seed, that reduces fruit quality and yields. Trees infected with sunblotch may show depressed streaks on twigs, depressed and discolored areas on the fruit, rough bark, or a stunted appearance. In some cases, no

symptoms may appear. Infected trees should be removed. California has a registration program to provide the industry with sunblotch-free propagation material. Losses due to sunblotch are rare in Florida.

Anthracnose

Anthracnose, *Colletotrichum gloeosporioides*, is a serious disease of avocado fruit in Florida. Anthracnose spores enter the fruit through lesions caused by other disease organisms or through wounds caused by mechanical damage and insects. The fungus becomes active as the fruit matures. Infection may not be apparent until the fruit ripens at the marketplace. As the infection progresses into the flesh, circular brown to black spots appear on the skin, enlarge, become sunken, and crack. Harvesting immature fruit may contribute to the spread of anthracnose among packed fruit. All avocado varieties are susceptible. Control depends on preventing physical damage by insects and other diseases, and by careful handling.

Scab

Avocado scab is caused by the fungus *Sphaceloma perseae*, and is favored by cool, moist weather. Scab attacks young tissue. The avocado leaves become resistant about a month after attack, and the fruit becomes resistant when it is half its full size. Symptoms of the disease include lesions on the leaves, which develop into spots that eventually form holes. Scab causes spots on developing fruit that are slightly raised and brown-to-purple colored. As the fruit matures, the spots form lesions that coalesce and the centers become sunken. Scab lesions can make the fruit skin rough and ruin the appearance of the avocado. However, the most significant adverse effect of scab infection is the creation of portals for the entry of fruit-rotting organisms, such as anthracnose.

Chemical sprays can provide effective control. In addition, some varieties are more scab-resistant than others. Lula, Hall, and most avocado seedlings are the most susceptible; Booth (3,5,7, and 8), Monroe, Choquette, and Trapp are moderately susceptible; and Waldin, Pollock, Booth 1, and Collins are only slightly susceptible.

Cercospora Spot

Cercospora spot is caused by the fungus *Cercospora purpurea* that can be spread by wind, rain, and insects. Florida's rainy season, which extends from May to September, is the most favorable time of the year for infection. As a result, later varieties, such as Lula and Choquette, require more frequent fungicide applications than do earlier varieties. Cercospora spot causes small, irregular brown spots to appear on the fruit that enlarge and coalesce, downgrading the avocado's appearance. In addition, fissures may form in the fruit, providing entry points for anthracnose fungus.

Algal Leaf Spot and Powdery Mildew

Algal leaf spot and powdery mildew cause the least economic damage to avocados because only the leaves are affected. An alga named *Cephaleuros* produces algal leaf spot, sometimes called red alga spot, in the late summer to late winter. Spots are microscopic at first, then enlarge to about one-fourth of an inch. The spots are slightly raised, circular, and range in color from green, yellow-green, and olive-green, to brown or rust. Copper fungicides are an effective control for algal leaf spot.

Powdery mildew is caused by the fungus *Oidium*. Dark-green spots of powdery mildew appear on the undersurface of young leaves. The spots turn purplish-brown as the leaf matures and show a whitish fungal growth. Chemical sprays used for other fungal diseases control powdery mildew adequately.

Insects

Insect pests of avocados include mites, loopers, thrips, and ants.

Mites

Brown mites feed on avocado leaves, causing defoliation which exposes the fruit to sunburn. Brown mites can be controlled with applications of oil sprays and also by their natural enemies: predacious mites, lacewings, and the Strethorus beetle.

A more recently arrived pest, the Perseae mite, also defoliates trees. These mites appeared in San Diego County about 5 years ago, and have recently been found in Ventura County. No effective biological or chemical control has yet been established for Perseae mites, which originated in Mexico (Bender).

Loopers

Larvae of the omnivorous looper (inchworm) feed on avocado leaves and fruit, causing defoliation and degrading the fruit's appearance. Loopers are biologically controlled by the tiny Trichogramma wasp, and by *Bacillus thuringensis* bacteria.

Thrips

Greenhouse thrips (*Heliothrips haemorrhoidalis*) can leave spots on both the fruit and foliage. Eggs inserted into the leaf or fruit tissue cause very small white discolorations that turn brown, and that then turn black and become visible. Visible spots on the fruit skin increase the cullage rate and reduce the fruit's value. Fuerte avocados are relatively resistant to thrip damage, but Hass avocados are highly susceptible. Thrips can be controlled by insecticides. Infestations are destroyed when trees drop their leaves during the flowering season.

Ants

Ants are considered a pest in that they destroy beneficial insects, thereby complicating the practice of using biological controls for the more serious pest problems.

Mediterranean Fruit Fly (Med Fly)

Mediterranean fruit flies infest avocados along with a number of other fruits. The State and Federal Departments of Agriculture operate a Med fly eradication program, and attack the flies vigorously when discovered in California. Not only does the Med fly damage fruit, but growers may not be able to sell their avocados because shipments from quarantined areas may be restricted.

Ranking Avocado Perils

Avocado perils, when ranked in an ordering of their potential for creating yield losses, include freezing temperatures, hurricanes, phytophthora root rot, and fungal diseases:

1. Frost and freezing temperatures appear to be the most serious production peril in avocado production. Temperatures below 30 degrees are possible in both the California and Florida avocado-growing areas. Although widespread freezes occur only infrequently, damage from low temperatures occurs nearly every year in California. Major freezes are anticipated to happen every 7-10 years in the avocado-growing area of Florida and less often in California. Historically, severe freezes occurred in Southern California's avocado areas in 1968, 1979, and 1990. When a severe freeze occurs, production can be reduced for 2 or 3 seasons following the freeze.

2. Hurricanes do tremendous damage to avocados, but direct hits occur only infrequently in south Florida and never in California. Strong winds and heavy rains that are less than hurricane force are probably responsible for nearly as much damage to avocados as cold temperatures.

3. Phytophthora root rot, commonly called avocado root rot, is favored by saturated soil and is ranked #3 as a problem. The fungus that causes the disease exists in both California and Florida. Presence of the disease lowers yields and may eventually destroy the tree. Resistant root stock has been developed, but all susceptible trees have not been replaced.

4. Fungal disease other than phytophthora root rot are fourth-ranked in their potential for creating yield loss. Due to the higher humidity, fungal diseases are a more serious problem in Florida than in California.

Other production problems mentioned by industry contacts include fires in California. However, most avocado orchards have sprinklers.

Insurance Implementation Issues

Adverse Selection

Adverse selection may be a problem in insuring avocados. Field-specific conditions influence the likelihood of losses from both frosts and freezes to avocado root rot. Adverse selection concerns arise because growers are likely to know more about the history of a specific location and, therefore, be better able than the insurer to assess the risks of loss to either of these perils.

Specifically, the avocado (Phytophthora) root rot fungus can live in the soil for extended periods without causing problems, and then become active when conditions are favorable. Experienced growers are likely to be aware of the history of a specific field and to know whether crop insurance premiums are a fair reflection of the risks due to losses from root rot.

In a similar manner, losses due to extremely low temperatures are more likely to occur in low lying areas with poor air drainage than in fields with good air drainage. Experienced growers are likely to know more about the risks of cold damage in a specific location than the insurer. Such growers would be better able than the insurer, therefore, to assess whether crop insurance premiums equitably reflect the risks associated with growing avocados in a specific location.

Setting Reference Prices

FCIC provides reference prices (price elections) for insured crops, which become the basis for calculating indemnity payments. Insured growers select a price election when they purchase insurance.

A reference price for avocados should represent the on-tree value of the crop, because growers would not incur the expenses of harvesting and marketing on any portion of the production that is lost.

There are two approaches for deriving an "in-field" reference price. One is to deduct the estimated harvesting costs from a market price. The market price refers to the grower price and not the retail price.

Weekly f.o.b prices for Hass avocados from California, as reported earlier in this report, are no longer collected by USDA's Agricultural Marketing Service. The California Avocado Commission estimates weekly field prices for Hass, Fuerte, and "all other" avocados. Establishing market prices for the other varieties in California and all varieties grown in Florida may be problematic.

The second approach to estimating an in-field price is to estimate the cost of production (exclusive of harvesting and marketing expenses) and use it as a proxy for an in-field price.

Market Prices and APH Distortions

Yield distortion due to variations in market prices are not likely to be an issue in estimating a grower's average production history for avocados. Although yields are measured in terms of the quantity of fruit harvested and marketed rather than in terms of the quantity produced and potentially available for harvest, grower' yields are unlikely to be distorted because of abandoning fruit on the tree due to low market prices.

Normally, growers harvest avocados trees several times during the season, as the fruit attains the size required to satisfy maturity standards. Growers may postpone harvesting for a time during periods of low prices, but abandoning a crop because of low prices is practically unheard of in either Florida or California.

Estimating "Appraised Production"

Estimating appraised production (harvestable, but unharvested yield) is not likely to be an issue with avocados, because almost all marketable fruit is eventually harvested. Only damaged fruit is likely to be abandoned, and that would not be counted as appraised production.

If the need arose to estimate appraised production, one approach is to count and weigh marketable fruit in a sample of plots (as is done in estimating citrus yields in Florida) and expand the area yields to a per-acre basis. For immature fruit, the yields per plot would be estimated by counting the potentially harvestable fruit in the plots and multiplying by an average or typical weight of the mature fruit.

Market Prices and Moral Hazard

Moral hazard occurs when a grower intentionally contributes to causing a yield loss. It would likely become an issue for avocados only if market prices dropped so low that an indemnity payment exceeded the net return from harvesting and marketing the crop. Given that avocado prices are extremely variable, this situation may at times arise.

A Dollar Plan Approach

When avocado yields are generally low in the major producing areas, the value of production often appears higher than in "normal" years (Appendix table 1). This implies that growers generally receive higher returns in low-yielding years than in high-yielding years. The fairly inelastic demand for avocados noted earlier in the text also provides evidence as to this situation.

Because of this situation, a "dollar plan" approach may be most appropriate for insuring avocados. Producers would receive payments based more on a revenue approach, rather than simply taking into account yield losses.

Availability of Individual Yield Data

The County Agricultural Commissioners in California report acreage, yield, production, and per-unit price data for avocados. Calavo Growers, the largest avocado growers' cooperative in California, has production and acreage data pertaining to its members, but will not release the information without the growers' permission. The Florida Avocado Administrative Committee and the California Avocado Commission have acreage and production data, but not for individual growers.

Demand for Insurance

Grower participation in buying insurance for avocados in California is likely to be proportionately similar to participation for citrus. Both are high value crops and both are subject to similar perils.

California citrus growers reported 256,900 bearing acres of citrus in 1993 and purchased crop insurance on 10,277 acres, or about 4 percent of their bearing acreage. The proportionate area of bearing avocados would have been about 2,900 acres.

The value of the 1993 California citrus is estimated at $740.7 million, while the insured liability was $12.5 million, or slightly less than 2 percent of the crop value. The proportionate liability in avocados would have been about $4 million. This estimate of proportionate liability is probably higher than would exist during most years, because California's avocado crop reached a record large value in 1993/94 due to unusually high prices.

One consideration that may diminish participation in avocado insurance, however, is that avocados appear to be a sideline or part-time job for a large number of California's growers. Nearly two-thirds of the farm operators reported some off-farm work during 1987, and 80 percent reported less than $25,000 in farm sales. Most growers have fewer than 20 acres of avocados.

One contact indicated that Ventura County avocado growers purchased theft insurance from the Farm Bureau, but that they did not buy freeze insurance (Faber). Disaster payments for avocados in California amounted to just 0.4 percent of the value of sales, indicating that yield losses amount to a relatively small share of total revenue.

There is likely to be a moderate amount of interest among Florida growers in purchasing insurance because of severe losses in recent years. Florida producers experienced a severe freeze in 1989 that damaged avocados. Further, Hurricane Andrew destroyed a large number of trees in 1992, along with fruit which had not yet been harvested.

Disaster assistance amounted to 6.7 percent of Florida's avocado crop value between 1988 and 1993. The overall demand for avocado insurance in Florida is quite limited, however, because of the small amount of acreage--5,800 bearing acres in 1993.

Insuring Trees vs. Insuring Fruit

There may be an interest among Florida's growers in purchasing insurance for avocado trees as well as for the fruit. Florida's avocado region lies near the ocean in an area where hurricanes occasionally strike with full-force winds. Hurricane Andrew, in August, 1992, was such a storm, and destroyed a large number of avocado trees in south Florida. Florida's bearing acreage fell 30 percent following the storm. The loss of trees may cause greater economic injury than the loss of fruit. A tree constitutes a long-term capital investment and its loss entails several years of foregone production, as well as the expense of establishing a replacement.

Other Implementation Issues

There do not appear to be any unmanageable implementation issues in developing a policy for avocado insurance. The problems encountered in offering avocado insurance would likely be about the same as those confronted with a commodity such as citrus, for which insurance is currently available.

Avocados, like citrus, are a perennial tree crop, have a wide harvest window, and are susceptible to frost and freeze damage. However, avocados have a more pronounced alternate-year bearing tendency than citrus. Further, harvesting and marketing expenses for avocados are not quite as large a share of production expenses as for citrus.

Defining "Areas" for the Non-Insured Assistance Program

The Non-Insured Assistance Program (NAP) of 1994 Crop Insurance Reform covers crops that are not currently insured by FCIC--including avocados--until the development of an insurance policy. Under NAP, an "area" must incur at least a 35-percent yield loss in order to trigger assistance payments. The definition of "areas" for purposes of calculating "area average yield" may determine whether or not growers with a qualifying yield loss (50 percent or greater of the individual average) are eligible for NAP payments.

Defining areas along county lines would likely be a reasonably equitable method for determining "area average yield" for disasters caused by excessive wind (hurricanes in Florida) and extreme freezes. These perils usually cause yield losses more or less equally on growers over a wide area.

For losses due to frosts, flooding, and fire, however, individual growers or groups of growers may not qualify for disaster assistance even though they incurred severe losses. Yield losses from these perils can be very local and individual growers may incur substantial losses while the area yield may not be reduced to the trigger level (65-percent of normal).

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Appendix table 1--Avocados: Area, yield, production, price, and value, by state, 1984/85 to 1993/94

Season 1/	California					Florida				
	Bearing acreage	Yield per acre	Production	Price	Value	Bearing acreage	Yield per acre	Production	Price	Value
	Acres	--- 1,000 pounds ---		$/pound	$1,000	Acres	--- 1,000 pounds --		$/pound	$1,000
1984/85	73,000	5.48	400,000	0.29	116,400	11,000	5.36	59,000	0.20	11,496
1985/86	74,500	4.30	320,000	0.51	163,200	10,700	5.32	57,000	0.29	16,415
1986/87	75,000	7.42	556,000	0.17	93,964	11,300	4.38	49,400	0.21	10,176
1987/88	74,800	4.82	360,000	0.57	205,200	11,300	5.14	58,000	0.16	9,048
1988/89	75,200	4.38	330,000	0.63	207,900	10,900	4.96	54,000	0.22	11,772
1989/90	75,000	2.80	210,000	1.14	239,400	10,600	6.32	67,000	0.17	11,122
1990/91	74,200	3.66	272,000	0.71	191,760	9,000	4.36	39,200	0.34	13,406
1991/92	73,500	4.24	312,000	0.59	182,520	8,600	6.58	56,600	0.24	13,471
1992/93	72,900	7.80	568,000	0.20	113,600	8,400	1.72	14,400	0.29	4,198
1993/94	72,500	4.06	294,000	0.71	207,270	5,800	1.52	8,800	0.41	3,608

Season 1/	Hawaii					United States 2/				
1984/85	270	4.30	1,150	0.26	298	84,000	5.46	459,000	0.28	127,896
1985/86	320	3.80	1,220	0.25	299	85,200	4.42	377,000	0.48	179,615
1986/87	330	3.90	1,300	0.26	333	86,300	7.02	605,400	0.17	104,140
1987/88	300	3.00	900	0.32	284	86,100	4.86	418,000	0.52	214,248
1988/89	290	4.14	1,200	0.37	438	86,390	4.46	385,200	0.57	220,110
1989/90	250	4.40	1,100	0.38	418	85,850	3.24	278,100	0.90	250,940
1990/91	250	3.60	900	0.45	405	83,450	3.74	312,100	0.66	205,571
1991/92	280	3.00	840	0.47	395	82,380	4.48	369,440	0.53	196,386
1992/93	220	3.18	700	0.46	322	81,520	7.16	583,100	0.20	118,120
1993/94	250	2.00	500	0.44	220	78,550	3.86	303,300	0.70	211,098

1/ California marketing season from November 1 the first year shown to November 30 the following year; Florida from June 20
to February 28; and, January through December of the first year for Hawaii.
2/ United States total excludes Hawaii prior to 1988/89.

Sources: USDA, National Agricultural Statistics Service, and Hawaiian Agricultural Statistics.

Appendix table 2--California avocado production, by county, 1980-93

County	Year	Harvested acres	Yield /acre	Production
			-----Tons-----	
Los Angeles	1980	710	0.70	497
	1981	710	3.00	2,130
	1982	612	2.10	1,285
	1983	208	2.96	615
	1984	208	0.96	200
	1985	298	1.06	315
	1986	238	0.59	141
	1987	273	0.85	233
	1988	226	0.24	55
	1989	90	0.50	45
	1990	295	1.39	410
	1991	250	0.94	235
	1992	250	0.79	197
	1993	240	1.57	378
Note: Low yields in 1988 and 1989 were due to cold temperatures.				
Orange	1980	1,008	1.10	1,109
	1981	1,012	4.76	4,817
	1982	1,010	3.13	3,161
	1983	1,787	5.10	9,114
	1984	1,782	4.45	7,930
	1985	1,763	3.19	5,624
	1986	1,728	3.03	5,236
	1987	1,642	6.14	10,082
	1988	1,641	3.20	5,251
	1989	1,464	2.75	4,026
	1990	1,464	1.63	2,386
	1991	1,819	6.40	11,641
	1992	1,620	3.92	6,350
	1993	1,370	7.21	9,878
Riverside	1980	5,552	0.59	3,249
	1981	6,700	2.94	19,720
	1982	7,512	3.56	26,725
	1983	7,512	3.98	29,871
	1984	7,852	4.50	35,320
	1985	8,358	3.33	27,823
	1986	8,434	1.81	15,240
	1987	8,554	3.71	31,693
	1988	8,644	3.35	28,992
	1989	8,130	1.60	13,000
	1990	8,051	1.70	13,711
	1991	8,051	2.11	16,955
	1992	8,465	3.21	27,181
	1993	7,872	4.19	32,952
San Bernadino	1980	120	4.06	487
	1981	105	4.00	420
	1982	110	2.91	320
	1983	120	4.30	516
	1984	145	3.52	510
	1985	130	3.12	405

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Appendix table 2--continued

County	Year	Harvested acres	Yield /acre	Production
			-----Tons-----	
	1986	188	2.71	510
	1987	197	1.52	300
	1988	211	1.60	338
	1989	215	1.50	322
	1990	210	4.00	840
	1991	210	0.14	29
	1992	210	3.46	726
	1993	210	3.53	742
San Diego	1980	24,820	2.00	49,640
	1981	27,050	3.00	81,150
	1982	31,320	4.20	131,554
	1983	34,500	4.10	141,450
	1984	35,683	4.50	160,574
	1985	35,350	3.70	130,795
	1986	36,800	3.60	132,480
	1987	36,360	3.80	138,168
	1988	36,410	2.50	91,025
	1989	36,792	2.20	80,942
	1990	33,310	1.63	54,200
	1991	32,314	2.36	76,254
	1992	32,043	2.36	75,655
	1993	29,324	4.31	126,451
San Luis Obispo	1980	737	0.54	398
	1981	833	1.12	933
	1982	843	1.42	1,197
	1983	1,523	0.68	1,036
	1984	1,523	1.19	1,812
	1985	1,523	2.50	3,808
	1986	1,340	2.59	3,471
	1987	1,300	1.70	2,210
	1988	1,299	1.81	2,346
	1989	1,320	3.52	4,646
	1990	1,220	1.37	1,671
	1991	1,165	1.16	1,351
	1992	1,165	0.60	699
	1993	1,135	3.32	3,768
Santa Barbara	1980	5,367	5.04	27,050
	1981	5,630	8.60	48,418
	1982	5,652	6.25	35,325
	1983	6,716	4.12	27,670
	1984	6,863	4.01	27,521
	1985	7,440	2.81	20,906
	1986	7,597	1.73	13,159
	1987	9,131	6.00	54,786
	1988	10,301	2.65	27,338
	1989	9,427	2.20	20,739
	1990	9,610	1.83	17,586

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Appendix table 2--continued

County	Year	Harvested acres	Yield /acre	Production
			-----Tons-----	
	1991	8,541	1.18	10,078
	1992	8,913	1.37	12,211
	1993	8,584	2.41	20,687
Santa Cruz	1982	60	1.38	83
	1983	60	1.00	60
	1984	60	0.50	30
	1985	85	0.76	65
	1986	85	0.59	50
	1987	85	2.00	170
	1988	81	4.20	340
	1989	81	1.10	89
	1990	100	0.50	50
	1991	100		
	1992	100		
	1993			
Note: No production since 1990 due to the December 1990 freeze.				
Tulare	1980	1,421	1.78	2,530
	1981	1,546	4.03	6,230
	1982	1,617	2.83	4,580
	1983	1,719	2.93	5,040
	1984	1,882	0.99	1,860
	1985	1,744	2.83	4,940
	1986	1,519	2.18	3,310
	1987	1,397	5.03	7,030
	1988	1,379	3.61	4,980
	1989	1,119	3.37	3,770
	1990	1,140	5.09	5,800
	1991	857	0	0
	1992	1,274	1.86	2,370
	1993	865	5.04	4,360
Note: No production in 1991 due to the 1990 freeze.				
Ventura	1980	10,917	0.77	8,440
	1981	12,100	4.31	52,151
	1982	12,748	1.40	17,847
	1983	15,636	2.54	39,778
	1984	16,251	3.20	52,070
	1985	16,448	2.13	35,079
	1986	16,503	2.17	35,855
	1987	16,303	2.37	38,564
	1988	16,103	2.93	47,257
	1989	16,170	2.24	36,180
	1990	16,198	1.30	21,084
	1991	12,926	1.68	21,702
	1992	13,911	1.67	23,214
	1993	16,199	5.10	82,600

Sources: California Department of Food and Agriculture, County Agricultural Commissioners' Annual Reports; California Agriculture Statistics Service, California Agriculture Statistical Review.

Appendix table 3--States reporting avocado production: 1992 and 1987

State and major counties	1992						1987				
	Total				Harvested		Total				
	Farms	Area	Trees	Trees 1/	Farms	Production	Farms	Area	Trees	Trees	Farms	Production
	Number	Acres	Number	Number	Number	Pounds	Number	Acres	Number	Number	Number	Pounds
California	5,973	67,509	6,279,932	5,804,675	4,650	295,463,791	5,920	79,270	7,763,941	7,038,153	4,968	491,003,465
San Diego	3,459	31,672	2,829,374	2,646,464	2,869	163,703,390	3,331	36,602	3,452,569	3,108,160	2,803	225,960,224
Ventura	966	14,610	1,379,285	1,278,086	712	36,174,575	917	15,757	1,594,088	1,447,297	791	89,717,184
Santa Barbara	461	7,739	694,354	623,391	316	18,734,031	447	8,862	862,615	776,469	407	68,888,800
Riverside	614	7,087	685,929	664,773	495	41,740,322	643	10,705	1,110,352	1,050,452	524	61,224,662
San Luis Obispo	97	1,501	158,858	126,605	46	2,190,325	90	1,371	145,156	126,813	57	5,673,081
Tulare	45	1,367	163,299	123,174	34	5,814,309	81	1,448	145,091	102,354	69	7,205,244
Los Angeles	156	529	43,240	41,552	85	1,276,991	179	999	91,008	81,792	134	3,866,104
San Bernadino	61	385	36,955	35,611	27	1,128,510	69	485	43,732	39,010	57	2,151,128
Other	114	2,619	288,638	265,019	66	24,701,338	163	3,041	319,330	305,806	126	26,317,038
Hawaii	610	637	31,301	22,830	378	809,322	412	(N)	(N)	18,845	278	926,210

Florida	604	6,126	511,921	467,612	328	16,425,436	554	7,728	704,170	613,144	471	48,505,337
Dade	585	5,829	484,701	441,996	318	15,366,314	531	7,331	660,759	594,121	456	47,321,613
These States	7,187	74,272	6,823,154	6,295,117	5,356	312,698,549	6,886	86,998	8,468,111	7,670,142	5,717	540,435,012
United States	7,203	74,344	6,830,669	(N)	5,365	312,888,285	6,902	87,700	8,505,366	7,674,891	5,727	540,503,777

(N): Indicates "not available" or "not published" to avoid disclosure of individual operations.
Note: Counties sorted by 1992 total acres.
1/ Trees of bearing age.

Sources: 1987 and 1992 Censuses of Agriculture.

Appendix table 4--Organizational type of farms growing avocados, by sales, 1987

Organizational type	All farms	$500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Total value of crop sales					
	Number of farms					
Individual or family						
California	4,857	23	176	177	294	4187
Florida	460	6	12	18	37	387
Other	366	0	5	15	19	327
U.S.	5,683	29	193	210	350	4901
Partnership						
California	769	30	108	79	106	446
Florida	37	3	4	0	6	24
Other	29	0	3	1	2	23
U.S.	835	33	115	80	114	493
Corporation						
Family held						
California	170	31	45	21	18	55
Florida	43	8	12	3	2	18
Other	21	1	0	2	0	18
U.S.	234	40	57	26	20	91
Other than family held						
California	29	3	10	1	5	10
Florida	10	3	3	2	1	1
Other	4	0	0	0	0	4
U.S.	43	6	13	3	6	15
Other						
California	95	3	10	10	17	55
Florida	4	0	0	1	0	3
Other	8	0	0	2	2	4
U.S.	107	3	10	13	19	62

Source: 1987 U.S. Census of Agriculture.

Appendix table 5--Principal occupation and number of days worked off the farm by operators of farms growing avocados, by sales class, 1987

Item	All farms	Total value of crop sales: $500,000 or more	$100,000 to $499,999	$50,000 to $99,999	$25,000 to $49,999	Less than $25,000
	Number of farms					
Farming is main occupation						
California	2,051	73	233	157	193	1,395
Florida	191	16	17	16	21	121
Other	229	1	6	17	20	185
U.S.	2,471	90	256	190	234	1,701
	Percent of all farms					
California	34.8	1.2	4.0	2.7	3.3	23.6
Florida	34.6	2.9	3.1	2.9	3.8	21.9
Other	53.5	0.2	1.4	4.0	4.7	43.2
U.S.	35.9	1.3	3.7	2.8	3.4	24.7
	Number of farms					
Operator days off-farm						
None						
California	1,806	44	139	111	139	1,373
Florida	173	9	21	14	20	109
Other	131	1	4	13	17	96
U.S.	2,110	54	164	138	176	1,578
Any						
California	3,888	40	186	164	279	3,219
Florida	348	8	9	9	22	300
Other	272	0	3	5	5	259
U.S.	4,508	48	198	178	306	3,778
1 to 99 days						
California	617	10	55	25	39	488
Florida	46	0	1	3	1	41
Other	80	0	1	1	2	76
U.S	743	10	57	29	42	605
100 to 199 days						
California	681	9	38	29	53	552
Florida	78	2	4	3	3	66
Other	77	0	1	0	0	76
U.S.	836	11	43	32	56	694
200 days or more						
California	2,590	21	93	110	187	2,179
Florida	224	6	4	3	18	193
Other	115	0	1	4	3	107
U.S.	2,929	27	98	117	208	2,479
Not reported						
California	226	6	24	13	22	161
Florida	33	3	1	1	4	24
Other	25	0	1	2	1	21
U.S.	284	9	26	16	27	206

Source: 1987 U.S. Census of Agriculture.

Appendix table 6--Avocado shipments in the United States, 1988-94

Source		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		Million pounds												
Florida:														
	1988	5.738	3.713	1.401	--	--	0.241	6.002	10.321	9.880	9.122	7.143	5.722	59.29
	1989	3.409	0.978	0.059	--	--	0.249	7.253	11.744	11.615	11.251	9.464	7.831	63.85
	1990	3.719	1.658	0.208	--	--	0.651	5.771	7.868	5.444	7.778	5.042	3.523	41.66
	1991	1.144	0.340	0.024	--	0.005	1.189	8.774	10.222	9.042	8.738	6.847	6.164	52.49
	1992	3.585	0.748	0.187	--	0.001	0.255	6.397	6.725	--	--	--	--	17.90
	1993	--	--	--	--	--	--	0.154	1.196	1.699	1.579	1.521	1.672	7.82
	1994	0.455	0.283	0.176	--	0.001	0.464	4.170	7.038	7.035	6.582	5.654	3.734	35.59
California:														
	1988	29.01	25.91	33.31	26.73	26.15	27.44	18.66	18.45	16.75	10.51	12.77	24.75	270.43
	1989	22.87	25.41	33.74	29.74	33.75	30.57	24.66	26.55	17.04	13.02	12.96	16.65	286.96
	1990	19.25	16.32	16.29	16.74	23.21	17.20	14.64	16.38	8.10	6.10	8.00	16.94	179.14
	1991	19.08	19.14	17.09	19.91	29.78	22.71	27.45	22.91	15.57	9.91	3.48	10.64	217.65
	1992	27.47	21.80	24.10	39.23	33.12	31.56	30.88	20.67	16.49	9.30	9.04	28.81	292.48
	1993	29.68	33.06	40.86	62.66	50.06	62.80	46.18	45.81	41.84	30.50	22.65	21.64	487.73
	1994	21.96	20.21	26.93	21.95	22.20	26.87	19.74	23.75	11.12	5.17	4.29	6.45	210.63
Imports:														
	1988	0.295	0.013	--	0.029	0.022	0.013	0.231	0.657	2.723	2.937	4.149	1.385	12.454
	1989	0.454	0.002	--	0.018	0.051	0.049	0.302	0.187	0.439	2.974	4.224	1.647	10.346
	1990	1.193	0.181	0.146	--	0.024	0.375	0.597	1.975	6.208	9.409	7.167	2.218	29.494
	1991	1.671	0.972	0.007	0.075	0.026	0.104	0.340	0.326	2.407	14.619	8.267	8.770	37.585
	1992	2.361	0.948	0.201	0.143	0.152	0.265	0.721	0.739	13.115	16.200	15.421	2.967	53.233
	1993	1.175	0.306	0.141	0.117	0.214	0.256	0.860	1.109	1.944	2.943	4.705	4.372	18.142
	1994	2.075	0.437	0.216	0.154	0.176	0.582	1.250	1.433	12.991	11.015	10.285	4.652	45.266

Total:

1988	35.04	29.63	34.71	26.76	26.17	27.69	24.90	29.43	29.35	22.57	24.06	31.86	342.17
1989	26.74	26.39	33.80	29.76	33.80	30.87	32.21	38.48	29.09	27.25	26.64	26.13	361.16
1990	24.16	18.15	16.64	16.74	23.24	18.23	21.00	26.22	19.75	23.29	20.21	22.68	250.30
1991	21.89	20.45	17.12	19.99	29.81	24.00	36.56	33.46	27.01	33.26	18.59	25.57	307.72
1992	33.41	23.50	24.49	39.38	33.28	32.08	38.00	28.14	29.60	25.50	24.46	31.78	363.62
1993	30.85	33.37	41.00	62.78	50.27	63.05	47.19	48.12	45.48	35.03	28.88	27.68	513.70
1994	24.49	20.93	27.32	22.11	22.38	27.92	25.16	32.22	31.15	22.77	20.23	14.84	291.49

--: No shipments reported.

Sources: Florida Avocado Administrative Committee and the U.S. Department of Commerce.

Appendix table 7--Fresh avocados: Supply and utilization, 1970-94

Year 1/	Utilized production	Imports	Total supply	Exports	Consumption Total	Consumption Per capita
	Million pounds					Pounds
1970	175.0	1.1	176.1	2.1	174.0	0.849
1971	91.4	2.3	93.7	1.0	92.7	0.446
1972	171.6	1.9	173.5	1.0	172.5	0.822
1973	90.8	2.3	93.1	2.3	90.8	0.428
1974	150.6	3.3	153.9	3.1	150.8	0.705
1975	269.0	3.2	272.2	5.8	266.4	1.233
1976	159.0	4.0	163.0	4.8	158.2	0.726
1977	261.4	4.8	266.2	7.2	259.0	1.176
1978	260.2	6.0	266.2	16.4	249.8	1.122
1979	300.6	2.1	302.7	20.0	282.7	1.256
1980	211.6	4.8	216.4	24.1	192.3	0.844
1981	527.6	1.9	529.5	50.7	478.8	2.082
1982	383.4	1.5	384.9	24.9	360.0	1.550
1983	458.0	3.4	461.4	28.9	432.5	1.846
1984	553.0	7.3	560.3	41.9	518.4	2.193
1985	457.0	3.7	460.7	24.1	436.6	1.831
1986	369.4	15.8	385.2	22.6	362.6	1.507
1987	614.0	4.0	618.0	47.2	570.8	2.351
1988	414.0	12.5	426.5	38.8	387.7	1.582
1989	397.0	10.3	407.3	25.9	381.4	1.542
1990	249.2	29.5	278.7	10.9	267.8	1.072
1991	328.6	37.6	366.2	10.1	356.1	1.410
1992	326.4	53.2	379.6	13.8	365.8	1.432
1993	576.8	18.1	594.9	33.7	561.2	2.173
1994	315.5	45.3	360.8	17.6	343.2	1.315

P: Preliminary.

1/ The marketing season extends over 16 months. For example, the 1993 season combines California marketings from November 1992 through November 1993, and Florida's marketings from June 1993 through February 1994.
Source: Unpublished estimates, Field and Specialty Crops Branch, USDA, ERS.