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Cuba's Tropical Fruit Industry

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Abstract

Cuba's tropical fruit industry primarily caters to domestic markets with fresh fruits that are Cuban diet staples. Plantains and bananas account for over 70 percent of production. Tropical fruit production fell with Cuba's collapsing economy in the early 1990s. With ideal climate and land resources, production potential remains high. Production and demand will both recover and grow as Cuba's economy recovers. If commercial relationships with the United States were restored, Cuba could initially look to U.S. sources for quality tropical fruits for Cuba's growing tourist market. Eventually, as Cuba's economy and its tropical fruit sector recover, the United States could provide new market opportunities for an increasingly competitive Cuban tropical fruit sector.

Keywords: Cuba, tropical fruit, banana, plantain, mango, guava, coconut, papaya, pineapple, avocado, trade.

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Introduction

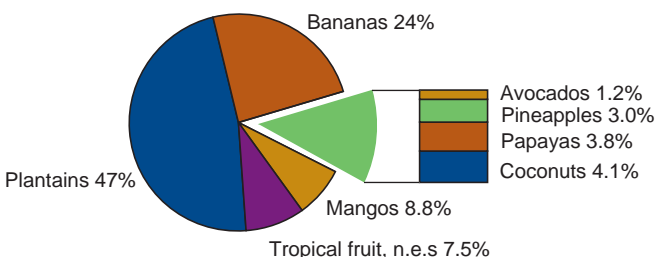
In the 1950s, raw sugar, inedible molasses, and unmanufactured tobacco accounted for more than 95 percent of all U.S. agricultural imports from Cuba. Pineapples, both fresh and processed, accounted for another 2-3 percent of those imports and citrus and tropical fruits accounted for 1-2 percent of the total. The total dollar volume of U.S. agricultural imports from Cuba also remained stable during this period, ranging from \$350 million to \$400 million annually.

Tropical fruits have been a staple in the Cuban diet for generations. In fact, the growth in Cuba's tropical fruit industry over the past 50 years has been driven primarily by increases in Cuban domestic demand generated by population growth.

In the 1950s, the United States was Cuba's principal market for tropical fruits. Cuba lost this market, however, when the U.S. imposed a total trade embargo in 1962. Cuba's tropical fruit export markets withered, leaving a smaller industry with a domestic focus. Attempts to expand export production of tropical fruits since the 1960s have been disappointing. Does Cuba have more potential to increase production of tropical fruits for both domestic and foreign markets in the future?

With respect to the world market, Cuba is a minor producer and exporter of tropical fruit. Cuba's tropical fruit industry primarily caters to a domestic fresh fruit market. Major tropical fruits produced include plantains (cooking bananas), bananas (sweet), mangos, papayas, pineapples, avocados, guavas, coconut, and anonaceae (sugar apple family) (fig. 1).

Figure 1
Plantains and bananas are the most important tropical fruits and are staples in the Cuban diet
Relative importance of tropical fruit consumed in Cuba, 1995-99



Note: Tropical fruit, n.e.s includes guava, anonaceae.
n.e.s = not elsewhere specified.
Source: FAOSTAT database.

Given their role as starchy staples in the diet, plantains and bananas are generally considered to be a separate category from other tropical fruits and are often reported separately in the statistics, as done in this report. As defined in this report, tropical fruit also does not include citrus fruit.

Plantain and Banana Production

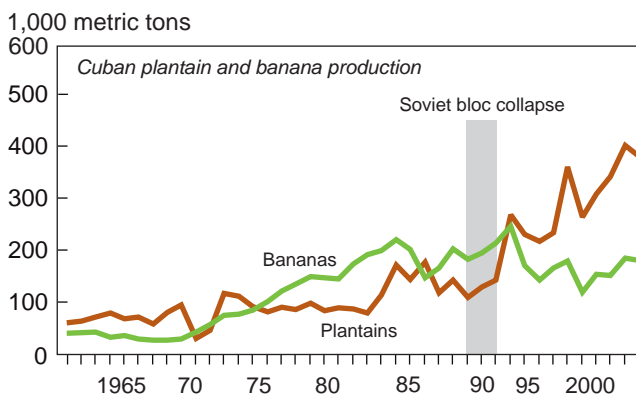
Plantains and bananas have long been major commodities in Cuban agriculture and staples in the Cuban diet. Together they account for over 70 percent of all tropical fruit produced in Cuba. Plantains represent about two-thirds of that share.

Although Cuba exported bananas during the 1940s, it currently produces bananas, as well as plantains, for domestic consumption only. Most are consumed fresh. Some bananas are processed into pulp for stewed fruit, and some plantains are processed into flour for banani-na (a soft sweet sandwich bread) and chips. Most bananas and about 80 percent of plantains are grown for human consumption. About 5 percent of plantains are fed to livestock, and the rest are considered waste.

Plantain: Plantain production, while somewhat variable, grew throughout 1961-2001. From 1961 to 1982, the rate of growth was almost 2 percent per year. From 1983 to 2001, the growth rate rose to about 7 percent per year, with the exception of 1993-95, when yields, and therefore production, declined as a result of Cuba's economic crisis (fig. 2).

Much of the growth in plantain production during 1983-2001 can be attributed to the growth of area harvested. Harvested area grew only about 1.5 percent

Figure 2
Plantain production increased in the early 1990s, but banana production fell as yields collapsed with the loss of purchased inputs



annually during 1961-82, then jumped to average almost 7 percent annually from 1983 to 2001. With plantains a major staple crop and well suited to the Cuban climate, the Government, over the last two decades, encouraged plantain production to increase self-sufficiency. Plantain area, yield, and production also benefited from the urban gardening programs in the 1990s. These programs used minimal purchased chemical, fertilizer, and other inputs and depended heavily on increased labor and management inputs and intensive intercropping of vegetables with tropical fruit trees. The Government encouraged plantain plantings to provide needed shade for vegetable crops as well as to increase the production of a major staple of the Cuban diet. During 1996-2001, however, area growth slowed and remained relatively constant. Plantain yields remained rather stagnant throughout the 1960s and 1970s, fell in the early 1980s by almost 50 percent, and remained at this lower level throughout the 1980s and 1990s. Yields have improved since 1998, returning to levels last reached in the 1960s (and 1984-86) and, thereby, allowing plantain production to continue growing throughout most of this period.

Banana: Cuban banana production has followed a somewhat different pattern. Production fell by a third during the 1960s as area harvested plummeted (fig. 2). In the early 1970s, banana area harvested grew and yields more than doubled, leading to a recovery in banana production. Production then continued to grow about 6 percent per year through 1992. At the same time, banana harvested area increased almost fivefold during the 1970s, then continued to grow over 3 percent annually for the next two decades.

Banana production fell over 25 percent in 1993-95 as yields collapsed over 40 percent. Cuba's economic crisis and the loss of needed purchased inputs, particularly those required to maintain effective irrigation systems, triggered this downturn. Even though banana yields remained stagnant during the latter half of the 1990s, production started to recover as area harvested continued to increase. In 2000-01, harvested area grew about 5 percent annually.

Because bananas have a longer production cycle than other tropical fruits, it took longer for banana production to feel the effects of Cuba's economic crisis. A banana crop requires 16-20 months to go from soil preparation to planting to harvest maturity (fig. 3). Thus, the 1993 crop was the first to feel the full impact of the 1991 dissolution of the Soviet Union.

Bananas benefited from Cuba's 1989 National Food Program, which expanded investments and labor in agriculture. The program sought to increase banana production by introducing micro-jet and drip irrigation systems. Between 1989 and 1992-93, irrigated banana acreage increased over 500 percent. Most of this irrigation investment was on state plantations. The share of irrigated acreage jumped from 10 percent to over 60 percent under this program (fig. 4). As a result, banana yields jumped 37 percent between 1989 and 1992 before collapsing in 1993 to a level 14 percent below 1989 levels, as energy to power irrigation equipment and other production inputs became unavailable.

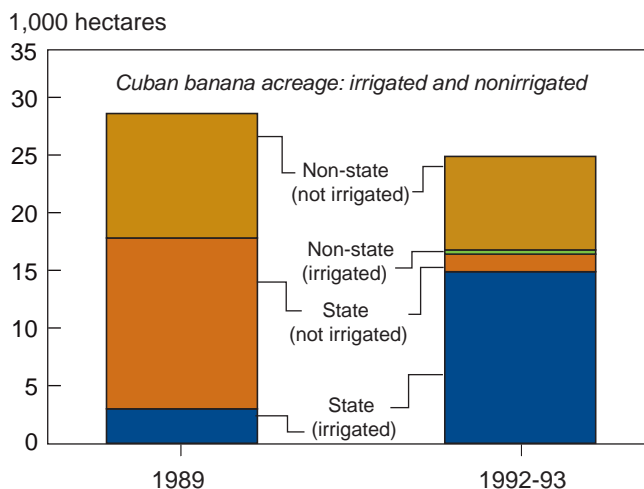
Figure 3
Plantain and banana production cycles are 16-20 months long

Cuba's plantains and bananas production calendar

Task	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.
Till	■	■	■	■	■	■														
Plant				■	■	■	■	■												
Cultivate					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Harvest																■	■	■	■	■

Source: Mosely et al.

Figure 4
Cuba's 1989 National Food Program irrigated over half of banana acreage



Note: Cuban, not FAO, data sources.
 Source: Moseley et al.

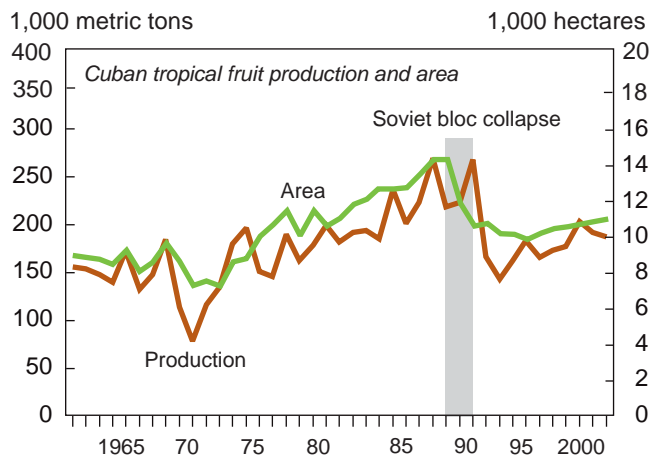
Tropical Fruit Production

With the exception of plantains and bananas, tropical fruit production in Cuba has not benefited from any specific Government programs to promote increased production. Even when tropical fruits were explicitly included in citrus programs, the emphasis and resources concentrated on citrus fruits. Tropical fruits were considered traditional crops grown in traditional ways, and producing foods for domestic consumption. Although two-thirds of tropical fruit area was managed by state farms in the early 1990s, that share has slowly declined since then.

Given a lack of Government attention to development, tropical fruit area grew slowly during the 1970s and 1980s, then declined about 20 percent in 1990 to late-1970s/early-1980s levels, where it remains today. Tropical fruit production also grew throughout the 1970s and 1980s, but dropped over 30 percent in the early 1990s to levels last seen in the 1960s and mid-to-late 1970s (fig. 5).

This downturn in the tropical fruit sector mirrored the reaction throughout Cuban agriculture to the collapse of the centrally planned economies of Eastern Europe in 1989 and the Soviet Union in 1991. Unlike the citrus market in Cuba, however, Cuba's tropical fruit market is domestic, and its decline did not stem from the loss of Cuba's major export market. Rather, losses occurred because of the economic downturn of the general economy, the loss of foreign exchange to pur-

Figure 5
Cuba's tropical fruit industry collapsed in the early 1990s after losing Soviet-backed markets and support, then recovered to 1980s levels



Notes: Excludes bananas/plantains. Area excludes coconut area.
 Source: FAOSTAT database.

chase inputs, and the elimination of subsidized imports of purchased agricultural inputs.

In the latter half of the 1990s, Cuban tropical fruit production started to recover and is now back to levels last reached in the 1980s. This recovery can be largely attributed to explicit Government programs promoting tropical fruit production as one way to increase and improve Cuban diets after the devastating decline brought about by the loss of Soviet-backed markets and support.

As part of this effort, Cuba instituted an urban gardening program to increase vegetable and fruit production. These urban gardens, plus over 4,000 larger, more intensive gardens generally located on the outskirts of cities and towns, employed minimal purchased chemical, fertilizer, and other inputs and depended heavily on increased labor and management inputs to increase both vegetable and tropical fruit production. Through agricultural extension programs, gardeners learned the value of intercropping fruit trees with vegetable crops. For example, many gardens now have guava and avocado trees planted in wide rows to provide the necessary shade for vegetable crops that cannot thrive under the hot tropical sun. Intercropping, coupled with a more labor-intensive and environment-preserving approach to farming that minimizes the need for the extensive purchased inputs that are no longer available, has led to an increase in the production of both fruit and vegetables. To expedite this intercropping

program, the Government has supplied gardeners with low-cost fruit tree saplings from urban seed houses.

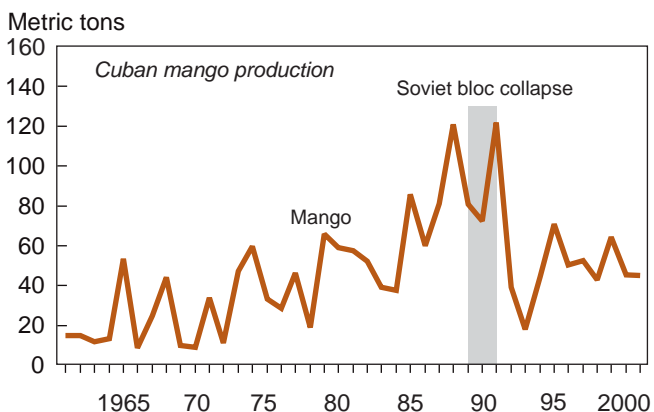
The establishment of private agricultural markets and the restructuring of state farms in 1993 also contributed to the production recovery. The Government began breaking many large state farms into cooperatives called Basic Units of Cooperative Production (Unidades Básicas de Producción Cooperativa, or UBPC). These UBPCs could use the assigned state-owned land and were given some additional decision autonomy in allocating scarce production inputs to achieve quota production levels for sale to the state. By August 1994, 83 UBPCs producing citrus and tropical fruit had been established. These UBPCs operated 70,334 hectares and had 6,465 workers. By June 1995, the number of UBPCs had increased to 101. The final factor that provided real incentives for expanding agricultural production was the Government's decision, in the summer of 1994, to allow establishment of agricultural markets where producers of all types could sell production beyond their quotas at free market prices. These actions created incentives for producers to operate more efficiently and to increase production.

Mango: Mangos are Cuba's third most important tropical fruit, after bananas and plantains. They account for about 9 percent of all Cuban tropical fruit production and almost a third of tropical fruit production when plantains and bananas are excluded. Although over three-fourths of the mango area was managed by state farms in the early 1990s, that share has since declined as Cuba broke up many state farms. In addition, mango production has been tied, in part, to Cuba's reforestation efforts. Mango trees are now regularly interplanted with fast-growing Caribbean pine trees.

Mango yields fell about 20 percent from the last half of the 1980s to the first half of the 1990s. Over that same period, production fell about 30 percent. Production fell about 60 percent when comparing the 1992-94 peak period with the earlier 1985-89 period. In the latter half of the 1990s, yields and production recovered to early-1980s levels (fig. 6). In more recent years, mango yields have benefited from the agriculture gardening movement, which, among other things, emphasized the use of organic fertilizers. For example, compost and vermicompost made from municipal garbage, sugarcane filter press cake, coffee pulp, plantain waste, and often enriched with cow, pig and/or sheep manure, is used to produce fertilizer. To help

Figure 6

Mango production collapsed in the early 1990s, then recovered somewhat later in the decade to early 1980s levels



Source: FAOSTAT database.

maintain optimum moisture and temperature levels, compost beds are often located in the shade of large mango trees. The mango trees benefit from the leached nutrients produced during the composting process. Mango production has also benefited from being included in Cuba's urban gardening programs.

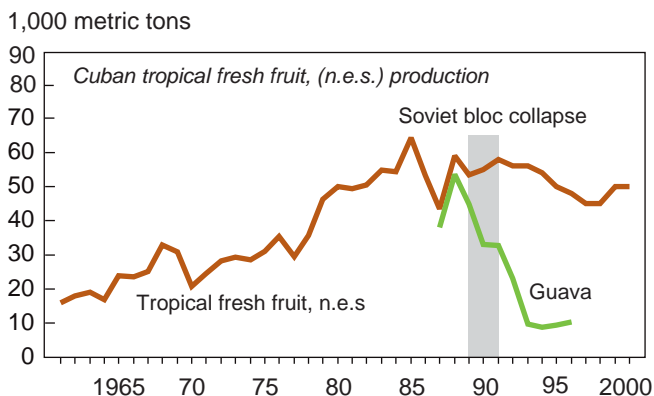
Tropical fresh fruit, not elsewhere specified (n.e.s.): Other tropical fresh fruit, not explicitly identified in the Foreign Agriculture Organization's FAOSTAT Agricultural Database, account for about 7.5 percent of all tropical fruit production in Cuba and over 26 percent of tropical fruit production when plantains and bananas are excluded. This category includes guavas (guayaba), mamey (*Pateria sapota*), and members of the anonaceae family (sugar-apple/ sweetsop, chinimoya/custard-apple/mamon, and soursop/guana-bana).

In the 1990s, other tropical fresh fruit (n.e.s.) production fell to early 1980s levels, as the Cuban economy collapsed. Much of this drop in production can be attributed to a fall in guava production (fig. 7).

Historically, guava has been a major component of other tropical fresh fruit (n.e.s.), accounting for 40-90 percent of the total during the late 1980s. In Cuba, guava is harvested from both commercial plantations and wild trees. In many areas, guava trees can spread rapidly, overrunning pastures, fields, and even roadsides to form extensive thickets. These wild trees produce a significant portion of the guava harvested for home consumption in Cuba (estimated at over 9,000 metric tons in the late 1940s).

Figure 7

Cuba's production of other tropical fresh fruit (n.e.s.), particularly guava, collapsed in the early-1990s and has shown only modest recovery since



Source: FAOSTAT database.

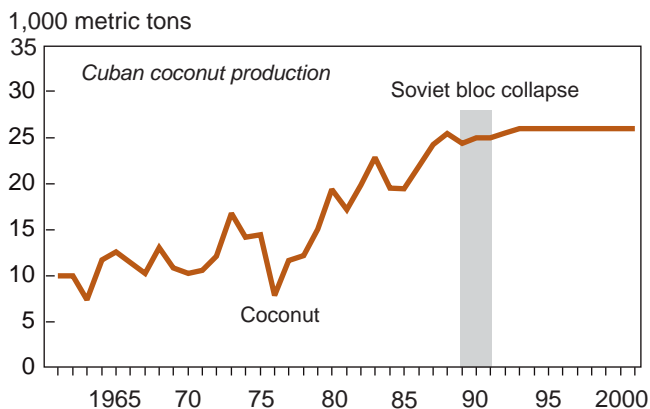
For high-yielding commercial production, guava needs heavy fertilizer applications. While the trees are drought tolerant, they also need heavy rainfall throughout the year or irrigation to produce high yields. Only about 9-10 percent of the tropical fruit area is irrigated in Cuba. Most of that irrigation is on guava and papaya plantations.

Given these input demands, commercial guava production fell about 70 percent in the early 1990s from late 1980s levels when the Cuban economy could not support the purchase of inputs and energy supplies. Guava production did benefit in the late 1990s from the Cuban Government's programs promoting environment-preserving farming techniques and urban gardening as ways to increase domestic food production. These programs encouraged the production and use of compost to improve soils and provide organic fertilizer to fruit and vegetable crops and the planting of fruit trees, including guava trees, in urban vegetable gardens to provide shade for sun-sensitive vegetables.

Coconut: Coconut accounts for about 4 percent of all tropical fruit production and over 14 percent of tropical fruit production when plantains and bananas are excluded. Cuban coconut production grew slowly throughout the 1960s, accelerated through the 1970s and 1980s to 2.5 times the 1960s production levels, then leveled off during the 1990s (fig. 8). Given the long life of the coconut palm and its limited need for purchased inputs, coconut production did not immediately collapse in the early 1990s like many other agri-

Figure 8

Growth of Cuba's coconut production ceased in the 1990s as both area and yield stabilized



Source: FAOSTAT database.

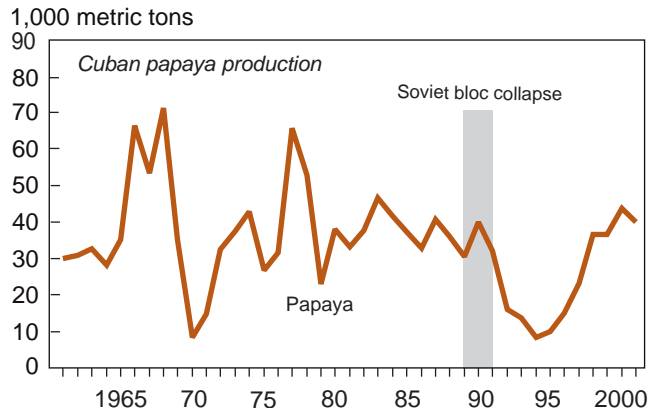
cultural products in Cuba. However, coconut palm acreage growth ceased in the 1990s.

Papaya: Papaya accounts for almost 4 percent of all tropical fruit production in Cuba and over 13 percent of tropical fruit production when plantains and bananas are excluded. Papaya acreage collapsed in the early 1990s, reducing area over 63 percent from 1985-89 levels. Acreage has increased only modestly over the last decade. As the Cuban economy collapsed in the 1990s, yields fell to levels of the 1980s. Papaya trees need fertile, moist soil. Most likely, much of the yield drop can be attributed to Cuba's inability to purchase fertilizer during this period. Since papaya plantations constitute a significant portion of the 9.4 percent of Cuba's tropical fruit acreage that is irrigated, the deterioration of irrigation equipment, due to the lack of foreign exchange to fix, improve, and operate the equipment, likely also contributed to lower yields. Yields did recover in the late 1990s. This recovery was partly due to the Government's emphasis on environment-preserving farming techniques that promoted compost production. In addition to improving soil fertility, this compost would also increase the moisture holding capabilities of the soil, thereby improving growing conditions for papaya trees.

Because of the drastic drop in acreage, papaya production fell about 38 percent in the early 1990s from 1985-89 levels. The combination of the recovery of yields and a modest increase in area harvested has restored papaya production to levels achieved in the 1980s (fig. 9).

Figure 9

Papaya production collapsed in the early 1990s, then recovered in the last half of the 1990s to 1980s levels



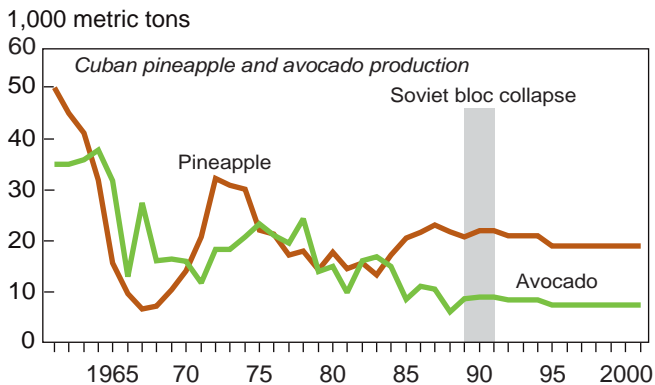
Source: FAOSTAT database.

Pineapple: Pineapple accounts for 3 percent of all tropical fruit production in Cuba and almost 11 percent of tropical fruit production when plantains and bananas are excluded. Pineapple acreage fell throughout the 1960s and 1970s and again slightly in the early 1980s. After a modest increase in the mid-1980s, pineapple area remained relatively stable at this now low level. Yields fell in the last half of the 1960s, then recovered and doubled during the first half of the 1970s. Pineapple yields remained relatively stable through the 1980s. Since then, yields have slightly declined. Pineapple production declined as acreage fell in the 1960s, then rose in the first half of the 1970s as yields jumped. In the late 1970s and early 1980s, production again fell as yields stabilized and area continued to decline. In the late 1980s, production recovered as acreage expanded and yields improved.

Although the accuracy of FAO pineapple data for the 1990s is somewhat suspect, it appears that area, yield, and production were little affected by Cuba's economic collapse of the 1990s (fig. 10). Given the 3-year life span of pineapple plants, any production effect related to the economic collapse would be somewhat delayed. Pineapple production also benefited somewhat from irrigation programs in the late 1970s and 1980s. Loss of irrigation inputs would have reduced yields and production, but these losses were offset by other factors, such as the environment-preserving farming practices promoted by the Government throughout the 1990s and the increased production of higher quality *in-vitro* seedling plants by the Ministry of Agriculture in the latter part of the decade. The economic crisis,

Figure 10

Pineapple and avocado sectors declined during the 1960-80s, but were relatively stable during the 1990s



Source: FAOSTAT database.

however, did lead to the elimination of production of processed pineapple products in the 1990s.

Pineapple is primarily grown in east central Cuba in the provinces of Ciego de Avila and Camaguey. Processed pineapple products were primarily produced in the Ministry of Food Processing's (Ministerio de Industria Alimenticia, or MINAL) three Majagua plants in Ciego de Avila province.

Avocado: Avocados account for a little more than 1 percent of all tropical fruit production and about 4 percent of tropical fruit production when plantains and bananas are excluded.

Avocado yields remained relatively stable throughout the 1960s, rose during the 1970s and early 1980s, plummeted in the mid-1980s (70 percent in 1985), and remained at those low levels throughout the 1990s. Harvested area declined during the last half of the 1960s and early 1970s, causing a corresponding decline in avocado production over this same period. Yield increases in the mid 1970s offset area declines and sustained production levels. The 1985 collapse in yields more than offset the doubling of harvested area that year and started the declining production trend seen in the latter half of the 1980s. Area harvested, yield, and production remained relatively stable throughout the 1990s at these significantly lower levels. While the reliability of the FAO avocado data for the 1990s is somewhat suspect, it appears that avocado production was not affected by Cuba's economic collapse in the early-1990s to the same degree that most other crops were affected. The stability in avocado area is most likely attributable to the avocado's long

productive life span (about 50 years). Yields, and therefore production, fell about 5 percent in 1992 and about another 12 percent in 1995, most likely a result of the lack of purchased production inputs during this period (fig. 10).

Tropical Fruit Processing Industry

Most of Cuba's tropical fruits are consumed fresh, but processed tropical fruit products are still important. Given the seasonality of production, much fresh fruit is processed in the beginning and latter part of a calendar year (fig. 11).

Cuba's fruit and vegetable processing capacity is concentrated in two institutions: The Ministry of Food Processing (Ministerio de Industrial Alimenticia, or MINAL) and the Local Agencies of Popular Power (Organos Locales del Poder Popular, or OLPP). MINAL plants dominate Cuba's fruit processing industry, maintaining about 80 percent of the processing capacity and producing over three-fourths of Cuba's tropical and citrus processed fruit products (table 1). These firms primarily produce juice and

fruit pulps, fruit slices and chunks, grated coconut in syrup, guava paste, bases for soft drinks, and jellies and jams (table 2). Most of these tropical fruit-based products are destined for the domestic market.

From 1961 through 1989, the amount of tropical fruit processed in Cuba increased almost 250 percent (fig. 12). With a reasonably constant extraction rate, the

Table 1—Two institutions control Cuba's fruit and vegetable processing capacity

Cuba's processing facilities, 1994		
	MINAL	OLPP
Number of plants	31	77
	<i>1,000 tons</i>	
Processing capacity		
Fruit	190.4	42.6
Vegetables	35.9	4.3
Tomatoes	169.8	12.0
Total	396.1	58.9

Note: MINAL = Ministry of Food Processing (Ministerio de Industrial Alimenticia); OLPP = Local Agencies of Popular Power (Organos Locales del Poder Popular).

Source: González et al; Moseley et al.

Figure 11

Cuba's fresh fruit harvest is concentrated at the beginning and latter half of a calendar year

Cuba's fruit harvest calendar

Fruit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Citrus</i>												
Orange, China (early)												
Orange, Valencia (late)												
Grapefruit												
Lemon, Eureka												
Lime, Persian												
Tangerine, Dancy												
<i>Tropical fruit</i>												
Mango												
Avocado												
Guava												
Coconut												
Papaya												
Pineapple												
Banana/Plantain												

Notes: Darkest shading represents highest volume harvest.

Source: Moseley et al.

production of processed fruit products increased by a similar amount. During the 1960s, growth in the amount of tropical fruit processed was achieved through increases in both the total production of tropical fruit and the share of total tropical fruit production shipped to processing plants. Over the next three decades, the share of total tropical fruit production that was processed declined as an increasing proportion of the tropical fruit was consumed as fresh fruit. But, because tropical fruit production continued to grow, the amount of processed tropical fruit products contin-

ued to grow. In 1990, however, following the collapse of Cuba's economy, processed tropical fruit production fell over 40 percent. This decline was due to both a drop in tropical fruit production (less plantains) and a drop in the amount of tropical fruit that was processed.

Furthermore, the domestic food shortage, created by the 1990s economic crisis, caused more tropical fruit to be consumed fresh.

Cuba's processing plants were hit hard by the economic collapse. The delivery of fresh fruit (and vegetables)

Table 2—The Ministry of Food Processing (Ministerio de Industria Alimenticia, or MINAL) enterprises control over three-fourths of Cuba's tropical and citrus fruit processing

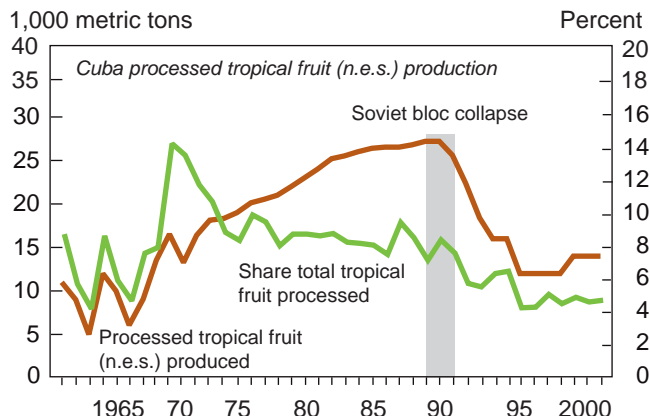
MINAL fruit and vegetable processing enterprises

Plant	Number of plants	Tropical and citrus fruit products produced
La Conchita Enterprise (for export, tourist sector, dollarized domestic market)	4	juices, nectars, puree, pulp, marmalade, products in syrup, stewed fruit, candied fruit, including: guava paste/shell/pulp, mango pulp/sections in syrup, banana pulp (for stewed fruit), orange pulp/rind, grapefruit rind/pulp marmalades
La Habana Vegetable Enterprise (mostly vegetables, fruit for export, tourist sector, & dollarized domestic market)	10 (1 for fruit)	fruit nectar/juice, some fruit pulp
Libertad Enterprise (primarily vegetables, some fruit)	1	guava pulp, mango pulp, citrus bases for beverage production
Villa Clara Enterprise (domestic market)	4	mango pulp/slices, guava pulp, papaya in syrup
Majagua Enterprise	3	pineapple slices/segments/pulp/concentrated juice/natural juice/nectar, mango pulp, coconut horchata (local beverage), guava pulp, papaya in syrup
Camagüey Processing Enterprise (primarily domestic market)	3	mango pulp, guava pulp/slices, papaya in syrup/pulp/marmalade, grapefruit rind/pulp
Holguin Vegetables Enterprise (primarily domestic market)	1	papaya in syrup, orange marmalade/rind in syrup
Gamma Processing Enterprise (for domestic market)	2	mango pulp, guava pulp, bananina and banapectina (from plantains), various juices and nectars
Santiago de Cuba Processing Enterprise (most domestic, but some export, tourist sector, & dollarized domestic market)	3	mango pulp, guava pulp, papaya in syrup, orange rind/marmalade, grapefruit in syrup/marmalade, various juices/nectars

Source: González et al.; Moseley et al.

Figure 12

Cuba's processed tropical fruit industry collapsed with the economic crisis of the early 1990s and has not yet recovered



Source: FAOSTAT database.

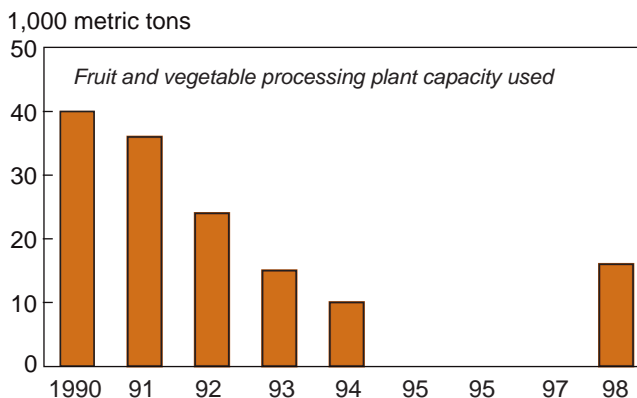
to processors shrank as production fell (fig. 12). The industry also faced severe production input shortages and rising input costs as Soviet-subsidized inputs were eliminated and foreign exchange shortages worsened. Shortages of fertilizer, fuel and electricity, and containers for processed products were particularly harmful to the industry. Fruit and vegetable processing capacity used dropped from an already-low 49 percent in 1989 to 10 percent in 1994 (fig. 13).

While the processing industry has begun to recover, the shortages described here continue. The fruit processing industry now looks to both the domestic and export market for its citrus fruit products. For noncitrus tropical fruit products, the industry still maintains a domestic focus.

Domestic demand for processed tropical fruit products is still constrained by Cuba's low incomes. Cuba's growing tourist industry, however, has the potential to generate increased demand for processed tropical fruit products (fig. 14). The tourist sector, in fact, may generate the hard currency needed to fund the purchase of inputs necessary to allow increased utilization of existing plants, to allow the capital upgrades needed to modernize and improve efficiency of existing facilities, and to allow expansion of sector capacities. Some processing facilities, however, have been idle for many years and will likely be very expensive to bring back into production. In addition, the product quality demanded by the tourist sector is higher than that normally produced for local domestic consumption. Many hotels catering to tourists may find that it is more cost effective to use the foreign exchange they earn to pur-

Figure 13

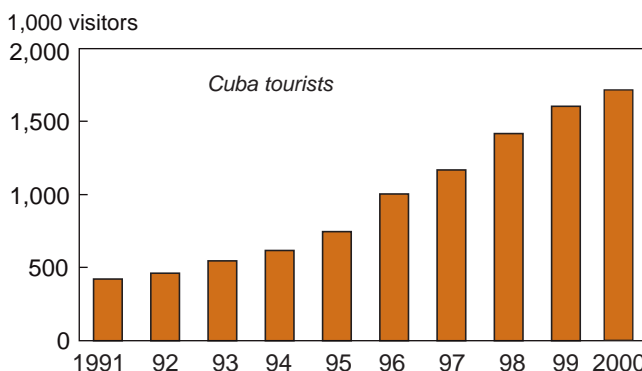
Cuba's underutilized fruit and vegetable processing capacity dropped further in the early 1990s



Source: CUBANEWS; González et al.

Figure 14

Cuba's growing tourist industry could become a new market for Cuban processed tropical fruit products



Note: 2001 estimates indicate a small drop from 2000 levels.
Source: Espino.

chase inputs, including tropical fruit products, directly from overseas wholesalers who can guarantee high-quality, regular shipments and even provide credit.

The Future of Tropical Fruit in Cuba

Cuba's climate and land resources are ideal for tropical fruit production, and the potential for production growth remains high. Domestic demand for quality tropical fruit and tropical fruit products is growing, particularly in Cuba's tourist sector. The Cuban population will continue to demand tropical fruit for domestic consumption. This domestic demand will only grow as population increases and Cuban incomes rise with a recovering Cuban economy.

Several factors, however, may constrain this potential market growth. Cuba's tropical fruit yields, which have historically been low, remain low because of the current economic situation. Prospects for improvement in the short run are dim. The economic crisis that started in the 1990s continues. Commercial production is hampered by a lack of inputs (energy, fertilizers, pesticides, machinery, etc.). Capital improvement funds for production purposes are also not available. For example, only about 10 percent of tropical fruit acreage is currently irrigated, mostly for guava and papaya on state plantations.

Cuba's marketing infrastructure is underdeveloped. Refrigerated storage facilities for tropical fruit are severely limited. The transportation infrastructure is equally limited, particularly refrigerated carriers. These constraints reduce fruit quality, lower consumable yields, and raise costs. These limitations occur when produce is moved from producer areas to fresh fruit consumer markets or to processors. These limitations also affect movement of processed product from the processing plants to both domestic and foreign consumer markets.

Cuba's tropical fruit processing industry is characterized by equipment that is old, inefficient, high cost, low capacity, and underutilized. The industry is also undercapitalized. Very little investment (or existing capital) is available to repair or modernize the industry. Furthermore, although Cuba relaxed restrictions on foreign investment in the 1990s, there has been little or no foreign investment in either tropical fruit production or processing enterprises.

The industry also faces constraints on demand for both fresh and processed tropical fruit. Low domestic incomes restrict domestic market demand. A lack of high-quality product affects demand in Cuba's tourist industry. Quality issues and high shipping costs constrain European and Asian foreign market potential for Cuban fresh or processed tropical fruit. Cuba's traditional markets in Eastern Europe and the former Soviet Union, while slowly improving, are still limited by low consumer incomes. Since these traditional Soviet bloc markets are no longer a closed block, Cuban products now face increased competition from other producing countries. Because of the U.S. embargo, Cuba's tropical fruit industry has no access to a large, close, high-income market. The future of Cuba's tropical fruit sector may well depend on export access

to North American markets, where it is likely to have some comparative advantage.

Cuba has encouraged the development of an environment-preserving agricultural production process that uses minimal purchased chemical, fertilizer, and other inputs and depends heavily on increased labor and management inputs and on intensive intercropping of vegetables and fruit trees. The country has been somewhat successful in increasing fruit and vegetable production from the lows of the early 1990s using these techniques and, thereby, improving the diets of the Cuban people.

Some consumers prefer eating both fresh and processed fruits and vegetables grown by these kinds of techniques. While such a domestic market could be supplied by Cuban producers, its size would likely be limited and predominantly be found in the higher income tourist sector. Catering to such a market involves a labor and management intensive, potentially higher cost production process.

In the 1990s, Cuban producers moved to these kinds of production processes by necessity and not to fill a market niche. As the Cuban economy improves, as demand for labor returns in other sectors of the economy, and as purchased inputs and fuels again become available at reasonable prices, producers may have increased incentives to return to more traditional commercial agricultural production techniques. Maintaining the now even higher cost production methods needed to cater to this niche market for tropical fruits would be commercially profitable only if producers can receive a sufficiently high price premium to sustain environment-preserving, purchased input minimizing, and labor and management intensive tropical fruit production processes. This Cuban domestic niche market would likely be too small to sustain such a system.

To be commercially profitable, producers of tropical fruit would have to look to organic niche-market exports. To participate in these export markets, Cuban producers would have to sell at competitive prices and have access to higher income, ecologically aware consumers. Shipping distances to lucrative European and Asian markets make marketing costs relatively high, compared with costs for competitors in southern Europe, northern Africa, and Asia. However, by 2001, Cuba had produced Swiss-certified organic citrus juices and sugar for export and packaging in

Switzerland for European markets. In addition, Cuba had started a similar Swiss-certified evaluation process for coffee and cocoa, as well as mangoes, coconuts, and other tropical fruits (Kilcher).

In addition to these European markets, the successful expansion and viability of Cuba's organic production may also depend on access to geographically close, high-income foreign markets, namely the United States and Canada. Currently Cuban produce is not certified-organic in either of these markets. Only after Cuban products are certified for these countries could Cuba legally export produce labeled organic to these markets. Given that many technical production practices currently followed by Cuban producers are potentially compatible with U.S. certification standards and given Cuba's prior experience in becoming Swiss-certified, Cuba could be well positioned to meet U.S. certification standards.

For the U.S. organic market, in addition to a lifting of the U.S. embargo, Cuba would have to be certified by a USDA-accredited certification program that assures U.S. markets that Cuban products labeled organic meet all National Organic Program standards and regulations under the U.S. Organic Foods Production Act of 1990 (USDA, AMS).

The price premium received in a niche organic export market will have to be sufficiently large to offset the additional costs of certification and additional organic production costs. Otherwise Cuba will have to look to the regular commercial export markets to create the demand growth needed for a viable, expanding tropical fruit industry.

Therefore, the growth of Cuba's tropical fruit industry will most likely depend on Cuba's success in exporting both fresh and processed tropical fruit. Cuba must be able to produce and ship on a timely basis a consistently high-quality, competitively priced product. Cuba's export potential will depend on its ability to identify markets and market characteristics. These markets will predominately be in higher income countries. Many will be niche commodity markets and niche organic markets. Tapping these markets will require significant investment and a major improvement in the existing industry infrastructure. It will also require Cuba to continue to improve and expand a market-oriented incentives system for all the people involved in the industry.

Potential Commercial Relationships Between the United States and Cuba

In the 1950s, the United States was a major export market for Cuban fresh tropical fruit. With the imposition of the U.S. embargo, that market was lost. Cuba shifted its fresh tropical fruit exports to the Soviet Union, but these perishable exports were limited because of the lack of refrigerated shipping and the long distance to the market. The United States found other sources for tropical fruit in the Caribbean, Mexico, the Dominican Republic, and Costa Rica. Currently, Mexico is the major exporter of tropical fruit (mangos, papayas, and some avocados) to the United States. Most avocado imports to the United States currently come from Chile.

In addition to affecting a shift in the sources for tropical fruit imports, the U.S. embargo encouraged the development of a domestic tropical fruit industry in Florida. With the elimination of low-cost tropical fruit from nearby Cuba, Florida found that it could now compete with the other countries exporting tropical fruit to the United States. Florida also benefited from the influx of skilled Cuban growers among the refugees coming to the United States. Many settled in southern Florida in the early 1960s and helped start the State's tropical fruit industry.

If a commercial relationship between the United States and Cuba were to resume, Cuba would likely initially look to the United States as a source of supply for the rapidly growing tourist market. Then, in the longer run, the United States might provide new market opportunities for Cuban tropical fruit products.

In the short run, given Cuba's shortage of foreign exchange and lack of production inputs, Cuba will continue to have problems meeting the growing demands for high-quality tropical fruit by their tourist industry. Opening commercial relationships with the United States would further increase the influx of tourists to Cuba, further increasing its tourist industry's demand for tropical fruit. Hotels and tourist-oriented restaurants would likely turn to U.S. wholesalers in Florida to provide them with a reliable, high-quality supply of a wide range of produce, including tropical fruit. A recent International Trade Commission (ITC) study estimated Cuba would likely import only \$40,000-\$72,000 of U.S. tropical fruit annually to meet this growing tourist demand (U.S. International Trade Commission). Even in this market, the United

States would face tough competition from Cuba's current suppliers: Chile, Argentina, and Mexico. Additionally, U.S. exports would be constrained by higher U.S. production costs and limited production potential. In the longer run, as Cuba's economy and agriculture recovers and with likely investment from foreign firms (including U.S. companies), its comparative advantage in tropical fruit production will begin to assert itself and both the quantity and quality of domestic tropical fruit production would increase, thereby reducing the demand for imports.

If the U.S. embargo were to be lifted, Cuba would likely start exporting tropical fruit to the United States in the longer term. The United States is a major importer and a minor world producer of tropical fruit. U.S. demand is growing and domestic production is limited. U.S. tropical fruit import duties are low. Cuba, with its available land, low labor costs, and good climate, has a comparative advantage in tropical fruit production. Even under Cuba's current poor economic conditions, Cuban yields of avocados, mangos, and pineapples exceed U.S. yields. With respect to Florida production, Cuba doesn't even have much of a distance or location disadvantage. Based on these factors, Cuban tropical fruit exports would be competitive in U.S. markets, particularly those in the eastern United States. As the Cuban economy improves and as Cuban agriculture develops and becomes more commercial, tropical fruit production will increase and become even more competitive. According to the ITC, Cuba would likely export \$90,000-\$180,000 of tropical fruit annually with the lifting of the U.S. embargo. This amount represents only about 0.1 percent of U.S. tropical fruit imports, but over 50-75 percent of Cuban exports. Tropical fruits exported to the United States would primarily be avocados, mangoes, and papayas (see box).

Following a lifting of the U.S. embargo, as conditions improve and Cuba's economy recovers, then grows, Cuba's comparative advantage in tropical fruit production would improve further, particularly as yields start to rebound from current low levels. Cuba has the potential to effectively compete with other U.S. market suppliers from the Caribbean and South America. The ITC study estimated that Cuban exports to the

United States could grow to "tens of millions of dollars." Thus, in the longer term, Cuban exports could have a negative impact on U.S. (particularly Florida) producers. The magnitude of that impact will depend on the growth in demand for tropical fruits in the United States, the ability of U.S. producers to remain competitive, and the speed with which foreign (particularly Cuba) tropical fruit production and processing sectors improve and grow. With a healthy growth in domestic demand, U.S. producers may be more limited by their geographic production potential constraints than by any other factors, including increased imports from Cuba.

Any Cuban move into the U.S. tropical fruit market would likely be gradual. Increasing productivity and production will not occur rapidly. It would require a significant turnaround in the Cuban economy as well as continuing economic growth. Cuba's tropical fruit sector will need to provide increased incentives and become more market oriented to provide the signals to producers and processors that will increase production, improve quality, and move product along the marketing chain in a timely and efficient manner. Given the state of the existing infrastructure, this process would likely be slow. It would take a significant amount of capital to improve the industry structure, as well as changes in the conduct of industry participants, to achieve the performance gains that would make Cuba a major competitor in the U.S. market.

Cuba will have to improve the quality of its tropical fruit to meet U.S. market standards. Significant improvements in transportation and refrigeration between Cuban producers and the U.S. market also will be needed. Furthermore, it will take time and require a change in handling procedures for Cuba to meet the U.S. technical sanitary and phytosanitary regulations governing U.S. agricultural product imports.

The Historical Relationship Between U.S. and Cuban Avocados

Historically, Florida avocados were summer fruiting, West Indian varieties that originated in Cuba. Because Florida avocados had to compete with cheaper Cuban avocados in the U.S. market, horticulturalists developed a West Indian x Guatemalan hybrid cross that matured later in the season, thereby expanding the length of the season and reducing competition from imports. West Indian avocado varieties have thick, leathery, nongranular skins and require a tropical climate with high humidity. In Florida, they are harvested from July to October. The Guatemalan varieties originated in a subtropical climate and are therefore hardier. They have granular or gritty skins. A pure Guatemalan variety is not well adapted to the southern Florida climate. West Indian x Guatemalan cross avocados are harvested in Florida from late November to March. California supplies most U.S.-produced avocados. California-grown avocados are primarily either Guatemalan or Mexican (even hardier) varieties. They are harvested year-round in California, though peak harvest season is April-May.

After the U.S. embargo eliminated Cuban avocado exports to the United States, Florida growers shifted some production back to the West Indian summer fruiting varieties to fill the early season gap in the market left by the loss of Cuban imports. Currently, Florida avocado plantings are about half West Indian varieties and half West Indian x Guatemalan varieties. With this variety mix, Florida's avocado harvest generally begins in late June and peaks during August-December.

Most U.S. avocado imports come from Chile during its November-March peak harvest period. After a long period of U.S.-imposed sanitary and phytosanitary plant quarantine restrictions, Mexican avocados are now allowed to be exported to U.S. markets in the Northwest, Midwest, and East from October 15 to April 15, when California production is at its lowest and when any potential pest infestation is not likely to survive the colder U.S. climate in those areas and spread to U.S. plantings.

If the U.S. embargo were to be lifted, Cuba may be able to regain a comparative advantage in avocado production that could result in renewed shipments of avocados to the United States, if the Cuban avocados were able to meet USDA inspection standards. This would, in turn, have an adverse effect on Florida producers. It would also likely cause Florida producers to revert back to their earlier mix of avocado varieties (Knight; Knight and Campbell).

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