Feasibility Study for Value Addition in the Fruit and Vegetable Sector of Sri Lanka

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Project STDF/PPG/576

Funded by The Standards and Trade Development Facility (STDF)

International Trade Centre

This study was undertaken on behalf of the International Trade Centre (ITC). It was financed by the Standards and Trade Development Facility (STDF) as part of a project preparatory grant (PPG) executed by ITC in cooperation with the Lanka Fruit & Vegetable Producers, Processors and Exporters Association (LFVPPEA).

Foreword

The International Trade Centre (ITC), in partnership with the Lanka Fruit Lanka Fruit and Vegetable Producers, Processors and Exporters Association (LFVPPEA), implemented a project preparatory grant (PPG) to develop:

a) a feasibility study for value addition to evaluate the economic, technical, and operational feasibility of value addition of five export crops: pineapple, papaya, banana, mango and passion fruit (component I), and

b) a strategic plan for LFVPPEA (component II).

Since a number of national and international initiatives, including the development of a National Export Strategy for processed food, are underway to develop the Fruit and Vegetable (F&V) sector in Sri Lanka, the feasibility study synergises with them and increase the likelihood that the findings and recommendations of the study will be picked-up and implemented. Components II and I are interlinked and respective experts interacted with inputs and data for complementarities.

The study was led by S.N. Venkat Prahlad, an International Consultant with experience in conducting value chain assessment studies in the agriculture space from Farm to Fork and by Dr. Shanthi Wilson, the National Consultant, with years of experience on post harvest management of fresh produce including sanitary and phytosanitary measures. Consultants collected data from of the five selected crops (Pineapple, Passion Fruit, Papaya, Mango and Banana growing regions), analysed and prepared a report for the study under the technical guidance and coordination of ITC. The assignment consisted of two study missions in Sri Lanka, exposure visits in Italy and interaction with prospective international collaborators. The project was funded by the Standards and Trade Development Facility (STDF) and exectuted by the International Trade Centre (ITC).

Acknowledgements

The authors of this report are indebted to the members and administrative staff of LFVPPEA for the numerous ways in which they have extended their support in the successful implementation of this study.

We are particularly indebted to Mr Suresh Ellawala and Mr Zuraish Hakim of LFVPPEA for the exceptional organizational and logistical arrangements provided by them with regard to the logistics of the two respective field missions and the identification of sources for data collection.

We are also grateful to the many different stakeholders of the fruit and vegetable supply chain and officers from service providing establishments including the Sri Lanka Export Development Board (EDB), the Department of Agriculture (DoA) and the Industrial Technology Institute (ITI), who gave of their valuable time during the process of data collection.

We are indebted to the leadership and guidance of Ms. Ludovica Ghizzoni, Project Manager, ITC for her guidance and support during the course of this study and for her untiring efforts in organizing the study tour to Europe by selected members of the LFVPPEA which included the participation of the National Consultant.

We greatly appreciate the kind co-operation of The Noberasco company for their input on export market requirements and willingness to engage in the implentation and practical fruition of this study.

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Acronyms

Unless otherwise specified, all references to dollars ($) are to United States dollars, and all references to tons are to metric tons.

ASMP	Agriculture Sector Modernization Project
Combi-HAVM	Combined Hot Air Vacuum Microwave Dehydration Technology
DOA	Department of Agriculture Sri Lanka
EDB	Sri Lanka Export Development Board
GAP	Good Agricultural Practice
GMP	Good Manufacturing Practice
LFVPPEA	Lanka Fruit and Vegetable Producers, Processors and Exporters Association
IARS	University of Colombo Institute for Agro Technology and Rural Sciences
ITC	International Trade Centre
ITI	Industrial Technology Institute
NPQS	National Plant Quarantine Services, Department of Agriculture, Sri Lanka
SPS	Sanitary and Phyto Sanitary Measures
SWOT	Strengths, weaknesses, opportunities and threats – Analysis
UNCTAD	United Nations Conference on Trade and Development
STDF	Standards and Trade Development Facility
SWOT	Strengths, weaknesses, opportunities and threats
WTO	World Trade Organization

EXECUTIVE SUMMARY

According to a World Food Programme report, Sri Lanka is a middle-income country, with a development agenda focused on accelerating economic growth while sustaining peace as it recovers from a 30 - year civil war which ended in 2009.

The per capita fruit consumption in Sri Lanka is 98g/day where WHO recommendations are 200g/day – a short fall of over 100g/day. The annual fruit requirement to meet the consumption requirement is thus 1,547,600Mt. Local fruit production is estimated at 1,120,900 Mt in 2017. While fruit imports are reported at 60,408Mt (Rs. 9,462Million), exports amount to 27,389 Mt (Rs. 4873Million) – 2.44% of the production.

Given the above scenario, the development of the Sri Lankan economy and the developments in the agricultural sector, the International Trade Centre (ITC) and the Lanka Fruit and Vegetable Producers, Processors and Export Association (LFVPPEA) commissioned a feasibility study with focus on five identified fruits (1) Pineapple 2) Mango 3) Papaya and 4) Banana and 5) Passion fruit and with the following objectives:

1) Study existing agricultural practices and collect data on the a) Yields per Acre b) Farm GMP c) Fertilization practices d) Varieties of the fruits grown

2) Study post-harvest patterns including delivery of fresh produce to respective markets which include exporters and processors

3) Identify the potential cost add-ons in the value chain

4) Study the smallholder farmers current situation and look at the possibility to improve their yields and land usage pattern

5) Study the current variety of fruits and analyse how Sri Lanka can compete globally

6) Work with existing processors to improve the standards of processing, vis-à-vis technology yields and product development. Look at the frozen and IQF options

7) Identify potential processors to partner with Noberasco to produce high value products

8) Identify any SPS issues that need to be addressed in order to ensure export market acceptance of products

9) Look into introduction of cold chain systems especially at collection centres to reduce post- harvest losses.

To achieve the above objectives, an international consultant with global experience in value chain analysis and a local consultant with experience and repute in the agriculture and research space have been engaged. The study has been carried out as per the structure detailed in the report and below is the brief of the outcomes and conclusions of the study.

Challenges and Weakness of the F&V value chains in Sri Lanka

1) Inadequate supply of Raw Material

2) Price increases year on year

3) Climate Change

4) Poor Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP) and Sanitary and Phytosanitary (SPS) issues at farm levels, low yields

5) Lack of good quality planting material

6) Processing facilities do not to conform to economies of scale with new age processing technology to be accepted

Positives and Strengths of the F&V value chains in Sri Lanka

1) There is an existing contract farming model in operation with private industry

2) Farmers are aware of the best practices, but need handholding from government and private sector to ensure best practices

3) Unique fruit quality like the Mauritius pineapple, high flavour bananas, new mango varieties with good flavour profile

4) Mature and knowledgeable exporters with global experience and benefit from the renowned Sri Lankan tea industry to scale up production opportunities

5) The export market for value added and close to natural feel for fruits and vegetable is growing rapidly

6) Domestic consumption is growing as well as the tourism industry

7) ASEAN region itself is a big market and the region has almost the same preferences in terms of flavour and taste of the produce

8) Organic food is gaining traction and Sri Lanka is well positioned to cater to this market

9) Well known producers and sellers of dehydrated fruit Noberasco has partnered and signed an Memorandumg of Understanding (MOU) with the association.

Threats of the F&V value chains in Sri Lanka

1) Neighbouring countries in the ASEAN, like Vietnam, Myanmar, Cambodia are upping their agricultural value chain

2) Africa in the next decade will be a potential hub for exports by unlocking a lot of land and develop sustainable agriculture. Africa can also be a big market for the future.

3) Non action from here on in developing the agriculture and the recommendations for SPS implementation, yield improvement, working with the government and private sector to develop the farm sector, will prove detrimental on the long term.

Based on the above conclusions and SWOT, the study has detailed the action plan with all the stake holders, i.e. Private, Government, Control Bodies, Associations. To take the initiative forward a MOU with a world class dehydrated fruit and vegetable company NOBERASCO has been signed with the LFVPPEA.

CHAPTER 1 INTRODUCTION

BACKGROUND AND OBJECTIVES OF THE STUDY

According to a World Food Programme report, Sri Lanka is a middle-income country, with development agenda focused on accelerating economic growth while sustaining peace as it recovers from a 30 - year civil war which ended in 2009. The country is credited with considerable advancement in several development areas, including promoting universal primary education, reducing maternal and child mortality, and halving poverty levels.

However, despite being blessed with a wide range of agroclimatic zones and the availability and possibility of growing a wide variety of tropical and subtropical fruits and vegetables; progress towards achieving food security, improved nutrition and gender equality, as well as minimizing geographic and socio-economic development disparities, has been slow.

The country has a 21 million population, where 22% of people are undernourished with 33% of people unable to afford a nutritious diet. The average fruit and vegetable consumption in Sri Lanka is below WHO recommendations with current fruit and vegetable consumption reported at 235g/person/day while the WHO recommendation is 400g/person/day. The per capita fruit consumption in Sri Lanka is 98g/day where WHO recommendations are 200g/day – a short fall of over 100g/day.

The annual fruit requirement to meet the consumption requirement is thus 1,547,600Mt. Local fruit production is estimated at 1,120,900 Mt in 2017.While fruit imports are reported at 60,408Mt (Rs. 9,462Million), exports amount to 27,389Mt (Rs. 4873Million) – 2.44% of the production (quoted from- 'Talking Economics', the blog of the Institute of Policy Studies of Sri Lanka (IPS), Sri Lanka's apex socio-economic policy think tank).

The markets with greatest potential for Sri Lanka's exports of Fruits are United States of America, Belgium and United Kingdom. Belgium shows the largest absolute difference between potential and actual exports in value terms, leaving room to realize additional exports worth $19.9 Mn.

Further data on current production and exports are presented in Appendix I.

Table 1 "Aggregated Data on Major Fruit Exports from Sri Lanka"

Country / Continent	Actual Fruit Exports from Sri Lanka (Mn US $)	Potential Fruit Exports from Sri Lanka (Mn US $)
Europe (Italy)	32.8 1.6	124.6 12.3
USA	19.1	29.6
Asia	74.2	91.3

Source: Lanka Fruit and Vegetable Producers, Processors and Export Association (LFVPPEA)

It is within this context that the expansion in the production and processing of fresh fruit and vegetables along with minimization of postharvest losses needs to be addressed; so as to increase availability of fresh produce for domestic consumption, improve the income of farmers, create employment opportunities and earn much needed foreign exchange for the country.

Thus, it is, that the overall objectives of the study were to report on findings of a value chain assessment and feasibility study for five selected crops (Pineapple, Mango, Banana, Papaya and Passion fruit) in order to develop and propose a sustainable model specific to Sri Lanka for establishing partnerships with world-class agribusiness firms such as the Noberasco fruit processing company in Italy. The crops were identified in close consultation with LFVPPEA and potential buyers such as Noberasco.

The specific objectives for the study were to:

1) Study existing agricultural practices and collect data on the a) Yields per Acre b) Farm GMP c) Fertilization practices d) Varieties of the fruits grown

2) Study post-harvest patterns including delivery of fresh produce to respective markets which include exporters and processors

3) Identify the potential cost add-ons in the value chain

4) Study the smallholder farmers current situation and look at the possibility to improve their yields and land usage pattern.

5) Study the current variety of fruits and analyse how Sri Lanka can compete globally

6) Work with existing processors to improve the standards of processing, vis-à-vis technology, yields and product development. Look at the frozen and IQF options

7) Identify potential processors to partner with Noberasco to produce high value products.

8) Identify any SPS issues that need to be addressed in order to ensure export market acceptance of products.

9) Look into introduction of cold chain systems at collection centres-reduce postharvest losses.

CHAPTER 2 METHODOLOGY

Two field missions were conducted by the International and National experts in collaboration with the members of the LFVPPEA. The missions were conducted in major production areas and processing operations of the five respective crops selected for this study.

Data was collected on the current production and processing operations of Pineapple, Passion fruit, Papaya, Mango and Banana. Discussions were held with producers, processors and exporters.

Key areas for data collection in the case of producers included:

- Fruit prices at farm gate
- Yield at the farms per Ha or Acre
- Costs faced by farmers
- Quantity of different varieties of fruits available
- End Product Pricing and Understanding the process cost drivers
- Quality and flavour of available fruits
- Possibility of establishing a unique Geographic Identity (GI) tag for Sri Lankan fruit varieties
- SPS based issues

Data was collected from processors engaged in the export of their processed products. Information collected from these visits included:

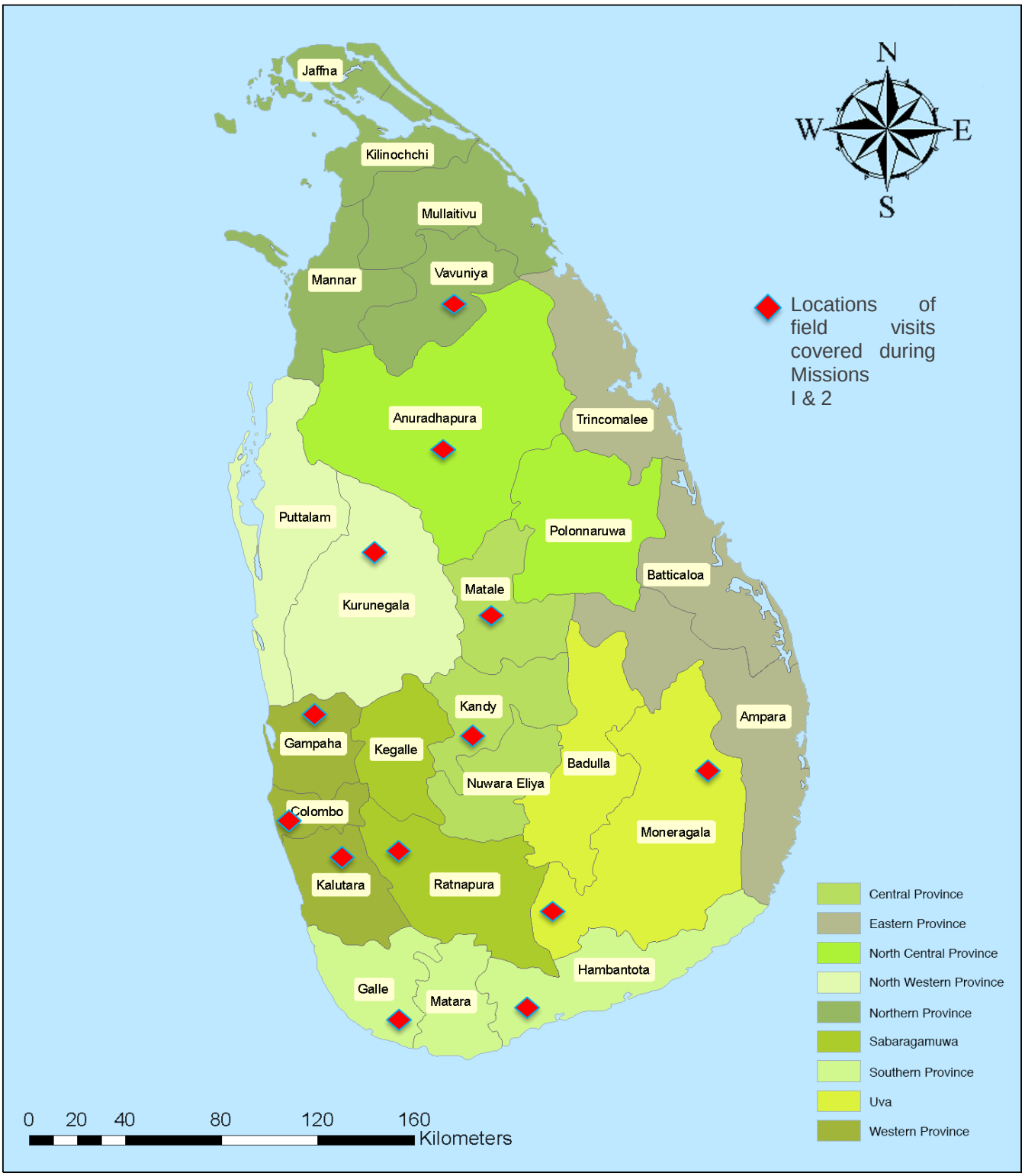
- Respective commodities exported
- General operational procedures
- Equipment used in the processing plants
- SPS issues faced by processors when exporting their products etc.

Preliminary observations were presented to members of the LFVPPEA Association after each of the two respective missions and industry partners interested in international collaboration were identified by the members of the Association.

Data was also recorded with respect to service providers to the respective value chains. These interviews included discussions with officials from the Government/ Public sector institutions and private sector organizations. Further information was also collected from via discussions with Development Partners currently engaged in uplifting the productivity of the agriculture sector.

Details of the visits for data collection from persons with respect to production and distribution of the five respective crops at major geographic production locations, along with visits to processors and exporters, and value chain service providers from private and public sector institutions and other development partners is presented in Appendix 2.

Figure 1 “Sri Lanka Missions 1 And 2 - Data Collection Locations of Field Visits”



CHAPTER 3 VALUE CHAIN OBSERVATIONS

3.1 Observations Common to Production of all Five Crops

Details of data collected on the production of the five crops selected for the study (pineapple, passion fruit, papaya, mango and banana) along with data from visits to processors and exporters, and value chain service providers from private and public sector institutions are presented in Appendix 3.

The challenges, positives, opportunities and threats common to and observed across all five crops is summarised via an analysis of strengths, weaknesses, opportunities and threats – a SWOT analysis - as follows:

3.1.1 Summary of the Analysis

- Positives and Strengths

1) There is an existing contract farming model in operation with the private industry.

2) Farmers are aware of best practices, but need support in terms of finance and handholding to sustain the best practices

3) Unique fruit quality like the Mauritius variety, Queen type pineapple, high flavour local bananas, new mango varieties being developed. These strengths need to be leveraged and pushed by the export industry

4) Mature and knowledgeable exporters who have a global knowledge of market trends and needs

5) The north has opened up for cultivation which has to be leveraged for enhanced cultivation

- Challenges and weaknesses

1) Inadequate supply of raw material available to processors, exporters and the markets

2) Price increases year on year and supply cycle are varying due to climate change

3) The export market is facing head winds due to high prices and non-availability of produce

4) The domestic market also faces headwinds where the cost of the fruits sometimes is not within reach of the common person

5) SPS issues at farm level, where poor GAP and GMP result in cross infestation and disease and reduced yields.

6) Labour availability challenges contribute to the above sanitary issues at farm level.

7) Water resources are scarce, hence urgent need to get efficient water collection and irrigation systems in place

8) Lack of quality certified planting material is a big challenge

9) Production units do not conform to the economies of scale and are therefore unable to afford the cost of technology that will improve yields and quality of produce.

- Opportunities

1) The export market is growing globally as the population increases

2) Domestic Sri Lankan market is in need for quality produce, since consumption will grow due to population, tourism and the natural growth in the economy. Hence good quality fruit with sustainable pricing will always be a winner

3) ASEAN as a region itself is a big market and typically has almost the same preferences in terms of flavour and taste of the produce

4) More health-conscious consumers are looking at niche organic foods. Hence, developing a robust organic cultivation and certified plantation will be a unique system for Sri Lanka

5) Sri Lanka has exotic varieties of pineapple banana and mango that can service high value niche markets

- Threats

1) Countries like Vietnam, Cambodia, Myanmar are also looking at upping their agriculture value chain to enter the export market

2) Labour outsourcing from neighbouring countries is a norm, thereby making labour availability at a sustainable cost to the industry in general. This keeps the industry competitive

3) Africa in the next decade will also become an agricultural hub for exports by unlocking a lot of land and delivering produce to the global market, for example Madagascar is looking at developing and improving their value chain in agriculture

4) If the current pattern of low land utilization and poor farming practices continues in a country with already low land availability, Sri Lanka stares at a future of becoming a net importer of fruits plus losing the opportunity to be competitive in the export market.

Overview of Recommended Solutions for Production of the Five Crops

- Recommendations for meeting requirements of international partners and markets have been detailed with respect to the five selected fruits, the wholesale market, the respective processors and their facilities. Consequently, the success of this report will be along with LFVPPEA, the government departments, the traders, and the private enterprises to see how the recommended solutions can be implemented.

- The well-structured training and contract farming programme models used by the existing private players and models extracted from the tea industry can be studied and implemented in order to address the issues of economies of scale faced by small holder farmers and their production units.

- Existing private players can be requested, as a part of their Corporate Social Responsibility (CSR) commitments, also to lead the way for conducting programmes and reaching out farmers to implement GAP and GMP practices at the farms.

- It is recommended that ripening facilities for Bananas are made available at wholesale markets. The current infrastructure at the regional wholesale centres is inadequate and the fruit distribution centres are required to reduce post-harvest losses.

3.1.2 Specific Observations with Respect to Individual Crops

Pineapple

Issues to be addressed

a) Low land utilization further compounds the problems arising from the intercropping

b) system of pineapple production practised in Sri Lanka

c) Shortage of labour availability

d) Lack of adequate volumes of planting material

e) Lack of quality control and certified planting material

Recommendations

a) Promote and increase the method of high-density plantation, this will help balance out labour shortage and increase yield per acre

b) Promote implementation of GAP and GAP certified farms

c) The introduction of drip irrigation as part of GAP in farms alongside use of the mulching techniques to retain moisture and reduce infestation

d) Promote production of certified suckers to address current shortfall and increase availability of good quality planting material planting material

e) Install a system of collection of suckers

f) Promote the nucleus farm model amongst growers to enhance volume of production of pineapple

g) Recommend nucleus farm to start planting material banks

h) Start cultivation of MD2 variety since this is the favoured in the international market MD2 can become the volume driver for exports both fresh and processed

i) Queen pineapples especially the Sri Lankan Mauritius variety should be applied for a GI status. This should be marketed as unique with all the certificates like Organic, Rain Forest Alliance and Fair Trade.

Passion fruit

Issues to be addressed

a) Majority of farmers are not aware of GAP as was observed in the farm of Mr Prasanna

b) Sampath at Kadigawa

c) Virus infestation is an issue

d) Cyclical market off-take, limits production and expansion of cultivation

e) Need to expand domestic market for fresh passion fruit

f) To expand the processing market - mainly juice and juice concentrate - the price of the raw material is still high, especially grade one price

Recommendations

a) Increase farmer training and certification in areas other than Vavuniya, especially with respect to crop rotation practices after the third year of cultivation in the same location

b) Involve the more end market players like Traders, Supermarkets, Processors and exporters to work with farmers for assuring market access. This will automatically increase cultivation

c) Domestic Sri Lankan market for fresh needs to be explored urgently, this will give a rise to more grade two fruit for processing which then can be converted to juice for export. Processors and processing capacity already exist. This can be an immense potential for scaling up export value

d) Install better irrigation systems and micronutrient-based feeds for better yields

e) Introduce purple variety fruit for the fresh market as an alternative to the yellow variety

Papaya

Issues to be addressed

a) Seed quality is an issue with variances in yields of the batches of imported seed

b) Since it is a mono cultivation Ring spot virus is an issue

c) Cultivation farming area needs to be increased from the current level to cater to the domestic and export market. If there is no increase in the next years there will be a shortage of fruits both for the domestic and export markets, consequently increasing the price.

Recommendations

a) Involve end market players like Traders, Supermarkets, Processors and exporters to work with farmers for assuring market access, this will automatically increase cultivation

b) New cultivation areas especially in the north need to be expanded

c) Install better irrigation systems and micronutrient-based feeds for better yields

d) Try and introduce the yellow variety for the fresh market as an alternative to the red variety.

Mango

Issues to be addressed

a) Wild elephant and monkey's attacks on the farms

b) Yields are going down due the ageing tree population in small holdings

c) Due to poor GMP on small holder plantations, disease and infestation is rampant

d) Existing plantations are getting fragmented and production by acreage is reducing

Recommendations

a) Involve end market players like Traders, Supermarkets, Processors and Exporters to work with farmers for assuring market access, this will automatically increase cultivation

b) New cultivation areas especially in the north needs to be expanded

c) Install better irrigation systems and micronutrient-based feeds for better yields

d) Develop more good quality certified planting material and plant material banks

e) Funding for training in GAP for pre and post harvest practices

f) Support the high-density planting route to get better yields (200 plants per acre or a planting space of 4m x 3m as discussed in the CIC farm)

g) Ensure availability of good quality planting material and increase cultivation of varieties like TomEJC or Karuthakolumban or Willard for fresh

h) Identify the needs for processing and work on increasing quality planting material and cultivation of the processing variety Malwana

i) Heavy pruning of old trees with large canopies

j) Promote the use of fruit fly traps and fruit covering bags

Banana

Issues to be addressed

a) Water is a major issue and hence is the limiting factor for increasing the cultivation of banana which needs a lot of water

b) New farms need to be developed, since new plantations need be set up for increased cultivations with availability of good quality planting material

c) Tissue culture centres need to be established to meet the need of new planting material

d) Lack of ripening chambers lead to all fruits manually ripened with uncontrolled use of ethylene

e) Poor handling of the bunches at collection centres and during transport leading to loss and poor-quality fruit

f) Lack of market access in the lean season thereby effecting the farmers revenue

Recommendations

a) Evaluation of the domestic varieties Sugar (seeni), Sour (Embul) and Ambun (Cavendish type) needs to be followed up

b) Processing of domestic varieties for dehydration needs to be studied for better flavour and taste.

c) Rain water harvesting and drip irrigation-based farming needs to be implemented. This needs to be done with private partnership since investment will be high. This is essential since water resources are limited

d) Setting up of ripening chambers at district level could be introduced e.g., via the ongoing World Bank programmes such as the Agricultural Modernization Project (WB) and or at market level. This will help in maintaining the quality of the banana and ensure lower post-harvest losses

e) Training of handling the bunches at the collection centres and upgrading the collection centres with covered area is another absolute requirement to improve the quality of the fruit by ensuring lower damages. This could also be conducted as part of the above WB project

f) Create market access during lean season to help the farmers obtain better prices to make the cultivation of Bananas sustainable

g) Promote the use of natural banana fibre with ITI technology as a valued added product

The possibility of implementing the above recommended interventions via the Ministry of Primary Industries and programmes such as the World Bank Agricultural Modernization Project need to be pursued.

3.2 The front end of the Value Chain

This aspect of the mission entailed study visits to the main whole sale market – the major Collection and distribution centre in the country.

3.2.1. Dambulla Wholesale Market

The Dambulla wholesale market was established in 1992. It is the largest wholesale market in Sri Lanka. The market has 155 stalls, with 146 stalls reserved for Fruit and Vegetables, the rest for groceries and dry fish. It is estimated that of the 200 MT passing through the market, 10MT go waste every day. Of the total 155 stalls only 4 stalls deal with fruits.

Findings and Observation

- 800,000 tons of vegetables and fruit pass through this market every year out of the total estimated 1.1 million MT produced every year in Sri Lanka.
- It is estimated that 70% of the produce in Sri Lanka is traded through this market.
- The 155 stalls are on monthly rents at Rs.25,000 per month.

The route in the value chain is as follows:

Farmer --------> Preferred Stall Holder ---------> Buyer

Rs.100 Rs.10 Rs.110

The normal commission is 10% to the preferred stallholder. Here even if the farmer realizes a lower price, he still has to pay the commission on the base price on which he has got it to the market.

Issues Observed

- Transport loss to and from market is around 20%
- Post harvest loss until product reaches the consumer works out to 25%
- The estimated post harvest loss from farmgate to consumer is 46%, which is very high.

Recommendations

- Grading at Farm level and farm gate will help get better quality produce
- Establish collection centres at farm level for better segregation of produce
- Establish better warehousing and storage facilities in cultivation areas
- Improve transport packaging to reduce damage
- Finally decentralize each zone and establish Dambulla type wholesale centres in the North, the South, the East and the Western regions of the country so that 1) freight costs can be saved and 2) produce can reach the customers directly. This will help with reducing cost and also help with reducing post-harvest loss
- By de-centralizing the distribution via the wholesale markets, the mafia and cartelization of distribution will also be reduced.

3.2.2 Sooriyawewa Sathi Pola, Banana market

This market is a private initiative and is representative of the local collection and distribution centres from where produce is purchased and transported to the large wholesale markets and in some instances to super markets, processing and export operations. Market conditions were not satisfactory as it was an open-air market with no shelter provided.

The market consists of traders, collectors and farmers. They bring their produce every day of the week. The price was decided on a per fruit basis in the bunch particularly with respect to high value varieties such as Rathkehel. Transport agents pay a toll charge for entry into the market. However, it was not possible to extract information on the volume of produce passing through the market.

As it was not possible to make prior arrangements to meet officials who handled the administrative aspects of the market data collection was not possible as stakeholders present were reluctant to engage in conversation with the team. In conclusion despite the poor infra structural facilities available, the important role of these privately-run local markets in the collection and distribution of bananas was obvious.

3.3 Fruit Processors, Exporters, Service Providers and Development Partners

3.3.1. Fruit Processors

Visits were conducted to fruit processing and export-oriented operations to understand the logistics of these establishments. Visits were made to CBL Natural facility, Expo Lanka and Nidro Pvt Ltd. While all three companies were exporters, Nidro dealt largely with fresh produce but were intending to go into the export of certain dehydrated products.

Micro-vacuum dehydration facility was observed in Vavuniya and this was one of the 5 facilities set up for initiating the dehydration of fruits in production areas. These operations were in the hands of selected merchant leaders and lead farmers in Oddusudan, Dambulla, Matale, Badulla and Gampaha respectively. However, technical expertise and experience in dehydration technology for operational purposes did not seem to be in place as per the facility visited in Oddusudan.

Discussions were also held with the Managing Director of Hayleys Agro Industries Pvt Ltd. This established company was catering specific processed products such as pickled gherkins, bell pepper and salad leaves to multi-national companies in Sri Lanka and overseas. The company had well-structured models for training and contract farming programme

3.3.2. Fruit Exporters

A data collection visit to Nidro Pvt, Ltd., was conducted besides, the previously mentioned CBL and the Ellawala Horticulture farms which were also engaged in the export of fresh produce. Discussions with exporters participating in the respective stakeholder meetings that were conducted as part of the project missions, also indicated the importance of the urgent need for engaging farmers to register for certification in the adoption of GAP.

As was observed with the Nidro enterprise, other exporters of fresh produce were also investing in improved pack house facilities. A keen interest in moving towards cold chain operations to expand on export volumes of fresh produce was noted. This was seen as a means of addressing the problem of the seasonality of produce and the occurrence of glut periods of seasonal produce.

Discussions with the Agricultural Sector Modernization Programme (ASMP) funded by the World Bank and the ECORYS Project funded by the European Union for technical assistant to modernize Agriculture in Sri Lanka were supportive of this concept and the latter were proposing to conduct a feasibility study for introducing cold chain facilities in Sri Lanka.

3.3.3. Service Providers

Service providers to the fruit and vegetable sector value chains included private and public sector Institutions. Private sector services included the marketing of seed material, fertilizer and pest and disease control, green house and irrigation related materials. Public sector services were availed with respect to the provision of technical inputs related to production, processing and export.

However, both public and private sector institutions were observed to provide services in the case of testing of chemical residues, training on husbandry techniques and fruit processing and good manufacturing practices.

3.3.4. Development Partners

Development partners visited included officials from the World Bank funded Agriculture Sector Modernization Project, The European Union Funded ECORYS Mission, The Institute for Agro-Technology and Rural Sciences (IARS) Weligatta, Hambantota. Meetings with the Director General of Agriculture, Department of Agriculture (DOA) and the Additional Secretary Development of the Ministry of Agriculture were conducted. These organizations and line ministries were in a position to assist members of the LFVPPEA with:

- Linking/supporting farmer groups with members to expand production base for produce

- Hiring international consultants to help upgrade production and processing operations
- Conduct GAP training for farmer groups
- Conduct feasibility study for introduction of cold chain facilities
- Purchase vapour heat treatment facility for use by the horticulture sector

Details of data collected from Fruit Processors, Exporters, Service Providers and Development Partners are presented in Apendix 3 and Appendix 4.

CHAPTER 4 MARKET DEMANDS AND TRADE IMPLICATIONS

4.1 Environment and Social Impact

4.1.1. Sanitary and Phyto-Sanitary (SPS) Status and Market Requirements

Exporters in Sri Lanka need to be prepared to meet the stringent SPS requirements stipulated by lucrative export markets such as countries of the European Union, United States of America, Japan etc. However, products imported into these countries require certification from internationally recognized institutions stating the absence of residues of any of the 500 plus chemicals at ppm level, specified in their lists of prohibited chemicals.

In-country service providers e.g., the ITI, and SGS laboratories, are unable to meet all the listed residue testing and certification requirements. Exporters are thus currently obliged to send samples of products to overseas laboratories such as Europhyn in Germany at considerable cost for clearance from pesticide residues in their respective products.

Discussion with stakeholders confrmed that expanding GAP certification is crucial to addressing and resolving sanitary and phytosanitary issues and meeting more and more stringent requirements of lucrative markets.

Field visit data also indicated some specific SPS problems currently faced by exporters:

- The presence of enthral was detected in dehydrated pineapple exports by Target Agriculture. This chemical is used to induce flowering in pineapple. Residues were observed to persist despite precautions taken by the processing facility.
- The plant growth regulator Chlormequat (Brand Cycosel) was detected and was also confirmed to be a problem faced by exporters. This chemical was not registered with the registrar of pesticides. This indicates the unauthorized import of this compound into the country.
- The third problem observed was the presence of mealy bugs on fresh produce. This was reported by banana growers in Embilipitiya and also by papaya and pineapple growers.
- Processing operations needed to be more conscious of maintaining hygienic conditions in the premises and around their processing operations. This matter was raised during the team visit of the prospective overseas collaborative partner.

The National Plant Quarantine service continues to monitor notification of detection of unacceptable contaminants and continues to train extension workers and growers on pest and microbial contamination. The Department of Agriculture is in the process of conducting a feasibility study for the purchase of a commercial vapour heat treatment facility to combat contamination of fresh produce with fruit fly species issues.

4.2 Commodities

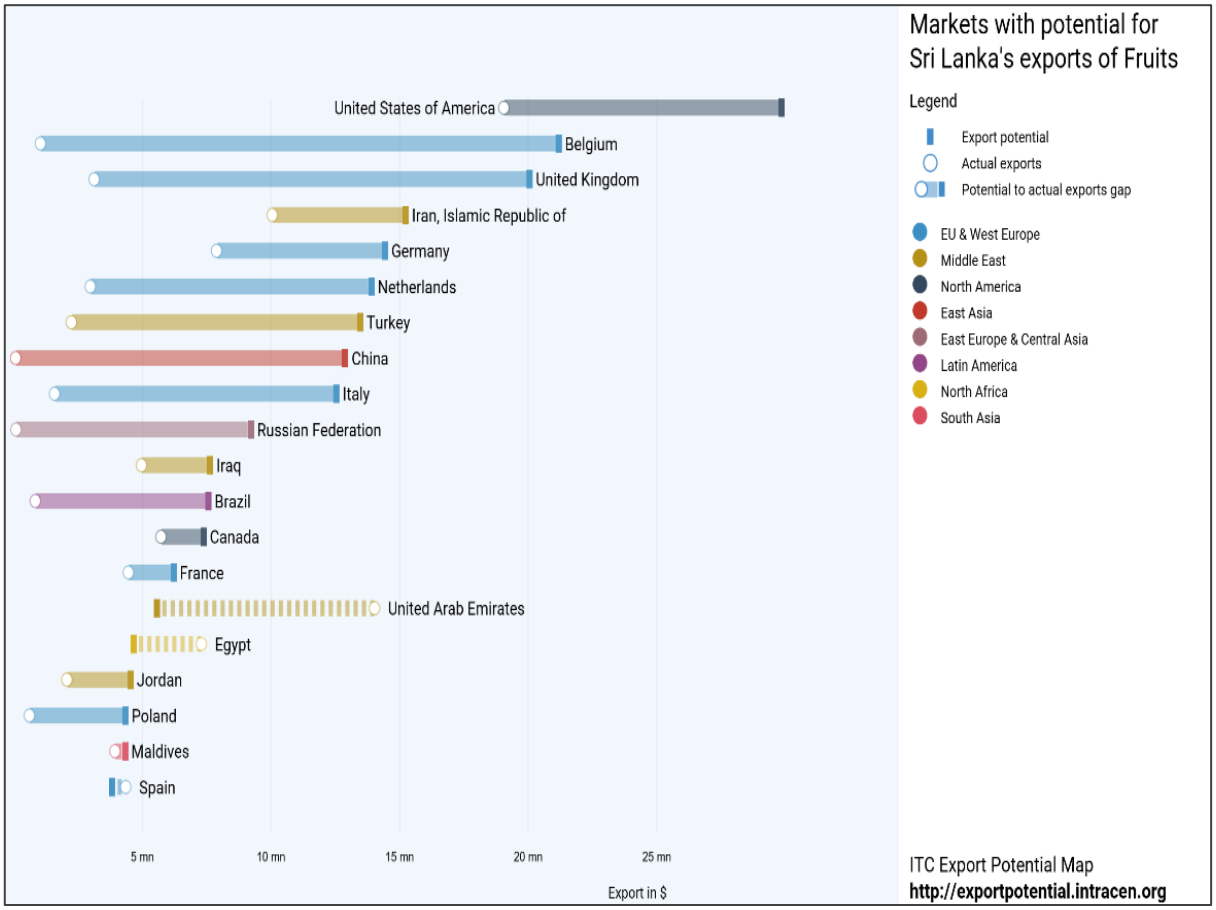
The actual value of Sri Lankan fruits export is $146.6 Mn while the potential export to the world could be $278.1 Mn. Data refers to 2017 except when specified:

Table 2 “Aggregated data of Sri Lankan fruit export in Eu, Asia and USA”

Key factors in Sri Lankan fruits exports to Europe:	Key factors in Sri Lankan fruits exports to Asia:	Key factors in Sri Lankan fruits exports to USA:
Actual export SriLa→ EU = $32.8mn (Italy 1.6mn) Potential export SriLa→ EU = $124.6mn (Italy 12.3mn)	Actual export SriLa→ Asia = $74.2 Mn Potential export SriLa→ Asia = $91.3mn	Actual export SriLa→ USA = $19.1 Mn Potential export SriLa→ USA = $29.6mn

Source: Trade Map and Export Potential Map

Figure 2 “Markets with Potential for Sri Lanka’s Exports of Fruits”



Source: ITC Export Potential Map

4.3 Technical Specifications

Technical specifications and market requirements for fresh and processed horticultural products are stipulated by respective buyers.

Members of the LFVPPEA who are engaged in the export of products need to be aware of such specifications and be able to conform to such requirements. An example of such specifications as provided by a prospective buyer is attached in Appendix 5.

CHAPTER 5 OPTIONS FOR VALUE ADDITION OPTION

5.1 Decision factors for Processing Opportunities in Lanka 2019

Within the framework of this feasibility study discussions were conducted with stakeholders and recommendations were given related to the different post-harvest processing opportunities for fruits. The following are the standard global processing technologies used for fruit processing post harvest:

- Preserved: Dices, Puree
- Canned: Dices in Sugar syrup and Puree
- Aseptic: Dices and Puree
- Frozen IQF and Puree

After this process, the fruit cannot be sold on the fresh market. The average market benchmark for a share between processing and fresh is: 80% of the fruit goes into fresh and the balance 20% goes to processing.

As per the socio-economic situation as of 2019, few factors were considered for not recommending the aseptic route and frozen route for fruit puree.

5.1.1 Rationale for the processing options considering the global trade volume

The minimum size for a bulk filling Canning/Aseptic/Frozen facility has a capacity of 2 tons per hour of puree filling. It produces 3 kg cans or 20 kg and 220 kg aseptic bags or frozen or preserved products in various size. This includes:

- the pasteuriser for hot fill in cans or to pasteurise the puree for frozen or pasteurisation for preserved puree
- the chiller for frozen or for cooling the puree for preserved
- for aseptic pasteurisation: the Filler and the peripheral utilities like cooling towers, boiler 1.5 ton per hour, chiller and dry compressed air associated with the plant.

This processing line is apart from the preparatory fruit handling line with online fruit washing stations, coarse pulp extraction, fine pulp finishing and centrifugation for fibre removal.

The estimated total cost for a line for processing fruits in either combination or with options just for equipment is estimated to be around 2.2 million USD. Land and building are additional and needs to be evaluated.

5.1.2. The economic viability situation

There are several reasons why the above is not viable.

The volume of fruits required per day is far above the capacity in Sri Lanka. In the case of Mango it requires 80 tons per day considering a yield of 50%. The cost of fruit per kg globally for aseptic like Totapuri, Tommy, Keit, Ngowe, is around Rs.16 LKR landed per Kg for a premium fruit like Alphonso and Magdalena it is around LKR 40 per Kg. In the case of Pineapple, the facilities primarily produced canned pineapple and the residual flesh from the skin is used to make pineapple puree. The average capacities of fruit per day intake is 300 tons per day. The average cost of fruit is around LKR 20 per kg of pineapple without the crown

The plant capacity volumes across India, Thailand Mexico and Brazil are designed to handle 8 tons per hour of puree, which is 16tons per hour of fruit. This will have a lower overhead, utility and processing cost.

Hence, considering the fruit volumes and prices in Sri Lanka, aseptic processing which is now a commodity market globally for the B to B segment is not viable for mango and pineapple. Instead, Sri Lanka rightly as it is being done focussed on Coconut processing which is value added and is for the health segment.

Further, the niche quality in terms of the varieties of Mango and Pineapple will be better in the fresh and Dehydrate market where flavour and mouth feel are appreciated and a small quantity can be sent for Individually Quick Frozen (IQF) processing.

Finally, most of the purees are used by formulated drinks rather than 100% drinks which are becoming expensive due the down turn in the global economy and hence value-added products like natural dehydrated fruits, IQF along with certifications like Organic and Rain Forest Alliance will gain better traction with better margins. Appendix 6 gives an indication of the price of dehydrated products.

Sri Lankan fruit processing industry is already engaged in the dehydration of fruits since many years; the quality of the fruit is a niche and the flavour profile is appreciated by the export market. Appendix 8 shows some photos of dehydration products.

Based on these considerations it is suggested to invest in the dehydrated industry and apply the following reccomendations:

- Upgrade the technology for the industry
- Ensure strict hygiene practices
- Ensure better raw material controls
- Ensure certifications in place
- Work with leading dehydrated product companies like Noberasco to grow the dehydrated fruit market for the niche Sri Lankan fruit quality.

5.2 Project Guidelines for Establishment of a Dehydration Facility

A model business investment plan is proposed for the production of dehydrated fruits based on proposed export markets as per the findings of the study. A Combi (hot air + vacuum microwave system-havm) dehydration facility is proposed as preferred solution for a sustainable fruit value chain in Sri Lanka.

The combination of Hot Air and Vacuum Microwave dehydration (see Appendix 8 - Figure 6, Vacuum Microwave Dryer) - is being proposed to achieve superior drying effect, higher output per shift & relatively lower energy consumption as compared to only Vacuum Microwave Dehydration or Hot Air Dehydration.

In the proposed Combi-HAVM dehydration technology, sensitive and high sugar tropical fruits like Mango, Pineapple, Banana, Jack-Fruit, Papaya are first dried for a few hours (2-4 hours) using closed loop hot air-drying technology. See Appendix 8 - Figure 7, Closed Loop Hot Air-Drying Schematic Diagram).

The benefit of this closed loop hot air-drying technology is the use of low drying temperature in the range of 55-70°C, thereby giving better colour and nutrient retention and thus an overall superior drying effect. In closed loop system, once the air to be used for extracting moisture is pulled into the drying chamber after passing through an appropriate filtration system, it is continuously recirculated during the entire drying cycle, without the need for mixing with fresh air from outside. Hot air is used to pick up moisture from the product and the moisture from the humid air is condensed, reheated and recirculated for moisture pick-up again and the closed loop process continues. Since, fresh air is not being added, less energy is consumed to heat up the air, to be used for recirculation. Closed loop system also offers protection from effects of outside temperature and humidity, and thus the dryer can operate in any season and location with same product efficiency and energy saving.

The partially dehydrated product from closed loop hot air-drying technology is then transferred to Vacuum Microwave Machine to achieve the desired moisture content of 5-10%. Typically, in Vacuum Microwave technology, heat required to remove moisture from the product is generated by directly transforming electro-magnetic energy into kinetic molecular energy, thereby helping heat to penetrate deep into the material and faster removal of moisture as there is higher partial pressure between surface and deeper layers. Additionally, use of vacuum helps in bringing down the temperature of drying. Therefore, thermo-sensitive tropical fruits which have relatively low thermal conductivity can get rapid and gentle drying by using Vacuum Microwave technology. A comparison of critical parameters between Combi (HAVM), Vacuum Microwave and Hot Air Dehydration Technologies for Mango is given in Table 13 below. A comparison of critical parameters between Combi (HAVM), Vacuum Microwave and Hot Air Dehydration Technologies for Pineapple is given in Table 14 below.

Table 3 “Comparison of critical parameters between Combi (HAVM), Vacuum Microwave and Hot Air Dehydration Technologies for Mango”

No.	Parameter	Technology		
		Hot Air (Closed Loop)	Vacuum Microwave	Combi - HAVM
1)	Drying Time (hours)	15 – 17	1.5 – 2	4 – 6
2)	Output (Kg) / 16h*	320-360	540-560	1000 - 1020
3)	Energy Consumed(kW) / Kg of Dehydrated Product	3.39	8.73	4.85
4)	Capex for the above output	Low	Medium	Medium (Optimized)

Number of machines taken into consideration: hot air-drying chambers (4 no’s) and vacuum microwave dryers (8 nos.)

Table 4 “Comparison of critical parameters between Combi (HAVM), Vacuum Microwave and Hot Air Dehydration Technologies for Pineapple”

No	Parameter	Technology		
		Hot Air (Closed Loop)	Vacuum Microwave	Combi - HAVM
1)	Drying Time (hours)	16 – 18	1.5 – 2	4 – 6
2)	Output (Kg) / 16h*	250-270	400-420	760 - 780
3)	Energy Consumed(kW) / Kg of Dehydrated Product	4.99	11.71	6.30
4)	Capex for the above output	Low	Medium	Medium (Optimized)

Number of machines taken into consideration: hot air-drying chambers (4 no’s) and vacuum microwave dryers (8 nos.)

The proposed model for establishing a dehydrated facility is given below along hte Budgetary Capital Expenditure Details in Figure 15.

Size of the factory excluding Utility Block – 70m(L) x 23m (Span / Width) (1610m²) (17323ft²)

Factory Clear Height - 4.5m

Size of the utility block – 25m(L) x 10m (Span / Width) (250m²) (2690ft²)

Pallet Size – Universal – 1200mm x 1000mm x 150mm

Load-ability / Pallet – 700 Kg

Finished Goods Storage Capacity – approx. 60 Pallets

Type of Racking considered – Single Deep with aisle width of 2.9m

Rack size – 2.3m(L) x 1.4m(Depth) x 2.2m(H) to hold 2 pallets

Number of levels – 2

Production Details [#]:
[#] - Basis Mango weighing average of 500g / fruit

Operating Hours / day: 16 (2 shifts of 8h)
Quantity of ripened fruit required / h: 1000 Kg
Yield after peeling, stone removal and wastage: 50%
Quantity of fruit slices available for dehydration: 500 Kg
Brix of Mango: 15; Total Solids: 16%; Moisture Content: 84%
Number of workers needed per shift for all operations[1]: 100 – 125

Number of supervisors and machine operators needed per shift for all operations: 8

Number of Hot Air-Drying Chambers: 4

Loading Capacity per chamber: 500 Kg of Mango slices

Duration of drying in Hot Air-Drying chamber: approx.3h including loading & unloading of trolleys into chamber

Power Consumption per hour per chamber: 18kW

Number of Vacuum Microwave Dryers: 8

Loading Capacity per Dryer: 40 Kg
Duration of drying in VM Dryer: 60 – 75min including loading & unloading of trays
Power Consumption per hour per oven: 45kW
Moisture Content of the final dehydrated product: 6%

Number of batches in 2 shifts with combi - HAVM dehydration technology: 12
Input Quantity of sliced fruit per batch: 500 Kg
Output Quantity of dehydrated product per batch: 85 Kg

Total Output of dehydrated product in 2 shifts: 1020 Kg
Finished production available for packing after grading (1.5%): approx.1000 Kg
Power Consumption per batch by Combi-HAVM dehydration technology: 404 kW

Power Consumption per batch by all equipment, utilities, lighting etc: 504 kW

Production Details [#]:
[#] - Basis Pineapple weighing average of 1200g / fruit

Operating Hours / day: 16 (2 shifts of 8h)
Quantity of ripened fruit required / h: 1200 - 1400 Kg
Yield after peeling, core removal & wastage: 60%
Quantity of fruit slices available for dehydration: 500 - 600Kg
Brix of Pineapple: 11; Total Solids: 12%; Moisture Content: 88%
Number of workers needed per shift for all operations[2]: 100 – 125

[1] Includes unloading of fruits, support for fruit washing, peeling, cutting, slicing, loading of slices into trays and stacking of trays into trolleys, loading of trolleys into drying chambers, unloading of trays from trolleys, reloading of partially dehydrated product into vacuum microwave ovens trays, unloading of trays from oven, final sorting and grading of the dehydrated product and packing into pouches / trays or bulk packing, stacking on pallets & final storage, loading support for containers, wastage disposal etc.

[2] Includes unloading of fruits, support for fruit washing, peeling, cutting, slicing, loading of slices into trays & stacking of trays into trolleys, loading of trolleys into drying chambers, unloading of trays from trolleys, reloading of partially dehydrated product into vacuum microwave

Number of supervisors & machine operators needed per shift for all operations: 8

Number of Hot Air-Drying Chambers: 4

Loading Capacity per chamber: 500 Kg of Pineapple slices

Duration of drying in Hot Air-Drying chamber: approx.3h including loading & unloading of trolleys into chamber

Power Consumption per hour per chamber: 18kW

Number of Vacuum Microwave Dryers: 8

Loading Capacity per Dryer: 40 Kg

Duration of drying in VM Dryer: 75 – 90min including loading & unloading of trays

Power Consumption per hour per oven: 45kW

Moisture Content of the final dehydrated product: 6%

Number of batches in 2 shifts with combi - HAVM dehydration technology: 12
Input Quantity of sliced fruit per batch: 500 Kg
Output Quantity of dehydrated product per batch: 65 Kg

Total Output of dehydrated product in 2 shifts: 770 Kg
Finished production available for packing after grading (1.5%): approx. 750 Kg
Power Consumption per batch by Combi-HAVM dehydration technology: 404 kW
Power Consumption per batch by all equipment, utilities, lighting etc: 504 kW

Table 5 “Budgetary Capital Expenditure Details”

No	Machine Description	Supplier	Quantity	Price (US$), FOB Basis
1.	Vacuum Microwave Dryer – 30KW capacity Input Quantity – 30 to 50 Kg; Output – 6 to 8 Kg Drying Time – 75 to 90min; Size – 3.5x2.8x2.2m	Kesu Machinery & Equipment (Zhengzhou) Co. Ltd., China	8	400,000
2.	Closed Loop Hot Air Dehydration Chamber (5.0x2.65x2.4m) including main heater cum condenser, touch screen controller, fans, 100mm thick polyurethane based structure, doors for entry & exit, trolleys (12 Nos), trays (600 Nos)	Guangzhou Kaineng Electric Equipment Co. Ltd., China	4	150,000
3.	Urschel Slicer – Model E Tran slicer with required slice assembly for 2 cuts (2mm & 3mm)	Urschel, USA	1	75,000
4.	Automatic Mango Peeling & Destoning Machine including connecting infeed & outfeed conveyors; Capacity: 2100-2400 fruits / hour	PND Srl, Italy Kronen GmbH, Germany	1	150,000
5.	Automatic Pineapple & Papaya Peeling & Decoring Machine including outfeed conveyor; Capacity: 600 – 800 fruits / hour	PND Srl, Italy Kronen GmbH, Germany	1	70,000
6.	Universal Dipping Station for slices treatment with ascorbic acid including dosing system & conductivity measurement; Capacity: 1000 Kg/h; Residence time: 90s	PND Srl, Italy	1	40,000

ovens trays, unloading of trays from oven, final sorting and grading of the dehydrated product and packing into pouches / trays or bulk packing, stacking on pallets and final storage, loading support for containers, wastage disposal etc.

		Kronen GmbH, Germany		
7.	Centrifuges with baskets for removing surface adhering water from slices	PND Srl, Italy Kronen GmbH, Germany	4	20,000
8.	Multifruit Washing Machine – 2 stage bubble wash; Capacity: Up to 3MT/h	B.K. Engineers, Karad, India	1	18,000
9.	Sorting & Grading Conveyor – 6m & Waste Screw Conveyor – 10m	B.K. Engineers, Karad, India	1+1	9,000
10.	SS Cutting Tables – Size: 2.0 x 1.5 x 1.0m	B.K. Engineers, Karad, India	30	15,000
11.	MS Powder Coated Racking System along with accessories for FG Storage – 60 pallets	Nilkamal / Godrej, India	1	2,750
12.	Electric Stacker - 1 Nos. & Hand Pallet Trucks (HPT) – 6 Nos.	Nilkamal / Godrej, India	1 + 6	22,750
13.	Fumigated Wooden Pallets – 200 Nos. & Plastic Crates – 10,000 Nos.	Nilkamal / Godrej, India	NA	56,000
14.	Utilities including WTP, ETP, Generator, Air Compressor, Transformer, HT & LT Panels, Electrical Cabling, Switches, Electrical lighting, UPVC Pipes etc, Top Hat Drains – single point & channel type	Various suppliers	NA	200,000
15.	Ventilation & AC for main process area & FG storage area including chiller, cooling tower, ducting, insulation, pipelines, automation etc	Hitachi / Reputed Supplier	NA	100,000
	Civil Work Related			
16.	Civil construction cost including plinth of 1.5m, compacting, PCC, RCC, Epoxy / VDF flooring, PEB, External Sheeting, PUF Panels(60mm thickness) as walls & roofing including supports, toilets accessories including taps, hand wash stations at different locations, doors for toilets & change rooms, High Speed doors at various locations, dock leveller, dock shelter, canopy for loading & unloading bays etc Office area including office furniture, computers etc & levelling of the site not considered	1860m² Cost / m² = USD 275		511,500
17.	Lab instruments			10,000
			Grand Total	1,803,500

(a) Considering that there is capacity available to run a third shift, which gives option to produce an additional 5-6 batches of production, it is advisable to have ethylene based ripening chambers – 4 Nos, with each chamber capable of ripening 20MT of fruit per day & a typical ripening cycle of 3-4 days depending on fruit maturity. Cost of installing a ripening chamber including civil work, PUF panels, doors, ethylene dosing & exhaust system, electrical wiring, lighting etc., have not been considered in the above table.

Estimated Cost – Approx. USD 100,000

(b) No budget has been allocated for the equipment needed for packing the dehydrated product as it will depend on what the end customer prefers. Options include easy tear pouches with or without zip lock depending on the grammage, stand-up pouches with / without zip lock or even bulk packing.

The proposed flow chart and information on the products and equipment are presented in Appendix 8.

CHAPTER 6 BUILDING AN ENVIRONMENT CONDUCIVE TO SUSTAINABLE VALUE ADDITION

6.1 International Business Partnership Programme

Building a conducive environment to sustainable value addition requires working with partners interested in long-term impact. Within the framework of this feasibility study further discussions and actions have taken place with two private sector identified partners:

6.1.1. Noberasco Business Model

Noberasco, a very prominent company in the world of dehydrated fruits and vegetable, has been involved in this project from inception. The collaboration started at the time of a previous STDF funded project in Sri Lanka for the fresh fruits and vegetable value chains implemented by ITC while enahcing market linkages. The top management of Noberasco has been involved with the project setting guidelines on the front end of the value chain, which is a very critical component of the project. Partnering with Noberasco and accessing their deep knowledge in the field of dehydrated fruits and vegetables, in terms of end market outreach, compliances and quality standards benefitted the project outcome. This culminated in the signing of a MOU with the LFVPPEA, to source and work with processors and farmers so as to develop a sustainable and long-term business model for Sri Lankan exports.

6.1.2. Goglio Business Model

Goglio SpA a world leader in systems packaging was approached in terms of assisting the processing community for bulk aseptic packaging as a follow up of the connection built during a visit to the company within the framework of a study tour from Sri Lanka to Italy. Based on facts the project decided to focus on dehydrated fruits and vegetables, no further collaboration would be explored in this specific area since Goglio does not work in this space for packaging.

However, during interactions with stakeholders it must be noted that further collaboration was built between Goglio and Sri Lanka where the company expanded its market presence in the areas of bulk aseptic packaging and supporting processors in the coconut water and coconut milk area of product development. The company also recruited an agent for supporting the Sri Lankan market, who is a member of the LFVPPEA.

CHAPTER 7 MODE OF ACTION AND STRATEGY FOR INTERNATIONAL COLLABORATION AND PARTNERSHIP

7.1 Selection of Industry partners to Champion the Collaborative Venture

Links with a key international partner such as Noberasco was made possible with assistance and guidance provided by STDF PPG Sri Lanka, ITC and the project consultants. A very informative overseas exposure visits to Italy was organised from 17 to 25 June 2018. The stakeholder meetings and visits organized during the course of the study provided the platform for members of the LFVPPEA to come forward as champions to lead the collaborative process. This was further supported by two mission visits to Sri Lanka by the team members of the prospective international partners to examine production and processing operations in the “field”. These visits built the foundation for credible links to be established between industry partners from Sri Lanka and Italy and paved the way for initiating and implementing the original objectives of this feasibility study.

During the study tour to Italy other prospective buyers were contacted and visited for establishing possible long term partnerships for both fresh and processed fruits. They mainly expressed interest to expand their portfolio of possible suppliers but less in terms of engaging in helping to build a sustainable value chains model. LFVPPEA was then in charge of following up directly with the contacts established in terms of transaction.

7.2 Signing of a Memorandum of Understanding between collaborative partners

A Memorandum of Understanding (MOU) was signed by Zuraish Hashim, President of LFVPPEA, and Benedetto Noberasco, Purchasing Director of Noberasco, on behalf of Mattia Noberasco, CEO of Noberasco, Italy. Signature ceremony was done in the presence of H.E. Ms Rita Mannella, The High Commissioner for Italy in Sri Lanka; Ludovica Ghizzoni, Project Manager of the ITC STDF PPG project; and representative members of LFVPPEA, and the National Project Consultant on Wednesday, 26th February 2019, at 6.00pm at “Residence by Uga Escapes”. The Agreement (MOU) developed within the framework of this feasibility study is presented in Appendix 9.

Figure 3 “Signing of the MOU on 26 th February 2019, Colombo, Sri Lanka”

7.3 Mode of Action and Role of the LFVPPEA

The proposed course of action of the cpllaboration with Noberasco is presented in Figures 9 and 10 below. The project is supposed to be implemented in three phases under the supervision of the LFVPPEA. The initial phase of the Project (January-April 2019) shall focus on moving ahead with the first orders following the previous submission of samples so that Noberasco may proceed with testing the products with their customers.

In phase 1 (2019/2020) - Existing supply and manufacturing capacity in Sri Lanka will be leveraged in order to get the project moving forward in a shorter timeframe.

Phase 2 (2020) - A broader engagement between the parties leading to the establishment of long-term sustainable supply of dried fruits from Sri Lanka.

The suggested model is to identify champions from the private sector who can work with farmers and distribution centres to improve yield, implement GAP and correct issues for implementing GAP more effectively in Sri Lanka. The role of the LFVPPEA has included the selection of champions for the collaboration and will continue with monitoring the progress of the project to ensure that an established code of conduct is practised as agreed by respective partners.

LFVPPEA shall maintain a data base on the volumes of produced exported via the project agreement. LFVPPEA will commit to capacity building of farmers to be able to service the expanding markets as per proposed in the project models adopted.

Figure 4 “Phase1- Proposed Value Chain Model”

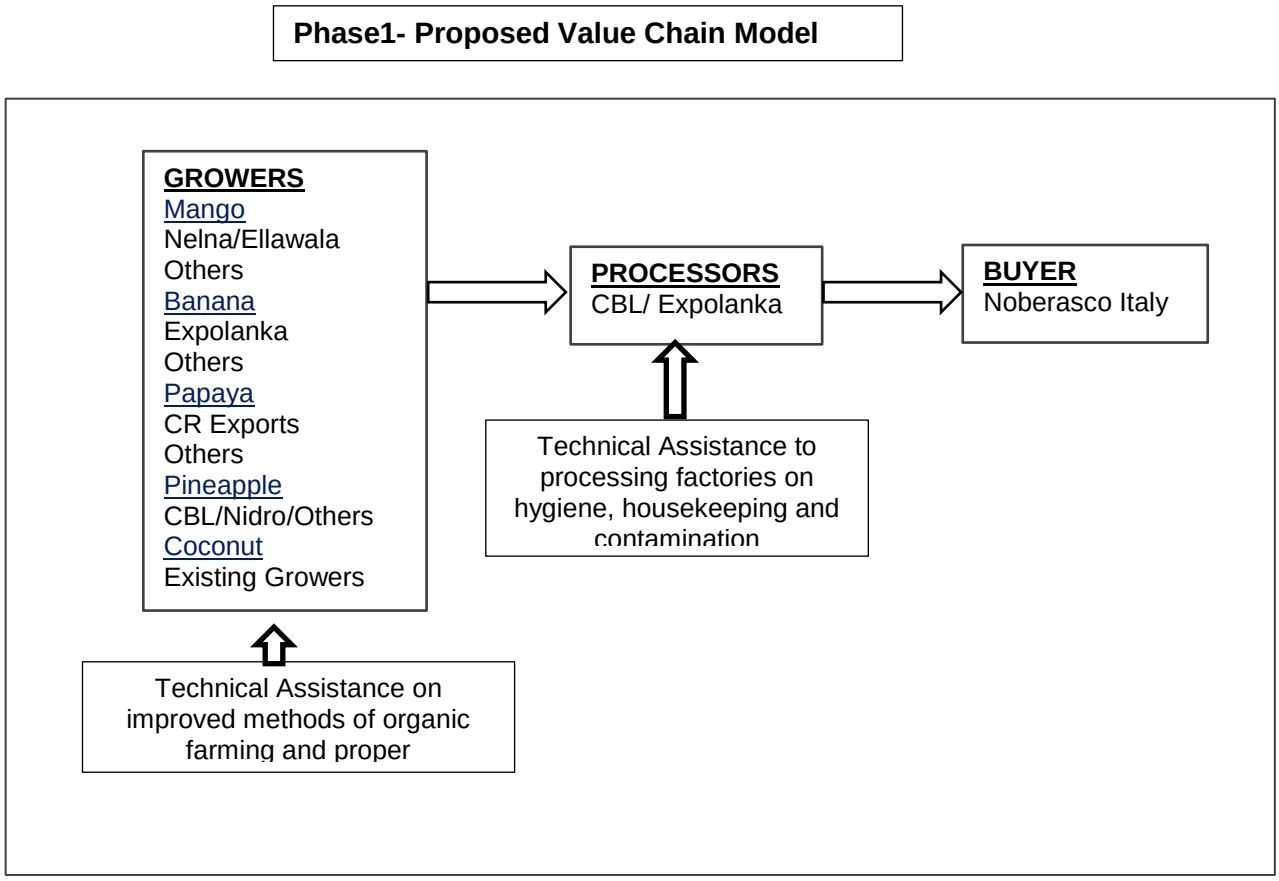
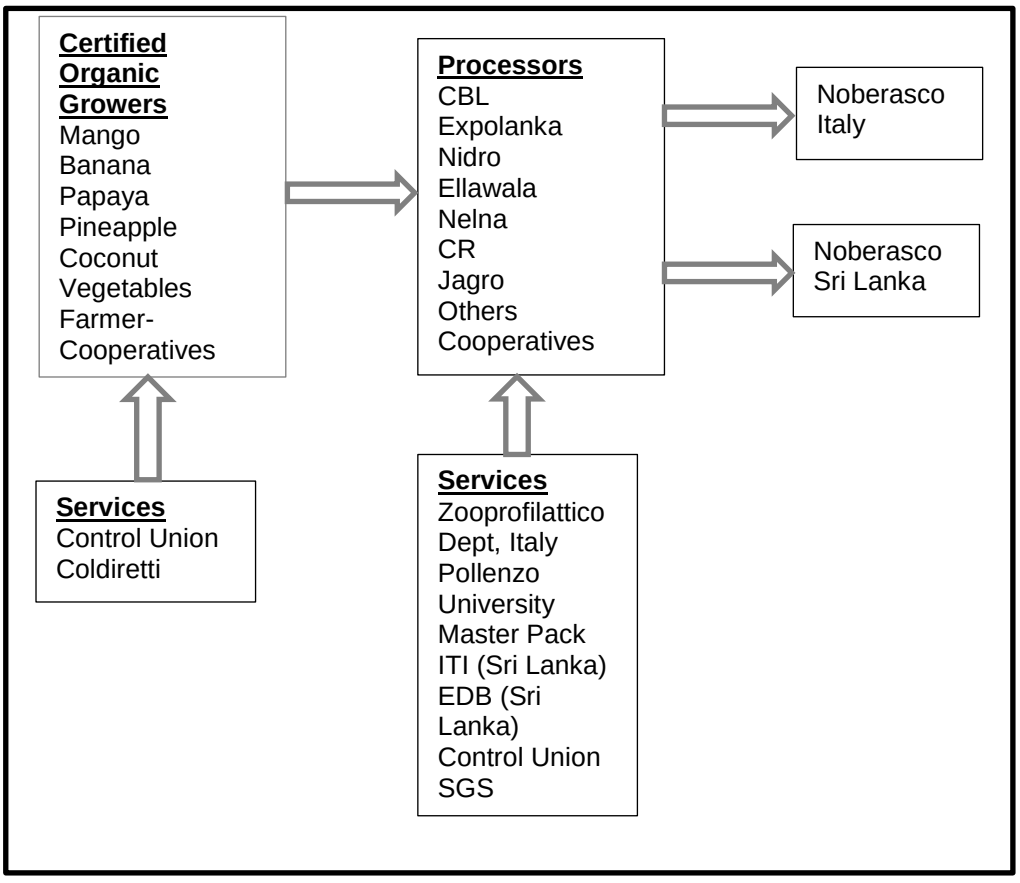


Figure 5 “Phase2 - Proposed Value Chain Model”



CHAPTER 8 CONCLUSION

8.1. Recommendations

8.1.1. Development of sustainable value chains

Sustainable value chains need to be established for traditional as well as organic fresh and processed products of the selected commodities. Promoting the adoption of Sri Lanka GAP and GMP need to be given priority so as to ensure food safety amongst consumers and also to promote exports to lucrative export markets.

Important post harvest considerations include the selection and introduction of suitable varieties/cultivars, and the availability of good quality seed and other planting materials, which not only produce good yields but also carry good post harvest characteristics, the use of maturity indices, proper harvesting tools and handling procedures and packaging materials that will protect the commodities during storage transportation and distribution, introduction of tagging and bagging procedures and the use of ripening chambers.

8.1.2. Development of Cold chain facilities and expansion of Sri Lanka GAP certification

Stakeholders need to be aware of the various components that make up a cold chain facility. Technical issues that need to be taken into consideration when setting up a cold chain facility must be addressed. Research needs to be conducted in order to develop necessary protocols for commodities destined for cold chain operations. While this technology enables the extending of storage life of commodities for varied periods of time, the cost of running cold chain facilities can only be sustained by the availability of adequate volumes of quality produce and demand from markets that can afford to pay for the increased costs these operations entail. Thus, it is imperative that the majority of farmers register for and adopt Sri Lanka GAP certification if cold chain facilities are to become a reality in the value chain.

8.1.3. Compliance with SPS measures and avoid related SPS interceptions / notifications due to pesticides residues

While monitoring SPS notifications that may occur and addressing such issues effectively and efficiently, it is necessary to ensure that chemical/pesticide residue levels in Sri Lankan produce does not exceed internationally permitted levels. Testing services for residue levels for a wide range of chemicals needs to be made available within the country at affordable rates for use by the fresh and processed fruit and vegetable industry. As such, the service provided by both public and private sector service providers need to upgrade the service currently offered by them to meet international standards required by the hospitality and export markets. Further, through the collaboration with an international partner such as Noberasco contacts with a preferred internationally accredited laboratory can be explored to enter into an agreement and access preferential rates.

8.2. Expected Socio economic impact of project and role of LFVPPEA

The Socio-economic impact of project and the role of LFVPPEA in taking the country forward in terms of fresh and processed horticultural commodities may be seen as follows:

- The increase in production base will ensure the availability of fruit and vegetables at affordable prices to domestic consumers and will provide the opportunity for the expansion of exports with better returns to farmers and increased foreign export earnings for the country.

- The adoption of Sri Lanka GAP and GMP will deliver safer quality products in the market for domestic consumers as well catering to overseas market requirements.

- The production and processing models promoted will help optimize available lands via organized, collective commercial farming via nucleus farms and out grower operational systems.
- Branding of Sri Lankan varieties of the selected crops and the possibilities of Geographic Identity could well become a reality.

8.3. Way Forward to Achieve the Overall Objectives Set Out for this Study

Implementing the recommendations emanating from the findings of this study would require necessary leadership from the LFVPPEA in all the respective areas mentioned in the report as follows:

- Identify, organize a working structure to implement the findings with respect to the crops
- Goals to be achieved
  - Increase the supply base
  - Increase the quality base of farming and farm practices via model farms
  - Increase certified organic growers with the help of Control Union or other certification bodies
  - Urge processors to implement certifications like BRC, FSSC 22000 and IFS
- Help improve infrastructure via government and international funds for the training centres which are outdated as of today. Make them up to date in technology and make them partners in training the trainers and stakeholders
- Work with input suppliers to educate farmers on correct practices of pesticide and chemical usage
- Work with traders and consolidators to support farmers to improve GAP and farm practices
- Work with implementing agencies, Control Union, GlobalGAP as partners to ensure private and government participation and hence get certification in place to larger farms
- Information dissemination should become a key focus of the association
- Exporters and companies should directly engage with companies like Noberasco to identify and plan business strategies in the value chain as identified in this study to develop a sustainable business model. The MOU between Noberasco and the association is an example of action to take the project forward.

APPENDICES

Appendix I Cultivation, Production and Export Data on Selected Fresh and Processed Commodities

Table 6 “Cultivation Extent of Major Fruits in Sri Lanka”

Fruit	Extent (ha)					
	2000	2004	2008	2012	2015	2017
Banana	46,042	51,488	47,682	52,819	53,246	49,307
Mango	24,336	27,840	25,747	28,126	27,786	28,272
Papaw	3,121	5,215	6,276	7,933	6,666	6,975
Pineapple	4,600	5,417	4,902	5,211	5,161	4,783
Orange	3,418	4,291	5,149	6,163	7,847	6,891
Passion fruit	454	300	434	446	642	470
Rambutan	2,718	2,856	4,687	5,987	3,923	5,899
Guava	2,537	973	1,287	1,393	769	1,123
Avocado	1,875	1,625	2,286	1,893	1,770	2,923
Lemon	406	429	552	574	-	-
Lime	7,337	9,945	9,898	12,141	11,394	10,799
Pomegranate	650	697	843	1,006	1,317	-
Water melon	229	810	159	1,053	735	1,214

Source: DOA, SriLanka

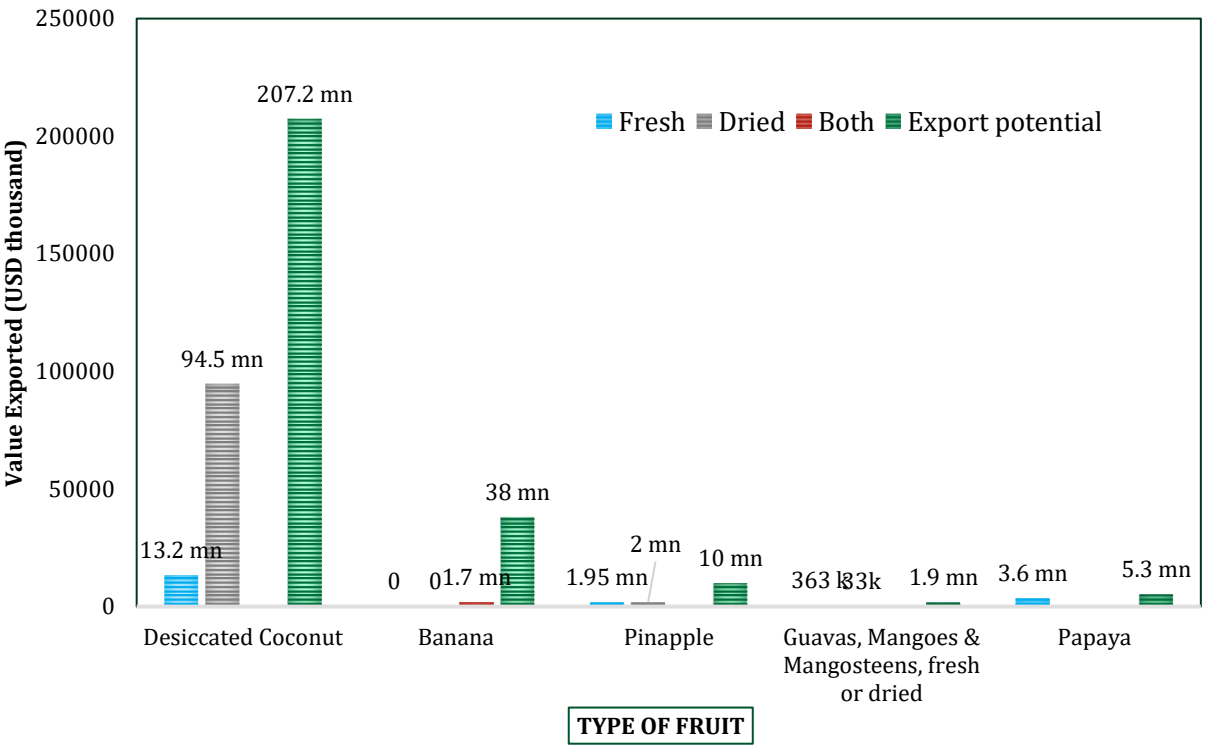
Table 7 “Annual Production of Major Fruits in Sri Lanka”

Fruit	Production (Mt)				
	2004	2008	2012	2015	2017
Banana	468,612	397,452	477,264	683,856	750,588
Mango	72,696	65,109	138,118	148,422	151,733
Papaw	23,711	24,935	92,226	92,016	86,219

Pineapple	54,901	54,350	58,268	54,886	52,786
Orange	4,119	3,606	4,356	6,792	7,049
Passion fruit	533	409	435	895	731
Rambutan	14,328	29,490	65,889	12,332	14,339
Guava	3,455	4,556	10,673	3,912	6,487
Avocado	9,616	12,076	19,592	17,994	10,100
Lemon	738	1,748	961	-	-
Lime	5,387	5,005	6,399	10,792	12,383
Pomegranate	1,927	5,499	3,931	7,524	-
Water melon	12,400	8,349	44,617	26,181	28,485

Source: DOA, SriLanka

Figure 6 “Sri Lankan export of fruit (actual and potential)”


250000
200000
150000
100000
50000
0
Value Exported (USD thousand)
Fresh
Dried
Both
Export potential
207.2 mn
94.5 mn
13.2 mn
0
0
1.7 mn
38 mn
1.95 mn
2 mn
10 mn
363 k
33k
1.9 mn
3.6 mn
5.3 mn
Desiccated Coconut
Banana
Pinapple
Guavas, Mangoes & Mangosteens, fresh or dried
Papaya
TYPE OF FRUIT

Appendix II Data Collection - Details of visits and persons interviewed

Mission 1

The field program for data collection was conducted from Monday 4th to Saturday 9th December 2017. An outline of the locations from where data was collected during this period is presented below.

Day 1: Monday, December 4th

Preliminary discussions and meeting with members of LFVPPEA and Members of the of working committee

Visits to Pineapple and Passion Fruit Growers in Gampaha District:

Plenty Foods Farm, Iryagolla, Pannala: Meeting with Mr. Anne Junaid and Mr. Janaka. Visited the farm of a fruit collection agent. Visited a passion fruit grower, Mr. Prasanna Sampath at Kadigawa who has 2 sites leased out for cultivation of passion fruit.

Persons met: Mr. Annes Junaid, Mr. Janaka and other team members from CBL. The fruit collector introduced by Mr. Annes Junaid and Mr. Prasanna Sampath.

Day 2: Tuesday, December 5th

Visits to Papaya Production, Collection and export packing facilities in Vavuniya District:

Visited CR Exports Packhouse and interacted with farmers, growing papaya and passion fruit respectively, the latter have an established supply base with Cargills for their fruit juice processing plant.

Persons met: Dr Upali Ranasinghe (Exporter) and Mr. Chandran and other farmers

Visited a Microwave-Vacuum drying facility at Oddusudan, a Department of Agriculture project. It was intended to check on the viability and utilization potential of this facility for small farmers and processors of the area.

Persons met: Dr Upali Ranasinghe and Mr. Prabaharan (Facilitator of the drying facility)

Day 3 : Wednesday, December 6th

Visited the CIC Farm Pelwehera, where organized cultivation of Cavendish variety Bananas is being carried out in the plains of Dambulla. More a demonstration farm to show case, good cultivation practices.

Persons met: Mr. Waruna Madawanarachchi

Visited the Ellawala Horticulture Farm and processing facility to understand the production of variety TJC and the husbandry techniques adopted in this successfully run operation. Information on different mango varieties and their different uses, cultivation practices and yields for Mango in Sri Lanka.

Persons met: Mr. Suresh Ellawala, Director, Mr. Bandara, Farm Manager and his team.

Visited the Dambulla Market centre, which is the biggest collection and re-distribution Centre in Sri Lankier is estimated that 70% of the national fruit and vegetable produce passes through the Centre. The purpose was to understand the mechanism of trader and commissions, losses on arrival and losses on redistribution.

Persons met: The Manager of the Market, the DOA representative; 3 stall holders selected at random.

Day 4 - Thursday, December 7th

Visited the high-density Pineapple Farm managed by Ruwan Hemage at Loluwagoda, Giriulla. This was to study the possibility and practicality of efficient land use and high-density plantation in Sri Lanka for Pineapple.

Persons met: Mr Ruwan Hemage

Visited the Expo Lanka aseptic plant for processing king coconut, to understand the procedures practiced for coconut processing and packaging.

Persons met: Mr. Imdadh Marikar

Afternoon - visited the Nidro Packhouse at Biyagama to understand the deliverables and supply chain process of fresh vegetables and fruits handled by Nidro in Sri Lanka.

Persons met: Ms. Dawn Austin

Day 5: Friday, December 8th

Breakfast Meeting with Mr. Rizvi Zaheed of Hayles to discuss the contract farming procedure practiced by Hayles and the cultivation and farmer training programmes developed by Hayles. Also discussed the possibility of working with Noberasco to produce dehydrated fruit for the export market as partners.

Person met: Mr. Rizvi Zaheed

Morning: visited the CBL fruit-processing factory at Averiwatte, Heenatiyana, to understand fruit sourcing practices and the cost structure in the logistics and the hurdles faced by CBL in scaling up operations. The facility was evaluated by Noberasco representative Andrea Callo for the suitability of a possible sourcing programme of joint production.

Person met: Mr. Anne Junaid

Afternoon: visited Expo Lanka facility for dehydrated products. The visit was to understand the exporters point of view in the involvement of agriculture to obtain raw material, the cost structure of logistics and losses during transport. Further the end market requirements and the price points were understood. Noberasco representative Andrea Callo evaluated the facility for a possible opportunity to buy products from Expo Lanka and also look at the possibility of a joint production cum sourcing option.

Persons met: Mr. Imdadh.

Day 6: Saturday, December 9th

Participated in an end of Mission 1 meeting with the LFVPPEA members. The meeting was primarily to inform the members of the Mission findings, discuss the possibilities that can be planned for increased productivity at farm level and to further discuss mentor programs from established exporters to drive the improvements at farm level. Thus, to show case good practices and incentivize farmers to implement such practices to improve yields and better-quality produce.

Persons met: Committee Members and Members of LFVPPEA.

Mission 2

The field program was conducted from Sunday 4th to Sunday 11th March 2018.

Day 1: Sunday, March 4th

Travel from Colombo to Embilipitiya. Feedback on the outcome of Mission 1 from visits to farms were discussed. The gaps from Mission 1 that needed to be covered were identified with regards to Banana. It was also decided to visit to the Nelna Farms for more data on Mango, as well as the Governmental training centres so as to close the loop in the value chain.

Persons Participating: Mr Suresh Ellawala, Mr Zuraish Hashim and Mr Venkat Prahlad Dr Shanthi Wilson

Day 2: Monday, March 5th

Meeting with the resident manager of the Mahaweli project, Mr. Wimalasekara,

The objective of the meeting was to obtain an overview and understand the current situation with regard to banana cultivation taking place in this region.

Farmers Meeting at Moraketiya

Thirty farmers were present at the meeting. All the farmers present were Banana growers. The objective of the meeting was to understand the crop prices, fluctuation in prices, post harvest issues, delivery issues and the size of farm holdings. Many of the farmers grew their produce on leased land. Average farm size was 2.5 acres, with 420 plants per acre. Farmers indicated that loss of produce from farm to wholesale point/distribution centre was 30%. Plant density was 420 plants /acre and they were able to harvest 4 bunches a year per stand. Bunch weight could vary from 14kg-35kg depending on availability of water. Sale price was between Rs. 35/- and Rs. 90/- per Kg. Cost of production was Rs. 25/- to Rs.35/- per Kg.

Visit to the Nelna Farm

The Farm was run by the Nelna Group. Ms. Punya Nanowalker and Mr. Nanayakkara were Directors of Nelna Group. The objective of the visit was to understand the model of the farm, the practices for the growing of Mangos for the market and price points.

Persons Met: Mr. Piyathilaka, Mr. Wimalasekara, Mr. Nanayakkra and Ms. Punya Nanayakkara and farm managers Mr Pradeep and Mr Madura.

Day 3: Tuesday, March 6th

Visit to Cathy Rich Foundation

The objective of the visit was to study the facilities available and see the possibility of using the Cathy Rich Foundation for training programs and assisting in the upstream value chain of processing.

Persons met- Mr. Jagath Basnayaka. Manager

Visit to NICO Products

This processing facility produced dehydrated fruit and was a supplier to a leading exporter. The objective was to understand the cost structures of the raw material, the different varieties used in processing of the various fruits, the process flow, and the certifications present and if the facility is ready to cater to the export market.

Persons met: Mr Sanath

Visit to Jewelex Mango Farm

The land was leased from the temple. The farm consisted of 300 acres. Of these, 75 acres was brought under cultivation with 50 acres were under TEJC mango and the remaining under banana. TEJC variety Mango and has Banana Plantations as well. The objective was to understand the yields the planting density and the cost structure at the farm level.

Persons Met: Mr. Duminda Gurusinghe and Mr Jayantha Hullangama

Visit to the Sooriyawewa Sathi Pola

This was a banana wholesale market. The objective was to interact with traders and wholesaler to understand the trading structure, from farm to the whole sale market, to understand the facilities available to stakeholders at the market, to ensure that post harvest losses are a minimum and the fluctuations in the pricing during the year. However, the persons we approached were busy and reluctant to engage in conversation with the team.

Persons Met: Selected Whole sale merchants and farmers

Day 4: Wednesday, March 7th

Visit to a Department of Agriculture Training centre at Anganokolapelessa

The training centre runs a range of training programmes for farmers for including the processing of fruits and vegetables. The objective was to check out the potential for involving the centre for expanding farmer training on GAP and also use their processing facility for training the upstream in the value chain for processing.

Persons Met: Mrs. R.C. Jayasinghe

Visit to Target Agriculture

The Industry was run by a German national, Dr, Nobert Kohl. The objective of the visit was to understand the process of organic certification of the raw materials, since target Agriculture exports only organic products, in frozen and dehydrate formats.

Persons Met: Mr Mahesh and Mr. Lochana

Day 5: Thursday, March 8th

Visit to the Plant Quarantine Services at Katunayake

The objective of the visit was to understand the SPS issues and the availability of online databases with the department. The visit was also to check the availability of the regulations of different countries at the department. Finally, the main objective was to see how the data available can be disseminated to the industry for export.

Persons Met: Mrs. K. Warshamana and Mrs. Jayani

Visit to Finlays cold storage facility This facility was the largest cold storage facility in Sri Lanka. The objective was to understand if Finlays has the capacity to offer the market cold storage facilities especially to farmers for storing fruits to reduce post harvest losses, Secondly if Finlays will be willing to participate in developing the cold chain and ripening facilities at wholesale market areas to assist farmers and exporters to improve the quality of the produce and reduce post harvest losses.

Persons Met: Mr. Saveen Gunaratne and Mr. Givantha Ariyaratne,

Day 6: Friday, March 9th

Meeting with Control Union representatives

The objective was to understand the scope of activities of Control Union in Sri Lanka. Gather data on the extent of organic cultivation in Sri Lanka. The competency of local laboratories to undertake testing for organic certification and capability to meet global MRL standards.

Persons Met: Mr. Sanjaya K Pathirage

Meeting with Project Team

Suresh, Imdadh, Zuraish, to discuss the way forward to implement the findings of the Mission 1 and Mission 2. To find champions from the private sector who can work with farmers and distribution centres to improve yield, implement GAP and correct issues for implementing GAP more effectively in Sri Lanka

Day 7: Saturday, March 10th

Meeting with LFVPPEA members

Meeting was held to appraise members of the LFVPPEA on the findings of Mission 2 and discuss the way forward for both Missions. To put on the table the ideas of Champion partnerships to take the findings and implement model farming practices and work with government to improve the distribution centres and facilities at these centres.

Day 8: Sunday, March 11th

The objective was to study the findings and try and work on strategies for forward action and to consolidate the data on the report and study data from the Export Development Board and to see if this makes value for this study.

Day 9: Monday March 12th

Visited ITI Laboratories

The ITI chemical and microbiological testing laboratories are the most advanced in Sri Lanka and are accredited by SWEDEC. The objective was to understand the capability at ITI laboratories to undertake in the long-term testing for all pesticides and heavy metals to meet global standards. The final goal being that the final testing can be done in Colombo and not necessary to be sent outside Sri Lanka for testing. The possibility for partnerships with Control Union to guarantee sample volume for ITI to invest and private partnership were discussed.

Meeting with Solar Green Plantation Group: the company was established in 2007 and had 250 acres intercropped with pineapple in Angunukolapellasa - Mahawelli upland irrigable land. They had 115 acres under drip irrigation. They are at present engaged in setting up a nursery for production of pineapple suckers so as to expand their pineapple plantation at 30,000 plants per acre.

Development Partners

Development partners were also visited; discussions were held with officials from the World Bank funded Agriculture Sector Modernization Project, The European Union Funded ECORYS Mission, The Institute for Agro-Technology and Rural Sciences (IARS) Weligatta, Hambantota, The Director General of Agriculture, Department of Agriculture (DOA)and the Additional Secretary Development of the Ministry of Agriculture. They all were updated on the proposal for building a sustainable value chain model.

Appendix III Details of Data Collected for Production of Respective Fruits

1.Pineapple

As per the plan, pineapple plantations were visited in Gampaha District, Bingiriya and the high-density plantation of Mr. Ruwan at Loluwagoda. Visits were also made to processing factories which processed pineapple including the dehydrated fruit product. The objective was the collection of data available on Fruit prices at farm gate; Yield at the farms per Ha or Acre; Costs faced by farmers; Quantity of different varieties of fruits available; End Product Pricing and Understanding the process cost drivers; Quality and flavour of available fruits; Possibility of an unique Geographic Identity (GI) tag for Sri Lankan fruit varieties; Current global demands on varieties and possibility of growing these varieties in Sri Lanka to catch the export market; Update on SPS issues if any particularly with respect to sales of fresh pineapple as well as dehydrated and canned fruit.

Findings and Observations

Table 8 “Summary of Field Data Collected on Pineapple”

Check List	Observations
Fruit price at farm gate	Fruit Size 1 to 1.2 Kg weight is Rs.50. Fruit Size 750 grams to 1 kg weight Rs.30 and below 750 grams weight is Rs.15 to Rs.20 per Kg
Yield at the farms per Ha or Acre	The average yield per is 5-7.5 MT per acre. Pineapples are intercropped with coconut with planting densities between 5000 to 6000 plants per acre. However, some high-density plantations had 10,000 plants per acre.
Costs faced by farmers per Acre	Planting material (suckers + pre planting costs) Rs.25/50 per plant; Land preparation Rs. 20,000/-; Fertilizer cost Rs.4000/-; Weed control Rs.12,500/-; Flower induction Rs.2000/-; Harvest Rs. 4000/-; Miscellaneous costs Rs.5000/-.
Quantity of different varieties available	The main variety cultivated is the Mauritius variety (Queen Group) It is estimated that there is close upon 6000ha under pineapple cultivation at present. DOA has not introduced MD2 variety for cultivation in Sri Lanka
End Product Pricing and Understanding the process cost drivers	Fresh Pineapple-Transport from farm Rs5/Kg; Processor/Exporter- Rs. 55/Kg; Wholesale price Rs.61/Kg; Distributor Margin 30% on wholesale price Super Market Margin 40% on distributor price; Consumer Price-Rs.110/-per Kg.
Quality and flavour of the fruits	Unique flavour. The Mauritius variety (a Queen type originally from South America with family name of *Ananas comosus)* High mean Brix value of mean 14° when harvested at Mature green to 10 % yellow stage

Check the possibility of a unique Geographic Identity (GI) tag for Sri Lankan fruit varieties	Mauritius variety
Current global demands on varieties and can they be grown in Sri Lanka to catch the export market	MD2 is currently the most widely grown variety in major pineapple producing countries for the fresh market. The key factors for the demand for MD2 are the firmness and keeping quality of the fruit and the flavour profile since the MD2 is a mix with two varieties Smooth Cayenne (more acidic lower flavour profile but firm) and Queen (low acid, but higher flavour and sugars hence short keeping quality). This fruit is primarily for the fresh fruit market. Fruit that does not qualify for the fresh produce market is used for processing e.g. dehydrates and canning, thereby have a lower cost of the frit raw material.

Further observations and information gathered on pineapple production from field study

Plenty Foods Farm owned by CBL, in Iryagolla, Pannala in Bingiriya - Collectors / Consolidator.

This is a demonstration farm for out growers enlisted and registered by the company to supply produce to them. The farm serves as a centre for dissemination of good agricultural practices (GAP) transferred for adoption to out their grower farmers. The acreages held by individual out grower farm holdings registered with the Plenty Foods farm are as follows: a) 5 to 7.5 acres 30% b) 7.5 to 10 acres 60% and 10 to 12 acres 10%.

The farm also grows other commodities with earnings generated from crops other than pineapple are as follows: Rs. 60,000 to Rs. 70,000/ acre for coconut. Rs.150,000/acre for Passion and Rs. 70,000/acre for Ginger or Turmeric. Income from Pineapple is Rs.20,000 to Rs.30,000/acre.

Around 350 acres of pineapple plantations are available with 3 acres being the average size of a plantation for pineapple in this location. There are around 60 out grower farmers in the area. The major pineapple variety grown in this area is Mauritius variety - a Queen group pineapple. In general pineapple production in Sri Lanka is by smallholder farmers.

The plantations are all intercropped farms, with coconut being the main crop for intercropping. Other crops like banana, turmeric and cardamom are also intercropped with pineapple in some instances.

Not all the farmers are full time farmers hence monitoring of farms is left to labourers and managers. GAP is not practiced by most pineapple growers and is an area of concern. Poor management of weeds and undergrowth will lead to cannibalization of nutrients in an already intercropped plantation.

The limited availability of planting material (around 50,000 plants/year) is a big concern. However, the ministry of primary industries has a program for producing 1 million tissue culture (TC) plants. The contact person for furthering this necessary requirement of planting material is Mr. Pythonlike (phone 0714803353 for info), particularly if there is a cartel amongst a group of growers, which prevents the fair access of planting materials to all growers. It is noted that the quality of planting material has no standards and no procedures to control the same, and that planting density is around 6500 to 7000 plants per acre of pineapple, intercropped with 64 coconut trees per acre.

Labour availability is an issue and of concern to growers. The cost of labour is Rs.1000/day (8 hrs for a casual labourer). This was considered a high rate for the skill level required.

The croppint time is 14 months to the 1st crop, 16 months for the 1st Ratoon and 18 months for the 2nd Ratoon. It is important to note here that the cost / Kg of fruit here includes the crown, shell and the stem end in the total weight. This differs from the international norm of just the weight of the fruit, which is sold on a per Kg basis in other countries except India.

Ruwan Hemage High Density Pineapple farm at Loluwagoda, Giriulla

Ruwan's farm is in a hilly area. He uses his resources in a good manner. He practices High Density plantation as a mono crop, which he has learnt on his visits to other countries previously funded by the STDF project on

fresh fruits and vegetables implemented by ITC. He also grows exclusively the Mauritius type Queen variety. He has a target to expand to 25 acres in two years. He has a crown nursery and generates about 4000 crowns. Collectors come and collect the fruit from his plantation and sometimes also supply labour to harvest the fruit.

In his farm planting distance between plants is 40 cm, while the distance between rows is 2.5 feet. This results in 10,000 plants per acre compared to 6500 plants - the norm with intercropped pineapple plantations in Sri Lanka. In this system the average yield per acre is around 10 tons per acre. When using crowns as planting material, fruits are harvested after 18 months. His production costs are presented in Table 2.

Moving on to the farm of the fruit collection agent, it was observed that he had rented the land for the purpose of growing pineapple. This grower indicated that he had a problem with hiring labour, although land hire charges appeared to be low in Sri Lanka.

However, the land utilization and the GMP was not satisfactory in this farm. It is noted that inputs with respect to GAP and product management skills are urgently required so that GMP will produce desired quality of fruits alongside satisfactory financial returns to the farmer.

Table 9 “Cost of high-density cultivation as per Mr Ruwan Hemage”

Cost Head	Cost in Rs/Kg
Planting Material	15
Sucker removal and transport	3
Mealy bug Treatment	1
Transplanting Sucker	2.50
Fertilization after 1 month	1.50
Solid Padding after 3 months	2.50
Total cost	25.50
Further costs after 3 months	
3rd Fertiliser when leaves form	Rs. 4000 per 25 kg bag, 10 grams per plant
Weed control Labour cost	Rs. 12,000 per acre
Machine, Fertilizer and Ethral (Forcing)	Rs. 2,000 per acre
Harvest Labour.	Rs. 2 per Kg as an estimate (For 1 acre 2 people are required - Rs.1000 for female and Rs. 1200 for male.

Hence the farm gate cost per Kg to a farmer is Rs.28 including the miscellaneous cost.

Mr. Ruwan gets a selling price at Farm Gate for Fruit Size 1Kg to 1.2 Kg weight - Rs.50; Fruit Size 750 grams to 1 kg weight - Rs.30 and below 750 grams weight - Rs.15 to Rs.20 per Kg.

2.Passion Fruit

Passion Fruit growing areas in Kadigawa and Vavuniya were visited. Data collected included the yields, the variety, area under cultivation, cultivation and pollination practices for passion fruit, current end market is mainly processing rather than for the fresh market. The intervention provided by the International Labour Organization (ILO) and the success of their efforts with this crop were apparent in the Vavuniya area in terms of farmers training and implementation of GAP amongst the farmers. This was apparent when the team visited other passion fruit growers as in Kadigawa. As mentioned for previous crops above, data was collected for preparation of the check list below.

Findings and Observations

Table 10 "Summary of Field Data Collected on Passion Fruit"

Check List	Observations
Fruit prices at farm gate	In Kadigawa Farm Gate Price: Rs.50/- per Kg to Rs.150/- Vavuniya Farm Gate Price: 60/- per Kg to Rs.180/-
Yield at the farms per HA or Acre	In Kadigawa 600 plants/acre; 800 plants/acre In Vavuniya - Passion fruit plantation yields around 24,000 kgs/acre/year. In a drought year the yield drops to 12,000 kgs/acre/year
Costs faced by farmers	Planting Material – VavuniyaRs.20; Kadigawa Rs.60/- Pole, Line, Planting – Rs.4,00,000 / acre Per month Labour – Rs.6,000 /acre; Kadigawa Rs.3000/ acre (Kadigawa Rs. 600/- to Rs.1000/- per day) 8th week plantation treatment – Rs.9,600/ acre 8th month harvest labour – Rs.19,200/ acre per day Natural fertilizer cost Kadigawa – Rs 48,000/acre Cost of production – Rs.50/kg (Kadigawa); Vavuniya –Rs.40/-
Quantity of different varieties available	The Yellow/green variety is the common variety grown in Sri Lanka; the purple variety is available but in very small volumes. Passion fruit plantation yields around 24,000 kgs/acre/year. In a drought year the yield drops to 12,000 Kgs/acre/year 107 acres of passion fruit in Vavuniya. The bulk of this produce goes to Cargills for foe processing.
End Product Pricing and Understanding the process cost drivers	Cost per Kg of Passion fruit works to around Rs. 70 and a low of up to Rs. 40 per kg. Hence considering grade 1 sells at Rs. 180 per Kg, the margin is very high and the second grade is sold at Rs. 60 this is more reasonable.
Quality and flavour of the fruits	Acceptable in International markets.
Possibility of a unique Geographic Identity (GI) tag for Sri Lankan fruit varieties	Not apparent
Current global demands on varieties and can they be grown in Sri Lanka to catch the export market	Cultivation of both the commonly grown yellow variety and the scarcely grown purple variety can expanded and promoted for the processed fruit market and fresh fruit markets respectively with due provision made for prevention of loss due to aphid borne virus infestation.

Further observations and information gathered on passion fruit production from the field study.

Farm of Prasanna Sampath at Kadigawa

The plantation in Kadigawa was not well managed. It was apparent that the farmer had little previous experience with cultivation of the crop and was not aware of the need to rotate the crop once in 3 years nor he was familiar with GAP that would increase yields and sustainability of his business. This was in contrast to

farmers and their passion fruit plantations in Vavuniya where the farms visited were structured passion fruit plantations, and where the farmers knowledge was very strong. Farmers were aware of the need for cross pollination and crop rotation requirement after a production cycle of three years. Out of a total of 500 acres cultivated in this area, 107 acres was under passion fruit cultivation. Papaya and to a lesser extent Moringa and Tapioca are grown on the remaining acreage.

A pilot project supported by local traders and exporters, for training 36 farmers on post-harvest management is an ongoing programme and is in progress. The plantation density is 400 plants/acre. This plantation density is a standard global practice. Passion fruit plantations yield around 24,000 kg/acre/year. In a drought year the yield drops to 12,000 kg/acre/year. Fruits are usually harvested after 8 months. Fruit grown in this location was mainly for processing where the major buyer is Cargills (Food City Chain). The price at farm gate in high season is Rs.180 per Kilo for first grade and Rs. 60 per Kilo for 2nd grade.

The Vavuniya farmers have adopted good farm practices and are willing to use better irrigation practices.

3. Papaya

Papaya growers at Puliyankulama were visited along with the export pack house facility of CR exports, where we were able to meet Dr. Upali Ranasinghe, the exporter. The CR exports pack house was visited to study the logistics of the handling, transportation and distribution procedures related to export of papaya to the middle-east market. As mentioned for previous crops above, data was collected for preparation of the check list below.

Findings and Observations

Table 11 “Summary of Field Data Collected on Papaya”

Check List	**Observations**
Fruit prices at farm gate	Rs.17/Kg
Yield at the farms per HA or Acre Costs faced by farmers	Could range from 20-50 Kg per tree. Vavuniya – 1000 – 1200Kg / quarter acre per month.
	Land preparation Rs.140,000/acre; Seeds Rs.1600/acre; Pest Control (not fixed) Rs.1000/month; Water Rs.28,000/acre month; Fertilizer Rs, 12,000/acre; Transport – Rs.10/Kg
Quantity of different varieties available	The majority of the farmers are growing the Red Lady Variety (Taiwanese import). Seed material for Rathna Variety was released from the DOA but is not available at present.
End Product Pricing and Understanding the process cost drivers.	Rs.34/Kg
Quality and flavour of the fruits	The fruits remain firm during transportation. Flesh colour is an attractive dark orange. The Red Lady is resistant to ring spot virus.
Possibility of a(GI) tag for Sri Lankan fruit varieties - a unique Geographic Identity	Could have been done with the Rathna variety if available.
Current global demands on varieties and can they be grown in Sri Lanka to catch the export market	Yes

Further observations and information gathered on passion fruit production from the field study.

CR Exports, Pulliyangkulam

Dr. Ranasinghe began his papaya cultivation for export in Pulliyangkulam as a pilot project with 36 farmers in 2011. The farmer co-operative now has 350 members engaged in papaya production. So far 200 farmers are certified for GAP and Fair Trade. Seed material is issued by one company in Vavuniya. The planting density is 600 plants per acre or 150 plants per quarter acre. Majority of the Papaya is marketed as fresh produce with a high demand for export and local markets, especially hotels. Processed Papaya is mainly for dehydrates and here the market is limited. Although papain extraction was prevalent in the past this not the case at present due to contamination issues.

4.2.4. Mango

Mango crop visits for data collection were conducted in the north central province. Accordingly, visits were made to Rajarata Farm managed by Ellawala Horticulture Pvt Ltd at Galkiriyagama. Green Tree Farms - a large farm - was also visited in Kirigalewa Road, Rathmalgahawewa. In addition, we saw a farm at the CIC farm at Pelwehera. The extent of mango cultivation in Sri Lanka is around 27,500 Acres. The main varieties of Sri Lankan mangoes are Karuthakolomban, Willard, Ambalavi, Chembatan and others. These are indigenous varieties. The normal spacing of the trees is 10m x 10m and for some other varieties 7 x 10. The major areas of production are the North and North central areas. The south also has plantations. The main season for mangoes in Sri Lanka is from May to July and from July to September. However, in the recent time, they can be had almost year-round but with reduced yields and taste profiles can vary.

Findings and Observations

Table 12 “Summary of Field Data Collected on Mango”

Check List	**Observations**
Fruit prices at farm gate	TomEJC Variety Grade 1 - Rs.308 /Kg Grade 2 - Rs.207 / Kg Grade 3 - Rs.117 / Kg Karutha Kolumban (KK) Grade 1 - Rs.120/ Kg Grade 2 - Rs. 90/ Kg
Yield at the farms per HA or Acre	TomEJC Variety – Could range from 5-6MT / acre Karutha Kolumban–2 MT / acre
Costs faced by farmers	All-inclusive cost – Rs. 80,000/ acre (Land preparation, fertilizer application, pest, disease & weed control, labour, Transport and bags for bagging of fruits)
Quantity of different varieties available	The majority of large-scale farms growth TEJC and KaruthaKolumban Variety. The less abundant Willard, Malwana and Beti Amba varieties are also available and mainly used for processing.
End Product Pricing and Understanding the process cost drivers	TomEJC - Rs. Rs.340/Kg Karuthakolomban variety – Grade 1 – Rs.120/Kg and Grade 2 – Rs.90/kg
Quality and flavour of the fruits	TomEJC fruits remain firm during transportation when harvested mature ripe, and have a unique flavour. Both skin and flesh colour are attractive. The KK is fibrous but also known for distinct flavour.
Check the possibility of a unique Geographic Identity (GI) tag for Sri Lankan fruit varieties	Could been done with the TomEJC and KaruthaKolumban varieties.

Current global demands on varieties and can they be grown in Sri Lanka to catch the export market	We should market our own varieties as no planting material is available for other varieties

Further observations and information gathered on passion fruit production from the field study.

Rajarata Farm managed by Ellawala Horticulture Pvt Ltd at Galkiriyagama

Discussions were held with the Director of the company - Mr. Suresh Ellawala, and the farm Manager Mr. Bandara. Ellawala horticulture Pvt Ltd. Was established in 1993 on a 60 Hectare farm leased from the government

The farm has introduced a new variety called TomEJC, registered as a new variety in 2004. Trees of this variety continue to be in bearing from July to February with the major season in July-August. The Brix value recorded of a not fully ripened TJC was 14. However, the Brix level should be around 16 to 18 Bx.

The farm had 7500 mango trees. A large part of the farm is under medium density planting (8m x 5m). The planting density is around 42 trees per acre.

They are targeting production at 10MT/acre and 20,000MT without-growers over 4 months for commercial operations and wish to tap lucrative fair niche markets. The average fruit size is 700gm at 60 fruits per tree. Planting density is to be increased to 100 trees / acre in the next 5 years. They have also facilities for processing mango and other products in the farm and are targeting sugar and preservative free products.

Traditional planting density is 35'x35' with 35 trees/acre and yield of 2 MT. Medium density planting is 15'x15' with 180-200 trees /acre and a yield of 5-6MT (they have 25 acres at this plant density) Ultra high-density planting is at 9.5'x 6.5' with 670 trees / acre and a yield of 11MT/acre. Increased planting density requires more planting material and labour inputs as high vegetative growth can be difficult to manage. Additionally, rainfall data needs to be considered and farm GMP needs to be very strict to avoid plant viruses and infections.

Large farm in Rathmalgahawewa

Green Tree Farms is a new 60-acre organic farm off the Kirigalewa Road, Rathmalgahawewa. The mango farm had 4500 trees with plant stock purchased from Ellawala Farm. Trees could be harvested 3 years after planting. Cost of plants was Rs. 500/ plant. Planting density was 100 plants /acre. They have installed an Israeli drip irrigation system - cost for 60 acres - 05 Million or Rs.80,000 /acre. Compost is internally made at Rs.3/Kg or Rs.300,000 for the farm. Labour cost/month, (6 labourers) Rs.860/day and Rs.150,000 per month. Cost of tractor driver is 1500/per day. Fruit bag cost is Rs.10/bag.

CIC farm at Pelwehera

Little inputs were seen to be put into the 50 acres of the farm allocated for mango production. However, the farm had retained 16 old mother plants – as a gene bank - of significant importance belonging to the Department of Agriculture. Mango planting density was 200 plants /acre – 4m x 3m. The farm also had 50 acres of cashew.

Nelna Farm

Nelna Farm is new farm and has currently 100 trees/acre with a spacing of 25 ft X 17 ft. On their other plantation they have another 150 acres and the spacing there is 35 x 30 feet per acre. The have their own variety and the selling price is Rs 200/Kg at Farm gate. They are able to harvest about 150Kg/tree after 6-7 years.

They have invested Rs.200 million on drip irrigation and built two new tanks. Irrigation is a major constraint and this needs to be planned for sustainable agriculture.

They employ 400 people at the farm level. The cost of labour is Rs.1000/ Labour per day. And they work from 6 am to 2 pm.

70% of the cost is labour in the production, the rest is weeding/pruning and pest management. The cost of the bag and bag tying comes to Rs. 5 per fruit.

Fencing around the farm is has cost them 6 million Rupees.

Major issues are labour and irrigation and also theft at the plantation.

Jewelex Farm

The Jewelex farm cultivates only the TomEJC variety. The farm has a land holding of 300 acres, out of which 75 acres are cultivated. Out of the 75 acres 50 acres are for Mango and 25 acres are for Banana. Please see the details for Banana in the Banana section.

The density of plantation is 8 m x 5 m or 100 trees/acre. The age of the trees is 4 years and the current yield is 15 Kg/tree. Hence the yields have not yet peaked since the trees are young.

They sell at Rs.250/Kg at Farm gate to Cargills and Keels mainly for the fresh market. Each of the fruit is packed in Styrofoam. The cost per truck to the market is Rs. 900 and each truck carries 400 Kg of fruit. They have 2 lakes and a deep well for irrigation and this is sufficient for their needs at the present.

With regards to the cost the farm employs 18 labour. month. The split is 5 males and 13 females for an 8-hour shift, from 7,30 am to 4.30 pm. The payment is Rs.800 for males and Rs. 700 for females. The main work is manual weeding around the tree and tractors are used for grass cutting.

It has been suggested to inter crop peanuts to have good Nitrogen Fixing for the soil.

General Observations:

- The domestic varieties of Mango are planted with medium density spacing.
- In many home garden plantations, the canopies of the trees are big and hence harvesting is difficult.
- With traditional varieties, trees in most home gardens are old and hence the yields tend to drop especially in the low cycle season, the. The tress with an average age between 11 to 25 years generally produce round 1200 fruits per tree in the peak and can be lower in the low cycle.
- Fruit fly and other typical infestations in Mango and farm GMP in the older farms further reduce the yield per acre.
- Commercial TJC plantings are better managed with higher planting densities and effective crop and canopy management.
- Main usage of the Mango is for fresh domestic markets. Usage for production of chutneys, pickles and processing for puree is very small. Dehydrate is a major user for the Mango crop and the Malwana variety is used for processing.

5. Banana

Visits were made to the major Udawalwe, Mahaweli irrigation project Banana growing area during Mission 2. Field data was collected on yields, the varieties grown, area under cultivation; cultivation practices, marketing distribution procedures etc. The area had a network of farmer organizations relating to the Mahaweli water distribution canal for the 12,000 farmers in this area. Discussions were held with Mahaweli project officials based in the Mahaweli Project Office in Embilipitiya. A meeting was also arranged with an active Farmer organization in Moraketiya system. Farmer organizations managed water distribution, cleaning and maintenance of canals. Seed and fertilizer distribution and farmer training programmes were also conducted via these associations. Farmers in this area used sprinkler in preference to drip irrigation. Lands used for banana production reverted to paddy cultivation after 4-5 years. These lands then went back to banana cultivation after 1 -1/2 years. Bananas were marketed at respective banana wholesale markets (Polas').

Findings and Observations

Table 13 "Summary of Field Data Collected on Banana"

Check List	Observations
Fruit price at farm gate	Can be as low as Rs. 20/kg. However breakeven point is Rs.50/kg.
Yield at the farms per Ha or Acre	Banana yield was around 20MT in irrigated lands but 8-10 MT / ha where there was no irrigation
Costs faced by farmers per Acre	Cost of production - Rs 35/- Kg; Labour cost Rs. 1000/day
Quantity of different varieties available	75%of the production was sour plantain. Other varieties included sugar plantains, Kolikuttu and the Cavendish type
End Product Pricing and Understanding the process cost drivers	**Breakeven price should be Rs35/- per Kg.**
Quality and flavour of the fruits	Fruits harvested at the mature green stage of maturity travel well when de-handed and packed according to international standards as was described at the Pelwehera farm. However, losses are high when bunches are stacked in lorries for distribution to domestic whole sale markets.
Check the possibility of a unique Geographic Identity (GI) tag for Sri Lankan fruit varieties	The sour plantain grown in Sri Lanka
Current global demands on varieties and can they be grown in Sri Lanka to catch the export market	There is a demand for sour plantains in overseas ethnic and specialty markets. Dole bananas are also grown for export by the Dole Company in this region.

Further observations and information gathered on passion fruit production from the field study.

The Udawalawe irrigation project was initiated in 1960 by the River Valley Development Board. and became a part of the accelerated Mahaweli development programme in1977. The scheme covers 65,000 hectares. The Udawalawe area is located in two climatic zones, intermediate and dry zones and hence irrigation especially the drip irrigation systems will be useful in the development and sustainability of the yield and health of plantations.

58% of the soil is not suitable for paddy and there is 23,500 hectares of irrigable land. Hence the current distribution I the project is based on 23,500 hectares. The utilization is as follows:

10,500 hectares Paddy, 5,943 hectares Banana, 4,000-hectare Sugar Cane and 3,500 Hectares other crops.

There is another 3,500 hectares outside the Mahaweli project where in the distribution is as follows: 700 Hectares Rice, 2800 acres for Sugar Cane. Hence this land there is no cultivation of bananas or any fruits.

The Chandrika Wawa (reservoir) area has 3,449 Hectares of Irrigable Land, here 35% of the land is under fruit cultivation and mainly Banana. There are about 12,000 Banana farmers in the area.

Hence considering the Mahaweli area and the Chandrika Wawa area the land under banana cultivation is around 7,200 Hectares.

The yields reported are as follows: Sri Lankan Average is between 8 to 10 tons per hectare. However, in the area due to GAP and there are about 20 farmers who are GAP certified the yields go up 20 tons per Hectare. This is double the national average and is a big potential for growth in volumes of Bananas.

Most of the irrigation is surface irrigation and drip irrigation is seldom used. The farming community is based on the irrigation systems. The land is leased by the state to the farmers. There are block coordinating committees in the D canals and channels. The main purpose of the block coordinating committee is ensuring maintenance of the channels, sourcing of feed, fertilizer, seed and training of the farmers.

For the project, 217,000-hectare feed is the maximum the project can supply water, out of which only 194,000-hectare feed is available to irrigate the entire area of 400,00 hectares. Hence, as one can see there is serious deficiency on the actual requirement vis-à-vis the availability. Paddy cultivation is maximum at 40%.

Banana Cultivation Practices are for a period of 4 to 5 years. After resting for a period of 1.5 to 2 years the farmers go back to Banana. The farmers are moving from Kolikottu variety to the Sugar variety. The reason being it has more demand in the retail space. The farmers sell their produce to collection centres almost every day and the collection centres are private initiatives by the farmers. The Mahaweli project assists with a field assistant and the Department of Agriculture (DOA) is involved in the extension system.

Farmer meeting at the Collection centre at Moraketiya.

The farmers at this meeting are growing on leased land, but the land is considered as their own. They are given around 2.5 acres of land. They grow around 420 plants per acre. The plant yields around 4 bunches per year with an average weight of 15 kilos. The average yield is 24 tons/acre.

The cost of production is Rs.35/kg including harvest, fertilizer and transport to collection centre. The benefit at the collection centre is immediate cash on delivery.

The main issue is fertilizer and prices which fluctuate from Rs 20/kg in lean season to Rs.80/Kg at festival time. The yield during the drought is 30% less and the consequently the selling price goes up to Rs. 90.

The route at this market is as follows:

FARMER → INTERMEDIATE COLLECTOR → CONSOLIDATOR → RETAILER EXPORTER

The retail prices at Galle market at the time of the mission was Rs. 120 per Kg. Hence the cost adds at the intermediate collector and consolidator is substantial. It was also noted that the price does fluctuate even at farm gate levels and this needs to be stabilized.

Once sold to the traders, the traders spray ethral and sell the fruit when they turn yellow. They have a 20% loss from this point to the retail end. On an average the trader generates an income of Rs, 50,000/month.

Jewelex farm

The Jewelex farm has 22 acres under Banana cultivation. The planting density is 500 trees/acre. The weight of the bunch is around 9 kg / bunch. They take around 3 harvests per year and yield is 13.5 tons /acre. There is a tissue culture laboratory at Kurunegala and the planting material is sourced from here. The selling price here at farm gate is Rs. 100/kg. They sell mainly to Cargills and the price to Cargills is Rs.120/Kg delivered to their collection centre.

CIC Pelwehera Farm

The Cavendish variety is grown on the CIC farms. The classic hexagonal method of planting is this variety is adopted with a spacing of 8.5' with 700 plants or production units / acre. The CIC pack house is fully equipped for international standard post harvest handling. The Dole Company is growing this variety on around 350 acres for the export market.

3.3.4. Development Partners

World Bank funded Agriculture Sector Modernization Project – Partnership of members of the LFVPPEA with this programme for small farmer development could expand and increase the volume of the production base and expand the production of the good quality produce to meet export market requirements.

The Institute for Agro- Technology and Rural Sciences (IARS)- This organization based in Weligatta, Hambantota, was interested in assisting with GAP training for farmers in the Southern districts.

Appendix IV Data collected from Fruit Processors, Exporters, Service Providers and Development Partners

4.1 Fruit Processors

CBL Natural Facility

This company processed dehydrated fruit pieces and spices. The fruits dehydrated included pineapple, mango, banana, and papaya. Andrea Callo from Noberasco had the technical details of the dryers. However, the dryers are of the old type and are non-vacuumed. The dryers are individually fired and temperature controls are semi-automatic.

Findings and Observation

- CBL Natural has 10,000 acres under cultivation, which includes spices and fruits. These are all contract farmed. Out of this 1200 acres are for fruits.
- A separate agronomy team of five people monitors the cultivation, prices and quality for the produces, including spices at the farms and for procurement. The farm is headed currently by Mr. Janaka. He explained the activities on the demonstration pineapple farm in Gampaha district.
- 2000 MT of pineapple is bought every year for dehydrates. Collectors are used and a commission between Rs.2 to rs.5 is paid. This is included in the final price of the fruit decided by the factory. The current price as of December 2017 is Rs. 45 per Kilo paid delivered to the factory, for all the grades, I, 2 and 3. Mostly grade 2 and grade 3 fruit are sourced.
- 1500 MT of Banana is bought every year; the local varieties are used for dehydration. This is due to a higher sugar value and better flavour profile. The Cavendish variety is not used for dehydration.
- 2000 MT of Red Lady variety papaya are bought every year and used for dehydration. The average price is Rs.15/Kg delivered at the factory.
- 5000 Mt of Mango is bought every year. The average price is Rs.45 / Kg and the collectors get Rs.5/Kg. All varieties are bought for processing. This ensures a sustainable supply.

Issues

As per Andrea Callo from Noberasco the processing expert and mission team member, the dryers are basically the old system with static oven system; this offers lesser controls on the temperatures and moisture percentages on the product.

- Some of organoleptic qualities and mineral content is lost in the process
- Not enough material is available especially concerning Pineapple and Mango.

Recommendations

- A gradual shift to new technology-based dryers to improve yield and better-quality product
- Optimizing the use of the new driers (Korean Government funded programme) for production of value-added dehydrated products.
- Work at the back end which is already being done to get a more sustainable raw material at the appropriate prices.
- Fruit Volumes need to be increased to cater to the export market.

- Other varieties especially yellow flesh papaya varieties are needed for the export market.
- The MD2 variety for Pineapple should be looked at in terms of lower cost and quality which is preferred in the export market

Expo Lanka

Visited the Expo Lanka facility. Expo Lanka has 6 different facilities close to the different growing areas. They have 400 hectares of certified plantation out of which 300 hectares is non organic. The fruits processed are Pineapple, Mango, Banana and Jackfruit. We visited Expo Lanka sister company Tropikal, which has a new coconut water with an aseptic packing capacity of 3000 lit/hr. This facility packs water in bottles and aseptic bags. The coconut is dehydrated and processed in the other facilities of Expo Lanka which was also visited.

Findings and Observations

- The availability of fruit s is as follows: mango - November and December; pineapple, banana, and papaya - available all-round the year.
- 240 tons of pineapple is bought per year
- 300 tons of banana is bought every per year
- 20 tons of mango is bought every per year
- 2016 pineapple price is Rs.85 to Rs.120 / Kg.
- 2017 Pineapple is Rs 60 to Rs.65 / Kg.
- Collectors commission is between Rs.5 to Rs.7 / Kg.

Issues

- As per Andrea Callo from Noberasco the processing expert and team member, the dryers are basically the old system with static oven system; this offers lesser controls on the temperatures and moisture percentages on the product.
- Not enough material is available especially concerning Pineapple and Mango.

Recommendations

- Suggest to shift gradually new technology dryers, to improve yield and better-quality product
- Work at the back end which is already being done to get a more sustainable raw material at the appropriate prices,
- Fruit Volumes need to be increased to cater to the export market.
- Varieties especially yellow Papaya need to be looked at for the export market.
- The MD2 variety for Pineapple should be looked at in terms of lower cost and quality which is preferred in the export market

Table 14 “Sales Prices of Organic Dehydrated Products - December 2017”

PINEAPPLE		**BANANA**		**MANGO**		**PAPAYA**	
PRODUCT	**PRICE** *(US$/Kg)*	**PROD**	**PRICE** *(US$/Kg)*	**PRO**	**PRICE** *(US$/Kg)*	**PROD**	**PRICE** *(US$/Kg)*

		UCT		**DUCT**		**UCT**	
Ring	14	**Coin**	4.3	**Strips**	11.0	**Strips**	9
Dices	12	**Slices**	4.7				
Titbit	12	**Dices**	5.0			**Dices**	9.5
		Flour	6.0				

(All prices are FOB Sri Lanka; All moisture levels between 12 to 14%. Water activity is below 0.65)

Nico

Products

Nico Products is primarily a toll packer and produces for exporters or companies in the retail business. They are a part of the Lalan Group. Met with Mr. Sanath the production manager.

Findings and Observations

The product profile is split into dehydrated fruit and bottled fruit in juice.

Dehydrated Fruit

Banana, Papaya, Mango and Papaya. This product is conventional and a little organic mainly for pineapple.

Bottled Fruit in Juice

Pineapple, Mango and Papaya, rings and chunks in Juice. This product is primarily organic and Pineapple is only bottled. The fruit for bottling since it is organic is bought from registered Organic farmers.

Their main customers are

Tropical Green, Expo Lanka, Cosmo Veda and SRS Fruit and Spice

Raw Material Prices and Quantity:

Banana: Delivered Price is Rs. 20 to Rs.25/kg around 75,000 Kg/ year. Most of the fruit is sourced from Embilipitiya. Ambul and Sugar are the main varieties (AAB types) used for processing. The issue with sugar bananas is the colour and this is a rejection.

Mango: Delivered price is Rs 35/Kg to Rs. 45/Kg they buy around 100,000 Kg per year. Most of the fruit is sourced from Dambulla and Kurunegala, which is at a distance of 150 Km. The cost of transport works out to Rs.3/Kg. The main variety of Mango is the Petti Variety, which is the main processing variety in Sri Lanka.

Papaya: Delivered price is Rs. 30 to Rs.50/kg and is sourced from a radius of 100 km. The main variety is Red lady.

Processing, Packaging and Price:

Purchase price of grade 2 banana was Rs.20 to Rs 25 per kg. Banana being the largest the conversion of Banana is 6.5 Kg to 1 kg of Dehydrated Banana. The selling price to the customer is around Rs. 450/kg. They processed 3000 kg of papaya per day.

The packaging is in Nitrogen gas. They have Kerosene fuelled, static dryer of 3 doors and 60 trays.

Packaging is in 2.5/kg bags and sealed. This is then delivered to the clients as mentioned above who repack for exports or the local market with 100,000 kg od mango strips produced per year.

Purchase price of “Petti “mango grade 2 quality was Rs.35-40 per Kg including transport. Transport cost was estimated at Rs.3 /kg.

Red lady papaya variety was purchased at Rs.30-50 per kg; and 75,000 kg were processed per month to produce chips and coins.

They also processed a small volume of pineapple – 15,000kg per year.

The factory employs 60 workers; 55 men and 5 women. The labour cost for casual workers is Rs.450/day. Permanent is rs.13,500 per month. Working hours is from 8 am to 5 pm.

Issues:

No issues have been reported so far from their clients and they have had no problems on sourcing the raw material as per their order and there have been no issues reported on microbiology, pesticides and heavy metals. They face rejections on the sugar bananas due to the colour of the fruit.

Recommendations

- To improve the technology of the drying system
- To revamp completely the factory layout and introduce GMP.
- Implement Certification like FSSC 22000 at the factory
- To install a proper microbiology and testing laboratory at the factory.

Target Agriculture

Mr. Thomas Gerbracht founded target Agriculture in 1994. The mission of the company is to export processed organic fruits, cashew, and desiccated coconut. Target agriculture is located in three countries Sri Lanka, Thailand and Vietnam and exports over 200 products overall. We could not visit the factory during the visit but had a fruitful meeting with Mr. Mahesh at the office.

Findings and Observations

The products produced mainly are: Desiccated coconut, and cashew. They also produce frozen pineapple juice (10 tons), dehydrated pineapple (100 tons), dehydrated mango (5 tons), dehydrated banana (5 tons). IQF fruit is 10 tons of Banana, Mango and Pineapple, Frozen Passion fruit juice is 150 tons.

The varieties for Mango are Willard and Petti. The varieties for Banana are mainly Sugar.

The pineapples are sourced from the Gampaha area from around 110 farmers. The bananas are sourced from Embilipitiya area.

Target agriculture has 3 field officers for 110 farmers, and they try and visit each field 3 to 6 times per year

Mr. Vikrant the former country manager of Control Union is the organic consultant for Target Agriculture

Issues:

- Quality raw material is a big constraint
- Agri input suppliers make a propaganda to go non organic
- Chloromorquatehas been detected in the Pineapple juice.

- Pesticide analysis still requires to be done in an external laboratory outside Sri Lanka
- The organic fruit is competing with general market fruit and hence price and quality is an issue.

Recommendation:

- It will be good to talk to Noberasco to expand their production in their entire value chain of organic from farm to the product. Target Agriculture is an entirely organic company and is deeply involved in organic cultivation.

4.3.2. FRUIT EXPORTERS

Nidro Pvt Ltd.

This company was at present engaged in exporting fresh produce to selected resorts in the Maldive islands and the Seychelles while servicing orders on demand to other destinations including Europe. A large investment had been made on a new pack house facility for handling a wide range of fresh produce. Provision was also made for engaging in processing fruit, in the future, particular dehydrated fruits.

4.3.3 SERVICE PROVIDERS

Cathy Rich Food Processing Centre

Visited the Cathy Rich Food Processing Centre and met with a Mr. Jagath Basnayake. The centre was started in 19192 with the ministry of policy planning and absorbed into the government in due course.

The main objective for the centre was to facilitate technology transfer for food processing in the areas of- Bakery, Fish Processing, Juice processing, and manufacture of Jams, Jellies and Pickles.

The other main purpose is to train the trainers e.g., Vidata extension officers.

Cathy Rich is also working with Dilmah in the Moneragala area on lime processing and are working on a Lime Juice processing facility. The lime plantation size varies from 5 acres to 20 acres.

Findings:

The processing centre laboratory and incubation facility has the basic processing equipment and is very small in capacity, and the current technology of processing has not been kept up with.

Recommendations:

Will be very good if a private partnership with international funding can be sourced to upgrade the facility. This will help the trainers keep up with the latest processes practiced globally and will in turn help the industry to test and incubate products for the world market.

Installing ripening chambers and good post-harvest practice laboratories with necessary equipment, which will include waxing will be advisable.

Training Centre for Fruits and vegetables at Angunukolapellessa

Visited the training centre at Anganokolapelessa and met with R.C. Jayasinghe, assistant director. The training centre has been established as a training division of the officers for fruit, vegetables and paddy. In addition, a food processing and technology laboratory and incubation facility is in place.

One of the major objectives of the centre is to train officers to disseminate information to the farmers on how to reduce pesticide usage. Also training on Sri Lanka Gap is being initiated.

The extension division of the Department of Agriculture is responsible for implementing the training.

Recommendations:

- Establish a mechanism whereby the implementation of the training is monitored when implemented by the extension division. This will help fine-tuning the training and also improve the training procedures.
- It will be ideal if a private partnership with international funding can be sourced to upgrade the facility. This will help the trainers keep up with the latest globally practiced technology. This in turn will help the industry to test and incubate products for the world market.
- Installing ripening chambers and good post-harvest practice laboratories with necessary equipment, which will include waxing will be advisable.

Control Union

We met with the Control Union representative in Colombo to understand the extent of Organic Farming in Sri Lanka. There are over 75 companies listed as being certified for organic production of a range of commodities including fresh fruit. Most of the testing of products for inorganic contamination is done overseas and cost is high for this service.

Issues:

- Water runoff from neighbouring fields leads to cross contamination of agro chemical this needs to be address as a GAP procedure
- All samples are sent to Eurofins Germany and TLR in Rotterdam for analysis.
- Local laboratories need to be accredited for 17025.
- Testing for Ethephon and presence of glyphosate are problematic
- Urgent need to train more personnel in organic certification and also to monitor the procedures for organic farming
- Urgent need for reliable testing services internally in Sri Lanka
- Local laboratories sometimes short cut procedures in the interest of commercial gains.

Recommendations:

This organization is interested in partnering with a private or Government laboratory by the way of assurance of sample volume to upgrade their facilities to meet international criteria and accreditation. This will help immensely the entire value chain in bringing a sustainable agriculture practice to global standards.

Industrial Technology Institute (ITI)

ITI has the best equipped laboratory in Sri Lanka. The laboratory is certified by SWEDEC and has accredited with ISO 17025; ISO19427 – 2017. They have the capability to analyse up to Parts Per Billion (PPB) and Parts per trillion (PPT) in certain tests.

The personnel have been trained abroad and are aware of the global requirements. The infrastructure is the latest with GCMS-MS and LCMS MS facilities available for testing 30-34 pesticides and are now able to expand to 100 such chemicals. test 100. They can carry out tests on Heavy Metals, in addition to the pesticides and residual Analysis. However, there is limitation on pesticides which is 100 pesticides can be carried out. These are the official 100 pesticides allowed in Sri Lanka.

Issues:

ITI needs to upgrade their testing procedure to include all pesticides.

There are unofficial and banned pesticides being used in Sri Lanka that need to be tested.

Such pesticide use needs to be monitored at farm level and conveyed to relevant authorities.

Based on the feedback of such investigations, ITI is willing to work on testing for these pesticides as well.

Recommendations:

ITI is willing to collaborate with the private sector as well as Control Union to scale up their testing sample base and infrastructure provided a minimum sample guarantee is given.

It is strongly recommended that Control Union be encouraged to communicate with ITI in order to initiate this partnership. Further recommended to ask ITI to make a presentation to LFVPPEA members to showcase their competency and see if the exporters and retail players can collaborate to strengthen and confirm sample quantities to ITI to scale up testing volumes.

Finlays

Visited Finlays at their cold room and freezer room facilities near Colombo. Met with Mr. Saveen Gunaratne and Mr. Givantha Ariyaratne. Finlays are a part of the Swire Group and are the 4th largest cold chain operators in the world.

Findings and Observations:

- They have 3.3 million cubic feet of cold storage facility
- 850 pallets positions
- Store 12,500 tons of product
- 850 KVA generator back up to ensure the cold chain does not break in the event of a power failure.
- Currently running on full capacity.
- Trucks handled per day at the highest is 3,681 trucks
- Main products are Dairy Products 166,000 lit/day
- They have their own fleet of reefer trucks
- Repacking/Relabelling and MRP labelling facility
- A comprehensive warehouse management.
- They have stored dehydrated products
- They have stored fresh Limes and Pomegranates

Possibilities to collaborate to enhance the value chain in agriculture:

Finlay's has land outside Colombo on which a 1000 tons capacity cold store can be constructed. However, volumes with a minimum of 1500 ton needs to be guaranteed to expand the facility.

According to Finlay's the western province is the best area for expansion due to the proximity to port and also easy access to the rest of the country.

4.3.4 Development Partners

World Bank funded Agriculture Sector Modernization Project – Officials met indicated that members of the LFVPPEA could be supported to link up with small farmers as a supplier's base for processors with respect to crops such as pineapple, passion fruit, banana, papaya and mango.

The European Union Funded ECORYS Mission– The feasibility study they will be conducting on cold chain facilities will include facilities for fruit and vegetable processing enterprises as well. They could help with hiring experts for assisting processing operations to upgrade their facilities.

The Institute for Agro-Technology and Rural Sciences (IARS) - The Director of this Weligatta, Hambantota, based Institution indicated that they were able to support the fruit and vegetable processing sector by engaging with industry partners in collaborative training programmes on GAP and GMP.

Department of Agriculture (DOA) and the Additional Secretary Development of the Ministry of Agriculture–the Director General was in the process of organizing a feasibility study for providing a vapour eat treatment facility for use by the horticulture sector.

Appendix V Technical Specifications for export products

TO ALL NOBERASCO S.p.A. SUPPLIERS MAY BE CONCERNED

Carcare, 23/05/2016

OBJECT: QUESTIONNAIRE ABOUT FOOD RISKS, VOLUNTARY CONTAMINATION AND FRAUDS IN PRODUCTS PROVIDED TO NOBERASCO S.p.A.

INTRODUCTION

Following the increasingly frequent disclosure of various types of frauds within the different food supply chains and in order to protect our Consumers, not only from a health point of view but also in terms of good faith, choice of products and the origin of the same, Noberasco S.p.A. is submitting the following assessment questionnaire to find out which activities are performed from their suppliers in the prevention of the main risks related to the abovementioned aspects,

regarding both food and materials in contact with food provided to Noberasco.

Thus, this questionnaire's goal is to evaluate if have been established adequate measures for management and control for the following issues:

1. RESPONSIBILITY FOR SAFETY / CRISIS MANAGEMENT / FOOD ALERTS
2. PATHOGENIC MICROORGANISMS
3. FOREIGN MATERIALS
4. MYCOTOXINS
5. GENETICALLY MODIFIED ORGANISMS (GMO)
6. HAZARDOUS CHEMICALS
7. HEAVY METALS
8. FOOD ADDITIVES
9. ALLERGENS
10. DELIBERATE TAMPERING / ACTS OF SABOTAGE (FOOD DEFENSE)
11. 11 FOOD FRAUDS

For filling of the questionnaire, we kindly ask you to mark with an "X" the box of the answer deemed most appropriate for each **"Requirements" from panel 1 to 11.**

In the bottom of the document are also reported:

a) the “Table 15: ALLERGEN DECLARATION”, to be completed for each of the products supplied to Noberasco;
b) the tables relating to “RISK CLASSES” proposed by Noberasco. For quick reference while reading the text, you can access it directly by clicking on the icon back [e.g.: (1)].
c) the “**Error! Reference source not found.** ”, on which we kindly ask you to indicate:
   - ✓ validation procedures applied on each control system (how has been carried out)
   - ✓ validation criteria used (which is the condition that let the system be "valid")
   - ✓ date and result of the last validation.

It is fairly clear that, the greater will be the level of detail provided, the more credible the system will result.

We must also point out that in the absence of complete information, in order to maintain[...] [...] the supply relationship in place with Noberasco, we reserve the right to ask you objective proof of your declarations and to verify the effectiveness of these systems through audits at your production facilities by our Quality Assurance.

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This questionnaire must be returned **within 2 weeks from receiving** to the attention of Noberasco S.p.A Quality Assurance.

As usual, **we kindly ask you to attach all relevant documents to support your answers** (e.g. Quality plan, Sampling plan, Test reports, HACCP flow chart etc.).

We remain at your disposal for any further information you may need. Thank you for your kind cooperation.

As usual, **we kindly ask you to attach all relevant documents to support your answers** (e.g. Quality plan, Sampling plan, Test reports, HACCP flow chart etc.).

We remain at your disposal for any further information you may need. Thank you for your kind cooperation.

Best Regards

Andrea Aufiero

(QAM)

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RESPONSIBILITY FOR SAFETY / CRISIS MANAGEMENT / FOOD ALERTS

N°	REQUIREMENTS		YES	NOT YET / PARTLY	NO	N.A.
A.	Has your Company already identified a Responsible for the management of any Food Alert? PLEASE INDICATE					
	✓ Name and Surname					
	✓ Function					
	✓ Telephone n° (for emergencies)					
	✓ e-mail					
B.	Has Your Company already identified a Responsible for the management of communications relating to food safety, including questionnaires and traceability test? PLEASE INDICATE IF DIFFERENT FROM ABOVE					
	✓ Name and Surname					
	✓ Function					
	✓ Telephone n° (for emergencies)					
	✓ e-mail					
C.	Has your Company already drawn up one or more "crisis" procedure for the management of public health emergencies / food alerts, etc., that clearly indicates: liability, actions, handling of product potentially at risk?					

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PATHOGENIC MICROORGANISMS

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	Has Your Company considered pathogenic microorganisms in the HACCP risk assessment?				
B.	In the analysis, have been also considered the risks from pathogens for each of the **raw materials** used?				
C.	Has been designed and implemented on a regular basis a plan for the analytical control of the raw materials microbiological conditions?				
D.	Have been ever carried out audits at your Suppliers, in order to verify the preventive measures of risk from pathogens they adopt?				
E.	Were collected specific information from your suppliers on measures to prevent the risk from pathogenic microorganisms undertaken by them?				
F.	In your process / flow are these elements / systems for monitoring the presence of pathogenic microorganisms in the products supplied to NOBERASCO?				
G.	*If yes, please specify what and when considered oPRP or CCP:*	**YES**	**CCP**	**oPRP**	
	✓ *Drying (low aW)*				
	✓ *Heat treatment (pasteurization / sterilization)*				
	✓ *Treatment with microwaves*				
	✓ *Blast cooling / freezing*				
	✓ *Chilling*				
	✓ *pH adjusting / NaCl concentration*				
	✓ *Adding of preservative additives* ✓ *(e.g., sulfites, Sorbates, Benzoates, other. - NOTE: in this case, see also the pictures nn 8 and 9)*				
	✓ *More .....*				
H.	The conditions process for the above transactions have been validated?				
I.	It was planned and implemented on a regular basis a plan to control analytical, microbiological status of the **finished product**?				
J.	Have been planned and implemented evidence of microbiological stability, for the release of the final product?				
K.	In your process / flow, in addition to cleaning and detergents, have been planned / carried out also steps of **disinfection** with further **verification of the microbial surface contam**ination of lines and production environment?				

PATHOGENIC MICROORGANISMS					
N°	**REQUIREMENTS**	**YES**	**NOT YET / PARTLY**	**NO**	**N.A.**
L.	Has your Company established criteria for the **handling of non-conforming product** resulting from the loss of control of the systems listed above and for the resulting **corrective actions**?				

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FOREIGN MATERIALS					
N°	**REQUIREMENTS**	**YES**	**NOT YET / PARTLY**	**NO**	**N.A.**
A.	Has your Company considered the "Foreign Bodies" in the HACCP risk assessment?				
B.	It has been defined and applied a rule / procedure for the control / protection or exclusion of breakable / splinterable materials from production areas and those communicating with them?				
C.	Has been set up and is filled in the register of glass and hard plastics / splintering materials?				
D.	Has been defined and applied a rule for the exclusion of wood (including pallets) from the areas of production?				
E.	In the analysis, have you also considered the risks from foreign bodies for each of the raw materials used by you?				
F.	Were conducted **audits** at your suppliers in order to verify the preventive measures of risk from foreign objects they have taken?				
G.	Were collected **specific information** from your suppliers on measures to prevent the risk from foreign objects they have taken?				
H.	In your process / flow have been installed **device for the control** / **elimination** of foreign bodies (e.g., filters, sieves, metal detectors, X-Ray Detectors, etc.)?				
I.	*If yes, please specify what and when considered oPRP or CCP:*	***YES***	***CCP***	***oPRP***	
	✓ *filters*				
	✓ *Sieves*				
	✓ *sifter / plansichter*				
	✓ *Magnetic Traps*				
	✓ *separator / centrifuge / homogenizer*				
	✓ *destoner / table densimeter / tarara / paddy*				
	✓ *optical sorter*				

FOREIGN MATERIALS

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
	✓ *Laser Sorter*				
	✓ *Metal Detector*				
	✓ *X-Ray Detector*				
J.	In your process / flow were inserted **steps of manual sorting** / **visual inspection** for the removal of foreign bodies?				
K.	*If yes, please specify where and when considered oPRP or CCP:*	***YES***	***CCP***	***oPRP***	
	✓ *…….specify phase……..*				
L.	On the undertaken risk control systems, was **in any case** established a **monitoring** plan to verify the proper functioning of the system (including ejection systems where provided)?				
M.	Has your Company established criteria for the **management of non-conforming product** resulting from the loss of control of the systems listed above and the resulting **corrective actions**?				
N.	The objects (foreign bodies) that may be recovered, are classified and subjected to critical evaluation / statistics				
O.	Have been / are periodically carried out one or more validation activities of such foreign bodies control systems?				
	If yes, please specify				

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MYCOTOXINS

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	Has your Company considered the Mycotoxins in HACCP risk assessment?				
B.	In the analysis, has been considered the risk from mycotoxins for each of the raw materials and for all types of Mycotoxins likely to be found?				
C.	Were the raw materials classified into risk classes for Mycotoxins? ([i])				
D.	Subject to the requirements of the law, for raw materials at "risk **2"** or for those who's a health emergency is in force, the risk Mycotoxins was treated as CCP, providing analysis on each incoming batch as positive release?				
E.	For raw materials at risk, irrespective of the level of risk, has in any case been established a sampling / monitoring plan for the verification of the absence of Mycotoxins, to the best of the analytical technique?				
F.	On the Technical Specification or Purchasing Documents or Contracts of raw materials most at risk (levels **1** and **2**), has been specified the required contamination limit by mycotoxins?				
G.	The limits set by you are more restrictive than those imposed by law and / or international health standards?				
H.	IMPORTANT: on products supplied to NOBERASCO, are you able to ensure a mycotoxin content not exceeding 50% of the legal limit, when established?				
I.	The control tests are carried out in an in-house laboratory?				
J.	The control tests are carried out also / only in an external laboratory?				
K.	The External laboratory is accredited for the tests in question?				
L.	Have you established a procedure for qualification and control of your suppliers that also includes the ability to effectively manage the risk Mycotoxins with objective evidence (e.g. a copy of the analytical results, etc.)?				
M.	Has your Company established criteria for the management of non-conformities and corrective actions on non-compliant product for mycotoxin content?				

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GENETICALLY MODIFIED ORGANISMS (GMO)

N°	REQUISITO	SI	NON ANCORA / IN PARTE	NO	N.A.
A.	Were applicable the product to be delivered to Noberasco is already certified for NON-GMO chain?				
B.	Has your Company considered GMOs in the HACCP risk assessment?				
C.	The GMO risk assessment is about all raw materials used (depending on the type of matrix / botanical origin of ingredients)?				
D.	Raw materials have been classified into risk classes ([ii])for GMOs?				
E.	The possibility of replacing the ingredients at risk has been evaluated?				
F.	For raw materials most at risk (consisting of more than 50% from botanical species at risk GMOs), have you dealt with GMOs as CCP, providing for the analysis of release of each incoming batch?				
G.	For raw materials containing less than 50% of soy, corn, canola, or other botanical species at risk GMOs, has been established a sampling plan to verify the absence of GMOs in the best of the sensitivity of the method?				
H.	On the Technical Specification or Purchasing Documents or Contracts of raw materials most at risk (1 and 2), has been specified the limit contamination by GMOs allowed?				
I.	With suppliers of risky GMOs deriving products, has been established, implemented and tested a procedure for checking the real source of non-GMO (e.g. by testing traceability on raw materials used by the suppliers, with collection of analytical evidence)				
J.	The limits set by you are more restrictive than those imposed by law?				
K.	The control tests are carried out in an in-house laboratory?				
L.	The control tests are carried out also / only in an external laboratory?				
M.	The External laboratory is accredited for testing PCR?				
N.	Has been established an appropriate procedure for qualification and control of your suppliers that also includes the ability to effectively manage the risk of GMOs, with objective evidence (e.g., certification of non-GMO supply chain, a copy of the analytical results, etc.)?				
O.	Has your Company established criteria for the management of non-conformities and corrective actions on product not-compliant for GMO content?				

HAZARDOUS CHEMICALS

(e.g.: pesticides / biocides / pah / pcbs and dioxins / solvents / cleaning agents, etc.)

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	Has your Company considered the contamination of food by hazardous chemical substances (**HCS**) in the HACCP risk assessment on raw material and during the process?				
B.	Further than the legal obligations, for raw materials at HCS risk or for which a health emergency is in place, did you treat HCS as CCP, including releasing analysis on each batch supplied?				
C.	Has your Company established a supplier qualification procedure and control that includes the ability to manage with the HCS risk?				
D.	If applicable, for pesticide residues control in Raw Materials with particular requirements (e.g., Organic, Integrated Pesticide Management, etc..), did your Company follow a particular disciplinary of production that allows the limitation / exclusion of Pesticides in the field or in storage?				
E.	Has your Company established and implemented a plan of analysis for the control of residues of pesticides for all Raw Materials?				
F.	Did you specify on the technical specifications or purchasing conditions or contracts on raw materials, the limit of contamination for pesticides required?				
G.	The limits set by you are stricter than those imposed by international health standards?				
H.	The analysis of control for residues of pesticides are carried out in an in-house laboratory?				
I.	The control analysis for residues of pesticides are only/also carried out in an external laboratory?				
J.	The external laboratory has an official accreditation for residues of pesticides analysis?				
K.	Has your Company established criteria for the management of non-compliance for HCS content?				
L.	For a proper restriction on the handling of "non-food" substances, in your plant has been established an appropriate and well-maintained "storage area", protected and locked, for the segregation of HCS?				
M.	Is the use of any HCS (including “medical use alcohol”), near the product and during production, expressively prohibited or restricted?				
N.	For the control of residues of detergent, has your Company defined actions to verify the chemical contamination from non-rinse after washing operations? (e.g., by checking the pH of the rinse water, etc.).				
O.	For the control of residues of detergent, Your Company has planned actions for the verification of chemical contamination from non-rinsed surface after the operations of cleansing? (e.g..: by checking the pH of the rinse water, etc.).				

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HEAVY METALS

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	Has your Company assessed heavy metals in HACCP risk assessment?				
B.	In risk assessment, did you consider the risk of heavy metals for each one of the raw materials used and for all types of toxic metal detectable?				
C.	For raw materials most at risk or for which a health emergency is in place, did you treat heavy metals as CCP, including releasing analysis on each batch supplied?				
D.	In any case, did you establish a sampling/monitoring plan to verify the absence of heavy metals at the best sensitivity of the method?				
E.	Does the analysis plan for the control of residues of heavy metals in foods, also consider the monitoring of the accidental release by the equipments through the process?				
F.	Did you specify on the Technical Specification or Purchasing Documents or Contracts of raw materials most at risk, the limit of contamination for heavy metals required?				
G.	The limits set by you are stricter than those imposed by international health standards?				
H.	The analysis of control for heavy metals are carried out in an in-house laboratory?				
I.	The control analysis for heavy metals are only/also carried out in an external laboratory?				
J.	The external laboratory has the accreditation for heavy metals analysis?				
K.	Has your Company established a supplier qualification procedure and control that includes their own ability to manage with heavy metals risk?				
L.	Has your Company established criteria for the management of non-compliance and corrective actions on non-compliant product for heavy metals content?				

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FOOD ADDITIVES

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	If applicable, has your Company considered the risk due to: ➢ both accidental contamination of food with additives regulated by law ➢ and an overdose of the same in HACCP analysis?				
B.	If applicable, did you define appropriate "deposits", protected and locked, for the segregation of additives?				
C.	Is the use of additives in production properly regulated (with recipes), and recorded?				
D.	Are the instruments for dosage of additives in an evident state of maintenance / calibration?				
E.	Has your Company established a supplier qualification procedure and control that includes their own ability to manage with risk?				
F.	Did you define any criteria for the management of non-compliance and corrective actions on non-compliant product for defects / excess of additives regulated by law?				

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ALLERGENS

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	Has your Company assessed Allergens in HACCP risk assessment, values as shown in Table 0?				
B.	In risk assessment, did you consider the risk of Allergens for each one of the raw materials used and for all types of Allergens supposed to be present?				
C.	Has your Company established a supplier qualification procedure and control that includes their own ability to manage with Allergens risk?				
D.	Did you define and formalize the action required for the management / segregation of the ingredients at "allergens" risk, both during storage and in production in order to minimize the risk of cross contamination?				
E.	Have been defined, formalized and implemented procedures for sanitizing the transition from a production with "allergen X" to a "without allergen X"? The validation of effectiveness is carried out with appropriate frequency?				
F.	Did you define rules for labelling / communication to the Consumer about "allergens" content of your products?				
G.	Did you define any criteria for the management of non-compliance and corrective actions on non-compliant product?				

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Please, will You fill in the table below for each of the products supplied to NOBERASCO SPA

Table 15: ALLERGEN DECLARATION

presence of allergen & derivatives (also including those for cross-contamination)				
PRODUCT:	**xxxxxxxx**			
ALLERGENS	**ABSENT As known**	**PRESENT IN THE PRODUCT**	**PRESENT IN OUR FACTORY (Noberasco's Supplier)**	**PRESENT IN THE FACTORY/PLANT OF OUR RAW MATERIAL SUPPLIERS (Noberasco's Supplier)**
GLUTEN				
SHELLFISH				
EGGS				
FISH				
PEANUTS				
SOY				
MILK				
LACTOSE				
NUTS				
CELERY				
MUSTARD				
SESAME				
SULPHITES				
LUPINES				
MOLLUSCS				

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DELIBERATE TAMPERING / ACTS OF SABOTAGE (FOOD DEFENSE)

N°	REQUISITO	SI	NON ANCORA / IN PARTE	NO	N.A.
A.	Has Your Company already considered the risk due to intentional acts of sabotage, aimed at somehow contaminate the products supplied to Noberasco?				
B.	Has a special "Food Defense Team" been appointed?				
C.	Was it carried out a formal analysis of the risk with the preparation of a special "work plan" that details: a) What needs to be done / where b) Completion time c) Responsibilities				
D.	Are already in place measures / exclusion tools / rules for personnel access to your premises, warehouses, facilities? ("Broad Mitigation Strategies")				
E.	Have already been identified vulnerabilities in the process ("Vulnerability Assessment) and any measures / exclusion tools / rules for protection / defense of the product during all stages of the process?				
F.	Have been defined and implemented the activities / checks for the presence of "tampering" that they may witness a potential voluntary contamination of the product?				
G.	It was already planned and built a special training of factory / warehouse and the general services officer, on the criteria of "Food Defense"?				
H.	Did you establish the criteria for the management of non-compliant products due to potential tampering / contamination voluntary?				

TO ALL NOBERASCO S.p.A. SUPPLIERS MAY BE CONCERNED

OBJECT: **QUESTIONNAIRE ABOUT FOOD RISKS, VOLUNTARY CONTAMINATION AND FRAUDS IN PRODUCTS PROVIDED TO NOBERASCO S.p.A.**

INTRODUCTION

Following the increasingly frequent disclosure of various types of frauds within the different food supply chains and in order to protect our Consumers, not only from a health point of view but also in terms of good faith, choice of products and the origin of the same, Noberasco S.p.A. has integrated its “Food Risks Assessment Questionnaire” recently submitted to your kind attention, in order to know what activities are carried out by its suppliers also in the prevention of:

11 FOOD FRAUDS

For filling of the questionnaire, we kindly ask you to mark with an "X" the box of the answer deemed most appropriate for each **"Requirements" from panel 1 to 12.**

As with previous versions, in the bottom of the document it has been shown the table of Food Fraud risk classes proposed by Noberasco. For quick reference while reading the text, you can access it directly by clicking on the icon back [e.g.: (1)].

It is fairly clear that, the greater will be the level of detail provided, the more credible the system will result.

We must also point out that in the absence of complete information, in order to maintain[...] [...] the supply relationship in place with Noberasco, we reserve the right to ask you objective proof of your declarations and to verify the effectiveness of these systems through audits at your production facilities by our Quality Assurance.

This questionnaire must be returned within 2 weeks from receiving to the attention of Noberasco S.p.A Quality Assurance.

We remain at your disposal for any further information you may need. Thank you for your kind cooperation.

Best Regards

Andrea Aufiero

(QAM)

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11 FOOD FRAUDS

N°	REQUIREMENTS	YES	NOT YET / PARTLY	NO	N.A.
A.	Has your Company considered food frauds among the possible risk factors for your business/your supply chain?				
B.	In the analysis, have you considered the risks of food frauds for each of the raw materials used and for all types of food frauds likely to be committed on them?				
C.	Raw materials have been classified into risk classes ([iii])for Food Frauds, considering: ✓ Likelihood of occurrence of fraud ✓ Likelihood of not detect the fraud ✓ Convenience of fraud				
D.	Without prejudice to legal requirements, for raw materials you buy do you have all the documentation to support origin, status, quality level of goods, including releasing analysis, accompanying each incoming batch?				
E.	Were applicable, for raw materials at risk has, in any case, been established a sampling / monitoring plan for the verification of the absence of Food Frauds to the best of the analytical technique?				
F.	The control analysis is carried out in an in-house laboratory?				
G.	The control analysis is only/also carried out in an external laboratory?				
H.	The external laboratory has an official accreditation for this type of analysis?				
I.	Has your Company established a supplier qualification and control procedure that includes their own ability to manage food frauds having an objective evidence (ex. Copy of analysis results, etc.)?				
J.	It is conducted with a frequency not exceeding 3 (three) years an audit of the supplier or a remote traceability test ("distant audit") in order to assess the management of traceability of the product chain provided to Noberasco?				
K.	Did you define any criteria for the management of non-compliance and corrective actions on non-compliant product?				

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Table 12 "Procedures Established for the Validation of Food Hazards Control Systems"

DESCRIPTION OF HAZARD	ESTABLISHED CONTROL MEASURES	METHOD OF VALIDATION	DESCRIPTION	FREQUENCY	VALIDATED IF..	DATE OF LAST VALIDATION	OUTCOME	FUNCTION AND SIGNATURE

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STATEMENT OF TRUTH	
The Undersigned ……, in charge of ……, declares that everything stated above correspond to truth assuming, at the same time, the whole responsibility for all legal and commercial commitments	
Filled by:	
Function / position:	
Date of compilation:	
Signature:	

[1]Example of **Mycotoxins Risk Classes**:

RISK CLASS		RISK DESCRIPTION
0	PRODUCT NO RISK	- product: - which by its nature or for the storage and consumption, is not subject to fungal attack and, consequently, to mycotoxin contamination - for which scientific evidence is lacking to the potential presence of mycotoxins - prepared, processed and packaged in factories / plants where there is no work / presence of risk products
1	LOW RISK PRODUCT	➢ product: - containing ingredients at risk, even if in small quantities; - not at risk but prepared, processed and packaged in establishments / plants in which there is processing / presence of risk products
2	PRODUCT AT RISK	- product: - which by its nature or for the storage and consumption, it is also potentially subject to fungal attack and, consequently, to mycotoxin contamination - for which there is scientific evidence of the potential presence of mycotoxins or for which limits have been established by law or health care nationally or internationally.

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[1]Example of **GMO risk Classes**:

RISK CLASS		DESCRIPTION OF RISK
0	PRODUCT NO RISK	- product: - contains, in its wording, parts of soybean, corn, canola c and / or other botanical species at risk GMOs - prepared, processed and packaged in factories / plants where there is no work / presence of soy products, corn, canola c and / or other botanical species at risk GMOs
1	LOW RISK PRODUCT	➢ product: - containing ingredients at risk, even if in small quantities;

		- not at risk, prepared, processed and packaged in establishments / plants in which there is processing / presence of risk products
2	PRODUCT AT RISK	- product: - constituted, in whole or in part, derived from soy, corn, canola c and / or other botanical species at risk GMOs.

[1]Example of **FOOD FRAUDS Risk Classes**:

RISK CLASS		PARAMETER	RISK DESCRIPTION
1	PRODUCT NO RISK	O	✓ if directly supplied from the manufacturer ✓ if there are no reports on RASFF
		D	✓ if the possibility of detection of fraud is at maximum, thanks to the actions normally performed
		P	✓ if there is almost no practical/economic convenience perpetrating this kind of fraud of that type of product
2	LOW RISK RODUCT	O	✓ if there are no recent reports from RASFF but in the past there have been
		D	✓ if the possibility of detection of fraud is normally due to the actions carried out relatively easy
		P	✓ if there is even a small economic/practice convenience to perpetrate that type of fraud on that type of product
3	PRODUCT AT RISK	O	✓ if supplies from traders / brokers ✓ if recent alerts on RASFF
		D	✓ if there is the possibility of detection of fraud or if its detection is possible only with extraordinary and expensive actions
		P	✓ if there is a clear practical/economic convenience perpetrating this kind of fraud of that type of product

Appendix VI Exporter Price Analysis of Dehydrated Fruit in Sri Lanka

Table 16 “Exporter 1- Price Analysis of Dehydrated Fruit in Sri Lanka. Period: December 2017 to March 2018”

PINEAPPLE		BANANA		MANGO		PAPAYA	
PRODUCT	**PRICE** *(US$/Kg)*	**PRODUCT**	**PRICE** *(US$/Kg)*	**PRODUCT**	**PRICE** *(US$/Kg)*	**PRODUCT**	**PRICE** *(US$/Kg)*
Ring	14	**Coin**	4.3	**Strips**	11.0	**Strips**	9
Dices	12	**Slices**	4.7				
Titbit	12	**Dices**	5.0			**Dices**	9.5
		Flour	6.0				

All prices are FOB Sri Lanka; All moisture levels between 12 to 14%. Water activity is below 0.65

Exporter 2

The prices below are per 100% natural fruit, with no added sugars, colours or preservatives, per kilogram, ex-factory, packed in bulk (4 bags x 2.5kgs per bag packed in a corrugated cardboard carton, net weight 10kgs per carton).

Dried TJC mango strips $12.50/kg

Dried papaya strips $8.50/kg

Dried pineapple rings $14.50/kg

Dried pineapple tit bits $13.50/kg

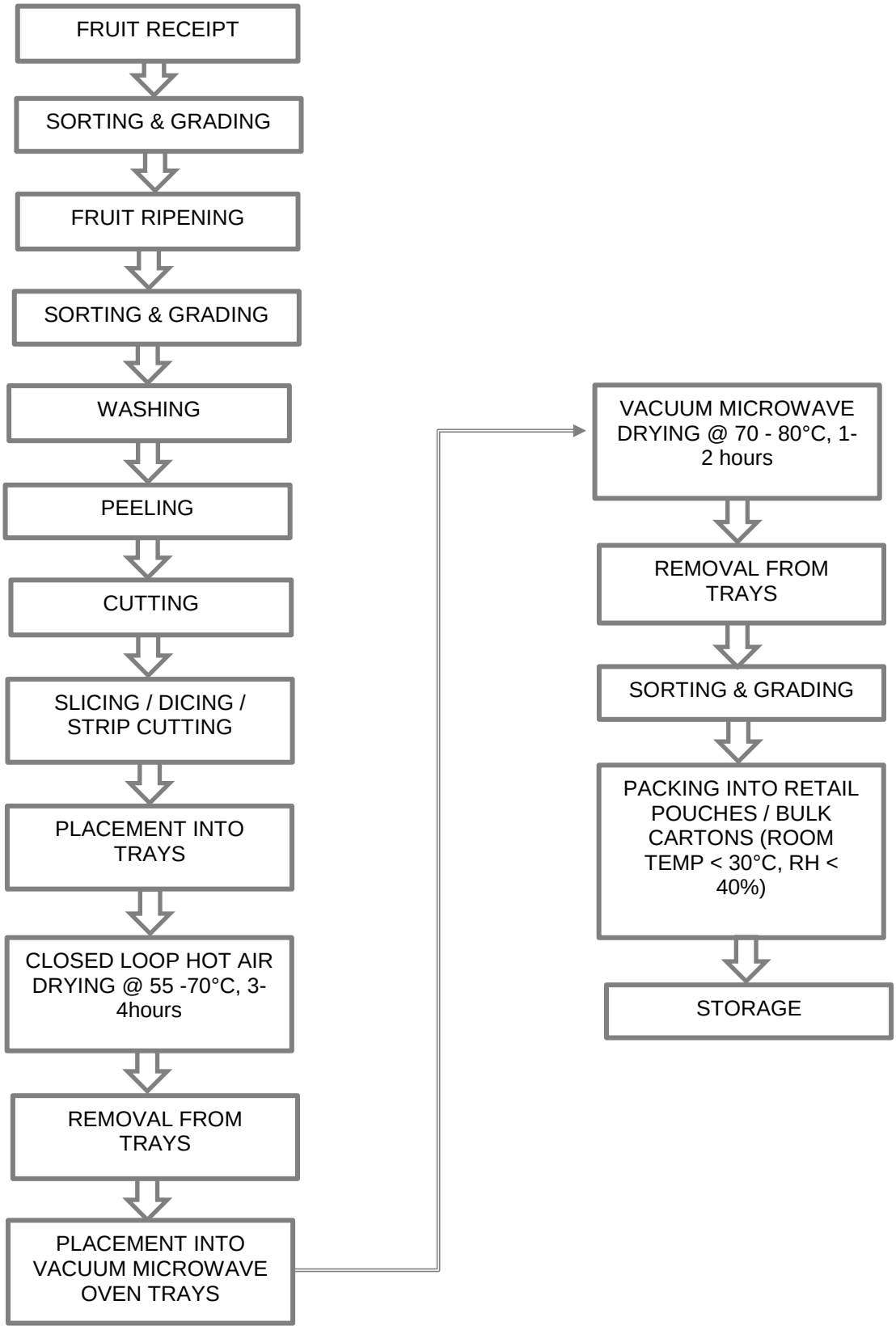
Dried (sour/sugar) banana coins $4.75/kg

Dried tomato halves $16.50/kg

Dried sweet jackfruit strips $12.00/kg

Appendix VII Flow-Chart for Combi-HAVM Dehydration Technology

Figure 7 “Flow-Chart for Combi-HAVM Dehydration Technology”

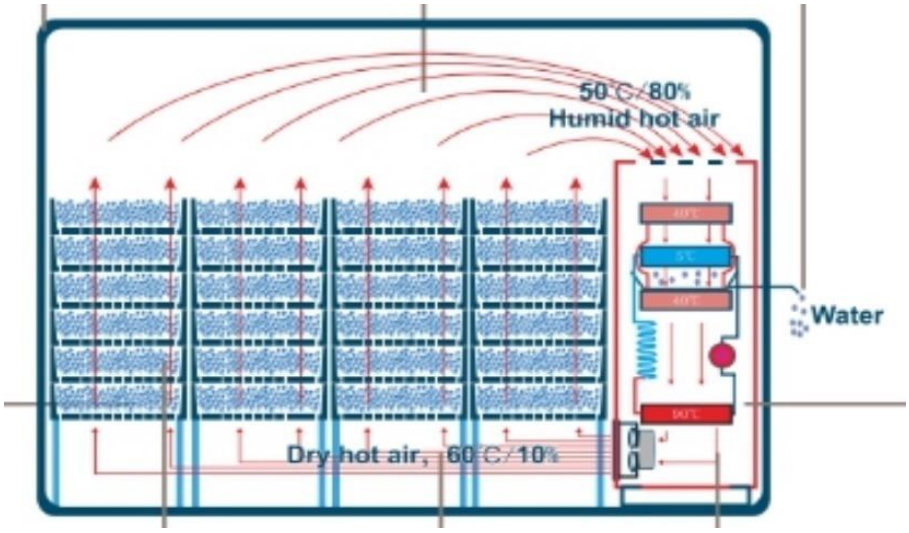


Appendix VIII Samples of Dehydrated Products and Dehydration Equipment

Figure 8 “Pictures of Mango & Banana dehydrated using Vacuum Microwave Technology”

Figure 9 “Picture of Vacuum Microwave Dryer”

Figure 10 “Closed Loop Hot Air-Drying Schematic Diagram”



Appendix IX Memorandum of Understanding - Noberasco Company and the LFVPPEA