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**Constraints in the Kenyan  
Fruit Juice Processing  
Industry**

**Final Report**

**September 1993**

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**in collaboration with the  
Agribusiness Association of Kenya**

**AGRICULTURAL MARKETING IMPROVEMENT STRATEGIES PROJECT**

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## ABSTRACT

This study catalogued the economic, institutional, infrastructural, and technological constraints perceived by fruit juice processors and fruit growers in Kenya. For fruit processors the main impediments to expanded business activity and increased investments were (1) the rapid escalation in the cost of packaging materials; (2) the weak economic climate characterized by stagnant growth, falling real incomes, and sharp currency devaluations; (3) and problems with raw material availability. For fruit growers the main obstacles to expansion and increased productivity were (1) the sharp rise in chemical input prices; (2) the lack of access to formal credit; and (3) poor horticultural extension services. Technically, the chief problems encountered were poor grading and sorting techniques which result in inconsistent product quality. Principle recommendations call for a program of technical assistance aimed at improving fruit procurement, processing plant efficiency, and quality control; the undertaking of a feasibility study on contract farming as a means to solve the availability of raw material problem; the establishment of an effective market information system, preferably operated by a private entity; and the strengthening of the Agribusiness Association of Kenya so that it can become an effective intermediary between the Government of Kenya, the donor community, and affiliated industries.

## ACKNOWLEDGMENTS

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Next, the team is most grateful to the seven individual managing directors in charge of the eight factories evaluated. These very busy businesspersons were extremely cooperative and obliging in sharing information and arranging extended hours of their facilities. The warmth and hospitality extended was most appreciated.

The eight fruit growers and one fruit trader visited shared a wealth of information and gave us a glimpse of their dreams and desires. We were made rich by the experience and wish them every success.

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# 1. INTRODUCTION

## 1.1 Statement of Problem

Export-oriented horticultural production in Kenya has expanded rapidly in recent years. In 1992, horticulture became the third largest foreigner exchange earner after tourism and tea and a substantial employment generator.<sup>1</sup> While the expansion in fresh horticultural exports has been welcomed, helping to replace lost coffee export earnings, several constraints to further growth in the horticultural subsector are emerging.

Product perishability, combined with low refrigeration capacity and limited air freight service, create significant risks for producers and financiers. In the last year, the Government of Kenya has taken remedial action, but the constraint is still binding. The Government reduced the tax on aviation fuel, but existing rates still make Kenya the most expensive refueling point in East Africa. Consequently, airlines prefer to originate flights from cheaper East African airports, reducing the amount of available cargo space for Kenyan exporters. In addition, the Government of Kenya and international donors are planning to relieve some of the cold storage constraints; however, no substantive action has occurred to date. Given this situation, there is interest in reducing business risks and adding more local value to horticultural products through processing.<sup>2</sup>

Strong export potential exists in European and Persian Gulf markets for pineapple, orange, passion, mango, and papaya concentrates, purees, and juices<sup>3</sup>. Developing this potential depends, however, on the effective and coordinated actions of the Kenyan public and private sectors in creating an auspicious business and investment climate, removing infrastructural constraints, identifying markets, improving agricultural research and extension, providing access to credit, and producing high-quality, low-cost products.

## 1.2 Objectives of the Study

This study aims to identify the economic, institutional, and technological constraints to the further growth and development of the fruit juice industry in Kenya. The specific tasks to be undertaken include:

- Description and evaluation of existing economic and institutional policies affecting the fruit processing industry.
- Report farmer perceptions of constraints to increased fruit production and marketing.

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<sup>1</sup> See pg. 103 *Economic Survey 1993*.

<sup>2</sup> Interview with Martin Mulandi, Managing Director, Horticultural Crops Development Authority.

<sup>3</sup> See "Market Study of Fruit Juice Concentrates" by Kienbaum Development Services, March 1992 and *Fruit Juices with Special Reference to Citrus and Tropical Fruit Juices: A Study of the World Market* by International Trade Centre UNCTAD/GATT, 1991.

- Report entrepreneur perceptions of constraints to increased fruit juice, beverage, and concentrate processing and sales.
- Description and evaluation of processing plant operations and equipment.

The findings and recommendations will serve as guidelines to develop a plan of action and as a reference aide in future project identification and design phases. The work complements on-going USAID activities in the Kenya Export Development Support Project, which has designated the horticultural subsector as the focal point for technical assistance.<sup>4</sup> It is hoped that this paper will also serve to rally support for a nascent Kenya Agribusiness Association.

### **1.3 Organization of the Study**

The organization of the paper is as follows. Chapter 2 reports the current levels of fruit production, juice extraction, and juice exports. The aim is to establish the size and structure of the juice processing industry and provide a perspective on juice export potential. Chapter 3 reviews how the main macroeconomic and sectoral economic policies affect the performance and structure of the fruit juice industry. It also identifies the institutional support services that exist for fruit processors and evaluates their effectiveness. Chapter 4 describes plant operations, identifies technical bottlenecks, and recommends ways to improve product quality and plant efficiency. Chapter 5 addresses the constraints fruit growers face and recommends how they may be overcome. Chapter 6 summarizes findings and reiterates principal recommendations.

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<sup>4</sup> See page 3 of "Private Sector Baseline Survey" KEDS Final Report, March 30, 1993.

## 2. OVERVIEW OF THE FRUIT PROCESSING INDUSTRY

### 2.1 Fruit Production

Kenya has a number of agroclimatic zones that permit the cultivation of a wide variety of tropical and temperate fruits. Tropical fruits can be grown in the lowlands along the coast and in the Rift valley, and both tropical and temperate fruits can be cultivated in the Central and Western highlands, depending on the altitude. Fruits, listed in order of production importance, include: bananas, pineapples, citrus, mangoes, papayas, avocados, passionfruits, pears, plums, watermelons, peaches, guava, pears, strawberries, loquarts, and grapes.<sup>5</sup>

Of the 16 commercially exploited fruits, only pineapple, citrus, mango, papaya, passion-fruit, and guava are considered suitable for commercial juice, puree, and concentrate processing. Avocados, plums, strawberries, and loquarts are usually consumed fresh or processed as spreads, jams, and preserves; not as juices, drinks, or nectars.

Temperate fruits such as pears, peaches, and grapes are grown but in very small quantities and are of low quality. The most binding constraint for these fruits is the very low level of orchard husbandry knowledge. Furthermore, expanded cultivation of these fruits will be constrained by limited availability of suitable land. For these reasons Kenya is likely to be uncompetitive with more established and unconstrained foreign producers of these temperate fruits.

In the case of bananas, strong fresh market demand exists both internally and in neighboring Uganda. The common practice of intercropping bananas with other crops does not represent the same severe land constraint as in the aforementioned temperate fruits. However, given the absence of a tradition of banana cultivation on a large scale, and Latin American and Caribbean dominance in world markets, Kenya is not likely to be a competitive banana juice and puree producer. A banana puree processing plant requires expensive and sophisticated equipment and significant through-put. The high initial cost and the tight supply conditions would make such a venture high risk.

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<sup>5</sup> Estimates provided by the Horticultural Crops Development Authority for 1991.

<b>Table 2.1 Estimated Basic Statistics for Fruits Suitable for Juice Processing</b>			
<b>Citrus</b>			
<b>Year</b>	<b>Area (HA)</b>	<b>Production (MT)</b>	<b>Yield (MT/HA)</b>
1990	19,031	189,002	9.93
1991	19,287	190,875	9.90
<b>Mango</b>			
1990	9,619	76,677	7.97
1991	10,173	93,995	9.24
<b>Pineapple</b>			
1990	7,947	376,363	47.36
1991	8,322	378,705	45.51
<b>Passion Fruit</b>			
1990	1,073	8,380	7.81
1991	1,464	16,256	11.10
<b>Papaya (Pawpaw)</b>			
1990	4,289	43,741	10.20
1991	4,400	44,593	10.13
<b>Guava</b>			
1990	492	3,956	8.04
1991	393	2,344	5.96
	<b>Total Area</b>	<b>Total Production</b>	
1990	42,451	698,119	
1991	44,039	726,768	
Source: Horticultural Crops Development Authority			

### 2.1.1 Citrus

Of the six fruits suitable for juice processing, citrus is by far the most commonly cultivated. As can be seen in Table 2.1, citrus (mostly orange) covers over 19,000 hectares and yields an annual harvest of approximately 190,000 metric tons. For the two years of data

available. citrus represents 44-45 percent of the total area planted and 26-27 percent of the total output of the six major fruits suitable for juice processing.

Nevertheless, citrus productivity is severely constrained by a high degree of disease incidence, greening in the highland areas and scales, root rot, and insects in the coastal area. Research is ongoing on the use of imported disease-resistant root stock, but results from field trials are not yet available.<sup>6</sup> Whereas maximum attainable yields under rainfed conditions are 20 MT/HA, Kenya is averaging 8-10 MT/HA.<sup>7</sup> In addition, the distribution of varieties suitable for juicing is regionally skewed. The juice variety (Valencia) is more widely grown in the Coast Province, while eating varieties (Navel, Washington, Hamlin) are more commonly grown in the Central highlands where most of the processors are located. The result of using an inappropriate variety for processing is that the quality of Kenyan orange juice is not comparable with the dominant exporters of Brazil, the United States, Israel, Spain, and Morocco. Other citrus fruits such as limes and grapefruits are relatively underdeveloped, and much extension and promotion work will have to be undertaken to make Kenya competitive with existing producers of these fruits.<sup>8</sup>

The fruits with more immediate potential for juice and concentrate processing are pineapple, mango, and passionfruit. Mango and pineapple are widely grown and passionfruit cultivation is expanding rapidly due to its high profitability.<sup>9</sup> Whereas these three cover 45 percent of the total area cultivated by the top six juice fruits, papaya and guava cover less than 11 percent. Guava, in particular, is very minor, with less than 500 hectares planted. The principal juice fruit growing areas are shown in Table 2.2.

### 2.1.2 Mangos

Mangos are predominately grown on the coast and the principal varieties used are well adapted: Ngowe, Boribo, Apple, and Batawi. The fruit is also grown in the lowland areas of the Eastern, North Eastern Province and the Rift Valley. Pests and disease vectors such as scales, mango weevils, fruit flies, anthracnose, and powdery mildew exist but are all treatable with chemicals (Farm Management Handbook). Nonetheless, the pest and disease problems affecting mangos are believed to be less severe than those confronting citrus. Research is under way to introduce Kent, Tommy Atkins, and Sensation varieties to areas above 1,600 meters. Successful adaptation of these hybrids would yield greater pulp, taste, and juice content. Also the mango producing season could be greatly extended, permitting a greater availability of products for both fresh and processing markets.

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<sup>6</sup> Interview with personnel at National Horticultural Research Center at Thika August 23, 1993.

<sup>7</sup> Interview with personnel at National Horticultural Research Center at Thika. August, 23, 1993.

<sup>8</sup> Interview with personnel at National Horticultural Research Center at Thika, August 23, 1993.

<sup>9</sup> Del Monte Kenya Ltd. is the major producer of pineapple in the country, with a 30,000-acre plantation. The production from this plantation is canned and exported.

**Table 2.2 Distribution of Fruit Production in 1991** (pages 1-2)

<b>Fruit</b>	<b>Province</b>	<b>Percent of Area Cultivated</b>	<b>Percent of Production</b>	<b>Yield</b>
Citrus	Coast	30.0	22.0	7.3
	Eastern	45.1	55.1	12.1
	Rift Valley	13.1	10.2	7.7
	North Eastern	0.0	0.0	0.0
	Central	2.1	1.0	4.9
	Nairobi	0.0	0.0	0.0
	Nyanza	3.8	7.3	18.8
	Western	5.8	4.4	7.4
Mangos	Coast	56.1	57.4	9.5
	Eastern	29.9	25.3	7.8
	Rift Valley	2.4	4.0	15.3
	North Eastern	0.0	0.0	0.0
	Central	2.5	3.9	14.7
	Nairobi	0.0	0.0	0.0
	Nyanza	6.6	7.5	10.5
	Western	2.5	1.8	6.7
Passion	Eastern	29.5	20.2	7.6
	Rift Valley	17.8	16.1	10.1
	Central	35.5	31.1	9.7
	Nyanza	9.8	28.5	12.4*
	Western	7.4	4.0	6.0
Pineapple	Coast	13.4	4.5	15.3
	Eastern	0.0	0.0	0.0

**Table 2.2 Distribution of Fruit Production in 1991** (pages 1-2)

Fruit	Province	Percent of Area Cultivated	Percent of Production	Yield
	Rift Valley	2.9	2.8	43.1
	Central	58.3	87.1	68.0
	Nyanza	14.3	2.1	6.6
	Western	11.2	3.6	14.7
Papaya	Coast	7.2	5.3	7.5
	Eastern	63.3	53.6	8.6
	Rift Valley	8.3	15.0	18.3
	Central	5.3	8.4	16.2
	Nyanza	0.0	0.0	0.0
	Western	15.8	17.6	11.3
Guavas	Eastern	77.1	87.8	6.8
	Rift Valley	3.8	2.6	4.0
	Central	0.3	0.2	5.0
	Nyanza	18.8	9.5	3.0
	Western	0.0	0.0	0.0

Source: Horticultural Crops Development Authority  
 \* Unreliable statistic. Believed to be an unverified estimate.

For processing purposes, the mango variety used is not of great importance. What determines a high-quality end product is a uniform degree of maturity and the appropriate type of pulper. In Kenya, ripening sheds, where humidity and temperature are controlled, are not widely used. Mangos at varying stages of ripeness are often processed together, resulting in inconsistent flavors and consistencies.

### **2.1.3 Passionfruit**

Passionfruit, in contrast to mango, is more of an upland crop, with most production occurring in the Central and Eastern Provinces. Two varieties are commercially exploitable, a purple variety with a high degree of acidity and a yellow variety with a low degree of acidity. In Kenya the purple variety is cultivated in the uplands and the yellow in the low-lands. While the purple is more suitable for making concentrate, it is also more susceptible to diseases and pests, namely woodiness (die-back), brown spot, fruit fly, and nematodes which cause root knots.

While all the problems are preventable or treatable through cultivation practices and the appropriate application of chemicals, a promising line being pursued by the Horticultural Research Center is the grafting of the purple variety to yellow root stock. Studies on adaptation and effects on juice content are underway. Despite the rapid rise in the cost of chemical inputs in the last two years, passionfruit continues to be much more profitable than tea and coffee. Because of its 8-month maturation period, it is much more attractive than the also high-profit but longer-gestating pineapple. This crop has experienced the most rapid area increases among the fruits studied for the two years of data available.

### **2.1.4 Pineapple**

More than 80 percent of the nation's pineapples are produced in the Central Province. The single most important producer is Del Monte Ltd., a vertically integrated multinational corporation with recognized technical expertise, solid financial resources, and a plantation of 30,000 hectares. Del Monte uses irrigation and ideal cultivation practices, thereby obtaining a very high yield per hectare of about 120 MT/HA.

The variety used almost exclusively is Smooth Cayenne. It has excellent processing qualities. The main problem with pineapple production in Kenya may be the cultivation of pineapple at its altitude limit by smallholders in the Thika region and inadequate application of fertilizer and water. This combination results in a significantly lower sugar content and pale color. Pineapple grown by smallholders in the lower Eastern and Nyanza Provinces has soluble solid contents close to the maximum 20 percent attainable, while many in the Central Province record 12-15 percent. The less sweet Central Province pineapple used in processing requires higher concentration factors, more raw material, and greater expense.

### **2.1.5 Papaya (Pawpaw)**

Papaya is restricted mostly to the Eastern Province. Local unidentified dioecious varieties predominate. Among the few commercial stands of papaya, Honeydew, Kiru, and Mountain varieties are used. These varieties require the planting of roughly one male tree to 20 female trees for a high degree of fruit set. Only the females bear fruit. A newer variety, Solo, is hermaphrodite and no sex distinction is necessary; however, the variety is not widely used. The major problem with papaya is that it is very water sensitive and susceptible to wind

damage. Common pests and diseases are aphids, mites, fruit flies, powdery mildew, and root and stem rot, all chemically treatable. In terms of marketing, the papaya market is rather undeveloped. The main use of papaya is for the extraction of papain, and not for fresh consumption or juice making. Very few commercial stands exist.

### 2.1.6 Guava

Guava, like papaya, is a minor fruit, mostly grown in the Eastern Province. There is no ongoing agricultural research on the suitability of varieties and disease control. The greatest pest for this fruit is the fruit fly and the greatest strength is that the tree is drought resistant. Few commercial stands exist. Guava yields, unlike those of other fruits, tend to be uniform across the country.

## 2.2 Size and Structure of the Fruit Juice Processing Industry

The fruit juice processing industry consists of 12 established factories (see Table 2.3). Two of the 12 firms are special cases: Kenya Wine Agencies Ltd. and East African Industries. The former is a winemaker and liquor bottler that produces fruit juices as an intermediate step. The latter is a diversified, multinational corporation that only blends imported juice concentrates on a small scale.

**Table 2.3 List of Kenyan Fruit Juice Processors** (pages 1-3)

Firm	Location	Type of Processing	Fruit and Vegetable Juice Lines
Bawazir Food Processors Ltd.	Mombasa	Juices Pulp Concentrate	Orange Mangos Pineapple Bananas Passionfruit Tomato Grape
Del Monte Kenya Ltd. *	Thika	Canned fruits Concentrate	Pineapple
East African Industries Ltd. (Food and Beverage Division)	Nairobi	Fruit juice blender of concentrates	Orange Pineapple Mango
Kabazi Cannery Ltd.	Nakuru	Canned fruit and juices Jams Tomato Pastes and Ketchups	Passionfruit Tomato

**Table 2.3 List of Kenyan Fruit Juice Processors** (pages 1-3)

<b>Firm</b>	<b>Location</b>	<b>Type of Processing</b>	<b>Fruit and Vegetable Juice Lines</b>
Kenya Fruit Processors Ltd. **	Thika	Drinks Concentrates	Passionfruit Orange
Kenya Orchards Ltd.*	Machakos	Jams Marmalades Squashes Juices Confectioneries	
Kenya Wine Agencies	Nairobi	Wines Spirits	Papaya Passionfruit Pineapple Banana Grapes
Mashambani Industries	Kisumu	Juices Drinks Papain	Papaya
Olympic Fruit Processors Ltd.*	Thika	Concentrates Juices Tomato Sauces and Paste	Passionfruit Pineapple Oranges Mango Tomato
Premier Food Industries Ltd.*	Nairobi	Tomato sauces Jams Juices Pulps Concentrates Squashes (diluted juices)	Passionfruit Mango Pineapple Orange Tomato
Seven Trees Farms Ltd.	Murang'a	Canned fruits Relishes Jams and Marmalades Juices Concentrates	Passionfruit Grapefruit Orange Mango Banana Tomato

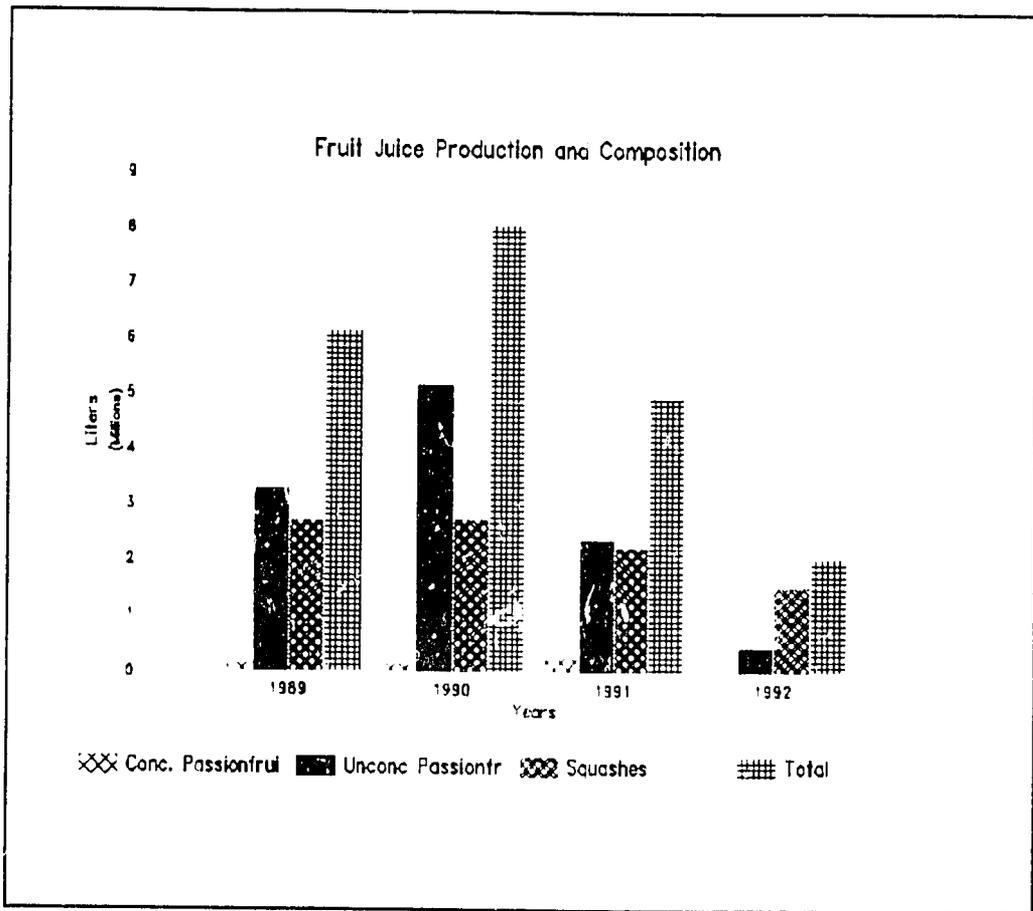
**Table 2.3 List of Kenyan Fruit Juice Processors** (pages 1-3)

Firm	Location	Type of Processing	Fruit and Vegetable Juice Lines
Trufoods Ltd.	Nairobi	Canned fruits and vegetables Juices Concentrates Jams Marmalades Peanut butter Baking powder Vinegar Custard powder Chutney Pickles Essences Food colors	Orange Mango Pineapple Passionfruit Black Currant Apple Lemon Lime
** Major exporter * Minor exporter			

In the last few years, fruit and vegetable juice production has been relatively stable: 5,300 metric tons in 1992; 5,200 metric tons in both 1991 and 1990. A significant increase in production occurred between 1989 and 1990, with output rising 44 percent from 3,600 metric tons (Economic Surveys).

### 2.3 Domestic Market Perspectives

Internally, market demand for the available disaggregated juices and juice products has declined considerably (74 percent) since 1990. As unit prices have risen, the quantity demanded has fallen (Figures 1 and 2). The main reasons for the fall in sales are the pass-through of higher packaging material costs and the decline in real incomes with the onset of economic crisis. The most common juice package is the tin metal can. Only one company (Carnum Metal Box) produces tin cans with wholly imported materials. The sharp devaluations in the Kenya Shilling, along with the rise in the cost of raw materials, have resulted in sharp domestic price increases in tin cans. Between January and June 1993, the cost of cans increased 240 percent. Other packaging materials, such as plastic bottles, Tetrapak, and glass bottles, have witnessed less spectacular but nonetheless appreciable price increases. Again, only one or a few firms dominate the fabrication of these other common packaging items.



**Figure 1: Juice Sales Volume**  
 Source: Central Bureau of Statistics

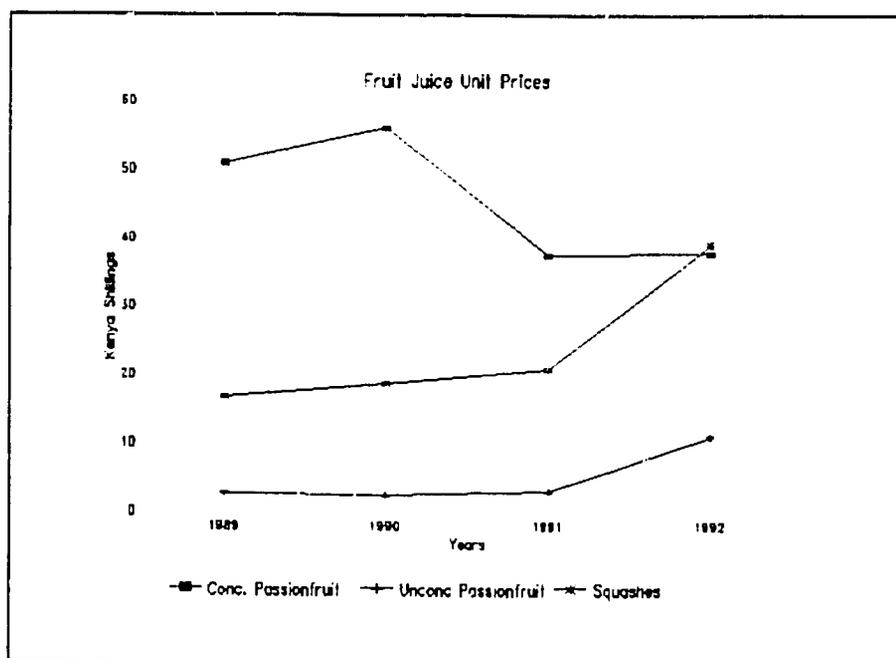


Figure 2: Juice Unit Prices

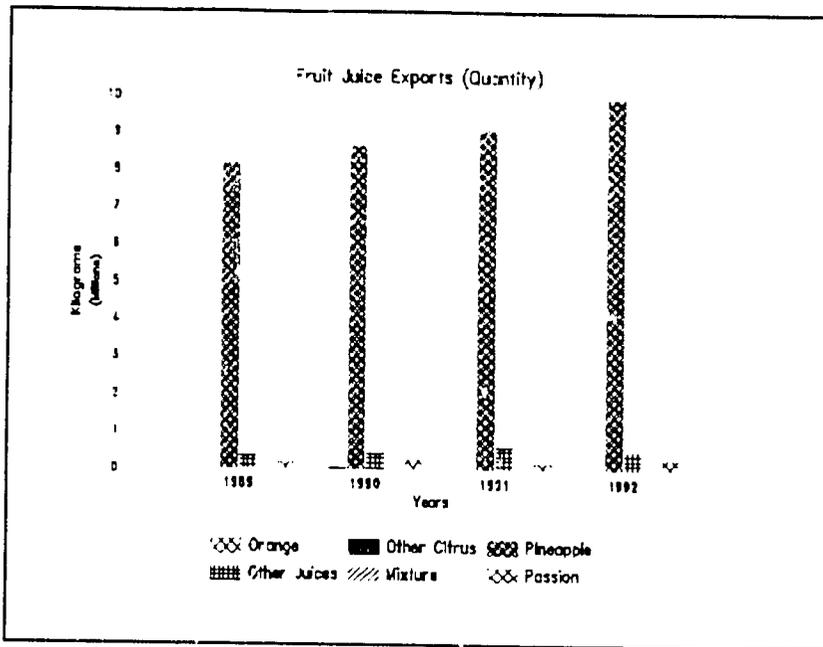
Source: Central Bureau of Statistics

Future domestic growth perspectives will continue to be limited by the general weaknesses in the economy. Uncertainty and weak job and income growth will continue to keep demand for juice products—nonessential items in the diet—low.

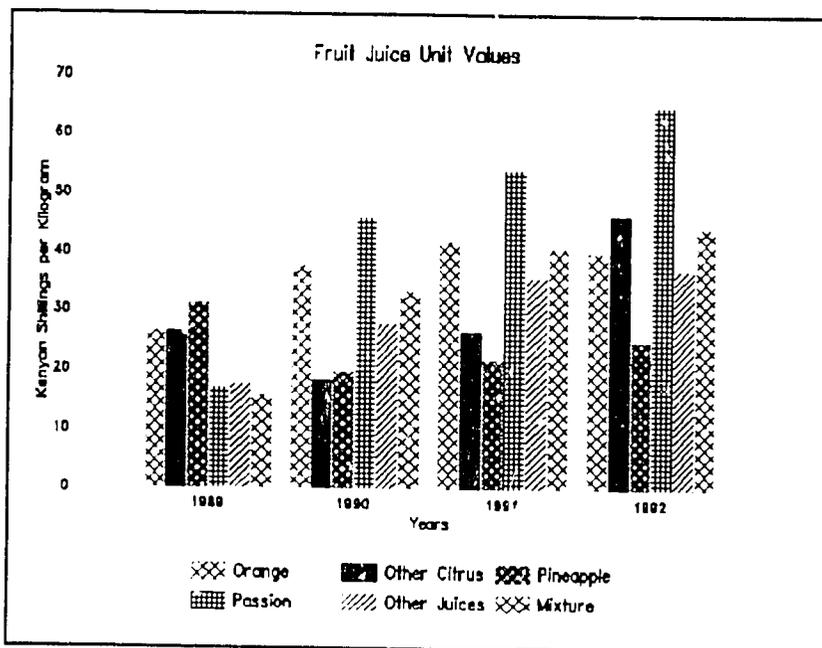
#### 2.4 External Market Perspectives

Externally, the growth perspectives for Kenyan juice products are better. Between 1989 and 1992 the volume of juice exports increased by 23.5 percent from 8.7 million kilograms to 10.8 million kilograms. On the value side, the increase was more pronounced, jumping 83 percent, from KSh 159 million to KSh 291 million (see Figures 3 and 4).<sup>10</sup> The leading fruit juice export was pineapple, followed by other juices and passionfruit. Sharp unit value increases were noted for passionfruit, citrus, other juices (mostly mango), and mixtures (Figure 5). Pineapple unit values were the only ones where a decline occurred (20%). The steady rise in prices indicates strong demand and tight supply conditions.

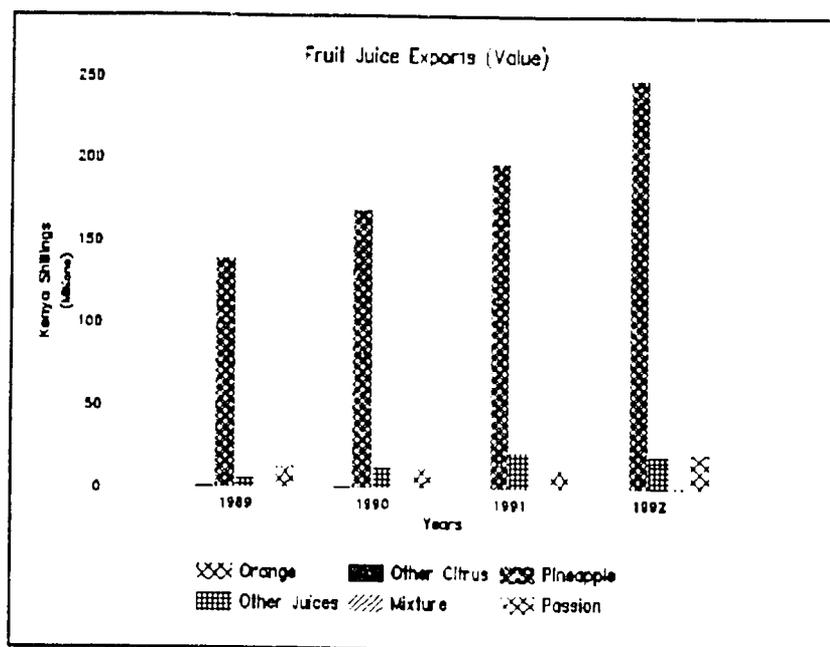
<sup>10</sup> When expressed in dollar equivalents, the dollar value percent increase is roughly equal to the Shilling devaluation (35 percent) between 1989 and 1992, indicating that there was no competitiveness gain due to devaluation.



**Figure 3: Fruit Juice Exports (Quantity)**  
 Source: Annual Trade Report, Customs and Excise Dept., Ministry of Finance



**Figure 4: Fruit Juice Exports (Unit Values)**  
 Source: Annual Trade Report, Customs and Excise Dept., Ministry of Finance



**Figure 5:** Fruit Juice Exports

Source: Annual Trade Report, Customs and Excise Dept., Ministry of Finance

With increasing per capita juice consumption in Western industrialized country markets, due to improved health consciousness and the lowering of trade barriers in Japan and South Korea, export opportunities are likely to abound in the near to medium term (ITC, 1991).<sup>11</sup> Major end uses include consumption as a beverage, yogurt, dessert, or baby food. The key to exploiting the opportunities lies in increasing quality and maintaining price competitiveness with the dominant tropical fruit juice and apple juice producers (See Table 2.4). When tropical juices, particularly pineapple, rise rapidly in price, industrial blenders tend to substitute apple juice (ITC, 1991). Thus, tropical fruit juice exporters should pay close attention to apple juice prices in developing marketing plans.

Kenya has limited potential to compete effectively with established citrus producers such as Brazil, the United States, and Israel because of lower product quality and economies of scale. However, opportunities seem to exist for pineapple, passionfruit, and mango juices. Based on 1991 data, Kenya's export price per kg. of concentrated passionfruit juice was KSh 53.92,

<sup>11</sup> The leading juice consuming countries in the world in 1989 were Germany with 36.2 liters per capita per year, followed by Switzerland with 34 liters, and then the United States with 31 liters. The two dominant juice importers were the United States, with a 23 percent share of total world juice imports, and Germany, with 16.3 percent for the same year (ITC, 1991).

while the CIF import price in Western Europe ranged from KSh 92.63 to 98.25.<sup>12</sup> Similarly, the Kenyan export price for pineapple was KSh 21.71 per kg and the import CIF price was KSh 64.56. If "other juices" are assumed to be mostly mango, then their export price compared to CIF import price was not as favorable as for the other products. Whereas the Kenyan border price for other juices was KSh 35.75, the import price range for mango puree and concentrate ran from KSh 19.64 to 36.49 per kg. Since 1991, the Kenyan shilling has devalued significantly (as of August 1993 KSh 70:US\$1 compared to December 1991 rate KSh 28.07:US\$1). The devaluation may have improved Kenyan competitiveness, assuming the CIF dollar prices remain more or less constant.

The most compelling proof of the dynamism of the juice export sector can be found in the positive rates of growth, for all categories except citrus and black currant. Pineapple, passionfruit, other juices, and mixtures grew at an average annual rate of 5.5, 16, 10.25, and 90 percent respectively, from 1989 to 1992. In contrast, orange, grapefruit, and black currant fell at an average annual rate of -11, -7, and -19 percent respectively over the same period.

The principal destination markets for the juices also indicate some of the competitive strengths and weaknesses. For example, pineapple and passionfruit exports mostly go to the Netherlands and the United Kingdom.<sup>13</sup> For other juices (mostly mango), the Netherlands, Israel, and Yemen alternate from year to year in absorbing the largest share. In the case of mixtures, the neighboring countries of Tanzania, Sudan, and Yemen can each account for a third of total annual exports. The least competitive juice category is citrus. Anywhere from 47 to 100 percent of the various citrus juices are absorbed by consumers from aircraft and maritime vessels stopping in Kenya. This high reliance on a "captive market" is not indicative of great open market acceptance.

Among the active exporting firms, Del Monte Kenya Ltd. and Kenya Fruit Processors are the most dominant. Del Monte is responsible for most of the pineapple juice exports, and Kenya Fruit Processors accounts for most of the passionfruit exports. The other firms are just beginning to penetrate export markets but are constrained by a variety of obstacles, namely inconsistent product quality, insufficient production volume, lack of export market information, and high overland transportation costs.

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<sup>12</sup> The data provided by the Central Bureau of Statistics do not specify whether the juices exported were in concentrate or single strength form. We assume concentrate form, since it is the most common way juice is shipped. Note also the data are for 1991.

<sup>13</sup> In the case of pineapple, the United Kingdom's import share ranges from 29-43 percent. The Netherlands' import share runs from 27-27 percent. In the case of passionfruit, the Netherlands is very dominant, absorbing 76-97 percent of Kenyan exports.

**Table 2.4 Major Suppliers, Market Requirements, and Import Prices as of July 1991** (pages 1 and 2)

Product/Origin	Form	Brix Strength	Shipping Form	Import Price US\$ CIF/ton W. Europe
<b>Tropical Fruit Juices/Pulps</b>				
<b>Passionfruit</b> Brazil, Colombia, Sri Lanka, Ecuador, Venezuela, Costa Rica, Kenya, Burkina Faso, Indonesia	Juice, Single Strength	12-15°	Hot pack/frozen	1,700-1,900
	Concentrate	24-30°	Frozen	3,300-3,500
	Concentrate	50°	Frozen	5,000-5,500
<b>Mango</b> Brazil, India, Mexico, Philippines, Colombia, Côte d'Ivoire, Peru, Mali, Guatemala, Venezuela, Thailand	Pulp	13-18°	Hot packed/frozen/aseptic	700 (15°) 900 (18°)
	Concentrate	28-30°	Frozen/aseptic	1,300
<b>Pineapple</b> Thailand, Philippines, Brazil, Côte d'Ivoire, South Africa, Kenya, Hawaii, Mexico, Swaziland, Venezuela, Honduras, Indonesia, Botswana	Juice, single strength	14-18°	Hot-packed/frozen/aseptic	700-800 (16°)
	Concentrate	60°	Frozen/aseptic	2,300
<b>Papaya</b> India, Malaysia, Taiwan, Mexico, Brazil, Colombia, Costa Rica	Pulp	10-13°	Aseptic/hot-packed/frozen	700
	Concentrate	25°	same	2,200
<b>Guava</b> Taiwan, India, Philippines, South Africa, Mexico, Brazil, Peru, Colombia, Venezuela, Thailand	Pulp	8-14°	Hot-packed/frozen/aseptic	700 (12°)

**Table 2.4 Major Suppliers, Market Requirements, and Import Prices as of July 1991** (pages 1 and 2)

Product/Origin	Form	Brix Strength	Shipping Form	Import Price US\$ CIF/ton W. Europe
<b>Banana</b> Honduras, Guatemala, El Salvador, Nicaragua, China, Thailand, Philippines, Panama, Costa Rica, Brazil, Ecuador, Peru, India	Puree	20-22°	Hot-packed/aseptic/frozen	900
<b>Temperate Juice</b>				
<b>Apple</b> (Close Substitute for tropical juices) US, EEC, Chile	Concentrate	71°	Frozen	1,200-1,300
<b>Citrus Juices</b>				
<b>Orange</b> Brazil (56% of world exports), US, Israel	Concentrate	65-66.5°	Frozen	1,350-1,400
<b>Grapefruit</b> US, Israel, Brazil	Concentrate	55-58°	Frozen	1,500-1,600
<b>Lemon</b> US, Israel, Brazil	Concentrate	45°	Frozen	1,450-1,800
<b>Lime</b> US, Brazil, Central American and Caribbean states	Concentrate	40° 325-350 grams acidity per liter	Frozen	1,100

Source: ITC, Fruit Juices With Special Reference to Citrus and Tropical Fruit Juices, 1991

## 2.5 Conclusions

Kenya is well endowed agronomically for production of a variety of fruits. Three fruits show strong potential for commercial extraction of juice: pineapple, passionfruit, and mango. There are several obstacles, however, impeding rapid expansion of area cultivated in these fruits and juice processing. First, the current weak economic situation in the country has dampened consumer spending and investor confidence. Second, low levels of husbandry knowledge and lack of improved planting material inhibit high-quality, efficient production. Third, the existing fruit juice processors are experiencing reduced profit margins due to escalating packaging costs. While the export market appears more lucrative than the domestic market, most existing fruit juice processors have not entered this market in a significant fashion because of firm-level constraints.

### 3. ECONOMIC AND INSTITUTIONAL POLICIES AFFECTING SUBSECTOR

#### 3.1 Review of Economic Situation

In the last three years the Kenyan economy has experienced a sharp economic slowdown. Annual real GDP growth has fallen steadily from 1990, when it was 4.3 percent to 0.4 percent in 1992, the lowest level ever recorded (see Table 3.1). A combination of unfavorable external events (poor rains and low coffee prices), inappropriate internal economic policies, and institutional weaknesses explain the decline in economic activity.

Since the collapse of the International Coffee Agreement in 1989, international coffee prices have plummeted, significantly reducing coffee export earnings, historically the leading export commodity. Increased tea and horticultural exports have replaced some of the lost earnings, but the trade deficit continues to widen due to faster rising import costs. Subnormal rains in 1992 also adversely affected agricultural production. Internally, weak economic management and disagreements with the donor community have compounded these negative external shocks. The excessive growth in the money supply in the last three years, the failure of parastatals to remit payments to farmers on a timely basis, and the inability to lower the public deficit have resulted in higher inflation, stagnant investment rates, lower real incomes and subsequently less consumer confidence, reduced agricultural productivity, and lowered manufacturing capacity utilization rates. Disputes with the donor community in 1991 over the pace of political liberalization and adherence to the structural adjustment program led to an aid moratorium which in turn precipitated a foreign exchange crisis, since a significant proportion of the public deficit is financed with external grants.

The uncertainty bred by unsustainable fiscal and monetary policies and the introduction of multi-party democracy has affected the general economy and in particular the fruit juice processing industry in three ways. First, real wages and incomes have fallen, reducing consumer confidence and purchasing power. In 1991 and 1992, real per capita GDP growth rates were negative for the first time since independence (see Table 3.1). Real wages in the formal sector similarly have dropped 23 percent between 1988, when a peak occurred, and 1992. This deterioration in purchasing power reduced outlays for nonessential goods. According to the National Household Welfare and Monitoring Evaluation survey, on average 71 percent of the household budget in the densely populated Central Province is devoted to staple food purchases, compared to figures of less than 30 percent for middle-income countries (Economic Survey, 1993). While juice is a food and beverage item, it is considered to be a luxury good among lower-income consumers. Therefore, demand for juice products has faltered.

Table 3.1 Key Economic Indicators

Item	Units	1985	1986	1987	1988	1989	1990	1991	1992
Real GDP growth	Percent	5.1	5.6	4.9	5.1	5	4.3	2.3	0.4
Real Per Capita GDP	KSh	3799	3896	3974	4064	4098	4141	4104	3982
Change Real GDP PC	Percent		2.56	2.00	2.26	0.84	1.05	-0.89	-2.97
Exchange Rate	KSh/US\$	16.28	16.04	16.515	18.59	21.6	24.08	28.07	29.3
Merchandise Trade Balance	KL millions	-385	-351	-641	-813	-1219	-1302	-1094	-1213
Current Account Balance	KL millions	-79	-31	-406	-408	-596	596	-295	-157
Foreign Reserves <sup>1</sup>	SDR million.	NA	362	202	222	255	194	134	99
Official Aid	US\$ millions	110.2	149	141.9	256.4	280.9			
Terms of Trade	1982 = 100	92	103	85	88	79	71	82	79
Consumer Price Index	1986 = 100	95	100	107	124	141	163	195	248
Annual Inflation Rate	Percent		5.80	6.85	16.05	13.71	15.60	19.63	27.18
Money Supply	KL millions	1346	1784	1983	2141	2418	2902	3587	4827
Money Supply Growth Rate	Percent		32.54	11.15	7.97	12.94	20.02	23.60	34.57
Domestic Credit	KL millions	1569	2018	2430	2589	2771	3509	4291	4919
Domestic Credit Growth Rate	Percent		28.62	20.42	6.54	7.03	26.63	22.29	14.64
Investment as % of GDP	Percent		21.8	24.3	24.9	25.2	23.7	18	17.9
Gross Capital Formation	KL millions	1286.33	1278.44	1592.55	1888.83	2118.24	2376.64	2355.52	2260.21
Domestic Savings	KL millions	1098.24	1129.67	1056.09	1275.51	1255.67	1508.01	1707.76	1613.04
Lending Interest Rates	Percent	14	14	14	15	15.5	19	29	30
Real Lending Rates	Percent	3.3	8.3	6.9	4.3	5	3.2	9.4	2.5
Government Deficit	KL millions	-3775	-5586	-9841	-5526	-6574	-8374	-11171	-4595
Deficit as % of GDP <sup>2</sup>	Percent		-7.6	-5.2	-4.8	-7.6	-8.4	-4.3	-4.7

Source: Economic Surveys 1981-93, International Financial Statistics, IMF reports

Notes: <sup>1</sup> 1992 is an estimate

<sup>2</sup> Excludes grants, and 1992 is budget estimate

KSh= Kenyan shilling

KL= Kenyan Pound = 20 Kenyan shillings

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Second, the rapid expansion in the money supply in 1992 created excessive liquidity in the system, which then obliged the monetary authorities to reduce some of the liquidity by selling Treasury bills at very attractive interest rates in 1993. The high interest rates attracted capital that could have been invested in real assets, and have exerted upward pressure on lending interest rates (see Table 3.1). Thus, borrowers face a tight money market, and many plans to invest in new businesses or expand existing ones are being postponed. The cost of this corrective action was a stalling of economic activity.

Third, a weak sales and profit environment prevents owner/operators from modernizing production facilities and obtaining better capacity utilization rates even if financing is available. Therefore, overall gross capital formation fell in 1991 and 1992 by modest negative amounts of 0.8 and 4.0 percent in nominal terms, and negative 9-10 percent in real terms. This decline will hamper future economic growth, especially in the agricultural sector, where the real declines were highest. Another factor contributing to the holding of discretionary funds as opposed to active investing was the uncertainty surrounding the elections in December 1992.

Fourth, weak public sector administrative performance has increased transaction costs in the economy and discouraged formal sector entrepreneurs. The quality of public and parastatal services continues to deteriorate due to low morale of personnel, inadequate resources, excessive work rules and permit requirements, and weak management. The high attendant information and transaction costs make for a poor business climate.

## **3.2 Macroeconomic and Sectoral Economic Policies**

### **3.2.1 Foreign Exchange Rate Regime**

The Government of Kenya has a flexible foreign exchange rate regime, but it has tended to be overvalued and prone to hard currency shortages. The Government of Kenya pegs its currency to a basket of foreign currency, with the buying/selling U.S dollar-shilling rate being set at .15 percent above and below the daily U.S dollar-Special Drawing Right rate. Other major currencies are set according to the daily U.S. dollar closing rates for those currencies in the New York financial market. However, due to the large trade deficits, the Kenyan economy has tended to experience foreign exchange shortages and used import licensing as a rationing device.

The donor community, especially the International Monetary Fund, has urged the government to move toward a unified, market-determined exchange rate system, free of licensing requirements. The government has responded slowly by sanctioning the existence of three foreign exchange markets: official, parallel, and interbank markets.

In October 1991, a system of foreign exchange bearer certificates (FEBCs) was introduced as a means of overcoming the foreign exchange scarcity and establishing a free market in foreign exchange purchase rights. These instruments are denominated in U.S. dollars, range in denominations from \$500 to 10,000 and can be purchased with convertible foreign

currency. The instruments can be redeemed any time after the date of purchase at the prevailing rate and if done after a three-month period with an interest payment accruing at the three-month London Inter-Bank Offer Rate (LIBOR). The hard currency received after redemption can be used to undertake any international transaction. In 1992 a secondary market developed with unrestricted sales and purchases. In March 1992, outstanding balances totaled US\$28 million and trading premiums were 20 to 25 percent over the official exchange rate (IMF, 1992). The secondary market constitutes a parallel exchange rate market and permits anyone desiring access to foreign exchange the means to do so without being subject to any controls.

A third market is the interbank market. Commercial banks are permitted to enter into forward exchange contracts with their customers in British sterling pounds, U.S. dollars, and German deutsche marks, for periods of up to three months for export receipts and up to six months for import payments, at premiums or discounts administratively set by the Central Bank. In order to cover transaction needs, the banks can buy and sell foreign exchange among themselves. Currently, the interbank rate is about 12-15 percent above the official rate. This market indicates the "true value" of the Kenya shilling.

Until May of 1993, an extensive system of import controls existed and foreign exchange was rationed. Approval of applications for imports was granted by the Import Management Committee (IMC) and allocation of the foreign exchange for each application was handled by the Foreign Exchange Allocation Committee (FEAC). Both committees were composed of representatives from the Ministries of Finance, Planning and National Development, Commerce and Industry, and the Central Bank. The bureaucratic requirements tended to delay business transactions and posed problems for firms needing vital imported equipment or materials on short notice. Now Foreign Exchange Retention accounts permit exporters to retain 50 percent of foreign exchange earnings for traditional exports and 100 percent of earnings for non-traditional exports for up to 90 days to finance import needs (interview with Stephen Ndele). This innovation, along with a large reduction in the number of import licenses required, has greatly facilitated import transactions.

In summary, the foreign exchange management regime, while improving of late, has over the course of the last few years had a significant negative impact on economic activity. The sharp devaluations in the shilling, especially in the first half of 1993, have discouraged investment, encouraged capital flight, and contributed to severe losses for enterprises that contracted loans denominated in foreign currencies.<sup>14</sup> For agricultural producers and agroprocessing, the costs of imported fertilizers, chemicals, equipment, and packaging materials increased dramatically. The strong devaluations may have improved export competitiveness, but they created a greater need for financing and reduced profit margins, especially for those wholly dependent on a domestic market.

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<sup>14</sup> As of August 1993 the exchange rate was KSh 70:US\$1. When compared to official rates in 1980, 1985, and 1990, the percentage devaluations are respectively -843 percent, -326 percent, and -205 percent.

### 3.2.2 Public Finance, Monetary, and Credit Policies

The fundamental cause of the weakness in the economy in the last few years is undisciplined fiscal policies and accommodating monetary and credit policies. Between 1991 and 1992, overall government deficits worsened 19 percent (Economic Survey, 1993, pg. 82). Despite an impressive 60 percent revenue gain in the same period due to the introduction of the Value Added Tax (VAT) in 1990, expenditure increases have been higher. As a consequence, the levels of domestic and external borrowing in 1992/93 were very high. Whereas in 1991, external borrowing was KSh 230 million and domestic borrowing was KSh 6.9 billion, in 1992 borrowing jumped to 3.5 billion and KSh 15.9 billion, respectively (Economic Survey, 1993). The continuing high deficit financing needs create large future debt servicing obligations, threaten to crowd out private investment in the future when credit expansion must be slowed, and lower the credibility of government vis-à-vis astute economic actors.

Because of the significant financing needs of the central government and the absence of an autonomous Central Bank, monetary and credit policies did not counteract expansionary fiscal policies. In 1992, the Central Bank extended a significant amount of credits in the form of advances, discount loans, and overdrafts to commercial banks, boosting the rate of private sector credit expansion (Economic Survey, 1993). In addition to the accommodating money policy, a lack of sufficient prudential control permitted financial scandals and undermined depositor confidence in banking institutions, thereby contributing to capital flight and currency substitution. For example, in 1992, half of the reporting banks had cash reserve ratios that were lower than the statutory requirement. When banks fail to comply with reserve regulations, the Central Bank loses effective control over monetary aggregates. Some financial institutions (Trade Bank, Postbank Credit, Pan African Bank, Exchange Bank, Delphis Bank, and Transnational Bank) engaged in irregularities. These included buying foreign exchange bearer certificates from the Central Bank and reselling them within days at considerable premiums back to the Central Bank even though the exchange rate fell; and laundering activities in the overnight interbank parallel foreign exchange market. This contributed to Central Bank operating losses and, along with currency speculators, spurred sharp fluctuations in currency markets (*The Economic Review*, Aug. 30, 1993). Some of these banks failed completely and/or defaulted on inter-bank contracts with minor consequences to the bank's principal investors/owners.

The unsound policies and lack of prudential regulation created a liquidity crisis in the banking system in the last quarter of 1992 and in early 1993. The liquidity ratio in the last quarter of 1992 was 11 percentage points, above the minimum statutory requirement. In May 1993, the Central Bank, with a new management team, began to remove some of this liquidity, which had created inflationary pressures, by offering treasury bills with an effective annual yield of 70 to 80 percent and by increasing reserve requirements (*The Economic Review*, Sep. 5). The result was a sharp drop in loanable funds and higher interest rates. Lending and overdraft rates ranged from 30 to 42 percent, creating difficulties for medium- and small-sized enterprises who could not meet the collateral requirements. For exporters, the high overdraft rates are particularly onerous, because overdrafts are commonly used for export pre-shipment finance

needs. A formal pre-shipment facility existed in the Central Bank, but it was canceled due to charges of abuse (Economic Survey, 1993).

The perspective for the money market continues to be uncertain, given that the Central Bank will have to honor the high yields, possibly stimulating a rise in the money supply and inflation if the treasury bill investors do not reinvest in government securities. Nonetheless, the liquidity mop-up operation was necessary. If the monetary authorities continue to focus on lowering inflation, high real rates of interest will be necessary. To assuage the contractionary effects of a high interest rate policy, the fiscal authorities will have to curb expenditures and the public deficit, thereby reducing government borrowing requirements and upward pressure on interest rates. To date, the public deficit as a percentage of GDP hovers in the 4.7 to 7 percent range, well above the target of 2-3 established by the International Monetary Fund.

### **3.2.3 Commercial Trade Policy**

The Government of Kenya has moved markedly toward a freer trade regime in the last year, yet cumbersome bureaucratic requirements remain in place for exporters. Between February and May of 1993, the Government eliminated import licenses except for corn and sugar. In June 1993, the Finance bill was presented, reducing average tariff rates. Prior to June, there were 11 customs nomenclatures with rates varying from 0 percent to 70 percent. Now the range is between 0 percent and 140 percent (Kenya Gazette Supplement No. 36, June 1993). The two top tariff categories of 140 and 120 percent only apply to cigarettes and other tobacco products. The vast majority of imported products are subject to tariffs in the 30 and 40 percent categories. The low end (5 percent) is reserved for machinery, vegetable oils, animal fats, and electrical components. For most imported items (food, beverages, vehicles, chemicals, clothing, appliances) the tariff savings compared to the previous regime are on the order of 42 percent.

On the export side, reporting and licensing requirements are extensive and increase the transaction costs for exporters considerably. For example, foodstuffs and agricultural commodities require special licenses and may be restricted in order to ensure adequate supplies for the domestic market. Exports of tea, coffee, minerals, precious stones, petroleum products, and other strategic materials are also subject to special licensing. Most other goods only require exchange control approval. Since October 1, 1987, coffee, tea, and horticultural produce exports must be registered with the respective governing parastatal for statistical control purposes only. For the typical fruit juice exporter, five to six stops are needed to clear an export transaction. The institutions involved are the Central Bank, a commercial bank, Customs, the Ministry of Finance, Ministry of Commerce, and Ministry of Health.

### **3.2.4 Fiscal Incentives for Exporters**

Prior to June 1993 the main incentive to exporters had been a duty drawback scheme which paid 20 percent f.o.b. export value in compensation for import duties paid on inputs used in the production of the final export product. About 1,251 items with at least 30 percent

domestic value added were eligible (IMF, 1992). However, the program was suspended as a result of the Goldenberg scandal, wherein billions of shillings were paid to a firm fictitiously exporting gold and diamond jewelry (*The Economic Review*, August 30, 1993).

The duty drawback scheme has been replaced by a duty and VAT remission scheme, under the Provisional Collection of Taxes and Duties Act (Kenya Gazette Supplement No. 37, June 10, 1993). The main advantage of this change is to conserve scarce budgetary resources by making no payments. Consequently, Central Government cash flow management is improved. All direct and indirect exporters are eligible. Parties seeking to benefit must present an export order or letter of credit and a list of the goods to be imported; including tariff classification, quantity, and value, according to production needs, to the Export Promotion Programme Office (EPPO) of the Ministry of Finance. Within seven business days the EPPO is to grant the permission to import duty free and request the posting of a security bond in the name of the Customs Department for the value of duties rescinded. Within three months, the party has to file a reconciliation form stating how the imported goods were used. The EPPO is then supposed to send auditors to double-check the veracity of the reconciliation document. If the documents are legitimate, the EPPO sends a letter voiding the security bond held by the Customs Department. If there are irreconcilable differences, the exporter is liable for forfeiture of the bond and fines. If the exporter did not use the imported materials, a rollover of remission rights can be obtained for 9 months at a time. For indirect exporters, the procedure is similar, except that documents of transfer showing how the dutiable goods were transformed and then passed to a final exporter have to be presented and audited.

The remission program is very document-intensive and in the last few months no locally owned fruit juice exporter has used the program. Four out of 120 exporters claiming remission received the most benefit. Larger, well-organized firms are the ones that utilize the program. Medium-sized and small firms are less able to cope with the documentation requirements.

Other major fiscal incentives include export processing zones and manufacturing under bond.<sup>15</sup> Export processing zones permit duty-free import of all materials and grant 10-year tax holidays. Manufacturing under bond permits the duty- and VAT-free import of all machinery as long as all output is exported. If the output is sold in the domestic market, a surcharge of 2.5 percent plus the value of dutiable goods used is levied. Most manufacturing under bond schemes are suitable only for drawback or maquila operations.

There are investment incentives for locating in rural areas (85 percent write-offs on corporate tax in year of first positive profits, versus 35 percent for urban areas), but these have not stimulated much siting of agroprocessing activity in rural areas. Most all the active firms are located in the Nairobi and Mombasa areas.

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<sup>15</sup> The Essential Good Production Support Program and Section 138 of the Custom Act are minor incentive programs. The first program protects the budding pharmaceutical industry by permitting the duty-free import of ingredients used in fabricating drugs. The second gives local contractors duty-free allowances in order to compete for donor-supported development projects and military projects.

### **3.3 Institutional Support Services**

There are many public and private sector entities that can assist the prospective exporter in obtaining market information, solving technical problems, learning about pertinent business and labor regulations, seeking financing, and claiming fiscal incentives. Many of the services, however, are very diffused and sometimes duplicated across agencies. Also the public sector agencies are considerably less effective at stated missions than private sector trade associations. Table 3.2 summarizes the purpose and effectiveness of the principal institutions that fruit juice processors and fruit farmers regularly depend on for assistance.

#### **3.3.1 Agricultural and Food Technology Research and Extension Services**

Research activity on food processing issues at the National Research Center for Horticulture (NRCH) and at the Kenya Industrial Research Development Institute (KIRDI) has been adversely affected by budget austerity. Nonetheless, the two institutions have excellent facilities and well-trained staffs. KIRDI, more than NRCH, has had a significant impact on the performance of fruit juice processors. Many mentioned consulting on a regular basis with the staff at KIRI and using its laboratory for quality tests. The University of Nairobi, the Polytechnic Institute, and Edgerton College also have faculty specialized in food sciences who occasionally have assisted some of the fruit juice processors. The schools, however, have focused more on teaching and less on applied research.

NRCH, on the other hand, is conducting interesting research on fruit varietal adaption and grafting, but it has not had the opportunity to widely disseminate findings and see major changes in husbandry and cultivar adoption. For example, NRCH conducts research on grafting locally adapted oranges to improved root stock and grafting purple passionfruit to yellow passionfruit root stock for improved disease resistance. However, the work is still in its early stages.

On the extension front, the Ministry of Agriculture Horticultural Division has not had much of a presence in the countryside, again due to limited resources. The Horticultural Crops Development Authority, on the other hand, has been quite active in the extension area. It has focused mostly on vegetable production and less on fruits. It has played an instrumental role in the horticultural export boom of the last 20 years. In recent years, falling budget resources have restrained activities.

#### **3.3.2 Market Information**

One public agency, the Kenya External Trade Authority, is responsible for market information. However, due to budget problems, the office has not been able to maintain up-to-date databases. It has focused its scarce resources on attending trade fairs and publicizing foreign importers' product requests. No private entities maintain an extensive and up-to-date database in the country. Fruit juice processors, however, clamor for information about overseas

**Table 3.2 Institutional Support Mechanisms** (pages 1 and 2)

ENTITY	MISSION	SPECIFIC SERVICES	EFFECTIVENESS
Kenya External Trade Authority	Assist exporters penetrate overseas markets	Sponsor delegations identifying contacts and promoting Kenyan products.	Office is underbudgeted. Database is out-dated (1990). Most effective in trade shows. Needs a sectoral focus. In order to improve timeliness of services, privatization should be considered. Some processors report that entity was not very helpful.
		Participate in and subsidize Kenyan exporters to attend international expositions	
		Publish catalogues and trade inquiries.	
		Maintain library and database.	
		Coordinate activities of 9 Commercial Attachés in Kenyan embassies.	
Export Promotion Programme Office	Administer fiscal incentives	Export Processing Zones	The program most applicable to fruit juice processors is the Duty-VAT remission program. In the last 6 months no fruit processor has applied and benefited from the program. Out of 120 regular exporters, only 4 use the program intensively. Administration of the program is complex and documentation requirements are intense. Tax Allowance for rural siting is very generous, but the majority of the processors are located in Nairobi and Mombasa.
		Manufacturing under Bond	
		Duty-VAT Remission	
		Essential Goods Production Support Program	
		Tax Allowance (Credit on taxable corporate income of 85% for rural investment, 35% for urban)	
Investment Promotion Center	Attract foreign investors	One-stop shop for all investor clearance procedures.	IPC screens investment proposals and secures all foreign exchange and trade permits needed. Was designed to circumvent many bureaucratic delays but is not functioning well. All relevant ministry personnel need to be in the same building. In the last five years, only three foreign agribusinesses have been established, none in fruit juices.
Central Bank	Foreign Exchange Management	Foreign Exchange Retention Accounts	Very helpful to exporters who are dependent on imported inputs.
Horticultural Research Station-Thika	Conduct applied research on varietal adaptation, breeding, diseases, and pests.	Performs informal consulting for farmers who arrive at station.	Excellent physical and human capital. Limited budget subscribes ongoing research and dissemination activity.

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**Table 3.2 Institutional Support Mechanisms** (pages 1 and 2)

ENTITY	MISSION	SPECIFIC SERVICES	EFFECTIVENESS
Horticultural Crops Development Authority	Promote the development of vegetable and fruit production through information dissemination and extension services.	Gathers statistics on horticultural production, trade, and prices.	More emphasis placed on vegetable production. Excellent source of statistics on entire horticultural sector.
Ministry of Agriculture	Provide extension services to farmers		Limited operational budget. Poor outreach to smallholders.
Kenya Industrial Research Institute	Conduct applied research on industrial topics, including food processing.	Provides quality tests.	Excellent equipment and personnel. Very active and helpful to food processors.
Kenya Industrial Estates	Provide loans to small-scale industries		
Kenya Association of Manufacturers	Lobbies government policymakers. Organizes seminars.	Seminars, workshops, presents memoranda to the Government.	Very active and effective.
Federation of Kenya Employers	Represents employers in trade union negotiations.	Training seminars.	Very helpful and effective.
Kenya Export Development Support Project	Assist trade associations and selected medium-size firms. Liaison with public sector.	Conducted baseline survey of private sector and is beginning to develop selection criteria for firm assistance program.	Fairly new project. Have just completed diagnostic survey work.

markets: prices, quantity demanded, technical and quality specifications, shipping procedures, and equipment catalogues. For horticultural producers and traders, currently the best source of price and quantity information is the Horticultural Crops Development Authority (HCDA). The data, however, is not as current as the leadership would like because of reporting delays from other public sector entities.

### **3.3.3 Investment and Trade Promotion**

The Investment Promotion Center (IPC) is responsible for attracting direct foreign investment in the country. IPC supposedly operates a one-stop-shop, but the reliance on case officers to guide individual applications through a maze of permit requirements has not proven efficacious. Delays are still long. An alternative may be to relocate the pertinent ministry officials needed to review an application to one office and centralize decision-making authority. The current configuration of diffused decision-making authority across a number of institutions does not permit rapid investor service.

### **3.3.4 Trade Associations**

The two relevant trade associations for fruit juice processors are the Kenya Association of Manufacturers (KAM) and the Federation of Kenya Employers (FKE). KAM serves generally to publicize the viewpoints of the private sector and to protect the interests of manufacturers as best as possible in the political and policymaking arenas. It does this through seminars, workshops, sponsoring studies, and communicating study findings and opinions to government officials and members of Parliament. FKE assists factory owners in contract negotiations with organized labor unions and keeps members informed of pertinent labor laws and developments in personnel management through newsletters and seminars.

No fruit producers' association exists. A Fresh Produce Exporter Association of Kenya (FPEAK) exists, but it is dominated by vegetable producers. Most of their main concerns are availability of air cargo, improving cold storage capacity, and gathering more overseas market information. Fruit producers are more concerned about chemical costs, access to credit, and improving extension services.

## **3.4 Conclusions and Recommendations**

The macroeconomic imbalances, namely high public deficits, a weak financial sector, and diffuse and underfunded institutional support mechanisms, create an inauspicious business environment. If the Government of Kenya (GOK) is committed to restoring economic growth, alleviating poverty, and exploiting the high horticultural potential of the country, sound economic policies must be pursued and administrative competence improved. Priorities would include the following:

stabilization of the exchange rate;

- control of inflation;
- reduction of the deficit;
- introduction of strong prudential controls in financial markets;
- improvement in public sector administrative efficiency;
- revitalization of agricultural and food technology research and extension activities;
- the creation of a functioning market information system with possible donor assistance and substantial private sector involvement; and
- the creation of a one-stop-shop for exporters in order to lower transaction costs and reduce the amount of time needed to clear an export.

## 4. MANAGERS' PERCEPTIONS OF CONSTRAINTS

### 4.1 General Firm Characteristics

Twelve firms are active in the fruit juice processing industry.<sup>16</sup> Out of this number, eight firms were visited but two were found to be special cases: East African Industries Ltd. and Kenya Wine Agencies Ltd.<sup>17</sup> The former is a mere blender of imported juice concentrates and plans to abandon blending shortly because of declining profit margins. The latter is a parastatal dedicated to spirit and wine production. It makes wines from papaya, passionfruit, and pineapple and processes a fair amount of these fruit juices as an intermediate product.

The other six firms visited (Kenya Orchards Ltd., Kabazi Cannery, Trufoods, Olympic Fruit, Seven Trees Farms Ltd., and Premier Foods), as in Table 4.1, have juice sales ranging from KSh 300,000 to KSh 24 million, generally low rates of capacity utilization, limited export experience, and modest profit margins.<sup>18</sup> The majority of these firms have very diversified lines and rely on juice production and sales only for a fraction of total revenue. Only two processors, Olympic Fruit Processors and Seven Tree Farms Ltd., depend on juice sales for the majority of total revenue. The strong competition from the fresh fruit market and weak domestic juice demand prevent the processors from holding large inventories of concentrates. Factory managers prefer to process small amounts of whatever vegetable or fruit is in season.

The most striking feature of the processors interviewed is the large number of product lines. With the exception of Olympic Fruit Processors, all can vegetables and produce jams and marmalades, in addition to producing juices. For example, Trufoods has 93 different products, Kenya Orchards Limited has 70, Premier Foods has 19, and Seven Trees has 17. At a maximum, only nine types of juice and/or concentrates are produced in any factory: passionfruit, orange, mango, pineapple, tomato, guava, grapefruit, lime, and lemon.

The second most striking feature is inconsistent product quality. Color, consistency, and flavor vary tremendously between batches and juice product lines. This inconsistency is due to poor grading and sorting, the inappropriate mixing of different fruit varieties (for example Navel and Valencia oranges), non-uniformity in the ripeness of the fruit processed, and violation of technical and sanitary norms during the production run.

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<sup>16</sup> See Table 2.3 for full list.

<sup>17</sup> Del Monte Kenya Ltd., Kenya Fruit Processors, Bawazir Food Processors, and Masharibani Industries declined to be interviewed.

<sup>18</sup> From this point on, only the six interviewed firms that process juice for final sale will be discussed. East African Industries and Kenya Wine Agencies will be ignored unless specifically mentioned.

Table 4.1 Profile of Fruit Juice Processors and Blenders

Firm	1992 Total Sales	1992 Juice Sales	Juice Share of Total Sales	1992 Juice Export Sales	Asset Value	Age of Firm	Full-Time Employees	Max. Casuals	Average Utilization	Foreign Equity Participation
	(KSh mn)	(KSh mn)		(KSh mn)	(KSh ms)		Years			
East African Industries Ltd. <sup>a</sup>	NA	0.9	NA	0	5.5	50	22	20	16	Yes
Kabazi Cannery Ltd.	2.5	0.3	12.00	0	150	20	120	200	30	Yes
Kenya Orchards Ltd. <sup>b</sup>	30	8.9	29.67	0.05	30	52	62	100	10	No
Kenya Wine Agencies Ltd. <sup>c</sup>	1000	0.28	0.03	0		24	93	120	30	No
Olympic Fruit Processors	12	12	100.00	10	41	2	18	25	10	No
Premier Foods	65	23.8	36.62	0.0975	65.8	4	55	100	60	Yes
Trufoods Ltd.	5	1	20.00	0	100	35	120	80	40	Yes
Seven Trees Farm Ltd.	1.1	0.875	79.55	0	5	11	4	16	30	No

<sup>a</sup> Figures are only for juice blending division.

<sup>b</sup> Reporting period June 1992 to July 93

<sup>c</sup> Estimated value of fruit juices used as intermediate product in wine making activity

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The third striking feature among the processors is that the factory owners and managers are struggling with market strategy. The domestic juice market has mirrored the general economic downturn and reduced profit margins. Several expressed an interest in exporting, but are concerned about meeting international quality standards and the ability to process the higher volumes needed to fill refrigerated containers. They are debating whether to abandon the domestic juice market, because of uncompetitive prices, to concentrate on marketing lower-priced commodities; or whether to make the necessary investments in equipment and acquisition of higher technical skills needed to be competitive in export markets. Those who have decided to focus solely on the domestic market are concerned about matching the high quality of two imported South African brands that have claimed the upper-income end of the juice market.

#### 4.2 General Owner/Manager Characteristics

The owner/managers tend to be male, fortyish and university-educated, with an average of 26 years of business experience. Asians and whites are overrepresented in the small leadership sample (28.5 percent each) relative to their weight in the general population. These two groups are generally advantaged because of superior academic preparation, more technical expertise, and greater access to financial resources. In the sample, the two Asians both hold advanced degrees in food processing, making them more qualified than any other racial group. When the years of business experience factor is corrected for average age, again the Asians as a group have 3.3 more years of experience after subtracting the difference in average ages between Asians and Africans. Asians are unequivocally ahead of whites on both counts. They are on average 4 years younger than the average white, yet have 5.5 years more experience. If the nonrespondents, Del Monte Kenya Ltd., Bawazir, Mashambani Industries, and Kenya Fruit Processors, had participated, the results could have been different.<sup>19</sup>

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<sup>19</sup> Del Monte Kenya Ltd. is managed by a white American, Bawazir's majority shareholder is an Arab Kenyan, and Kenya Fruit Processor is a joint Swiss-Kenyan government operation with the race of its managers unknown. The race of the owners and managers of Mashambani Industries is also unknown.

**Table 4.2 Profile of Owner/Managers**

Firm	Owner/Manager	Sex	Age	Race/Ethnicity	Education	Nationality	Years Experience
East African Industries Ltd.	Michael Karanja	Male	47	African	BA Engineering	Kenyan	20
Kabazi Cannery Ltd.	J.N. Shah	Male	64	Asian	Ph.D Food Preservation	Kenyan	40
Kenya Orchards Ltd.	Edwin Dougherty	Male	55	European	BA Chartered Accountant	Kenyan	31
Kenya Wine Agencies Ltd.	Paul Chemng'orem	Male	44	African	High School Diploma	Kenyan	25
Olympic Fruit Processors	Peter Ng'ang'a	Male	48	African	BA Administration	Kenyan	21
	Keziah Ng'ang'a	Female	46	African	Teaching Diploma Biology	Kenyan	21
Premier Foods	C. I. Roy	Male	45	Asian	MA Food Technology	Indian	22
Trufoods Ltd.	J.N. Shah	Male	64	Asian	Ph D Food Preservation	Kenyan	40
Seven Trees Farm Ltd.	James Mogwanja	Male	67	African	BA Chemistry	Kenyan	31
	Annette Mogwanja	Female	62	European	BA Sociology	Kenyan	20

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### 4.3 Managers' Perceived Constraints

According to interviews conducted with managing directors and plant supervisors, the six overriding constraints perceived were (1) the rapid escalation in the cost of packaging, which has reduced profit margins and adversely affected sales; (2) the weak business climate, characterized by inconsistent fiscal and monetary policies, falling real incomes, frequent unveiling of corruption scandals, and a poorly functioning public sector which deters new investment and plant modernization; (3) the limited availability of raw materials; (4) lack of access to working capital; (5) poor telephone service in rural areas; and (6) the low quality of domestic sugar that gives products unpleasant (see Table 4.3).

<b>Constraint</b>	<b>Somewhat Important</b>	<b>Very Important</b>
Access to Credit		1
High Interest Rates	1	
High Collateral Requirements	1	
Fruit Availability	1	2
Quality of Fruit	1	
Quality of Local Sugar	3	1
Cost of Packaging		7
Currency Devaluation	2	
Government Permits & Licenses	1	
VAT and Excise taxes (Kenya Wine Agencies)		1
Quality of Roads	2	
Poor Phone Service in Rural Areas		2
Export Market Information	3	
Access to Improved Technology/Equipment	2	
Low Consumer Purchasing Power		3
Competition from Informal Sector	1	

When the firms are categorized by sales size, race of the managing director, and market focus, slightly different concerns emerge (see Tables 4.4, 4.5 and 4.6). For example, small firms are more concerned with securing a market niche, finding customers, and developing a "name"; securing raw materials; and coping with poor roads in the rainy season. The small firms tend to be located outside of Nairobi and have fewer supermarkets and stores as potential wholesale customers. The final consumers, rural wage earners and farmers, also have significantly less purchasing power than urban dwellers. Infrastructural weaknesses also tend to be more glaring, especially poor telephone service and unpaved roads which make transit more difficult in the rainy season.

Table 4.4 Factors Having the Most Negative Effect on Past Sales by Firm Size			
Factors Ranked	Small Firms (Less than Ksh 1 mn in Sales)	Medium Firms (Between Ksh 1-20 mn in Sales)	Large Firms (Over KSh 20 mn in Sales)
Number in Cell	1	3	1
First Order	Marketing	Cost of Packaging	Cost of Packaging
Second Order	Cost of Feasibility Studies	Raw Material Avail- ability	Raw Material Availability
Third Order	Poor Roads	Access to Credit	Outgrower Contract Enforce- ment Problem
Note: East African Industries and Kenya Wine Agencies excluded. They are not primarily juice processors. Small firm defined as having less than KSh 1 million in juice sales. Medium firm defined as having between KSh 1-20 million, and large firm as having more than KSh 20 million in sales.			

Medium-sized firms have solved the problem of capturing market share but feel most affected by the rapid rise in packaging costs, especially tin cans, the most commonly used container. Others complain both about fruit availability and the quality of fruit procured. Many know they are receiving poor-quality fruit but have few alternatives.

Large firms, like medium-sized firms, are most concerned about cost of packaging. One firm attempted to solve the fruit input availability problem by contracting with smallholders. Unfortunately, contract noncompliance occurred because the fresh market price for tomatoes,

the vegetable in question, was more attractive. The firm, nonetheless, is planning on planting its own nucleus farm to supply a sizeable proportion of its needs.

<b>Table 4.5 Factors Having the Most Negative Effect on Past Sales by Race of Owner/Manager</b>			
<b>Factors Ranked</b>	<b>African Kenyan</b>	<b>Asian Kenyan</b>	<b>White Kenyan</b>
Number in Cell	1	2	2
First Order	Access to Capital	Cost of Packaging	Marketing
Second Order	Market Information	Raw Material Availability	Cost of Packaging
Third Order		Access to Modern Equipment	Financing and Operating Contract Farming Scheme
Note: East African Industries and Kenya Wine Agencies excluded. They are not primarily juice processors.			

When the firm-identified constraints are stratified by race of the managing director, as in Table 4.5, interesting differences appear. The African- and white-managed firms are struggling with structural problems (capital access, poor debt/equity ratio, marketing, and equipment problems), typical of "start-up" and "turn-around" operations. The Asian-managed firms report more "external" problems such as raw material availability, export market and equipment information. These are generic problems common to growing firms.

When firms are compared according to market orientation, domestically oriented firms have a wider set of problems than the one firm that focuses on exports to the European market (see Table 4.6). The domestically oriented firms are most concerned with the external shock of rising packing costs, while the export-oriented firm is trying to raise working capital. Interestingly, no firm is exporting to the regional market in a significant manner. One firm is targeting the Preferential Trade Area (PTA) market but insists on dollar payments; this has scared buyers away. The poor road network in the region substantially magnifies transport costs and appears to be another barrier to increased regional exports.

<b>Table 4.6 Factors Having the Most Negative Effect on Past Sales by Market Focus</b>			
<b>Factors Ranked</b>	<b>Domestic Market</b>	<b>PTA Export Market</b>	<b>OECD and Arab Export Markets</b>
Number in Cell	4	0	1
First Order	Cost of Packaging		Access to Capital
Second Order	Raw Material Availability		
Third Order	Marketing		
Note: East African Industries and Kenya Wine Agencies excluded. They are not primarily juice processors.			

The institutions found to be most helpful to factory owners/managers were the trade associations, Kenya Association of Manufacturers and Federation of Kenya Employers, which overlap in many of their functions. In the public sector, the Kenya Industrial Research Development Institute (KIRDI) and the Kenya Bureau of Standards were found to be highly professional, responsive, and helpful. Many owner/managers raved about the laboratory at KIRDI and the prompt assistance they received in testing products. Many of the public agencies with a mandate to promote exports were roundly criticized.

<b>Table 4.7 Which Institutions Provided Effective Assistance?</b>	
<b>Institution</b>	<b>Frequency of Positive Responses</b>
Kenya Association of Manufacturers	3
Federation of Kenya Employers	3
Kenya Industrial Estates	1
Kenya Industrial Research Development Institute	2
Kenya External Trade Authority	1
Kenya Bureau of Standards	2
Kenya Polytechnic Institute	1
Horticultural National Research Center-Thika	1

Regarding sources of market information, among the six firms studied and five visited in person, all depended on a personal knowledge of the local market. All reported that it was rather easy to contact and develop a relationship with wholesale distributors, supermarkets, and large institutions such as the military, hotels, and hospitals. In the rural areas, because of the long distances and poor communications, it was more difficult to contact small shopkeepers. On the export side, where it was much more difficult and costly to gather information, no preferred means of acquiring information was identified. Friends, reconnaissance/marketing trips abroad, and diligent reading of trade publications were the sources reported. Interestingly, not one exporter mentioned using a government entity.

Table 4.8 Sources of Market Information		
Source	Domestic Market Information	Export Market Information
Individual contact with wholesale distributors, supermarkets, institutions, grocery stores	6 cases	
Use of government offices		
Use of vertical integration links (subsidiary selling to parent company)		
Personal friendship with foreign importer and/or broker		One case
Subscriptions to United Nations publications, trade and industry journals		One case
Attendance at trade fairs and expositions		One case
Reading newspapers and responding to advertisements		
Cold phone calls to importers and brokers		

#### 4.4 Cost Margins

In assessing variable cost contributions, the packaging component was the largest when compared to fruit input, sugar, preservatives, labor, labeling, and carton boxes. In the cases for which estimates were provided, packaging costs ranged from 50-63 percent of cost, with costs at the upper end for the smaller 300cc size and at the lower end for the No. 10 or 2.9 liter can. The second leading cost items were fruit and labor. Fruit costs constituted between 8 and 13 percent, depending on the fruit and time of season. Factory labor costs went from a low of 7 percent to a high of 11 percent. The next leading cost item was sugar, ranging from 3 to 8.2 percent, depending on the fruit. Preservatives and labeling were minute costs, each accounting for less than 1 percent of the total unit cost.

Transportation for both the local market and Mombasa port were not mentioned as being costly or problematical, except for one factory situated in a rural area whose market is in surrounding rural towns, mostly served by poor roads. Overland transport costs to Uganda, Sudan, and Tanzania, however, were mentioned as being very high and service as unreliable.

## 4.5 Technical Observations on Fruit Processing

The production of high-quality juices and juice concentrates depends fundamentally on the interaction of technological and economic factors. Knowledge, raw materials, labor, and equipment have to be combined within capital and market constraints to produce a product at a profit. In competitive and discriminating markets, quality products will carry a premium; therefore, higher quality should yield a higher profit margin. In noncompetitive, trade-protected, and/or low-income markets, quality may be a less important factor. However, in the context of Kenya, where significant trade liberalization has occurred and many have expressed interest in exporting, producing a quality product will become critical for continued success in the industry.

Fortunately, quality fruit juice processing is less sensitive to equipment sophistication than to technical know-how and quality raw material inputs. Technically, a quality finished product is a function of quality fruit input, efficient pulping and crushing, correct concentration procedures, and strict sanitation.

This section will contrast international industry standards with the common practices observed in Kenya and point out the areas where improvement and assistance are needed. Case-specific information, however, cannot be provided, in order to respect the proprietary and competitive interests of each firm.<sup>20</sup>

### 4.5.1 Buying Standards of Fruit for Processing of Fruit Juice Concentrate

The selection of fruit input is the single most important factor in producing a high quality product. Other steps in processing cannot compensate for mistakes made in sorting and grading or the simple purchase of poor-quality raw material.

High-quality fruit is a function of three variables:

- Degree of moisture
- Degree of maturity<sup>21</sup>
- Fruit freshness

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<sup>20</sup> A detailed diagnostic report and list of specific recommendations to improve plant efficiency were presented to factory managers in a series of private meetings on August 27, 1993 at the Nairobi Hilton Hotel. Because of the sensitive nature of the information, the information will not be reproduced in this report. If the USAID mission desires the information it can be requested from the authors.

<sup>21</sup> More than the color appearance, maturity is the combination of juice content, soluble solid content, and level of aromatic content.

The input fruit should be of a variety that yields high juice content and/or pulp; each processing batch should be of uniform ripeness and of the same variety; and the fruit should enter the processing system less than 30 hours from the point of peak ripeness. Therefore, distances from the farm to the processing plant should not be excessive. Fruits that have low juice content require a large input volume to extract a commercial juice volume, implying higher operating costs. Fruit that is immature or more often mixed with ripe fruit will affect the taste and consistency of the final product. Fruit that is not fresh likewise will change the color, taste and consistency of the final product and the aromas will be lost.

Good fruit production in turn is a function of proper varietal adaption; proper husbandry techniques, especially watering and fertilization; and proper harvesting, packaging, and transport to the processing factory.

The ideal technique for ensuring the purchase of high-quality fruit is to buy on the basis of soluble solids. In this procurement system, both the grower and the processor use refractometers to determine the amount of solids and sugars in a fruit or vegetable. Payment is proportionate to the degree of sweetness. This technique gives incentives to the grower to produce pounds of soluble solids per hectare and not just pounds of fruit.

The following numerical examples demonstrate the utility of this procurement system in yielding more juice per amount of fruit purchased and processed. A kilogram of soluble solids is calculated according to the following formula: a kilogram of soluble solids = weight of juice from 25 kg fruit sample multiplied by its specific gravity multiplied by its fruit sweetness (degrees Brix)/100 = total soluble solid.<sup>22</sup>

**Example A:** If a 100 kg sample of fruit gives 80 liters of juice at specific gravity 1.045 if the Brix is 11.2%, then it implies that the sample has a soluble solid content of 9.3 kgs.<sup>23</sup>

$$\frac{(80 \times 1.045) \times 11.2}{100} = 9.3 \text{ kg of soluble solids}$$

**Example B:** If a 100 kg sample of fruit gives 80 liters of juice at specific gravity of 1.052 if the Brix is 13.0%, then it implies that the sample has a soluble solid content of 10.94 kgs.

$$\frac{(80 \times 1.052) \times 13}{100} = 10.94 \text{ kg soluble solids}$$

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<sup>22</sup> Brix is a measurement scale (0–100) that indicates the sugar content of a product. The higher the number, the greater the sweetness. Corrections, however, must be made for ambient temperature.

<sup>23</sup>Specific gravity is the ratio of the density of the material in question to the density of water. The more mature the fruit, the higher will be its density.

The more soluble solids in the fruit, the less water there is to be evaporated and the less steam must be used. Thus, the 18 percent gain in soluble solid by purchasing fruit with a higher sugar content (higher Brix) can result in economic savings. The practice of buying fruit on the basis of kg of soluble solids will educate the grower to plant fruit with a high content of soluble solids. This will help the industry obtain fruit more suitable for processing at an economic savings.

In the U.S., it is common to buy fruit and tomatoes on the basis of soluble solid in pounds. For this system to work, it must be implemented at the fruit receiving point in the processing system. An accurate sampling technique exists that is insensitive to the size of the incoming load or the rate of unloading. The grower/middleman should witness and understand the scientific method used. The scientific measuring equipment needed is minimal: a refractometer for sweetness, a hydrometer for measuring density of the juice, and a balance.

In the five Kenyan plants visited, none were using this strict procurement technique. A product would be purchased if it were in a tolerable Brix range, but premiums were not paid to growers/middlemen who provided a better-quality fruit. Prices paid were reduced after estimation of the quantity of immature or decayed fruit.

Some openly acknowledged buying poor fruit out of desperation. The factories had large orders for the United Nations Operations in Somalia (UNOSOM) and were buying fruit out of season and were buying whatever was available on the market. UNOSOM is a non-discriminating buyer and is only concerned with procuring volume. Therefore, the factories had little to fear by delivering a poor-quality product. However, many of the managers said that during the peak fruit season of November to April, raw material availability problems sometimes occurred. Growers are accustomed to producing for a fresh market and selling not only blemished but degraded material to processors. Because of the urgency to keep the factory running and the lack of a "discriminating consumer," it has become standard practice to use whatever is available and simply discount the price paid to the grower. This, of course, violates the dictum in food processing of using quality inputs to get quality outputs.

#### **4.5.2 Grading and Sorting**

Once the purchase has been made, then comes the critical grading and sorting step. Immature and decayed fruit has to be separated from acceptable fruit and thoroughly washed. The sorting operations in the plant are much easier if careful selection has been carried out in the field. However, this may not be rigorously adhered to in the absence of a long-standing personal relationship between the processor and grower on contract.

Once at the processing factory, incoming loads of fruit should be carefully checked for the following:

1. Presence of undermature or overmature fruit
2. Presence of mold and insect contamination

3. Presence of excessive dirt and other foreign matter
4. Cleanliness of containers or trucks
5. Damaged containers
6. Presence of fruit of other varieties

Under well-organized conditions soft fruit should be unloaded and dumped directly into the water tanks for preliminary washing. Generally, when fruit is stacked, care must be taken that the stacked fruit is used in order of entry (first-in, first-used basis), and that its processing is not delayed by the handling of other incoming fruit. Preferably, the transportation of the fruit into the processing plant is by the flume method. Fruit is dumped into a receiving water tank stationed in front of the factory and is conveyed by flumes (large troughs filled with water under directional pressure and angled so that the fruit is transported in a chosen direction) directly into the plant. An additional advantage is that it allows for a low-cost scientific grading of the fruit. Completely immature fruit tends to rise to the surface, partially mature fruit is below the surface and very mature fruit tends to sink.

Fruit that has become contaminated by rotten fruit requires vigorous washing. The use of a well-designed wash tank fruit cleaner is highly effective in the removal of a wide variety of field soils, spray residues, and other organic matter. In the tank the fruit is dumped into a receiving tank filled to an overflow level with water and then vigorously agitated by water jets in order to remove dirt and other materials, that have sunk. The lower end of an elevator picks up the fruit, and as the fruit is elevated, it is washed again by water spray nozzles.

Sorting fruit to remove the partially or completely decayed fruit is the most important operation in the production of first-quality fruit juice. Sorting is best carried out on moving white "grade food" belts but roller type conveyors can also be used. The sorters must be well trained and very familiar with the fruit material. The speed of the inspection belt should be slow enough for the sorters to recognize and discard all decayed or heavily damaged and contaminated fruit. The speed of the belt should not exceed 25 ft/min (7.6 m/min).

The incoming fruit from the grower may be inspected at the factory gate. Discarded fruit, dirt, and stones should be turned back, if possible, to the truck that delivered the fruit and subtracted from the weight of the incoming load. Strict quality control and rejection of loads with a high percentage of rotten fruit will discipline the growers to harvest higher-quality fruit and guarantee the processor less inspection work and first class fruit juice products.

In the context of Kenyan fruit juice processing, of the five plants visited during operating hours, only four were receiving fruit and tomatoes at the time of the visit. Among the four, two performed only satisfactory grading and sorting. The two with substandard practices were culpable of dumping material on concrete floors and leaving it there for extended periods, thereby breaking the skins and facilitating putrefaction; stacking material too high in storage bins, thereby crushing the fruit on the bottom; allowing rotten and moldy fruit and vegetables to be stored for a long time with ripe fruits and vegetables; and improperly washing and sorting.

None of the factories had flumes or used "white food grade" sorting belts. Three of the five factories had very adequate stainless tables and two had incline elevators that facilitate sorting and efficient movement to the next phase.

#### **4.5.3 Crushing and Pulping**

In order to obtain the greatest possible juice concentrate yield, the fruit must be opened and pulped. Depending on the consistency of the skin and the size and hardness of the skins or pits, two or more machines may be needed to do the job. The technological challenge is to avoid grounding the seed and the skin, yet crush the fruit pulp and separate the seed/skin. Usually a combination of pulping and sieving is used with fruits.

In pulping, the adjustment of the paddles in the finisher is critical for high juice recovery rates. When the fruit is picked up, juice should not flow out of the pomace (discard matter). If the waste matter is too moist, adjustments are needed or another processing step must be added using a different machine.

In the visits to the Kenyan factories, only three were actively pulping. In two of the three cases, the pomace was excessively wet, indicating that greater juice efficiency could be attained, and in one case the pulper was misaligned and repeatedly ruining expensive sieves and exuding crushed seeds. Many of the pulpers encountered were of Indian or "*jua kali*" (informal sector) origin. They were not sophisticated, but some were very well built and quite adequate. Others, however, were very shoddily designed and built and subject to breakdowns. In one case, the pulper was Italian-designed and very modern but the blades were not properly adjusted for crushing tomatoes.

#### **4.5.4 Concentration, Packaging, and Storage**

Preservation of liquid food stuffs by concentration, originally by boiling in open kettles over fire, is an ancient technique. By using temperatures below 80 degrees Celsius and a very short holding time, the effects of oxidation and heat damage can be remarkably reduced and the process becomes essentially the removal of water vapor.

The advantages of concentrated fruit juice are:

- Reduction of liquid volume to reduce storage, packaging, and transportation costs.
- The increase of soluble fruit solids by concentration increases microbial stability.
- Pre-concentration of fruit products prior to further processing (before drum drying, spray drying, and other operations).

Concentrates can be reconstituted to original juice strength and used as such or fermented for cider or wine.

In the past, deterioration in the quality of concentrates was often associated with an extremely high contamination of diacetyl-producing bacteria. Today HT-ST (High Temperature-Short Time) evaporators are most common. Higher temperature (60-80 degrees Celsius) concentration and extremely short holding time (30-60 seconds) is the great advantage in modern juice concentration. Enzymes are inactivated and microorganism contamination is remarkably reduced. As a result, natural colors and taste are better preserved and the product becomes very stable.

These HT-ST evaporators tend to be very expensive but have become crucial to attaining first-rate international quality. The leading U.S., Brazilian, Israeli, and European juice processors all use this type of evaporator, making it a necessary piece of equipment for any processor seeking to export to an industrialized country market.

Besides the pulping, evaporation, and filling steps, there are other factors that are quite important but not as driven by the type and quality of machinery used. These other factors, including holding tanks, heat inactivation, labeling and storage, require common sense and diligence—in short, competent oversight and monitoring.

Factors that influence final concentrate quality are as follows:

- **Pulping:** Screen size and operating pressures influence concentrate quality. Damaged screens might influence the homogenous consistency of the product.
- **Holding tanks:** If juice is held too long prior to heat-treating and evaporating, flavor and stability can be adversely affected.
- **Heat inactivation:** Time and temperature of inactivation should be adequate but not excessive.
- **Evaporation:** Holding time and temperature are important.
- **Filling:** Hot-filled products should not have an excessive holding time.
- **Sanitation:** Good sanitation throughout the plant and at all stages of production is essential, not only to maintain the quality of the product, but to eliminate opportunities for off-flavor or odor absorption.
- **Proper handling in marketing channels:** Improper handling (e.g., storage of the product at high room temperature, exposure to sunlight) can adversely affect juice quality.

Among the plants visited, the array of equipment used runs the gamut from "kitchen-style processing" to the equivalent of a small Western-style pilot plant. The intermediate plants had a very adequate mix of Kenyan, Indian, American, and European equipment. All the plants,

except one. had a very logical layout. Only one had a HT-ST or an agitated thin film evaporator.

In most plants filling was done by slow, rudimentary machines and the most common container was a tin can. The second most common container was a plastic bottle. Plastic pouches are not used but should be investigated, given the rapid escalation in the cost of tin cans.<sup>24</sup> For exports, the common shipping vessel was the 50-gallon drum. Because of the small volumes being processed at any given time, the current filling systems do not constitute a binding factor in a production run.

In terms of the latest filling technology, only one of the five commercial juice processors had an aseptic filling machine but did not use it on a large scale because of the high cost of the final product. Aseptic or Tetrapak-like filling systems are emerging as the preferred shipping form in the West, but the high initial cost of the investment in the needed machinery does not make it feasible in Kenya at the present time, except perhaps for a wholly export-oriented venture.

#### **4.5.5 Plant Sanitation and Maintenance**

Microbiological spoilage of the final product can be caused initially by using rotten and over-mature fruit, which will contaminate the equipment of the processing plant during manufacturing. Therefore, good sanitation and plant maintenance are essential to ensure not only a high quality product but also an efficiently run plant. Unsanitary products destroy reputations in the marketplace. Poorly maintained equipment leads to frequent work stoppages and worker accidents.

In general, clean-up should be carried out every 12 hours. Any short production stop within 12 hours should be used to rinse out the processing equipment with cold water. As soon as the last fruit in a 12-hour production run has been processed, the clean-up starts. Care must be taken so that sanitizing material is not mixed with the fruit or juice. Therefore, before using sanitizers, all pipes and tanks should be flushed with cold water to push any juice residues out of the system, to avoid any loss of finished product on the subsequent run.

The wash tank cleaner should be drained completely and flushed out with clean water to remove all dirt and fruit residues. Elevators, conveyors, and other moving equipment should be run and the residues washed away by using scrubbing brushes or high-pressure water spray.

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<sup>24</sup> Polyethylene Form-Fill-Seal machines would be needed. They are expensive new and so only moderately used. The availability and cost of poly plastic films would also have to be investigated. The advantage of this pouch system is the ease of creating different sizes directly on the line from a roll of plastic film, without having to keep an inventory of various sized containers. Of course, there is a tradeoff between container durability and weight, but the cost escalation of tin seems to be forcing the active search for substitute containers.

A caustic solution can be run in tanks, pumps, and pipes. After circulation with soda solution, the piping system and tanks should be rinsed with hot water.

During the plant visits, the team witnessed two complete clean-up operations and several partial wash-outs. All staff at every plant were adequately dressed. On two occasions of complete clean-up operations, the procedures seemed to be very adequate. What struck the team as unhygienic, however, was hand-filling operations in one plant. What may be more problematical and more commonplace is slight contamination of batches through poor sorting that degrades final product quality. Only laboratory testing of random samples would detect this. As far as the team knows, no factory was shut for violating the Kenya Bureau of Standards or the Ministry of Health inspections.

In conclusion, the five Kenyan fruit juice processing factories visited show a level of competence consistent with small- and medium-sized firms. The capability exists to easily surmount the most common problems, which are lax procurement policies and poor sorting and grading. During the processing steps, greater attention needs to be paid to increasing juice extract yields and improving final quality through continuous flow processing. Substantial machinery and human capital investments, however, would have to be made that may not be justifiable given the current macroeconomic situation and level of market demand. For the firms that were visited to become viable exporters, two of them need little in order to attain European or American quality standards; another two should not even consider exporting; and the fifth one would need massive investments in new machinery, roads, and personnel training.

#### **4.6 Conclusions and Recommendations**

Of the six fruit juice processing firms studied, most are medium- and small-sized, with total juice sales for the largest amounting to KSh 24 million in 1992. Low levels of utilization, diversified product lines, and inconsistent product quality were some of the most common features. The industry is expecting a period of flux and is trying to develop new marketing strategies and contain costs. The new era started two years ago when tariffs were lowered. As a result, the South African Ceres brand entered the market and has made substantial inroads in the upper-income market due to its very high quality. At the same time, the domestic economy soured drastically, reducing demand. Now the industry participants have to decide whether to (1) abandon juice making; (2) focus on exports of high-quality concentrate; (3) compete effectively with the South Africans for the high end of the juice market; or (4) depend on other product lines while the purchasing power of lower-income clients recovers. Several expressed interest in exporting, but several barriers exist; including lack of working capital; lack of market information; high cost of transportation to neighboring countries; and the even weaker economies of Kenya's neighbors.

The most common constraints perceived by managers were: (1) the rapid increase in the cost of packaging; (2) the weak business climate that has dampened sales and deterred investments in new equipment; and (3) the limited availability of quality raw material.

Technically, the firms visited used a wide range of equipment and operated with diverse bases of knowledge. The most common problem encountered was poor grading and sorting. The food processing dictum of using quality input to get quality output was violated in several of the firms visited. In other cases, the poor color and taste of the final product indicated that sorting was also a problem. To determine which quality problems could be directly attributable to processing shortcomings, much more extensive plant visits and access to laboratory equipment would have been needed.

In summary, the Kenyan plants have potential to grow and improve, provided appropriate marketing strategies are adopted and the necessary resources to execute them are procured. It is recommended that the Agribusiness Association of Kenya seek donor assistance for members of the industry in the following areas:

- **Technical Assistance.** Some firms need expert advice for several weeks at a time on how to improve plant efficiency and product quality through changes in layout, acquisition of new equipment, refurbishing of existing equipment, and training of personnel. Other firms need assistance in launching an outgrower contracting scheme in order to solve the problem of lack of availability of high-quality raw material.
- **Equipment and Market Information.** Several firms need access to equipment catalogues and contact numbers for used equipment sales people in order to modernize their plants. As mentioned in the previous chapter, an improved export information system is needed. Most factory managers rely on personal contacts, the International Trade Center in Geneva, and trade journals for leads.
- **Production and Trade Finance.** If the industry is committed to reaching a higher level of productivity, factory operators and growers will need access to credit. East Asian NICs have been successful in part because they have guaranteed access to credit for both direct and indirect exporters. As mentioned in chapter 2, Kenya's domestic juice potential seems limited. If an export strategy is adopted, loan guarantees, innovative trade finance mechanisms, and export credit insurance may be needed to bolster the industry. Fruit growers will also need access to financing either directly through formal institutions or indirectly through on-lending activities by processors. At present, most factory operators are either not seeking financing or are depending on self-financing and overdrafts because of the soft economy. However, if a strong expansion were to occur, self-financing would probably be inadequate.

The Agribusiness Association of Kenya can play a vital role in mobilizing support for an assistance agenda. It can also lobby government policy makers to pursue sound macroeconomic policies and either improve the functioning of relevant institutional support mechanisms (National Horticultural Research Center at Thika, Kenya Industrial Research and Development Institute, Kenya External Trade Authority, Export Promotion Programme Office, and Investment Promotion Center), or help fund parallel entities under private sector management.

## 5. FARMER'S PERCEPTIONS OF CONSTRAINTS

### 5.1 General Characteristics of Fruit Growers

Most growers interviewed were medium-sized operations with 3 to 20 acres, of which 1 to 5 acres were planted in fruits.<sup>25</sup> Other crops on the farm typically included coffee or tea and corn. The largest proportion of their land tended to be for coffee, but most farmers were trying to diversify into more profitable activities, given low international coffee prices and great payment delays from the parastatal in charge of marketing coffee. Passionfruit and pineapple were seen as particularly promising products given their high gross margins.

All the farms visited were intensively cultivated, using both family and hired labor and relying heavily on chemical inputs and manure. Some farmers intercropped passionfruit to maximize revenue, and a small number irrigated. All those within a reasonable distance of a water source wanted to irrigate, but most could not afford the equipment. They were forced to hand-carry water to maintain appropriate moisture levels during dry spells.

Most commercialization is through middlemen, even if the farmer owns a truck. The preferred market is the fresh one in the case of passionfruit, where a blemish-free fruit (grade 1) can earn KSh 30 per kg and spotted or pitted fruit (grade 2) commands KSh 1.5 to 4.5 per kg at the farmgate. Middlemen in turn usually sell the passionfruit to processors for KSh 4.5-8 earning approximately a 20 percent margin.<sup>26</sup> In the case of pineapple, the difference between the fresh and processed markets is not so great—KSh 10 per kg versus KSh 6 per kg.

In the case of passionfruit, planting material tends to be obtained from self-propagated nurseries. The largest barrier to cultivation is the high investment in trellising. Posts are rather expensive given the scarcity of wood in the Central Highlands (KSh30-80 for a ten-foot length), and a significant number of person-days are needed to dig holes and string the galvanized barbed wire used for support. Once the parcel is established, however, the vine requires only modest maintenance—weeding, pruning, and the application of chemicals.

For pineapples, the planting material (crowns) is much more expensive and the gestation period is 18-24 months, as opposed to 8 months for passionfruit. The amount of land needed for a viable operation is also greater because plantings should be staggered to ensure steady production. Thus pineapple is best suited for plantation cultivation and for larger farmers.

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<sup>25</sup> Only passionfruit and pineapple farmers were visited. The East Coast, where mango is mostly grown, was not visited.

<sup>26</sup> Interview with trader Cecilia James. Calculation based on 20-mile delivery trip of 7 metric tons of passionfruit, with an farmgate price of KSh 4 per kilo and a factory price of KSh 6 per kilo, and transport cost of KSh 5,000 per trip.

## 5.2 Farmers' Perceptions of Constraints

Farmers were principally concerned with the rise in price of chemical inputs in the last two to three years. As can be seen in Table 5.1, the percent price index increase between 1988 and 1992 was 62 percent. Meanwhile the quantity index, especially for fertilizer, plummeted, contributing to lower outputs. For the passionfruit farmers visited, Daconil, a fungicide, and DAP (20-10-10 formula), a fertilizer, are the two most important purchased inputs. In 1992, Daconil sold for 560 Ksh per kg. In July 1993, it sold for 840 Ksh per kg, a 50 percent increase. Similarly, DAP jumped from Ksh 600 per 50 kg bag in 1992 to Ksh 800 in 1993, a 33 percent increase. Cash-constrained passionfruit farmers have been forced to reduce the number of recommended applications and the strength of the dose. Yields have suffered. Among the farmers reporting cutbacks in chemical use, passionfruit yields per acre have been below the theoretically attainable maximums of 12-14 mt per hectare. Some report yields of 8-9 mt per hectare.

Indice	1988	1989	1990	1991	1992
Total Input Quantity Index	159.9	131.6	131.0	130.8	122.8
Total Input Price Index	145.5	152.2	186.7	216.1	235.1

Source: *Economic Survey 1993*

The second main concern of farmers was lack of access to formal credit. Each farmer interviewed wanted to expand passionfruit area or to intensify production by acquiring irrigation equipment, but most lacked credit on favorable terms. Some of the younger farmers lacked a title deed, because the deed was in a parent's name and the parent had not yet subdivided the farm among the heirs; others were discouraged by the heavy collateralization requirement (120-123 percent of loan) and the custom of compounding interest rates; still others were stymied by the high transaction costs (long application processes and slowness in disbursements) that are common in the subsidized smallholder credit schemes of the Agricultural Finance Corporation, the leading rural lender. A minority were simply averse to using formal credit, fearing a debt burden. In the absence of external finance, most were using savings, proceeds from the sale of animals, and transfers from family members with formal sector wages to expand area cultivated.

The third main concern of farmers was the absence of adequate extension services. Of the ten farmers interviewed, only two had received visits by a Ministry of Agriculture extension agent. In one case the extension agent lived on the opposite hill, a short distance from the farmer, and in the other case, the farmer drove to the extension office and brought the agent to

inspect and give advice on how to treat a particular disease problem. The Ministry of Agriculture states declining budget resources, especially for vehicle maintenance, and few agents specialized in horticulture as the main reasons for the limited outreach.

Farmers do not expect much service from the Ministry of Agriculture and depend on each other and agricultural input distributors for most of their information. The lack of a good extension service, however, keeps husbandry standards low and prevents opportune and appropriate interventions. The costs include reduced yields and higher dependence on chemicals than is necessary, because cultivation techniques are suboptimal.

### **5.3 Cost of Productions and Gross Margins**

Compared to coffee, which is currently producing a loss of KSh 2-10,000 per acre, and tea, which is producing a profit of approximately KSh 5,000 per acre, all of the fruits exhibit better midlife gross margins than earlier in the life cycle of the plantation. (See Appendix B). Passionfruit is the most remunerative. With an initial high investment of KSh 46,450 (\$663), in the first year an hectare will yield a gross margin of KSh 45,917. The other fruits—oranges, pineapples, and mangos—have negative returns in the first few years, until the parcels reach maturity and start to yield very substantial profits. However, with the exception of oranges, these other fruits are extremely expensive to establish.

### **5.4 Conclusions and Recommendations**

Farmers are bedeviled by rising chemical, transport, and fertilizer prices; lack of financing; and poor extension services. All farmers contacted expressed a strong interest in either expanding or intensifying passionfruit production because of its high profitability. However, for varying reasons, they suffered capital constraints. They were also willing to entertain a guaranteed price contract with a nearby processor, because they realized that not all the passionfruit produced could be absorbed by the fresh market.

## 6. CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions and Further Research

The Kenyan fruit juice processing industry has good potential to grow and become a very dynamic sector. However, at the moment the industry is experiencing a downturn in the domestic market and particularly strong foreign competition for the upper-income client. Whether the potential of the industry is realized will depend on how well the public and private sectors can collaborate to overcome policy, institutional, and technological weaknesses; and will also depend on how market demand and consumer tastes evolve. At the present time, the industry is hampered by the lack of an enabling environment. Currency stability, credible macroeconomic policies, and stronger, more efficient public institutions are needed to renew general economic and income growth, as well as stimulate higher levels of investment and plant modernization.

At the firm level, the factory operators have to overcome the obstacle of rising packaging costs, which are eroding profit margins, and strive diligently to improve product quality, especially if an export marketing strategy is adopted. First, in order to reduce packaging costs, the root cause of the escalation needs to be identified. Is it due to the devaluation effect or to the exercise of market power by Metal Box, the only supplier in the country? An empirical investigation could determine whether lobbying for entry by another firm or simple substitution of plastics for tin cans would be warranted. Secondly, the improvement of product quality is imperative for increased international competitiveness and retention of the upper-income market. Some immediate and inexpensive steps can be taken to improve grading and sorting, such as procurement by the soluble solids method, use of flumes, and more meticulous selection.

In order to solve the problem of raw material availability, contract farming should be seriously investigated, especially in the case of passionfruit. The characteristics of passionfruit production, (medium crop cycle, a medium degree of specialization of production inputs and technical knowledge, a low degree of crop perishability [1 week], low quality standards, and need for less timely deliveries to the processing factory) could make this fruit well-suited for a contracting arrangement (Jaffee). In the case of pineapple and mango, the very high initial investments and long gestation periods and the large scales of operation needed for efficient production make the case for vertically integrated operations.

The Agribusiness Association can play an important catalytic role in mobilizing support for donor project assistance and lobbying the Government of Kenya to improve institutional and policy performance. If public services continue to deteriorate, more private sector initiatives and voluntary, collective actions will be needed to fill the void and perform needed social overhead functions.

## 6.2 Recommendations

An organization is needed to represent and promote the interests of the fruit juice industry. Obvious common problems exist and unified action is likely to be less costly and more effective, especially vis-à-vis the government and the donor community. Several institutional configurations are possible if fruit juice processors are committed to collective action.

First, the processors can form an industry group committee within the Kenya Association of Manufacturers (KAM). The advantage of this option is that KAM is established, well respected and effective. One possible drawback is that the KAM leadership may not be very interested in the agricultural issues underlying the "availability of raw material" problem (i.e. poor extension services for growers, poor rural telephone service, poor roads, underfunded agricultural research stations.)

Second, the processors could form their own trade association and be assured that their heartfelt interests would be vigorously represented. The main weakness of this alternative is that the overhead costs would have to be borne by a small number of firms. At the moment, only 12 firms are active.

Third, the processors could form a working committee within the nascent Agribusiness Association of Kenya. The advantage of this alternative is that the underlying agricultural supply issues could be more fully addressed and economies of scale could be obtained, provided the Association is successful in generating sufficient interest in other sectors and forming a number of industry-specific committees (i.e. farm machinery distributors, fertilizer and chemical distributors, commercial seed producers, vegetable oil processors, millers, etc.). The weakness of this option is that without a galvanizing issue and strong, dynamic leadership, developing a critical mass of interested work groups will be very difficult.

If the third option is adopted, the Agribusiness Association of Kenya should openly and democratically constitute itself and actively recruit a membership that is representative of the major agribusiness sectors in the country. In order to do so, the Agribusiness Association of Kenya will have to hire a professional, full-time staff person(s) to direct the membership campaign, raise funds, and provide tangible services to members.

If the first or second option is adopted, a nucleus of fruit processors will have to volunteer a substantial amount of their time to organizational activities.

Once the institutional design has been settled, a plan of action should be developed that is feasible and yields tangible benefits to affiliated fruit processors. The team recommends that the plan contemplate action in the following four areas where constraints have been identified:

- Seek donor assistance in a cost-sharing venture to provide 1-2 months of technical assistance in food processing engineering, quality control, and training.

- Commission a detailed study on the causes for the rapid escalation in tin can prices and a thorough investigation of the technical and financial feasibility of packaging alternatives.
- Commission a study and draft a proposal on how best to proceed with a contract farming scheme for passionfruit.
- Develop a proposal directed to international donors on how to create and administer a functional export market information database. This should be done in cooperation with other existing trade associations.

## REFERENCES

- Agricultural Finance Corporation, *Statistical Digest*, Nairobi, Kenya. December 1992.
- Bess, M., Paul Guenette, William Oleche, and Karen Potter, "Private Sector Baseline Survey" KEDS Report for USAID, Development Alternatives Inc., Nairobi, Kenya, March 30, 1993.
- Central Bureau of Statistics. *Economic Survey 1993*. Ministry of Planning and National Development, Nairobi, Kenya.
- Central Bureau of Statistics. *Economic Survey 1991*, Ministry of Planning and National Development, Nairobi, Kenya.
- Central Bureau of Statistics. *Economic Survey 1990*. Ministry of Planning and National Development, Nairobi, Kenya.
- Central Bureau of Statistics. *Statistical Abstract 1991*, Ministry of Planning and National Development, Nairobi, Kenya.
- Daines, S., Bryant Smith, William Rodgers, and Fred Mann. (1980) *Agribusiness and Rural Enterprise Project Analysis Manual*. Agribusiness Division, Office of Agriculture, Development Support Bureau, Agency for International Development, Washington, DC.
- Deloitte, Haskins, Sells Management Consultants Ltd. and African Development and Economic Consultants Ltd. *Private Sector Industrial Growth: Financial Sector Analysis for Policy Discussions*. Report for Kenya Association of Manufacturers, December 1991.
- The Economic Review*. "Central Bank: Cleaning Up the Paper Money Mess." Nairobi, Kenya, Issue No.47, August 30 to September 5, 1993.
- Ender, Gary, *The Agribusiness Policy Inventory: The Tool and Its Use in Policy Analysis and Reform*. Agricultural Policy Analysis Project II. Abt Associates, Bethesda, MD. 1993.
- Foreign Broadcast Information Service. "Kenya: Finance Minister's Budget Proposal." July 23, 1993 broadcast, Washington, DC. Reproduced from *Kenya Times*, Nairobi, Kenya, June 11th and 12th, 1993 editions.
- Harris, S. and Thomas Muthugu, "Kenya Horticultural Subsector Survey." KEDS Report for USAID. Development Alternatives Inc., Nairobi, Kenya, September 1992.

- Holtzman, J. et al. (1992). *Agribusiness Development in Sub-Saharan Africa: Suggested Approaches, Information Needs and an Analytical Agenda*. Volume I: Synthesis. Agricultural Marketing Improvement Strategies Project. USAID. Abt Associates. Bethesda, MD.
- International Monetary Fund, "Kenya Statistical Annex," Washington, DC. June, 1992.
- International Monetary Fund, "Recent Developments in Kenya," Washington, DC. September 30, 1992.
- International Trade Center. (1991). *Fruit Juices with Special Reference to Citrus and Tropical Fruit Juices: A Study of the World Market*. Geneva, Switzerland.
- Jaffee, Steven M. *How Private Enterprise Organized Agricultural Markets in Kenya*. Policy Research Working Paper No.823. World Bank, Washington, DC.
- Kenya Chamber of Commerce and Industry. *Business*. Vol. 10 No.10. September 1992.
- Kenya Chamber of Commerce and Industry. *Business*. Vol. 11 No.1, January-June 1993.
- Kienbaum Development Service GmbH. "Market Study of Fruit Juice Concentrates," Report prepared for the Center for the Development of Industry, Gummersbach, Germany, March 1992.
- Labat-Anderson Inc. (1992). *Critical Issues for American Investors in Kenya*. U.S. Agency for International Development.
- Ministry of Agriculture (1989). *Farm Management Handbook of Kenya: Horticultural Production Guidelines Volume V*. Nairobi, Kenya.
- Pragma Corp. and African Development and Economic Consultants Ltd. (1988). *Rural Industrialization in Kenya: Expectation, Opportunities, and Constraints with Particular Reference to the Provision of Basic Rural Infrastructure*. Report for Kenya Association of Manufacturers, Nairobi, Kenya.
- Republic of Kenya. *Kenya Gazette Supplement No.36: Bills 1993*, Government Printing Office, June 10, 1993.
- Republic of Kenya. *Kenya Gazette Supplement No.37: The Provisional Collection of Taxes and Duties Act*. Government Printing Office. June 10, 1993.
- Republic of Kenya. *Kenya Gazette Supplement No.38: The Customs and Excise Act*. Government Printing Office. June 11, 1993.

- Salunkhe, D.K., H.R. Bolin, and N.R. Reddy. *Storage, Processing, and Nutritional Quality of Fruits and Vegetables, Volumes I and II*. CRC Press Inc., Boca Raton, FL., 1991.
- Schapiro, M. and Stephen Wainaina. (1989). "Kenya: A Case Study of the Production and Export of Horticultural Commodities." in *Successful Development in Africa: Case Studies of Projects, Programs, and Policies*. Economic Development Institute, EDI Policy Case Series, Analytical Case Studies, Number 1, World Bank, Washington, DC.
- Schluter, M. (1984). *Constraints on Kenya's Food and Beverage Exports*. International Food Policy Research Institute in collaboration with the Institute for Development Studies, University of Nairobi, Research Report 44.
- Weideman, Wesley. (1986). *Institutional Analysis and Recommendations for Kenya Small Scale Business Association*. Robert R. Nathan Associates, Inc. and Economic and Management Consultants. Report for USAID/Nairobi Projects Office. November.
- Wenner, M., John Holtzman, and Gary Ender. (1993). *Agribusiness Promotion in Developing Countries: Policy Regimes and Institutional Support*, APAP II Collaborative Research Report No.351, Abt Associates Inc., Bethesda, MD, July.
- World Bank, Country Operations Division Eastern Africa Department. (1988). *Kenya Recent Economic Developments and Selected Policy Issues*, Report No.7411-KE, Washington, DC.
- World Bank, Public and Private Enterprise Division, Country Department II. (1992). *Kenya Private Sector Assessment: Volume II Main Report*. Draft Report, Washington, DC.

## APPENDIX A

### List of Persons Contacted

#### PUBLIC SECTOR

B. Chege	Post Harvest Specialist, National Horticultural Research Center, Thika
C. Gathungu	Pathologist, National Horticultural Research Center. Thika
Tom Hobgood	Director of Agricultural and Private Enterprise Offices, USAID/Kenya
J. Kamau	Plant Breeder, National Horticultural Research Center, Thika
S.T. Kenyagia	Nematologist, National Horticultural Research Center. Thika
Migwe Kimenia	Private Enterprise Officer, USAID/Kenya
Peninnah K. Kimweli	Project Manager, Horticultural Crops Development Authority
David Michiaka	Director, National Horticultural Research Center, Thika
Mr. Charles Mbara	Farm Management Division, Ministry of Agriculture
Mr. Mbatia	Technical Director Farm Loans, Agricultural Finance Corporation
F. P. Muema	Deputy Director for Horticulture, Ministry of Agriculture
Lawrence Makumba	Kenya External Trade Authority
Martin Mulandi	Managing Director, Horticultural Crops Development Authority
Steven Ndele	Economist, USAID/Kenya
Peter M. Nyamiaka	Horticulturalist, Horticultural Crops Development Authority
Ben K. Nzioki	Investment Promotion Center
Paul Osiro	Central Bureau of Statistics
Karen Potter	Kenya Export Development Support Project/USAID
Florence C. Serem Rotich	Horticulturalist, Horticultural Crops Development Authority
Phil Steffen	Kenya Market Development Program/USAID Project
Adrian Strain	Kenya Export Development Support Project/USAID

## TRADE ASSOCIATION AND FRUIT JUICE PROCESSORS

Lorenzo Bertolli	Director, Kenya Agribusiness Association & FIDEA Ltd.
Rajan Bhandari	4M Enterprises
Paul K. Chemng'orem	Managing Director, Kenya Wine Agencies Ltd.
Edwin Dougherty	Managing Director, Kenya Orchards Ltd.
Michael M. Karanja	Technical Director, East Africa Industries Ltd.
Namu Ben Kavita	Winery Manager, Kenya Wine Agencies Ltd.
Bethuel Kiplagat	Chairman, Agribusiness Association of Kenya
Chris Malavu	Director, Agribusiness Association of Kenya and 4M Enterprises
James Mogwanja	Co-Owner and Manager, Seven Trees Farm Ltd.
Annette Mogwanja	Co-Owner and Manager, Seven Trees Farm Ltd.
Peter G. N. Ng'ang'a	Olympic Fruit Processors Ltd.
Raphael N. Omusi	Kenya Chamber of Commerce and Industry
C.I. Roy	Managing Director, Premier Food Industries Ltd.
J.N. Shah	Managing Director, Trufoods Ltd. & Kabazi Cannery Ltd.
Jagmeet Singh	Manager, Trufoods Ltd.

## FRUIT GROWERS AND TRADERS

Cecilia James	Fruit trader, Kanyoni
Chege Kamori	Passionfruit grower, Thika
Joseph Kariui	Passionfruit grower, Thika
George Githiri Kariuki	Passionfruit grower, Thika
Vivek Mehta	Passionfruit grower, Thika
Stephen Mwora	Passionfruit grower, Gituambe
Lawrence Muiruri	Pineapple grower, Kanyoni
Joel Ng'anga	Passionfruit grower, Thika
Moses Ng'anga	Passionfruit grower, Kiambu

## **APPENDIX B**

### **Cost of Production Estimates for Selected Fruits**

Costs of Production for Principal Fruits

Pineapple									
Variety: Smooth Cayenne									
Area: 1 HA									
	Quantity	First Year	Total	Quantity	Second Year	Total	Quantity	Third Year	Total
		Unit Price			Unit Price			Unit Price	
<b>TOTAL OUTPUT</b>									
Yield kg/ha & Price kg				45000		0	25000	15	375000
Grade 1 Fresh				0.7	15	472500	0.7	15	262500
Grade 2 Processing				0.3	6	81000	0.3	6	45000
GROSS VALUE						553500			307500
<b>ESTABLISHMENT COSTS</b>									
Land preparation			6000						
Planting Material	49000		2	98000					
Irrigation equipment			600000						
Polythene	4000 meters		85	340000					
Labor (man-days)	250		40	10000	250	40	10000	250	40
SUBTOTAL				1054000			10000		10000
<b>VARIABLE PRODUCTION COSTS</b>									
Fertilizer CAN (26%)	800	700 per 50kg	11200	300	700 per 50kg	2800	200	700 per 50kg	2800
Murate of Potash	400	613.5 per 50kg	4908						
Diazinon	2 liters	668.8	1337.6	2 liters	668.8	1337.6	2 liters	668.8	1337.6
Furadan	125	182.5	22812.5						
Packing Material				4625 cartons	18	74000	1333 cartons	18	23994
SUBTOTAL			40258.1			4137.6			4137.6
<b>VARIABLE LABOR COSTS (Man-days)</b>									
Land Cultivation	25	40	1000	20	40	800	10	40	400
Spraying	15	40	600	20	40	800	10	40	400
Harvesting				80	40	3200	70	40	2800
Packing				25	40	1000	60	40	2400
SUBTOTAL			1600	145	160	5800	150	160	6000
TOTAL COSTS			1095858			19937.6			20137.6
GROSS MARGIN			-1095858			533562.4			287362.4
TOTAL CUM MARGIN*									325066.7

Passionfruit												
Variety: Purple												
Area: 1 HA												
	Quantity	First Year Unit Price	Total	Quantity	Second Year Unit Price	Total	Quantity	Third Year Unit Price	Total	Quantity	Fourth Year Unit Price	Total
<b>TOTAL OUTPUT</b>												
Yield kg/ha & Price kg	4500			10000			12000			12000		
Percent Grade 1 Export Fresh	0.7	35	110250	0.7	35	245000	0.7	35	294000	0.7	35	294000
Percent Grade 2 Processing	0.3	6	8100	0.3	6	18000	0.3	6	21600	0.3	6	21600
<b>GROSS VALUE</b>			<b>118350</b>			<b>263000</b>			<b>315600</b>			<b>315600</b>
<b>ESTABLISHMENT COSTS</b>												
Digging & planting	173	40	6920									
Planting Material	2000	2	4000									
Trellising Materials												
Posts	940	30	28200									
Preservative	8	75 per 4 lt can	600									
Galvanized wire	250	26.92	6730									
<b>SUBTOTAL</b>			<b>46450</b>									
<b>VARIABLE PRODUCTION COSTS</b>												
Manure	16000	0.714	11424									
Fertilizer CAN (26%)	500	700 per 50 kg	7000	500	700 per 50 k	7000	500	700 per 50 k	7000	500	700 per 50 k	7000
Fertilizer TSP	200	818 per 50 kg	3272									
Mancozeb	6 cans	124.3	745.8	6 cans	124.3	745.8	6 cans	124.3	745.8	6 cans	124.3	745.8
Dithane	6 liters	645	2580	6 liters	645	2580	6 liters	645	2580	6 liters	645	2580
Bayfolan	4 liters	96.25	385	4 liters	96.25	385	4 liters	96.25	385	4 liters	96.25	385
<b>SUBTOTAL</b>			<b>13982.8</b>			<b>10710.8</b>			<b>10710.8</b>			<b>10710.8</b>
<b>VARIABLE LABOR COSTS</b>												
(Weeding, pruning, spraying)	300	40	12000	350	40	14000	350	40	14000	350	40	14000
<b>SUBTOTAL</b>			<b>12000</b>			<b>14000</b>			<b>14000</b>			<b>14000</b>
<b>TOTAL COSTS</b>			<b>72432.8</b>			<b>24710.8</b>			<b>24710.8</b>			<b>24710.8</b>
<b>GROSS MARGIN</b>			<b>45917.2</b>			<b>238289.2</b>			<b>290889.2</b>			<b>290889.2</b>
<b>TOTAL CUM. MARGIN*</b>												<b>865984.8</b>

Oranges

Varieties: Washington, Navel, Valencia, Pineapple, Hamlin

Area: 1 HA

	First Year			Second Year			Third Year			Fourth Year				
	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total		
TOTAL OUTPUT														
Yield kg/ha & Price kg							150 bags		500	75000	200 bags		500	100000
GROSS VALUE														
ESTABLISHMENT COSTS														
Digging & transplanting	25		40			1000								
Seedlings	3600		2			7200								
SUBTOTAL						8200								
VARIABLE PRODUCTION COSTS														
Manure	4000	0.71	2840	4000	0.71	2840	4000	0.71	2840	4000	0.71	2840		
Gustathion	1 liter	430	430	1 liter	430	430	1 liter	430	430	1 liter	430	430		
White oil	5 liter	126.4	632	5 liter	126.4	632	5 liter	126.4	632	5 liter	126.4	632		
Ambush	1 liter	1132	1132	1 liter	1132	1132	1 liter	1132	1132	1 liter	1132	1132		
Fungicide	33	27.42	904.86	33	27.42	904.86	33	27.42	904.86	33	27.42	904.86		
SUBTOTAL			5938.86			5938.86			5938.86			5938.86		
VARIABLE LABOR COSTS														
(Weeding, pruning, spraying)	208	40	8320	208	40	8320	208	40	8320	208	40	8320		
SUBTOTAL			8320			8320			8320			8320		
TOTAL COSTS			22458.86			14258.86			14258.86			14258.86		
GROSS MARGIN			-22458.9			-14258.9			60741.14			85741.14		
														109764.6

Source: Farm Management Handbook 1989, Agricultural Finance Corporation Farm Budgets

Mango  
 Variety: Locals  
 Area: 1 HA

	Quantity	First Year Unit Price	Total	Quantity	Second Year Unit Price	Total	Quantity	Third Year Unit Price	Total	Quantity	Fourth Year Unit Price	Total
TOTAL OUTPUT												
Grade 1 Fresh Export										700	14	9800
Grade 2 Domestic/Processing										300	3	900
GROSS VALUE												10700
ESTABLISHMENT COSTS												
Land preparation			2500									
Irrigation equipment			120000									
Planting materials	250	30	7500									
Fencing material			5000									
Labor	100	40	4000									
SUBTOTAL			139000									
VARIABLE PRODUCTION COSTS												
Manure	5000	0.71	3550	2500	0.71	1775	2500	0.71	1775	2500	0.71	1775
Fertilizer	40	16	640	60	16	960	100	16	1600	200	16	3200
Chemicals	0.5	320	160	1.5	320	480	3	320	960	4.5	320	1440
Fuel for water pump			1120			2200			2200			2200
Post-harvest treatment										1000	0.9	900
Hired machinery			1100			1150			1150			1150
Owned Machinery			700			700			700			700
Packing material										1000	0.4	400
SUBTOTAL			7270			7265			8385			11765
VARIABLE LABOR COSTS												
(Weeding, pruning, spraying)	62	40	2480	89	40	3560	135	40	5400	135	40	5400
SUBTOTAL			2480						5400			5400
TOTAL COSTS			148750			7265			13785			17165
GROSS MARGIN			-148750			-7265			-13785			-6465

Mangos (Cont.)												
	Fifth Year			Sixth Year			Seventh Year			Eighth to Tenth Year		
TOTAL OUTPUT	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total	Quantity	Unit Price	Total
Grade 1 Fresh Export												
Grade 2 Domestic/Processing	3500	14	49000	7000	14	98000	10500	14	147000	10500	14	147000
GROSS VALUE	1500	3	4500	3000	3	9000	4500	3	13500	4500	3	13500
			53500			107000			160500			160500
ESTABLISHMENT COSTS												
Land preparation												
Irrigation equipment												
Planting materials			1200			1200	1200	1200	1200	1200	1200	1200
Fencing material			1100			1100	1100	1100	1100	1100	1100	1100
Labor												
SUBTOTAL			2300			2300	2300	2300	2300	2300	2300	2300
VARIABLE PRODUCTION COSTS												
Manure												
Fertilizer		0.71	0	2500	0.71	1775	2500	0.71	1775	2500	0.71	1775
Chemicals	200	16	3200	200	16	3200	200	16	3200	200	16	3200
Fuel for water pump	6	320	1920	6	320	1920	6	320	1920	6	320	1920
Post-harvest treatment			2200			2200			2200			2200
Hired machinery	5000	0.9	4500	10000	0.9	9000	15000	0.9	13500	15000	0.9	13500
Owned Machinery			1150			1150			1150			1150
Packing material			700			700			700			700
SUBTOTAL	5000	0.4	2000	10000	0.4	4000	15000	0.4	6000	15000	0.4	6000
			15670			23945			30445			30445
VARIABLE LABOR COSTS (Weeding, pruning, spraying)												
SUBTOTAL	166	40	6640	186	40	7440	201	40	8040	241	40	9640
			5400			5400			5400			5400
TOTAL COSTS												
GROSS MARGIN			23370			31645			38145			38145
CUM. MARGIN			30130			75355			122355			122355
												418640