The National Master Plan for Agricultural Development in Suriname











March 2016









Citrus: Lime and Oranges

Business Plan



March 2016

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Abstract

Citrus is an important sector that presents a potential export market and addresses some of Suriname's internal issues such as development of southern districts, creation of jobs and import replacement. There is a need to upgrade quality, but the know-how and market partners are available.

The current citrus production in Suriname is estimated at 20,000 tons annually. Suriname imports 5,000 tons of dried or fresh citrus annually. On top of that, the processed industry imports pulps that travel from Brazil through Europe to Suriname. Therefore, there is room for reducing both fresh and processed citrus by producing them locally

One of the main limitations of citrus production in Suriname is the relatively low yield per hectare. Even in the most efficient regions, Para and Saramacca, the productivity is still less than 15 tons per hectare. Grapefruit production is concentrated in Commewijne. Orange production is mainly concentrated in Saramacca and Wanica. The plan is to increase the yield to 30-40 tons per Ha, and some of which will be ready to harvest much earlier in the season.

The first farm will include cultivation of up to 100 hectares, to be newly planted as follows:

50 hectares of two species of lime, Tahiti and Mexican, half of which will be grafted to Macrophylla and the other half to Rangpur (Cravo) lime. Lime is to be planted with spacing of 5 x 2.0 meters, which is 1,000 trees per hectare, in plots five meters wide, with one row in the center of each plot on a raised bed.

50 hectares of Valencia, Pera, Hamlin and Pineapple oranges are to be grafted onto Rangpur (Cravo) rootstock. Those are four good varieties for juice as well as for fresh consumption. Oranges are to be planted with spacing of 5 x 2.5 meters, which is 800 trees per hectare, on plots arranged similarly to those of the limes.

The plan includes investments related to the post-harvest handling: two packing houses which include offices, a pavilion, a sorting array room and a cold storage room, and a small locale processing unit is able to extract the juice of limes and oranges

Annual production is expected to be 4,000 tons, with 50% of that for export, 25% for the local consumer market and 25% for industry. The labor force will consist of 46 direct workers. The farm model requires a total investment of SRD 7.3 M in its first three years. The farm is evaluated at SRD 22 M, assuming tax free activity, with a period of return of six years.

The orchard will be used as a model for other areas. A number of parameters will be examined, such as specific species, appropriate rootstock, preparation of the land, and correct planting and care that will lead to a good yield and overall financial profitability of the orchard. Clearly, replication in other areas will be made with necessary changes, according to the differences in soil and water composition and other conditions.

Current Analysis

General Overview: Citrus

The Citrus sector holds great potential for the export market, and it addresses some of Suriname's internal issues such as development of southern districts, creation of jobs and import replacement. The development of this sector might considerably reduce costs of import. There is a need to upgrade quality, but the know-how and market partners are available. Table 1 shows the current citrus production in Suriname. The reported production is estimated at 20,000 tons annually. The calculation includes unreported local production.

Table 1 – Citrus, Current analysis

Table 1 – Citrus, Current analysis							
Citrus	Quantity (1,000 tons/year)	Value (1,000 SRD)	Price - SRD/Kg				
Local Production	25	64,000	2.6				
Import (fresh or dried)	5	8,205	1.6				
Export	0	0					
Consumption	30						

Prices: Local production is expressed in farm gate prices; imports are expressed in CIF prices. Source: ITC, LVV data, Processed with Ms. Sheila Aldjah

One of the main limitations of citrus production in Suriname is the relatively low yield per hectare. Figure 1 shows orange yields in different regions of Suriname. Even in the most efficient regions, Para and Saramacca, the productivity is still low compared to other countries.





Geographic Regions

Table 2 and Table 3 show that grapefruit production is concentrated in Commewijne. Orange production is mainly concentrated in Saramacca and Wanica which in 2012 represented 59% and 26% respectively of the total production in tons.

Table 2 – Citrus	Production:	Regional	Distribution	of Grapefruit	and Orang	e Cultivation,	ton 2	2012 –
Officially Report	ed Data							

<u>Ton 2012</u>	<u>Marowijne</u>	<u>Commewijne</u>	<u>Wanica</u>	<u>Para</u>	<u>Saramacca</u>	<u>Coronie</u>	<u>Nickerie</u>	<u>Total</u>
Grapefruit	0	1,051	421	11	18	0	0	1,501
	0%	70%	28%	1%	1%	0%	0%	100%
Oranges	9	1,752	3,809	235	8,565	54	0	14,425
	0%	12%	26%	2%	59%	0%	0%	100%
Total	9	2,803	4,230	246	8,583	54	0	15,926

Source: ITC, LVV data, Processed with Ms. Sheila Aldjah



Table 3 - Regional Distribution of Grapefruit and Orange Cultivation, Ha 2012 – Officially Reported Data

<u>Ha 2012</u>	Marowijne	Commewijne	<u>Wanica</u>	<u>Para</u>	<u>Saramacca</u>	<u>Coronie</u>	<u>Nickerie</u>	<u>Total</u>
Grapefruit	0	39	41	1	1	0	0	83
	0%	48%	50%	1%	1%	0%	0%	100%
Oranges	1	140	328	16	571	6	76	1,137
	5%	11%	53%	3%	20%	0	9%	100%
Total	1	179	369	17	572	6	76	1,220

Data Source: ITC, LVV data, Processed with Ms. Sheila Aldjah

Local Market

Figure shows the citrus production trend over the years. As can be seen, the average price rose between 2007 and 2012, except for pummelo. Local production has increased at a slow pace.



Figure 3 – Citrus Production and Citrus Farm Prices, 2007-2012

Most of the agricultural production in Suriname is currently marketed by farmers themselves and with the help of middlemen. The middlemen take a large portion of the revenue, leaving the individual farmer with too little. Middle man net margin is about 34% - see details in Table .

	SRD – Box	Kg - SRD	% of Revenue
Revenue at Farm Gate	40	1.3	50%
Transportation	0.2	0.01	0%
Sorting and Packing	1	0.03	1%
Losses	2	0.07	3%
Market Shopper Gross Margin	10	0.3	13%
Middle Man Net Margin	26.8	0.9	34%
Price to the End Consumer	80	2.7	100%

(Source: Own calculation)

Source: ITC, LVV data, processed with Ms. Sheila Aldjah

Figure **4**4 reinforces these findings and shows that the difference between farm prices and consumer prices had increased during 2007 to 2012.



Figure 4 – Oranges, Nominal Price – SRD/kg

Source: ITC, LVV data, Processed with Ms. Sheila Aldjah

The following tables show nominal prices for grapefruits, oranges, limes and mandarins from 2008 to 2013.

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Figure 5 – Grapefruit, Oranges, Limes and Tangerines, Nominal Price Index, 2008 = 100



Source: ITC, LVV data, Processed with Ms. Sheila Aldjah

There is a need to create more options for local production. Nowadays, local farmers are restricted to supply for local consumption. The price stabilization cannot happen without "buffers", which means other market channels such as export and citrus processing industry.

Imports

Suriname imports 5,000 tons of dried or fresh citrus annually. On top of that, the processed industry imports pulps that travel from Brazil through Europe to Suriname. Therefore, there is room for reducing both fresh and processed citrus by producing them locally.

Exports

Currently, citrus exports are almost nonexistent in Suriname. Table 5 shows import values in CARICOM during 2009 and 2012. Just in CARICOM, citrus imports form a

market that turns over 12M USD annually, and about 6% thereof remains within the CARICOM.



Table 5 - Caribbean Import Value - thousands USD

Draduct label	Caribbean Community (CARICOM)'s imports from Caribbean Community (CARICOM)		Caribbean Community (CARICOM)'s imports from world					
	Value in 2009	Value in 2010	Value in 2011	Value in 2012	Value in 2009	Value in 2010	Value in 2011	Value in 2012
Oranges, fresh or dried	611	602	346	604	3,610	3,567		3,727
Grapefruit, fresh or dried	54	28	23	46	633	673		719
Mandarins, clementines & citrus hybrids,								
fresh/dried	30	13	2	41	558	626		646
Fresh or dried lemons and limes	5	21	56	24	2,852	3,253		5,558
Lemons and limes, fresh or dried	20	11	3	15	67	84		156
Citrus fruits, fresh or								
dried,	0	0	0	3	19	7		16
Total	720	675	430	733	7,739	8,210		10,822

Barbados is the second biggest citrus importer country of CARICOM after the Bahamas.

The country is geographically close to Suriname– 629 nautical miles. Table **6**6 shows that Barbados imports about 2,400 tons of citrus annually.

Table 7 shows the value of oranges imported to the country. In 2013, it imported 1.3 M US dollars' worth, 67% from the United States and 28% from Jamaica.

Table 6 - Barbados - Fruit Imports, tons

Product label	2010	2011	2012	2013
Bananas and plantains, fresh or dried	3,674	3,574	4,109	3,833
Apples, pears and quinces, fresh	2,028	2,058	2,244	2,451
Citrus fruit, fresh or dried	<u>2,416</u>	<u>2,387</u>	<u>2,434</u>	<u>2,392</u>
Grapes, fresh or dried	1,269	1,391	1,617	1,571
Dates, figs, pineapples, mangoes, avocadoes, guavas	710	712	664	639
Melons (including watermelons) & papayas, fresh	906	899	630	528
Total	11,003	11,021	11,698	11,414

Table 7 – Supplying Markets for Oranges – Barbados, thousands USD

Exporters	Imported value in 2009	Imported value in 2010	Imported value in 2011	Imported value in 2012	Imported value in 2013
World	1,038	1,116	1,109	1,143	1,343
United States of America	587	594	702	622	894
Jamaica	388	480	319	456	375
Dominican Republic	52	34	77	55	44
Others	10	9	10	11	32
Total	2,075	2,233	2,217	2,287	2,688

Furthermore, Netherlands-Suriname relations can be a huge comparative advantage over other countries. Suriname has direct access to Netherlands, which means access to all of Europe. Suriname's products are able to arrive in France in 9 days and in Netherlands in about 11-12 days by shipping. As a result, many vegetables and fruits can be exported to Europe through this channel. Table 8 shows that during 2010-2013, Netherlands imported, on average, 1 million tons of citrus, of which 500 thousand tons were oranges. The data is limited to fresh or dried fruits – it does not include juice or other processed products.

Table 8 – Netherlands, Citrus Imports, tons

	2010	2011	2012	2013
Oranges	505,895	460,193	492,185	517,857
Mandarins	216,292	192,802	195,670	191,389
Grapefruit	176,193	172,812	169,848	172,356
Lemons and limes	153,892	132,788	153,992	155,106
Others	1,455	2,155	3,071	2,563
Citrus , Total	<u>1,053,726</u>	<u>960,751</u>	<u>1,014,767</u>	<u>1,039,270</u>

Source: ITC Calculations Based on UN COMTRADE Statistics

Nowadays, Suriname suffers from lack of export logistical facilities which are an obstacle to many farmers who could, otherwise, export their products to CARICOM countries. Currently, farmers must find their own creative logistic solutions to facilitate export. Meetings with several logistic companies show that there are viable solutions to tackle this bottleneck.

Industry

There are many small household fruit and vegetable processers. These processers produce from their home, use relatively simple facilities and often employ family members. They often supply stores under their own brand names. Although the production volumes are relatively low, fruit and vegetable processing on the household level creates jobs mainly for women and contributes to the family income. These products are sold to supermarkets in the local market or to the hospitality industry. The products include juices, coconut water, pickles, grated coconut and preserves.

Currently, processers do not rely on local production. As a result, they import Brazilian pulp that travels through Europe before arriving in Suriname.

Main Characteristics of the Household Processors

- Often have little capital to invest in equipment
- They purchase small quantities of inputs: fresh vegetables and fruits, ingredients and packaging

- As a result of their purchasing small quantities they face higher costs which makes it difficult for them to compete against products from the formal sector and imported products
- Have little access to credit facilities, lack collateral
- Little experience in quality control
- Product standardization is a big problem
- They often use market surpluses and seasonal availability of fruits and vegetables to process
- Appearance of the product is often not inviting
- Short shelf life due to insufficient knowledge of conservation techniques

Forecasts

According to estimates, in twenty years, citrus consumption in Suriname will increase from the current 30,000 tons to 35,000-40,000 tons per year. The rate of increase depends on three main factors: changes in consumption patterns, availability of quality products and natural demographic growth. Currently, Suriname has a relatively low consumption of citrus, and according to the consumption patterns in other developing countries, it is expected to increase in the next years. See details in Table 9.

Table 9 – Citrus	Consumption	in Suriname,	1,000 tons	per year
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Item	Consumption	Consumption -	Consumption –	Consumption per	Expected Consumption
	2013	Expectation 2035	Expectation 2035	capita , kg/year	per capita , kg/year 2035
		(a)	(b)	2013	
Citrus	30	35	40	53	60

(a) Consumption expectation 2035 takes into account just the population growth of 1.3% per year.(b) Consumption expectation 2035 takes into account both population growth and changes in the consumption patterns of the population. Consumption patterns are defined as shown in column (6)

Business Environment

The following are structural challenges to developing the food processing and export market:

Economies of Scale

- a. The small size of the farms does not allow economies of scale. This results in high fluctuations in fresh fruit and vegetable prices, discontinuity in quality and insufficient supply. Food processors are therefore inclined to use imported raw materials.
- b. Suriname's agriculture must develop export and industry channels. Nowadays, farmers are strongly dependent on the local market which reduces the incentive for modernization. In order to advance and become competitive in CARICOM, Suriname's agriculture needs economies of scale and focus on export markets.

Local Market

c. Examination of prices over recent years shows a gap of 50% between consumer price and the price at the farm gate. The middle-man layer does not function well. He takes the vast part of the revenue, and generally does not bring added value to the farmers.

Institutional Facilities

- d. Not enough research facilities, and especially implemented research
- e. Lack of a residual laboratory for export certifications.
- f. Extension services: The academic and practical know-how with respect to agricultural production is low, and lacks of interconnections with parallel bodies worldwide.
- g. The introduction of IPM (Integrated Pest Management) and biological controls is only beginning
- h. Farmers have too little contact with extension people.
- i. Lack of credit

Suriname Farmer's Fresh (SFF)

Based on the aforementioned analysis, the plan is to establish several licensed export companies in Suriname. Together they will hold the brand name of "Suriname Farmer's Fresh" (SFF) – a licensed company that will focus on the development of fresh products by enabling private farmers to increase productivity and quality, and by addressing the main bottlenecks that impede Suriname's agriculture development. In order to become an SFF, a company will have to show financial resources, and will have to commit itself to helping the farmers with extension services and temporary credit during the growing season.

Some of SFF's policies with respect to infrastructure improvements will be provided by matching grants. For example, the government will match every SRD invested in logistics, in export-oriented land transportation and in branding – by a ratio that will be determined.

Mission

SFF's mission is to handle basic infrastructure, export logistics, low-cost credit and branding. SFF will provide the necessary structure to develop a cooperative of efficient and modern farmers that will supply fresh products to the local market, to other CARICOM countries and to Europe, and to the local developing industry.

Vision

SFF aims to become an international brand for Suriname's fresh products by exporting its products to CARICOM and to European markets.

Operation

SFF will provide farmers with instructions on land preparation, on growing techniques and on standard packaging. The farmers that decide to join and commercialize their products through the company are required to accept the instructions and protocols of the company.

One of SFF's main objectives is to guarantee uniformity and continuity in the production process. That is the key to reaching specific export markets that demand weekly regular shipping. As a result, SFF's instructions will be based on the Business Plan for Citrus: Lime and Oranges 17

requirement of product standardization, use of high-yield varieties, employment at above-average wages and implementation of modern techniques.

The farmer who wants to join SFF will be offered two options of contracts:

- 1) Net profit of the sale after calculating the costs of SFF
- 2) Farm-gate price pre-established by SFF

Market Goals

SFF's production goals:

- Import substitution
- Increased exports to Caribbean countries
- Increased exports to Europe mainly through Holland
- Marketing to the developing food processing industry

The plan is to achieve these objectives gradually, i.e., at the beginning SFF will target local market and Caribbean countries. After becoming an established player, the company will shift its focus towards exporting to Europe and developing the food processing industry.

Farm Model

This Business Plan provides a farm model for citrus. The proposal is that SFF, besides providing the previously-described services, will operate its own farm that will serve as a model.

The model farm has 100 hectares divided as follows: 50 hectares of oranges and 50 hectares of lime. Since the orchards are mature, there is a need to replace them with new ones, as will be explained in the Project Overview.

The plan is to have alternative species in order to deal with price volatilities in the international market. The model represents just the beginning; being modular, it can be reproduced according to SFF's development. The plan is to create other farms based on this model according to the accomplishment of SFF's aforementioned objectives.

Project Overview

The model farm will be built in such a way that it can be adapted to other locations and easily shifted to accommodate different varieties of citrus just by changing its operational assumptions. The original plan focuses on two different kinds of citrus fruits: oranges and limes. In the last years, the lime market has increased and, as a result, market prices are currently very high. The orange market, on the other hand, has not presented stable prices in recent years.

Since citrus fruits are long-term investments, the model is based on alternative orchards which aim to reduce the risks associated with market price volatilities and diseases. Both limes and oranges are also divided into different species, as will be shown in the next section.

Farm Model Optional Location

The farm at Alliance sprawls over 2,200 hectares in the northeast of Suriname, in the district of Commewijne. The farm is on the bank of a river and accessible from Paramaribo only by a trip over land of about an hour and then another hour by boat. From the aforementioned plot, the net area that is theoretically suitable for planting is about 1,500 hectares. The rest is essentially flooded swampland. From the 1,500

hectares, about 600 were drained and improved in the past but have since been neglected, and only 100 hectares of that area are accessible for immediate cultivation. The soil is mostly clay-like with a few narrow sandy veins, and acidic with a PH of between 3.5 to 5, and there is fresh water available.



Figure 6 - Reconnaissance soil map of Northern Suriname (1: 100 000), Alliance Farm

Figure 7 – Alliance Map



Currently 97 hectares of the farm are actively cultivated, out of which 95 are planted with different varieties of citrus. There is a mature 82-hectare orchard which is in an abandoned state, in which are planted mainly oranges of two local types across 56 hectares. There are also 7.5 hectares of recently-planted oranges. In addition there are about 25 hectares of grapefruit planted in 1978, as well as another hectare and a half of young grapefruits. There are also three hectares of Orlando Tangelos and one and a half hectares of mandarin oranges of an undetermined variety. Table 10 summarizes this information.

All of the above is grown on Mandarina Cleopatra rootstock, which is the plant most widely used in the area but which is not appropriate to the soil conditions and climate, nor to the intensive cultivation needed for the area.

The mature orchard, which is more than 35 years old, gives a yield of four tons per hectare and needs to be uprooted and replaced immediately. The young orchard is also planted with undesirable methods, spacing, and varieties, and these trees are also grafted on the objectionable Cleopatra rootstock. They will need to be replaced according to the plan to be described as follows.

Сгор	Acreage (ha)	Plant year	Age in 2013 (years)
Orange	56	1977/1978	36/35
Orange	1	2010	21/2
Orange	41/2	2013	
Orange	2	2013	1/4
Grape fruit	26	1978	35
Mandarijn	1½	2012	1/2
Pompelmoes	11/2	1995	18
Tangelo	3	1995	18
Bananas	0.8	2012	1/2
Sugar bacove	1/2	2012	1/2
Total planted acreage	96.8		

Table 10 – Alliance, Current Crops, plant year and age

Source: Project Paper Rehabilitation and Restructuring of Alliance, by ProPlan

Consultancy

For more land and soil details about the Alliance farm, see the ppt file: "presentatie 20141114".

Figures 8 and 9: Citrus in Alliance – Trees and Nursery



Figures 10 and 11: Citrus Orchards in Alliance I



Figures 12 and 13: Citrus Orchards in Alliance II





Figures 14 and 15: Citrus Orchards in Alliance III





Execution Plan

The intention is to plant a new orchard that will be used as a model for other areas. A number of parameters will be examined, such as specific species, appropriate rootstock, preparation of the land, and correct planting and care that will lead to a good yield and overall financial profitability of the orchard. Clearly, replication in other areas will be made with necessary changes, according to the differences in soil and water composition and other conditions.

The first process to be initiated immediately is the replacement of all existing citrus and cultivation of up to 100 hectares, to be newly planted as follows: 50 hectares of two species of lime, Tahiti and Mexican, half of which will be grafted to Macrophylla and the other half to Rangpur (Cravo) lime; and 50 hectares of Valencia, Pera, Hamlin and Pineapple oranges to be grafted on Rangpur (Cravo) rootstock.

Limes: The rationale behind this choice is that Tahiti & Mexican Limes are the two types of limes grown and marketed all over the world. Tahiti lime is a slightly less acidic and less juicy , but keeps green longer on the tree, which allows it to be can picked selectively for size and color and shipped fresh to the local or export market. The markets in Europe & North America like these limes "stone" green as they call them and already juicy & ripe. They are used this way in gin & tonic, on fish and on salads and they are very popular in the market.

The Mexican lime is quite similar and higher in acidity, used locally in Mexico with Savitsa food, and in South America in general (Mexico, Brazil, etc.) for cooking, for preparing the "Caipirinha" drink, etc. The Mexican lime is a little better than the Tahiti for processing & byproducts. Its higher acidity, additional juice, essential oil and pectin, are all important for the processing industry.

Oranges: 50 hectares of Valencia, Pera, Hamlin and Pineapple oranges are to be grafted on Rangpur (Cravo) rootstock. Those four varieties are good for juice and also for fresh consumption. Hamlin and Pineapple mature earlier in the season, Pera is a midseason orange, and a main one for processing, and Valencia matures later. As a result, this specific choice will enable the picking, marketing and processing to be spread over a longer period. Valencia well as Pineapple might be better than the others to be eaten fresh, while Pera and Hamlin are better for juice. Pera is the main variety grown in Brazil for juice, but it is sold also fresh for immediate consumption in local markets all over. Hamlin is the main variety grown for juice in Florida and it is therefore recommended since the U.S. market is a huge and potential target.

The Alliance plantation is intended to be a test case, and as such and the plan is to try new varieties and rootstocks there as much as possible. Another recommendation is to try a small plot of Navel oranges, of early and late varieties.

It is additionally recommended to arrange a research program with the university which in order to plan experimental plots and evaluate them.



OUR LIMES

<u>PERSIAN, TAHITI OR</u> <u>BEARSS LIME</u> (Citrus latifolia)

Persian limes are thought possibly to have been introduced to the USA through San Francisco from Tahiti some time between 1850 and 1880. Despite its name this variety is not grown now in either Tahiti nor for that matter in what was formerly Persia (Iran).

Although believed to be a hybrid between the small acid lime and possibly the citron, its true origin is obscure, having probably come from the Orient by way of Persia, the Mediterranean, then possibly via Brazil and Australia (where it was reported to have grown as early as 1824), thence to Tahiti and finally to California in the second half of the 19th century. To complicate this history further, the Persian lime is not known by that name in California but is referred to as the Bearss lime. The Bearss, Persian and Tahiti limes are the same variety.

While Persian lime trees are larger than the West Indian type, in Florida they are usually pruned several times a year to restrict their height to around 3 m, but left unpruned reach twice that size in Mexico. Unlike the West Indian lime they are nearly thornless and have larger, darker green leaves. They are also far more resistant to cold but are somewhat more sensitive than the lemon.

In Florida it was common for Persian limes to be propagated as marcots or air layers because it was cheaper than using budded trees, and they came into bearing after just one to one and a half years rather than a year later. However, own-rooted trees proved highly susceptible to Hurricane Andrew in August 1992 due to their shallow root system and many more were destroyed compared with budded trees. Today the majority are propagated on either



PERSIAN LIME (LEFT) WEST INDIAN LIME (RIGHT) The Persian lime is seedless and larger than the West Indian variety

macrophylla or rough lemon rootstocks. In Mexico citrange rootstocks are also recommended but growers have ignored this advice as they have for oranges and grapefruit and continue to bud around 90 per cent of their trees on sour orange, which puts the entire nation's citrus crop at risk from citrus tristeza virus.

Fruits of the Persian lime, particularly the smaller ones, may often be mistaken for those of West Indian lime since externally they are virtually indistinguishable; moreover, both may sometimes be mistaken for small immature lemons.

It was for this latter reason that Persian limes were and still are picked and marketed when dark green in colour since the fully mature fruit is greenish-yellow or pale yellow, like the West Indian lime. The rind is very thin with the distinctive but less pungent rind oil aroma than the West Indian variety. Persian limes are susceptible to citrus scab. If left on the tree until past peak maturity the fruit is yellow and unsaleable, and tends to develop a rind breakdown problem at the stylar-end.

Since the Persian lime is a triploid and produces no viable pollen, the fruit is almost always completely seedless. The greenish-yellow flesh is very juicy and extremely acid.

Persian limes have been grown in Mexico for less than 25 years but today they account for an estimated 20 per cent (or 180,000 tons) of the total lime crop. Harvested year-round with a peak period from May to September, they are grown principally for the export markets in North America, Europe and Japan. Of the two types of lime it is not the preferred variety on the local market where in times of undersupply the Mexican lime can command a high premium.

Florida's production has recovered from the 1992 hurricane and now covers an estimated 1,500 ha (albeit down from 2,500 ha), producing 17,500 tons in 1997–8, 75 per cent of which was sold fresh. The California crop is on a much smaller scale produced in the San Diego area on around 300 ha. With average per capita consumption of fresh limes in North America around 0.75 kg per annum, domestic US production accounts for only a minority share of the market, the balance being almost exclusively imported from Mexico.

Fresh lime exports to Europe originate primarily from Mexico and Brazil, although small consignments are occasionally sent from Florida, Israel, Guatemala, Belize, Honduras and Venezuela. In Australia production is increasing and is limited to the eastern coastal areas since most inland areas present a marked frost hazard. Much of the fruit is used fresh and is regarded as being unsuitable for lime cordial products.

W<u>est</u> Indian, M<u>exican or Key</u> Lime

(Kagzi nimboo, Limun beladi, Limão galego, Lima)

(Citrus aurantifolia)

This lime is often referred to as the true lime as well as by the three names above. Originating in the Malaysian region of south-west Asia, it has been cultivated in many countries worldwide where climatic conditions permit its growth. Although at one time the Key lime was grown in the Florida Keys, less than 10 ha remain in production today and Persian lime has long been the preferred variety in the USA.

The tree is fairly vigorous and of medium size and somewhat bushy growth habit, with slender branches covered with many small thorns. The leaves are small, pale green in colour and bluntpointed, while the tree as a whole is extremely sensitive to cold: far more so than the Persian lime.

It has long been commonplace to propagate West Indian limes from seed, especially in India and Egypt. This is, however, no longer so in Mexico where it is now the practice to bud them on sour orange rootstock with the associated risk – shared with other citrus in the region – from citrus tristeza virus to which this variety is extremely susceptible. Some different varieties have been selected, such as the Giant Key with fruit almost twice the size of the Key lime, but most (which form the majority of world production) are indistinguishable. The fruit is small, roundish in shape with a small nipple and a very slight neck. The rind has a smooth texture and is extremely thin, and the rind oil has the distinct pungent aroma which typifies both the West Indian and Persian limes.

When the fruit is allowed to mature on the tree the rind is greenish-yellow or yellow, but it is often harvested earlier while still dark green in colour. The flesh is a light greenish-yellow, tender when fully mature and very juicy, but sometimes less so when harvested earlier. It is highly acid, having as high, and sometimes higher, citric acid levels as lemons.Whereas Persian limes are seedless, the West Indian variety can sometimes be very seedy, often with 15 or more seeds per fruit.

In tropical areas, West Indian lime will flower throughout the year depending upon rainfall distribution but in the sub-tropics it bears one crop which usually matures in late summer and is overmature by mid-winter. When West Indian limes are allowed to become overmature on the tree, the fruit soon drops on the ground thereafter.

Key lime production in Mexico only began to assume importance in the 1920s but today it leads world production with an estimated 800,000 tons per annum, most of which is grown under irrigation in the west coast states of Colima, Michoacan, Guerrero and Oaxaca and to a far lesser extent in Tamaulipas on the Gulf of Mexico. The lime trees are often in mixed plantations with coconut palms, mangoes or papayas. Some of Mexico's tonnage is processed, but more than 85 per cent is sold on the local fresh market and some exported to the USA. Mexican consumption of fresh limes averages a world's high of over 6 kg per capita per year, enjoyed with most meals in much the same way lemons are in Mediterranean countries.

Much of the West Indies' production is processed, most by a method which results in a distinctive form of lime juice greatly appreciated by the British. The whole fruit is crushed with rollers and, after screening, the juice is held for periods up



WEST INDIAN LIMES These turn yellow when fully mature but are most often harvested when they are still green

to 30 days. Normal fermentation is inhibited by the high acidity, low sugar content and the presence of peel oil. The juice is later drawn off from the residue. It has a distinct musty aroma quite different from that of freshly squeezed lime juice or processed juice sold in the USA and Canada.

In Peru lime production is increasing at a fast rate with an annual crop in excess of 250,000 tons, much of which is processed. Peru supplies an estimated 20 per cent of world lime oil production.

In Brazil, where it is known as the Galego lime, approximately 300,000 tons are produced annually, most of which are sold fresh on the local market with less than 1 per cent being processed. They are not exported fresh on any scale; lime exports to Europe are of the Persian type.

In Iran (formerly Persia) only the West Indian variety is grown, and is known locally as Shirazi or Torsh (meaning acid); it is grown mainly near Fars in the Shiraz region and in the south in Bandar Abbas. to around 5 per cent of nursery trees in the last ten years. Although it is recommended only for Valencias it has been an acceptable rootstock for Midsweet but not with Hamlin orange. In Arizona, lemons are budded on Volkameriana but on a lesser scale than the main rootstock rough lemon. There is limited use in Israel where Volkamer lemon is restricted to new lemons and Valencia plantings, while in South Africa its importance has declined from around 20 per cent a decade ago to below 5 per cent at present. In Spain, where Volkameriana accounts for under 5 per cent, its main shortcoming is its lack of uniform tree size in the orchards.

<u>ALEMOW OR</u> <u>MACROPHYLLA</u> (Citrus macrophylla)

Alemow (more commonly referred to as macrophylla) is thought to be a hybrid of citron and pummelo originating on the island of Cebu, Philippine Islands. While trees on this rootstock are vigorous



ALEMOW OR MACROPHYLLA Probably a hybrid of citron and pummelo

they are most noticeably precocious, having outstanding productivity from an early age. They are very tolerant of high soil levels of chloride, calcium and boron, but often show magnesium deficiency.

It has some serious limitations: sensitivity to cold, susceptibility to blight and no tolerance to nematodes. It also produces trees which tend to lean to one side.

Trees on Alemow are susceptible to tristeza and xyloporosis. With the exception of lemons, the internal quality of most varieties is poor on macrophylla rootstock.

In Spain and California, two of the world's principal lemon producers, macrophylla has become a very popular rootstock. Around 75 per cent of new Spanish lemon plantings are on macrophylla and it seems to be particularly well suited to Eureka since it increases yield and early bearing and produces larger fruit of finer rind texture than on sour orange. The Fino (Primofiori) variety yields are also increased but maturity is also advanced, which is a disadvantage; and increased fruit size and cold susceptibility of the Verna are serious adverse characteristics.

Alemow is not recommended for Eureka lemons in Australia, while in California this same combination which was once a popular choice in coastal districts is no longer used because rootstock sieve tube necrosis makes the trees short-lived.

Macrophylla was widely used in Arizona as a lemon rootstock until around ten years ago. It produced precocious trees which were highly productive with large size. However, its popularity has declined due mainly to a problem with desert lemons known as brown heartwood rot (or macrophylla disease). Today, principally rough lemon and to a lesser extent Volkamer lemon are used.



RANGPUR Much of Brazil's orange crop is grown on Rangpur

developed root system, they have good droughttolerance and are tolerant of calcareous soil conditions as well as tristeza. However, Rangpur is susceptible to exocortis and xyloporosis and is phytophthora-sensitive although its susceptibility to foot rot in Brazil is not a limiting factor.

Like rough lemon, Rangpur is blight-susceptible which is a very serious problem among commercial orange trees in Brazil. Since much of Brazil's enormous orange crop is still grown on Rangpur (known locally as Limâo Cravo) it is extremely vulnerable to declino (blight). There is considerable interest in Brazil in the possibility of replacing Rangpur with the more blight-tolerant Sunki mandarin. Rangpur is of some minor importance in Argentina and India where it originated.

Two Rangpur variants grown for their fruit and as an ornamental respectively are:

Kusaie This is a yellow-fruited form otherwise indistinguishable from Rangpur, known in Hawaii as Kusaie lime where it is reported to be a useful fruit.

Otaheite This is a semi-dwarf, acidless form first grown in the UK in 1813 as a potted ornamental and is now a popular conservatory plant in the USA. It is almost thornless and has attractive purple-coloured new shoots.

RANGPUR

(Citrus limonia)

Not related to the Mexican lime (*C. aurantifolia*) nor the Persian lime (*C. latifolia*), Rangpur (sometimes referred to as Rangpur lime) is probably a hybrid acid mandarin with either the rough lemon or sour orange involved in the parentage.

Trees on Rangpur have vigour similar to those on rough lemon and are just as productive. Fruit size is large and only slightly smaller than that from trees on rough lemon but it is of better quality, although considered to be only medium and lower than fruit from trees on citranges and sour orange.

Trees on Rangpur start to bear early and excel in salt-tolerance but do not tolerate either citrus or burrowing nematodes. They have the same lack of cold-hardiness as rough lemon. Due to their well-

HAMLIN

Arising as a chance seedling in 1879 near De Land, Florida, and named by the owner A. G. Hamlin a few years later, Hamlin was developed on a large scale in its native Florida and to a limited extent elsewhere worldwide. It is Florida's leading early orange variety and continues to be very popular with growers, accounting for around 25 per cent of the state's recent orange plantings compared with Valencia's 65 per cent.

The tree is moderately vigorous, developing medium to large size when fully grown, and it is one of the more cold-tolerant orange varieties. It is productive but fruit size is small, sometimes too small for the fresh fruit market. It develops early colour, maturing at almost the same time as Washington navel. This earliness is a decided advantage in Florida where there is a threat of winter freezes. However, if need be Hamlin, like Pineapple, can be left to hang on the tree quite successfully until late February.



HAMLIN Florida's most important early orange

The fruit has a tendency to split and in Brazil it drops from the tree if left on too long. In semi-tropical areas such as Brazil and Florida, the rind is smooth, thin and pale orange in colour, whereas in Morocco and Turkey peel thickness is moderate with a slightly pebbly texture, and colour develops well to deep orange.

Hamlin fruit is not difficult to peel, the flavour is sweet but not especially rich and juice content is high, with only an occasional seed. The juice of much of Florida's Hamlin crop is pale in colour which necessitates its being blended with that of better quality, later maturing varieties.

Hamlins make up about 5 per cent of Brazil's production, much of which is sold fresh. The Hamlin from Morocco is of good quality but there, as in South Africa, its small size precludes its continued long-term production, especially when in competition with better quality navel oranges of the preferred sizes. Grown on a limited scale in Corrientes Province, Argentina, most of the Hamlin crop is processed.

Fairly recently, Hamlin has become increasingly important in China and is now the tenth most popular orange variety. It is clearly well suited to the climatic conditions in many of the country's citrusproducing regions which are not unlike those in

PERA

The origin of this important Brazilian variety is unknown but believed by some authorities to be the same as Lamb's Summer of Florida, a variety regarded there as being virtually indistinguishable from Valencia but which never attained much significance.

Pera trees are vigorous, upright in habit, large and very productive. Fruit is smaller than the Valencia and ripens earlier, being regarded as a late midseason. It is harvested from June to October in Sao Paulo State but some fruit is often exported several weeks earlier before attaining full maturity.

Slightly oval in shape, with a smooth thin rind that adheres fairly tightly but is not too difficult to peel, Pera is pale orange both externally and internally, although this colour does improve later in the season. Pera fruit does not have the same sugar content as Valencia and the acidity is usually low, making for a somewhat sweet but insipid flavour lacking in richness. Like the Valencia grown in Sao Paulo State, it has a high juice content but when eaten it is rather tough and raggy. It is moderately seedy with five to ten seeds per fruit. However, on account of its exceptional productivity, Pera is well suited to the processing industry of Brazil.

The Pera is inclined to uneven flowering, which leads to fruit of differing maturity being borne on the tree at the same time, a condition further aggravated when it is grown without irrigation.

An appreciation of the importance of the Pera in Brazil may be gained from the fact that well over 50 per cent of Brazil's massive 16 million ton orange crop is derived from this variety. It is not grown outside Brazil.





PERA Brazil's most important orange variety

PINEAPPLE Florida's leading midseason orange

was shaped like a pineapple, others said the fruit resembled a pineapple in either smell or flavour.

The Pineapple tree has moderate vigour, medium to large size and is very productive. However, it has a tendency to alternate-bearing, and when carrying a heavy crop during midwinter the tree is particularly susceptible to cold damage. The fruit is also very susceptible to preharvest drop. Also, occasionally the peel disorder, Pineapple-pitting, occurs on heavy bearing crops.

The fruit is medium in size, almost round in shape, and has a fairly smooth, thin rind which attains good colour – better than Parson Brown – when fully mature. In Florida it is at its best in January and February. The juice content is high, with good colour and a fine, very sweet and rich flavour. However, it is even more seedy than Parson Brown, regularly having 20 or more seeds per fruit.

Grown in Florida primarily for its fine juice processing characteristics, it remains the most important midseason variety but its position is now being challenged by the Midsweet variety. Pineapple was also planted to a very small extent in South Africa (and Brazil) for the fresh fruit export trade, but the excessive seediness brought about its discontinuance many years ago.





VALENCIA A well-coloured variety when produced in a sub-tropical climate

VALENCIA In tropical regions such as Cuba the rind is poorly coloured and the flesh and juice are pale orange

season without losing quality except that the rind may regreen somewhat while still on the tree. Moreover, the later it is picked, the smaller the next year's crop because of the 'two crops on the tree at one time' phenomenon.

In tropical regions, the rind, like that of other citrus varieties, never attains good colour and is often greenish, extremely thin and tightly adhering while the flesh and juice are a paler orange than that of Valencia fruit produced in sub-tropical Mediterranean climates.Valencia juice has excellent processing characteristics, including a deep orange colour, and the fruit ships and stores exceptionally well.

There are several clones of the Valencia, some of which have been given separate variety names. The most common improved selections are all thought to be nucellar in origin, having the following characteristics:

Cutter Trees are more vigorous, larger and more thorny than the standard Valencia as well as being somewhat slower to come into bearing but are more productive. The fruit is indistinguishable from other Valencias but has the distinct advantage of producing fewer fruit chimeras.

Frost Grown as a nucellar seedling in 1915 by H.B. Frost at the Citrus Research Center, Riverside, California, and released in 1952, this selection has exceptional vigour and is highly productive, but fruit quality is very similar to old budline Valencia.

Hughes This is the most popular Valencia selection in Florida, accounting for 50 per cent of new plantings. It originated from an open pollinated seedling on the Hughes Grove near Plymouth in Orange County and was released in 1960. All Hughes budlines are more cold-hardy than old lines and have better productivity.

Olinda Originating as a seedling on O. Smith's property at Olinda, California, in 1939 and released in 1957, it is indistinguishable from Frost except the fruit has a tendency to produce more chimeras, i.e. fruit which is ribbed or has variegated rind.

Rohde Red This selection was found by P. E. Rohde as a limb sport near Sebring, Florida, and named in 1955. Since its release in 1983 it has been of increasing interest to Florida Valencia growers as a way of significantly enhancing juice colour scores which are typically increased from 38 for standard Valencia to 40 for Rohde Red.

Planting

Lime is to be planted with spacing of 5 x 2.0 meters, which is 1,000 trees per hectare, in plots five meters wide, with one row in the center of each plot on a raised bed. That is, it will be necessary to prepare the land with channels at a distance of five meters apart. Oranges are to be planted with spacing of 5 x 2.5 meters, which is 800 trees per hectare, on plots arranged similarly to those of the limes.

Since the orchards are already old, they demand replacement. The costs of replacements are expressed in the next section that considers the costs of cleaning and levelling the land. One of the reasons to have more trees per hectare is to increase the crop yield from less than 10 tons per hectare to 30 or 40, and to have fruit ready to harvest much earlier in the season.



Investments

The farm model requires a total investment of SRD 7.3 M in its first three years. The first steps: cleaning, levelling and drainage are based on a cost of SRD 2,373 per Ha (USD 700), since the model is based on already-cleared area, previously used for agriculture.

For details about the drip irrigation system calculation, see Table 12. The costs of drip irrigation pipes are based on the distance between the trees – for example, 5 x 2.5m as described in the last sections.

Planting costs include both importing the seeds and the nursery operations in Suriname. Other investments include buying farming tools (plows, harvest forks, disk plates, others) estimated at SRD 34,000; two tractors that cost SRD 169,500 each and two pick-up trucks at SRD 135,600 each. In the model, the prices are expressed in SRD assuming an exchange rate of 3.39.

The model includes investments related to the post-harvest handling: two packing houses which include offices, a pavilion, a sorting array room and a cold storage room. Since citrus trees may yield their first fruit in their second year of growth, there are some investments such as cold storage, packing house and sorting array that are not necessary at the beginning of the project. They cost SRD 101,700 and SRD 34,000, respectively.

The processing unit is able to extract the juice of limes and oranges. It costs SRD 678,000 and is based on the model referenced in the Project Paper for Rehabilitation and Restructuring of Alliance, by ProPlan Consultancy.

Cold storage demands an investment of SRD 67,800, which is the price of a new cold storage unit (50m²) imported from Miami, including transportation costs.

	Dep. Years*	Price -SRD	Year 0	Year 1	Year 2	Year 3
Cleaning / Ha	10	2,373	1			
Levelling and Drainage / Ha	10	15,255	1			
Lime: Planting / Unit	20	33	1,000			
Oranges: Planting / Unit	20	33	800			
Distribution Pipes / Ha	5	1,700	1			
Drip Irrigation pipes / Ha	5	2,517	1			
Head of Irrigation System and other irrigation items	5	15,191	2			
Farming Tools (plows, harvest forks, disk plates, others)	7	33,900	2			
Tractor	5	169,500	2			
Pick-up Truck (2 ton)	5	135,600	2			
Packing House	10	101,700			2	
Sorting Array	10	33,900			2	
ATV	5	33,900	2			
Car	5	101,700	1			
Offices / Residence of Director	10	237,300	1			
Spraying Equipment	5	6,780	2			
Fruit Juice Extractor – for both lime and orange	10	678,000				1
Nursery	10	93,225	1			
Cold Storage	10	67,800			1	
Total (for 100 Ha)	SRD	7,325,675				

Table 11 - Investments	, price	(SRD)	and	quantity
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It should be emphasized that the project does not include investments in some buildings (e.g. shed / workshop and living quarters for workers) and some machinery (e.g.: excavator) since it assumes that the project will be set up on Alliance where this infrastructure already exists. The last section presents an analysis that checks the results of including these investments.

^{*}Depreciation years are just for accountability purposes.

Item description	# of Items	Item price	total price	comments
Drip line 16mm every 20cm 1l/h 4	2200.00	0.27	594.00	2200m per acre drip lines (5-8 years) = 5500 per hectare
bar 2200m	22 00	0.28	6 16	100m per H/C
Head-connectors for tape type	100.00	0.20	0.10	
Connectors 16mm for tape type	100.00	0.20	20.00	
Irrigation head for fertilizer control	1.00	1.00	1.00	
Fittings to connect component	300.00	1.00	300.00	
Bell valve 3" bronze	2.00	45.00	90.00	
Filter 3" automatic flash	1200.00	1.00	1200.00	
Fertilizer injector Amiad	600.00	1.00	600.00	
P"E pipe 75mm 4 bar	50.00	3.08	154.00	mail line
P"E pipe 50mm	30.00	1.00	30.00	
Fittings + 3 -2" valves /acre	1.00	80.00	80.00	sub main valve
				if electricity available if not use generator or diesel
q/m/h including panel	1.00	800.00	800.00	pump
Foot valve + 4" pipe suction 20m	1.00	200.00	200.00	
Pump house	1.00	1000.00	1000.00	from local wood + galvanize

Table 12 – Item list for drip irrigation – 1 acre

Assumptions regarding equipment maintenance, renewal and upgrade are described in the next table.

Equipment renewal and upgrade includes the follow investments: Distribution pipes, drip irrigation pipes, head of irrigation system, farming tools, tractors, pick-ups, packing houses, sorting arrays, ATV's, offices and spraying equipment.

Equipment maintenance includes all the aforementioned investments, except for distribution pipes, drip irrigation pipes and head of irrigation system, since maintenance of these items is already included in the operational costs.

Table 13: Maintenance	and	Upgrade	Costs
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Maintonanco and Ungrado:	Start	from	
Maintenance and opgrade.	year		% per year
Equipment Maintenance	3		5%
Equipment Renewal and			
Upgrade	3		10%

Operational Assumptions

The operational assumptions of the model are described in this section. All model assumptions can be changed in the Excel file which allows adjustments to the model according to government/market priorities with respect to locations, crop prices and other financial, operational or business environment changes. The farm model is composed of two main crops: oranges and limes. Table 14 presents the main operational structure of the farm.

	Annual Production, tons	Export : Annual production, tons	Local Market: Annual Production, tons	Processing: Annual Production, tons	Full Time Employees (FTE)/ year	Farm Size - Ha
Limes	1,750	875	438	438	23	50
Oranges	2,250	1,125	563	563	23	50
Total	4,000	2,000	1,000	1,000	46	100

Table 14 – Operational Structure, tons and FTE's – From year 6 to 20

Annual production will affect the local market, since it represents a significant part of the lime's market share in the country. For oranges, the impact on the market will be lower. As a result, the model assumes that prices of limes and oranges will both decrease annually in the local market. Lime prices start decreasing by 5% annually from year 3, and orange prices start decreasing by 5% annually from year 7, since the orange market share is less affected by local production.

Regarding exports, the model keeps the prices stable since the quantity exported does not impact the markets. Citrus has an advantage over vegetables because it endures storage and shipping for some weeks.

The assumption is that at the end of the maturation period, one hectare of lime will provide 35 tons annually on average and one hectare of oranges will provide about 45 tons annually on average. At year 6 onwards, 50% of total production will be exported, 25% will be consumed in the local market and 25% will be used for processing.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 to 20
Lime	0	0	0.5	3	10	25	35
Orange	0	0	0	5	15	35	45
Export quantity, %							
Lime	0%	0%	0%	50%	50%	50%	50%
Orange	0%	0%	0%	0%	50%	50%	50%
Local Market, %							
Lime	0%	0%	100%	50%	50%	25%	25%
Orange	0%	0%	0%	100%	50%	25%	25%
Processing, %							
Lime	0	0	0%	0%	0%	25%	25%
Orange	0	0	0%	0%	0%	25%	25%

Table 15: Quantity, tons per year per Ha

The following tables summarize all the operational assumptions used to calculate the direct costs of production. The mechanization costs include fuel costs and specialized work: trimming, spraying by tractor, harvest mechanization and crushing trimmings. Fertilizers and growth products includes NPK (nitrogen, phosphorus and potassium). Limestone is used to raise the pH level of the soil. Most crops and plants grow best in soil that has a pH between 6 and 7, which is slightly acidic or neutral. According to the soil analysis in Alliance, the addition of limestone is recommended. The model assumes a need to add about 1 ton per Ha per year. Each ton costs SRD 593 (including transportation costs).

Table 16: Technical A	ssumptions
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	Per Ha	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 to 20
Mechanization	SRD	1,880	1,880	2,350	2,870	4,010	5,470
Fertilizers and Growth Products	SRD	1,350	1,840	2,260	4,700	6,170	6,500
Limestone	SRD	593	593		593		593
Herbicides	SRD	220	220	440	410	380	380
Pesticides	SRD	1,590	1,410	1,980	2,210	3,250	3,430

Plastic mulch will be used only during the planting period. Irrigation was calculated based on energy costs related to the water pump. The assumption is that apart from the energy, water is cost-free.

F		
	Per Ha	SRD
Irrigation: Maintenance	SRD	400
Plastic Mulch (once before planting)	SRD	2,737
Packaging Material (per Kg)	SRD	0.30
Post-Harvest Handling (per Kg)	SRD	0.25
Refrigeration for Export and Local Market (per Kg)	SRD	0.50
Water (m ³)	SRD	0.34

Table 17: Materials and Other Services

The model assumes that there is one field worker per four hectares; one field production foreman, one mechanic and one administrator for every 50 hectares. It is assumed that daily workers will complete the sorting, packing and processing during the harvest periods. An irrigation specialist is assumed to work on average 20 days annually.

Workers		SRD	FTE 100 Ha	per
Field Workers	Month	2,200	25	
Field Production Foreman	Month	2,900	2	
Mechanics	Month	2,900	2	
Administrators	Month	2,900	2	
Operational Workers	Month	2,800	5	
Head of Processing Unit	Month	5,000		
Daily Workers: Irrigation Specialist	Day	270		
Sorting, Packing and Processing Workers				
Daily Workers: Sorting and Packing: 2.5 tons/day	Day	100		
Daily Workers: Processing , 5 tons/day	Day	100		

Table 18: Variable Employee Costs

The next table shows the permanent employees of the farm and their monthly salaries. The salaries already include social benefits.

Table 19: Permanent Employees

	Unit	SRD
Executive Manager	Month	10,000
Secretary	Month	1,800
Housekeeping / General Service (3 workers)	Month	2,000
Head Marketing	Month	4,100
General Manager	Month	11,200

General and Administrative Expenses

Professional consulting costs include extension services, assistance and supervision twice a year. The extension and consulting services are prerequisites for SFF's operation. The table also includes legal and accounting services.

Table 20: General and Administrative Expenses, year

Item	SRD
Office Expenses	20,000
Professional Consulting	100,000
Communication	15,000
Car maintenance	10,000
Others	10,000

Other Assumptions

The model assumes 2% of unexpected costs over the total costs – including unexpected investments and also insurance (2% of investment costs).

Table 21: Other Assumptions

Unexpected Costs	2.0%
Insurance	2.0%



Standard Year

Table 22 exemplifies how the calculation of costs and revenues are done based on the aforementioned assumptions. The last column matches the item (detailed in column one) with the category presented in the Profit and Loss statement.

Item	Year 6	Category		
Mechanization	547,000	Factory and Machinery		
Fertilizers and growth products (includes	709 325	Raw Material		
limestone)	100,020			
Herbicides	38,000	Raw Material		
Pesticides	343,000	Raw Material		
Plastic mulch	0	Raw Material		
Water	68,000	Raw Material		
Workers	968,600	Labor		
Equipment maintenance	94,918	Equipment Maintenance		
Equipment renewal and upgrade	155,045	Equipment Renewal and upgrade		
Packing & cooling+ material	2,962,500	Packaging		
Sorting, packing and processing workers	22,400	Wages		
Total Selling Costs	2,984,900			
Permanent employees	397,200	Salaries		
Office expenses	20,000	Office expenses		
Professional consulting	100,000	Professional consulting		
Communication	15,000	Communication		
Car maintenance	10,000	Car maintenance		
Others	10,000	Others		
Unexpected costs	256,319	Others		
General and administrative expenses: Total	808,519			
Insurance	32,873	Insurance		
Depreciation	466,313	Depreciation of equipment and machinery		
Total Expenses	7,216,493			

Table 22 – Standard Year – Example

Business Plan

OPEX

Table 23 – OPEX, SRD per year

Costs of sale, SRD	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Variable expenses											
Raw materials	333,025	333,000	431,825	507,100	842,325	1,048,000	1,158,325	1,158,325	1,158,325	1,158,325	1,158,325
Factory and machinery	0	188,000	188,000	235,000	287,000	401,000	547,000	547,000	547,000	547,000	547,000
Labor	150,200	963,600	963,600	963,600	963,600	968,600	968,600	968,600	968,600	968,600	968,600
Fixed expenses											
Equipment maintenance	0	40,000	40,000	94,918	94,918	94,918	94,918	54,918	54,918	54,918	54,918
Equipment renewal and upgrade	0	0	0	0	0	155,045	155,045	155,045	155,045	155,045	155,045
Rent	0	0	0	0	0	0	0	0	0	0	0
Insurance	0	32,873	32,873	32,873	32,873	32,873	32,873	32,873	32,873	32,873	32,873
Depreciation of equipment and		- /									
machinery	616,588	616,588	657,268	725,068	725,068	466,313	466,313	256,980	148,500	0	0
Total selling cost	<u>1,099,813</u>	<u>2,174,062</u>	<u>2,313,567</u>	<u>2,558,560</u>	<u>2,945,785</u>	<u>3,166,749</u>	<u>3,423,074</u>	<u>3,173,741</u>	<u>3,065,261</u>	<u>2,916,761</u>	<u>2,916,761</u>

<u>Selling expenses, SRD</u>	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Variable expenses											
Packaging	0	0	12,500	370,000	1,187,500	2,175,000	2,962,500	2,962,500	2,962,500	2,962,500	2,962,500
Fixed expenses											
Wages	0	0	20	320	1,000	16,800	22,400	22,400	22,400	22,400	22,400
Total selling expenses	<u>0</u>	<u>0</u>	<u>12,520</u>	370,320	<u>1,188,500</u>	2,191,800	<u>2,984,900</u>	<u>2,984,900</u>	2,984,900	2,984,900	<u>2,984,900</u>

General and											
Administrative Expenses	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Salaries	132,400	397,200	397,200	397,200	397,200	397,200	397,200	397,200	397,200	397,200	397,200
Office expenses	0	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Professional consulting	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Communication	0	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Car maintenance	0	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Others (include											
unexpected costs)	171,522	96,962	113,891	154,275	175,371	224,342	266,319	256,346	252,006	246,066	246,066
Total general and											
administrative expenses	<u>303,922</u>	<u>639,162</u>	<u>656,091</u>	<u>696,475</u>	<u>717,571</u>	766,542	808,519	<u>798,546</u>	794,206	788,266	788,266

Table 24 – General and Administrative Expenses – SRD per Year

Table 25 summarizes the expenses:

Table 25 – Expenses, SRD per year

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Total fixed expenses	920,510	1,328,624	1,386,253	1,549,655	1,571,431	1,532,491	1,580,068	1,320,762	1,207,943	1,053,503	1,053,503
Total variable expenses	483,225	1,484,600	1,595,925	2,075,700	3,280,425	4,592,600	5,636,425	5,636,425	5,636,425	5,636,425	5,636,425
Total expenses	1,403,735	2,813,224	2,982,178	3,625,355	4,851,856	6,125,091	7,216,493	6,957,187	6,844,368	6,689,928	6,689,928

Revenues

The prices expressed are those at the packinghouse door. Average consumer price in Suriname in 2012 and 2013 was 9.2 SRD/Kg for oranges and 24.5 SRD/Kg for lime. Assuming that the packinghouse-door price is 55% of consumer price, the model estimates packinghouse-door prices of 13.4 SRD/Kg and 5.1 SRD/Kg for limes and oranges, respectively. Export prices are based on a USDA report that specifies the average packinghouse-door price in the United States. They are not too much distinct from FOB prices reported by the ITC. Processing prices are based on data from the ITC and the Brazilian Institute CEPEA. As aforementioned, local market prices decrease by 5% annually until they achieve 6 SRD and 3.5 SRD, respectively, for limes and oranges.

Price , SRD/Kg	Export	Local Market	Processing
Lime	3.58	13.4	1.5
Orange	2.1	5.1	1.3

Based on these prices, the model revenue is expressed in Table 27:

Revenue , SRD	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Fresh Lime: Export	0	0	268,940	896,467	2,241,167	3,137,633	3,137,633	3,137,633	3,137,633	3,137,633
Fresh Lime: Local										
Market	0	336,267	958,360	3,194,533	3,793,508	5,045,366	4,109,482	3,179,839	2,625,000	2,625,000
Lime: Processing	0	0	0	0	468,750	656,250	630,391	599,496	570,114	542,173
Fresh Orange: Export	0	0	0	781,819	1,824,244	2,345,456	2,345,456	2,345,456	2,345,456	2,345,456
Fresh Orange Local										
Market	0	0	1,272,922	1,909,383	2,227,613	2,864,074	2,332,806	1,968,750	1,968,750	1,968,750
Orange: Processing	0	0	0	0	568,750	731,250	731,250	731,250	731,250	731,250
Total Revenue	0	336,267	2,500,222	6,782,202	11,124,032	14,780,030	13,287,019	11,962,424	11,378,204	11,350,263

Table 27 – Revenues, SRD per year

Profit and Loss

Table 28 - P & L , SRD

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Revenues	0	0	336,267	2,500,222	6,782,202	11,124,032	14,780,030	13,287,019	11,962,424	11,378,204	11,350,263
Cost of sales	1,099,813	2,174,062	2,313,567	2,558,560	2,945,785	3,166,749	3,423,074	3,173,741	3,065,261	2,916,761	2,916,761
Gross profit	-1,099,813	-2,174,062	-1,977,300	-58,338	3,836,417	7,957,283	11,356,956	10,113,278	8,897,163	8,461,443	8,433,501
Selling											
expenses	0	0	12,520	370,320	1,188,500	2,191,800	2,984,900	2,984,900	2,984,900	2,984,900	2,984,900
General and											
administrative											
expenses	303,922	639,162	656,091	696,475	717,571	766,542	808,519	808,519	808,519	808,519	808,519
Total sales,											
general and											
administrative											
expenses	303,922	639,162	668,611	1,066,795	1,906,071	2,958,342	3,793,419	3,793,419	3,793,419	3,793,419	3,793,419
Operating											
income (loss)	-1,403,735	-2,813,224	-2,645,911	-1,125,133	1,930,346	4,998,941	7,563,537	6,319,859	5,103,744	4,668,024	4,640,082
Income (loss)											
after finance											
expenses	-1,403,735	-2,813,224	-2,645,911	-1,125,133	1,930,346	4,998,941	7,563,537	6,319,859	5,103,744	4,668,024	4,640,082
Income taxes											
(allowance)	0	0	0	0	0	0	2,722,873	2,275,149	1,837,348	1,680,488	1,670,430
Net income											
(loss)	-1,403,735	-2,813,224	-2,645,911	-1,125,133	1,930,346	4,998,941	4,840,664	4,044,710	3,266,396	2,987,535	2,969,653
EBITDA	-787,147	-2,196,636	-1,988,643	-400,065	2,655,414	5,465,254	8,029,849	6,576,839	5,252,244	4,668,024	4,640,082

In the Appendix, it is possible to see the P & L in terms of % of Revenue and SRD/Kg. See tables A-1 and A-2.

Cash Flow

Table 29 – Cash Flow, SRD

Cash Flow, SRD	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Operating income											
(IOSS)	-1,403,735	-2,813,224	-2,645,911	-1,125,133	1,930,346	4,998,941	7,563,537	6,319,859	5,103,744	4,668,024	4,640,082
Tax	0	0	0	0	0	0	2,722,873	2,275,149	1,837,348	1,680,488	1,670,430
Operating income											
(loss) after tax	-1,403,735	-2,813,224	-2,645,911	-1,125,133	1,930,346	4,998,941	4,840,664	4,044,710	3,266,396	2,987,535	2,969,653
Investment	6,376,475	0	271,200	678,000	0	0	0	0	0	0	0
Depreciation	616,588	616,588	657,268	725,068	725,068	466,313	466,313	256,980	148,500	0	0
Investment											
excluding											
depreciation	5,759,887	-616,588	-386,068	-47,068	-725,068	-466,313	-466,313	-256,980	-148,500	0	0
Working capital	63,168	126,595	134,198	163,141	218,334	275,629	324,742	313,073	307,997	301,047	301,047
Balance	-7,226,790	-2,323,231	-2,394,041	-1,241,206	2,437,080	5,189,625	4,982,234	3,988,616	3,106,900	2,686,488	2,668,606
Realization of											
assets	0	0	0	0	0	0	0	0	0	7,325,675	0
Annual cash flow	-7,226,790	-2,323,231	-2,394,041	-1,241,206	2,437,080	5,189,625	4,982,234	3,988,616	3,106,900	10,012,163	2,668,606
Accumulated cash											
flow	-7,226,790	-9,550,021	-11,944,062	-13,185,268	-10,748,188	-5,558,563	-576,329	16,947,747	33,961,445	55,395,289	68,773,724
Annual discounted											
cash flow	-7,226,790	-2,112,028	-1,978,547	-932,536	1,664,559	3,222,349	2,812,341	1,537,784	743,767	1,488,244	246,302
Accumulated											
discounted cash											
flow	-7,226,790	-9,338,818	-11,317,365	-12,249,901	-10,585,342	-7,362,994	-4,550,653	3,341,914	8,363,904	12,027,593	13,535,660









Financial Analysis

The financial assumptions used to develop the financial analysis are described in Table

30. In the model, the working capital is calculated for 6 months.

Table 30 – Financial Assumptions	
Exchange Rate - SRD/USD	3.39
Income Taxes - % of Profit	36%
Working Capital per year	9.0%
Period of Analysis	20
Discount Real Rate	10%

The financial analysis of the model is described in **Table 31**.

Cash Flow Net Present Value	12,027,593
Return Period, years	8
IRR	20%
EBITDA, year 10	6,576,839
EBITDA, year 10: % of Revenue	49%

Table 31 - Model Main Results

Alternative Models

<u>New Farm</u>

The model presented in the last section is based on the restructuring of Alliance, therefore some of the investments such as shed/workshop, living quarters for workers, and excavator are not included. This section shows the main results after including these investments.

Cash Flow, SRD	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Operating income (loss)	-1,711,479	-3,122,419	-2,955,107	-1,528,638	1,526,841	4,572,520	7,137,116	5,995,138	4,779,023	4,343,302	4,315,361
Тах	0	0	0	0	0	0	2,569,362	2,158,250	1,720,448	1,563,589	1,553,530
Operating income (loss)											
after tax	-1,711,479	-3,122,419	-2,955,107	-1,528,638	1,526,841	4,572,520	4,567,754	3,836,888	3,058,574	2,779,713	2,761,831
Investment	8,190,125	0	271,200	678,000	0	0	0	0	0	0	0
Depreciation	877,618	877,618	918,298	986,098	986,098	568,013	568,013	256,980	148,500	0	0
Investment excluding											
depreciation	7,312,507	-877,618	-647,098	-308,098	-986,098	-568,013	-568,013	-256,980	-148,500	0	0
Working capital	77,017	140,509	148,112	181,299	236,491	294,818	343,931	327,503	322,426	315,476	315,476
Balance	-9,101,003	-2,385,310	-2,456,120	-1,401,838	2,276,448	4,845,714	4,791,835	3,766,365	2,884,648	2,464,237	2,446,355
Realization of assets	0	0	0	0	0	0	0	0	0	9,139,325	0
Annual cash flow	-9,101,003	-2,385,310	-2,456,120	-1,401,838	2,276,448	4,845,714	4,791,835	3,766,365	2,884,648	11,603,562	2,446,355
Accumulated cash flow	-9,101,003	-11,486,313	-13,942,433	-15,344,271	-13,067,824	-8,222,109	-3,430,274	13,300,356	29,202,798	51,339,037	63,606,217
Annual discounted cash											
flow	-9,101,003	-2,168,464	-2,029,851	-1,053,222	1,554,844	3,008,807	2,704,866	1,452,097	690,562	1,724,796	225,789
Accumulated discounted											
cash flow	-9,101,003	-11,269,466	-13,299,318	-14,352,540	-12,797,695	-9,788,888	-7,084,022	455,583	5,152,751	8,884,337	10,267,171

Table 32 – Cash Flow, SRD – Alternative Model: New Farm

Table 33 - Main Results - Alternative Model: New Farm

Cash Flow Net Present Value	8,884,337		
Return period, years	9		
IRR	17%		
EBITDA, year 10	6,252,118		
EBITDA, year 10: % of Revenue	47%		

Without Processing

Another alternative model that can be evaluated is a model without processing that focuses on both the local and export markets. The original model assumes that 25% of total production will be processed from year 5 onwards. The alternative model without processing assumes that exports will represent 75% of total production and the local market will still represent the same 25%. This alternative includes the removal of every cost and investment related to processing. The results are presented in the following tables.

Cash Flow, SRD	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25
Operating income											
(loss)	-1,403,735	-2,813,224	-2,645,911	-1,027,501	2,000,858	5,330,834	7,986,262	6,768,443	5,515,423	5,109,084	5,109,084
Тах	0	0	0	0	0	0	2,875,054	2,436,639	1,985,552	1,839,270	1,839,270
Operating income											
(loss) after tax	-1,403,735	-2,813,224	-2,645,911	-1,027,501	2,000,858	5,330,834	5,111,208	4,331,803	3,529,871	3,269,814	3,269,814
Investment	6,376,475	0	271,200	0	0	0	0	0	0	0	0
Depreciation	616,588	616,588	657,268	657,268	657,268	398,513	398,513	189,180	148,500	0	0
Investment											
excluding											
depreciation	5,759,887	-616,588	-386,068	-657,268	-657,268	-398,513	-398,513	-189,180	-148,500	0	0
Working capital	63,168	126,595	134,198	158,748	215,160	305,478	366,652	354,983	353,079	346,129	346,129
Balance	-7,226,790	-2,323,231	-2,394,041	-528,980	2,442,965	5,423,869	5,143,068	4,166,000	3,325,292	2,923,685	2,923,685
Realization of											
assets	0	0	0	0	0	0	0	0	0	6,647,675	0
Annual cash flow	-7,226,790	-2,323,231	-2,394,041	-528,980	2,442,965	5,423,869	5,143,068	4,166,000	3,325,292	9,571,359	2,923,685
Accumulated cash											
flow	-7,226,790	-9,550,021	-11,944,062	-12,473,043	-10,030,077	-4,606,209	536,860	18,745,857	36,748,661	58,653,257	73,271,679
Annual discounted											
cash flow	-7,226,790	-2,112,028	-1,978,547	-397,431	1,668,578	3,367,796	2,903,128	1,606,173	796,048	1,422,722	269,844
Accumulated											
discounted cash											
flow	-7,226,790	-9,338,818	-11,317,365	-11,714,795	-10,046,217	-6,678,422	-3,775,294	4,422,781	9,731,059	13,501,816	15,149,243

Table 34 - Cash Flow, SRD - Alternative Model: without processing

Table 35 - Main Results - Alternative Model: without processing

Cash Flow Net Present Value	13,501,816
Return Period, years	7
IRR	21%
EBITDA, year 10	6,957,623
EBITDA, year 10: % of Revenue	47%

Figure 12 shows a comparison between the three models.

Figure 12 - Accumulated Discounted Cash Flow - Comparison



Prices and Financial Measures

Table 436 shows how the NPV would have changed if the prices were modified.

Table 4 – The effect of lower prices of produce in financial estimators, in thousands SRD

	-30%	-20%	-10%	0% (model)
NPV	-1,213	3,100	6,996	12,027
Return Period	25	14	10	8
IRR	10%	13%	16%	20%

Government Policies: Tax Reduction and Financial Measures

According to the 'Project Paper: Rehabilitation and Restructuring of Alliance', by ProPlan Consultancy, the current company that runs the citrus farm on Alliance is heavily subsidized by the government. The government can influence many of the model assumptions. For example, it can reduce taxes, loan money for lower costs and

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guarantee fixed exchange rates for farmers. Presented here is the consequence of a tax reduction policy:

Тах	0%	10%	25%	36% (model)
NPV	22,351	19,483	15,182	12,027
Return Period	6	7	7	8
IRR	25%	24%	22%	20%

Table 37 - The effect of tax reduction in financial estimators, in thousands SRD

Yield, Ton/Ha and Financial Measures

Another sensitive alternative analysis can be done by assuming lower expected yields for each crop. This is also a way to check what would happen if there were natural disasters or other factors that might reduce productivity.

Table 38: The effect of low yield, in thousands SRD

Тах	-30%	-20%	-10%	0% (model)	
NPV	688	3,918	7,973	12,027	
Return Period	19	12	9	8	
IRR	11%	14%	17%	20%	

The Excel model allows many other simultaneous changes that can be combined with the sensitive analysis presented here.

Attachments

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Table A 1 – BP Summary as a % of Revenue

	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
<u>Revenue, %</u>	3	4	5	6	7	8	9	10	15	20	25
Fresh Lime: Export	11%	13%	20%	21%	22%	22%	23%	24%	26%	28%	28%
Fresh Lime: Local Market	38%	47%	34%	34%	33%	33%	32%	31%	27%	23%	23%
Lime: Processing	0%	0%	4%	4%	5%	5%	5%	5%	5%	5%	5%
Fresh Orange: Export	0%	12%	16%	16%	16%	17%	17%	18%	20%	21%	21%
Fresh Orange Local Market	51%	28%	20%	19%	19%	18%	18%	18%	16%	17%	17%
Orange: Processing	0%	0%	5%	5%	5%	5%	5%	6%	6%	6%	6%
Total Revenue	<u>100%</u>	100%	<u>100%</u>	<u>100%</u>	100%	100%	<u>100%</u>	<u>100%</u>	100%	100%	100%

	Year										
Expenses, % of Revenue	3	4	5	6	7	8	9	10	15	20	25
Total fixed expenses	62%	23%	14%	11%	11%	11%	11%	10%	10%	9%	9%
Total variable expenses	83%	48%	41%	38%	39%	40%	41%	42%	47%	50%	50%
Total expenses	145%	72%	55%	49%	50%	51%	53%	52%	57%	59%	59%

	Year										
P & L as % of Revenue	3	4	5	6	7	8	9	10	15	20	25
Revenues	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cost of sales	102%	43%	28%	23%	24%	24%	25%	24%	26%	26%	26%
Gross profit	-2%	57%	72%	77%	76%	76%	75%	76%	74%	74%	74%
Selling expenses	15%	18%	20%	20%	21%	21%	22%	22%	25%	26%	26%
General and administrative											
expenses	28%	11%	7%	5%	6%	6%	6%	6%	7%	7%	7%
Total sales, general and											
administrative expenses	43%	28%	27%	26%	26%	27%	28%	29%	32%	33%	33%
Operating income (loss)	-45%	28%	45%	51%	50%	49%	47%	48%	43%	41%	41%
Financial expenses											
(income), net	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Income (loss) after finance											
expenses	-45%	28%	45%	51%	50%	49%	47%	48%	43%	41%	41%
Income taxes (allowance)	0%	0%	0%	18%	18%	18%	17%	17%	15%	15%	15%
Net income (loss)	-45%	28%	45%	33%	32%	31%	30%	30%	27%	26%	26%
EBITDA	-16%	39%	49%	54%	53%	52%	51%	49%	44%	41%	41%

Table	A 2	- P	& L,	SRD,	/Kg
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	Year									
P & L , SRD/kg	3	4	5	6	7	8	9	10	15	20
Revenues	5.43	3.71	3.70	3.59	3.50	3.41	3.32	2.99	2.84	2.84
Cost of sales	2.36	1.06	0.86	0.85	0.85	0.85	0.79	0.77	0.73	0.73
Gross profit	3.07	2.65	2.84	2.75	2.65	2.56	2.53	2.22	2.12	2.11
Selling expenses	0.95	0.73	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
General and administrative	0.57	0.26	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total sales	0.57	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
general and administrative										
expenses	1.52	0.99	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Operating income (loss)	1.54	1.67	1.89	1.80	1.70	1.61	1.58	1.28	1.17	1.16
Financial expenses (income), net										
Income (loss) after										
finance expenses	1.54	1.67	1.89	1.80	1.70	1.61	1.58	1.28	1.17	1.16
Income taxes (allowance)	0.00	0.00	0.68	0.65	0.61	0.58	0.57	0.46	0.42	0.42
Net income (loss)	1.54	1.67	1.21	1.15	1.09	1.03	1.01	0.82	0.75	0.74
Depreciation and amortization	0.58	0.16	0.12	0.12	0.12	0.12	0.06	0.04	0.00	0.00
EBITDA	2.12	1.82	2.01	1.92	1.82	1.73	1.64	1.31	1.17	1.16