A REVIEW OF THE FLORIDA AVOCADO INDUSTRY

J. Crane[1], E. Evans[1] and C. Balerdi[2]
[1] University of Florida, IFAS, Tropical Research and Education Center, 18905 S.W. 280 St., Homestead, Florida 33031, USA. Email: jhcr@ufl.edu
[2], Miami-Dade County Cooperative Extension, 18710 S.W. 288 St., Homestead, Florida 33030, USA

The Florida avocado industry, which produces "green-skinned" cultivars, is worth an estimated US$12 million annually with recent seasonal average prices ranging from $8 and over $30 per 5 kg. The 2004 crop (prior to two 2005 hurricanes) amounted to 25,402 MT, equivalent to the pre-1992 Hurricane Andrew season but harvested from approximately half the number of ha in 1986. Orchard area has increased during the past 3 years and now covers nearly 3000 ha. The harvest season is from June through mid-March with new cultivars poised to extend the season through May. Despite suffering a major set back as a result of hurricane damage in 2005, the industry is set to resume its upward trend. The resilience of the industry and general favourable performance can be attributed to a decrease in the number of major cultivars grown making harvesting, shipping, and marketing more efficient. Current pruning practices have been successful in tree size control, maintaining production and decreasing tropical storm damage. Routine postharvest pre-cooling and recent research on the use of 1-MCP has provided the industry the potential to improve postharvest quality and storage time. Private company marketing strategies based on the reduced fat content of the Florida avocados offer the industry the potential to expand their markets and meet the demand for low calorie, healthy avocado fruit in the U.S. market. Current research on developing root rot resistant rootstocks, cost-effective irrigation management, planning for potential insect and disease pests, and cost-effective iron applications may assist the industry maintain or expand its production.

RESEÑA DE LA INDUSTRIA DEL AGUACATE EN FLORIDA

J. Crane[1], E. Evans[1] and C. Balerdi[2]
[1] University of Florida, IFAS, Tropical Research and Education Center, 18905 S.W. 280 St., Homestead, Florida 33031, EUA. Email: jhcr@ufl.edu
[2], Miami-Dade County Cooperative Extension, 18710 S.W. 288 St., Homestead, Florida 33030, EU

La industria del aguacate en Florida, que principalmente produce aguacates de cáscara verde, tiene un valor anual de $12 millones de dólares con precios promedios que van de $8 a $30 por Kg. En 2004 la cosecha (antes de los dos huracanes de 2005) fue de 25.402 TM, equivalente a la de la temporada que precedió al huracán "Andrew" en 1992 y fue cosechada en aproximadamente la mitad de las hectáreas sembradas en 1986. El área sembrada ha aumentado durante los últimos 3 años y ahora cubre cerca de 3.000 ha. La temporada de cosecha va desde Junio hasta mediados de Marzo, y nuevos cultivares podrían

extenderla de Marzo a Mayo. Aunque los huracanes de 2005 provocaron un considerable retroceso, la industria está preparada para seguir creciendo. La conservación de la industria y su desarrollo favorable en general, pueden atribuirse a una disminución en el número de importantes cultivares, lo que conduce a su vez a hacer más eficientes la cosecha, el embarque y el marketing. Las actuales prácticas de poda han sido muy efectivas en el control del tamaño de los árboles, en el mantenimiento de la producción y en la reducción de daños causados por tormentas tropicales. El enfriamiento de poscosecha de rutina y las recientes investigaciones sobre el uso del 1-MCP han provisto a la industria el potencial para mejorar la calidad poscosecha y el periodo de almacenamiento. Las estrategias de marketing de las empresas privadas basadas en promover el contenido bajo en grasas de los aguacates de Florida, ofrecen a la industria el potencial para ampliar sus mercados y satisfacer la demanda de frutos saludables bajos en calorías en el mercado estadounidense. Las actuales investigaciones sobre el desarrollo de portainjertos resistentes a la pudrición de raíces, manejo eficaz del regadío en función de los costos, planes contra posibles plagas de insectos y enfermedades y aplicaciones foliares de hierro rentables, pueden ayudar a la industria a mantener o aumentar la producción.

Historical background. Avocados were introduced to Florida sometime before 1835 (Fairchild, 1945). During the mid-1800s early settlers of Miami found seedling West Indian (Antillean) avocados naturalized in the higher elevation wooded areas (hammocks) (Wolfe et al., 1949; Fairchild, 1945). In the early 1900s most commercial orchards were West Indian (Antillean) seedlings; however, the first grafted West Indian cultivars ‘Pollock’ and ‘Trapp’ were locally selected and planted by 1915. During the late 1920s and 1930s the commercial avocado season of Florida and Cuba coincided (May to September/October) and this competition placed the survival and expansion of the Florida industry in jeopardy (Anonymous, 1934; Brooks, 1929; Fairchild, 1945). In the early 1900s, Guatemalan cultivars were introduced to Florida, however, none but one, ‘Taylor’ proved well adapted to the marine subtropical climate of southern Florida. Seedling Guatemalan trees propagated from seed brought into Florida by the USDA in 1904-1906 and later crossed with local West Indian germplasm resulted in the first Guatemalan-West Indian hybrids (Wolfe et al., 1949; Knight and Campbell, 1999). In addition, local growers William and Isabelle Krome had an experimental planting of mixed cultivars and selections of Guatemalan and West Indian race avocados (Knight and Campbell, 1999). Later Will Booth planted seed from Krome Guatemalan germplasm which resulted in seedlings of hybrid origin. From these seedlings numerous selections of ‘Booth’ were named and propagated as cultivars (e.g., ‘Booth 7’, ‘Booth 8’, etc.). By the mid-1930s, armed with the ‘Taylor’ and the locally selected Guatemalan-West Indian hybrids, Florida producers were able to extend their harvest season into the winter and early spring keeping the Florida avocado industry economically viable (Anonymous, 1934; Brooks, 1929; Knight, 2002; Knight and Campbell, 1999).

Industry statistics. The area and production of avocados in Florida have varied due to market conditions and natural disasters (Fig. 1, 2, and 3). Generally, production per ha and total industry output slowed or declined after the hurricanes of the 1960s, hurricane Andrew in 1992, and hurricanes Katrina and Wilma in 2005 (Attaway, 1999). In contrast, prices per MT did not consistently rise or decline after major disasters (Fig. 4). This was probably due to the interaction between the time of the season at which the disaster occurred, the amount of harvested fruit prior to the disaster, the subsequent fruit loss, and demand for the remaining fruit.

The area planted increased during the mid-1970s through the mid-1980s and peaked in 1986 at 4,573 ha (Fig. 1). However, a major freeze in 1989 and hurricane Andrew in 1992 contributed to a drastic decline in avocado acreage (2,307 ha) (Attaway, 1979; Attaway, 1999). Interestingly, MT produced per ha and total production from the mid-1990s and early 2000s have equalled or surpassed those of the 1980s when nearly double the acreage existed (Fig. 1 and 3). This may be attributed to the industry removing low yielding cultivars, planting of high yielding cultivars, and improved production practices. Currently there are about 3,000 ha of commercial avocado worth an estimated $11 to $12 million (US) annually (Fig. 1 and 5).

Cultivar perspective. In the early years of the industry from about 1900 to 1925 orchards of West Indian seedlings predominated, however, after about 1915 and certainly after the late 1920s, budded or grafted trees predominated in commercial plantings (Wolfe et al., 1949). During the 1950s through the 1970s Florida producers attempted to serve two markets; the small fruit (Hass-like) market and the large, green-skinned market. This along with the very large number of commercial cultivars and their diversity of shapes, sizes, and quality resulted in marketing difficulties.

During the 1970s, the number of commercially grown cultivars in Florida peaked at about 60, however, the top 10 cultivars accounted for 80% of the production (Anonymous, 1979). As market conditions changed the industry realized its strength and best returns were for the green-skinned, large fruit segment of the avocado market. This emphasis on large, green-skinned avocados has led to consistently higher per ton prices, higher production per ha, and a general industry increase in production (barring natural disasters) despite less acreage than during the 1980s (Fig. 2, 3 and 4).

Florida cultivars are divided into 3 seasons, early (late May-Aug.), mid- (Sept.-Oct.), and late season (Nov.-March) (Anonymous, 2007; Crane et al., 1996) (Table 1). The West Indian cultivars predominate in the early season whereas the Guatemalan-West Indian hybrids dominate the mid- and late season production. Currently the Florida avocado season begins in May and ends during late March. The top 10 Florida cultivars varies from season to season but usually includes these 12 cultivars: 'Bernecker', 'Beta', 'Choquette', 'Donnie', ‘Dupuis’, ‘Hall’, ‘Lula’, ‘Monroe’, ‘Nadir’, ‘Nesbitt’, ‘Simmonds’, and ‘Tonnage’ (Anonymous, 1979; Anonymous, 2007).

Local producers are actively selecting for superior very early and late season (March-May) avocado cultivars. Recently, 3 prospects have been identified with 1 patented cultivar planted on about 40 ha. These new cultivars include ‘Alfa’ (patented), ‘Pedro’, and ‘Buck II’.

Production practices and recent research

Pruning. During the past 5 years substantial changes in pruning practices have occurred. Three pruning systems have been adopted by most producers. Many producers practice traditional mechanical topping of trees to 4 to 7 m and hedging to maintain a 2.5 m row middle, alternating the tree rows pruned in any one year. More recently, some producers have combined traditional topping and/or hedging with hand pruning to encourage re-establishment of additional productive canopy in lower inside of the trees. This is accomplished with mechanical pole saws and chain saws where selective major limbs are removed to increase and maintain light levels sufficient to induce new canopy on the lower inside area of the trees. Similarly, some producers now utilize hand pruning exclusively.

Flowering and pollination. The divergent phenology of avocado flowering is well understood with cultivars either categorized as having an A or B flower mechanism (Gustafson and Berg, 1966; Davenport, 1986). The degree and importance of wind and insect (entomophily) pollen transfer is debated and much of the early research on avocado flowering documented and described the importance of insect pollination and the A and B flowering mechanisms. Much of this work was done on Guatemalan race avocados such as ‘Fuerte’ and later was conducted using Guatemalan x Mexican hybrids such as ‘Hass’. The general conclusions were that the major mechanism of pollen transfer was entomophilic (usually bees) and that most of the fruit set was the result of cross pollination among A and B-type avocado cultivars. More recently, evidence for self-pollination and wind pollination of avocado has been documented with West Indian, Guatemalan x West Indian hybrids, and Mexican x Guatemalan hybrids (Davenport, 1989; Davenport et al., 1994; T.L. Davenport, personal communication).

Research has shown that weather conditions (i.e., temperature and relative humidity) during flowering influence the sequence and length of time of female and male flowering stages, time length of stigma receptivity, and the percent fruit set (Gustafson and Berg, 1966; Davenport, 1986). In addition, anecdotal evidence from various cultivars able to consistently set commercially acceptable yields when grown in solid blocks suggests that there is a strong cultivar, climate, and weather effect on the amount of self and cross pollination (Davenport, 1986). Thus, interaction between weather conditions during flowering and genetic potential appears to play a major role in the importance of entomophilic and wind pollination in any given year and for any given cultivar.

Flooding, pruning and potential tree recovery. Avocado trees are generally slightly tolerant of flooded soil conditions or phytophthora root rot (*Phytophthora cinnamomi*) alone but, very intolerant of flooded soil conditions along with phytophthora root rot (Menge and Ploetz, 2003; Schaffer et al., 1992). Typical recommendations to minimize the effects of flooding include post flooding removal of any fruit and pruning the canopy in an effort to reduce potential transpirational water loss. Although this recommendation is based on the fact most tree water loss is via the leaf stomata whether a reduction in leaf surface area (i.e., the canopy) actually improves the chances for recovery from flooding or not has only recently been investigated (Schaffer, B., personal communication; see Gil, P., and B. Schaffer in these proceedings). The general conclusion with containerized plants is that pruning the canopy in anticipation of flooded soil conditions or before leaf flooding symptoms appear (wilting) reduces the potential for tree recovery.

Rootstock development. The most efficient and sustainable cultural solution to controlling tree losses due to flooding and/or phytophthora root rot is the utilization of flood tolerant and phytophthora root rot resistant rootstocks. Currently, a joint project of the University of Florida plant pathology faculty (Dr. Randy Ploetz) at the Tropical Research and Education Center and a geneticist (Dr. Raymond Schnell) at the USDA Subtropical Horticultural Research Station and National Clonal Germplasm Repository are selecting flood tolerant and phytophthora root rot resistant West Indian and Guatemalan x West Indian rootstocks (Ploetz et al., 2001; Ploetz et al., 2002).

Plant iron nutrition. The most common and costly avocado tree nutritional deficiency in Florida is iron. The oolitic limestone-based soils of the south Florida avocado production area are highly calcareous with a high pH (7.4-8.5). Iron from such common sources of iron such as iron sulphate are tied up with the soil calcium and phosphorous and unavailable for plant uptake. Currently, iron must be applied in a chelated form as a soil drench; this is a very costly and time consuming practice. Recent investigations on the use of foliarly applied mild acids plus ferrous sulphate have shown promise for preventing and maintaining leaf iron content of avocado at acceptable levels (Crane et al., 2007).

Postharvest handling. The climacteric nature of avocado fruit lends itself to the use of ethylene inhibition with 1-methylcyclopropene (1-MCP) (Jeong et al., 2002; Jeong et al., 2003). Recent research has resulted in a complete postharvest avocado protocol for the use of 1-MCP along with cold storage to prolong storage and enhance the shelf quality of Florida avocados.

Molecular-tissue culture assisted selection. Genetic transformation of embryogenic avocado cultures with the SAMASE gene has been employed to investigate the control fruit ripening and prolong on-tree storage potential of West Indian avocados (Litz et al., 2007). This work is on-going.

Irrigation management. Currently, a root-based control system using switching tensiometers wired to an irrigation control system is being tested for managing avocado irrigation along with reducing potential leaching of nitrogen and phosphorus fertilizers (K. Migliaccio, personal communication).

Insect control. Refinement of the IPM program for avocado lacebug (*Pseudacysta perseae*) (Peña et al., 1998) and investigation of the Redbay ambrosia beetle (*Xyleborus glabratus*), a potential new pest of avocado in the U.S. are underway (J.E. Peña, personal communication).

Disease control. Laurel wilt caused by a new species of ascomycete fungus in the genus *Raffaelea* sp. is vectored by a mycangial redbay ambrosia beetle, *Xyleborus glabratus*, which is native to Asia (see Fraedrich, Ploetz and Mayfield in these proceedings). Not much is known about this disease or its control at this time.

Marketing

Florida produces a range of mostly large, green-skinned avocado cultivars; prominently distinguished from 'Hass' by its large size and green peel. The market for this fruit is smaller than that for 'Hass' and is purchased mostly by people from Latin America, the Caribbean region, and those throughout the U.S. familiar with large, quality avocados. Recently, the lower fat content of many of Florida's avocado cultivars has been used successfully as a marketing tool for consumers concerned about the high oil and fat content of the Guatemalan-Mexican hybrid 'Hass'. The bulk (80%) of the avocados produced in Florida is sold outside the state; hence the industry is an important revenue generator for Florida. Federal Marketing Order 915 (in existence since 1954) regulates production practices and harvesting procedures, such as the size and quality of the fruit, packing and shipping containers, and shipping dates. The Order is aimed at increasing grower returns by promoting orderly marketing conditions while ensuring consumer satisfaction. Permits must be obtained for anyone wishing to sell in excess of 25 kilograms of avocados. As a consequence, most of the avocados grown in Florida are sold to the packing houses.

The prices Florida avocado growers have received for their fruit have fluctuated year to year from 1957 to 2005 (Fig. 4). However, as clearly shown by the trend line, despite the fluctuations, prices have been steadily increasing; between 1957 and 2005 prices have increased from approximately US$100 per metric ton to an average of over US$700 per metric ton. Over the same period the total revenue has increased from US$1.3 million to US$11.3 million, having peaked in 2002 at US$17.3 million (Figure 5). As mentioned earlier the increased price is due largely to improvements in post harvest handling and quality assurance.

Economics of production

Yields vary widely with cultivar, season and location from less than 8,000 kg per hectare to 12,000 kg per hectare. Average yield would be expected to be about 9,000 kg per hectare or about 51 kg per tree. Evans (2005) examined the profitability of avocado orchards in south Florida, with average yields of 9,000 kg per hectare and an average fob price of US $1.40 per kg. He calculated total pre-harvest cost (operating and fixed costs) of $5,000 per hectare, or $0.55 per kg of avocados produced (on the tree). Of the total pre-harvest cost, operating costs totaled $2,850 (57%) and fixed costs were estimated at $2,150 (43%) per ha.

Inputs. The main operating cost elements were fertilizers, fungicides, and herbicides, with shares of 36.9%, 19%, and 13.3% of total operating costs, respectively. This is not surprising, given that most of the avocado trees in Florida are grown in calcareous soils and require generous applications of fertilizers including applications of the expensive micronutrient, chelated iron. In addition, precautionary measures taken to prevent foliar and fruit diseases caused by fungi usually mean that all susceptible parts of the plants must be thoroughly coated with fungicide before infection occurs (Crane, et al., 2001). Included under fixed costs were land rent, supervision, and overhead expenses. Of these land rent was the main cost item accounting for more than half of the estimated costs. Although the majority of farmers own the land, it was decided to include an opportunity cost for the land equal to the existing land rental rate of US$1,300 per hectare. This reflects the standard practice of valuing the contribution of the land.

Harvesting and marketing costs amounted to US$5,400 per ha. The main contributors to the harvesting and marketing costs are the costs associated with picking, hauling, packing, including the cost of the packing material and inspection fees. Together they account for 90% of the harvest and marketing costs. The high harvest and marketing costs are due to labor, avocado harvesting methods, and federal regulations. Because the fruit is easily damaged, avocados are hand picked, which makes harvesting a highly labor-intensive operation.

When harvesting and marketing costs (US $5,400) are added to production costs, the total per hectare cost increased to US$10,400 per hectare, or by 108%. This translates into a cost of $1.16 per kg to produce, harvest, and market avocados. Of the total costs of production, marketing and harvesting costs account for the largest share (52%) followed by operating (27%) and fixed costs (21%). Viewed from slightly different perspective total variable costs comprising operating and harvesting and marketing costs of US$8,250

(US$2,850 + US$5,400) account for 79% of the total cost of production with fixed cost accounting for the remaining 21%.

A gross revenue of US$12,600 per hectare results in a gross margin (gross revenues less variable costs) of US$4,350 per hectare. This represents the returns to grower before accounting for fixed costs used in the operation. When fixed costs are taken into account, the net returns per hectare amount to US $2,200 (US$4,350 - US$2,150) or US$0.24 per kg. Both the gross margin and net returns are very sensitive to price. For example with 9,000 kg per hectare and a price of US$1.68 (a 20% increase in price) per hectare gross net returns increase to about US$5,000 per hectare, a rise of about 127%.

Future of the industry

The Florida avocado industry will remain relatively small due to competition for land, urban pressures, and competition from other avocado producers (e.g., the Dominican Republic, Chile, Mexico, and California). However, the acreage of the industry has expanded during the past 5 years due to land conversion from vegetable production and the replanting with avocado of existing tropical fruit crops such as carambola and lychee which have experienced losses in income.

The outlook for continued economic viability of the Florida industry is good. Acreage appears to have stabilized for the near-term and prices have remained good to very good. Large, green-skinned avocados of high quality have an appeal and market that is different than that of ‘Hass’. In addition, many of the West Indian and Guatemalan x West Indian cultivars combine the fine flavour of the Guatemalan and Guatemalan x Mexican cultivars with low calories, offering health conscious consumers an alternative to ‘Hass’. Finally, very late and early season cultivars are actively being sought and in the near future Florida type avocados will be available year-round helping to further strengthen the Florida industry.

Literature cited

Anonymous. 1934. New Cuban treaty delivers blow to avocado industry. Calif. Avo. Soc. Yearbook 1934. p. 50-51.

Anonymous. 2007. Shipping schedule. Avocado Administrative Committee. Homestead, Fla. P. 1-2.

Anonymous. 1979. Avocado Committee Annual Report. Avocado Administrative Committee, Homestead, FL. P.1-20.

Attaway, J.A. 1997. A history of Florida citrus freezes. Fla. Sci. Source, Lake Alfred, Fla. P. 1-368.

Attaway, J.A. 1999. Hurricanes and Florida agriculture. Fla. Sci. Source, Lake Alfred, Fla. P. 1-444.

Brooks, C.I. 1929. Avocados. Proc. Fla. State Hort. Soc. 42:123-129.

Crane, J.H., C.F. Balerdi, and C.W. Campbell. 1996. The avocado, Circular 1034. Florida Coop. Extn. Service, IFAS, Univ. of Florida, Gainesville, FL.

Crane, J.H., B. Schaffer, Y.C. Li, E.A. Evans, W. Montas, and C. Li. 2007. Effect of foliarly-applied acids and ferrous sulphate on the iron nutrition of avocado trees. Proc. IV Avocado Congress, Santiago, Chile. (in press).

Davenport, T.L. 1986. Avocado flowering. In: Horticultural Reviews, vol. 8. AVI Publ. Co., Westport, CN. P. 257-289.

Davenport, T.L. 1989. Pollen deposition on avocados stigmas in southern Florida. HortScience 24:844-845.

Davenport, T.L., P. Parnitzki, S. Fricke, and M.S. Hughes. 1994. Evidence and significance of self-pollination of avocados in Florida. J. Amer. Soc. Hort. Sci. 119:1200-1207.

Evans, E.A. 2005. Florida Avocado Production and Profitability Analysis. Electronic Data Information Source (EDIS) FE575. Food and Resource Economics Department, University of Florida, Gainesville, FL (September).

Fairchild, D. 1945. Personal recollections of George B. Cellon, horticultural pioneer of south Florida. Proc. Fla. State Hort. Soc. 58:205-209.

Gustafson, C.O. and B.O. Berg. 1966. History and review of studies on cross-pollination of avocados. Calif. Avocado Soc. Yearbook 50:39-49.

Jeong, J., D.J. Huber, and S.A. Sargent. 2002. Postharvest ethylene treatment for uniform ripening of West Indian type avocado fruit in Florida. Proc. Fla. State Hort. Soc. 115:68-71.

Jeong, J., D.J. Huber, and S.A. Sargent. 2003. Delay of avocado (*Persea americana*) fruit ripening by 1-methylcyclopropene and wax treatments. Postharvest Biol. and Tech. 28:247-257.

Knight, R.J. and C.W. Campbell. 1999. Florida's contribution to the world avocado industry. Proc. Fla. State Hort. Soc. 112:233-236.

Knight, R.J., Jr. 2002. History, distribution and uses. In: The avocado: botany, production, and uses. Whiley, A.W., B. Schaffer, and B.N. Wolstenholme, editors. CABI Publishing, New York, NY. P. 1-14

Menge, J.A. and R.C. Ploetz. 2003. Diseases of avocado. In: Diseases of tropical fruit crops. CABI Publ., Cambridge, MA. P. 35-71.

Peña, J.E., S. Sundhari, A. Hunsberger, R. Duncan, and B. Schaffer. 1998. Monitoring, damage, natural enemies and control of avocado lacebug, *Pseudacysta perseae* (Hemiptera:Tingidae). Proc. Fla. State Hort. Soc. 111:330-334.

Ploetz, R.C., J. Haynes, and R.J. Schnell. 2001. Phytophthora root rot-resistant avocado rootstocks for south Florida: selection of open-pollinated seedling progeny. Proc. Fla. State Hort. Soc. 114:6-10.

Ploetz, R., R.J. Schnell, and J. Haynes. 2002. Variable response of open-pollinated seedling progeny of avocado to phytophthora root rot. Phytoparasitica 30:262-268.

Schaffer, B., P.C. Andersen, and R.C. Ploetz. 1992. Responses of fruit crops to flooding. Horticultural Reviews 12:257-313.

Schaffer, B. and A.W. Whiley. 2002. Environmental physiology of avocado. In: Avocado: Botany, Production and Uses. A.W. Whiley, B. Schaffer and B.N. Wolstenholme (eds.). CAB International Inc., London. pp. 135-160.

Wolfe, H.S., L.R. Toy, and A. L. Stahl (G.D. Ruehle, revised). 1949. Avocado production in Florida, Bull. 141. Agric. Extension Service, Gainesville, Fla. P. 124.

Table 1. Major, early, mid-, and late season Florida avocado cultivars.

Season[z]	Cultivar	Race
Early	Donnie	West Indian
	Dupuis	West Indian
	Simmonds	West Indian
	Nadir	Guatemalan x West Indian
	Nesbitt	Guatemalan x West Indian
	Bernecker	West Indian
	Beta	Guatemalan x West Indian
	Tonnage	Guatemalan
Mid-	Choquette	Guatemalan x West Indian
	Hall	Guatemalan x West Indian
Late	Lula	Guatemalan x West Indian
	Monroe	Guatemalan x West Indian

Z, Early = late May-Aug.; Mid- = Sept.-Oct.; Late = Nov.-March.

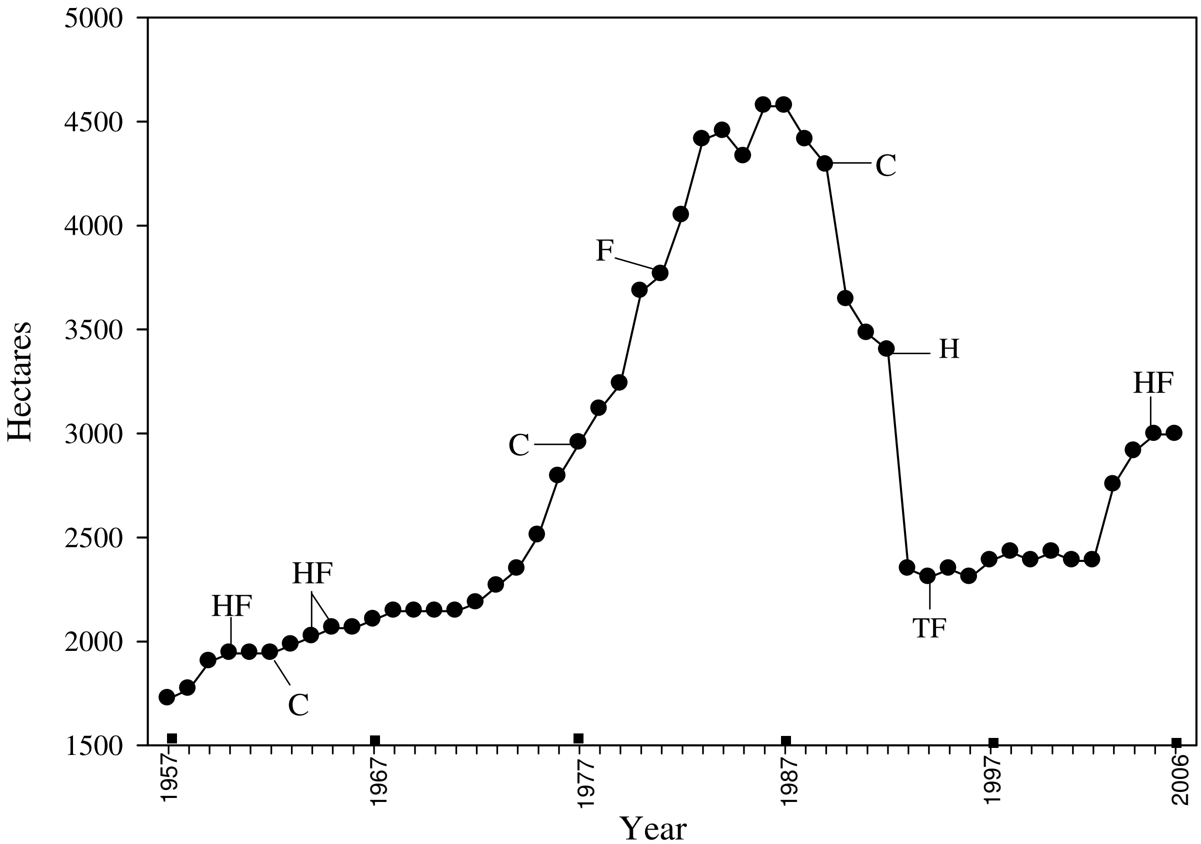

Fig. 1. Total area planted to avocado in Florida from 1957 to 2005. H = hurricane, C = freeze, F = flood, T = tropical storm.

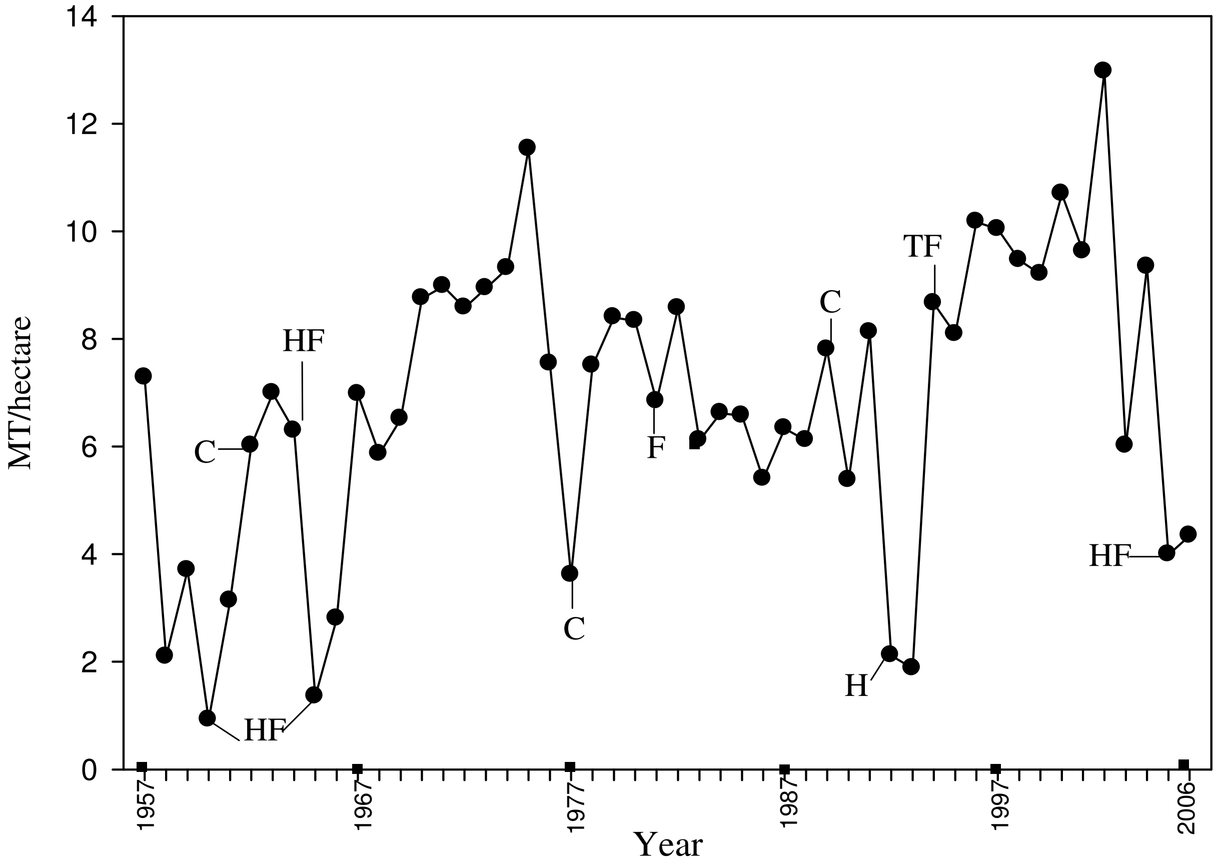

Fig. 2. The avocado production per ha in Florida from 1957 to 2005. H = hurricane, C = freeze, F = flood, T = tropical storm.

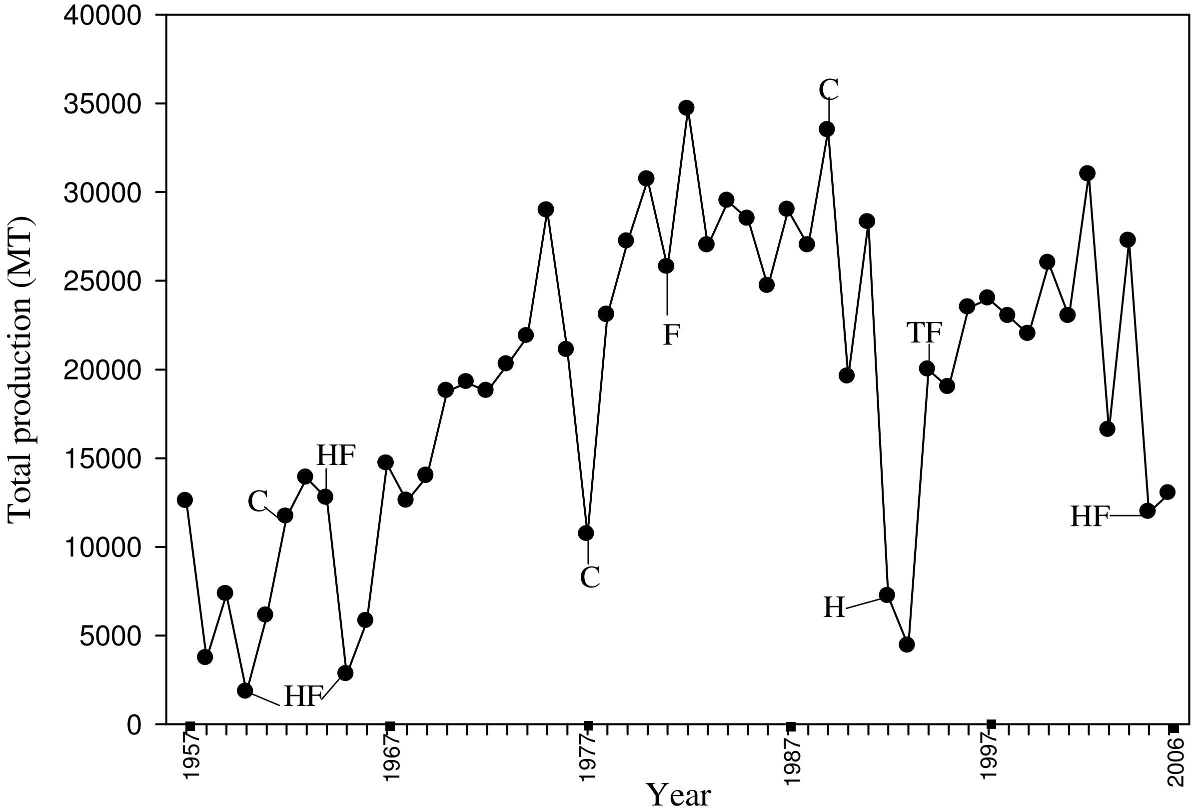

Fig. 3. The total Florida avocado production from 1957 to 2005. H = hurricane, C = freeze, F = flood, T = tropical storm.

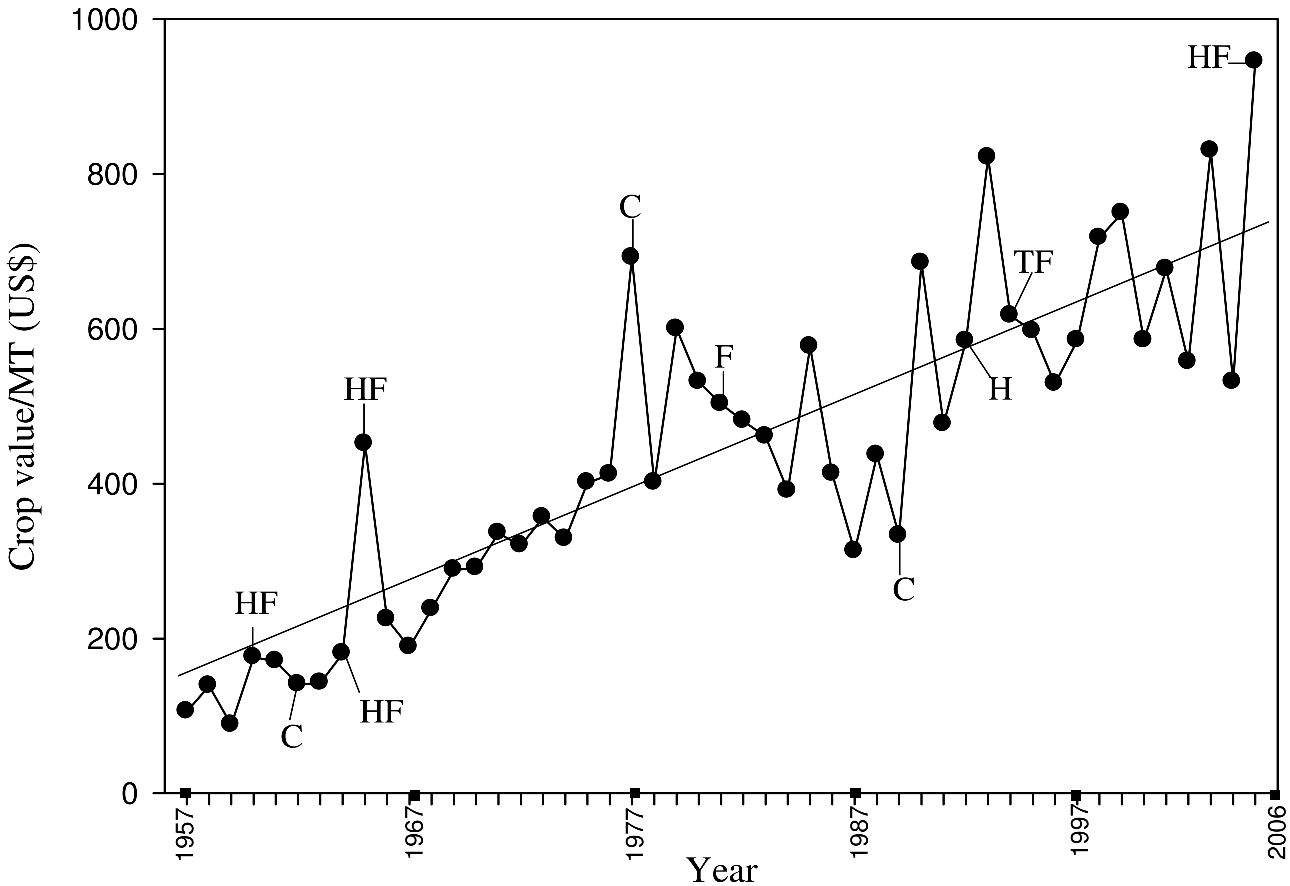

Fig. 4. The value of Florida avocado production per ha from 1957 to 2005. H = hurricane, C = freeze, F = flood, T = tropical storm.

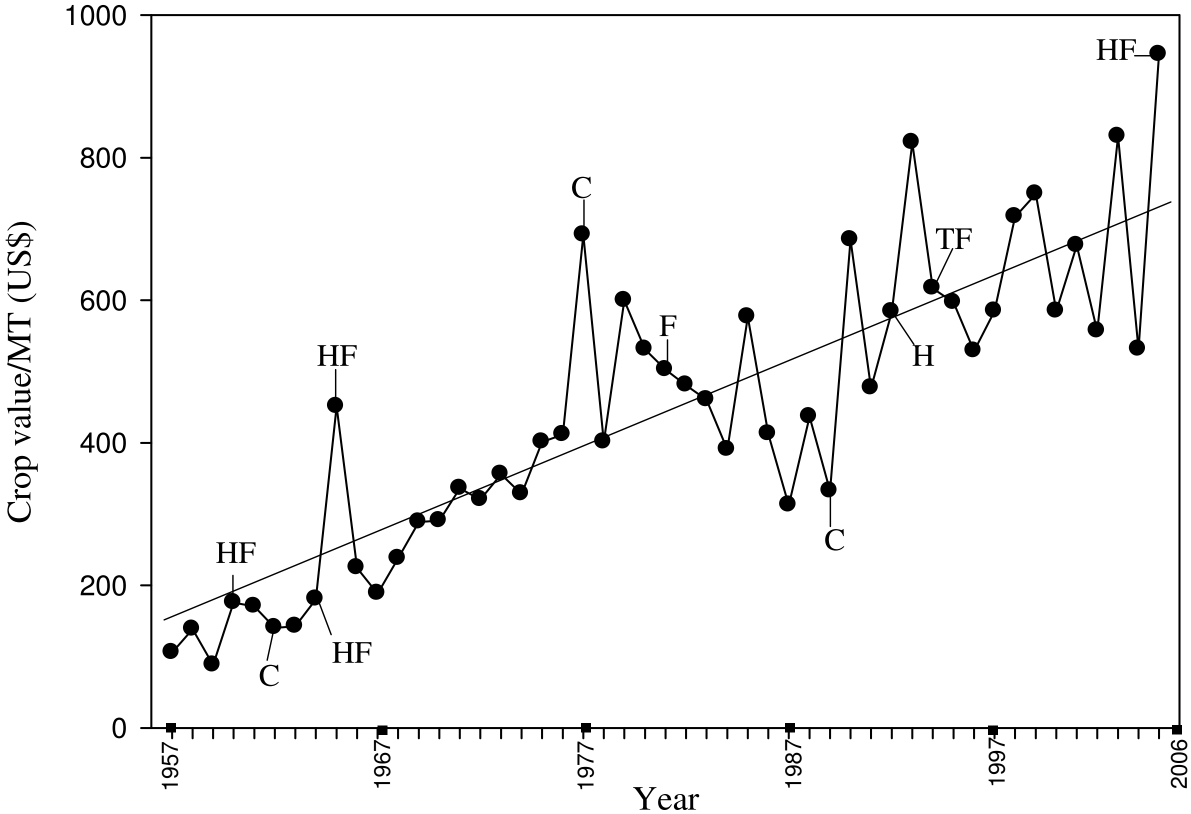

Fig. 5. The total value of Florida production from 1957 to 2005. H = hurricane, C = freeze, F = flood, T = tropical storm.