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Department of Foreign Affairs and Trade
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Papua New Guinean specialty cocoa

Technical Report 107

Prepared for – Department of Foreign Affairs and Trade – ABN: 47 065 634 525

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Prepared by

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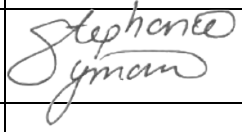
1	28-Feb17	FINAL	Stephanie Symon, AECOM Project Manager	

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Acronyms

Abbreviation	Description
ACIAR	Australian Centre for International Agricultural Research
AUD	Australian Dollars
B4MD	Business for Millennium Development
CCI	Cocoa and Coconut Research Institute
CIWG	Cocoa Industry Working Group
CPB	Cocoa Pod Borer
DFAT	Department of Foreign Affairs and Trade
EFM	Express Freight Management
ENBDC	East New Britain Development Corporation
EU	European Union
FCIA	Fine Cocoa Industry Association
FCL	Full Container Load
FDA	Food and Drug Administration
FLO	Fairtrade Labelling Organizations
FOB	Free on Board
FSP	Fairtrade Sourcing Partnership
FT	Fairtrade
FT ANZ	Fairtrade Australia & New Zealand
GCA	Global Cocoa Agenda
ICCO	International Cocoa Organisation
ICM	Integrated Crop Management
IPA	Investment Promotion Authority
IPDM	Integrated Pest and Disease Management
IWG	Industry Working Group
kg	Kilo
LCL	Loose Container Load
LIFFE	London International Financial Futures and Options Exchange
MMJV	Morobe Mining Joint Venture

Abbreviation	Description
MOQ	Minimum Order Quantity
mt	metric tonne
NGO	Non-Government Organisation
NSW	New South Wales
NY ICE	New York Inter Continental Exchange
NYC	New York City
NZ	New Zealand
NZD	New Zealand Dollar
OCHO	The Otago Chocolate Company
PARDI	Pacific Agribusiness for Development Initiative
PGK	Papua New Guinean Kina
PHAMA	Pacific Horticultural Agricultural Market Access Program
PNG	Papua New Guinea
PPAP	Productive Partnerships in Agriculture Projects
QLD	Queensland
RFA	Rainforest Alliance
TADEP	Transformative Agriculture and Enterprise Development Program
TKAS	Tree Kangaroo Conservation Society
TOR	Terms of Reference
UK	United Kingdom
US	United States
USA	United States of America
USD	United States Dollar
UTZ	UTZ Certified
VSA	Volunteer Services Abroad
WCF	Wellington Chocolate Factory

1.0 Executive Summary

This study was undertaken in May and June of 2016 and took the form of over 70 interviews with international and domestic stakeholders; those with the greatest relevance were included in this report.

The objective of the study was to identify barriers to entry to the specialty market from both demand and supply viewpoints. To achieve this, the scope of the study was as follows:

- Determine the domestic supply of differentiated cocoa and cocoa beans suitable for the specialty market. The specialty market was defined as the craft chocolate industry globally, which amounts to some 1,000mt across the United States of America, Australia, New Zealand, Europe and The United Kingdom. Differentiated beans were those with Fairtrade or Rainforest Alliance Certification and cocoa from plantations.
- Consult with Paradise Foods Ltd to determine supply and quality of cocoa products and identify specific buyers.
- Determine if there is international demand for Papua New Guinean differentiated or specialty cocoa beans and provide contact information for buyers and identify potential partners within Papua New Guinea (PNG).
- Determine the economic feasibility of exporting to different boutique markets based on transport costs, logistics and other factors.

The study revealed that whilst there is a great deal of interest in Papua New Guinean cocoa, specialty buyers have reservations about entering this market. PNG offers prospective buyers a unique product grown in incredible natural surroundings. Each province has a different microclimate and consequently, around the country there many different flavour profiles.

There is considerable supply of non-smoky cocoa throughout the country but often these producer groups were remote and difficult to contact. There is a lack of coordination and consolidation of smoke free cocoa within PNG. Buyers are thus unable to contact producer groups to purchase quality cocoa and arranging logistics can be arduous for volumes smaller than 15mt (a full 20ft container load). Furthermore producer groups do not have contacts in the international cocoa industry, nor an understanding of international commodity markets.

An unexpected outcome of this report was the discovery that Non-Governmental Organisations (NGOs) have considerable influence over the yield, quality and cocoa supply in PNG. In the wake of cocoa pod borer there has been a surge of support for the industry resulting in strong livelihoods projects. These projects have a wealth of detailed information on producers, yields and genetics and the financial means by which to further support these groups.

Industry constraints

PNG is an expensive country in which to conduct business. The minimum cost of preparing a 20ft container for export is PGK4,030 (USD 1,306). Sadly this cost remains the same even if the container holds 1mt or 15mt of cocoa. If the container is destined for Europe or the USA then desiccants need to be imported in order to protect the beans from moisture damage during shipment. These costs are prohibitively high for small businesses. In addition to this, the Cocoa Board of Papua New Guinea regulations also require a minimum export volume of 1000mt per annum in order to retain an export license. Regulations and high costs of business mean that the industry structure lends itself to larger businesses that can achieve economies of scale.

Trading houses, cocoa factories and chocolatiers alike stated a preference to buy from a trusted source from whom they received consistent quality cocoa and with whom they had an open and honest business relationship. In more established cocoa origins such as Ghana and Ecuador, buyers and growers alike have had the opportunity to establish relationships over years of successful business. This is yet to be the case in PNG as often the international perception of PNG is different to the reality. In international press PNG is often portrayed as corrupt and dangerous, neither of which is encouraging to international guests. It can be a daunting place to visit, and an expensive one. Businesses may be interested in buying cocoa from PNG but they do not have an understanding of the industry structure nor have the required contacts such as producer groups, cocoa exporters and

freight companies. Furthermore, this information is difficult to source and is apt to change, particularly in regards to contact personnel and details for farmers and producer groups.

Misinformation and petty feuds have long hampered the growth of a collaborative cocoa industry. The Cocoa Industry Working Group (CIWG) being established by PHAMA will hopefully dispel some of the anti-exporter sentiment in the PNG cocoa industry. As the market has evolved, so has the role of exporters. This can be seen by the surge in exporter funded development and training programs in the last 5 years.

Capacity issues

The reality is that producer groups do not yet have the capacity to export themselves. They lack basic business skills and business structure, and often growers may not speak sufficient English/French/German etc. to be able to communicate with prospective buyers, nor do they have reliable telecommunications such as phone and internet. Buyers and producer groups alike have reported the absence of an impartial, unbiased and trustworthy intermediary as one of the major barriers to entry to buy PNG cocoa. The second most cited barrier to entry is the high cost of logistics in the Pacific region and a difficulty in connecting with the correct service providers.

This report recommends three major action points to address the aforementioned issues;

1) Exporters to formalize a service to better facilitate specialty trade. This would be in the form of a set per bag or per tonne price that would cover the cost of warehousing, fumigation, export documentation and transport. This would allow buyers to negotiate a price for the cocoa directly with the producer organisation of their choice and thus have more marketing potential than if they were to buy from a national or multinational exporter. It would empower producer groups and growers to promote and sell their own product on an international scale and to better understand the global market in which they operate. Lastly, it would not displace the current exporters and would provide a formalized platform for them to support their more advanced suppliers.

2) A trade visit proposed in October 2016. B provides a draft schedule (tab 1) and a draft budget (tab 2). This would be a trial visit limited to six potential buyers (tab 3) who were identified under the PNG7.1 market study. The buyers include distributors in both the European and U.S markets and if successful, would almost double the current demand for boutique beans from PNG. If successful, the visit could be replicated with other interested parties. It is vital that this be coordinated by an unbiased industry stakeholder such as PHAMA with no preference given to province, exporter or industry group.

3) Appendix B is a “cocoa directory” with a database of producer groups, suggested exporters, suggested freight forwarders, suggested shipping lines and current development projects for potential buyers. This information is difficult to source for interested buyers and would have a huge impact on opening up the market. This document will only be of value if it is continually updated and maintained, it is recommended that this be the responsibility of the Cocoa Industry Working Group (CIWG).

In addition to these immediate action points, the report makes the following recommendations:

4) Link NGO cocoa livelihood projects and the World Bank funded Productive Partnerships in Agriculture Projects (PPAP) projects to prospective buyers. A registered exporter will still export the cocoa but producer groups would have the ability to negotiate pricing direct with buyers and they would have support to improve their business skills and marketing by either the NGO body or a lead partner. This is a simple recommendation that has the potential to motivate farmers and access new markets and opportunities.

5) In many other developing nations, cocoa farmers have a thorough understanding of cacao varieties, the pricing structure and expectations of buyers in both the bulk and specialty markets, an understanding of the different types of certification and perhaps most importantly, an understanding of the businesses to whom they sell. Training on the international market, what price to ask for, how to negotiate and how to market cocoa to an international audience

is an important step that is missing in the industry. It is recommended that PHAMA develop this material and distribute to industry bodies, exporters and NGOs to disseminate.

6) Cocoa in PNG has been exported in the same way for decades despite new innovations being adopted in the global cocoa industry in warehousing, pest control, biosecurity measures and container packing materials. Further collaboration in the industry with PNG's National Agriculture Quarantine and Inspection Authority (NAQIA), freight forwarders and shipping companies could hopefully see some of these ideas trialed and adopted as part the industry strengthening recommended in this report.

7) PHAMA to co-ordinate and fund samples to be tested by the Fine Cocoa Industry Association (FCIA) to be added on to the Heirloom Cocoa register. Currently most growers do not know much about the genetics of their trees, testing by the FCIA would provide clarity of where the best cocoa is grown. As this register is accessed and managed by most major players in the U.S specialty cocoa market, it would also result in immediate (and free) marketing of PNG cocoa.

8) PHAMA to establish strategic partnerships with Marobe Mining Joint Venture (MMJV), World Vision, CARE, PPAP and the Australian Centre for International Agricultural Research (ACIAR) to facilitate better industry communication and demonstrate an ability to better coordinate industry wide activities.

9) Access to capital remains a problem across the industry and smaller groups need pre-financing which is not attractive to overseas buyers. PHAMA should assist the CIWG to explore micro-finance options with exporters and banks.

10) Specific recommendations are included for Paradise Foods and plantations at the conclusion of this report.

2.0 Introduction

Papua New Guinea (PNG) is the biggest cocoa producer in the Pacific with an annual production between 30,000 – 45,000mt. PNG once had an excellent reputation for both quality and high volumes, however both of these have dwindled in the past 20 years with lack of maintenance of cocoa dryers, the onset of cocoa pod borer (CPB) and unpredictable weather patterns.

Cocoa is a lifeline for thousands of small farmers in PNG, providing vital income for 20% of the country's population. In 2006, CPB ravaged the crops of thousands of small farmers in East New Britain, the first province in PNG to be affected by the insect. The impact of this pest is severe, untreated, its larvae tunnel into fresh cocoa pods and decimate cocoa harvests. CPB changed the landscape of the cocoa industry in PNG and the industry responded strongly. The Cocoa and Coconut Research Institute developed CPB tolerant varieties, which were then distributed through the Cocoa Board of PNG nurseries and the Productive Partnership in Agriculture Projects. A decade on, farmers can confidently manage the pest and yields have significantly improved.

In the inception phase of PHAMA stakeholders identified priority areas for assistance by PHAMA in the cocoa sector as:

- Assisting industry to better define market opportunities (eg niche)
- Promoting market development, including value adding initiatives (e.g. chocolate making)
- Assisting industry to meet market needs, (e.g. quality improvements, certification).

The priority to assist in identifying market opportunities was confirmed by the ad hoc Cocoa Industry Working Group. This group has asked PHAMA to investigate opportunities to potentially improve terms for smaller exporters, certified producer groups selling to exporters, and to identify potential niche markets for cocoa from selected producer groups with appropriate production and quality. The findings from this market survey will inform market development activities. During the first Cocoa IWG, the group also asked PHAMA to support a much-needed baseline survey of producer groups to collate information on production, processing and export capacity to determine supply options for markets that can be identified through this current activity.

The objective of this work is to determine the nature, size and requirements of potential overseas markets such as EU, US, Australia and NZ for PNG cocoa beans (including Bougainville) sourced from:

(1) From small producer groups, certified producer groups supplying for export and specialist plantation producers.

(2) Cocoa products from PNG based commercial chocolate producer – roasted cocoa nibs, raw cocoa nibs, cocoa powder, cocoa mass/liqour, cocoa butter, chocolate chip (dark, milk) chocolate buttons (dark, milk, single source), single source dark chocolate, and other retail products.

3.0 Methodology

This report was undertaken in three stages. The first stage was an internet and online academic catalogue search of relevant journal or news articles related to PNG cocoa. The second stage was desk work which commenced on 11th May 2016 and concluded on 30th June 2016. This was to reconnect with potential boutique buyers in Australasia, Europe and the U.S to gauge interest in PNG beans and understand any past experiences they may have had when working with PNG cocoa.

The third stage was an in country visit to Port Moresby, Lae, Madang and Rabaul from 13th June – 25th June visiting stakeholders from all areas of the supply chain.

4.0 Limitations

The following report includes the contact details and information relating to a number of potential buyers for PNG cocoa. This is by no means an exhaustive list but one that highlights the most

interested players. More buyers were interviewed than listed in this report however only those with serious interest to pursue a purchase or those with relevant past experience in buying from PNG have been included.

Given the short duration of the in-country component, it was not possible to visit all of the producer groups and stakeholders and hence some of the information is second hand. Tonnage information differed greatly from different sources, the lack of record keeping and accurate data is a problem with the vast majority of the grower groups. Much of the co-operative/producer group information provided by the Cocoa Board was unfortunately out of date and there was no baseline data available on these groups as was indicated in the Terms of Reference for the study. It is hoped that these data gaps will be at least partly addressed by the baseline survey of selected cocoa producer groups under PHAMA activity PNG7.2 planned for August 2016.

Report Findings

5.0 Domestic Market

5.1 Overview

Production figures over the past five years show the impact of CPB from 2011 to 2012. East New Britain, Sepik and Bougainville (North Solomons) were the first to see a serious decrease in volumes and this spread over the country in the following years. 2015 was an El Nino year and this is often followed by a bumper crop the following year. This appears to be in the case in 2016, high yields coupled with high cocoa prices have reignited national interest in cocoa.

	2011			2012			2013			2014			2015		
Province	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**
East New Britain	921	6,272	7,193	520	3,541	4,061	602	4,102	4,704	663	4,511	5,174	686	4,671	5,357
North Solomons	-	17,743	17,743	-	13,121	13,121	-	12,543	12,543	-	8,119	8,119	-	8,406	8,406
New Ireland	31	1168	1,199	13	471	484	11	420	431	7	265	272	7	275	282
West New Britain	-	1439	1,439	-	898	898	-	510	510	-	1,020	1,020	-	535	535
Manus	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Madang	263	1,655	1,918	206	4,870	5,076	230	5,650	5,880	208	5,900	6,108	203	6,641	6,844
Morobe	12	707	719	17	986	1,003	26	1542	1,568	42	2444	2,486	51	2950	3,001
East Sepik		16,304	16,304		13,278	13,278		12,582	12,582	-	9,640	9,640	-	8,220	8,220
West Sepik	24	935	959	20	761	781	16	611	627	18	677	695	14	522	536
Oro		480	480		351	351		392	392	-	420	420	-	455	455
Milne Bay	-	-	-	-	-	-	-	-	-	-	10	10	-	10	10
Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gulf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simbu	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
TOTAL	**1,251**	**46,703**	**47,954**	**776**	**38,277**	**39,053**	**885**	**38,352**	**39,237**	**938**	**33,006**	**33,944**	**961**	**32,689**	**33,650**

(Cocoa Board, 2016)

The PNG industry is well aware that the majority of the country's cocoa ends up in the Asian bulk market. As can be seen from the figures below, in the most recent 2015 harvest, 68% of the crop went into Asian ports.

The bulk market was previously defined by genetic variety, with Forastero beans attracting lower prices. This has changed over time and poorly fermented and dried Trinitario cocoa is now common in the bulk market. Each geographic region has its equivalent of "bulk" market, with better quality cocoa attracting better prices. Given the high cost of shipping from PNG to Europe and the USA, it would be illogical to ship smoke tainted beans to these markets, especially as pricing would be much the same as the major Asian grinders.

	2011		2012		2013		2014		2015	
Destination	Tonnes	K'000	Tonnes	K'000	Tonnes	K'000	Tonnes	K'000	Tonnes	K'000
Australia	62	406	102	711	39	426	46	508	46	477
Belgium	3,268	24,108	3,312	17,344	2,700	17,280	4,263	32,356	4,212	36,193
China	1,935	13,295	-	-	210	1,059	-	-	4	28
France	253	1,938	50	300	124	825	139	1,159	73	1,017
Germany	1,304	10,299	821	3,729	517	1,640	1,266	8,581	709	5,517
Indonesia	2,407	16,810	4,538	20,491	4,956	29,417	6,554	45,097	3,479	29,209
Japan	-	-	-	-	-	-	-	-	75	642
Malaysia	21,346	139,940	13,653	65,535	19,210	100,948	10,571	76,950	14,690	119,745
Netherlands	-	-	30	112	-	-	100	827	277	2,375
New Zealand	15	111	-	-	8	52	5	75	3	32
Phillipines	-	-	-	-	220	271	-	-	-	-
Singapore	12,916	86,528	11,652	54,409	7,429	35,602	2,622	17,379	1,557	12,414
Switzerland	-	-	-	-	250	1,364	456	3,535	-	-
Thailand	2,109	13,427	2,584	12,214	1,995	10,468	2,079	14,987	2,730	21,999
United Kingdom	397	3,565	930	5,438	-	-	-	-	-	-
United States	1,433	9,879	1,081	4,875	1,337	7,524	5,476	41,605	5,235	42,249
Total	**47,445**	**320,306**	**38,753**	**185,159**	**38,995**	**206,876**	**33,577**	**243,059**	**33,090**	**271,897**

(Cocoa Board, 2016)

From these figures and various interviews we can surmise that the boutique industry for 2015 in PNG comprises of some 64mt, 49mt of which went to Australia/NZ and 15mt which went to the U.S. Thus using 2015 figures, we can conclude that less than 1% of PNG's cocoa is going to the specialty market.

5.2 Costs of Exporting

PNG is an incredibly expensive country to export out of, which is one of the main reasons why smaller exporters (including co-operatives and producer groups) fail if they do not have sufficient startup capital or economies of scale. Most sales are contracted as FOB (Free on Board) meaning that the buyer bears all the expenses of international shipment and insurance. The cost of packing an international container and loading it on to the international vessel are met by the exporter and the costs associated with this process are outlined below.

VARIABLE	Bougainville	East Sepik	Madang
	PGK	PGK	PGK
Cocoa Board Levy	PGK 40.00	PGK 40.00	PGK 40.00
Container Packing Materials	PGK 35.00	PGK 32.00	PGK 28.00
Variable Labour (Container packing labour)	PGK 4.67	PGK 4.67	PGK 4.67
NAQIA	PGK 8.00	PGK 10.00	PGK 10.00
Customs	PGK 18.00	PGK 14.00	PGK 12.00
Cartage	PGK 60.00	PGK 30.00	PGK 26.50
Jute Bags	PGK 96.00	PGK 80.00	PGK 64.00
PNG Pest (Fumigation)	PGK 17.00	PGK 15.00	PGK 13.50
Domestic Freight	PGK 166.67	PGK 100.00	PGK 70.00
TOTAL /mt	**PGK 445.33**	**PGK 325.67**	**PGK 268.67**
TOTAL /15mt container	**PGK 6,680.00**	**PGK 4,885.00**	**PGK 4,030.00**

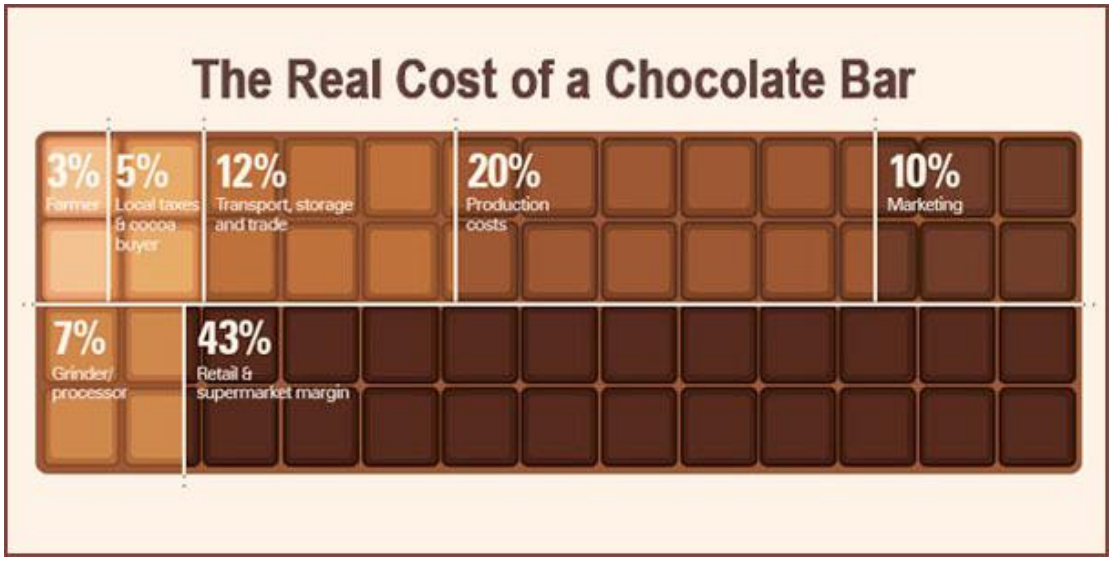
These costs are indicative and in some cases where items have to be imported (jute bags and container packing materials such as desiccant) the cost can vary significantly with foreign exchange variation.

This estimate does not include any fixed costs (warehouse rental, staff wages, utilities, security etc.), nor cost of the actual cocoa. This is merely a breakdown of unavoidable expenses associated with shipping cocoa to an international market.

5.3 Cocoa Price

Cocoa prices for the boutique market are often not based against the global commodity market. This is largely due to the fact that the minimum sized lot that a buyer can hedge against is 10mt. Thus small chocolate makers determine their pricing from the profit margin approach (income minus expenses). They are able to change the price of their chocolate bars for each batch if necessary without too much backlash from consumers. Small to medium buyers may benchmark their purchase price against the gate-price (per bag price) to ensure that they remain competitive in the local market.

As with many industries, there is a common belief among stakeholders that the next "step" along the supply chain is exploiting the businesses or individuals from whom they buy. This lack of trust in the supply chain can be damaging to the industry as a whole. There are many images that have been used in the push for certification to highlight the low price that farmers receive for their cocoa in relation to the cost of a chocolate bar. This below image from *Chocolate Class* has been used in a number of campaigns and similar images can easily be found on the internet.



(Chocolate Class, 2015)

What this image actually shows is that the major players in the industry that deal with the physical beans are not the ones who receive the majority of the financial benefit of the sale of a chocolate bar. Farmers receive 3%, local exporters receive 5% and grinders (factories) receive 7%. The biggest "winners" of chocolate manufacturing are in fact retailers who do not in fact ever purchase or value add to the raw cacao beans or cocoa products (butter, liquor and powder).

5.4 Processors

5.4.1 Paradise Foods

Location: Port Moresby, Lae

Contact: David Peate

Job Title: Managing Director

Email: david.peate@paradisefoods.com.pg

Phone: +675 325 0000

Paradise Foods is the only commercial cocoa processor in the Papua New Guinea and the surrounding Melanesian nations. They produce the Queen Emma range of chocolates; a 75% dark chocolate and a 35% milk chocolate bar are currently available in stores throughout PNG. They produce a range of chocolate wholesale products in addition to the chocolate bars and the item/price list is included in Appendix G. In addition to this, Paradise Foods recently were approved for their own export license for dry bean.

Paradise Foods buys cocoa from all of the major producer groups in PNG. To secure larger volumes for their commercial bars, they source predominantly through a third party individual in Bougainville and then domestically ship the beans to Port Moresby to the cocoa processing facility. All of the beans are purchased from fermentries that have been pre-approved by Paradise Foods, if the bean quality standards drop, then fermentry is removed from the supply chain. Paradise Foods pays a 17% premium for beans on top of the advertised gate price on the day of purchase. From each purchase, Paradise Foods withholds 3% of the purchase price in an account, the funds of which are to be used to purchase tools, fermentry upkeep and other cocoa related expenses.

Paradise Foods would benefit from partnerships with Original Cocoa Traders for their cocoa powder, with TCHO and Ecom/Atlantic Cocoa for roasted nibs and with Artisan du Chocolat and Chocolate Alchemy for liquor. These businesses have been connected to Paradise Foods.

5.5 Producer Groups

PNG has very few Investment Promotion Authority (IPA) registered co-operatives and even fewer of these co-operatives have cocoa cry bean export licenses. The PNG export requirements can be nigh impossible for a local producer group to adhere to, in particular the capital requirement of PGK300,000 and a minimum of 1,000mt exported per annum. PNG export requirements can be found in Appendix C are summarized below:

- New applicants and existing registered exporters must demonstrate their financial ability through evidence of overdraft facilities or cash at the bank for purpose of cocoa exporting. This must be verified by a letter from a bank together with bank statements.
- The minimum financial requirement for a cocoa exporter is K300,000.
- Any credit arrangements with overseas companies and partners must be approved by the Board. The company must demonstrate that this is strictly a credit arrangement and provide all the necessary supporting documents.
- New applicants should be wholly Nationally-owned PNG registered companies with preference given to broad-based grower shareholding. Companies and their employees who already have shares in existing registered export companies either directly or indirectly are disqualified.
- Registered exporters with overseas shareholding are required to conform to the Investment Promotion Authority requirement for a national enterprise status-which means 50 percent or more ownership by nationals. They have a period of six (6) months to obtain 51 percent national shareholding.
- Registered exporters shall not hold shares in other export companies. The Board must be advised of any changes in shareholding.
- Each exporter must be a qualified cocoa trader of international repute who can demonstrate expertise in international cocoa trading, quality control and general marketing of cocoa. The management and trading credentials of the individual (s) must be included in the submission.
- The minimum export volume of any exporter is 1,000 tonnes per annum. Any exporter not meeting the minimum volume will be required to show cause why its license shall not be cancelled.

- Each exporter must have its own winnower or grader/cleaner, cut-test equipment, moisture meter and bagging and marketing equipment.
- The exporter must undertake to purchase from registered premises only. Any exporter in breach of this condition will have its license suspended.
- License fee for an exporter shall be PGK2,323.20 for a major port and PGK950.40 for a minor port. The license fee shall be refunded to the applicant if his application is unsuccessful.

There are however a number of "unofficial" producer groups who produce significant volumes of cocoa of international standards. These groups are outlined below.

5.5.1 Wals Cocoa Co-operative Society (Morobe)

Location: Lower Watut, Morobe

Contact: Francis Anton

Job Title: Chairman

Phone: +675 7074 5900

Wals Cocoa Co-operative were the suppliers of the sample of cocoa sent to the Salon du Chocolat in Paris in October 2015 and they were placed fifth out of the Asia/Pacific entrants. More information can be found at the following link http://www.salonduchocolat.fr/evenement.aspx?event_id=120.

Exact annual tonnage from the group was not forthcoming, however they usually sell with other Lower Watut producers to the Outspan Markham branch.

5.5.2 Padamot Cocoa Co-operative (Morobe)

Location: Siassi, Morobe

Contact: Bernard Maladina (the island has no mobile connection)

Phone: +675 7339 7833

The Cocoa Board and Niugini Strategic Services both work with members of this co-operative and in recent years, a clone nursery has been established on the island. Transport of the cocoa to Lae remains a huge problem for the co-operative. Bags are often damaged en route and freight prices for the rental of a boat significantly reduce the profit margin on the bags. The group continues to produce cocoa in spite of these challenges.

5.5.3 Lower Watut Co-operative (Morobe)

Location: Lower Watut, Morobe

Contact: David Nehem or contact via Bernard Maladina

Phone: +675 7339 7833 (Bernard Maladina)

There are over 30 cluster groups in the Lower Watut region that grow cocoa and are known collectively as the Lower Watut producer group. They have worked with Morobe Mining Joint Ventures (MMJV) over the years who have supported the farmers with tools and boats for transporting the cocoa bags to Lae. Now that MMJV is building roads in the region in the lead up to the new Wapi-Golfu mine, agricultural trade is opening up for farmers in the region.

Currently most of the farmers in the area sell to the Outspan Markham branch. This cocoa then gets freighted to Madang and is exported out to the branch there. Outspan pays a premium on top of the gate price for that day to all Lower Watut producers. The group is producing approximately 20mt dry bean per month in the peak season.

The group also sells smaller quantities to Paradise Foods who was instrumental in marketing for the producer group through their Queen Emma brand for the last 2-3 years. The farmers currently have support from Cocoa Board, Bernard Maladina, Fairtrade, Outspan and Paradise Foods and are one of the largest and successful producer groups in the country.

The group would be well advised to link with the buyers outlined the second half of this report to arrange a price, and then pay Outspan a service fee to export the beans.

5.5.4 Goodenough Islands Co-operative (Milne Bay)

Location: Goodenough Islands

Contact: Bede Tomokita

Job Title: Co-operative senior lead partner

Phone: +675 7360 9945

At the time of this report, Michal Lames from Cocoa Board was en route to the Goodenough Islands to collect baseline data on this group. Bede's number was inaccessible at this time and information on the group is limited.

What is clear is that the group currently ships the beans to Lae before arranging for sale. This is very costly for the group and they are hoping to arrange for direct export from Alotau. Paradise Food buys from the co-operative currently and produces both a dark and milk chocolate range with the beans under the Queen Emma brand. The product has a very different flavour profile from the other regions and consequently, would no doubt attract international attention.

The producer group would be advised to export direct to interested buyers (depending on price), using Paradise Foods as an intermediary and paying a fixed service fee.

5.5.5 Karimui (Simbu)

While this farmer group has previously sold through two exporters in Madang, there has been no reported cocoa from the group since August 2015. It is definitely worth tracking the progress of the group through Cocoa Board regional representatives in Morobe and Madang, however from all accounts, one can assume that this group is not yet as advanced as many other producer groups and has a total production of under 6mt.

5.5.6 Illugi Co-operative Society (East New Britain)

Contact: Samson Mori/ Roland Kerina

Job Title: Chairman/ General Manager ENBDC

Email: rkerina@endbc.com.pg (ENBDC is joint partners with Illugi in a PPAP project)

Phone: +675 7258 5726/ +675 7199 2311

The co-operative society is supported by ENBDC though the Productive Partnerships in Agriculture Projects (PPAP). Given the close partnership the co-operative already has with ENBDC it would be beneficial to continue to export via the group, with the aim to target a more niche market. PPAP has a wealth of information on the group, including member lists, annual yield and production, cocoa prices etc..

5.5.7 Teonena Association (Bougainville)

Location: Kovanis Village, Tinputz, North Bougainville

Contact: John Bunsip

Phone: +675 7141 4862

The association was founded in 2013 with the assistance of the Queen Emma Chocolate Company (Paradise Foods). Most members of the association currently sell to Peter Joyce (Paradise Foods' agent) and they would be an excellent fit for Fairtrade certification should they wish to pursue certification of some kind. Jonathon Sutton from Fairtrade previously visited the group and outlined the necessary requirements and these have since been actioned (e.g. bank account, IPA registration etc.) Fairtrade certification could potentially be supported by Paradise Foods as their promoting body

under the contract production Fairtrade standards[1]. Given the interest in Wellington Chocolate Factory (WCF) in Bougainville beans, the group would benefit from collaborating with WCF as well.

The group has access to not only a solar drier, but also a biogas drier that was provided by Paradise Foods and established in partnership with CCI. The cocoa from the group is used for the Cape L'Averdy chocolates produced under the Queen Emma label.

5.5.8 Buin Cocoa Dealers (Bougainville)

Location: Buin, South Bougainville

Contact: Mallinson Kipau

Phone: +675 7386 7749

The group produces a minimum 80mt per year and often has to transport their cocoa up as far as Kokopau in the peak season when the banks down south do not have enough cash on hand. Some of the members are included in the World Vision PPAP Buin project and consequently have ongoing training on post-harvest practices. They also have the added benefit of having selected fermentries being rebuilt/rehabilitated as part of the PPAP project. Given the interest in Wellington Chocolate Factory in Bougainville beans, the group would benefit from contacting the company.

5.5.9 Tinputz Cocoa Farmers Association (Bougainville)

Location: Tinputz, North Bougainville

Contact: Marlon Sira/ Patrick Gairovi

Phone: +675 7377 6941/ +675 7077 9027

The group produces around 180mt per year and is well supported by the CARE PPAP program. Most of the fermentries were rehabilitated between 2014-2016 and the group produces excellent quality cocoa. The group is IPA registered and has been connected to Dandelion Chocolates in San Francisco as part of this study but would also benefit from further marketing and international promotion of their product.

Most of the farmers currently sell to Peter Joyce who is the agent for Paradise Foods. They receive a premium for high quality beans and their cocoa is part of the Bougainville blends which produce Paradise Foods' new Queen Emma chocolate bars.

5.5.10 Okuromu Cooperative Society (Bougainville)

Location: Tinputz, North Bougainville

Contact: Edward Kamuai

Phone: +675 7377 7899

The co-operative is made up of farmers that live on one of the old plantations (Dios) that was active prior to the crisis. They produce over 100mt per year and sell through a number of exporters, usually in Kokopau. Few of the co-operative members are part of a PPAP project and consequently they would benefit through a direct-sales method with exporter facilitation.

5.5.11 Opiuk Cooperative Society (Bougainville)

Location: North Bougainville

Contact: Raphael Komai

Phone: +675 7247 2391

The co-operative produces 60-80mt per year and sells through a number of exporters in Kokopau. Few of the co-operative members are part of a PPAP project and consequently they would benefit through a direct-sales method with exporter facilitation.

[1] See Fairtrade section on page 43 for further information

5.5.12 Nomorolai Cooperative Society (Bougainville)

Location: Konnou, South Bougainville

Contact: Philip Marave

Phone: +675 7364 0754

The Nomorolai co-operative was a major candidate for Fairtrade certification in 2013 and 2014 and is IPA registered. The group can produce 80-100mt per year and the majority of the farmers are part of either the Buin or the Konnou PPAP projects managed by World Bank. The co-operative has their own nursery and exports through various exporters, often having to transport beans as far as Kokopau in north Bougainville.

5.5.13 Paiscy Limited (Bougainville)

Location: North Bougainville

Contact: Paiscy Silabes

Phone: +675 7352 4357

Paiscy and his wet bean suppliers produce a minimum of 80mt dry bean per year. They transport the cocoa to Kokopau for sale and sell to a range of exporters. None of the suppliers are part of a PPAP project and consequently they would benefit through a direct-sales method with exporter facilitation.

5.6 Certified Cocoa

5.6.1 Rainforest Alliance (Outspan – Wewak)

Location: Wewak

Contact: Shekhar Dwivedi

Job Title: Branch Manager

Email: shekhar.dwivedi@olamnet.com

Farmers in East Sepik were the first to be Rainforest Alliance certified in PNG. This certification is financed and administrated through Outspan who have expanded the program over the years. There are now 5000 registered farmers in the province, producing between 1500-1800mt per year. Farmers receive a PGK16 per bag premium for adhering to the Rainforest Alliance standards.

5.6.2 Rainforest Alliance (Outspan – Madang)

Location: Madang

Contact: Basavaraj (Raj) Mashetty

Job Title: Branch Manager

Email: basavaraj.m@olamnet.com

Phone: +675 7188 2518

Outspan has certified 2,000 farmers in the Usino region of Madang. The member farmers receive a PGK16 premium per bag price for delivering under the Rainforest Alliance certification brand. The group produces between 700-800mt per year.

5.6.3 Fairtrade – Club 3000 (Agmark – Madang)

Location: Madang/ Lae

Contact: Norman Nayak/ Gabriel Iso

Job Title: Fairtrade Extension Officer/ PNG Fairtrade Representative

Email: Gabriel : lopng@fairtrade.org.nz

Phone: +675 7398 6637/ +675 7200 4491

In 2014 Club 3000 exported over 200mt cocoa between February and November. The group is certified under the FT Contract Production standards and Agmark (the current promoting body) retained a license to buy and trade Fairtrade beans in June 2016. Both the Agmark extension team and the Fairtrade Producer Support staff are working hard to re-engage existing members and to grow the number of member farmers.

5.7 Plantation cocoa

5.7.1 Kulili Estates (Madang)

Location: Karkar Islands, Madang

Contact: Derek Middleton

Job Title: Managing Director

Email: derek.wadau@global.net.pg

Phone: +675 423 7461

The onset of CPB in 2012 had a devastating impact on Karkar Island and the livelihoods of all of those relying on cocoa for income. Kulili Estates established a nursery with the capacity to produce 100,000 CPB tolerant clones. These clones were distributed around the island to help alleviate the damage done by the pest and to boost income on the island.

There is a great deal of interest from Australian buyers to buy from plantations so that they can secure consistent quality cocoa. Kulili has the capacity to produce between 200-300mt cocoa per year. The plantation would benefit from international market by arranging sales with boutique chocolate makers in the Asia Pacific region. Interested buyers have been provided with Derek Middleton's contact details.

5.7.2 Kulkul (Madang)

Location: Karkar Island, Madang

Contact: Paul and Barbara Goodyear

Job Title: Owners

Email: barbara.goodyear77@gmail.com

Phone: +675 7255 4050

Kulkul is located on Karkar Island off Madang. The plantation has the capability to produce 200-250mt per year. In the past, Kulkul supplied Rausch directly, however in previous years this has not been the case. Kulkul now sells to both Globe and Outspan and ship their bags into Madang using their own vessels.

Kulkul would also benefit for connections with boutique/specialty buyers in the region and they have been put in contact with a number of businesses as part of this study. They also expressed a willingness to consolidate a container of beans from both Kulkul and Kulili plantations to reduce the number of shipments needed to supply Australian buyers and also to reduce freight costs.

5.8 Other Domestic Industry Stakeholders

5.8.1 Productive Partnerships in Agriculture Projects (PPAP)

Location: Kokopo, East New Britian

Contact: John Moxon

Job Title: Project Manager

Email: pm@ppap.cocoaboard.org.pg

Phone: +675 982 9114

The PPAP projects are a fantastic data resource for the cocoa industry. They list farmer groups and individual farmers throughout East New Britain and Bougainville that have access to best practice training, tools, new planting material and, most importantly for this study, rehabilitated fermentries. Thus through the PPAP projects buyers and industry stakeholders alike are able to connect with some of the best producers in the country.

The PPAP projects already operate under a similar grower/exporter partnership encouraged by this report and would be an excellent starting place to establish sales. For example CARE partners with the Tinputz Farmer Association in Bougainville and most of the farmers sell through Peter Joyce who is an agent for Paradise Foods. Likewise World Vision partners with the Buin Farmers Association, many of whom sell through Outspan who is a formalized co-partner on the PPAP project. Illugi Co-operative in East New Britain is co-partners with East New Britain Development Corporation (ENBDC) whom they also export through. There are many other examples of such private/public partnerships in the other PPAP projects currently running and those proposed for call three of funding.

PPAP have had two calls for tenders thus far for projects in East New Britain and Bougainville. The third call is soon to be finalized and this will include projects in the Momase region. East New Britain and Bougainville have already seen significant improvements in yield and quality of cocoa during the past three years of the projects. PHAMA should maintain regular contact with PPAP keep up to date with the progress of these projects and link the CIWG and producer groups with buyers listed in this report and vice versa.

The missing link for these projects appears to be the connection to the end market. Two lead partners had expressed a concern about farmers losing motivation if they do not see price differentiation for better quality cocoa. Given the large volumes of cocoa produced through the PPAP projects, it would be an excellent opportunity for lead partners, co-partners and PHAMA to work together to link PPAP producers to buyers identified in this report.

5.8.2 Cocoa Board of Papua New Guinea

Location: Kokopo, East New Britain

Contact: Dr Arnold Parapi

Job Title: Executive Manager – Field Services

Email: aparapi@gmail.com

Phone: +675 982 9083/ +675 7111 1107

At the time of this report, Cocoa Board and CCI were finalising major administrative changes that would see CCI incorporated into the Cocoa Board. PNG is a member of the International Cocoa Organisation (ICCO) with ratification to the International Cocoa Agreement 2010 signed by the Ambassador to the United Nations on April 21st 2016. PNG is also a signatory to the Global Cocoa Agenda (GCA) that lays out issues affecting all cocoa producer countries, and progress is reported back to the ICCO in the GCA monitoring questionnaire.

The Cocoa Board is encouraging supply chain consolidation to group smallholders into cluster groups with the hope that this will encourage more business minded activities among growers. They also work to control quality of the beans and they also hope that by grouping producers, this will centralise processing and reduce the numbers of small and poorly maintained fermentries/dryers. The Cocoa Board is in the process of arranging biannual Cocoa of Excellence awards which will incentivise farmers to improve their post-harvest practices.

There was however some negative feedback of the Cocoa Board from both domestic and international players. Buyers indicated that Cocoa Board staff had often presented a biased view of the industry or instead offered to supply cocoa from their local village or family blocks. Whilst this may have been perfectly innocent, it was viewed from overseas buyers as a conflict of interest. One buyer reported inaccurate information from the Cocoa Board in regards to the genetic profile of PNG cocoa in that all

of the trees were said to be “fine flavour” cacao. Three buyers reported instances where they had attempted to contact the Cocoa Board and received no response.

The Cocoa Board acknowledged these comments but also wished to point out a number of positive initiatives currently being implemented or supported by their organisation:

The current PNG Government has committed considerable funding to the cocoa industry and these have allowed the Cocoa Board to implement two major projects:

1) District Cocoa Nurseries. The nursery project targets non PPAP coverage areas and is jointly funded by District Development Authorities in twelve districts throughout PNG.
2) Cocoa Freight Subsidy for remote areas. This helps farmers cover often prohibitively high freight costs to move their cocoa from local fermentries to major townships or cocoa buying points.

The Cocoa Board agreed that partnership agreements and collaborative efforts are the best way to steer the industry forward and they indicated their willingness and intent to participate and support wherever possible. The Cocoa Board also acknowledged the drive in the industry to promote better quality cocoa and in an effort to support this, they have developed a combination cocoa drier program to assist producer groups to remove smoke taint. Testing from the Cocoa Board will continue to ascertain levels of smoke contamination, cadmium and other heavy metals. Initial cadmium testing was completed in 2014 and the PNG samples were found to be within permissible limits.

The Cocoa Board manages a cocoa directory that they provided to the ICCO for inclusion in the ICCO World Wide Cocoa Directory and this information is also held by the Investment Promotion Authority (IPA). The Cocoa Board agrees that this document can be further strengthened with the inclusion of the niche buyers/producer groups contained in PHAMA Market Study Report.

5.8.3 Cocoa and Coconut Research Institute (CCI)

Location: Kerevat, East New Britain

Contact: Kenny Francis/ David Yinil

Email: kenny.francis@ccipng.org.pg/ davyinil@yahoo.com.au

Phone: +675 7351 0052/ +675 983 9131

Cocoa Coconut Institute (CCI) is a subsidiary organization of the Cocoa Board of PNG and Kokonas Industri Koporesen. The institute’s main function is to conduct research, development and extension of cocoa and coconuts in the country. For cocoa, through the research conducted by the different research disciplines, the institute has been able to make available several new and improved technologies to address cocoa industry issues relating to pests and diseases, low productivity, cocoa yield decline and cocoa quality issues. These technologies include the release of cocoa planting materials including SG1, SG2 and modified SG2 hybrids, release of two series of hybrid cocoa clones (First Series in 2003 and Second Series in 2013), the integrated pest and disease management (IPDM) package of cocoa, cocoa curriculum and the combination solar/kiln cocoa driers and mini fermenting boxes. These research technologies together with several other information bulletins are now available for use by cocoa farmers in the country. They are all aimed at improving and maintaining the country’s current 90 % fine flavor cocoa status.

To gain experience and understand some of the issues relating to cocoa markets and marketing along the cocoa value chain, the institute has recently begun exporting small volumes of fermented and solar dried cocoa beans. The institute has so far made three shipments and preparations are underway for the fourth shipment. The beans exported are from CCI’s commercial plantations in East New Britain. The beans were fermented and dried using the combination solar/kiln cocoa dryers in the central cocoa drying facilities at Tavilo Cocoa Research Centre.

Australian Centre for International Agricultural Research (ACIAR)

Location: Port Moresby, Papua New Guinea

Contact: Rebecca Bogosia

Job Title: Assistant Country Manager PNG

Email: rebecca.bogosia@aciar.gov.au

Phone: +675 7090 0315

The ACIAR program is focused on understanding and resolving the social, economic and biophysical constraints to smallholder production, including the adoption of sustainable integrated crop management (ICM) practices.

Previous work on cocoa production in East New Britain province showed that smallholders can achieve good yields, even in the presence of cocoa pod borer, if they adopt a package of more-intensive management practices. A project now working country-wide seeks to understand and overcome the constraints that prevent some farmers from adopting these practices, and to supplement the existing package through the deployment of newly available pest-resistant cocoa varieties.

This work in turn feeds into two new projects under the Transformative Agriculture and Enterprise Development Program (TADEP) in Bougainville and other major producing areas in PNG, that will strengthen the value chain for cocoa and support related enterprise development, through the provision of better planting material, intensified production techniques and improved links to higher value markets.

Intensification (and diversification) requires transformation in the management of soil health and plant nutrition, which will be guided by a proposed project linked to the TADEP cocoa projects.

Virtually all cocoa smallholders with access to land also maintain gardens to supply food for their families. But these communities face multiple threats to their food security, including severe population, cocoa pod borer and land-use pressures. One project aims to understand the problems faced by these communities, and to design interventions to help them adapt and strengthen their livelihoods.

5.8.4 World Vision

Location: Port Moresby

Contact: Heather MacLeod/ Clinton Beukes

Job Title: Country Manager/ Team Leader, Technical Group

Email: Heather_MacLeod@wvi.org/ clynton_beukes@wvi.org

Phone: +675 311 2530/ +675 7092 1170

World Vision is currently the lead partner for three PPAP projects, all located in Bougainville (Buin, Konnou and Torokina). West and South Bougainville are particularly inaccessible, providing a real challenge for World Vision and their member farmers to transport their cocoa for sale.

The PPAP projects have stringent monitoring and evaluation requirements, data collected includes yield of wet bean and dry bean every quarter. Theoretically, PPAP lead partners have access to some of the best quality cocoa in PNG due to the training and fermentry rehabilitation components of the projects.

World Vision has expressed an interest in connecting their member farmers to prospective buyers and a willingness to participate in the proposed trade visit.

5.8.5 CARE

Location: Buka, Bougainville/ Arawa, Bougainville

Contact: Sarah Letts/ Geraldine Paul

Job Title: Regional Manager/ Project Manager

Email: sarah.letts@careint.org/ g06.geraldine@gmail.com

Phone: +675 7223 6206/ +675 7381 4715

CARE took over as lead partner for the Tinputz PPAP project in mid 2015. Much the same as World Vision, CARE has a wealth of information about cocoa farmers in the Tinputz region of North Bougainville. The project has been hugely successful and the majority of the farmers that are part of the project sell their cocoa through Peter Joyce, Paradise Foods' Bougainville agent.

CARE has expressed an interest in connecting their member farmers to prospective buyers and a willingness to participate in the proposed trade visit.

5.8.6 Express Freight Management (EFM)

Location: Lae

Contact: Dan Simpson/ Stephen Dobunaba

Job Title: Branch Manager – Lae/ Export Forwarding Manager

Email: dsimpson@expressfreight.com.pg / sdobunaba@expressfreight.com.pg

Phone: +675 7369 1669/ +675 7625 0690

EFM is the most widely used freight forwarder in the cocoa industry. Specialty buyers in Australia and New Zealand often arrange for small consignments (<5mt) to be shipped through EFM. They have branches in Lae, Madang and Port Moresby.

Given that logistics is one of the major barriers to entry for new players in both supply and processing, freight forwarders and shipping companies should be involved more in industry discussions. They are at the forefront of logistics technology and have valuable input in regards to cost savings and the best ways to preserve the cocoa quality during transit.

5.8.7 Morobe Mining Joint-Ventures (MMJV)

Location: Lae

Contact: David Wissink

Job Title: General Manager – Sustainability and External Relations

Email: david.wissink@morobejv.com

Phone: +675 7031 6561

MMJV works well with other NGOs (such as B4MD and World Vision) and has close links to exporters (such as Outspan and Paradise Foods). Their focus is solely on the Lower Watut region and they have been supporting farmers in this area using their own funding for over 3 years.

Now that MMJV is starting to construct roads into the region (due to the Wapi Golfu mine), agricultural trade in Lower Watut is increasing. Fresh produce and cocoa farmers are able to sell their goods into Lae via road instead of via dugout canoe which significantly reduces their transport costs and transport time.

MMJV is requesting for partnership funding through DFAT for an agricultural training centre in the region. Given MMJV's constant presence in the region and access to resources, PHAMA would be advised to collaborate on future projects and future funding possibilities in the Morobe region.

5.8.8 Tree Kangaroo Conservation Society (TKAS)

Location: Lae

Contact: Mikal Nolan

Job Title: Assistant Director

Email: mikal.nolan@treekangaroo.org

Phone: +675 7250 0788

Given the increase in popularity of environmental and conservation efforts in tree crop commodities, the work of organisations such as TKAS should be leveraged for the benefit PNG farmers and speciality buyers. Original Beans[2] , a chocolate company in Denmark, has particular interest in partnering with a conservation project to promote organic certification, reforestation and conservation of flora and fauna.

Many farmers living in the TKAS conservation area (158,271 hectares) farm cocoa as their sole source of income and TKAS is planning to accelerate their support to these growers in the near future. As part of this study, TKAS has been introduced to Original Beans with the hope that they can collaborate on these efforts.

6.0 International Market

6.1 Overview

The total global production of cocoa is in excess of 4.8million tonnes (World Cocoa Foundation, 2014). 68% of global production is produced in Africa, 17% in Asia and 15% in the Americas. PNG produces approximately 40,000mt per year meaning that it contributes less than 1% of the global market. This can work both in favour of the PNG cocoa industry and against it. The relative scarcity of PNG beans in the market makes it ideal for the specialty market. Unfortunately overall poor quality (smoke taint and poor fermentation), high logistics costs and location also make it inaccessible to prospective buyers.

Cocoa is unlike many products in that when it is fermented and dried properly, it displays the distinct set of all environmental factors that affect a crop's epigenetic qualities. The French call this *terroir* and it is also associated with wine. However with both cocoa and wine, those manufacturing the end product are able to strip out all of the flavours and re-create a new flavour should they wish to. Much of the chocolate consumed today is in the form of sweet chocolate, a combination of cocoa solids, cocoa butter or other fat, and sugar. Milk chocolate is sweet chocolate that additionally contains milk powder or condensed milk. White chocolate contains cocoa butter, sugar, and milk, but no cocoa solid. Production costs can be decreased by reducing cocoa solids content or by substituting cocoa butter with another fat.

The boutique market believes that chocolate should showcase the distinct terroir characteristics and hence seek out both the most diverse genetic characteristics and the best fermented and dried beans. The global market for boutique beans is small, annually 500mt for North America, 400mt for Europe and 100mt for Australia/New Zealand. Thus out of 4.8 million tonnes of cocoa worldwide, 1000mt of that has the potential to reach the boutique market.

6.2 Australasia

6.2.1 Overview

The specialty cocoa industry in Australia and New Zealand is still in its infancy. There are approximately 26 specialty chocolatiers in the region, purchasing between 20kg-160mt per year. The market is much more disjointed than the U.S and has a much lower level of cooperation. In such a small industry, businesses are understandably protective of their supply chain contacts and

[2] Company overview on page 39

information. In 2015 Condesa, originally a coffee consolidator/distributor in Sydney imported 35mt of cocoa from Central and South American origins which was the first shipment of its kind into Australia. This significantly boosted the output of Australian chocolatiers however there is no guarantee that Condesa will continue to distribute cocoa as this is not their core business.

Quite a few businesses may specialize in one origin (such as Spenser Cocoa who sources solely from Vanuatu) or are happy to work with more "mainstream" and accessible origins such as Ecuador, Madagascar etc. There is a push from many chocolatiers to support regional cocoa producing nations however currently this is a difficult market to access for them. Common complaints have been; lack of consistency in samples and cocoa shipments, communication problems, expensive logistics and pre-payments for cocoa being misappropriated and cocoa never arriving in its end destination.

6.2.2 Condesa (Sydney, Australia)

Location: Sydney, Australia

Contact: Tom Barne/ James Frame

Job Title: Managing Director/ Cocoa Consolidating

Email: tbarne@condesa.com.au/ jframe@condesa.com.au

Phone: +61 2 9114 8171/ +61 400 966171

Condesa is originally a coffee consolidator. There is however demand in Australia for cocoa consolidation/distribution and Condesa has dabbled in this area in the past two years. Condesa currently sells micro-lots (eg/ 15mt or less) to various chocolatiers around Australia. They work with Atlantic Cocoa in New York to bring in mixed containers of Central and South American beans. In 2015 they bought in 35mt of beans from the Americas and distributed on both a per-kg and per-mt basis. Their current buyers have requested cocoa from Pacific origins, however without a local consolidating partner this has proved difficult for Condesa to source.

Ideally Condesa would like to work with another consolidator on the ground in PNG and the plantations seem a good fit for this role. Kulkul and Kulili plantations could consolidate and ship in 15mt container loads, Condesa would then bear the inventory risk and distribute around Australia.

6.2.3 Wellington Chocolate Factory (Wellington, New Zealand)

Location: Wellington, North Island, New Zealand

Contact: Gabriel Davidson

Job Title: Chocolate Entrepreneur

Email: gabe@kokodeluxe.com

Phone: +64 4385 7555

Gabriel is the Managing Director of two cocoa related companies, the Wellington Chocolate Factory (WCF) and Original Cocoa Traders which is based in Melbourne.

Gabriel first came to Bougainville after a contact of his had worked in the region with Volunteer Services Abroad (VSA) and had discussed the potential for Bougainville cocoa with him. Gabriel then visited Bougainville in 2013 before partnering with James Rutana. Before making a purchase from James, WCF invested NZD15,000 to upgrade James' fermenting and drying facilities. Once this had been accomplished and the beans contained minimal smoke taint, Gabriel purchased 1mt of beans which were sailed to Wellington as part of the Wellington Chocolate Voyage, more information can be found on the website (https://thewellingtonchocolatevoyage.wordpress.com/).

1mt of beans produced 12,000 chocolate bars which are currently sold through the company's website. They plan to buy another 3mt in the near future and sail them to Wellington as they did previously. WCF uses 52mt of cocoa a year from Peru and the Dominican Republic which they blend. If they were able to adjust this blend to include PNG beans then their demand for PNG cocoa would increase. However at this stage they would like to develop their South Pacific origins more and specialize in a range of Pacific single origin bars.

Original Cocoa Traders is Gabriel's Melbourne based business which buys 35mt of cocoa per year to make 70mt of specialty drinking chocolate. The company has expanded in the U.S and Japan recently and consumers are increasingly demanding traceability in this product. As part of this report Gabriel has been introduced to Paradise Foods in the hope that Paradise Foods may be able to supply the cocoa powder for a fully traceable drinking chocolate product.

6.2.4 Haighs (Adelaide, S.A, Australia)

Location: Adelaide, South Australia

Contact: Ben Kolly/ Peter Millard

Job Title: Quality Control/ Sourcing and Procurement

Email: benk@haighs.com.au/ peterm@haighs.com.au

Phone: +61 8 8372 7040/ +61 8 8372 7040

Haighs currently buys approximately 60mt per year of PNG beans from Agmark and 190mt per year from Ghana. Haighs has more flexibility than other small to medium grinders as they manage all of their own retail stores; hence they have more leeway in regards to when to launch a product or when to discontinue a line.

From a sourcing perspective, there is no real benefit for Haighs to buy direct from farmers in micro lots. Communication is more difficult, there is no established trusted relationship and they spend more time collaborating on logistics. Their preference is to buy thorough a consolidator like Condesa/Cargill NYC who will take the risk for shipping, storage etc..

6.2.5 Origin Chocolate (NSW, Australia)

Location: Orange, New South Wales

Contact: Matt Chimenti

Email: matt@originchocolate.com.au

Phone: +61477 812 076

http://www.originchocolate.com.au/

Origin chocolate is interested in sourcing through a consolidator and has approached Condesa in Sydney to provide this service. They are currently sourcing from Ghana, Dominican Republic, Ecuador and Uganda but have expressed an interest in Pacific beans. Origin prefers to use organic certified beans in their chocolate bars but have the flexibility to work with conventional beans as well.

6.2.6 Zokoko (Sydney, NSW, Australia)

Location: Sydney, Australia

Contact: Dean Morgan

Job Title: Manager

Email: dean@morganscoffee.com

Phone: +61425 216 394

Zokoko currently buys from SolKom in the Solomon Islands and has a keen interest in supporting the Pacific cocoa industry. Zokoko pays a premium for non-smoky beans and would be a good fit for plantation cocoa.

6.2.7 Cravve (Burleigh Heads, QLD, Australia)

Location: Burleigh Heads, Queensland

Contact: Peter Mengler

Job Title: Manager

Email: dprawfood@bigpond.com.au

Phone: +61 7 55201983

Cravve started in Queensland in 2000 and they previously have made single plantation PNG chocolate bars with Kulili and Saidor beans, sourced from a PNG exporter. Since 2015 they have had difficulties importing beans from PNG, made all the more challenging by the fact that when they buy smaller consignments there is no possibility to reject them if the quality is not what they requested. Often they receive samples that are not indicative of the final shipment and have no recourse to seek reimbursement for the cocoa even though it is not able to be used for their chocolates.

Cravve makes mainly single origin bars but also buys cocoa to be made into drinking chocolate. This would once again be a good fit for the plantations but also a probable market for Paradise Food's cocoa powder.

6.2.8 San Churro (Melbourne, Vic, Australia)

Location: Melbourne, Victoria

Contact: Giro Maurici

Job Title: Founder and owner

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Phone: +61 3 8415 5800

San Churro is a Mexican churro and hot chocolate chain who are looking to source Pacific beans for their Mexican hot chocolate. As this drink is made from tempered chocolate blocks, thus the beans need to be smoke free. Giro is looking for Fairtrade beans if possible. Pricing and tonnage is as yet unknown as this is a new venture for them. They would benefit from a partnership with Agmark to source the Club 3000 beans in Madang. Alternatively if they were happy to source beans produced with Fairtrade principles they could partner with Paradise Foods to buy from the Teonona Association in Bougainville.

6.2.9 Cicada (Sydney, NSW, Australia)

Location: Sydney, New South Wales

Contact: Katie Robb

Job Title: Managing Director

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Phone: +61458 384 766

Cicada buys between 20mt and 50mt per year from a range of destinations; Madagascar, Peru, Bali, Dominican Republic and Venezuela. Two years ago they experimented with PNG beans but were disappointed with the results. They were told that the beans were Trinitario however once the sample batches had been made up, it was clear the beans were Forastero and had a very flat flavour. Julian, the head chocolate maker, suggested that this could perhaps been from a lack of knowledge of the difference between the two cocoa varieties instead of being deliberately misleading. Many farmers, including from Pacific origins, regularly send Cicada samples but often have unrealistic price expectations. For example PNG growers have requested 2.5 times the market price at the time, a price that even the best beans in the world can rarely achieve. The best quality cocoa in the world can generally command a price of 1.6-1.8 times the world cocoa price.

Cicada buys only heirloom varieties, another reason why PNG growers should register their blocks with the Fine Cocoa Industry Association (FCIA)[3]. In future, Cicada would prefer to source thorough a distributor as souring is not their core business. The only co-operatives they deal directly with are very business savvy and understand the price pressure on downstream manufacturers, something that Julian feels is lacking in the PNG market.

[3] More information can be found on the Heirloom registration project on page 45

Another issue cited was the lack of unbiased information in the PNG cocoa industry. There is no one focal point for information and no one individual with whom you can speak to get an unfiltered picture of the PNG cocoa industry without being directed to an individual's province, village or family block. Transparency and honesty are vital for buyers and given PNG's high levels or corruption, they feel the market is too complicated to buy into.

6.2.10 Charleys Chocolates

Location: Mission Beach, Queensland, Australia

Contact: Chris and Lynn Jahnke

Job Title: Owners

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Phone: +61 7 4068 5011

There was much the same feedback from Charley's Chocolates as other buyers. Previously they purchased from Mamo Co-operative in Madang and pre-paid for cocoa that they never received, samples were not indicative of the end consignment, communication was lax and unprofessional. The variability was frustrating and difficult to plan chocolate batches around and logistics was very expensive.

Charley's grows their own cocoa and also buys small quantities in from the Pacific region for which they pay upfront. Their own cocoa yields 4mt per hectare and they can control every quality aspect. Having said this, they would like to continue to support fellow Pacific growers and have made a conscious decision to only purchase from other origins in the Pacific region. As part of this study Chris and Lynne were introduced to both Kulkul and Kulili plantations.

There would be scope in the future for Charley's chocolates to consolidate their purchases with other Australian businesses if the plantations could also work together to fill a 15mt FCL.

6.2.11 OCHO

Location: Dunedin, New Zealand

Contact: Liz Rowe

Job Title: Chocolate Maker

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Phone: +64 274 901 421

OCHO – The Otago Chocolate Company – was founded by Liz Rowe, an artist and journalist. She is an advocate of the two-ingredient rule when making real chocolate. Her chocolate bars contain only raw cacao and cane sugar.

Liz recently acted as a judge for the Solomons Island chocolate festival and has an interest in sourcing from the Pacific region. She has had a bad experience in buying from PNG previously and this has changed her approach to buying PNG beans. She first contacted the NZ Embassy who connected her to Pacific Trade Invest. They in turn directed her to the Cocoa Board who suggested she contact Mamo Co-operative in Madang. She found the co-operative difficult to communicate with and she paid for beans up-front and then never received the final shipment. This led Liz to contact Outspan in Madang, whom she currently buys approximately 1,5mt from at a time. She has confidence that her queries will be responded to in a timely fashion and that her money will not be misappropriated.

Liz imports beans using EFM in Madang and has had a very positive experience. She sources approximately 3mt annually for her chocolate production.

6.3 North America

6.3.1 Overview

The North American boutique market has grown exponentially in the last five years. There are now hundreds of bean to bar manufacturers and chocolatiers trying to make a name for themselves in this market. The market size is difficult to define as some businesses buy chocolate products (liquor, butter and powder) while others work with whole beans. It is estimated that the market for beans is approximately 400-500mt per year.

The market is currently trying to standarise definitions and flavours to ensure consistency. Many terms such as “boutique”, “bean to bar” and “specialty” are ambiguous and mean different things to different individuals. Thus the Fine Cocoa Industry Association (FCIA) is in the process of developing standard flavour profiles much like the coffee industry has in place. This initiative has received mixed reviews across the industry however the main benefit would be felt by growers and exporters. The suggested standardization would allow them to better supply a consistent product. Appendix D outlines the recent developments in a report by CAOBISCO and is a valuable resource for all supply stakeholders.

Central and South American countries remain the most favoured sourcing origins, thanks to the close proximity and ease of logistics. However, with increasing number of players and little real differentiation in the market, most companies are looking for new flavours. The market is flooded with ‘*red fruit*’ flavours and there is an increasing demand for something with a ‘*savoury chocolatey, nutty flavour*’. In addition to a differentiated flavour profile, industry stakeholders want something that is unique and exotic - an origin which can be easily marketed. Both of these factors work to the advantage of the Papua New Guinean cocoa industry.

Consistency and quality are synonymous in this market. Any business of scale aims to provide their customers with a recognizable portfolio of chocolate products. It is thus of utmost importance to ensure for them to identify a supplier who can be relied upon to provide consistent volumes and quality of raw materials. As blending is less common in the boutique market, there is less scope to use beans from another origin as a substitute. Therefore, for the boutique chocolatier, the single most important consideration while choosing a supplier is consistency of supply.

Due to the small volumes involved very few chocolate makers choose to import their own beans into the country, instead opting to use intermediaries. At times they may choose to negotiate price directly with the supplier at origin, but use a third party importer to perform the actual logistics and documentation functions. Atlantic Cocoa is the largest intermediary for the boutique chocolate market, with the vast majority of specialty beans passing through them. Meridian cacao and Uncommon Cacao also provide an aggregating function but on a much smaller scale.

It is also important to note that the boutique chocolate manufacturers tend not to follow the terminal (futures) market of cocoa (NY ICE or LIFFE). These are small businesses that rarely hedge their purchases against the market price and instead purchase insurance to cover any potential physical stock losses. This completely changes the market dynamics as price/flavour is different for each business and hence one business’s pricing cannot be benchmarked against another.

Certification is somewhat irrelevant in the boutique market as smaller buyers generally wish to have full traceability and a personal relationship with their sourcing partner. The bulk players still find certification of some form vital to connect with their customer base. Fairtrade International (America) is a well-recognised brand, as is Organic. Mars is the biggest buyer of Rainforest Alliance beans in the U.S, and UTZ has a much smaller presence in the U.S than in Europe.

Logistics may well prove to be the most difficult aspect of access to the U.S market. The transit time from Papua New Guinea is approximately three months, possibly longer depending on the shipping agency. In addition to this, exporters have to be registered with the Food and Drug Association (FDA) in order to be able to import in to the U.S. This can often take some time to establish hence it is best to plan ahead of time.

6.3.2 Guittard (San Francisco, U.S.A)

Location: San Francisco, California

Contact: John Kehoe

Job Title: Director of Sustainability

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Phone: +1 650-552-2248

Guittard has a history of sourcing from the Pacific. When the company was originally founded in 1868, they bought beans from Samoa in the late 1800's and early 1900's. For a decade in the early 2000's they purchased from Markham Farms in PNG however in recent year have been unable to source PNG beans of a suitable quality.

Guittard has a preference for strong, chocolate flavoured beans and has a favourable impression of the amelonado variety. They also have a preference of sourcing through a trading house or third party exporter who would be able to arrange shipping, customs, quarantine and storage upon arrival etc. Lately, they have moved away from single origin branding on their chocolates as the market is now awash with these from other boutique chocolatiers.

Being a family owned business they have a great deal of flexibility with sourcing, If they found a flavour profile that they wanted to work with they could bring in any volume, with a minimum order quantity of 15mt (1 FCL). Guittard has an excellent working relationship with both Olam and Ecom, hence if they trialed the samples and were interested in purchasing, they would be able to request for the beans to be exported through Olam/Outspan.

Fairtrade is important to Guittard, and they buy both Fairtrade America (smallholders) and Fairtrade USA (plantations) cocoa. Club 3000 in Madang exports through their promoting body, Agmark. Guittard trialed Club 3000 samples in 2014 through Club 3000's then promoting body, Monpi Cocoa Exports. Guittard accepted the samples at the time and if the quality of the beans is still consistent, this could be a potential partnership in the future.

Since Guittard is a family owned business they were unable to disclose the volume of beans that they currently purchase annually or pricing.

6.3.3 Dandelion (San Francisco, U.S.A)

Location: San Francisco, California

Contact: Greg D'Alesandre

Job Title: Founder

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Phone: +1 415 349-0942

Dandelion is a very visible brand, with the chocolate bars being made in front of customers at their San Francisco café. It is a rapidly expanding company, in 2015 they purchased 60mt, in 2016 they plan to buy 100mt and they plan to scale that up to 300mt by 2018. They have recently opened a new café in Japan and have other plans to expand internationally.

They prefer to negotiate price directly with their sources in origin, occasionally importing directly to San Francisco. Where the volumes involved are smaller and the logistics more complex than from their key Central American origins, they channel the purchase through Atlantic or Meridian. The price is still negotiated with the farmers directly, Atlantic/Meridian simply charge a service fee for logistics, customs clearance, storage etc..

Greg handles all management tasks, including sourcing for this growing company. They have tweaked a few aspects of the procurement/manufacturing process by leveraging Greg's experience in the tech industry. For example to combat pest/disease they freeze all of their cocoa once it arrives in the States. They initially had problems with moth infestation and hence they now freeze the beans anywhere from 4 days to 2.5 years. They do not believe this has an impact on the flavour potential of the bean, provided the bean is able to defrost slowly. Tech wise they also use an optical sensor to sort the rubbish from the beans, this has been used before in the coffee industry and can be more effective than winnowing and hand sorting.

Dandelion places a great deal of importance on having a story to tell and full traceability of their beans. Certification is not something they actively seek, nor are any of their products currently certified. They

only produce dark chocolate and use just cocoa beans and sugar in their product range. They like to have 12 months inventory on hand at all times and using the freezer storage gives them a great deal of flexibility to manage their inventory, despite being an expensive process.

Like the vast majority of the buyers in the U.S, what they are looking for is an interesting and unique flavour profile that brings something new to the market. Their purchasing has no set quality specifications in regards to bean size or waste etc. and is based purely upon flavours.

Dandelion currently uses some PNG beans in their products and has a keen interest in continuing their PNG bars. Dandelion came to PNG to meet with Mamo Co-operative in Madang that has now been disbanded due to financial problems. Dandelion had problems with reliable communication and professionalism in dealing with the co-operative, the samples they were sent were also not representative of the beans they received in the final shipment.

6.3.4 TCHO (San Francisco, U.S.A)

Location: San Francisco, California

Contact: Brad Kintzer/ Zohara Mapes

Job Title: Chief Chocolate Makers

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TCHO currently sources from 4 origins and makes both single origin bars and inclusion bars (with nuts, fruits, cereals etc.). Their products are available throughout Asia and Europe but the majority of their business is in the U.S. In addition to their chocolate bars, they produce couverture, liquor and powder for the catering/manufacturing markets.

They currently buy approximately 100mt per year, and they source through Atlantic Cocoa for the vast majority of their beans. This is simply because the logistics, customs and storage become very expensive at the scale these small businesses operate at. They tend to negotiate price direct with suppliers and then Atlantic charges their fees on top. Pricing is dependent on the quality of the beans, specifically the flavour.

They buy four different flavour profiles; Fruity (Peru), Nutty (Ecuador), Bright (Madagascar) and Chocolatey (Ghana). TCHO has developed a number of flavour/sensory labs with the co-operatives or communities that they source from. They find this saves time and money in regards to sampling and means that farmers have a great understanding of the value chain. Zohara, the head chocolate maker recommended that there needs to be at least three permanent members of the sensory panel to ensure consistency. They would be interested to diversifying their supply base if it could fit into the current flavour profiles

Since their primary priority is the flavour profile when they are buying, certification is not required for them but traceability is. They have changed their source origin in the past when the flavour changed and impacted on the consistency of their product lines.

TCHO is the only business that roasts either at origin or as close to origin as possible. They do this to value add as much as possible in country but send one of their chocolate makers to oversee the process to ensure control over the roast temperature and length of roasting etc. They then ship the roasted beans/nibs back to the U.S. As the beans are now fully dried out, it reduces a number of logistical issues such as high moisture in the beans, mould etc.

There would be potential for Paradise Foods to partner with TCHO either for their product line or as an intermediary for co-operative beans.

6.3.5 Atlantic Cocoa/ Ecom (New York, U.S.A)

Location: New York City, New York State

Contact: Richard Falotico/ Dan Domingo

Job Title: Senior Cocoa Trader/ Cocoa Trader

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Phone: +1 (212) 785-5710

Atlantic Cocoa is the U.S branch of Ecom Agroindustrial. Five years ago they started dabbling in the boutique market by supplying beans to Mast Brothers who are arguably the founders of specialty chocolate in the U.S.

These days Atlantic is the preferred trading house of the big industry players such as Blommer, Mars and Hersheys as well as all of the boutique players. Ecom has adapted their model to support the purchase and sale of micro-lots, a market that the other major trading houses are yet to participate in. They provide an intermediary service for buyers to connect with producer groups. Thus buyers can negotiate price directly with the farmers and Atlantic can charge a set service fee per tonne to ensure that their costs are also covered.

Rich Falotico handles the larger clients (bulk market) while Dan Domingo manages the vast majority of the boutique business. Dan also represents Atlantic on the Fine Chocolate Industry Association (FCIA) Board.

Atlantic has an interest in sourcing Pacific beans, there is scope here for both the larger scale smoke tainted beans and also 15mt mixed container loads of smoke free beans. Their minimum order would be 12-15mt full container load (FCL).

Atlantic is a certified trader in all of the major certification bodies so can source Fairtrade, Rainforest Alliance, UTZ and Organic for their customer base.

6.3.6 Uncommon Cacao

Location: Boston, Massachusetts

Contact: Maya Granit

Job Title: Managing Director

Email: maya@uncommoncacao.com

Uncommon Cacao does not produce chocolate but instead sources from lesser-known origins and distributes throughout the U.S, Middle East, U.K, Europe and Australia. 85% of their business is U.S based. They are best known for the cocoa sourced from Belize and Guatemala (around 60mts each annually) from community groups with whom they have been working with since 2010 and 2013 respectively. Their cocoa from Belize is so highly sought after that they have over 100 businesses on a waitlist for samples.

Uncommon Cacao is in the process of taking over a company called Cacao Vivo which was previously the micro-batch distributor affiliated with Taza Chocolate. Once the businesses are combined, they will import and distribute a total of 150mt per year from 6 origins, all in Central and South America. Their minimum order quantity used to be 1mt and over, however now they are also selling micro-batches (<1mt)

A number of their clients are Organic certified and hence they source both conventional and Organic beans. They do not source Fairtrade, Rainforest Alliance or UTZ beans. Every year Uncommon Cacao produces an “Impact Report” which has been attached to this report in Appendix E. They advocate transparent pricing and for their Belize sourced cocoa, 60cents from every dollar of cocoa they sell goes to the farmer.

Perhaps of the most immediate value to PHAMA and the Pacific origins is the source of finance that Uncommon Cocoa has invested in. They partner with Kiva to provide microfinance to farmers. They applied for a USD150,000 credit line with Kiva and then vetted the farmers and distributed loans from between USD100-2000 to individuals. They now offer three loan products including individual loans, group loans and business loans. This could be an excellent solution to the pre-finance cycle in which many producers and exporters are locked into. There is a two-year repayment period on individual and group loans and 90 days on business loans.

6.3.7 Meridian

Location: Portland, Oregon

Contact: Gino Dalla Gasperina

Job Title: Founder and Managing Director

Email: gino@meridiancacao.com
Phone: +1 503 473 6437

Meridian was started by Gino in 2012 to supply the growing boutique cocoa industry in the U.S. They source from a range of origins globally, and they sell in micro batches and also fill larger orders for businesses such as Dandelion.

The demand is for consistent quality beans with a consistent flavour profile. Gino has 4 main origins that he sources; these are Ecuador, Tanzania, Trinidad and Vietnam. He has visited Papua New Guinea (PNG) before, but his attempt to source from a local co-operative was met by communication lags and logistics difficulties. The difficulties he has faced in PNG and the lack of consistency in samples from here has made him reticent to invest again without support from an intermediary.

6.4 Europe

6.4.1 Overview

The European market is a much older, more established market than the U.S. It is understated in the sense that there is less marketing done than in the U.S because consumers already know the business from which they buy. The focus tends to be on high quality, excellent chocolates instead of a “story” or the social element of chocolate making.

The boutique market size is estimated between 300-400mt and there are very few industry players sourcing beans directly from origins. It is more common in Europe for chocolate companies to source products (liquor, butter and powder).

In the bulk market, the vast majority of trading houses and large-scale businesses buy from West African origins and have no interest in buying from smaller origins in the Pacific. This is partly because they cannot reliably secure the volume they need and also because the transit time can be over 3 months from the Pacific. Given this extended transit time, interested buyers have requested the beans to be shipped in reefer (refrigerated) containers.

As with the U.S, demand for certification is driven mainly by the large companies whereas boutique/mid-size businesses are looking for a specific flavour/quality. Because the vast majority of European cocoa in the bulk market is sourced from West Africa, the main certification body used is UTZ. Some buyers are also interested in Organic certified beans, driven by large brands such as Green and Black however demand for Fairtrade and Rainforest Alliance remains small.

6.4.2 Original Beans

Location: Copenhagen, Denmark

Contact: Anders Prien

Job Title: Conservation Cocoa Leader

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Original beans have a unique business structure that is focused more on conservation than chocolate making. They outsource the processing of their beans to a company in Switzerland and currently process beans from five origins, equaling 20mt per year in total.

Original Beans first establishes a partnership with a co-operative or a community group (they prefer not to work with large exporters or individuals) and they then establish a conservation plan. For example they have projects in 12 origins at the moment but are only buying beans from 5 origins. In year 1 they will buy 1-2mt to launch a product and establish a market. In year 2 this can increase to 5mt and is often as much as 15mt (a FCL load) in year 3 of partnership. In year 1, given the small

volumes they buy, they meet 60% of the export costs and expect their in country partner (or a third party group) to fund 40% of the export/logistical fees. For shipments 5mt and over Original Beans covers 100% of the export costs.

They source a large percentage of their beans through Cocoanect as sourcing such small volumes can often be difficult and prohibitively expensive. They have shipped 2mt from PNG before and have just shipped 2mt as an FCL, which was very expensive, but the only option.

Original Beans sources first and foremost for a flavour profile, secondly a great story and thirdly for the possibility to support a conservation initiative. They have a number of conditions that partners need to adhere to in order to work with Original Beans. The group needs to commit to becoming organic certified within 2-3 years of working with Original Beans and they partly finance this. They also need to partner with a local conservation group. This can be either environmental conservation or conservation of native fauna.

Pricing wise they base their price off the LIFFE market and then offer a range of premiums for preserving forest/natural environment, organic certification, unique flavours or unique genetic material. These premiums can be up to USD2000 per mt on top of the market price.

They have a one bar, one tree policy which means that for every bar of chocolate sold, they either plant one cocoa tree or preserve one tree. Therefore for every mt of cocoa sold, their partner group needs to be committed to planting 12,000 new trees or conserving this number of trees in a forest or established cocoa block (with the financial assistance of Original Beans).

As part of this study Original Beans has been introduced to the Tree Kangaroo Conservation Society as a potential partner.

6.4.3 Le Cercle du Cacao (Brussels, Belgium)

Location: Brussels, Belgium

Contact: Nico Regout/ Mathieu Bors

Job Title: Founder/ Associate

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Phone: +32 477 67 44 22

Nico has been in the cocoa industry for the past 20 years and through her brokerage business with her business partner, Mathieu, they supply some of the best chocolatiers in France and Belgium.

Their business supplies chocolate makers with two different products; firstly a more mainstream bean which is blended to make couverture, pralines etc. Secondly they source high quality and often niche market beans for chocolatiers to make single origin and single plantation/farm bars. Clients of theirs, such as Pierre Marcollini, may market 3-10 single origin bars a year and Cercle Du Cacao sources and imports these beans into Antwerp where they are stored. They sell micro batches (<1mt) of the specialty cocoa and often over 100mt of the cocoa to be used in blends. The cocoa intended for blends is expected to follow the terminal markets whereas the niche cocoa has a different pricing structure.

Like most of the boutique market players, they have no demand for certified beans but traceability is of the utmost importance. Where possible, they would prefer to work with individual farmers or co-operatives instead of plantations.

Of particular concern to their customers at the moment are the cadmium levels in the cocoa and this is one of the first tests they conduct on the samples. As cadmium levels are usually higher in volcanic soils this may be particularly applicable to Pacific origins.

Initially they would like 2kg samples from different regions in each origin. If the samples meet their approval, then they would ship 2-5mt FCL to Australia, then re-pack into an LCL container into Antwerp. If they find a viable market for the cocoa then both Nico and Mathieu would be very interested to visit both origins and understand more about the genetic varieties and also the communities producing the beans.

6.4.4 Rausch (Berlin, Germany)

Location: Berlin, Germany

Contact: Christina Rohsius

Job Title: Leiterin Kakao – Qualität und Research

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Phone: +49 171 3002597

Rausch is a well-known global brand based in Germany. They offer a wide range of chocolate products, including 7 single origin products, one of which is a 35% PNG bar (made from Kulkul plantation cocoa). They buy only "fine flavour" cocoa and prefer to work with plantations where they can secure a regular and consistent supply of large volumes of cocoa (45mt+). Their rationale is that if they can source the volume of cocoa they require with the required quality characteristics then they can pay significantly above the global market price for this.

They source directly from plantations, often working with a trade facilitator or export intermediary but they value a close relationship with the suppliers. They do not buy certified beans but traceability is a core business model for them.

They would be very interested to continue work with plantations and producer groups that have full traceability and a high level of quality control with post-harvest practices.

6.4.5 Daarnhouwer (Amsterdam, The Netherlands)

Location: Zaandam, The Netherlands (offices also in San Diego, USA & Medan, Indonesia)

Contact: Ted Boereboom

Job Title: Cocoa Trader

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Phone: + 31 75 612 63 88

Daarnhouwer imports cocoa, tree nuts and coffee. They trade in specialty beans and also cocoa products (butter, powder and liquor). The company is well established, having been founded in 1908. They have long supplied the European chocolate market and it is only in recent years that they have lost some of their market share to newcomer, Cocoanect. Daarnhouwer is certified to trade Fairtrade and Organic cocoa but mainly deal with conventional beans. It has been difficult to ascertain what their pricing levels are and likewise the volumes they purchase. For a new origin, they would be interested in one container only (12-15mt) which they could store and find a market for. If they had back to back sales they would be able to increase their import volumes.

6.4.6 Cocoanect (Consolidator/Broker)

Location: Rotterdam, The Netherlands

Contact: Albert Smith

Job Title: Trader

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Phone: +31 (0)10 7603 100

Cocoanect started in 2014 in The Netherlands to cater to the growing boutique cocoa industry. The trading team in Rotterdam is supported by an office in Ivory Coast as well as representatives in Ecuador, Indonesia and Nigeria. Their pricing model is much more open and they send out a regular email to clients with the products in stock and transparent pricing.

They have a genuine interest in sourcing from Pacific origins but have concerns about the quality of the cocoa which could be worsened by the long shipment time from PNG to Europe (approx. 3 months in transit). Currently they would prefer to ship using reefer containers, which is a limiting factor for export from PNG. They have a thorough understanding of not only the post-harvest procedures but also the container packing and export quality control process.

Cocoanect has access to the specialty market in Europe and supplying to them would be an excellent starting point to improve PNG's image. Being a consolidator, Cocoanect has a much higher demand for tonnage than other small chocolatiers that may only have requirements for 1mt of less of cocoa beans.

6.5 Other International Industry Stakeholders

6.5.1 Rainforest Alliance

Location: Indonesia

Contact: Putri Mayasari

Job Title: Agriculture Auditing Services Coordinator

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The Rainforest Alliance is a non-governmental organization (NGO) working to conserve biodiversity and ensure sustainable livelihoods by transforming land-use practices, business practices and consumer behavior. Their certification is a good fit with many of the current practices undertaken by PNG farmers however the audit costs and cost of community awareness can make accessibility to this certification very expensive.

Outspan is currently the only certified Rainforest Alliance (RFA) group in PNG and given the lack of demand internationally, it would be unwise at this stage to further promote RFA certification. It would especially difficult for small co-operatives and producer groups to undertake certification with RFA as would be unable to achieve economies of scale through standard annual audit costs.

6.5.2 Fairtrade ANZ

Location: Auckland, New Zealand

Contact: Rachel Levine

Job Title: Producer Support Program Manager

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Globally, certification in its traditional form seems to be going out of fashion. Many of the large producers (Mondelez, Hersheys, Blommer) have decided to implement their own version of certification through their supply chains and this has reduced their demand for Fairtrade. Most small batch manufacturers have a preference for particular flavour and a "story". Hence it is predominately the medium grinders that need to have traceability in their supply chain, but cannot afford to implement their own certification/traceability system that demand Fairtrade.

The demand for Fairtrade varies greatly region by region, and unfortunately the demand throughout Asia/Pacific is limited, as Club 3000 has discovered. This is a huge shame as the Fairtrade ANZ team is one of the most pro-active and supportive certification bodies globally. They offer cost effective solutions, with the Producer Development Fund providing funds towards certification and implementation costs. Fairtrade works with the whole supply chain, connecting producer groups to exporters and to a global network of Fairtrade buyers. This sort of industry support is not offered by any other type of certification, nor do other forms of certification provide the same price incentive to farmers.

With Fairtrade, the producers have to receive at least the Fairtrade minimum price (USD2000/mt) and a USD200/mt premium that also has to go directly to the farmers.

There are two types of Fairtrade certification:

Contract production works with a farmer group and a promoting body (usually an exporter) to certify a whole in country supply chain. This ensures that a farmer group is able to export once they have

certification. To gain access to Fairtrade financial benefits a product can only be sold through a certified supply chain, eg. Fairtrade producer sells to a Fairtrade exporter who sells to a Fairtrade manufacturer. Farmers are of course able to sell their product elsewhere, but they will not receive the premium.

Small Producer Organisation standards is applicable to co-operatives and similar groups that have an export license and produce a significant enough volume to negotiate their own contracts. The same certification of supply chain applies in that every aspect must be certifies in order for the group to receive the Fairtrade premium.

6.5.3 Fine Chocolate Industry Association (FCIA)

The FCIA promotes the artistry and craftsmanship of the chocolate industry in America. They support best practices in cacao processing and chocolate production; and transparent labeling and marketing practices. Their membership list boasts all of the major industry players in the U.S and they are the driving force behind a number of industry initiatives. Currently one of their programs is to standardise flavour testing industry wide so that there is consistent messaging to suppliers. More information on this is included in Appendix D.

The Heirloom Initiative is another project, which would be beneficial to PNG growers. Together the US Department of Agriculture and FCIA are coordinating chocolate industry professionals, chocolate makers, farmers, and chocolate enthusiasts from around the world to save the quickly diminishing Theobroma cacao genetics that are behind “fine flavour” cocoa. Farmers can send in samples to The Heirloom Cacao Preservation (HCP) Fund and be certified if they have the required cocoa genetics. The HCP application fee is only $1 per submission to have beans evaluated by the tasting panel. Appendix F outlines exactly how interested participants can submit a sample.

This is a great way to gain publicity for good quality cocoa and unique genetics. It will provide verification for farmers, and the PNG cocoa industry that the beans are indeed fine flavour. In addition to this it will give producer groups and growers an excellent entry point into the biggest network of specialty chocolate makers in the world, it could be a huge leap forward for PNG’s imagine on the international market.

More information is available on their website http://www.finechocolateindustry.org/

7.0 Constraints

Many farmer groups in PNG are difficult to access and this report was unable to visit and interview many of the remote producer groups that do not have access to telecommunications. Likewise on the other end of the supply chain, 37 out of over 200 specialty chocolatiers were interviewed for this report, which represents only 18% of the entire U.S industry. 28 European and UK buyers were interviewed, which once again, represents less than 15% of the overall European market. There was better market coverage in Australia and New Zealand however many of those chocolate makers have no interest in extending their product range into the Pacific due to quality and logistical constraints.

The reality is that PNG cocoa has a bad reputation internationally. This bad reputation is for poor quality cocoa, high cost and complicated logistics, corruption, dishonesty and lack of transparency. The main quality issue is for smoky beans. This smoke flavour is caused by poorly maintained hot air dryers and renders the cocoa un-useable unless shipped to the bulk market and the butter is deodorized. PNG farmers are often told that they have fine flavour cocoa when in fact, Forastero cocoa is present in all provinces and the beans are often mixed. Trinitario and criollo genetic strains are deemed to be fine flavour, however once again so much depends on the post-harvest practices to ensure that this fine flavour comes through in the end product.

The cocoa industry is segregated, with national exporters pitted against foreign exporters and corruption and misinformation present at all stages of the supply chain. Growers do not trust exporters and have a belief that pricing is unfair when in fact, PNG bean prices are considerably higher than that of their Indonesian neighbours.

At many stages of this report, buyers reported the lack of an impartial, unbiased intermediary in the PNG cocoa industry. It was nigh impossible for potential buyers to uncover a clear picture of the PNG

cocoa industry that gave equal opportunities to all provinces, exporters, freight forwarders and shipping companies.

The specialty market cannot be compared to the bulk market. They deal with differentiated products and consequently have different pricing structures. This is not yet understood in the market and farmers are unclear on why their cocoa cannot be sold into the boutique market. By its very nature, this specialty/niche/boutique market only accepts the best cocoa in the world in small volumes, it is illogical to assume that any more than 1-2% of PNG's entire cocoa crop will be able to supply into this market.

8.0 Recommendations

With reference to the objectives and findings of this study the following actions are recommended for PHAMA to consider and act upon in terms of follow up activities:

1. Trade Visit

Support for a visit to PNG by potential buyers for PNG cocoa who were identified in this initial study. The purpose of the visit is to familiarize overseas buyers with differentiated cocoa in PNG. PNG is seen by many small-medium sized grinders/ chocolatiers as a risky market to enter. This activity aims to develop the specialty market by making buyers more comfortable with the industry players in PNG and providing a step-by-step export process. This activity is supported by Appendix B the "PNG Cocoa Directory" to make available industry information. It is recommended that the visit be linked to a similar activity in Solomon Islands so that buyers can visit both countries.

- Appendix A contains the details of a proposed trade visit
- The invitees have been chosen due to the relatively large volumes that they could buy, should they find a suitable supplier
- It is vital that this visit be managed and supervised by an unbiased party who can present an accurate overall picture of the various types of cocoa available in PNG and introduce visitors to all relevant industry representatives (eg. all exporters, producer groups, plantations, logistics companies)
- Given that the PPAP projects have such a wealth of information about the farmers in their area, and have also recently undertaken to rehabilitate the fermentries in these areas, it would be beneficial for the visitors to assess some of these project sites

2. Industry Strengthening

Currently boutique buyers do not want to buy from "big name" exporters as they need a "story" to be able to market their chocolate bars. Likewise exporters have no benefit from segregating and exporting less than a 15mt FCL to boutique buyers. This requires a different pricing model and causes unnecessary administrative tasks. For those with an export license, a freight forwarder can provide this service (such as EFM). However for the smaller producers they face the issue of both compliance with export requirements and engaging with NAQIA for fumigation and phytosanitary certificate, storage in a central location, compilation of export documentation and communication to the buyer via reliable telecommunication. Given the absence of a specialty bean exporter in country, and the myriad of problems associated with establishing such a business at this point in time, the below option is the most logical solution to ensure that small consignments can still reach interested buyers.

- **PHAMA and CIWG to facilitate formalizing with exporters service charge based exports to better facilitate specialty trade.** This would be in the form of a set per bag or per tonne price that would cover the cost of warehousing, fumigation, export documentation and transport. This would allow buyers to negotiate a price for the cocoa directly with the producer organisation of their choice and thus have more marketing potential than if they were to buy from a national or multinational exporter. It would empower producer groups and growers to

promote and sell their own product on an international scale and to better understand the global market in which they operate. Lastly, it would not displace the current exporters and would provide a formalized platform for them to support their more advanced suppliers.

In order to implement this, PHAMA would engage with current exporters to confirm their willingness to offer this service to producer groups. Exporters would confirm a per-bag or per-tonne price ensuring that their costs are met. This would then be communicated directly to the producer groups identified in this survey by PHAMA or by regional cocoa board representatives. This would provide a clear export plan for producer groups without an export license prior to the October trade visit. Exporters would perform their usual quality control measures on the cocoa prior to export and would have the power to reject a shipment if they felt progressing with the export would in any way damage their reputation.

Other recommended measures to improve market linkages are:

- **Coordinate linkages of NGO cocoa livelihood projects and PPAP projects to prospective buyers.** A registered exporter will still export the cocoa but producer groups would have the ability to negotiate pricing direct with buyers and they would have support to improve their business skills and marketing by either the NGO body or a lead partner. This is a simple recommendation that has the potential to motivate farmers and access new markets and opportunities.
- **Provide information to assist new buyers looking to buy PNG cocoa**. Appendix B is provided as a "PNG Cocoa Directory" with a database of producer groups, suggested exporters, suggested freight forwarders, suggested shipping lines and current development projects for potential buyers. This will only be of value if it is continually updated and maintained. This can be circulated by PHAMA to industry stakeholders and be maintained by the Cocoa Industry Working Group.
- **PHAMA to co-ordinate and fund samples to be tested by the FCIA to be added on to the Heirloom Cocoa register**. Currently most growers do not know much about the genetics of their trees, testing by the FCIA would provide clarity of where the best cocoa is grown. As this register is accessed and managed by most major players in the U.S specialty cocoa market, it would also result in immediate (and free) marketing of PNG cocoa.
- **Assist CIWG to consider options for improving exporting processes** including; bulk sourcing of current desiccants, new types of desiccants and container packing methods (possibility to use reefer containers), packing into large sacks similar to coffee industry instead of individual jute bags, biosecurity methods for exporting organic cocoa (not chemical fumigation), and streamlining of export documentation with the potential of subsidizing this cost for small to medium sized businesses.

Measures recommended to strengthen industry coordination are:

- **PHAMA to work with the CIWG to improve co-ordination across the industry with the many aid funded projects being replicated by different players**. The Cocoa Industry Working Group (CIWG) could maintain a database of such projects to ensure there is no replication.
- **PHAMA to establish strategic partnerships with MMJV, World Vision, CARE, PPAP and ACIAR** to facilitate better industry communication and demonstrate an ability to better coordinate industry wide activities.
- **Promote membership of the CIWG to include more active commercial members such as shipping companies, freight forwarders, farmers and plantation owners.** There is a focus in the industry on government and regulatory bodies however this does not accurately reflect the voice of those working day-to-day in the industry.

3. Cacao Products (Paradise Foods Ltd- PFL)

The following actions have been taken to support market development for PFL:

- Few UK chocolatiers produce from bean to bar, and consequently there is a sizeable market for cocoa products, in particular liquor. Paradise Foods has been provided with the contact details for Chocolate Alchemy in Leicester and Artisan du Chocolat in London.
- Original Cocoa Traders in Australia is looking for a cocoa powder supplier with full traceability. Paradise Foods has been provided with the contact details for this business.
- Paradise Foods requested to be connected to distributors of cocoa products in Australia, the UK and the US. Tom Barne from Condesa in Australia, Martyn O'Dare from Chocolate Wave in the UK and Gino Gasparina from Meridian in the U.S are distributors of cocoa products who would be an excellent entre point for the full Paradise Foods product range into their respective countries. Paradise Foods has been connected to these businesses.

4. Plantations

The specialty market is split between those who want good quality and consistent cocoa supply and those that need a good marketing "story" and prefer to work with smaller producer groups. Co-ordination by PHAMA between the Australian chocolate industry and the plantations would benefit all parties. The following actions are recommended:

- **Arrange a follow-up meeting with all Australian buyers identified in this report** (Origin Chocolate, Spencer Cocoa, Zokoko, Condesa, Cravve, Original Cocoa Traders, San Churro and Charley's Chocolates) to establish what the total demand is for PNG cocoa between them and if they would be prepared to order together as an industry and then arrange for distribution amongst themselves.
- **Take this information to the plantations and establish who will supply** (presumably a 50/50 split of demand) and facilitate handover between plantations and Australian industry representative to manage export/imports moving forward.

5. Finance

Access to capital remains a problem across the industry and smaller groups need pre-financing which is not attractive to overseas buyers. It is recommended **PHAMA work with the CIWG to explore micro-finance options with exporters and banks, and alternative finance options such as Kiva**.

6. Co-Operative/ Producer Group Strengthening

PHAMA to work with strategic partners to facilitate an ongoing cocoa market education program. At grower level, there is still a lack of basic business knowledge and industry information. Ongoing sessions would be beneficial to follow up on lessons learnt, reiterate important points, co-ordinate regular discussions about events in the global market and build confidence in participants. A recommended program would be as follows:

Cocoa industry overview

Where cocoa is sourced from globally

Where cocoa is processed globally

Who the major chocolate consuming countries are

Different types of cocoa

Explanation of bulk market and Australasian examples

- Explanation of boutique market and Australasian examples
- Review of NY ICE prices and London LIFFE prices
- Discussion of global industry trends and impact on PNG

Cocoa pricing

- Review of NY ICE prices and London LIFFE prices
- Discussion of global industry trends and impact on PNG
- Sales terms (FOB, CIF etc.)
- Understanding of differentials
- Understanding foreign exchange

Cocoa to chocolate, the needs of processors (to be held at CCI or nearby training facility)

- Conduct quality testing on various samples
- Liquor tasting
- Dry bean to chocolate bar volume conversion
- Quality information for international bulk standards reiterated
- Review of current bulk market prices vs boutique market prices
- Discussion of global consumer trends

Post harvest practices to promote quality beans (field trip)

- Pod harvest
- Fermenting
- Drying
- Storage
- Comparison of samples and tie in with lab work

Business skills

- Understanding own businesses financials
- Calculating break-even purchase price
- Calculating differentials from GBP and USD to PGK
- Analysis of global markets
- Discussion of different sources of finance

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Appendix A

Trade visit

Appendix A Trade visit

Proposed itinerary

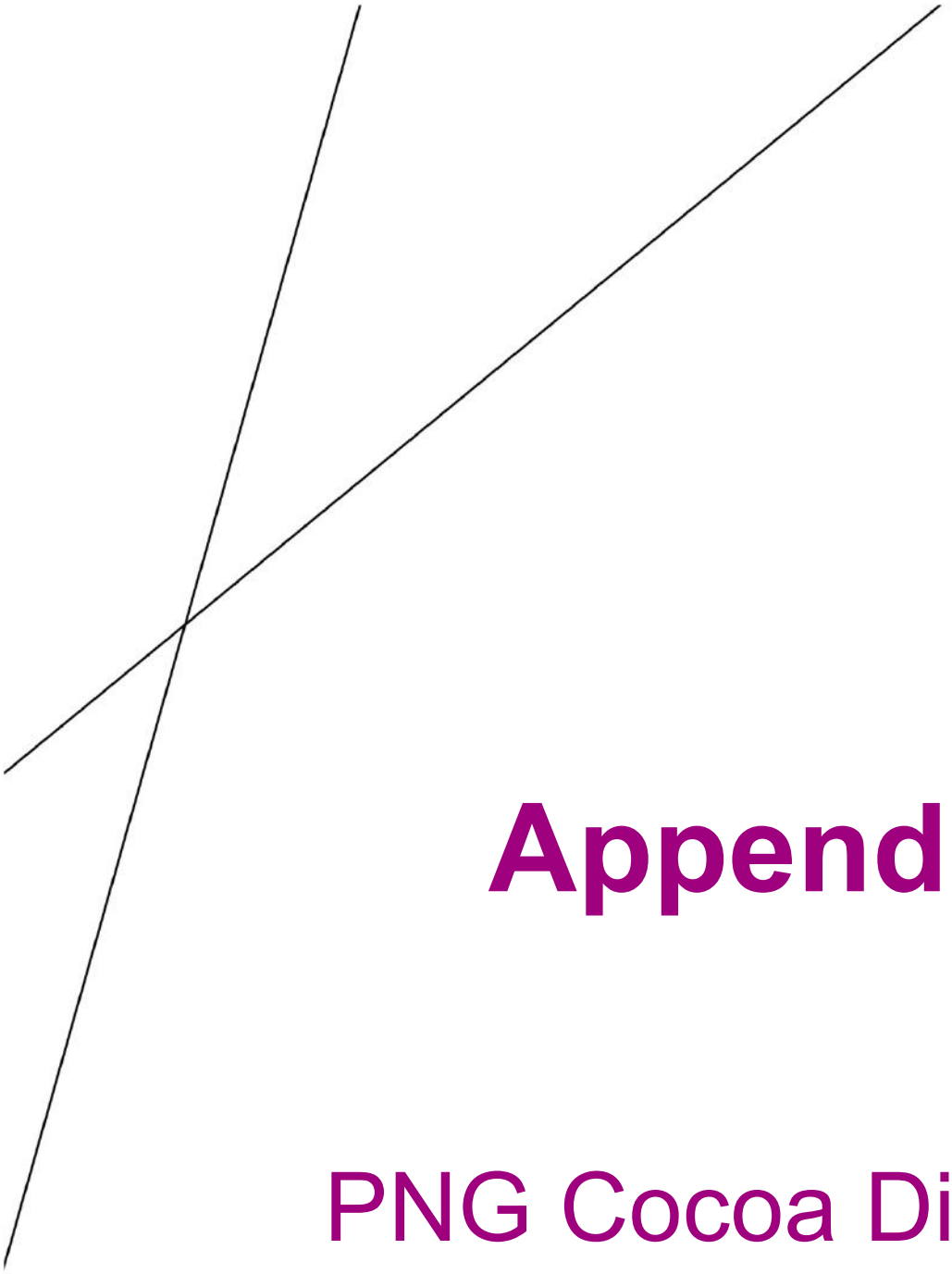
COMPONENT 1.			
2/10/16	**Sunday**		
		Port Moresby	Meet and Greet
3/10/16	**Monday**		
		Arawa	9am - 11am - Visit to Paradise Foods
			12:40 - 3:40pm - POM - Kieta
4//10/2016	**Tuesday**		
		Arawa	Konnou farmers (World Vision project)
			Meet exporters in Arawa
5/10/16	**Wednesday**		
		Buka	Drive up to Tinputz
			Tinputz farmers (CARE project)
			Teonena Association (Producer Group)
6/10/16	**Thursday**		
		Madang	Meet exporters in Buka
			12:35 - 2:05pm - Buka -POM
			3:10pm - 4:10pm - POM-Madang
7/10/16	**Friday**		
		Madang	Outspan - Rainforest Alliance certified
			Agmark - Fairtrade Certified
			Visit to Transgogol/Usino
8/10/16	**Saturday**		
		Karkar Island	Madang - Karkar - Kulkul
9/10/16	**Sunday**		
		Madang	Karkar - Kulili - Madang
10/10/16	**Monday**		
		Lae	7:20am - 8:20am Mad-POM
			9:45am - 10:30pm - POM-Lae
			Tree Kangaroo Conservation Society
			Fairtrade (Gabriel)
			MMJV (NGO projects)
			EFM (Freight Forwarder)
11/10/16	**Tuesday**		
		Lae	Day trip to visit Lower Watut Producer Group
12/10/16	**Wednesday**		
		POM	11am - 11:45am - LAE - POM
			debrief
			with options to fly out to Brisbane 1:30pm
			with options to fly out to Hong Kong 3pm

			with options to fly out to Singapore 2:10pm
13/10/16	**Thursday**		
			with options to continue trade visit to Honiara 10am

Draft budget

Item	Units	Unit Cost (PGK)	Unit Cost (AUD)	Total Units	Sub-totals
Travel Expenses					
International Travel:					
Flight Brussels - POM	Lump sum		1879	2	3,758
Flight San Francisco - POM	Lump sum		2724	1	2,724
Flight New York - POM	Lump sum		2991	1	2,991
Flight Berlin - POM	Lump sum		2427	1	2,427
Flight Amsterdam - POM	Lump sum		1687	1	1,687
				Subtotal	*13,587*
Domestic travel					
Flight POM- Kieta	Lump sum	697.8	288	6	1,726
Buka - Rabaul - POM	Lump sum	606.5	250	6	1,500
POM - Mad	Lump sum	409.6	169	6	1,013
Mad - POM - Lae	Lump sum	669.2	276	6	1,656
Lae - POM	Lump sum	360.1	148	6	891
Accommodation Port Moresby	1 night	624.71	258	6	7,727
Accommodation Buka	1 night	500	206	6	1,237
Accommodation Arawa	2 nights	300	124	6	1,484
Accommodation Madang	3 nights	600	247	6	4,453
Accommodation Karkar	1 night	0	0	6	-
Accommodation Lae	2 nights	550	227	6	2,721
Accommodation Port Moresby	1 night	624.71	258	6	1,545
Vehicle Hire: Bougainville (2 vehicles)	Lump sum	600	247	3	742
Vehicle Hire: Madang (2 vehicles)	Lump sum	1500	618	2	1,237
Vehicle Hire: Lae (2 vehicles)	Lump sum	1678	692	3	2,076
				Subtotal	*26,697*
				TOTAL	**40,284**

OANDA rate (PGK-AUD): 0.41231
dated: 19/08/16



Appendix B

PNG Cocoa Directory

Appendix B PNG Cocoa Directory

Overview

PNG has 22 provinces, 10 of which produce cocoa. This guide will focus on the five main producing regions, Madang, East Sepik, Morobe, Autonomous Region of Bougainville and East New Britain. All of these regions have major ports, infrastructure and a service sector established to support cocoa exports.

Below the production figures for the last five years per region are outlined below:

	2011			2012			2013			2014			2015		
Province	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**	**Plant**	**Small**	**Total**
East New Britain	921	6,272	7,193	520	3,541	4,061	602	4,102	4,704	663	4,511	5,174	686	4,671	5,357
North Solomons	-	17,743	17,743	-	13,121	13,121	-	12,543	12,543	-	8,119	8,119	-	8,406	8,406
New Ireland	31	1168	1,199	13	471	484	11	420	431	7	265	272	7	275	282
West New Britain	-	1439	1,439	-	898	898	-	510	510	-	1,020	1,020	-	535	535
Manus	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Madang	263	1,655	1,918	206	4,870	5,076	230	5,650	5,880	208	5,900	6,108	203	6,641	6,844
Morobe	12	707	719	17	986	1,003	26	1542	1,568	42	2444	2,486	51	2950	3,001
East Sepik		16,304	16,304		13,278	13,278		12,582	12,582	-	9,640	9,640	-	8,220	8,220
West Sepik	24	935	959	20	761	781	16	611	627	18	677	695	14	522	536
Oro		480	480		351	351		392	392	-	420	420	-	455	455
Milne Bay	-	-	-	-	-	-	-	-	-	-	10	10	-	10	10
Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gulf	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simbu	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
TOTAL	**1,251**	**46,703**	**47,954**	**776**	**38,277**	**39,053**	**885**	**38,352**	**39,237**	**938**	**33,006**	**33,944**	**961**	**32,689**	**33,650**

(Cocoa Board, 2016)

Each of the regions have differing micro-climates and different cocoa varieties, consequently there are many cocoa favour profiles throughout the country.

Table of Contents

Producer Groups, Certified Groups and Plantation Cocoa

Madang

Fairtrade – Club 3000 (Agmark)

Location: Madang/ Lae

Contact: Norman Nayak**/** Gabriel Iso

Job Title: Fairtrade Extension Officer/ PNG Fairtrade Representative

Email: nnayak@agmark.com.pg / lopng@fairtrade.org.nz

Phone: +675 7398 6637/ +675 7200 4491

Club 3000 is made up of some of Madang's best smallholder farmers. The group made international news in 2014 when they became the first group in Asia-Pacific to be certified under the new Fairtrade contract production standards. The smallholders sell their cocoa under a single contract to their promoting body, Agmark (a nationwide exporter). Agmark then arranges for sale of the beans, however the USD200/mt premium is paid directly to the farmers who then decide as a group how to spend the money.

Club 3000 is able to export over 200mt annually of Fairtrade certified beans. Interested parties should contact Agmark or Fairtrade for further details.

Kulili Estates (Plantation cocoa)

Location: Karkar Island, Madang

Contact: Derek Middleton

Job Title: Managing Director

Email: derek.wadau@global.net.pg

Phone: +675 423 7461

Kulili Estates is one of the largest plantations remaining in PNG and is one of the biggest employers on Karkar Island. The plantation has well controlled post-harvest practices and can produce over 200mt per year of consistent quality cocoa.

Kulkul (Plantation cocoa)

Location: Karkar Island, Madang

Contact: Paul and Barbara Goodyear

Job Title: Owners

Email: barbara_semlinger@yahoo.de

Phone: +675 7255 4050

The 700 hectare Kulkul plantation is also based on Karkar island and they produce about 120mt per year. The fermenting and drying practices are centrally controlled, much the same as Kulili and cocoa is currently shipped into Madang to be exported. Kulkul has experience managing their own export procedures as they previously sold their cocoa to a German chocolate maker.

Rainforest Alliance (Outspan)

Location: Madang

Contact: Basavaraj (Raj) Mashetty

Job Title: Branch Manager

Email: basavaraj.m@olamnet.com

Phone: +675 7188 2518

Outspan has certified 2,000 farmers in the Usino region of Madang. The member farmers receive a PGK16 premium per bag price for delivering under the Rainforest Alliance certification brand. The group produces between 700-800mt per year.

East Sepik

Rainforest Alliance (Outspan)

Location: Wewak

Contact: Shekhar Dwivedi

Job Title: Branch Manager

Email: shekhar.dwivedi@olamnet.com

Farmers in East Sepik were the first to be Rainforest Alliance certified in PNG. This certification is financed and administrated through Outspan who have expanded the program over the years. There are now 5000 registered farmers in the province, producing between 1500-1800mt per year. Farmers receive a PGK16 per bag premium for adhering to the Rainforest Alliance standards.

Morobe

Lower Watut Co-operative

Location: Lower Watut, Morobe

Contact: David Nehem or contact via Bernard Maladina

Phone: +675 7339 7833 (Bernard's number)

There are over 30 cluster groups in the Lower Watut region that grow cocoa and are known collectively as the Lower Watut producer group. They have worked with MMJV over the years who has supported the farmers with tools and boats for transporting the cocoa bags to Lae. Now that MMJV is building roads in the region in the lead up to the new Wapi-Golfu mine, agricultural trade is opening up for the growers in this region.

Padamot Cocoa Co-operative

Location: Siassi, Morobe

Contact: Bernard Maladina (the island has no mobile connection)

Phone: +675 7339 7833

Cocoa Board and Niugini Strategic Services both work with members of this co-operative and in recent years, a clone nursery has been established on the island. Transport of the cocoa to Lae remains a huge problem for the co-operative. Bags are often damaged en route and freight prices for the rental of a boat significantly reduce the profit margin on the bags.

Wals Cocoa Co-operative Society

Location: Lower Watut, Morobe

Contact: Francis Anton

Job Title: Chairman

Phone: +675 7074 5900

Wals Cocoa Co-operative were the suppliers of the sample of cocoa sent to the Salon du Chocolat in Paris in October 2015 and they were placed fifth out of the Asia/Pacific entrants. More information can be found at the following link http://www.salonduchocolat.fr/evenement.aspx?event_id=120.

Autonomous Region of Bougainville

Buin Cocoa Dealers

Location: Buin, South Bougainville

Contact: Mallinson Kipau

Phone: +675 7386 7749

The group produces a minimum 80mt per year and often has to transport their cocoa up as far as Kokopau in the peak season when the banks down south don't have enough cash on hand. Some of the members are included in the World Vision PPAP Buin project and consequently have ongoing training on post-harvest practices in addition to fermentry rehabilitation.

Nomorolai Cooperative Society

Location: Konnou, South Bougainville

Contact: Philip Marave

Phone: +675 7364 0754

The Nomorolai co-operative was a major candidate for Fairtrade certification in 2013 and 2014 and is IPA registered. The group can produce 80-100mt per year and the majority of the farmers are part of either the Buin or the Konnou PPAP projects managed by World Bank. The co-operative has their own nursery and exports through various exporters, often having to transport beans as far as Konnou.

Okuromu Cooperative Society

Location: Tinputz, North Bougainville

Contact: Edward Kamuai

Phone: +675 7377 7899

The co-operative is made up of farmers that live on one of the old plantations (Dios) that was active prior to the crisis. They produce over 100mt per year and sell through a number of exporters, usually in Kokopau.

Opiuk Cooperative Society

Location: North Bougainville

Contact: Raphael Komai

Phone: +675 7247 2391

The co-operative produces 60-80mt per year and sells through a number of exporters in Kokopau.

Paiscy Limited

Location: North Bougainville

Contact: Paiscy Silabes

Phone: +675 7352 4357

Paiscy and his wet bean suppliers produce a minimum of 80mt dry bean per year. They transport the cocoa to Kokopau for sale and sell to a range of exporters.

Teonena Association

Location: Kovanis Village, Tinputz, North Bougainville

Contact: John Bunsip

Phone: +675 7141 4862

The association was founded in 2013 with the assistance of the Queen Emma Chocolate Company (Paradise Foods). The group has access to a solar drier and a biogas drier provided by Paradise Foods and established in partnership with CCI. The cocoa from the group is used for the Cape L'Averdy chocolates produced under the Queen Emma label.

Tinputz Cocoa Farmers Association

Location: Tinputz, North Bougainville

Contact: Marlon Sira**/** Patrick Gairovi

Phone: +675 7377 6941/ +675 7077 9027

The group produces around 180mt per year and is well supported by the CARE PPAP program. Most of the fermentries were rehabilitated between 2014-2016 and the group produces excellent quality cocoa.

East New Britain

Illugi Co-operative Society

Contact: Samson Mori/ Roland Kerina

Job Title: Chairman/ General Manager ENBDC

Email: rkerina@endbc.com.pg (ENBDC is joint partners with Illugi in a PPAP project)

Phone: +675 7258 5726/ +675 7199 2311

The co-operative society is supported by ENBDC though the Productive Partnerships in Agriculture Projects (PPAP). has a wealth of information on the group, including member lists, annual yield and production, cocoa prices etc.

Other

Goodenough Islands Co-operative (Milne Bay)

Location: Goodenough Islands

Contact: Bede Tomokita

Job Title: Co-operative senior lead partner

Phone: +675 7360 9945

The group currently ships the beans to Lae before arranging for sale. This is very costly for the group and they are hoping to arrange for direct export from Alotau. Paradise Food buys from the co-operative currently and produces both a dark and milk chocolate range with the beans under the Queen Emma brand – the product has a very different flavour profile from the other regions and consequently is in high demand.

Exporters by Region

Madang

Agmark

All purchasing queries to go through:

Contact: John Nightingale/ James Narokai

Job Title: Owner/ Export Manager

Email: jnarokai@agmark.com.pg/ njnightingale@agmark.com.pg

Phone: +675 472 1106/ +675 7250 3592

Elliven

Contact: Ron Neville

Job Title: Managing Director

Email: rneville@ellivengroup.com

Phone: +61 401 914 375

Globe

Contact: Dananjaya

Job Title: Branch Manager

Email: dananjayas@globepng.com

Phone: +675 717 59 098

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Port Moresby (National Capital District)

DHL

Phone: +325 7846

Email: na

Express Freight Management (EFM)

Phone: +675 321 0197

Email: pom@expressfreight.com.pg

EFM International Air Freight

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LD Logistics

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Swift

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Madang

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Autonomous Region of Bougainville

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East New Britain

BES Customs and Logistics

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Deroel Customs and Logistics

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Email: tntrab@pngaf.com.pg

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Carpenters Shipping

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Email: carpentersshippingpom@carpenters.com.pg / carpentersshippinglae@carpenters.com.pg

Website: http://www.carpentersshipping.com/contacts/pacific.html

Consort Express Lines Limited

Phone: +675 321 1288

Email: exports.pom@consort.com.pg

Website: http://consort.com.pg/?page_id=119

Maresk Line Shipping (Inchcape Shipping services)

Phone: +675 321 2599

Email: auslinisl@maersk.com

Website: https://classic.maerskline.com/link/?page=lhp&path=/oceania/papuanewguinea/general/introduction

Swires Shipping

Phone: +675 322 0370/ +675 322 0400

Email: agent.pomgenl@swirecnco.com

Website: http://www.swireshipping.com/index.php?option=com_content&view=article&id=144&Itemid=11

Other Shipping Options

New Pacific Line and Asian Trades

Contact: Roger Maniago

Phone: +675 321 0197

Email: rmaniago@expressfreight.com.pg

Sofrana and Oceania Trades

Contact: Leah Gonda

Phone: +675 321 0197

Email: lgonda@expressfreight.com.pg

Appendix C

Policy guidelines – exporters

Appendix C Policy guidelines – exporters

COCOA BOARD OF PAPUA NEW GUINEA
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COCOA BOARD OF PAPUA NEW GUINEA

POLICY GUIDELINES FOR THE REGISTRATION OF COCOA EXPORTERS

PREAMBLE:

Under the Cocoa Industry Act (1981) and Cocoa Regulations (1982), the Board is empowered to;

- control, and regulate the growing, processing, marketing and export of cocoa beans and cocoa products; (Section 10 (a);
- request persons engaged in the cocoa industry to supply to the Board prescribed information in respect of their activities in the industry (Section 11(a);
- prohibit or restrict the sale of or purchase of cocoa beans which fail to comply with minimum prescribe values; Section 11(b);

A. INTRODUCTION

1. Any application that does not fulfill one or more of the guidelines will be rejected. Therefore full documentation of each of the guidelines is essential for the application to be considered at all by the Board.

2. No person except the Board has the right to export cocoa from Papua New Guinea. An export license issued by the Board is a consent to export cocoa on behalf of the Board and can be terminated at any time.

3. Reports on progressive achievements of any conditions endorsed by the Board must be submitted for annual review. All licenses expire on 30th September each year.

4. An export license is **not** transferable.

5. These guidelines replace all previous guidelines and Board directives on the registration of Exporters.

B. CREDIT WORTHINESS AND FINANCIAL STANDING

6. New applicants and existing registered exporters must demonstrate their financial ability through evidence of overdraft facilities or cash at the bank for purpose of cocoa exporting. This must be verified by a letter from a bank together with bank statements.

7. The minimum financial requirement for a cocoa exporter is K300,000.

8. Any credit arrangements with overseas companies and partners must be approved by the Board. The company must demonstrate that this is strictly a credit arrangement and provide all the necessary supporting documents.

C. CORPORATE DETAILS (SHAREHOLDING)

9. New applicants should be wholly Nationally-owned PNG registered companies with preference given to broad-based grower shareholding. Companies and their employees who already have shares in existing registered export companies either directly or indirectly are disqualified.

10. Registered exporters with overseas shareholding are required to conform to the Investment Promotion Authority requirement for a national enterprise status-which means 50 percent or more ownership by nationals. They have a period of six (6) months to obtain 51 percent national shareholding.

11. Registered exporters shall not hold shares in other export companies. The Board must be advised of any changes in shareholding.

12. Corporate details that must be submitted are:

All Applicants

a) List of Shareholders/Copy of share register;
b) List of Board of Directors
c) Audited Accounts for the last three years or a certified financial statement from a registered accountant.
d) Copy of Certificate of Registration;
e) Memorandum and Articles of Association.

D. MANAGEMENT EXPERTISE

13. Each exporter must be a qualified cocoa trader of international repute who can demonstrate expertise in international cocoa trading, quality control and general marketing of cocoa. The management and trading credentials of the individual (s) must be included in the submission.

14. The Board may accept a management agreement with an overseas partner but any such arrangement must be fully documented and subject to the Board's approval.

E. TRAINING OF NATIONALS

15. It is a pre-requisite for each exporter to train, PNG nationals in all facets of cocoa trading under relevant Government legislation and regulations. The Board requires copies of exporter's training program.

16. All exporters seeking renewal must demonstrate that reasonable efforts have been undertaken to train nationals and localize expatriate held positions.

F. EXPORT PERFORMANCE

17. The minimum export volume of any exporter is 1,000 tonnes per annum. Any exporter not meeting the minimum volume will be required to show cause why its license shall not be cancelled.

G. WAREHOUSE & FACILITIES

18. Each exporter must have its own winnower or grader/cleaner, cut-test equipment, moisture meter and bagging and marketing equipment.

19. The exporter must undertake to purchase from registered premises only. Any exporter in breach of this condition will have its license suspended.

H. QUALITY CONTROL

20. Cocoa for export must be graded, marked and packed according to the specifications provided by the Board.

21. The specification of any shipment of cocoa must match the description as marked upon the bags and in the shipping documents relevant to it.

22. Exporters trading in certified organic cocoa must have copies of certification documents from an approved agency authenticating every smallholder farm, block or plantation from which any such cocoa for export has originated.

23. Similar documentation covering all factories and warehouses through which cocoa has passed must also be submitted to the Board. Cocoa said to organically produced will not be certified for export unless current and proper authentication is available.

I. SALES OBLIGATIONS

24. Each exporter must observe their contractual obligations both to suppliers internally and buyers overseas.

25. All contracts with processors must be sent to the Board. Serious breaches of domestic and overseas contractual obligations will result in the termination of the license.

J. EXPORT PRICES/REGISTRATION

26. All export contracts must be registered with the Board under the appropriate Sales Contract Form and ICCO Form 1.

27. Exporters will be requested to show cause and justify in the case where sales contract prices fall below 10 percent of the world market price. Failure to justify divergence will result in a penalty equivalent to the different times the tonnage involved. Continuous breaches will result in suspension and eventual termination of license.

K. MONIES DUE TO THE BOARD

28. Any monies due to the Board shall be settled within 30 days in accordance with normal accounting practice. Any exporter with monies owing over the require period shall have its license suspended.

L. FAILURE TO TRADE

29. Any exporter that fails to trade in any one year shall not have its license renewed.

M. PURCHASES FROM UNREGISTERED FERMENTARIES

30. Licensed exporters are prohibited from making purchases from unregistered fermentaries. Any exporter caught in breach of this condition shall be penalized by paying K500 fine and deducting the late registration fee.

N. APPLICATION/REGISTRATION FEES

31. The closing date for receiving applications for export licenses (including renewals) is 31st July of each year.

32. A non-refundable application fee of K200 shall be paid when an application for an export license is lodged with the Board.

33. A non-refundable fee of K500 shall be payable to the Board if an application is received after the closing date.

34. Any incomplete application will be subject to an additional non-refundable fee of K200.

35. License fee for an exporter shall be K2,323.20 for a major port and K950.40 for a minor port. The license fee shall be refunded to the applicant if his application is unsuccessful.

O. REVIEW OF CONDITIONS OF LICENSING

36. The Board may by within ten (10) working days review, amend and revise any of the conditions of an exporter's license.

37. The Board shall revoke an export license issued to a registered exporter, if the exporter is proven to have supplied false or incomplete information or inaccurate or misleading information when an application was first lodged.

BOTO GAUPU
CHIEF EXECUTIVE OFFICER

Appendix D

Cocoa beans industry quality requirements

Appendix D Cocoa beans industry quality requirements

Cocoa Beans: Chocolate & Cocoa Industry Quality Requirements

eca european cocoa association

CAOBISCO Chocolate, Biscuits & Confectionery of Europe

FCC FEDERATION OF COCOA COMMERCE

Acknowledgements

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Disclaimer:

The CAOBISCO ECA FCC Cocoa Beans: Chocolate and Cocoa Industry Quality Requirements Guide can in no case be taken as a legal reference document. The present guide is only used as an information tool for actors along the cocoa supply chain. The English version of the guide is the reference version. This guide has been developed with input from experts from the European cocoa and chocolate industry, Cocoa Research Centre, The University of the West Indies, St. Augustine, Trinidad and cocoa quality consultants. The views and opinions expressed here are those of the editors and contributors and do not necessarily reflect those of their institutions. Since the legislation and standards for cocoa quality, and recommendations for best practices, continue to evolve, readers are advised to check the web links provided for current information. It is anticipated that this guide will be updated as new information becomes available and specific comments and suggestions for improvements should be addressed to the Secretariats at CAOBISCO: caobisco@caobisco.eu, ECA: info@eurococoa.com and FCC: fcc@cocoafederation.com

Cleaning fermented beans on the sun drying floor at the Manickchand Estate, East Trinidad". Photo: D. Sukha

[1]ADM, Armajaro, Barry Callebaut, Cargill, Casa Luker, Cemoi, Dutch Cocoa, Ferrero, Guittard, Mars, Mondelez, Nederland, Nestlé, Olam, Storck, Touton, Valrhona.

[2]CRA Ltd. is a UK-based non-profit scientific research association that is supported by Mars Chocolate, Mondelez International and ICE Futures Europe.

Contents

Introduction

Global Cocoa Agenda Actions:
"Improve cocoa quality by better communication of industry needs, post-harvest processing and quality assessment."

The European Cocoa Industry needs a sustainable and consistent supply of cocoa beans with the quality attributes to meet our diverse requirements. Various types of cocoa beans are needed to meet the demands of a complex market for chocolate and cocoa-derived products in which food safety, efficiency and cost effectiveness are key factors alongside consumer demands for taste and quality. We all need cocoa beans which will allow us to produce products that are wholesome and comply with European legislation and other international food safety standards. As the source of unique cocoa flavour and nutritional components, the importance of a consistently high standard of quality in cocoa beans cannot be over emphasised. Chocolate sells in a very competitive market, where quality and value are paramount. If the quality of the cocoa beans is poor, final products suffer and the industry as a whole loses as consumers turn to other snack foods. As set out in the Global Cocoa Agenda[2] which has been internationally agreed as the road map to achieve a sustainable world cocoa economy, there is a need to "improve cocoa quality by better communication of industry needs, post-harvest processing and quality assessment"; and to "enhance food safety by wider promotion and adoption of Good Agricultural Practices…". This publication aims to provide a comprehensive, up-to-date reference document which brings together the key information from a range of publications covering aspects of cocoa farming practices, food safety and quality and provides linkages to sources of further details. This publication "Cocoa Beans: Chocolate and Cocoa Industry Requirements" is based on The UK Biscuit, Cake, Chocolate and Confectionery Alliance (BCCCA) publication "Cocoa Beans- Chocolate Manufacturers'

Quality Requirements" which was last revised in 1996 (BCCCA, 1996). The focus will remain on factors affecting quality of cocoa beans from post-harvest through to the factory gate, but as in the BCCCA publication, aspects such as Good Agricultural Practice (GAP), climate and planting materials will be covered where they also have an impact.

In Part I of this guide, the industry's requirements with regard to cocoa bean quality are set out in detail under a number of headings as before, but are updated on the basis of new information that has become available. Most of these requirements can be met by sound methods of cultivation and appropriate fermentation and drying practices, although some are governed by factors beyond the control of the grower. Part II describes some of the quality standards currently used in producing countries and by the cocoa trade. In Part III the factors influencing the quality requirements are highlighted and recommendations for practices that will promote good quality are provided.

These recommendations follow those made in a number of sources including the publications from Codex Alimentarius, the ICCO's Consultative Board, and industry publications. Cocoa growing, post-harvest practices and quality evaluation methods vary widely and further information sources are available for detailed guidance suited to particular situations (for example see Schwan & Fleet, (2014) Wood & Lass, (1985) and Wyrley-Birch, (1978)). However, protocols for the small-scale preparation of cocoa samples for evaluation as liquors and chocolates, including methods suitable for fermenting small quantities of cacao beans, are appended.

[2]The Global Cocoa Agenda was agreed at the First World Cocoa Conference, Abidjan, Côte d'Ivoire in November, 2012. It provides the roadmap towards achieving a sustainable world cocoa economy and outlines the strategic challenges facing the cocoa value chain, the recommended actions to address them and the responsibilities of the stakeholders in the cocoa sector at national, regional and international levels.

Part 1
Aspects of Cocoa Bean Quality

1. Flavour
2. Food Safety & Wholesomeness
3. Physical Characteristics
4. Cocoa Butter Characteristics
5. Colour Potential - "Colourability"
6. Traceability, Geographical Indicators & Certification

Part 1:
Aspects of Cocoa Bean Quality

"Although the term "cocoa" is generally used for the plant and its products in many English speaking countries, this document will refer to "cacao" for the plant and the unprocessed seeds of the species ***Theobroma cacao* L.**"

Although the term "cocoa" is generally used for the plant and its products in many English speaking countries, this document will refer to "cacao" for the plant and the unprocessed seeds of the species *Theobroma cacao* L. Once the cacao seeds, commonly known as "beans", are harvested, fermented and dried, the product is known as cocoa. Beans are shelled and roasted, and then ground to form a paste known as cocoa mass or liquor. Some cocoa liquor is pressed to extract the fat, known as cocoa butter, leaving a product known as cocoa cake. The cocoa cake is then pulverised to give defatted cocoa powder which is used in drinks and confectionary. Cocoa liquor and butter are usually combined with sugar, milk and other ingredients to form chocolate. There are European and Codex standards which define the composition and labelling of certain of these cocoa products[1]. The focus of this publication will be cocoa beans, though reference will be made to some quality aspects of these cocoa products especially in relation to food safety regulations and processing characteristics.

In this publication the word "quality" is used in its broadest sense to include not just the all-important aspects of flavour and food safety, but also the physical characteristics that have a direct bearing on manufacturing performance, and aspects such as traceability, geographical indicators and certification to indicate the sustainability of the production methods.

The different aspects of quality are discussed under the following headings:-

1. Flavour
2. Food Safety and Wholesomeness
3. Physical Characteristics
    - 3.1 Consistency
    - 3.2 Yield of Edible Material
4. Cocoa Butter Characteristics
5. Colour potential - "Colourability"
6. Traceability, Geographical Indicators and Certification

These are the key criteria affecting a manufacturer's assessment of the "value" of a particular parcel and hence the price he will pay for it.

[1]See for example EC Directive 2000/36/EC (EU, 2000) and CODEX standards CXS_105 Rev 2001 for cocoa powders (Codex Alimentarius, 1981 Rev. 2001), CXS_141 1983 Rev 2001 Amended 2014 for cocoa mass (liquor) (Codex Alimentarius, 2014) and CXS_86-1981 for cocoa butter (Codex Alimentarius, 2001.)

1. Flavour

Flavour is a key criterion of quality for manufacturers of cocoa products. The flavour criterion includes both the intensity of the cocoa or chocolate flavour, together with any ancillary flavour notes, and the absence of flavour defects.

Flavour is a key criterion of quality for manufacturers of cocoa products. The flavour criterion includes both the intensity of the cocoa or chocolate flavour, together with any ancillary flavour notes, and the absence of flavour defects. Defects include effects of under-fermentation, over-fermentation and taints.

The cut-test, which is used in grading cocoa beans for the market, and is described in Appendix A, may give an indication of gross flavour defects, eg. excessive bitterness and astringency from a high proportion of slaty beans, or mouldy/musty notes from mouldy or infested beans. Other than these examples, however, the cut test is not a reliable indicator of flavour quality.

To assess the flavour of a sample of cocoa beans it must be turned into cocoa liquor or made up fully into chocolate and tasted. This is usually done by a taste panel of between five and ten experienced tasters. However, single expert tasters can also be used effectively for detection of off-flavours and, providing that more tasting repetitions are carried out for increased statistical rigour, also for comprehensive flavour description. Liquor tasting is the more demanding but benefits from the fact that liquors can be tasted directly without the addition of cocoa butter, sugar and milk products which dilute the taste impression and impart flavour notes unrelated to the cocoa beans being tested. Chocolates also require time for the flavour to stabilise after preparation, do not keep as well as liquors, either deep frozen or at ambient temperature, and are often difficult to prepare to normal standards on the farms and estates where the beans are produced due to the need for processing equipment.

Figure 1. Sensory table layout.
Foto: D. Sukha.

Samples can be evaluated for strength of cocoa or chocolate flavour, residual acidity, bitterness and astringency, normally present in liquors and chocolates, as well as the presence of any off-flavours and any positive ancillary flavours such as fruity or floral notes. The sensory evaluation methods and terminologies used by manufacturers and research institutions will vary but protocols for the small-scale preparation of liquors and chocolates, and their flavour evaluation, as used by the internationally recognised "Cocoa of Excellence" and "Heirloom Cacao Preservation" initiatives are provided in Appendix B. Additionally, the FCC has included an Optional Clause in its commercial contract rules – "Off Flavours in Cocoa Beans". If the Parties have failed to agree upon the selection of an independent taste panel then CIRAD (Centre de coopération Internationale en Recherche Agronomique pour le Développement) will be appointed to undertake the independent assessment of the specific off flavours or, if CIRAD are unable to act, such other competent body as may be nominated by the Federation.

The inherent potential chocolate flavour of a particular source of cocoa beans is determined principally by the variety of the trees (see the CacaoNet Global Strategy for Conservation and Use of Cacao Genetic Resources (CacaoNet, 2012) for further details on cacao's genetic diversity). Traditionally, the trade has considered there to be three main types, "Criollo", "Forastero" and "Trinitario". The type of cacao historically grown in MesoAmerica and the circum-Caribbean region is known to the cocoa trade as "Criollo" (meaning native) and is characterised as having lightly pigmented beans which require little fermentation. The flavour is characterised as being delicate and sweet with caramel, honey and fresh hazelnut notes. "Forastero" (meaning foreign-from another part of the country) was the term originally used for the Amazonian types, which entered the trade as cocoa cultivation spread to other regions. Although a new nomenclature for the various Amazonian types based on their genetics has been proposed (Motomayor, et al., 2008), the term "Forastero" is still used by the trade to refer to mainstream cocoas. These include those produced by the Lower Amazon Amelonado type that was traditionally grown in West Africa, Brazil and Indonesia and mixed hybrid varieties which often include one or more of the Upper Amazon genetic groups in their ancestry. "Forastero" cocoa is characterised by mid to dark purple beans which present a strong chocolate flavour when properly fermented and processed. The term "Trinitario" (meaning native of Trinidad) although perhaps only originally applied to the hybrid populations between Criollo and Amazonian types occurring in Trinidad, has since been used to describe various hybrid types, which are now known in the trade for their floral/fruity flavours. The Ecuadorian "Nacional" type, probably derived from a local Amazon population with some hybridisation with Trinitario types, is also known for its distinctive flavour with floral and fresh nut notes.

Figure 2. Beans from different types of cocoa vary in levels of pigmentation. Foto: G. Ramos.

Today so called “fine” or “flavour” cocoas produced by Criollo and Trinitario varieties represent approximately 8% of the total world crop (ICCO, 2014). Mainstream “Forastero” cocoa, such as many of the cocoas produced by Côte d’Ivoire, Ghana, Nigeria, Cameroon, Indonesia and Brazil, is sometimes referred to as “bulk” cocoa but it is important to recognise that the terms “fine or flavour” and “bulk” in this context apply to types of cocoa rather than to flavour or any other aspect of bean quality. In fact, the characterising flavour of cocoa is generally stronger from most “Forastero” types than from Trinitarios in which Criollo characteristics of pod morphology, bean size and colour are dominant. Recent studies have revealed a distinct genetic contribution to flavour, not only between Criollos and Amazonian types, but between and within the Amazonian and Trinitario types (Clapperton J. F., 1994), (Clapperton, Lockwood, Yow, & Lim, 1994), (Sukha D., et al., 2009). Flavour characteristics are heritable, which implies that if two types with contrasting flavour characteristics are crossed, the flavour quality of the resulting progeny will tend towards the average of the two parents. An averaging of flavour quality has already occurred with the introduction of Trinitario trees to replace Criollos. The same applies to planting materials grown in Southeast Asia and elsewhere to provide mainstream cocoa targeted on West African flavour. West African Amelonado, which had survived in West Africa for a hundred or more years, succumbed to Vascular Streak Dieback in less than twenty years under conditions of more intensive agriculture and in a different climatic environment in Malaysia. Disease resistant varieties developed in Malaysia to replace the Amelonado are genetically different and produce different flavour characteristics, some more than others.

The various mainstream cocoas, which are grown principally in West Africa and Brazil, are similar in that they possess a good, strong, chocolate flavour with few pronounced ancillary flavours. The trees are of a closely similar type, but there are differences in the way the farmers prepare and market the beans which give rise to certain differences in the further development of chocolate flavour and, in some instances, off-flavours. These mainstream cocoas, when they are well prepared, are eminently suited to the manufacture of milk chocolate, which forms the major part of the chocolate market worldwide. Manufacturers of milk chocolate require good chocolate flavour and no off-flavours. As explained in the previous paragraph, very different trees may produce cocoas with distinctly different flavour profiles. Where there are major effects of the planting materials on flavour, conditions of post-harvest processing become more critical and demanding in order to compensate for the inherent genetic differences, and it is not always possible to achieve the target West African or Brazilian flavour quality. On the other hand, careless or faulty post-harvest processing will negate the potential benefit of particular planting materials on flavour.

Figure 3. Quality evaluation panel at the Cocoa Research Institute of Ghana.
Foto: S. Opoku.

Fine or flavour grade cocoas are of various types, each having its own characteristic flavour.

"Fine or flavour" grade cocoas are of various types, each having its own characteristic flavour. These cocoas are required by some chocolate manufacturers who pay a premium for them. They are chiefly used in the manufacture of specialty and high cocoa solids chocolates, usually from a blend of different types of beans, to give a distinctive flavour profile to the finished chocolate. However, the yields, tonnes per hectare, tend to be lower with such cocoa.

There are indications that in addition to the effects of genetic background and post-harvest practices, the climate and soil may also contribute to flavour differences, referred to as the "terroir" effect as in wine production (Sukha D. , Butler, Comissiong, & Umaharan, 2014). There are two recent initiatives which aim to recognise and celebrate the diversity of cocoa flavours which are the result of all of these factors, and to promote the linkages within the supply chain which will help reward those producing high quality cocoa:

- Heirloom Cacao Preservation Initiative is a partnership between the Fine Chocolate Industry Association and USDA/ARS which aims to identify the finest flavoured cocoas, understand their genetic diversity and find ways to preserve them and reward the growers who cultivate them. Further details can be found from the website: http://www.finechocolateindustry.org/hcp
- Cocoa of Excellence is an initiative supported by several research institutions, chocolate manufacturers and cocoa organizations which aims to promote and provide global recognition for high quality cocoas by presenting the best samples with International Cocoa Awards. All cocoa growing regions of the world are represented and recognized in these awards. National Organization Committees have been established in each of the participating countries to ensure that samples, of either commercial or experimental origin, are submitted for evaluation by panels of experts. Further details are available from the website: http://www.cocoaofexcellence.org/

Whatever the genetic background of the trees producing the cocoa, the development of flavour is also dependent on correct fermentation and drying procedures, and further processing steps such as roasting, alkalisation or conching. All types of cocoas can suffer from several off-flavours and these are described below, along with the method of assessment or detection. The causes of the off-flavours, and guidance on good practices which can minimise them, are discussed in detail in Part III of this booklet.

1.1. Mouldy off-flavours

These arise from the presence of moulds primarily inside the beans, and samples with as little as 3% of internally mouldy beans can impart a mouldy/musty flavour to liquor, henceforth to chocolate. This type of off-flavour cannot be removed during processing by the manufacturer. The main causes of the flavour defect are prolonged fermentation, inadequate or too slow drying (for example, due to poor weather conditions) and adsorption of moisture during storage under adverse conditions. The presence of mouldy beans is revealed by the cut test. Mould growth results also in increased levels of free fatty acids (FFA) in cocoa butter (see 4. Cocoa Butter Characteristics) and specific moulds could even lead to the formation of mycotoxins (see 2.9 Mycotoxins, including Ochratoxin A (OTA).

Figure 4. Beans with internal mould can give rise to off-flavours.
Foto: M. Gilmour / R. Dand.

1.2. Smoky off-flavours

Contamination by smoke from wood fires or other sources during drying or storage causes a characteristic smoky off-flavour in liquor and chocolate. This is another off-flavour which cannot be removed during chocolate manufacture. The presence of smoky beans in a sample may be detected by crushing some beans in the hand, or preferably in a mortar, and sniffing them. This is a quick test but it is not as reliable as liquor tasting or making the liquor up into chocolate on a small scale. A smoky off-flavour is sometimes described as “hammy” because of it is reminiscent of smoke-cured bacon. Hammy off-flavours can also arise from over-fermentation although it is quite easy to distinguish between the two defects. In smoke contaminated beans the hammy note is dominant. In over-fermented cocoa it occurs as a minor note against a putrid, ammoniacal or occasionally soapy/phenolic background. The presence of phenols, such as guaiacol, is probably common to both smoke contaminated and over-fermented cocoas. The off-flavour can be prevented by ensuring proper fermentation and avoiding contact with all sources of smoke contamination during drying and storage. Preventing exposure to smoke will also reduce contamination of the cocoa by mineral oil hydrocarbons and polycyclic aromatic hydrocarbons (PAH) which are a food safety concern (See 2.7 Mineral oil hydrocarbons and 2.8 Polycyclic Aromatic Hydrocarbons for further details).

1.3. Earthy off-flavours

Earthy off-flavour tends to increase in the last beans in a silo due to the accumulation of dirt and debris. An earthy off-flavour can be very unpleasant and should be rejected when present at high levels.

1.4. Acid taste

This is due to excessive amounts of certain acids which are formed during fermentation. Two acids are involved: acetic acid which is volatile and lactic acid which is non-volatile. Appropriate drying will reduce the acidity in the fermented beans, however if this is conducted too quickly the acidity will remain in the cocoa. During manufacture, the acetic acid present in dried beans will normally be reduced to an acceptably low level, but the non-volatile lactic acid remains and if present in excess will cause an off-flavour in chocolate. Furthermore, the presence of excessive acidity usually correlates with poor development of chocolate flavour. The presence of acetic acid is readily detected by smelling the beans, but the acidity due to lactic acid can only be detected by tasting cocoa liquor or chocolate made from them. A high degree of acidity is usually associated with a pH of 5.0 or less in the dried bean. The pH of liquors prepared from properly fermented and dried West African beans in which the perceived acidity is very slight or absent is around 5.5. Control of pH, however, is not an assurance of good chocolate flavour and if measures are taken to raise the pH, by neutralising for instance, they will not achieve an acceptable chocolate flavour.

For some cocoas, acidity can be reduced by storing the unopened pods for a few days before commencing fermentation. However, care must be taken that only undamaged pods are stored to reduce the risk of ochratoxin A formation. Acidity may also be reduced by the combined action of removing about 20% of the pulp prior to fermentation and reducing the fermentation time. The disadvantage of this treatment is that cocoa flavour may not be fully developed, although on balance, limited cocoa flavour development with slightly increased bitterness and astringency may be a lesser flavour defect than excessive acidity.

Another way of reducing acid taste is to continue the fermentation for an extra 4 or 5 days, usually with extra turning of the fermenting beans. The pH of the beans is increased but this leads to mould growth and putrefaction and the production of ammoniacal off-flavours mentioned above. Acid taste, which might have been corrected by the manufacturer during processing, is replaced by these much more serious off flavours which make the beans virtually unusable.

It should also be stressed that there is no connection between the presence of acetic and/or lactic acids and the Free Fatty Acid (FFA) content which is dealt with later.

1.5. Bitterness & Astringency

Some bitterness and astringency is part of the complex of chocolate flavour but if either is present in excess it becomes objectionable.

Figure 5. Unfermented/slaty (above) and partially fermented (below) beans.
Foto: C.Rohsius / D.Sukha.

Some bitterness and astringency is part of the complex of chocolate flavour but if either is present in excess it becomes objectionable. Excessive bitterness and astringency cannot be removed by normal factory processing. These flavours are associated with poor fermentation and/or certain varieties. Unfermented or slaty beans, as revealed in the cut test, give extremely bitter and astringent cocoa liquors, and samples with more than 3% of slaty beans usually impart excessive astringency to chocolate. Fully purple beans also produce bitter and astringent flavours. While excessive amounts of slaty and purple beans should be avoided, chocolate manufacturers do not expect to receive beans which are all fully brown. Even cocoa that has been correctly harvested, fermented and sun-dried may contain a proportion of partly brown/purple beans.

Recent studies have shown that planting materials differ markedly in astringency and in their concentrations of polyphenols which contribute directly to that flavour characteristic. The concentrations of polyphenols are reduced markedly during post-harvest processing but not to the same limiting concentration for all planting materials, assuming that a standardised processing treatment has been used.

1.6. Contamination

Cocoa beans must always be handled and treated as a food grade material.

Cocoa beans can absorb off-flavours from other products such as copra, rubber, oil based fuels, chemicals, paints, cement etc, both in stores and in vessels/containers used to transport cocoa. The high fat content of cocoa beans acts as an extremely effective absorbent for all manner of taints. Cocoa beans must always be handled and treated as a food grade material and, as a general rule, bagging materials and warehouses used to handle and stock cocoa beans should be used exclusively for that purpose.

SUMMARY OF CAUSES OF MAJOR OFF-FLAVOURS

Mould

- Prolonged fermentation
- Slow or inadequate drying
- Storage under highly humid conditions
- Germinated beans and damaged beans are prone to becoming mouldy

Excessive acid taste

- Deep box fermentation
- Inappropriate turning
- Too rapid drying

Smoky

- Contamination by smoke during drying due to inappropriate fuel, bad design, faulty operation or poor maintenance of dryer.
- By exposure of dried beans in store to smoke contamination

Excessive bitterness and astringency

- Certain planting materials
- Lack of fermentation

2. Food Safety & Wholesomeness

It is essential that cocoa and chocolate products, in common with all other food products, should be safe to eat and wholesome.

It is essential that cocoa and chocolate products, in common with all other food products, should be safe to eat and wholesome. It follows that the ingredients, including cocoa beans, should not contain any impurities which could be present in the finished foods and prove injurious to the health of the consumer. There is a responsibility throughout the supply chain to ensure that raw materials and products are wholesome and meet all national and international legislative requirements enforced at point of entry and in the market place.

A number of organisations have been set up to establish standards for food safety management so that hazards at any stage of the foods supply chain, from the farm to the consumer, can be identified and controlled.

These include:

The Codex Alimentarius Commission - Created in 1963 by FAO and WHO to develop harmonised international food standards, guidelines and codes of practice to protect the health of consumers and ensure fair practices in the food trade. The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations. (http://www.codexalimentarius.org/).

International Organisation for Standardization - The ISO 22000 family of International Standards contains a number of standards each focussing on different aspects of food safety management (http://www.iso.org/iso/home/standards/management-standards/iso22000.htm)

In Europe, there is an integrated approach to food safety through farm-to-table measures and adequate monitoring. The framework for this was established in EC Regulation 178/2002 and its amendments. The Regulation includes the establishment of the European Food Safety Authority (EFSA) which provides scientific advice and scientific and technical support in all areas impacting on food safety. It also established the Rapid Alert System for Food and Feed (RASFF) which enables information exchange to facilitate the restriction or the withdrawal of unsafe food from the market and share information on rejections of food consignments by an EU border post. The Regulation sets out food safety standards, risk assessment/management procedures and the responsibilities of those involved in food businesses to ensure compliance with the legislation and traceability of foodstuffs at all stages of the food chain, from the production, processing, transport and distribution stages through to the supply of food. For further information see http://europa.eu/legislation_summaries/consumers/consumer_safety/f80501_en.htm

EU food business operators must comply with the EU hygiene legislation (Regulations 852/2004, 853/2004, 854/2004 and associated regulations) and put in place, implement and maintain a permanent procedure, or procedures, based on HACCP (Hazard Analysis and Critical Control Point) principles to ensure that food is produced safely and public health is protected. (See http://ec.europa.eu/food/food/biosafety/hygienelegislation/comm_rules_en.htm). Guidelines have been published for good manufacturing practices in the cocoa, chocolate and confectionery industry (CAOBISCO, 2011) (ICA, 1991) and (Syndicat du Chocolat, 2012).

The principal food safety concerns for the cocoa industry are:

- Allergens
- Dioxins & PCBs
- Bacteria
- Foreign Matter
- Heavy Metals
- Infestation
- Mineral Oil Hydrocarbons
- Polycyclic Aromatic Hydrocarbons (PAH)
- Mycotoxins including Ochratoxin A (OTA)
- Pesticide Residues

2.1. Allergens

Food allergies are life changing and can be fatal. Chocolate, biscuit and confectionery manufacturers face specific challenges, since allergens such as peanuts, treenuts, milk, eggs, soya and gluten-containing cereals are commonly used.

For allergens present as an ingredient, it is a legal requirement that these are clearly labelled in the ingredients list (EU Regulation 1169/2011 (EU 2011)). For allergens present as potential traces in finished products due to cross contact during manufacturing, precautionary labelling should be the last resort after other means of control have been evaluated, in order to offer the allergic consumer the best information available. Beyond allergen management in manufacturing, it is important to review the supply chain since there may be allergenic components present in ingredients or present through cross contact.

2.2. Bacteria

Raw cacao beans are a natural agricultural product and, as such, manufacturers recognise that there is an intrinsic risk of microbiological contamination of finished cocoa-based products. Cocoa and chocolate factories and the manufacturing processes are designed to sterilise the beans and so eliminate the risk of contamination. They follow stringent HACCP-based systems as outlined in the CAOBISCO Guide to Hygiene (CAOBISCO, 2011). Beans which have been mistreated at origin or during shipping and storage can acquire a level of contamination which exceeds the design capabilities of the sterilising treatments. Excessive microbiological contamination can result from too slow or inadequate drying, storage of wet beans, and contamination during drying or storage by animals including livestock and rodents. In addition to the care that should be taken to minimise contamination at source there must also be an effective hygiene barrier in cocoa and chocolate factories between incoming raw materials and finished goods. This obligation applies to all processing of cocoa beans to both final and intermediate products.

2.3. Dioxins & PCBs

Dioxins are a group of harmful chemically-related compounds that are persistent environmental pollutants (POPs) which can originate from natural sources (such as volcanic eruptions and forest fires) though they are mostly formed as by-products of industrial processes. There are also dioxin-like polychlorinated biphenyls (PCBs) which have similar toxic properties. Since these contaminants are very widespread and contaminate many foods and feedstuffs, the Codex Alimentarius Commission has adopted a Code of Practice (CAC/RCP 62-2006) for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds (CAC, 2006) and levels are monitored and controlled by various food safety authorities.

In Europe, Regulation 1259/2011 (amending Regulation 1881/2006) establishes maximum limits for these contaminants in a range of foodstuffs (EU, 2011).

Although typically not significantly contaminated with dioxins, the following limits have been set for vegetable fats and oils, including cocoa butter,:

Sum of dioxins (WHO-PCDD/ F-TEQ)[1] 0.75 pg/g fat

Sum of dioxins and dioxin-like PCBs (WHO-PCDD/F-PCB- TEQ): 1.25 pg/g fat

Sum of PCB28, PCB52, PCB101, PCB138, PCB153 and PCB180 (ICES - 6): 40 ng/g fat

[1]Dioxins (sum of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), expressed as World Health Organisation (WHO) toxic equivalent using the WHO-toxic equivalency factors (WHO-TEFs)) and sum of dioxins and dioxin-like PCBs (sum of PCDDs, PCDFs and polychlorinated biphenyls (PCBs), expressed as WHO toxic equivalent using the WHO-TEFs) See http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32011R1259&from=EN for further details).

2.4. Foreign Matter

Contamination of cocoa bean parcels with foreign matter should be avoided at all stages of the supply chain from fermentation through drying and subsequent handling. Bulk supplies should be cleaned and graded before bags are filled since foreign matter not only affects the wholesomeness of the product but may also affect the flavour, cause damage to plant and machinery and reduce the yield of edible material (see 3.2.5 Foreign matter for further details).

2.5. Heavy Metals

Heavy metals which are toxic to humans, can be found in various agricultural raw materials, including cocoa, and some food safety authorities have set maximum limits based on their assessments of the tolerable weekly intake (TWI) ("safe level"), and mean dietary exposure of groups and sub-groups of their populations, to protect the health of consumers. EU maximum limits for environmental contaminants are reviewed on a regular basis, and are subject to future revision to take account of the latest evidence and data, but there are currently no maximum regulatory limits in Europe for arsenic or mercury in cocoa products.

2.5.1 Cadmium:

This heavy metal can accumulate in human tissue over time and can cause kidney and bone damage as well as being a carcinogen. The EU has recently set maximum limits for cadmium in cocoa products which will be applicable from 1st January 2019 (EU, 2014) (see Table 1). The Codex Alimentarius commission set up a working group in 2014 to develop harmonised maximum levels which will protect consumer health and facilitate international trade.

The cadmium problem relates to beans from certain regions of some producing countries, particularly in the Latin America and Caribbean area. Although high levels in the beans are generally associated with naturally high levels of cadmium in the soil, levels are likely to be affected by a number of factors including the physical and chemical nature of the soil, the variety of cacao and anthropogenic factors including the use of contaminated fertilisers. Research is ongoing to elucidate these factors, but suggestions are made in Section 3 to mitigate against cadmium uptake based on the current findings from cacao and other crops.

Table 1.

EU Maximum Limits for Cadmium in Cocoa Products to be applicable from 1st January 2019 (commission Regulation (EU) No 488/2014 amending Regulation (EC) No 1881/2006).

Specific cocoa and chocolate products as listed below - Milk chocolate with <30% total dry cocoa solids	0.10mg/kg as from 1 Jan 2019
Chocolate with <50% total dry cocoa solids; milk chocolate with ≥ 30% total dry cocoa solids	0.30mg/kg as from 1 Jan 2019
Chocolate with ≥ 50% total dry cocoa solids	0.80mg/kg as from 1 Jan 2019
Cocoa powder sold to the final consumer or as an ingredient in sweetened cocoa powder sold to the final consumer (drinking chocolate)	0.60mg/kg as from 1 Jan 2019

'For the specific cocoa and chocolate products the definitions set out in points A. 2, 3 and 4 of Annex I to Directive 2000/36/EC of the European Parliament and of the Council of 23 June 2000 relating to cocoa and chocolate products intended for human consumption (OJ L 197, 3.8.2000, p. 19) apply

2.5.2 Lead:

This heavy metal can accumulate in human tissue over time and can cause kidney failure and brain damage. Due to its effect on neurodevelopment, food safety authorities are particularly concerned about lead intake by infants and children and have introduced maximum limits for a number of foods. However, EFSA issued a scientific opinion on lead in food in March 2013 (EFSA CONTAM, 2010 rev 2013) in which it indicated that cocoa, cocoa semi-finished products and chocolate are considered as minor contributors to lead exposure and maximum limits for lead in cocoa (powder and beans) and chocolate products are not currently under consideration, though there is a maximum limit of 0.10mg / kg for lead in vegetable oils and fats in EU Regulation 1881/2006 (EU, 2006). However, lead levels in cocoa and chocolate products should continue to be carefully monitored and steps taken throughout the supply chain to minimise contamination.

Lead can occur naturally in the soil though, depending on soil factors such as pH and organic matter content, it is often insoluble and thus not taken up by the plant. However, lead can be released into the environment during forest fires, mining, smelting and petroleum extraction operations and when fossil fuels are burned (Baligar, Fageria, & Elrashidi, 1998). Contamination attributed to car exhaust fumes has considerably decreased since lead has been removed as an additive from petrol in most countries, though traffic fumes may still be a source of contamination and cocoa should not be dried or stored close to busy roads. Codex has published a code of practice for the prevention and reduction of lead contamination in foods (CAC/RCP 56-2004) (CAC, 2004)

Click here for further sources of information.

2.6. Infestation

Cocoa beans frequently become infested at origin by several species of insects and other pest species including the tropical warehouse moth (*Ephestia cautella*), Indian meal moth (*Plodia interpunctella*), dried fruit beetle (*Carpophilus spp.*), foreign grain beetle (*Ahasverus advena*), red-rust grain beetle (*Cryptolestes ferrugineus*), the tobacco beetle (*Lasiodema serricorne*) and the coffee bean weevil (*Araecerus fasciculatus*). If these infestations are not treated at origin by effective pre-shipment fumigation, these species will survive the voyage to traders, processors and manufacturers. If not then controlled at port of entry, the infestation will spread to cocoa stores and chocolate factories and spoil finished goods.

Over recent years disinfestation in Europe has been complicated by the EU being a signatory to the Montréal protocol, which has banned the use of methyl bromide as a fumigant. This has been further complicated in certain countries where stringent requirements on the fumigation process have been imposed, notably in the Netherlands, which makes fumigation an expensive and lengthy process as the cocoa has to be moved from the warehouse to a fumigation chamber to be processed. Until recently the only fumigant which could be used in lieu of methyl bromide was Phosphine (hydrogen phosphide PH^3), generated from compounds such as aluminium phosphide or in the form of a cylinderised gas. While phosphine is an effective fumigant, it requires much longer to penetrate the stack of cocoa and achieve reliable kill of both the adult and larval stages of pests compared to methyl bromide. Another fumigant that has been registered for use on stored cocoa in some countries, including the Netherlands and Belgium, is sulfuryl fluoride. Although trials using this fumigant have shown it be fast and effective, without any adverse effects on the quality of the cocoa beans and their processing (Noppe, Buckley, & Ruebsamen, 2012), a decision regarding its re-registration for use in the USA is still awaited. Various alternatives have been offered; ranging from the removal of oxygen from the cocoa stack in order to asphyxiate the pests to putting the cocoa in refrigerated containers and reducing the temperature to well below freezing point to kill the pests. Other attempts have included storing the cocoa in temperature-controlled warehouses thereby keeping the pest activity to a minimum but without eradicating the infestation. It should be noted that the comments above are related to cocoa stored in bags, the most likely mode of cocoa to be transported and used by the cocoa industry, but given the rise of bulk, loose cocoa, disinfestation still presents issues. However, bulk cocoa can be sieved before storage, and this removes not only the unwanted undersize material but also a high proportion of insects that would otherwise be in the stack.

While prevention remains the best option, it is possible that infestation will occur, particularly at origin and in consuming regions where the climate is tropical. Care needs to be taken at all stages of transport and storage from farm to export that infestation is kept to a minimum by ensuring clean surroundings and that, if required, the cocoa is fumigated by a reputable agent before shipment.

Click here for sources of further information.

2.7. Mineral Oil Hydrocarbons

Cocoa products, in common with many other foods, could potentially be exposed to mineral oil hydrocarbons (MOH) at various points in the chain from the farm to the consumer since they are found in various packaging materials and food additives as well as arising from contamination by lubricants, fuels, and debris from tyres and road bitumen (Figure 6). MOH can be separated into two groups; mineral oil saturated hydrocarbons (MOSH) and mineral oil aromatic hydrocarbons (MOAH), with the latter group including the polycyclic aromatic hydrocarbons (PAH) which are considered in more detail in Section 2.8. EFSA considers that background exposure to MOSH via food in Europe is of potential concern and has recommended that the existing acceptable daily intake for some food grade MOSH are revised (EFSA, 2012). Furthermore, some MOAH may be mutagenic and carcinogenic and are therefore of potential concern. There are a number of approaches which can be taken to minimize MOH contamination in cocoa products and these are currently being investigated in a new project supported by the BDSI and Foundation of the German Cocoa and Chocolate Industry (http://www.lci-koeln.de/download/vorstellung-toolbox-konzept http://www.lci-koeln.de/download/toolbox-flyer-englisch) (Matissek, Mineral oil transfers to food: Strategies for preventing the migration of MOSH/MOAH, 2014), (Matissek, Raters, Dingel, & Schnapka, 2014).

Cocoa beans might be exposed to MOH contamination during drying, particularly from fuel or fumes from oil fired burners when cocoa beans are dried artificially in direct dryers (ie those without gas/air heat exchangers), or from exhaust fumes and debris if they are dried close to roads (see 2.8 PAH and Part III 3.b drying). Cocoa beans and cocoa products may also be contaminated during transportation and storage from fuels and lubricants used on machinery and from packaging materials (see Part III Storage and Part III Transportation and Shipping). Recycled cardboard packaging, including the dressings used to line containers for shipping, may be contaminated by mineral oil-based printing inks from the recycled paper used to produce it. Another source of contamination can be jute sacks manufactured using fibres which have been processed using mineral oils rather than vegetable oils. Although the use of mineral oils in the manufacture of sacks sent to Europe was largely stopped in the late 1990s, they are widely used elsewhere. In 1998, the International Jute Organisation (IJO) adopted 'special criteria for the manufacture of jute bags used in the packaging of selected foods (cocoa beans, coffee beans and shelled nuts)'. The batching oil shall only contain non-toxic ingredients and it shall not contain compounds that produce off-flavours or off-tastes in food. The IJO also specifies limits for the presence of unsaponifiable material in the bags (less than 1250 mg/kg jute fibre).

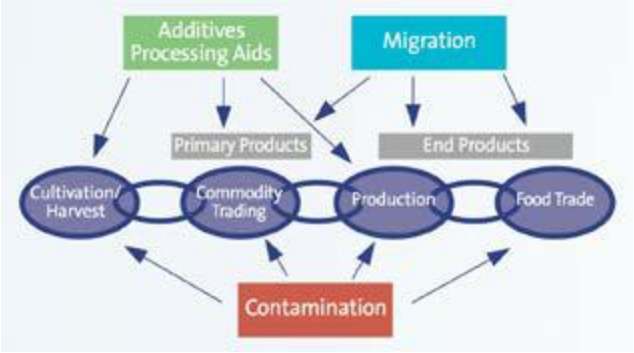


Figure 6. MOSH and MOAH contamination sources in the food chain. (Matissek et al. 2014)

This limit was adopted by the ICCO in March 1999 and stated that the methods to be adopted in determining the limits were to follow British Standard 3845:1990 on methods for the determination of added oil content of jute yarn, rove and fabric. In addition, subsequent saponification shall be done according to the methodology described in WG 1/90 of the International Union of Pure and Applied Chemistry (IUPAC). Further, the organoleptic properties of the bags were included such that no undesirable odours or odours untypical of jute shall be present. No unacceptable odours shall develop after artificial ageing of the bags. The ageing procedure to be followed shall be the one described in European Standard EN 766 on bags for the transport of food aid.

In 2004, The European Food Safety Authority evaluated the IJO criteria and concluded that:

- If these specifications for unsaponifiable residues in the bags are followed, the use of mineral oils as batching oils, and thus contamination of food, is effectively ruled out and the release of semi-volatile mineral hydrocarbons from jute and sisal bags is expected to be significantly reduced;
- If the proposed specifications are followed, human exposure to semi-volatile mineral hydrocarbons from jute and sisal bags is estimated to be well below the temporary ADI for mineral hydrocarbons set by the Scientific Committee on Food in 1995;
- Adherence to the specifications can be monitored in the producing countries with simple laboratory equipment.

Recognition of the importance of using food grade vegetable oil has been made and clear improvements have occurred. Cocoa and chocolate manufacturers now require that only brand new compliant jute bags, clearly marked as “Food Grade” to indicate that they have been processed with vegetable oils, are used when transporting and storing cocoa.

Click here for further sources of information.

Figure 7. Jute bag with label to show that it meets the IJO food grade standard.
Foto: M. Gilmour.

2.8. Polycyclic Aromatic Hydrocarbons (PAH)

Polycyclic aromatic hydrocarbons are a group of compounds present in the environment as a result of past and current incomplete combustion (burning) of organic substances (e.g. wood, gas, diesel) and geochemical processes. Some of these compounds are genotoxic and carcinogenic and food safety authorities recommend that levels in foods should be as low as reasonably achievable to protect public health. Foods, including cocoa products, can become contaminated by deposition of soot particles from the air, by growing in contaminated soils or contact with contaminated water, or during post-harvest processing. For cocoa, the principal source is from smoke contamination during artificial drying. It is therefore essential to ensure the guidelines on good drying and storage practices in Section 3. Post-harvest: Drying are followed, with particular attention given to the design and adequate maintenance of artificial dryers, to minimize PAH contamination. Furthermore, since most of the PAH contamination will reside on the outer surface of the bean, it is also important that bean breakage is kept to a minimum, and the removal of the shell fraction during processing is carefully carried out.

The EU has set maximum limits for some of these PAHs in a number of foods, including cocoa beans and derived products (Regulation 1881/2006 as amended by Regulation 835/2011) where the levels are established on a fat basis since PAH concentrate in the cocoa butter (see Table 2). In recognition of the challenges that some producing countries faced in improving drying practices throughout their cocoa producing regions, the EU deferred the date that the limits came into force until April 2013 and specified a transition period until April 2015 when the limits became more stringent. The EU has indicated that the levels of PAH in cocoa beans and derived products should continue to be regularly monitored with a view to assessing the possibility for further decreasing the maximum levels in future. Indeed, the EU has recently set maximum limits for PAH in cocoa fibre and derived products. The limits are set on a wet weight basis since cocoa fibre products are low in fat and produced from the shell of cocoa bean and are thus likely to contain higher levels of PAHs than cocoa products produced from the cocoa nibs (EU, 2015/1933).

Figure 8. Smoke from a fire below a drying table can contaminate beans with PAH.
Foto: D.Sukha.

Table 2.

EU Maximum Limits for PAH in Cocoa Products (Regulation 1881/2006 as amended by Regulation 835/2011 and 1933/2015).

	Maximum levels (µ/kg)	
	Benzo(a)pyrene	Sum of benzo(a)pyrene, benz(a) anthracene, benzo(b)fluoranthene and chrysene*
Cocoa beans and derived products with the exception of the products referred to in point 6.1.11	5.0 µg/kg fat as from 1.4.2013	35,0 µ/kg fat as from 1.4.2013 until 31.3.2015 30,0 µ/kg fat as from 1.4.2015
Cocoa fibre and products derived from cocoa fibre, intended for use as an ingredient in food.	3,0 µg/kg as from 27.10.2015	15,0 µ/kg as from 27.10.2015

* Lower bound concentrations are calculated on the assumption that all the values of the four substances below the limit of quantification are zero.

COCOA GAP - MITIGATION OF PAH RESIDUES

- ✓ Sun-dry where possible (protect beans from rain).
- ✓ Use indirect drying if sun drying not possible.
- ✓ Direct drying with wood or diesel fires are not to be used.
- ✓ Avoid smoke contamination
  - Well maintained, functional exhaust/ chimney
  - Regular maintenance of dryers required.
- ✓ Handle beans carefully to avoid broken beans
- ✓ Carry out effective de-shelling of beans

See 3. Post-harvest: Drying for more information.

Click here for sources of further information.

2.9. Mycotoxins, including Ochratoxin A (OTA)

Mycotoxins are a group of naturally occurring toxic chemicals produced by certain moulds (fungi) which affect a number of food crops and commodities. For cocoa, the most important mycotoxin is ochratoxin A (OTA) produced by *Aspergillus* moulds, though aflatoxins have also been detected. There are currently no specific regulatory limits for OTA in cocoa in European legislation. However, since these compounds are carcinogenic, it is important that measures are taken to minimise their formation during post-harvest processing, storage and transportation. Furthermore, it is important that de-shelling of the cocoa beans is carried out carefully since most of the mycotoxin is found on the outside of the bean. Further information and recommendations on good practices is provided in the Codex Code of Practice for the prevention and reduction of Ochratoxin A contamination in cocoa (CAC, 2013).

http://www.codexalimentarius.org/download/standards/13601/CXP_072e.pdf

Figure 9. Diseased and insect damaged pods may allow proliferation of ochratoxigenic fungi.
Foto: M. Gilmour.

COCOA GAP - MITIGATION OF OTA RESIDUES

- ✓ Discard insect damaged/rotten/ mummified pods.
- ✓ Avoid wounding pods with machete.
- ✓ Do not store harvested pods longer than 7 days.
- ✓ Follow heap fermentation, sun drying guidelines.
- ✓ Dry cocoa down to ≤ 8% moisture.
- ✓ Careful handling of beans.
- ✓ Effective de-shelling of beans.

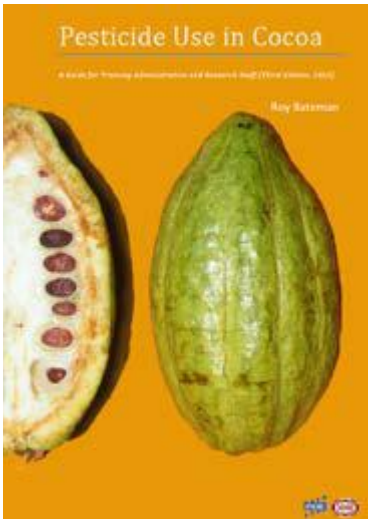
See Part 3 for more details.

2.10. Pesticide Residues

Despite the protective barrier of the cacao pods and shells (if undamaged), the use of pesticides on cacao trees and in cocoa stores can lead to the presence of residues in cocoa products. There is a growing body of knowledge and increasing public awareness of this subject which have led to limits being set for the maximum level of pesticide residues in raw materials including cocoa beans. The cocoa industry requires that all supplies of cocoa beans and products comply with these limits and will monitor closely the levels of pesticide residues on all cocoa raw materials. In Europe, all cocoa and cocoa products must comply with EU Regulation 396/2005 and its amendments, which set out Maximum Residue Levels (MRLs) of pesticides in or on food or feed of plant and animal origin. This legislation provides MRLs, or temporary MRLs where the MRL for a particular active ingredient/commodity has yet to be finalised, with a default value of 0.01 mg/kg (10 ppb). For cocoa, the MRLs are determined on "beans after removal of shells", as referred to in Regulation EC 178/2006. However, in some other countries MRLs are determined on whole beans (i.e. prior to removal of the shell or seed coat). Lists of the strategic pesticides used on cocoa, with their current MRLs, and also those pesticides that MUST NOT be used on cocoa can be found in the Manual on the Safe Use of Pesticides in Cocoa Growing (Bateman, 2015) and updates available from http://www.icco.org/sites/sps/manual.html.

Pesticide Maximum Residue Levels

Maximum Residue Levels (MRLs) are primarily trading standards, but they also help ensure that residue levels do not pose unacceptable risks for consumers. They are set to reflect the highest amount of pesticide residue expected in food when pesticides are applied correctly. The MRLs are usually determined by measurement during a number of field trials where the crop has been treated according to approved conditions (known as Good Agricultural Practices (GAP) and where an appropriate interval has elapsed between the last pesticide application and harvest). The data from these trials and safety assessments for the pesticide users, consumers and environment are considered before a pesticide is approved for use on a crop. However, there are many pesticide active ingredients that have not yet been trialled on cocoa. In these cases, the MRL is often set at the Limit of Determination (LOD) which can be considered a measure of presence/absence. Since true residues may not be quantifiable at very low levels, sometimes the Limit of Quantification (LOQ) is quoted in preference.



The issue of pesticide residues is kept under constant review by food safety and environmental protection agencies. Information on active compounds that are under review, and newly introduced maximum levels and restrictions can be found on various websites including:

Codex Alimentarius:
http://www.fao.org/fao-who-codexalimentarius/standards/pestres/pesticides/en/

European Food Safety Agency :
(http://www.efsa.europa.eu/en/panels/pesticides.htm),

European Commission:
(for example http://ec.europa.eu/agriculture/envir/pesticides/index_en.htm and http://ec.europa.eu/food/plant/pesticides/index_en.htm)

US Environmental Protection Agency:
(www.EPA.gov/pesticides)

Japanese Ministry of Health, Labour and Welfare:
http://www.mhlw.go.jp/english/topics/foodsafety/

Pesticides can have an important role in controlling the pests and diseases that would otherwise lead to high percentage loss of the cocoa crop, or adversely affect its quality. However, they must be used appropriately (the right pesticide at the right time at the right dosage), safely and responsibly, as part of an Integrated Crop and Pest Management (ICPM) strategy, which minimises risks to the operator, the farmer and his community, the environment and the consumer. Pesticides can also be used as fumigants to control storage pests and prevent deterioration of quality during transportation and storage.

See sections Part III Pest and Disease Control and Storage.

COCOA GAP - MITIGATION OF PESTICIDE RESIDUES IN COCOA PRODUCTION

- ✓ Usage must comply with all national and international regulations.
- ✓ Spraying as part of Integrated Crop and Pest Management (IPM).
- ✓ Manage tree architecture to allow for air circulation and easy access to pods when applying pesticides,
- ✓ Correct equipment, timing (respecting any pre-harvest interval) and target.
- ✓ Recommended pesticide.
- ✓ Even application.
- ✓ Personal protective equipment.
- ✓ Correct disposal of containers.
- ✓ Avoid pesticide cross-contamination (drying tables, storage areas, etc.)

Click here for further sources of information.

COCOA GAP - MITIGATION OF PESTICIDE RESIDUES DURING FUMIGATION, STORAGE & TRANSPORT

- ✓ Usage must comply with all national and international regulations.
- ✓ Cocoa stored according to Good Warehousing Practice.
- ✓ Correct equipment, timing and target.
- ✓ Recommended pesticide.
- ✓ Personal protective equipment.
- ✓ Correct disposal of containers.
- ✓ Monitoring and assessment to ensure effectiveness.
- ✓ Prevent cross-contamination from pesticides used on other crops or to control termites, for example on pallets.

Click here for further sources of information.

3. Physical Characteristics

3.1. Consistency

It is very important that the quality of cocoa, both from bag to bag within a particular consignment, and between different consignments of the same mark, is consistent.

It is very important that the quality of cocoa, both from bag to bag within a particular consignment, and between different consignments of the same mark, is consistent. Since manufacturers aim to produce chocolate of consistent quality, a mark or origin which can be relied upon to supply beans of consistent quality will be valued more highly than one of heterogeneous quality. Consistency refers not only to the amount of defective beans but also the bean sizes and degree of fermentation.

To some extent consistency can be achieved by mixing beans, but all the cocoa being mixed should be of the same grade standard. It is not advisable to mix or blend poor quality cocoa with good quality cocoa to obtain a cocoa that just meets average minimum grade standards. While the value of the poor cocoa can be increased in this way, the value of the good cocoa is correspondingly reduced and future demand for that cocoa will diminish. Mainstream cocoas from sources with a reputation for supplying cocoas where the quality can often very close to the prescribed Grade 1 standards tend to sell at a discount to mainstream cocoas which are consistently well within the standards. Cocoa which is very near to the prescribed Grade 1 standards may contain as many as 8 or 9% defective beans and this cocoa is unsuitable for good quality chocolate. The mixing or blending at origin of cocoas of different grades should not be practised.

3.2. Yield of Edible Material

The yield of the useful part of the bean significantly affects its value to the manufacturer and hence the price he is willing to pay for the cocoa. A number of factors which can be measured objectively affect the amount of edible material (cocoa nib), and in particular the amount of cocoa butter, that can be obtained from a parcel of cocoa. Some of the factors affecting yield such as bean size, shell content and fat content are largely determined by climatic and genetic factors, whilst others can be influenced by good post-harvest, storage and transportation practices. One of the most significant factors that can be addressed by the grower is the removal of foreign matter, see Section 3.2.5. A parcel of cocoa which consists of whole single cocoa beans is worth more than one which includes foreign matter, even if that matter is of cocoa material. It is noted that while the grower has the capacity to deliver clean cocoa (by visually sorting out any foreign matter during drying), there is the temptation by some growers and exporters to blend in a degree of foreign matter in order to meet the minimum requirements of the export contract. This is regrettable and could be avoided by reducing the amount of foreign matter acceptable under the contracts (or the national quality standard in case of farmer fixed price); paying more for such clean cocoa so that the parties are clear what the premium is for; and by introducing traceability to the cocoa chain.

3.2.1 Bean size and uniformity:

The weight of a cocoa bean should be at least 1.0g. Smaller beans have higher shell contents and, consequently, less nib, which may also have a lower percentage of fat. Small beans can be used (provided the parcel is homogeneous) but require adjustment to factory processes which is inconvenient and costly - causing a reduction in plant throughput. For this reason beans should be sold on the basis of a bean size classification, e.g. Less than 100 beans per 100g, 100 to 110g, more than 120/100g etc (See Part II for further information on bean count). Manufacturers also require beans to be reasonably uniform in size because it is difficult to achieve effective bean cleaning in a parcel containing beans that are very variable in size. A general guideline is that no more than 12% of the beans should be outside the range of plus or minus one third of the average weight. This distribution applies to most cocoa as harvested, but not after small beans have been blended into a parcel in order to bring the average bean size closer to the limit of a particular size classification. However, applying and checking this standard formally is time consuming unless specialised equipment is to hand. Informal judgement by eye on a given weight of a random sample of whole beans is usually sufficient; for example, if 72 of the smallest-looking beans taken from 600 grams of beans consisting of 600 beans collectively weigh less than 24 grams; there is a problem. By the same manner, if 72 of the largest-looking beans weigh more than 96 grams there is also the likelihood of blending. Note that ‘a single whole bean’ here does not include flat beans as they, by definition, have no nib and are therefore not whole beans. Such a test is unusual; the better option is to rely on the grower and to use traceability of the parcel to ensure uniformity.

3.2.2 Shell percentage:

Manufacturers require the shell to be loose enough to be easily removed during processing, but strong enough to remain unbroken under normal handling. The shell should also be free of adherent matter such as lumps of dried pulp, which are liable to interfere with the separation of nibs from shell. The shell of main crop West African cocoa beans normally makes up 11-12% of the total bean weight, a norm against which other cocoas are judged. Higher shell percentages mean less edible material and hence a lower value, although offering more protection to the nib. The shape of the seed and thickness of the seed coat varies with the type of cacao grown, and this together with varying post-harvest practices affect the shell weight.

Careful de-shelling is required as a first step in the production of edible cocoa products, especially since the shell is often the most contaminated part of the bean, for example for microbes (including moulds), PAH, OTA and some pesticide residues. The Codex Standard for Cocoa Mass and Cocoa Cake (Codex Alimentarius, 2014) specifies that the shell and germ must be less than 5% m/m of the cocoa mass (cocoa liquor) calculated on the fat-free dry matter or not more than 1.75% calculated on an alkali free basis (for Cocoa Shell only). For cocoa cake, the shell and germ should not be more than 5% m/m calculated on the fat-free dry matter, or not more than 4.5% calculated on an alkali free basis (for Cocoa Shell only). Shell % in cocoa products can be estimated using a method based on the analysis of fatty acid tryptamides.

3.2.3 Fat percentage:

Cocoa butter is still generally the most valuable part of the bean and the potential yield of butter affects the price paid for a particular mark or grade of cocoa beans. Main crop cocoa from West Africa normally contains about 55-58% fat in the dry nib, with Ghanaian beans generally containing a higher percentage of fat than beans from either Côte d'Ivoire or Nigeria. Some typical values for a number of origins, expressed on a whole bean basis, are given in the table below (Pontillon, 1998). Pontillon notes that these values should be taken as indicative only, since the number of samples used to produce these figures varies for each origin and especially since fat percentages can vary considerably depending on factors such as the climate (seasonal and annual variations), geographic and genetic factors, and the methods used to extract the fat.

Origin	Fat % of whole bean	
	Pontillon 1998[1]	Industry Source[2]
Brazil - Bahia	44.6	
Cameroon	47.6	47.1/46.7
Cote d'Ivoire	46.7	46.4
Ecuador	43.6	44.2
Ghana	48.0	46.8/48.0
Indonesia: Sulawesi	45.6	39.9
Madagascar	43.5	
Nigeria	46.9	45.1/47.2
Papua New Guinea	44.0	
Sierra Leone	47.0	
Tanzania	47.6	45.7
Togo	47.0	

[1]Extract from: Cacao et chocolat : production, utilisation, caractéristiques. J. Pontillon, coordonnateur, © Technique & Documentation, 1998. [2]Additional data from industry sources on current typical values from main crop beans

3.2.4 Moisture content:

Manufacturers require cocoa beans to have a moisture content of approximately 7%. If it is above 8%, there is not only a loss of edible material, but also a risk of mould and bacterial growth with potentially serious consequences for food safety, flavour and processing quality (see Part 1, Section 2). If the moisture content is less than 6.5% the shell will be too brittle and the beans disintegrate to give high levels of broken beans (see Part 1, 3.2.5b). This is of particular importance if the cocoa is transported and/or stored in bulk as the beans are less well protected from damage if not bagged, and thus more likely to have higher levels of lipolysis giving rise to Free Fatty Acids.

3.2.5 Foreign matter:

The presence of foreign matter will also affect the yield of edible material and hence reduce the value of the cocoa to the chocolate manufacturer, and may also affect the flavour and be a source of contamination to the product.

Foreign matter in this case may be divided into two types, one that has no commercial value to the manufacturer and the other that has only a reduced value (known as “Residue” or Cocoa Related Matter).

3.2.5a Foreign matter with no commercial value:

The type of foreign matter which has no value to the manufacturer consists of material that is (a) not cocoa-related, e.g. sticks, stones etc., which can damage the manufacturer’s machinery; or (b) cocoa-related but has no commercial value, e.g. placenta, pod husk and flat or shrivelled beans which contain very little nib etc., which can be detrimental to the flavour as well as reducing the yield of edible material.

Figure 12. Foreign matter. a) large pieces of husk, placenta and other material with no commercial value. b) residue separated using a 5mm round hole sieve.
Fotos: R. Dand / M. Gilmour.

3.2.5b Cocoa residue including broken beans and fragments:

Cocoa residue consists of broken beans and fragments of beans and shell. Some bean breakage is inevitable during shipping and storage, although from normal production the amount seldom exceeds 2%. The process of moving the cocoa in bulk form may generate more broken beans and fragments if not properly managed (e.g. limiting free fall, mechanical damage etc...). Higher levels can result in greater amounts of nibs and fragments being removed by bean cleaners with corresponding loss of edible material. There are two main areas of concern to the manufacturer. The first is that cocoa nibs of broken beans and fragments are likely to have a higher FFA content than whole beans, due to higher rates of lipolysis because of the greater surface area exposed to oxygen, and a higher likelihood of their being affected by mould. Moreover, the FFA content of butter from broken beans will continue to rise during storage and therefore cocoa beans containing high levels of broken beans and fragments cannot be stored for any appreciable period. The second area of concern is that broken beans and fragments are not easily processed as the effectiveness and consistency of the roasting process depends directly on the homogeneous size of the nibs. This difficulty also occurs with bean clusters – see Section 3.2.7.

Figure 13. Broken Beans.
Foto: R. Dand / M. Gilmour.

3.2.6 Insect damaged beans:

Substantial insect damage results in a loss of usable nib and detracts from wholesomeness.

Figure 14. Insect damaged beans.
Foto: R. Dand / M. Gilmour.

3.2.7 Clumped beans (clusters) and double beans:

Clumped beans and doubles are rejected together with foreign matter during cleaning and can represent a serious loss to manufacturers. Because they may not be collected in stab samples, the entire contents of sacks have to be inspected, either during grading of subsequent supplies or in cases of arbitration.

Figure 15. Bean clusters.
Foto: R. Dand / M. Gilmour.

4. Cocoa Butter Characteristics

4.1. Free Fatty Acid (FFA)

FFA can have an impact on the hardness of cocoa butter and therefore its processing quality, specifically its crystallisation properties. High FFA butter makes poor quality chocolate, affects bloom, tempering, and can affect the flavour. FFA are most likely released from the triglycerides constituting the cocoa butter due to the action of lipase enzymes. Lipases within the seed itself are activated during seed germination but it is likely that when high levels of FFA are found in cocoa beans this is due to the action of microbial lipases as a result of poor post-harvest practices. The fat from whole and healthy beans which have been fermented and dried thoroughly without delay, stored properly and exported promptly from origin will generally have an FFA content of less than 1% and certainly less than 1.3%. Beans which contain fat with a higher FFA content may be due to the use of beans from diseased pods, very slow drying after fermentation (particularly where there are clusters of beans which have not been properly separated from the placenta), high % of broken beans, prolonged storage under humid conditions or with a moisture content above 8%, insect infestation during storage or prolonged storage of beans at tropical temperatures in the country of origin. These abuses can result in an FFA content above 1.75% which is the legal limit for cocoa butter within the EU (Directive 2000/36/EC) (EU, 2000) and in the Codex Standard for cocoa butter (86-1981, Rev.1-2001) (Codex Alimentarius, 2001). As explained above, increased levels of broken beans and fragments can significantly increase the FFA content of the fat extracted. Cocoa butter with an FFA content of 1% or less, together with acceptable flavour in both butter and liquor, is the best indication that the beans were sound at origin and have been prepared and stored properly.

Click here for further sources of information.

4.2. Hardness

Cocoa butter consists of a mixture of triglycerides, ie fats which are made up of glycerol and three fatty acids. Most of the triglycerides of cocoa butter contain stearic acid, palmitic acid and/or oleic acid but the proportions of these fatty acids vary and this results in different physical properties of the fat. This in turn affects the way chocolate behaves in the manufacturing process and the texture and appearance of the final product. Manufacturers prefer cocoa butter that is relatively hard and consistent in this respect. Cocoa butter from most West African beans gives the desired physical properties. Butter from Cameroon and Brazilian beans tends to be softer, while butters from Southeast Asia tend to be harder, with temperature conditions during bean development likely to be one of the major factors contributing to these differences.

Cocoa butter from beans which contain high levels of FFA also tends to be softer than that from sound whole beans irrespective of the country of origin.

5. Colour Potential - "Colourability"

The colour of cocoa powder is an important attribute since it is often used as a colouring agent as well as for its flavour in various foods. Cocoa powder contains naturally occurring colorants, including flavonoids, and it is the extent to which these can be influenced during the alkalisation and roasting processes which is of particular interest to manufacturers. The levels and types of the chemicals responsible for colour potential are influenced by a complex of factors including the genetic background of the cocoa, climatic and soil conditions and post-harvest processes. Good fermentation is particularly important since it is essential for the oxidation and condensation reactions which result in the formation of new, very large and insoluble tannin compounds which give the characteristic brown colour to the bean. It is important that the fermentation is stopped at the right time by drying otherwise 'over-fermented' beans of a very dark colour are produced (Kamphuis, n.d.).

6. Traceability, Geographical Indicators & Certification

Under EU law "traceability" means the ability to track any food or substance that will be used for consumption, through all stages of production, processing and distribution.

Under EU law (EC Regulation No 178/2002) (EU, 2002), "traceability" means the ability to track any food or substance that will be used for consumption, through all stages of production, processing and distribution. The traceability of raw materials is a basic requirement for quality, food safety and sustainability. Ideally it should be possible to trace a particular lot of cocoa beans from the end user back to the farmers who produced it. However, the smallholder nature of the crop and the mixing and blending export systems used in some cocoa producing countries make this very difficult to achieve. Nevertheless, there are some good examples where bag marking has been used as part of a traceability system. Indeed the ICCO Total Quality project demonstrated that it is possible to achieve high level of traceability in mainstream cocoa exports from a major cocoa producing country like Cote d'Ivoire with benefits throughout the supply chain from the farmer to the consumer (ICCO, 2013). For traceability systems to work, it is essential that appropriate records and marking/coding systems are maintained from the farmer level through the collector/ cooperative onwards and that the integrity of lots is maintained without mixing or blending throughout the supply chain.

The importance of social, environmental and economic issues in the cocoa sector has continued to increase over recent years and there has been an increased demand by the cocoa industry for certified cocoa as a means to comply with sustainability requirements

Certification schemes vary in their main focus or strategy for improving the sustainability of cocoa production but they share similar objectives in seeking improvements in farmers' livelihoods, most often in conjunction with implementing good agricultural practices to improve quality and productivity. The European Committee for Standardization (CEN) and the International Organization for Standardization (ISO) are creating a standard for sustainable and traceable cocoa (ISO 19381). This will give a common definition of sustainability and traceability in the cocoa sector broadly accepted by the stakeholders in the cocoa value chain. The standard ISO 19381 establishes a scalable, rigorous and verifiable standard. It will ensure farmers who are responsibly managing farms that are viable in the long term and generate sufficient income for farmers to transition away from current poverty levels.

The sustainability requirements of the standard will use criteria that aim for:

- Profitable farming based on good agricultural and business practice
- Improving social conditions that respect human rights, workers' rights, health and safety, and support the eradication of forced labour and the worst forms of child labour
- Sound environmental practice

The traceability requirements will make the supply of sustainable cocoa transparent requiring a rigorous record keeping system and supply chain management. It will acknowledge the reality of the existing supply chain and offer two separate paths to compliance:

- Physical traceability
- Mass Balance

It is anticipated that the standard will be operational by the end of 2016.

COCOA GAP - TOWARDS TRACEABILITY IN THE COCOA SUPPLY CHAIN

- ✓ Maintain appropriate farmer records.
  Prepare export grade cocoa as close to farmer as possible.
- ✓ Avoid mixing and blending.
- ✓ Marks, codes should allow traceability to and from collector/cooperative.
- ✓ Maintain lot integrity throughout the supply chain.

7. Summary Of Industry Requirements

For the production of good quality chocolate, manufacturers' seek cocoa beans with the following qualities:

Quality	Reference
Have good, intrinsic flavour attributes	P1: 1. Flavour
Free from off-flavours, particularly:-	
Smoke	P1: 1.2. Smoky off-flavours, P3: Drying
Mould	P1: 1.1. Mouldy off-flavours, P3: 2. Harvesting, P3: 3. Post-harvest
Excessive acidity	P1: 1.4. Acid taste, P3: 2. Harvesting, P3: 3. Post-harvest
Excessive bitterness and astringency	P1: 1.5. Bitterness and astringency, P3: 1. Planting material.
Be grown, harvested, fermented, dried and stored using recommended practices so as to ensure levels of contaminants are as low as reasonably achievable and comply with food safety legislation.	
Allergens	P1: 2.1. Allergens, P3: 5. Transportation & Shipping Practices
Bacteria	P1: 2.2. Bacteria, P3: 3. Post-harvest
Dioxins and PCBs	P1: 2.3. Dioxins and PCBs, P3: 3. Post-harvest
Foreign Matter	P1: 1.6. Contamination, P1: 2.4. Foreign Matter, P3: 3. Post-harvest
Heavy Metals	P1: 2.5. Heavy metals, P3: 1. Cadmium uptake mitigation
Infestation	P1: 2.6. Infestation, P3: Storage, P3: 5. Transportation & Shipping Practices
Mineral Oil Hydrocarbons	P1: 2.7. Mineral oil hydrocarbons, P3: 3. Post-harvest
Polycyclic Aromatic Hydrocarbons (PAH)	P1: 2.8. Polycyclic Aromatic Hydrocarbons (PAH), P3: 3. Post-harvest
Mycotoxins including OTA	P1: 2.9. Mycotoxins, including Ochratoxin A (OTA), P3: 2. Harvesting, P3: 3. Post-harvest
Pesticide Residues	P1: 2.10. Pesticide residues, P3: 1. Pre-harvest, P3: 3. Post-harvest

Quality	Reference
Well within the International Grade 1 standard	P1: 3. Physical Characteristics, Appendix A
Beans uniform in size and on average at least 1g in weight	P1: 3. Physical Characteristics, Part II Quality Standards, Appendix A
Be well fermented and thoroughly dried, with a moisture content of approximately 7%, with an absolute maximum of 8%	P1: 1. Moisture content, P3: 3. Post-harvest
Consistent in quality both within parcels and between shipments	P1: 3.1 Consistency
Essentially free from live insects	P1: 2.6 Infestation, P3: 3. Storage
Free from foreign matter	P1: 1.6 Contamination, P1: Foreign Matter, P3: 3. Post-harvest
Free fatty acid content less than 1%	P1: 4. Cocoa Butter Characteristics, P3: 3. Post-harvest
In addition, manufacturers prefer cocoa beans with:-	
Fat content of 55-58% (dry nib basis)	P1: 4. Cocoa Butter Characteristics, P3: 1. Pre-harvest
Shell content of 11-12%	P1: 3.2 Yield of Edible Material, P3: 1. Pre-harvest
Hard cocoa butter	P1: 4. Cocoa Butter Characteristics, P3: 1. Pre-harvest

Part 2
Quality Standards

1. International Cocoa Standards
2. Other Standards
3. Bean Size

Quality Standards

The six aspects of quality that have been described cover the subject in its broadest sense and all have a bearing on the price paid for beans from a particular source compared with other sources.

The six aspects of quality that have been described cover the subject in its broadest sense and all have a bearing on the price paid for beans from a particular source compared with other sources. In a narrower sense "quality" may refer solely to the first two aspects: flavour and purity or wholesomeness and it is these aspects that are covered, at least in part, by various cocoa standards. These standards must use objective measurements. They cannot measure or ensure good flavour although they can, by means of the cut test (see Appendix A), detect gross flavour defects. The standards can also help to ensure good keeping quality.

There are various standards of which the most important are the International Cocoa Standards and the standards as defined in the physical contracts of the Federation of Cocoa Commerce, Ltd. (FCC) and, in the United States, the Cocoa Merchants Association of America, Inc. (CMA). It is worth mentioning that there are quality standards dictated in the cocoa futures contracts, used by market participants to hedge their physical commitments, however a chocolate manufacturer is not likely to source their beans through these markets as they are not designed for that purpose.

1. International Cocoa Standards

ISO 2451 defines the terms used and the grade standards used to classify cocoa beans. The grade standards are based on the cut test which allows certain gross flavour defects to be identified.

These standards, as issued by the International Standards Office (ISO), form the basis of the grading regulations of several cocoa producing countries. ISO 2451 "Cocoa beans – Specification", originally issued in 1973, was revised in 2014 to bring it into line with current commercial practices. It references three other ISO standards: ISO 1114 Cocoa beans – Cut Test, ISO 2291 Determination of moisture content (routine method) and ISO 2292 – Sampling.

ISO 2292 is currently under revision and further changes are under discussion for ISO 2451, particularly regarding the bean size specifications and the possible integration of this standard with ISO 1114 and ISO 2291. Current versions of the Standards are available for purchase from the ISO website, http://www.iso.org/iso/home.htm, which also provides further details on the process by which the Standards are developed.

The standard specifies that cocoa beans shall be:

- Fermented, then dried until their moisture content no longer exceeds 7.5% mass fraction.
- Free from any evidence of adulteration.
- Virtually free from living insects and other infestation.
- Free from odour contamination.
- Virtually free from any foreign matter.
- Reasonably free from broken beans, fragments and pieces of shell.
- Within the standard for violet or purple beans, typical of the specified grade or origin.
- Reasonably uniform in size, fit for production of a foodstuff.
- Reasonably free from bean clusters, flat beans, germinated beans, residue and sievings.

The Grade Standards lay down the following maximum limits for producing country internal classification for fermented beans: -

	Maximum percentage of beans[1]		
	Mouldy	Slaty	Insect damaged, germinated or flat
Grade I	3%	3%	3%
Grade II	4%	8%	6%

1 The percentages in the last column apply to the combined total of all the defects specified in the colum header.

ISO 2451 now also specifies bean size standards, defined by the bean count and usually expressed by the number of beans per 100g (see Appendix A for further details). The specifications are currently:

- Large beans:
  Bean count of less or equal to 100
- Medium beans:
  Bean count of 101 to 120
- Small beans:
  Bean count greater than 120

2. Other Standards

Most of the world's cocoa is traded using the contracts of the FCC or CMA, which historically have slightly different standards.

Most of the world's cocoa is traded using the contracts of the FCC or CMA, which historically have slightly different standards. These standards do not imply acceptability for chocolate manufacture, however, merely the levels at which allowances become due under arbitration procedures.

From June 2015, the FCC terms require the cocoa to be of a certain condition; namely "In addition to any specified quality terms, the parcel shall consist of beans which shall be reasonably;

- Uniform in size,
- Uniform in fermentation,
- Dry,
- Homogenous in all other respects and the parcel shall be:
- Fit for the production of a foodstuff,
- Free from adulteration, contamination and rodents,
- Virtually free from live insects (including mites) or other type of infestation,
- Virtually free from germinated beans,
- Within the customary range for violet or purple beans of the specified grade/ origin."

It should be noted that the definition of Foreign Matter, Cocoa Related Matter and Sievings have specific meanings under FCC terms, see Appendix A. Either singularly or collectively; excessive Cocoa Related Matter, Flat Beans, Bean Clusters or Foreign Matter may result in an allowance.

If the term "Main crop" is used to describe the cocoa traded or is used in the quality parameters of the cocoa, then the size of the beans, measured by bean count, must be consistent with that of beans normally produced during the main harvest period of that particular origin. No allowance will be considered for a bean count of 100 beans or fewer per 100 grams. More than 100 beans per 100 grams may result in a quality claim, which if considered to be above 120 beans may result in the parcel having to be replaced rather than subject to an allowance.

Other FCC terms are available to describe the bean size standards:

STANDARD BEANS – means bean count ≤ 100

MEDIUM BEANS – means bean count 101-110

SMALL BEANS – means bean count 111-120

VERY SMALL BEANS – means bean count > 120

FCC contracts lay down two grades - good fermented and fair fermented. The maximum limits for these grades are:-

	Good fermented	Fair fermented
Slaty	5%	10%
Defectives	5%	10%

1 The percentages in the last column apply to the combined total of all the defects specified in the column header.

"Defectives" are defined as internally mouldy beans, or insect infested or insect damaged beans. The CMA contract calls for cocoa beans to meet the United States Food and Drug Administration Standard, which stipulates a maximum 4% mouldy and 4% infested or damaged beans, but also no more than 6% of the two combined.

Note that cocoa which may comply with Grade 1 under the ISO standards as having 3% insect damaged and 3% mould would exceed the defective limits of the FCC definition of Good Fermented.

Finally there are standards set down by different terminal or futures markets as a basis for deciding whether a particular parcel is suitable for tendering on the market in question at the contract price, or at a premium or discount. Again these contract standards are not based on acceptability for chocolate manufacture.

There are also quality standards set by the authorities in cocoa origins which are their practical internal quality standard – against which the quality is assessed throughout the internal marketing chain in the country.

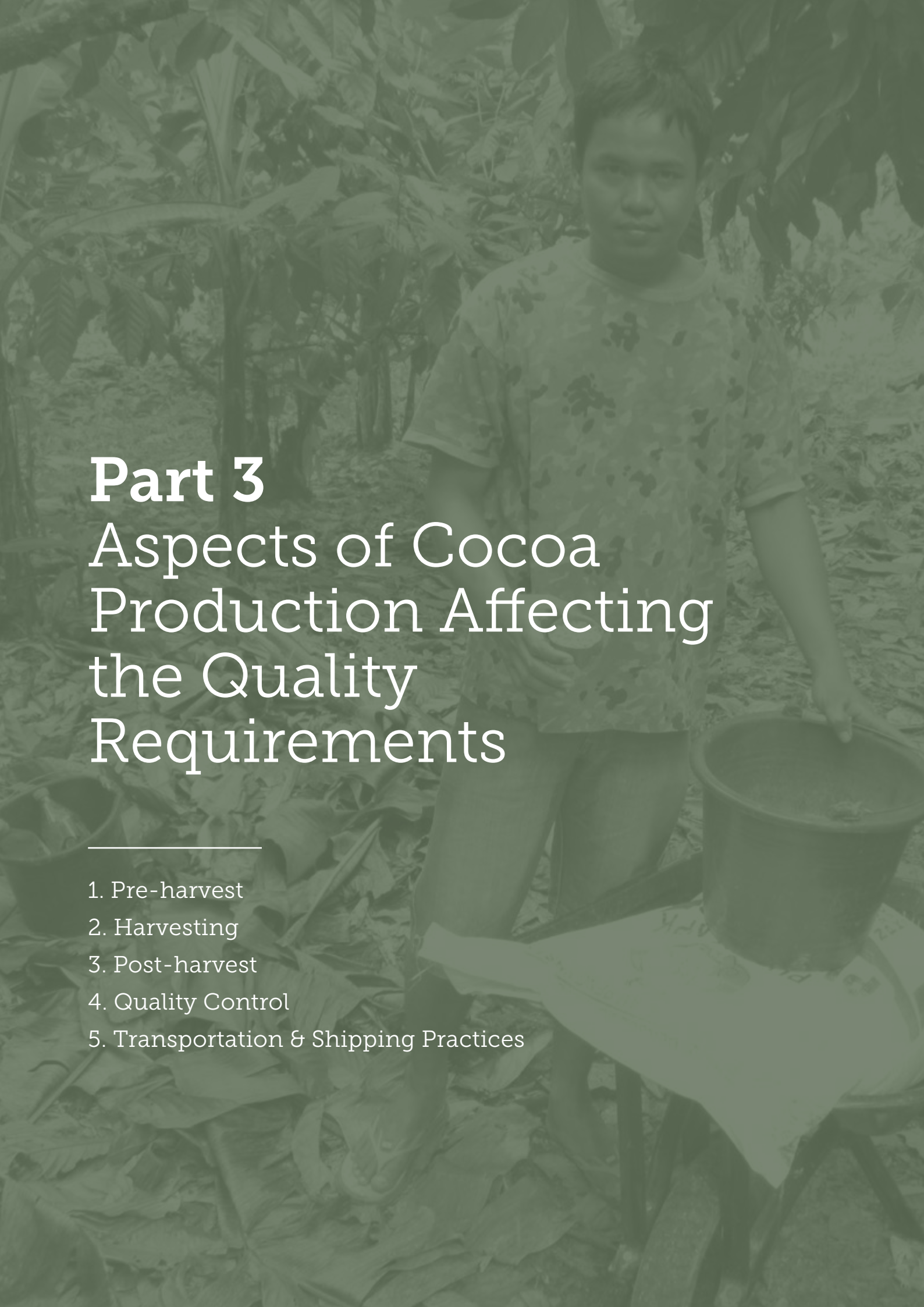
3. Bean Size

With new cocoa areas being opened up, there is increasing variation in bean size from a greater diversity of planting materials. It is becoming more important that beans are sold not only on the basis of the agreed quality standards but also on the basis of an agreed bean size and distribution criterion so that manufacturers know what they are buying and the seller's reputation is protected.

A number of origins and markets have their own particular criteria, for example: -

Nigeria defines cocoa as a main crop if 300 beans weigh 11ozs or above (104 beans/100g) and light crop if it does not meet this standard.

The futures markets based in London provides for an allowance if the bean count is greater than 100 beans/100g, with beans in excess of 120 beans/100g not being tenderable.



Part 3
Aspects of Cocoa Production Affecting the Quality Requirements

1. Pre-harvest
2. Harvesting
3. Post-harvest
4. Quality Control
5. Transportation & Shipping Practices

This publication does not set out to prescribe a method or methods of producing cocoa beans of good quality. This would involve going into the details of fermentation and drying suitable for many widely differing local conditions and is beyond the scope of this booklet.

The aim of this section is to highlight the main factors affecting the various aspects of quality. Recommendations follow those made in a number of sources including the **Codex Code of Practice for the Prevention and Reduction of Ochratoxin A Contamination of Cocoa** (CAC/RCP 72-2013) (CAC, 2013), **The CCE Sustainable Cocoa Trainers' Manual Ghana Version 1.5** - May 2012 (Dohmen, Helberg, & Asiedu, 2012), the **Guidelines on Best Known Practices in the Cocoa Value Chain** (CS-16-2-Rev 1) (ICCO, 2009), **Gap recommendations to achieve the characteristics of good quality cocoa** (Gilmour, 2009) and the information available from **www.cocoasafe.org** (CocoaSafe, 2015).

1. Pre-harvest

a) Environmental aspects.

Some physical characteristics of cocoa beans are influenced by the climate during the period of development of the pod. The major climatic factor is rainfall, though factors such as temperature and light conditions are also likely to affect pod and bean characteristics. Pods developing during the dry season will tend to contain smaller beans than pods developing during a wet season. Studies have shown that rainfall during the first 2-3 months of pod development is correlated with mean bean weight. Apart from bean weight, rainfall also influences fat content, the fat percentage being reduced by dry conditions.

The ambient temperature affects the composition of the cocoa butter, and thus its hardness. Evidence from Brazil indicates that the cocoa butter from beans which develop during cooler months contains a higher proportion of unsaturated fatty acids and is therefore softer (Lehrian, Keeney & Butler, 1980.) Ambient temperature around the fermentation could also affect the initial progress of fermentation micro-flora activity. The climate in a cocoa growing area will also affect the choice of the methods of drying and may have some effect on storage. These matters are discussed later.

b) Methods of cultivation.

i). Planting Material

Effects of planting materials on flavour have already been noted in Part 1: Section 1. Selection of planting material affects also yield, colour, bean size, cocoa butter content and, to a limited extent, cocoa butter hardness. There is fundamental choice between Criollo and Trinitario trees to produce "fine or flavour" grades, or "Forastero" or Amazonian types and their hybrids to produce mainstream cocoa. For most growers this choice is not open to them as their planting material will be dictated by what is available locally, though growers are strongly encouraged to obtain recommended varieties (seed or clonal materials) from a reputable source rather than use materials from their own or neighbouring farms. If production of significant quantities of "fine or flavour" grades are being considered, it is important that due consideration is given to the potential market for such cocoas. Where "fine or flavour" grades are grown in areas where mainstream cocoas are also grown, it is important that the types can be segregated and marketed separately.

KEY POINTS

- ✓ Plant varieties that are recommended for the local area and which have been confirmed as having the quality and flavour characteristics desired by the intended buyers.

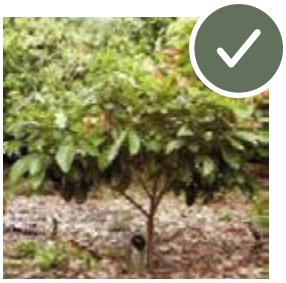
Within the "Forastero" populations, particularly within the Amazon hybrids planted widely today, there are appreciable differences in bean weight and it is prudent to avoid planting selections which tend to produce small beans.

There are significant effects of pollen donors on colour and bean size. It is important not to have stands of trees for "fine or flavour" and mainstream cocoa production in close proximity, especially if pale colour is a critical characteristic of the "fine or flavour" cocoa. Pods resulting from cross pollination will contain a higher proportion of darker beans. The much darker colour of beans from the Amazon type trees is dominant. The maternal parent has the strongest effect on the flavour of the beans (Clapperton, 1994) though the pollen donor may have some effect on certain flavour (Sukha, 2008)

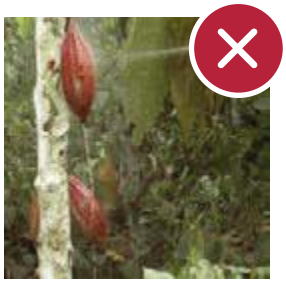
ii). Pest and disease control

Integrated Crop and Pest Management (ICPM) should be implemented in order to achieve sustainable good yields and ensure the cocoa produced complies with regulatory limits for pesticide residues. The key elements of ICPM are the prevention of conditions on the farm that favour pests and diseases, quick identification of the pest or disease and assessment of the level of infestation. Control methods can then be used which are appropriate for the infestation level. Such control methods may include the responsible and effective use of crop protection products in cases where if left untreated, the infestation would cause unacceptable financial losses. Detailed information on Responsible Pesticide Use (RPU) and ICPM practices for cocoa can be found in a number of sources. The recommendations will vary according to the pests endemic to a particular region. However, improved planting materials, coupled with good farm sanitation and the use of agronomic techniques to create ecosystems favouring the cocoa tree and the natural enemies of its pests rather than the pests themselves, will help to ensure that there is a continual reduction in the use of agrochemicals for crop production, and that where pesticides are used they are applied based on sound knowledge of the pest and good practices.

It is essential that only pesticides that are registered and approved for use on cocoa are used and that they are obtained from reputable sources to avoid counterfeit or contaminated products. They must only be used in full accordance with Good Agricultural Practice (GAP) which will include aspects such as dosage/timing of application (especially in relation to the gap between the last application and harvest), appropriate application technology and personal protective equipment. The ICCO "Pesticide Use in Cocoa: A Guide for Training Administrative and Research Staff" (http://www.icco.org/sites/sps/documents/manual_icco_2nded_final.pdf (Bateman, 2015) provides detailed information including the selection of appropriate control strategies, Good Agricultural and Storage Practices, and annexes which list strategic/recorded pesticides for cocoa, compounds which should only be used with great caution (compounds with an uncertain future and a history of issues, such as with (eco)toxicology or frequent exceeding of MRLs) and those that MUST NOT be used on cocoa.



Arbol podado para permitir el seguimiento eficaz de problemas de plagas y, si procede, la fumigación.



Una técnica inapropiada de fumigación resulta antieconómico e ineficaz debido a la escorrentía.

La infestación por BMC dificulta la separación de los granos y merma la calidad.

Los fertilizantes deben aplicarse de acuerdo con las recomendaciones, y su contenido de cadmio se debe comprobar, sobre todo si se sabe que los suelos tienen niveles elevados de cadmio.

Fotos: R.Bateman, M.Gilmour.

KEY POINTS: IMPLEMENT INTEGRATED CROP & PEST MANAGEMENT (ICPM)

- ✓ Implement good farm sanitation and agronomic practices which promote healthy growth of the cocoa trees and favour the natural enemies of its pests, rather than the pests themselves
- ✓ Where pesticides are used as part of ICPM, usage must comply with all national and international regulations
- ✓ Identify the pest and ensure that the recommended pesticide is used at the right time in the pest lifecycle/crop season.
- ✓ Ensure appropriate application and personal protective equipment are used and that all equipment is well-maintained.
- ✓ Manage tree architecture and adopt spraying patterns to ensure the crop can be treated evenly and effectively
- ✓ Dispose of containers correctly
- ✓ Avoid pesticide cross-contamination (drying table, storage areas, etc)

iii). Cadmium uptake mitigation

Research is currently underway to investigate ways to reduce cadmium (Cd) uptake in areas where levels of this heavy metal are naturally high in the soil. Based on the limited current information on cocoa, and experience from other crops, it is likely that uptake is favoured by low soil pH and when the soil is deficient in certain other mineral nutrients, particularly zinc. Accordingly, the following general recommendations have been made:

- Increase soil pH, for example by liming, to reduce availability of Cd;
- Only use phosphate fertilizers and/or manure which has been checked to ensure it does not contain high Cd levels;
- In areas where soil levels of Cd are high, remove pruned material and pod husks from the ground since these could contain Cd which will be released in to the top layers of the soil when they decay;
- Avoid irrigation with contaminated water;
- Test for macro and micro nutrient deficiencies;
- Increase organic matter content of soil to stabilise nutrients and heavy metal contaminants;
- Avoid post-harvest contamination, particularly by protecting drying/stored beans from dust and traffic fumes; and
- Develop and promote utilisation of cocoa varieties or root stocks with low accumulation levels.

2. Harvesting

Healthy pods should be harvested as soon as they ripen. Care should be taken to minimise damage to the tree and flower cushions, and to prevent the introduction and spread of disease, by using clean, well-maintained tools. It is important that only beans from just-ripe, healthy pods are used in the fermentation since the beans from immature, overripe or damaged/diseased pods will be of lower quality and may give rise to food safety issues. Immature pods (often fully or partly green, but sometimes purple or red depending on the variety) contain beans which are generally smaller and contain less cocoa butter than pods which are fully ripe (often yellow, or orange-red depending on the variety). Moreover, since there is little or no liquid pulp (mucilage) in unripe pods, the beans are often hard to remove and do not separate easily from each other and the placenta. Since the pulp contains lower levels of sugars, the beans do not ferment well, leading to poor flavour. Moreover, if beans remain stuck together in clusters, they dry more slowly and this can give rise to problems with mould development, and therefore potentially Free Fatty Acids (FFA) and Ochratoxin A (OTA) formation.

Conversely, if harvesting is done too late, the pods become over-ripe and the beans may germinate within the pod. The beans may stick together leading to the problems of poor drying and mould development, as mentioned above, and there is also the risk that damage to the seed coat (shell) during germination, or the subsequent loss of the radical during drying or storage, may allow the entry of moulds, insects and contaminants into the beans.

Damaged pods are more likely to be infected with microorganisms, regardless of whether the wound is caused by disease, insect pests or rodents whilst on the tree or inflicted by tools during harvesting and transporting the pods. It is therefore important that any wounded or damaged pods are not stored for longer than one day before opening and fermenting since they may already be infected with microorganisms which could lead to flavour deterioration, FFA and OTA formation during post-harvest processing.

The interval between harvesting and opening the pods has been found to influence fermentation. An interval of 3-4 days will result in a more rapid rise in temperature during fermentation. Such an interval should be adopted for undamaged pods wherever practical. Storage for more than 7 days is not recommended due to the risk of proliferation of ochratoxigenic fungi. Whereas different cocoa genotypes all show the more rapid rise in fermentation temperature following pod storage, the extent of the flavour improvement differs markedly between genotypes. These flavour differences relate to differences in the composition and biochemistry of the cotyledons rather than to changes in pulp composition that result from post harvest storage. Post harvest storage of unbroken pods is also impractical on large estate scale production because of the amount of extra handling involved, and in parts of Southeast Asia where the Cocoa Pod Borer (CPB) is prevalent.

Those involved in manually removing beans from pods should maintain an appropriate degree of personnel hygiene. It is preferable to open pods by striking them with a wooden baton, or a mechanical device designed to minimize damage to the beans, rather than a machete which may cut the shell of some of the beans thereby allowing mould and insects

to enter, and increase the proportion of broken beans as well as increasing the risk of injury to the farmer/operator.

During the opening process any defective parts of the cocoa pod, mouldy beans, diseased beans, and damaged beans should be removed and appropriately disposed of. Good quality beans should be placed in a suitable container during transport.

Transport of fresh/wet beans from pod opening sites to on-farm fermentation facilities should be done under conditions that will prevent contamination e.g. spilled beans must be free of soil before being fermented.

For some varieties a pre-drying or de-pulping stage is advocated before fermentation starts to reduce acidity and/or improve the expression of desirable flavour notes.

Ripe pod: seeds are fully developed, but not germinated, and easily separated.

Immature pod: seeds are not fully developed and are difficult to separate.

Open pods with a wooden baton to minimise damage to beans.

Beans have been damaged by opening pod with a machete.

Over-ripe pod: seeds are germinating and pulp is dry.

Diseased pod.

Fotos: D.Sukha.

Diseased pods should be discarded and damaged pods must not be stored.

Fermentation should not include black, diseased or clumped beans.

Fotos: D.Sukha, M.Gilmour.

KEY POINTS: POD HARVESTING, OPENING & STORAGE

- ✓ Keep tools and equipment clean and well-maintained.
- ✓ Harvest pods as soon as they ripen: generally, harvest every week during peak periods and every two weeks in non-peak periods.
- ✓ Carry out a separate weekly sanitation check and remove diseased, insect damaged and mummified pods using tools that are only used for this purpose.
- ✓ Avoid damaging the flower cushions and other parts of the tree when cutting the pods.
- ✓ Avoid unnecessary cutting or wounding of the pods: do not use a machete to pick up pods from the ground.
- ✓ Do not store wounded or damaged pods for longer than one day before they are opened and fermented.
- ✓ Undamaged pods should normally be opened within a week of harvest.
- ✓ Keep tools and equipment for opening pods clean and well-maintained.
- ✓ Break open the pods without causing any damage to the beans.
- ✓ Discard any beans which are mouldy, diseased, discoloured, damaged or germinated.
- ✓ Keep good quality beans free from contamination as they are moved to the fermentation area.

3. Post-harvest

a). Fermentation

Fermentation is normally carried out in heaps or boxes and is a crucial stage in the development of the chocolate flavour precursors. Moreover, fermentation is recommended to avoid ochratoxigenic fungal growth and OTA production because acetic, lactic and citric acid produced by bacteria during fermentation can inhibit these undesirable fungal species. Research has shown that OTA production can increase if wet beans, or partially depulped beans, are allowed to ferment during drying on a drying mat.

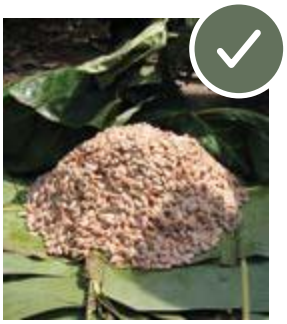
The fermentation process can be influenced by factors such as the variety of cocoa, addition of starter cultures of micro-organisms, altering the pulp:bean ratio, aeration and frequency of turning though in most cases good quality beans can be obtained by simply allowing the fermentation to proceed for between three to five days with a single turn after 24 and 36 hours to ensure uniformity. Lack of fermentation or under-fermentation will give rise to slaty and purple beans with consequent increases in bitterness and astringency. Except in cases where tradition has shown that longer fermentations are desireable, extending fermentation beyond 120 hours brings a danger of over-fermentation with loss of chocolate flavour and development of off-flavours from putrefaction. Traditionally, some “fine or flavour” cocoas require shorter periods of fermentation. Although modern cocoa estates may carefully control the fermentation conditions, in smallholder production systems it is more of an art than a science. Farmers often assess the progress of fermentation by cutting a few beans at intervals to observe the colour changes and judge the end-point on the smell and the external appearance of the beans, together with well defined internal ridging on cut beans, which through experience will indicate that they are ready to be dried.

Fermentation heaps or boxes should include wet beans from sound pods that are sufficiently ripe to allow the individual beans to be separated easily by hand from the placenta and husk. Damaged and diseased beans, pieces of husk and placenta should be separated and discarded.

Any baskets, trays or platforms used for the fermentation, and any tools such as paddles and shovels, should be maintained reasonably clean and dry between fermentations. Care should be taken to prevent cocoa beans from coming into contact with water during fermentation. A covered and/or sheltered space should be chosen to provide adequate protection against rain, wind and direct sunlight.

The fermentation process generates a considerable heat and temperatures close to 50°C can be reached within the mass of beans during fermentation. The fermentation of very small quantities of beans will allow the heat to dissipate and the fermentation will be unsatisfactory. The minimum quantity of wet beans for a normal fermentation is considered to be about 100kg, although, as described in Appendix B, there are methods for fermenting smaller quantities of cocoa which are suitable for experimental purposes. Heaps of between 250 and 500kg are typical in West Africa, while in Southeast Asia and Brazil where box fermentation is practised, bed depths of between 40 and 100cm are normal with quantities being between 500 and 2,000kg of wet beans.

Ferments very much larger than 2,000kg are difficult to manage in order to achieve uniform and effective fermentation. For practical reasons, therefore, about 2,000kg wet beans is considered to be the upper limit for a single fermentation.



Fermentation heap typical of West Africa.

Fermentation should not include black, diseased or clumped beans.

Box fermentation.

Do not add beans to a fermentation already in progress.

Fotos: E.Cros, D.Sukha, M.Gilmour.

KEY POINTS: FERMENTATION

- ✓ Ensure fermentation method is appropriate to the variety, climate, quantity of beans and locally available technology.
- ✓ Discard any pieces of husk, placenta, black beans, germinated beans.
- ✓ Ensure basket, platforms and any equipment is kept reasonably clean between fermentations.
- ✓ Site fermentation in a space with adequate protection from rain, wind and direct sunlight.

b). Drying

The drying process must be carried out carefully to ensure the beans are adequately prepared for storage and transport without becoming contaminated by moulds, *Salmonella* bacteria, PAH and other contaminants. Drying should be started immediately after the fermentation period to stop the beans from over-fermenting with consequent loss of cocoa flavour. Although drying under direct, natural sunlight is preferable, it may be necessary to use artificial drying to complement or replace sun-drying depending on climatic conditions. Amoa-Awua has reviewed the different drying techniques, including solar and artificial dryers (Amoah-Awua, 2014). Drying by whatever means must be thorough, with the moisture content being reduced below 8% over an appropriate time period. This period will vary according to local conditions and/or whether artificial drying is used, but for sun-drying it should ideally be 6-10 days. Prolonged drying periods and re-wetting should be avoided since moisture contents over 8% can lead to mould development, and thus mouldy/ musty off-flavours and the possibility of OTA production, inside the beans during subsequent storage and transport.

Care should be taken to control the rate at which drying occurs when using artificial dryers since when beans are dried quickly at elevated temperatures the rate of water loss from the shells is faster than the rate of migration of acids from the beans to the shells. Consequently, water is evaporated and lost in preference to the acids which are concentrated in the cotyledons or nibs where they not only give rise to an excessively acidic taste but also, they inhibit the cocoa flavour forming reactions during subsequent drying and roasting. Moreover, excessive drying will result in cocoa beans that are brittle and break easily, causing a high proportion of waste and fostering lipolysis and FFA development.
In order to dry the beans effectively, with minimum exposure to contaminants, the following recommendations are made:

Drying surfaces/equipment should be located away from sources of contaminants and drying platforms should be elevated (ie the cocoa beans should not be spread out in direct contact with bare ground, tarmac or concrete floors) and protected from rodents, birds and livestock which can be a source of biological contamination.

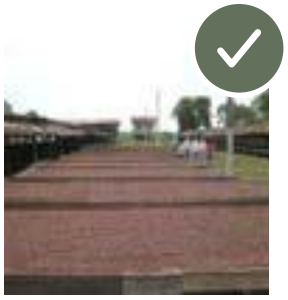
Platforms for sun-drying should be sited so that they receive maximum sun exposure and air circulation during most times of the day, to speed up the drying process.

The layer of drying cocoa beans should not exceed 6cm thick, (40 kg of wet cocoa beans per square meter of drying area) to avoid slow or inadequate drying and the beans should be turned several times (5 to 10) each day to ensure uniformly dried beans. This also provides an opportunity for defective beans to be removed.

The beans should be protected from rain or dew, by heaping and covering the beans at night and when rain threatens, and re-spreading once the drying surface has dried. There should be no mixing of cocoa beans at different drying stages and specific identification methods should be used in order to distinguish and identify each drying stage.

Where artificial drying is necessary, it is essential that wood fires and other forms of direct fuel burners are not used since these will result in smoky off-flavours and PAH contamination. Fuel-burning dryers must incorporate heat exchangers and be designed, operated and maintained so that combustion gas and smoke does not come into contact with the beans during drying or while the dried beans are being stored to prevent off-flavours and contamination by PAH and other mineral oil hydrocarbons.

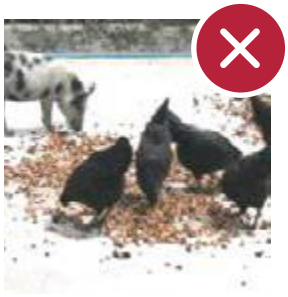
Smoke contamination and related PAH contamination are very obvious when beans are dried by wood fuelled kiln dryers. When direct fuel burners are used it may be less obvious that contamination has occurred, since there may not be the distinctive smoky aroma, but the beans may well be contaminated with PAH.



Sun drying on raised platforms.

Indirect fired artificial dryer.

Drying by roadside on tarmac.



Livestock feeding in and around cocoa drying on the ground.

Exposure to smoke during drying.

Fotos: D.Sukha.

KEY POINTS: DRYING

- ✓ Sun-dry where possible, but complement or replace with well designed and maintained artificial dryers where necessary.
- ✓ Dry cocoa beans off the ground so that they are not in direct contact with soil, tarmac or concrete and are inaccessible to animals.
- ✓ Ensure beans cannot be contaminated by smoke, fumes from dryers or vehicles.
- ✓ Protect beans from rain and dew (including covering at night).
- ✓ Turn the beans frequently but do not mix beans at different stages of drying.
- ✓ Dry for minimum of 6 days in the sun (<8% moisture).
- ✓ Control rate and length of drying period carefully when using artificial dryers to avoid high acidity levels and/or over-drying.

c) Storage

Before the cocoa beans are stored they should be sorted to remove any defective beans including those that are flat, shrivelled, black, mouldy, germinated, insect damaged, small and/or fused together. The cocoa beans should then be properly identified by lots, either at the farm level or in out-of-farm warehouses. Any bags used to store the cocoa should be labelled to indicate that they are suitable for food contact use, new, unused, clean and sufficiently strong and properly sewn or sealed to withstand transport and storage and discourage pest infestation. Moreover, in regions where cocoa production overlaps with allergenic crops (e.g. peanuts or sesame), new or cocoa dedicated bags must be used to avoid cross-contamination. Storage conditions for cocoa beans in the tropics are generally marginal, mainly because of high temperature and relative humidity, and therefore storage periods should not exceed three months unless special precautions are taken. The hazards to quality arising from storage in the tropics are mould development, both internally and on the shell, fat degradation, infestation and possible contamination from other stored products.

i) Mould development.

Dried cocoa beans can absorb moisture if the humidity is high. At 8% moisture content, cocoa beans are in equilibrium with the ambient relative humidity (about 70%) and normal temperatures in the tropics. Where the relative humidity exceeds this level for prolonged periods there is danger of internal mould development.

ii) Fat degradation.

Prolonged storage under humid conditions can also lead to a rise in FFA concentration. The normal FFA in the cocoa butter from beans which have been prepared correctly and exported without undue delay will be less than 1%. This compares with an EU limit for FFA in cocoa butter of 1.75%.

iii) Infestation.

Wherever cocoa is stored in the tropics it is liable to become infested with various types of moths, beetles and mites. Some of these pests have a life cycle of only a few weeks in the tropics and can rapidly increase in numbers. Pest monitoring and reporting by the workforce and the timely use of selected insecticides is an important part of an in-store integrated crop and pest management strategy. Cleanliness and good stock control are essential, but in some cases this will need to be supplemented by the careful use of insecticides and in the last resort by approved methods of fumigation. In the latter case, appropriate documentation accompanying the cargo should state in clear and correct terms the fumigants and the quantities that were used.

The construction and operation of a cocoa store helps to minimise the hazards that have been described. Such stores should be well-maintained to ensure they are kept clean, properly ventilated and weatherproof. They should have a concrete floor and walls of brick or concrete blocks. A wooden floor or walls should not be used because the spaces between the joints offer places where pests can breed. The doors and windows should provide adequate light and ventilation but exclude pests (birds, rodents, etc.). However, the cocoa should not be stored in direct sunlight nor near heating sources to avoid the possibility of temperature differentials and water migration.

Sacks should be stored on pallets off the floor. Wooden pallets should have a layer of protective polythene or plastic between the surfaces of the pallet and the first layer of sacks if the pallets have been treated with wood preservative containing phenols.

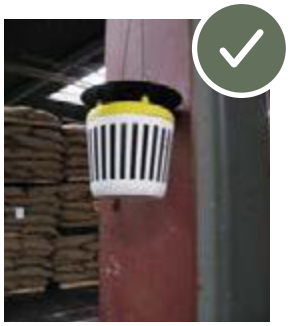
Extra care is required if such sheeting is used as condensation may occur on the plastic thereby damaging the cocoa. The stacks should not exceed 30 tons and should be separated from the walls to allow free access for inspection and sampling.

The use of battery powered or liquified petroleum gas (LPG) fueled forklift trucks rather than diesel oil in stores will reduce the risk of contamination from spillages of fuel and from fumes.

If and when fumigation is performed it should be carried out under expert supervision according to national requirements using well maintained gas proof sheeting of appropriately low permeability. Sufficient fumigant must be added and maintained for a sufficiently long period of exposure (at least 5 days for phosphine) commensurate to eradicate the particular pest species targeted. This is not only to ensure that the infestation is eradicated completely but also to minimise the amount of fumigant used and reduce the risk that the insect species develops resistance to the fumigant.

Quality testing in a warehouse at origin.

Warehouse in Europe.



Pheromone trap to monitor pest population.

Secondary mould due to excess moisture during shipping/storage.

Fotos: M.Gilmour, D.Sukha.

KEY POINTS: STORAGE

- ✓ Sort and remove any defective beans.
- ✓ Identify bean lots and manage stocks carefully.
- ✓ Use new, clean bags suitable for food contact use and do not use bags which have been used for other foods such as peanuts or sesame.
- ✓ Seal bags carefully to prevent infestation.
- ✓ Stores should be clean, weatherproof and well ventilated.
- ✓ Store sacks off the ground but protected from contact with wooden pallets that have been treated with wood preservatives.
- ✓ Ensure stacks are clear of walls to allow access for inspection.
- ✓ Ensure stores are not contaminated by fuel spills, exhaust fumes or smoke.
- ✓ Monitor pest levels and if necessary, treat with approved pesticides, or fumigate as a last resort, following GAP.

4. Quality Control

The quality of the cocoa beans in the bags must be checked before the cocoa is sold. This process is a crucial one as it can considerably affect the final price paid to the farmer. At this stage, the cocoa beans must fulfil certain criteria agreed in the contract, including the following: the cocoa must be properly fermented and dried; the cocoa must be free from any foreign odours; the beans must comply with limits in contents of slaty, flat, clusters, broken, mouldy, insect-damage, foreign matter and germinated beans; the cocoa must conform to the required moisture level; and there have to be a number of cocoa beans per unit weight (100 or 1000 grammes) (See Appendix A).

Currently, in many cocoa-growing regions quality control is performed by officials from cooperatives and local buyers. At this stage it is too late to rectify any shortcomings, nor perhaps, is it in the interest of the officials to recognise and pay adequately for any of the strengths of the cocoa. It is therefore highly desirable in the context of sustainable, modern cocoa production that farmers understand the quality parameters and are involved in the marketing of their produce. This will lead the cocoa growers to have a larger role in the quality control and allow any inadequacies to be addressed at an optimum moment. By taking on more responsibility for the quality of their own cocoa, the farmers may command better marketing opportunities. In such an approach of closer involvement of farmers in the cocoa production and marketing process, current important issues such as traceability could also be addressed.

KEY POINTS: QUALITY CONTROL

Check that the cocoa fulfils the criteria agreed in the contract. The cocoa must:

- ✓ Be properly fermented and dried;
- ✓ Be free from any foreign odours;
- ✓ Comply with limits in contents of slaty, flat, clusters, broken, mouldy, insect-damage, foreign matter and germinated beans;
- ✓ Conform to the required moisture level; and
- ✓ Comply with bean count requirements.

5. Transportation & Shipping Practices

Whenever cocoa is transported, it is important to ensure that the beans do not become wet and are not contaminated by other materials. Precautions that can be taken include:

Covering cocoa bean loading and unloading areas to protect against rain;

Ensuring that vehicles are cleaned from residues of previous cargos before they are loaded with cocoa (especially with regards to allergenic crops);

Checking that vehicles are well-maintained and the floor, sidewalls and ceilings (in closed vehicles) do not have points where exhaust fumes or rainwater could be channelled into the cocoa cargo. Tarpaulins and plastic canvas used to cover the cargo should also be regularly checked to ensure that they are clean and without holes; and

Reliable transport service-providers, which adopt the recommended good transportation practices, should be selected by operators.

a). Cargo Ship Loading & Transport

Cocoa beans are transported from producing to consuming countries in bags or in bulk, usually in 12.5 to 25 tonnes capacity containers. To avoid mould growth and therefore possible OTA formation, it is essential that precautions are taken to minimise the risk that moisture levels exceed 8% at any point from where the cocoa beans leave the loading area to the point at which the cocoa is unloaded, stored and/or subjected to other processing procedures such as roasting. Temperature fluctuations during shipping can cause condensation to form even within consignments of well-dried cocoa and so precautions are needed to prevent re-wetting and mould growth. The recommended practices during transportation in the port are:

1. Cover cocoa loading and unloading areas to protect against rain;
2. Check cocoa lots to ensure that they are uniformly dried and below 8% moisture content, free of foreign matter and conforming to the established defect levels;
3. Check containers before loading to ensure they are clean and free from residue of previous cargo. They should be well-ventilated, dry and without structural damage that could allow water to enter into the container. They should not have been used previously to carry chemicals or other materials giving off strong odours;
4. Bags should be well stacked and crossed over for mutual support in order to avoid the formation of empty vertical columns (chimneys). The top layer and sides of the container should be covered with materials that can absorb condensed water, e.g. cardboard, for protection against the growth of fungi that could result in OTA production. Additionally, a sufficient number of water-absorbing bags should be placed along the walls of the container. For cocoa in bulk, a sealable plastic liner (e.g. big bag which allows aeration) is desirable and this should be kept away from the roof of the container;
5. If possible, choose an appropriate place to site the cocoa aboard the ship so that the risk of temperature fluctuation and contamination is minimised (e.g. avoid unprotected stowage on the deck (top layer) and stow away from boilers and heated tanks or bulkheads). Ideally cocoa beans should be stored, segregated from other cargoes in one location of the cargo vessel. High-fire-risk materials, hazardous or poisonous chemicals, should never be stored with cocoa beans; and
6. Keep the ventilation holes in the containers free from clogging.

To avoid mould growth and therefore possible OTA formation, it is essential that precautions are taken to minimise the risk that moisture levels exceed 8% at any point.

KEY POINTS: SHIPPING & TRANSPORT

Protect cocoa from becoming wet and contamination from other materials:

- ✓ Cover loading/unloading areas to protect from rain.
- ✓ Ensure vehicles are well maintained and thoroughly cleaned.
- ✓ Ensure tarpaulins/covers are clean and free from damage.
- ✓ Ensure containers have not been used for chemicals or noxious substances, are well-maintained and clean.
- ✓ Ensure humidity levels are as low as possible by using ventilated containers if available and cardboard/kraft paper lining, with silica gel bags.
- ✓ For bagged cocoa: load bags carefully and cover with materials to absorb condensation.
- ✓ For cocoa in bulk: use a sealable plastic liner if possible and ensure it is kept clear of the roof of the container.
- ✓ Ensure ventilation holes in containers are free from clogging.
- ✓ Try to ensure cocoa is not exposed to temperature fluctuations or stored near to noxious materials.

Appendix A

Definitions
Specification of Quality Requirements & Standards

Definitions

Various standards have been developed to ensure that cocoa consignments can be assessed and classified using an agreed terminology and set of methods. Progress continues to be made in clarifying and harmonising these standards. The Federation of Cocoa Commerce (FCC) has recently updated its Quality Rules in order to take account of changes in the 2014 revision of ISO 2451, harmonise with the standards used by Conseil Café-Cacao and clarify some of the terminology used. The information on definitions and methods presented below has been extracted from the FCC Quality Rules (Applicable to contracts concluded on or after 01 June 2015)[3].

Adulteration
Means alteration of the composition of a parcel of cocoa beans by any means whatsoever.

Bean Cluster
Means two or more beans joined together which cannot easily be separated by using the finger and thumb of both hands.

Bean Count
Means the total number of whole beans per 100g derived from a test sample (a method is provided - see below for further information).

Bean Size Standards:
a) standard beans - means bean count ≤ 100
b) medium beans - means bean count 101-110
c) small beans - means bean count 111-120
d) very small beans - means bean count >120

Broken Bean
Means a cocoa bean of which a fragment is missing, the remaining part being more than half of a whole bean.

Cocoa Bean
Means a raw cocoa bean, which is the whole seed of the cocoa tree (*Theobroma cacao* L.)

Cocoa Related Matter
Means bean clusters, broken beans and associated fragments and pieces of shell which do not pass through the sieve.

Contamination
Means the presence of a smoky, hammy or other smell not typical to cocoa, or a substance not natural to cocoa which is revealed during the Cut Test or physical inspection of an Arbitration Sample.

Cut Test
Means the procedure by which the cotyledons of cocoa beans are exposed for the purpose of determining the incidence of defective and/or slaty cocoa beans, and/or violet or purple beans and/or the presence of contamination within an Arbitration Sample [a method is provided - see below for further information].

Defective Bean
Means an internally mouldy or insect-damaged bean.

Fair Average Quality
Means the quality specification for that season applicable to the cocoa origin referred to in the contract when the terms Good Fermented and Fair Fermented are not customarily applicable to that origin.

Fair Fermented
Means cocoa beans that are not more than 10% slaty and 10% defective by count.

Flat Bean
Means a cocoa bean which is too thin to be cut to give a complete surface of the cotyledons.

Foreign Matter
Means any substance other than Cocoa Beans, Cocoa Related Matter, Flat Beans and Sievings (Husk and placenta are to be considered as Foreign Matter).

Fragment
Means a piece of cocoa bean equal to or less than half a bean.

Germinated Bean
Means a cocoa bean, the seed germ of which has pierced the shell as evidenced either by the physical presence of the seed germ or by a hole in the shell following its detachment.

Good Fermented
Means cocoa beans that are not more than 5% slaty and 5% defective by count.

Insect Damaged/Infested Bean
Means a cocoa bean the internal parts of which are found to contain insects or mites at any stage of development, or to show signs of damage caused thereby, which are visible to the naked eye.

Main Crop
Means a cocoa parcel with a bean count consistent with that of beans normally produced during the main harvest period of that particular origin.

Mouldy Bean
Means a cocoa bean on the internal parts of which mould is visible to the naked eye.
(Mould is not to be confused with WHITE SPOT which is a concentration of theobromine or cocoa fat).

Sieve
Means a screen with round holes the diameter of which shall be 5.0mm min./max.

Sievings
Means the matter which passes through the Sieve.

Slaty Bean
Means a cocoa bean which shows a slaty colour on at least half of the surface of the cotyledons exposed by the Cut Test irrespective of texture.

Violet or Purple Bean
Means a cocoa bean which shows a violet or purple colour on at least half of the surface of the cotyledons exposed by the cut test.

Specification of Quality Requirements & Standards

Bean Count Allowances
For Main Crop, the following shall apply:

1. If the bean count is 100 or less, then the parcel shall not be subject to an allowance;
2. If the bean count is between 101 and 120 inclusive, the parcel shall be subject to an allowance;
3. If the bean count exceeds 120, then the parcel shall be replaceable or subject to an allowance.

Cocoa Related Matter
If the combined weight of the Cocoa Related Matter exceeds 3.5% of the weight of the whole arbitration sample the arbitrators may award an allowance.

Flat Beans
If the weight of the Flat Beans exceeds 1.5% of the weight of the whole arbitration sample the arbitrators may award an allowance.

3.5 Foreign Matter
If the weight of the Foreign Matter exceeds 0.75% of the weight of the whole arbitration sample the arbitrators may award an allowance.

Sievings Standards
If the weight of the Sievings exceeds 1.5% of the weight of the whole arbitration sample the arbitrators may award an allowance.

[3]Included with kind permission from FCC, see http://www.cocoafederation.com/ or contact fcc@cocoafederation.com for further information.

QUALITY ASSESSMENT

The quality of the parcel will be assessed in accordance with the following procedure:

1. A sample shall be drawn in accordance with the FCC Sampling Rules.
2. The Assessment of Sievings shall be conducted according to the methodology set out in Rule 5.
3. The Assessment of Cocoa Related Matter, Flat Beans and Foreign Matter shall be conducted according to the methodology set out in Rule 6.
4. The Assessment of Bean Count shall be conducted according to the methodology set out in Rule 7.
5. The Assessment of Defective and/or Slaty Beans and/or Violet or Purple Beans shall be conducted by a Cut Test according to the methodology set out in Rule 8.
6. The Assessment of Contamination shall be conducted during the Cut Test or physical inspection of the Arbitration Sample according to the methodology set out in Rule 8.

Quality tests for the Optional Quality Clauses must be conducted in accordance with the relevant methodology set out in Part 4 of these Quality Rules.

The Cut Test

The cut-test is the most common form of quality test used for cocoa beans. It is based on a visual observation of the cut surfaces of a sample of beans and an assessment of the numbers of defective beans. It is quick and easy to carry out, requiring little equipment or training, and can be used to infer some quality characteristics. It is important to note that these inferred quality characteristics can only provide an indication of the quality of the sample, with further checks needed to measure the characteristics more directly. Dand (Dand, 2010) provides further details of the procedure, the definition of the faults and the variations between the methods stated by the ISO standard 1114 (ISO, 1977a) and that used by the FDA (FDA, 1968).

In summary the ISO 1114 states that a sample should be taken, following the ISO standard 2292 for sampling (ISO, 1973) and 300 beans shall be opened or cut lengthwise through the middle, so as to expose the maximum cut surface of cotyledons. Both halves of each bean shall be visually examined in full daylight or equivalent artificial light. Each defective type of bean shall be counted separately, and the result for each kind of defect shall be expressed as a percentage of the 300 beans examined. ISO defines nine categories of bean defects, including those which may infer poor fermentation (slaty and violet/purple beans) or be indicators of high FFA levels, poor flavour and/or other contaminants (bean clusters, broken beans, smoky beans, mouldy beans, germinated beans, flat beans, insect-damaged/infested beans). However, only five of these are used in the grade standards (ISO 2451 for cocoa bean specification (ISO, 2014), namely mouldy, slaty, insect-damaged, germinated and flat (with these last three grouped together).

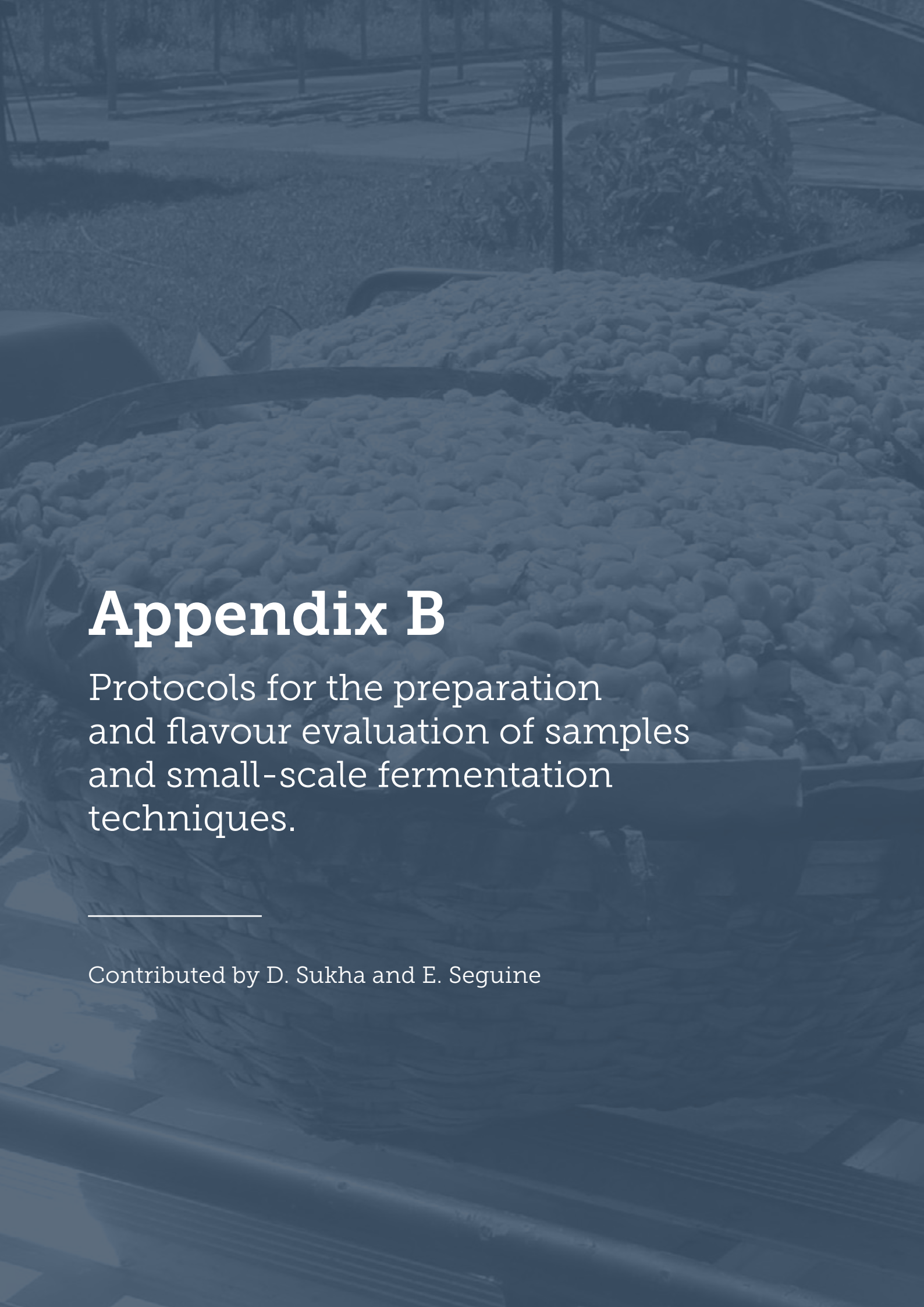
The FDA method involves the examination of samples of 100 beans which have been broken to expose their internal surfaces. Only three categories of fault are recognised; mouldy, infested, or both infested and mouldy.

The FCC has developed definitions for defective beans (insect and/or mouldy), slaty beans and germinated beans though the latter category is not used in standard contracts. Both ICE Futures Europe and CME Europe futures contracts adopt the same categories for mould and/or insect damage and slaty beans identified by the cut-test.

Bean Count

Another commonly used quality test is the bean count which determines the average number of whole cocoa beans that weigh 100 g. The recently revised ISO 2451 cocoa bean – specification standard (ISO, 2014) ie provides methods to assess the bean count of a test sub-sample of at least 600 g that has been prepared according ISO 2292 cocoa bean – sampling (ISO, 1973) and sieved through a screen with 5 mm diameter round holes. Any residue, foreign matter, flat beans and bean clusters are then removed and weighed, and an equivalent mass of whole beans taken from the whole sample is added. Here “residue” refers to any cocoa element other than whole cocoa beans, flat beans, and clusters which does not pass through the sieve (broken beans, fragments and pieces of shell) with the exception of husk or placenta which is considered as “foreign matter”. The total number of beans is then counted and the result expressed using the formula:

$$\text{Bean Count} = \frac{\text{Number of whole beans} \times 100}{\text{Mass of whole beans (g)}}$$



Appendix B

Protocols for the preparation and flavour evaluation of samples and small-scale fermentation techniques.

Contributed by D. Sukha and E. Seguine

Introduction

Chocolate manufacturers and users of other cocoa products will each have their own criteria to assess flavour quality. Procedures for detecting specific off-flavours in cocoa liquors, such as smoke, mould and excessive acidity have been published (IOCCC, 1996) and were included in an abbreviated form in the previous edition of this guide (BCCCA, 1996). There are also procedures, both from IOCCC (now ICA) and ISO, for other aspects of cocoa quality assessment viz. ISO 2451:2014; ISO 2292:1973 and ISO 1114:1977. However, at that time, there was little agreement within the industry on how flavour notes (other than off flavours) could be assessed due to the different terminologies and interpretations in use. Moreover, many of these flavour notes would be lost if the high temperature roasting conditions advocated in the IOCCC method were used to prepare the samples.

Over the past twenty years, however, there has been a growing awareness of intrinsic flavour attributes as well as the need to confirm the absence of defects flavour in cocoa samples. To this end, there have been a number of international initiatives to identify interesting flavours and gain an understanding of the influences of genetic, environmental and post-harvest processing. An important aspect of these initiatives was the development of common protocols and terminology so that flavour evaluations could be carried out to the same standard by different institutions or companies. The protocols presented in this section have been developed by partners in these initiatives from both the cocoa industry and research institutions and are designed to enable flavour assessments to be made using small-scale or basic laboratory equipment.

Guidance is also included on appropriate post-harvest methods to use when only limited quantities of fresh cocoa beans are available, for example in breeding programmes and other research and development activities and on how to train sensory panels.

These protocols have been adopted by two international initiatives, the Cocoa of Excellence Programme (CoEx) (http://www.cocoaofexcellence.org/) and Heirloom Cacao Preservation Initiative (HCP) (http://www.finechocolateindustry.org/hcp), since they are eminently suitable for use on the small samples of beans (3 kg) that are submitted for evaluation. The protocols could also be adopted by those looking to introduce flavour quality assessment for research or monitoring purposes at larger cooperatives and estates, government offices, research stations/institutes in producing countries and, of course, by manufacturers.

1. Guidance on post-harvesting processing techniques suitable for use where limited quantities of beans are available.

Both the Cocoa of Excellence Programme and HCP recommend that commercial samples are harvested, fermented and dried according to best local practices.

Both the Cocoa of Excellence Programme and HCP recommend that commercial samples are harvested, fermented and dried according to best local practices. The methods used will depend on the genetics of the planting material, local environmental conditions, technologies and facilities available. Further information on some of these factors can be found in Part III. Typically, fermentations require in the order of 50kg of wet beans, but the following guidelines can be used to prepare samples for flavour evaluation where more limited quantities of beans are available.

Harvesting, Pod-breaking and Bean Extraction for Small-Scale Fermentations.

The guidelines provided in Part III Section 2 should be followed to ensure that only fully mature, ripe but not over ripe, non-diseased pods are harvested. Where the Batch insert micro fermentation method is to be used to ferment a sample of beans enclosed within a mesh bag within a larger fermentation mass, it is important to ensure that the pods to provide beans for the surrounding fermentation mass are harvested on the same day as the sample pods.

Fermentation.

Fermentations of samples for flavour testing can be achieved in different ways but regardless of method used, should be carried out in a covered and sheltered space providing adequate protection against rain, wind and direct sunlight and should start immediately or within six hours after the beans have been extracted as detailed in Part III Section 3a. The timing of turning(s) or mixing of the fermentation mass, and the optimal endpoint of the fermentation will vary according to the variety. For most "Forastero" and Trinitario types the first turning will be at 48 hours, with a second turning at 96 hours, and the optimal end point is likely to be between 120 – 168 hours. Fermentation times for Criollo varieties could be as short as 48 hours with no turning or one turning after 24 hours. Regardless of variety, optimal end point can be assessed visually by cutting a few beans and looking for well defined internal ridging (Figure B.1).

Figure B.1 Beans at the end of fermentation showing well defined internal ridging.
Foto: D. Sukha.

Batch insert micro fermentations.

This technique can be used to ferment samples of beans contained within a mesh bag (also referred to as a "net" bag) within a larger fermentation mass, The size of the mesh bag can be adapted according to the amount of beans available, and the technique has been used successfully for samples ranging from approximately 200g to 3000g, though samples of approximately 750g to 1000g are typical. It is important to keep the surface area to volume ratio of the fermentation mass constant and this can be achieved with heaps, baskets or fermentation boxes of at least 50 kg capacity. Baskets made of woven rattan with dimensions of approximately 38-50 cm diameter by 48 cm deep, can be used for this purpose. Good results have also been obtained using inverted plastic laundry baskets of similar dimensions which have had their bases removed and been strengthened with rattan hoops. Fermentation boxes 60 x 60 x 60 cm (200 kg capacity) or 90 x 90 x 90 cm (700 – 900 kg capacity) can also be used.

These should be made of suitable non-resinous, hardwood with slats with gaps large enough to allow drainage of the fermentation exudates (known as "sweatings") whilst small enough to prevent beans from passing through.

The bean sample for evaluation must be placed in labelled bags, made of an inert material such as nylon or polyethylene with no metal parts, and are of approximate size 20 x 35 cm to allow a layer 2-3 beans thick when spread flat in the fermentation box. A mesh size opening of 10 mm mesh allows good contact between the sample and the fermentation mass and the thread diameter should be 0.7 mm or greater for strength. As a cautionary point, there could be a risk of flavour transfer from the fermenting mass to the micro fermentation in the mesh bag. This possible fermenting mass effect could be overcome by using similar varieties for the fermenting mass as the sample in the mesh bag and/or by using a finer (<10 mm) mesh size opening.

It is important that each mesh bag is not overfilled and that there is enough spare capacity to allow the bag to be held at each end to facilitate turning. The label on each mesh bag must contain information relevant to the sample such as (but not limited to) the clone name, the date of the start of fermentation etc.

Mesh bags should be buried in the top 15 – 20 cm of the fermenting mass ensuring that each bag is at least 5 cm from the wall of the box and separated from other bags by at least 3 cm. A maximum of two layers of bags, with four bags per layer, can be included but there must be at least 3cm of fermentation mass between the layers and the top layer must be covered by at least 5cm of beans. The top of the fermentation must be covered by at least two layers of banana leaves and then two layers of food grade jute bags for insulation.

The first turning is done after 48 hours by removing the jute bags and leaves, then transferring the top of fermentation mass into a food grade plastic box or bucket. Each layer of fermentation mass and mesh bags as well as the bottom layer of the fermentation mass are placed into separate plastic boxes or buckets and are thoroughly mixed. The beans in the mesh bags are mixed by holding the ends of individual bags in each hand shaking them from left to right a few times. The layers of beans and mesh bags are replaced in reverse order so that the top layer moves to the bottom and the bottom layer is at the top, whilst the central layer remains in its original place, and the mass is re-covered with the banana leaves and jute bags. The second turning is done after 96 hours by repeating the process and the optimal end point determined by visual assessment of the beans as described above.

Figure B.2 Small scale fermentation using adapted laundry baskets.
Foto: M.Gilmour.

Figure B.3 Small scale fermentation using baskets.
Foto: D.Sukha.

Figure B.4 Beans enclosed in a mesh bag for batch insert fermentation.
Foto: D.Sukha.

Styro-cooler Fermentation.

Styrofoam coolers of dimensions 27 cm (L) x 26 cm (W) x 17 cm (D) or 44 cm (L) x 28 cm (W) x 29 cm (D) respectively are a convenient way to ferment small (between 15 – 30 kg) bean quantities from the same variety or a defined mixture of varieties. Styrofoam coolers are relatively cheap and easily available in most countries. Six to eight holes evenly spaced at 4 cm and of diameter 1.5 cm are made on the underside to facilitate the drainage and aeration of the fermenting mass. It is recommended that the coolers (regardless of size) are placed off the ground (on small blocks of wood) to allow for optimal drainage and aeration.

New coolers can be inoculated artificially with a defined micro-floral matrix at particular time intervals, scrapings from a used fermentation box (preferred) or left to be naturally inoculated by fruit flies. Inoculation from a used fermentation box is achieved by taking scrapings from the inside top and bottom surfaces and mixing in double the volume of water (distilled water is best) to create a paste. This paste is thoroughly mixed into the wet beans when they are filled into the cooler at the start of fermentation to evenly distribute the inoculum from the used fermentation box throughout the fresh wet bean matrix. This is then covered with banana leaves and the matching Styrofoam lid to retain the heat given off during fermentation. The beans are generally turned by mixing well after 48 hours and 96 hours and the optimal end point is determined by visual inspection.

Figure B.5 Styrofoam box microfermentation.
Foto: N. Ali.

Single Pod Micro Fermentation.

There are currently a number of patented ways to achieve single pod micro fermentation which allows for preparation of samples from an individual tree and for working with wet bean samples weighing less than 1 kg. Almost all use a starter culture mixture of some sort, either obtained from a previous fermentation (for example, from scrapings taken from a fermentation container or sweatings) or using a pre-defined inoculum matrix, and added at different times. One method adds aromatic substances during fermentation whilst another physically pierces the beans before fermentation. Each will be briefly mentioned citing the appropriate Patent publication number reference for further reading:

Single pod micro fermentation processes:

WO2013025621 A1 (Seguine, E; Mills, D.; Marelli, J-P.; Motomayor-Arias, J-C. and Silvia Coelho, I.)

Starter cultures and fermentation method:

WO2007 031186 A1 (De Vuyst, L. and Camu, N.)

i. Microbial composition for the fermentation of cocoa material: EP 2459699 A2 (Camu,N.; Bernaert, H. and Lohmueller, T.)

ii. Method for fermenting cacao beans: WO 2014087816 A1 (Kawabata, Y.)

iii. Augmentation de la qualité et de l'arôme du cacao en utilisant une culture starter de levure pichia kluyveri pour la fermentation du cacao: WO 2013064678 A1 (Saerens, S. and Swiegers, J.H.)

Processing cocoa beans and other seeds:

US 20120282371 A1 (Robert Miller, C.)

Process for the fermentation of cocoa beans to modify their aromatic profile:

WO 2009103137 A2 (Dario, A. and Eskes, A.B.)

Improved cocoa fermentation via de-pulping:

EP 0442421 B1 (Bangerter, U.; Beh, B.H.; Callis, A.B. and Pilkington, I.J.)

Plant for the fermentation of vegetable or agricultural products such as cacao beans, and process for carrying out such a fermentation:

EP 0343078 B1 (Barel, M.).

Recommended application of fermentation methods.

The method chosen from the options provided above should be appropriate to both the quantities of wet bean available as well as the objectives of the study. The styro-cooler method is used for homogenous or defined bean masses and takes more beans than the batch insert micro fermentation method. The batch insert micro fermentation allows more samples to be processed but requires larger fermentation masses (mother heaps/boxes) to insert the mesh bags into. There is also the potential risk of some flavour transfer from the larger fermentation mass. Single pod micro fermentations handle small quantities without contamination but suffer from the lack of averaging a larger number of pods. Each method used therefore has advantages and disadvantages which must be considered and weighed against the benefits derived from using a particular method.

Drying:

The beans should be carefully and thoroughly dried. Further guidance on best drying practices is provided in Part III Section 3b. Where the batch insert microfermentation method has been used, the samples can be dried in their mesh bags though care should be taken that the beans are not spread in a one bean thick layer on a drying tray, since this would result in drying at too fast a rate due to full exposure of all beans both to air as well as to the sun. Samples from Styrofoam container fermentations should be dried in small heaps. All samples, including those in mesh bags, should be heaped up at night to allow moisture levels to equilibrate.

It is essential that when many samples are being prepared at the same time (such as with multiple batch insert micro fermentations) they are not mixed up during drying and trays with individual labelled cells or separations can be used to minimise this risk. The optimal end point of drying should be between 6.5 – 8% moisture content as assessed by a suitably calibrated moisture meter.

Figure B.6 Beans from microfermentations drying in a compartmentalised tray.
Foto: D. Sukha.

2. Flavour Evaluation.

The flavour evaluation protocols described here are applicable whether the samples have been processed using one of the small-scale fermentation methods described above or have been produced commercially.

Aging and storage of beans.

Freshly fermented and dried beans usually have: a)very strong fruit notes that are very volatile, b) lower cocoa flavour notes, c) higher acidity (especially acetic acid), and d) a range of possible off notes (such as yeasty, musty and other odd notes). Therefore it is recommended that the bean samples are stored for a period of time to “age” before they are transformed into liquor.

Aging for between 6 – 12 weeks improves stability, makes the samples more representative of commercial shipments and facilitates optimal expression of the true flavour potential of the beans. Beans should be stored in a new, clean bag suitable for food use and made from a breathable material such burlap, jute, or cotton. It is important that any bags used to store the beans are odour-free to ensure that the material used does not impart any off-odour or flavour to the beans as a result of storage.

It is important that the beans are stored carefully under conditions where they will not suffer from mould damage, infestation by pests or contamination from other samples or substances which could cause taints or pose health risks (See Part III Section 3c).

Physical quality assessment via cut test can be carried out during this time to visually assess fermentation progression and bean fissuring using appropriate representative sampling protocols and assessment charts (See Appendix A).

i) Roasters

There are many options available for roasting samples for flavour testing. These include:

- Static oven tray roasters such as table top toaster ovens and home ovens.
- Converted small scale rotary type coffee roasters and rotisserie ovens.
- Lab scale non ventilated box ovens.
- Mechanically ventilated convention ovens.
- High efficiency convection ovens.

The heating systems in these various roasting options vary from electric elements to infrared heaters with or without air or ventilation control and temperature or timer settings. At the very least, there should be some form of either temperature or timer control.

Critical factors for the most optimal roasting method to prepare samples for flavour testing include:

- Thermal uniformity of the air flow throughout the oven cavity unloaded and loaded.
- Thermal recovery time from door opening to set point.
- Air volume movement through a circulating fan.

ii) Roasting trays

Roasting trays should be a wide mesh stainless steel (preferred) or non-treated, mild steel wire mesh tray with mesh size small enough to prevent beans from falling through but large enough to promote optimal air flow across the beans. Galvanized or plastic coated screens should not be used to construct roasting trays. Rotary type ovens should have either mesh screen or evenly perforated drums. Solid drums are not recommended. Loading and unloading should also be uncomplicated and allow for complete discharge and cleaning which is always necessary to ensure uniformity of air flow.

Ideally, static tray ovens should be loaded with a single, wide mesh screen tray. Beans should be loaded as a single bean depth across the loading area. Where there is insufficient sample to fill the tray, filler beans should be used so that all roasts are carried out with the same bean loading. It is important to note that filler beans cannot be used to ensure uniform charge size for rotary drum roasters and so these are limited to applications where sufficient beans are always available.

iii) Roasting conditions

Roasting conditions should be chosen to maximize the flavour potential for each type of cocoa bean and would need to be mapped according to temperature, time and loading capacity for each variety and for the specific type of roaster used.

Typically the following is used and suggested as a starting guide for individual roast mapping using a convection tray roaster:

- Trinitario Types - 120°C for 25 minutes
- “Forastero” Types - 130°C for 25 minutes
- Ancient Criollo Types - 112°C for 25 minutes

Time is measured starting from 2°C below the set point. Note that these times are based on an oven recovery time of 5 – 7 minutes from the time that the door is closed to 2°C below the set point.

Most modern Criollo types will usually be roasted following the Trinitario conditions as they are generally much closer genetically and in terms of processing requirements to traditional Trinitario beans.

Roasting conditions should be selected that will promote the expression of the intrinsic fruity and floral ancillary flavours of Trinitarios whilst preserving the delicate the nutty/ caramel notes of Criollo types. The roasting conditions for “Forastero” should seek to bring out any ancillary flavours as well as the maximum cocoa / chocolate base flavour inherent in these types.

Both bean size and moisture content of the beans prior to roasting are important considerations and samples with very low moisture contents (<6.5%) or very high moisture contents (> 8.5%) may require adjustment to be made to the roasting conditions to ensure a standardized roast for flavour evaluation. Similarly, beans may need to be sorted for size consistency before roasting. As long as bean size is in the range of 70 – 130 beans / 100 g, the roasting conditions should not need adjustment for bean size.

Breaking and Winnowing.

Optimal fermentation and roasting have a direct impact on breaking and winnowing performance. Under-fermented and low-roasted beans tend to have shell that adheres tightly to the nib and makes efficient breaking and winnowing difficult.

Breaking and winnowing should occur immediately following cooling of the beans after roasting (usually between 20 – 60 minutes) for efficient breaking and to ensure that no off-flavours are picked up from the environment. Cooling to room temperature can be done on an elevated rack or by using a small fan to accelerate the cooling process. The area where sample preparation is done should be neutral smelling.

Note: prior to roasting, the beans are considered to be a raw agricultural product that is likely to be contaminated with large numbers of microbes, potentially including pathogens. Roasting conditions should ensure the killing of pathogens, though samples should be checked for presence of pathogens prior to sensory analysis. It is essential that precautions are taken to prevent cross-contamination between raw and roasted beans as part of an active HACCP programme to ensure the wholesomeness of any products which will be tasted.

Where only a few samples are to be processed, breaking and winnowing can be done most simply by placing cooled beans in a high quality snap seal bag, removing as much of the air as possible and using a rolling pin to lightly break the beans. Afterwards a home use hand-held hairdryer can be used to blow off the free shell from the nibs in a flat tray in a well ventilated area. Higher throughput sample preparation for flavour evaluation will require at least a mechanised winnowing system. Industrial winnowing systems include mechanisms to adjust airflow to the size of the nib/shell particles (a process known as “sizing”) to optimise shell separation. Laboratory scale mechanised individual cocoa breakers and winnowers are available but since the broken nibs/shells are not “sized”, separation is less efficient with nib yields frequently as low as 62 – 78% of the starting raw beans. This is an important point in planning the sample size of beans needed for the roasting process in order to meet the volume needs for flavour evaluation.

Since winnowing is generally less efficient in laboratory systems, it is recommended that the residual shell in the winnowed nibs (including both loose shell fragments and pieces of shell adhering to a piece of nib) be manually removed with tweezers to take the shell content to effectively zero. This ensures low contamination from residual shell with an additional benefit of producing liquors which have much lower levels of microbiological contamination (ie extremely low Standard Plate Counts/Total Plate Counts) since most of the microbes reside on the shell.

Nibs will pick up both environmental humidity as well as off flavours if they are present in the environment, therefore storage of nibs following winnowing and before hand picking as well as after hand picking should be in airtight storage containers or in high quality snap seal bags suitable for food use.
Nib samples deteriorate quickly and every effort should be made to convert them to liquor within 48 hours of roasting. Where necessary nib samples can be stored for a maximum of seven days at 10-24°C in sealed bags.

Liquor Milling.

There a number of options available for milling nibs into liquor and these include:

- Table top liquidizers for coarse grinding and coarse liquor milling (up to 100g of nibs).
- Table top and free standing mortar and pestle mills of varying capacities (100 – 500g of nibs).
- Laboratory scale melangeurs capable of handling from 200g up to 2.5 kg of nibs.

It is important that the nibs should be gently warmed (not more than 40°C) before milling and equipment such as bowls, pestles, and the stones from melangeurs should be pre-warmed to ensure that the cocoa butter in the sample melts and facilitates liquor grinding. The temperature of the milling mass can be measured using an infrared thermometer and should remain below 55°C. Above this temperature, volatiles are lost at a substantially higher rate—similar to what would occur in full conching. By holding the temperature below 55°C the liquor displays the inherent flavour of the beans without being stripped or reduced as it would be in conching. Should the temperature of the mass rise above this value, the room can be ventilated (cooled) or the mill can be turned off to allow the sample to cool off.

Regardless of the milling equipment used, particle size, as determined by a micrometer, is a critical parameter in determining milling end point. A particle size range between 14 – 25 microns is optimal for effective flavour evaluation since it ensures that all the volatiles in the sample will have been released and that there is no grittiness in the sample which would distract the taster during the flavour evaluation.

The temperature of the milling mass can be measured using an infrared thermometer and should remain below 55°C. Above this temperature, volatiles are lost at a substantially higher rate.

Chocolate Making.

It is often desirable to evaluate how liquor flavour potential translates in to chocolate where the interplay of sugar and other ingredients in the matrix is important in holistically assessing the full potential of a bean sample. Additionally, cocoa liquor tasting is more technically challenging to perform compared to chocolate evaluation since acidity, bitterness and astringency are sometimes dominant attributes. Often the liquor alone does not display the full flavour potential that will be present in the chocolate and sometimes flavours that are present in the liquor are not present in the chocolate and vice versa.

The recipe used in chocolate making for this purpose is important and standard formulations range between 65 – 70% cocoa mass with 2 – 10% added deodorized cocoa butter used. Recipes that have been successfully used for semi-sweet chocolate evaluations internationally in both the Heirloom Cacao Preservation (Recipe 1) and Cocoa of Excellence (CoEx)(Recipe 2) initiatives as well as an average recipe from SeguineCacao (Recipe 3) include:

The cocoa butter, sugar and soya lecithin used must be neutral tasting to avoid influencing the flavour inherent in the liquor. Sugar can be evaluated by placing a 50 – 120 g sample in a jar large enough to hold at least twice that amount, securely capping the jar and warming it to 50°C. It should be held for at least 1 hour at 50°C then uncapped and immediately smelled. An acceptable result is a sugar that has no inherent odour.

The chocolate should be refined to less than 20 microns measured using a micrometer. Conching at a low temperature (not more than 55°C) should be kept to a minimum, if used at all, to retain the intrinsic flavour potential of the bean whilst gauging its performance as a chocolate.

Ingredients	Recipe 1 (%) ingredients	Recipe 2 (%) ingredients	Recipe 3 (%) ingredients
Chocolate liquor	65.10	61.00	55.00
Deodorized cocoa butter	3.00	5.00	10.00
Sugar	31.55	33.65	35.00
Soya lecithin (double bleached)	0.35	0.35	0.35

Tempering.

Chocolate samples for flavour evaluation can be assessed as either un-tempered or tempered pieces. Tempering produces a uniform sheen, sharp ‘snap’ and crisp ‘bite’ in the chocolate pieces and results from consistently small/dense cocoa butter crystals in the product.

The fats in cocoa butter can crystallize in six different forms (identified using Roman numerals I to VI) at different temperatures and each of the six different crystal forms has different properties. Well tempered chocolate has the largest number of the smallest sized type V crystals possible which provides the best appearance and texture. Type V crystals are also stable so texture and appearance will not degrade over time.

The careful manipulation of temperature during the cocoa butter crystallization process to accomplish tempering can be achieved a) manually using a marble slab, b) using a double boiler and c) using a small table top tempering machine.

Regardless of the equipment used, the chocolate must first be heated to 45 °C to melt all six forms of crystals. Next, the chocolate is cooled to about 27 °C which will allow crystal types IV and V to form. At this temperature, the chocolate is agitated to create many small crystal “seeds” which will serve as nuclei to create small crystals in the chocolate. The chocolate is then heated to about 31 °C to eliminate any type IV crystals, leaving just type V. After this point, any excessive heating of the chocolate will destroy the temper and this process will have to be repeated. Moulding and cooling into small bars or pieces immediately follows tempering.

Refrigerators and air conditioned rooms are often used to cool filled chocolate moulds but both need to be checked prior to use to ensure they are neutral smelling and do not contain any off odours.

Chocolate (particularly semi-sweet chocolate) will change its flavour profile over time, particularly mellowing with long term storage. While this is recognized, it may not be practical to hold the chocolate 2-4 months following creation to allow this to happen before assessment.

Flavour Testing.

Flavour testing or sensory evaluation is defined by the Institute of Food Technologists (IFT) as "...a scientific method used to (1) Evoke, (2) Measure, (3) Analyse, and (4) Interpret those responses to products as perceived through the senses of sight, smell, touch, taste and hearing" . From this definition one can infer that the same rigour and attention to detail placed on sample preparation must be extended to the flavour evaluation process for both liquors and chocolates.

Flavour Testing - "A scientific method used to (1) Evoke, (2) Measure, (3) Analyse, and (4) Interpret those responses to products as perceived through the senses of sight, smell, touch, taste and hearing".

Flavour assessment of both liquors and chocolate take the following formats:

- Evaluation by a panel of trained tasters for presence or absence of defects.
- Evaluation by a panel of unskilled tasters using Hedonic preference indicators.
- Evaluation by a panel of skilled tasters providing both quantitative and qualitative assessment (including presence or absence of defects), as well as an overall global quality or preference score.
- Evaluation by a single or few highly skilled tasters providing both quantitative and qualitative assessment (including presence or absence of defects), as well as an overall global quality or preference score.

Each flavour assessment format identified above has a direct implication on the amount of sample needed, the size of the panel and number of repetitions of tasting required for a robust dataset based on the inherent purpose and need of the evaluation exercise. Critical elements in this process therefore include:

- Tasting area and layout
- Panellist training or experience
- Tasting design and/or sample randomization
- Sample presentation
- The evaluation process
- Flavour descriptors - interpreting the results

Tasting area and layout.

Ideally, flavour testing should be carried out in tasting booths with appropriate light and temperature control etc. This set up could be prohibitively expensive and a simple air-conditioned room that is clean, free from distractions and strong odours with a large enough table for the panellists is often sufficient. There should however, be easy access to a sink.

Panellists should not be distracted when tasting so the layout of the room (location of samples, water and expectorant cups, scoring sheets and pencils etc.) should be the same each time.

Panellists should also consider the following guidelines carefully and try to put them into practice whenever they participate in a tasting session:

Panellists should neither smoke nor drink alcohol or coffee, nor eat food which will alter their sense of taste, nor undertake prolonged periods of strenuous exercise within 60 minutes prior to a tasting session.

The use of strong scents, perfumes and aftershaves should be avoided by panellists and anyone else involved in the setup of the tasting area or sample handling. Hands should be washed prior to tasting using perfume-free soap.

Any instructions handed out at tasting sessions should be read carefully and understood before commencing. Panellists should feel free to ask any questions if they are unsure about the instructions.

Any persons suffering from colds should not attend or participate in tasting sessions or set up.

Panellists should avoid talking until everyone has finished tasting.

Panellists should strive to be independent tasters by following their first instinct about a particular flavour attribute and trust in their ability.

Panellist training or experience.

Some form of intensive training is required for cocoa liquor assessments whilst training for chocolate assessment is very desirable. Only Hedonic (preference tasting) can be done with an untrained panel.

A detailed guide for panellist training and selection for flavour testing is given in Sukha et al (2008). As a summary, sensory panellists can be trained in identification of basic tastes using aqueous solutions such as sweet (sucrose at 5.0g/500 mL), bitter (quinine chloride at 0.072g/500 mL), salt (sodium chloride at 0.8g/500 mL), acid (citric acid at 0.25g/500 mL), astringent (maleic acid at 0.25g/500 mL) as well as flavour attributes associated with cocoa liquor (fruity and floral at a concentration of 2 mL/500 mL of kola flavour and orange blossom water, respectively). This can be followed by identification of acid, bitter and astringent tastes at threshold level concentration using citric acid, quinone chloride and maleic acid (at 0.1, 0.009 and 0.15g/500 mL, respectively) in solutions to gauge the sensitivity of individuals to these attributes.

A critical element of panel training is flavour association to flavour descriptors and after the initial taste identification part of training, panellists can now progress to associate specific flavour descriptions for cocoa liquors with either previous taste experiences or with flavour references provided so that all panellists gain agreement on the same sensory language. Nine core flavour attributes can be considered in initial training viz. cocoa, acid, astringent, bitter, fruity, floral, nutty, woody and spicy flavours. In addition identifiable off-flavours such as smoky, hammy, mouldy and unfermented can be included. Panellists should also be encouraged to identify any other ancillary flavours or defects that are apparent in the cocoa liquors, (recorded under 'other' flavours).

Training for chocolate tasting should include an exposure to a wide variety of different origin chocolates to build a mental library of associations linked to key chocolate flavour descriptors.

Tasting design, sample randomization and presentation.

Liquors should be assessed by a panel of at least six trained individuals using a factorial statistical design that incorporates hidden reference liquors. Liquors should be coded with three-digit numbers and randomised over three repetitions to minimise carry-over effects. Prior to panelling, bring liquor samples to room temperature. Label small plastic soufflé cups with random 3-4 digit numbers to ensure that all flavour evaluations are blind. Cover the cups with the matching tight fitting lids. Prepare three replicates of each sample and assemble into sets of 18 samples for each panellist. Place randomly ordered samples in a dry-bath incubator or clean box or convection oven set at 55-60°C for 20 minutes prior to flavour evaluation and taste with a timer marking 10 minutes between flavour evaluations. No two panellists should receive liquors in the same order for any given evaluation session and a maximum of six liquors should be tasted in any one session to prevent panellist fatigue.

Chocolates can be evaluated in the same way as either solid blocks or pieces melted at 45^{o}C. Evaluation using solid blocks is recommended unless an assessment of the melting performance on the palate is not important.

The evaluation process.

Place about 1 ml of cocoa liquor on a small spatula and place directly on the tongue and keep it there for 20 seconds. During this time the different attributes making up the flavour profile become apparent at three contiguous time intervals viz. initial front flavour notes, middle flavour notes and residual end flavour notes. Panellists should note that some flavours either appear or disappear very quickly or are easily masked whilst other flavours could linger for a longer time with distinct after tastes. Score the intensity of the flavour attributes for each flavour descriptor using 10-cm line scales with a possible range of scores from 0 to 10 where the higher numbers denoted stronger flavour intensities. After liquor evaluation, the following clearing procedure is used:

- Expectorate the sample
- Rinse with warm water, expectorate rinse water
- Chew 1/8 – 1/6th of a Table Water Cracker Wafer (non yeast based) with the front incisors and not the molars and swallow
- Rinse with warm water, expectorate rinse water
- Rinse again with warm water this time swallowing the rinse water

The performance of the sensory panel can be optimised during evaluations by including a hidden reference samples to check panellist consistency between repetitions during training and evaluation sessions.

Flavour descriptors - Interpreting the results.

One of the most difficult parts of flavour testing of both liquors and chocolates is finding the right words to describe the perceived flavours, especially since this relies heavily on a mental association to the flavour descriptors. Glossaries of flavour descriptors with comments and flavour wheels have been developed to group terms used to describe the flavours and can be used by panellists to ensure they use a common language when describing their perceptions and to aid in the interpretation of results.

Having a Global Quality indicator in the flavour testing for both liquor and chocolate is very useful as it goes beyond simple attributes of the sample but is intended to reflect an overall attribute standing. It should not be a score derived using a formula or calculation from the attributes but stands on its own for each evaluator to indicate their impression of overall quality.

Glossary of Terms

Glossary of terms for flavour evaluations (for both liquor and chocolates) with some matching descriptors and examples of some origins/reference notes for calibration (Seguine & Sukha, Glossary of terms for flavour evaluations (for both liquor and chocolates) with some matching descriptors and examples of some origins/reference notes for calibration, Cocoa of Excellence Edition 2015., 2015a)

Flavour Descriptor	Matching descriptors with comments
Cocoa	Describes the typical flavour of cocoa beans that are well fermented, roasted and free of defects - chocolate bars, fermented/roasted cocoa.
Acidity	**Citric acid** - Fruit **Acetic acid** - Vinegar (you can smell it in the sample) **Lactic acid** - Vomit like, like in sour milk or molasses **Mineral acid** - Metallic tasting
Bitterness	Usually due to a lack of fermentation; perceived on the back of the tongue/throat – Caffeine (Coffee), Beer, Grapefruit
Astringency	Usually due to a lack of fermentation; mouth drying and/or puckering effect which boosts the production of saliva; perceived between tongue and palate or at the back of the front teeth. – raw nut skins, Banana skins, some wines
Sweet	Describes liquors with a characteristic flavour of unrefined caramelised cane juice (Panela). – Caramel, brown sugar, fudge
Fresh Fruit	Broad range of fresh fruits: **Fruit berry** - currants, not fully ripe raspberry. **Fruit citrus** - essence of citrus. **Fruit tropical** - banana, passion fruit, orange, almost always some citrus note involved.
Browned Fruit	**Fruit dark tree** - plum, dark cherry. **Fruit dried** - dried apricot, banana etc. caramelization of fruit sugar, essence of a fruit that has undergone the drying process, sulphur and nutty notes also. **Fruit over ripe** - beginning of over fermentation, over ripe fruit as a step to over fermentation. **Fruit brown** - prunes or dates.

Flavour Descriptor	Matching descriptors with comments
Nutty	**Nutty** - nut meat **Nut skins** – associated with some astringent sensation like skins of almond and peanuts etc.
Floral	Broad range from green grassy vegetative to flowers and perfumed type notes: **Floral** - coming from natural environment you can get this by taking a walk in your garden, green earthy, herbal and woodsy. **Floral grassy** - green on fresh cut grass, very fresh grass, young leaf (green floral). **Floral green vegetative (dark green)** - green vegetative, old cocoa leaf crushed, dark green note. Green beans, cooked bell peppers (dark green vegetables) **Floral woodsy (generic)** - was grown now dried essential oil, structural bases, going for walk in forest before winter, the dried flowers. **Floral mushroom** - mushroom, meaty, savoury, MSG. **Floral earthy** - forest after the rain, smell of dampness coming up from the cocoa estate soil. **Floral herbal** - Aged dried spices. Commonality of all the dried herbs and linked with astringency at times. **Floral perfumy** - a persistence that lingers like when fixatives (e.g. Vanilla) are added to perfume to kick the smell into a persistent mode. **Floral flowers** - breathe it in and it's gone. Difference between most roses and a strongly scented rose variety such as Mister Lincoln. **Floral orange blossom** - Is essentially floral-flowers but with orange blossom flavour specifically.
Woody	**Woody light wood** - ash, beach, maple, white pine, cut cocoa tree. **Woody dark wood** - oak, walnut, teak. **Woody resin** - pitch pine, balsam of dark or light tree resins.
Spicy	**Spice tobacco** - Tobacco spice is the smell outside a tobacco shop, not ashy and dirty but rather like pipe tobacco, sweet. **Spice peppery** - spicy, peppery, savoury.
Off flavours	**Hammy** - carved meats, ham, and improper fermentation. **Smoky** - happens when burning vegetative matter (wood, grass, cocoa hulls etc) Other off flavours – cocoa contaminated with diesel fumes **Leather** - not freshly tanned in a leather store, but rather more like leather with sweat and urine, like horse saddles. **Over fermented manure** - farm yard, manure. **Over fermented putrid** - Faeces. **Dirty** – unpleasant dirty character, like dirty utensils, often associated with quality of astringency, increased astringency = increased dirty flavour etc. Function of dusty. **Bark wood** - not good, typically unpleasant, dry, dusty, smelly, not a clean smell. Under fermented, astringency, raw, leather, dirty tend to be associated with bark wood as well.

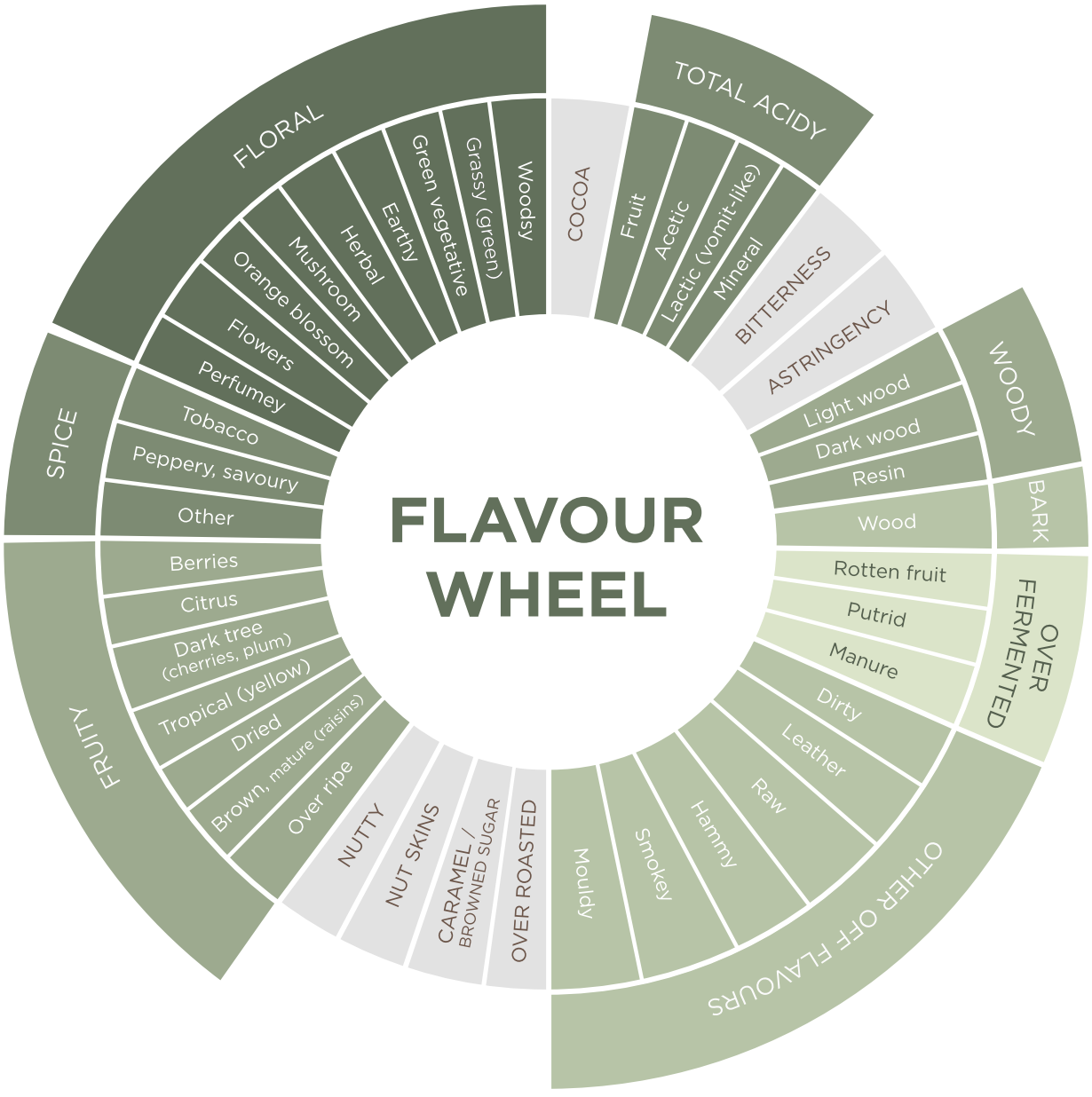
Flavour wheel

With main categories for both liquor and chocolates

(Seguine & Sukha, Flavour wheel with main categories and sub categories for both liquor and chocolates. Cocoa Research Centre Sensory Training Guide., 2015b).

Meanings of Attribute Intensity Scores

Attribute Intensity	Meaning
0	None present
1	Just a trace and may not be found if tasted again
2	Present in the sample
3-5	Clearly characterizing the sample
6-8	Dominant
9-10	Maximum that you have experienced



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FCC FEDERATION OF COCOA COMMERCE LTD.

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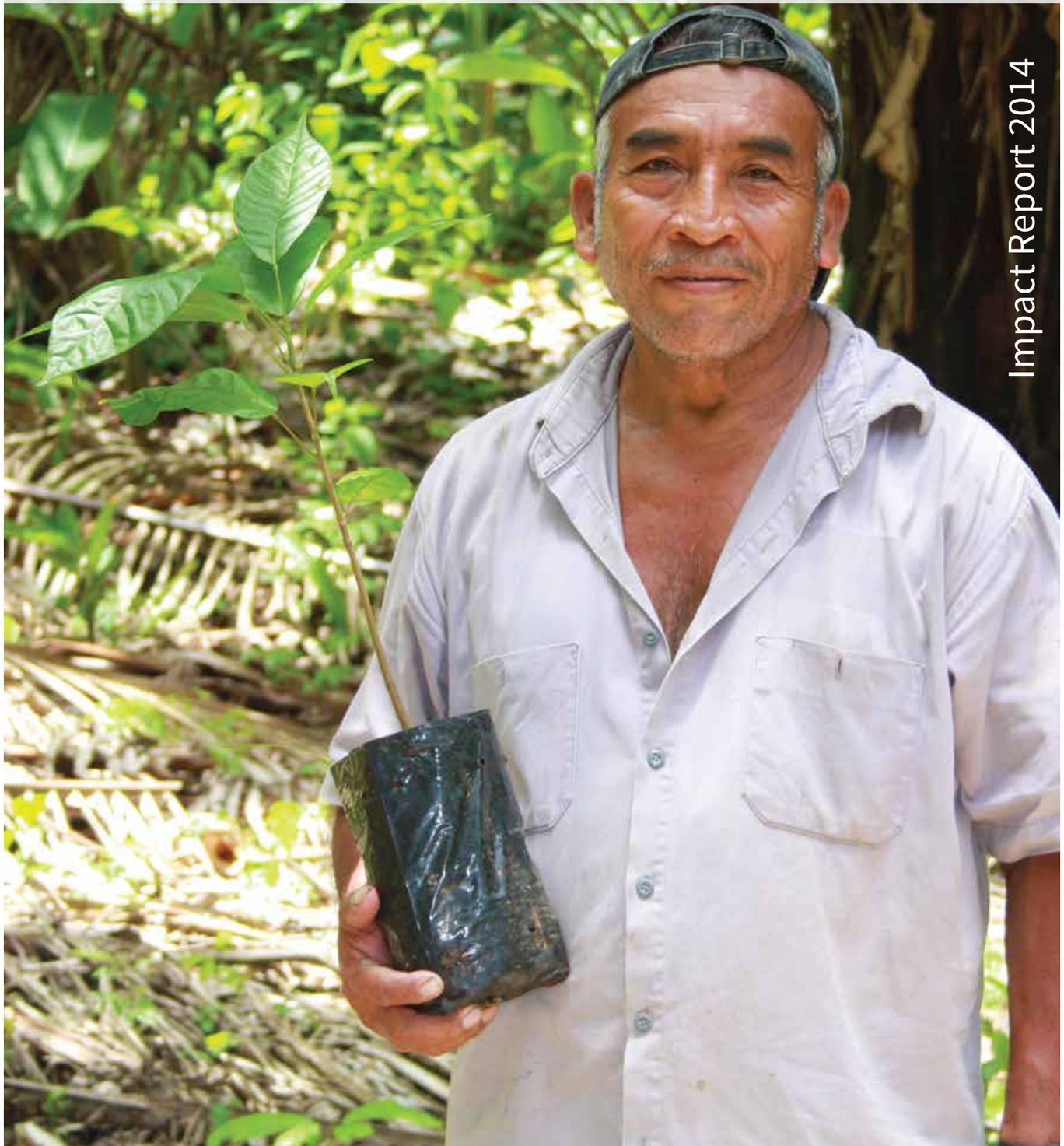
Appendix E

Uncommon Cocoa Annual Impact Report

Appendix E Uncommon Cocoa Annual Impact Report

UNCOMMON COCOA GROUP



Impact Report 2014

THE UNCOMMON COCOA GROUP IS

the first impact-driven, vertically-integrated cacao sourcing enterprise, spanning the value chain and allowing for groundbreaking transparency and quality control from farm to chocolate maker. Through unique value chain engagement and commercial concepts, we drive greater flows of capital to cacao origins and cacao farmers, catalyzing industry-shifting change and formalizing what is now a segmented, loose non-commodity cacao sector.

CONTENTS

Alex Whitmore, Emily Stone, Gabriel Pop and Jeff Pzena at the annual farmers meeting.

OUR STORY

Alex Whitmore and Jeff Pzena, two chocolate makers from the U.S., visited Belize in 2010 in search of cacao. What they found was a large number of Maya smallholder cacao farmers with excellent cacao, but poor market access to sell their production. Alex and Jeff sought to change that by introducing a cacao processing and exporting operation to create better quality and market access for the farmers, and to secure a great supply of premium, organic cacao from Belize by creating Maya Mountain Cacao, Ltd. Jeff brought his years of experience in local Belizean businesses, and Alex his depth of knowledge in cocoa sourcing and centralized cocoa fermentation and drying as the founder of Taza Chocolate.

Alex and Jeff both ran their own businesses full-time in the U.S. and knew they couldn't develop and run this operation on their own. Serendipitously, Emily Stone, a young and ambitious activist frustrated by corporate over reliance on low-impact certifications and seeking adventure in Central America, ended up in the Taza Chocolate factory early in the days of Alex and Jeff's scheming.

She decided to join the team and move to Belize to launch and grow Maya Mountain Cacao. During her first week in Belize, she met Gabriel Pop, a young cacao farmer with big dreams for the local cacao industry. Together, Emily and Gabriel and their growing team built what is now the largest cacao exporter in Belize and a highly-recognized innovative source for high-quality, smallholder-grown fermented and dried cacao beans.

Through further investment from Emily, Alex, and Taza Chocolate, and by the hard work of Gabriel, Emily, and their team, Maya Mountain Cacao has grown from being a small, fledgling cacao exporter, to being a brand recognized across the industry as a model for developing the specialty cocoa sector. Today, Maya Mountain Cacao is now just one of a family of companies in the Uncommon Cocoa Group, whose mission is to create a sustainable, prosperous cacao industry in which farmers, chocolate makers, and the environment thrive together.

The Uncommon Cocoa Group looks forward to sharing more information with you as it expands operations and strategies throughout Central America and beyond. Please read on for in-depth, comprehensive information on impact of the Uncommon Cocoa Group enterprises to date. We hope you will feel as inspired and humbled by the work of Central America's thousands of cacao farmers as we do; and we hope you will join us in supporting and executing a vision of a better cacao industry and a better chocolate world for us all.

{ UNCOMMON ORIGINS.
UNCOMMON FLAVORS.
UNCOMMON TRANSPARENCY.
UNCOMMON PARTNERSHIPS. }

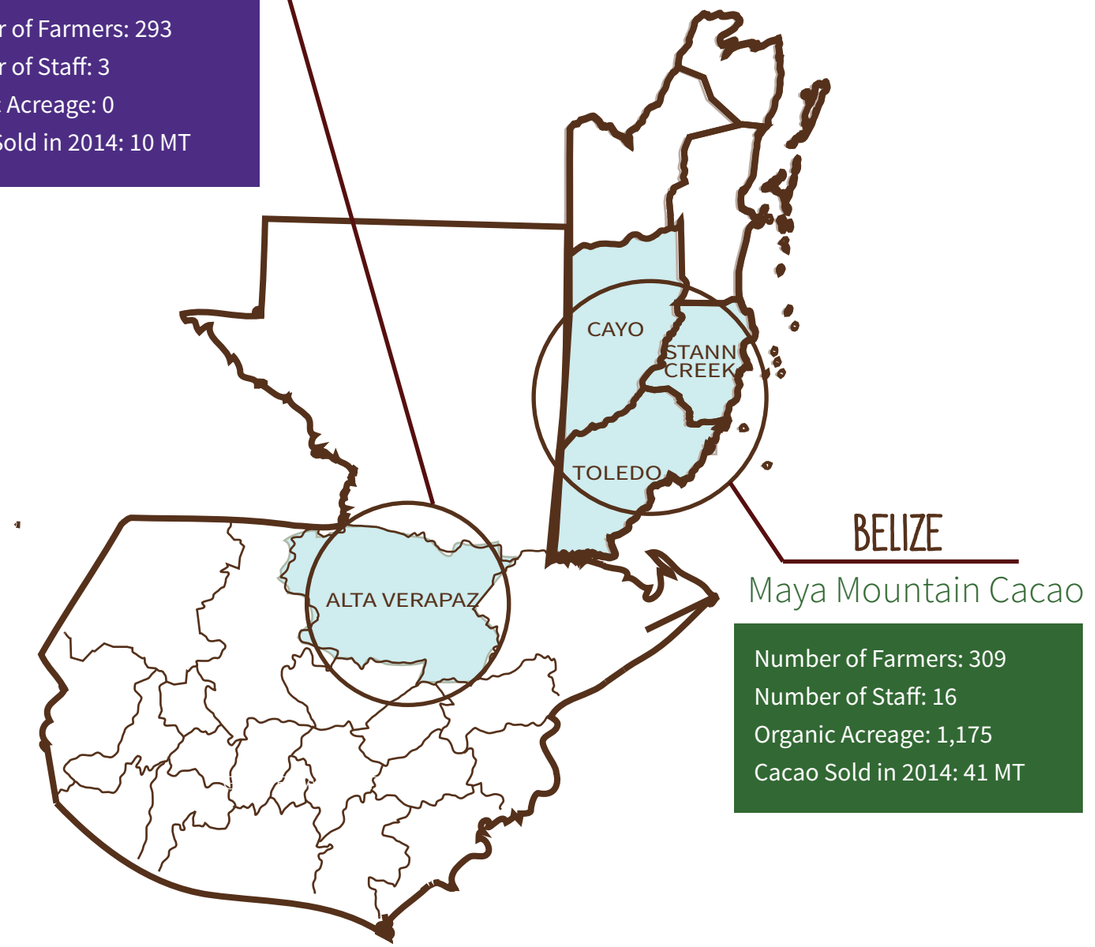
WHERE WE WORK

Uncommon Cocoa Group currently works in two origins; Maya Mountain Cacao Ltd. in Belize and Cacao Verapaz S.A. in Guatemala. Maya Mountain Cacao works in three districts of Belize, a small country of approximately 350,000 on the Caribbean coast of Central America. Cacao Verapaz works primarily in the lush tropical hills of the Alta Verapaz department in the north central region of Guatemala, and is at the beginning stages of operations in Petén, Izabal, and the Costa Sur.

GUATEMALA

Cacao Verapaz

Number of Farmers: 293
Number of Staff: 3
Organic Acreage: 0
Cacao Sold in 2014: 10 MT



BELIZE

Maya Mountain Cacao

Number of Farmers: 309
Number of Staff: 16
Organic Acreage: 1,175
Cacao Sold in 2014: 41 MT

Mid-fermentation cacao bean cut test at the Cacao House processing facility in Belize.

MAYA MOUNTAIN CACAO, BELIZE

Mr. Canti, a farmer for Maya Mountain Cacao, smiles under his recently pruned cacao tree.

LETTER FROM THE DIRECTOR

Maya Granit, Managing Director of Maya Mountain Cacao, Belize

Dear supporters:

I'm so honored to present Maya Mountain Cacao's 2014 Impact Report!

We started the year with ambitious goals: more farmers, exports, acres certified organic, trees planted, microfinance loans, technical trainings – and I'm excited to report successes across all teams. This year we expanded our reach in local Maya farming communities, working with more than 300 cacao farming families. Farmers in the region, motivated by the stable, high value market, have increased their yields and focused more heavily on maintaining their cacao orchards.

This year MMC invested more than ever to develop Belize's local industry. MMC executed one of the largest cacao seedlings projects in Belize. We distributed over $133,000 to hundreds of farmers in Kiva microcredit loans. Excitingly, we partnered with the community to develop our own 120-acre cacao-based agroforestry Demonstration Farm. Thank you to the many backers who supported the Demo Farm through our Kickstarter campaign! In 2014 we also cemented our collaboration with Xibun River Estate, a 400-acre farm previously owned by Hershey Company. We are thrilled to announce our partnership with Valrhona Chocolate on the development of our processing facility at this farm.

In 2014 we saw the incredible value in establishing partnerships that support our small producers and develop the local industry. We hope that in 2015, we will see the government support southern Belize's basic road and infrastructure needs; NGO's provide technical trainings for farmers; the Ministry of Agriculture execute seedlings programs; and research institutions support data collection projects to better understand Belize's local cacao varietals.

I'd like to send a big message of thanks to the chocolate makers, and consumers who choose responsibly-produced chocolate bars, who have been some of MMC's biggest supporters. We are proud to be part of an industry where so many stakeholders are striving to treat each other as fairly as possible – and we can't wait to continue to develop a value chain driven by these principles.

With that, I invite you to grab a chocolate bar and enjoy the Maya Mountain Cacao portion of the 2014 Impact Report!

Best,

Maya Granit
Managing Director | Maya Mountain Cacao Ltd.

MAYA MOUNTAIN CACAO LTD

Deon Chavarria, Maya Mountain Cacao's Logistics Manager, weighs a bag of cacao before purchasing from farmers in Red Bank.

MAYA MOUNTAIN CACAO VALUE CHAIN

MMC works with 309 indigenous Mayan farming families located in 31 communities in the foothills of the Mayan Mountain Range in Southern Belize. Cacao pods grow directly from the trunk and branches of the Theobroma Cacao tree, which grows only in the tropical Cocoa Belt, 20 degrees north to 20 degrees south of the equator.

1. HARVEST

During the harvest, farmers cut the pods from the trees and collect them in piles. Then they crack them open, harvesting the beans, which are covered in white, tangy fruit called baba.

2. BUY WET CACAO

On a weekly basis, MMC's buying team reaches 31 rural villages to pick up the freshly harvested wet cacao directly at farm gate, paying farmers immediately for the transaction.

3. TRANSPORT

Once the wet cacao is purchased from farmers, it is loaded into MMC trucks and transported to our centralized processing facility, the Cacao House.

4. FERMENT

The beans and fruit are packed in large wooden boxes to ferment for 6 days and rotated on the second, fourth and fifth days to ensure they reach the right temperature. Fermentation is one of the most critical factors affecting flavor of the beans, and ultimately of the chocolate.

5. DRY

The beans are then spread out to dry on large decks for 8-10 days. We like to carefully dry our beans in direct sun for the first day or two, and then transfer the beans to our solar drying houses.

6. PACKAGE

Once beans are fully dried they are collected and sorted by hand. The sorting process gets rid of any beans that have germinated, or are cracked, flat, or too small. Then we package the beans in 120 pound burlap sacks lined with GrainPro bags to ensure dry and fresh beans.

7. EXPORT

When ready for shipment, the bags are loaded into shipping containers bound for specialty, bean-to-bar chocolate makers in the United States, and soon Europe!

Samuel Tzui, Mercedes Ishim and Nazario Cho (left to right) lead the cacao processing from fermentation to export.

PRODUCT IMPACT

In 2014, MMC purchased 45 metric tonnes of cacao from our farmer network more than doubling last years 21.6 metric tonnes. This is in large part due to our expanding farmer network, more loyal farmers and an increase in average per-farmer sale. Additionally, MMC sold 41 metric tonnes to both local Belizean chocolate makers and internationally, up from 20.5 metric tonnes in 2013.

DEMAND

Demand for Belize's cacao continues to grow with **110 chocolate makers inquiring about purchasing cacao, up from only 12 in 2013**. Currently MMC directly sells cacao to 6 chocolate makers in the United States and four locally in Belize. At least 20 chocolate makers purchase MMC beans through secondary sale.

BRAND AWARENESS

In 2014 **MMC ran a Kickstarter campaign and raised $86,721** to support the development of our organic, cacao-based Demonstration Farm. The Kickstarter campaign attracted support and contributions from industry folk, including chocolate makers, other farmers, and chocolate enthusiasts. Impressively, over half of the funds came directly from chocolate makers, many of whom contributed in exchange for right of first refusal to get taken off the cacao waitlist, and purchase tonnage from Belize. **The campaign did not only have financial benefits, but also had incredibly significant social implications.** Farmers and local staff were inspired to see the industry's enormous demand for Belizean cacao and reinvigorated by the growing global context of their local work.

DID YOU KNOW?

In total, 91 unique chocolate products – ranging from nibs to chocolate bars – were created with MMC beans in 2014.

QUALITY

The quality and individuality of the flavorful Belizean cacao blend has proven its deliciousness once again by winning two awards in 2014. We are so proud that the industry has acknowledged Belize's unique, local terroir. We expect that recognizing Belize's remarkable cacao quality will ultimately drive more value to the farmers for their hard work in developing this growing industry.

2014 Good Food Awards
Dick Taylor 72% Belize, Toledo Bar

2014 Heirloom Cacao Preservation Award
Maya Mountain Cacao beans from Toledo

Chocolate bars made with MMC beans.


Rupert Errol is responsible for the Xibun Processing facility housed in the Cayo District on the Hummingbird Highway. Here he sits with the refurbished original Hershey drying boxes.

Women from San Pedro Colombia pose in their traditional Maya dresses.

SOCIAL IMPACT

INCOME

MMC understands that farming is the sole source of income for **75% of its farmer network and cacao is the main cash crop**. We care about how our farmers are compensated for their hard work and high quality product. For the second year in a row, **MMC farmers received 60% of the selling price of cacao** -- for every dollar of cacao we sell to bean-to-bar makers in the United States, $0.60 goes directly to the farmer.

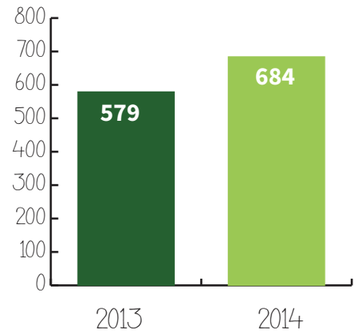
In 2014 **MMC raised its wet cacao price from $0.48 to $0.55 per pound**, putting more money in farmers' pockets. Price increase, combined with yield improvements and farm expansions, created a **92% increase in average annual family income** (see Figures).

FINANCIAL ACCESSIBILITY

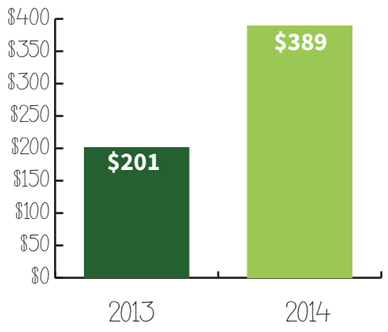
2014 marked a year of growth among MMC farmers in large part due to increased financial accessibility. **Through our partnership with Kiva, 187 farmers have received affordable microloans.** MMC has disbursed $133,625 to farmers -- expanding financial accessibility to 61% of our farmer network.

In the past, rural smallholders in southern Belize have had trouble accessing loans because of land tenure

INCREASE IN ANNUAL FARMER YIELD (LBS)



INCREASE IN AVERAGE ANNUAL PER FARMER INCOME



issues, lack of collateral, and high interest rates. Farmers used their affordable, non-collateral-based loans to help with cacao-related work:

1) expanding their farms,

2) purchasing high yielding grafted seedlings from MMC,

3) pruning their farms to increase yields and prevent disease, and

4) hiring help to clean and maintain their orchards.

MMC also successfully received approval from Kiva in 2014 to implement school fee loans on top of our agricultural loans, ensuring ongoing investment in education for the families in our network.

EXPANDING MARKET ACCESS

In response to increasing demand from bean-to-bar chocolate makers worldwide, **MMC has expanded operations into the Stann Creek and Cayo districts of Belize**. This expansion will allow us to deliver increased amounts of high quality cacao to chocolate makers while providing meaningful market access to hundreds of farmers interested in entering the rapidly growing cacao industry.

MMC has opened a second processing facility in the Cayo district to serve as a depot for farmers to sell their wet cacao and to process cacao from the 400 acre Xibun River Estate farm. Xibun River Estate was developed by Hershey Company in the 1980's and abandoned in the '90s after the cacao market downturn. In 2014 MMC entered into a long-term partnership with Valrhona Chocolate in France to process all cacao from the Xibun River Estate and sell directly to Valrhona.

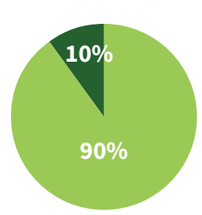
JOB CREATION

MMC is committed to building a sustainable cacao industry by creating opportunities for local employment. In 2014 we directly employeed **53 people, 98% of whom are native to the communities in which we work.** In 2014, we had 16 permanent staff, and 23 temporary staff supporting our cacao processing and our nurseries. We also employed 19 farmers to develop our Demonstration Farm. The total number of direct beneficiaries from MMC's work, including employees, farmers, and their families grew from **983 in 2013 to 1,242 people in 2014**. This number does not reflect the indirect employment opportunities created from farmers hiring additional labor to support farm work.

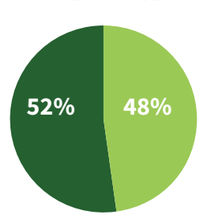
EDUCATION

Maya Mountain Cacao annually tracks child education levels. A survey at our annual meeting revealed that 90% of primary school age children are attending school and 48% of secondary school age children are attending school (see Figure). This data was collected using farmer surveys of 75 farmers at our Annual Farmer Meeting. We are surprised about this drop in secondary school attendance since our last report (85% in 2013), and plan to further investigate the dynamics behind this figure.

PRIMARY SCHOOL ATTENDANCE



SECONDARY SCHOOL ATTENDANCE



ATTENDING
NOT ATTENDING

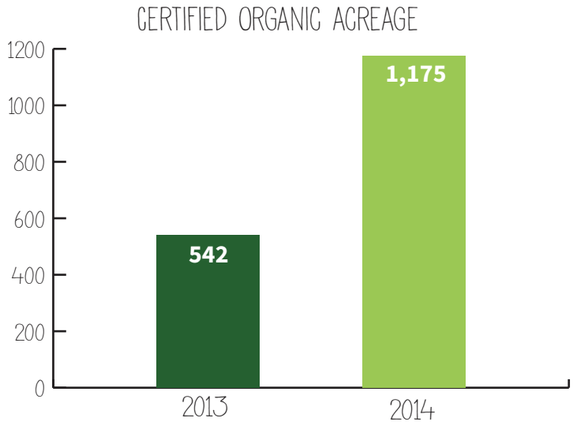
WE DIRECTLY EMPLOY 53 PEOPLE, 52 OF WHOM ARE NATIVE TO THE COMMUNITIES IN WHICH WE WORK.

Ermain Requena, MMC's Demonstration Farm Manager, treks into the 120 acre farm.

ENVIRONMENTAL IMPACT

ORGANIC ACREAGE

In organic cacao-based agroforestry, cacao trees are strategically interplanted with other species to create more diverse, productive and sustainable land-use system. Many indigenous farmers in Belize have used this system traditionally; MMC continues to encourage and recommend new methods in cacao agroforestry as it provides an economic incentive for rural communities to preserve tropical forests, improving farmer livelihoods and ensuring responsible stewardship of critical resources for generations to come. MMC provides trainings, certifications and inspections so farmers can certify their farms as organic. **Between 2013 and 2014, MMC increased the total number of USDA organic certified acres from 542 to 1,175 and certified 34 additional farmers as organic**.



TRAININGS

MMC held three grafting trainings at our nurseries where **30 local Maya community members learned and practiced cacao grafting techniques**. Grafting, or "cloning," is an all natural, non-GMO method of propagating new seedlings by inserting genetic material from a selected tree into the thin trunk of a new seedling. This advanced nursery practice allows for much better control over productivity, disease resistance, and other important agronomic factors to improve yields for farmers. Of the 30 farmers trained, **MMC hired 15 to help on our nurseries** and 6 went on to secure jobs elsewhere in the cacao industry. **Fifty percent of the grafters trained and hired by MMC were women.**

DEMONSTRATION FARM

MMC spent a great part of 2014 establishing the first 30 acres of our cacao-based agroforestry Demonstration Farm. This farm is an important symbol of MMC's investment in and commitment to the smallholder farmers of Belize. The farm will serve as;

1) a valuable clonal garden for smallholders to source high-quality genetic material to improve the production yields and quality of their own farms;

2) a demonstration space and training center open to farmers to learn about best practices in cacao agriculture; and

3) a source of specialized, well-paid jobs for cacao farmers and their families.

Additionally, the Demonstration Farm, located close to a protected area, will protect the pristine jungle environment from ever-increasing slash and burn farming. Finally, **it will add over 40 metric tonnes of production annually** over the next five years, representing **more than 50% growth in Belize's current annual cacao production volume.**

CLONAL SELECTION

In 2014, cacao beans originating from Mayan villages in the Toledo district of Belize and processed by Maya Mountain Cacao, Ltd. received an **heirloom designation from the Fine Chocolate Industry Association**. As part of the designation, the USDA did genotyping work to understand more about the origin of Belizean cacao and why it tastes so good.

A genetic analysis of trees in Toledo revealed that Belizean cacao is a mix of hybrids but is most closely related to the Amelonado variety. Amelonado is a cacao that originates from the lower Amazon basin, and is the traditional variety grown in West Africa, Bahia state in Brazil, and in the past, on the Atlantic coast of Costa Rica. In addition, Belizean cacao consists of a mix of varieties that originate in the upper Amazon, including the famous Nacional cacao of Ecuador.

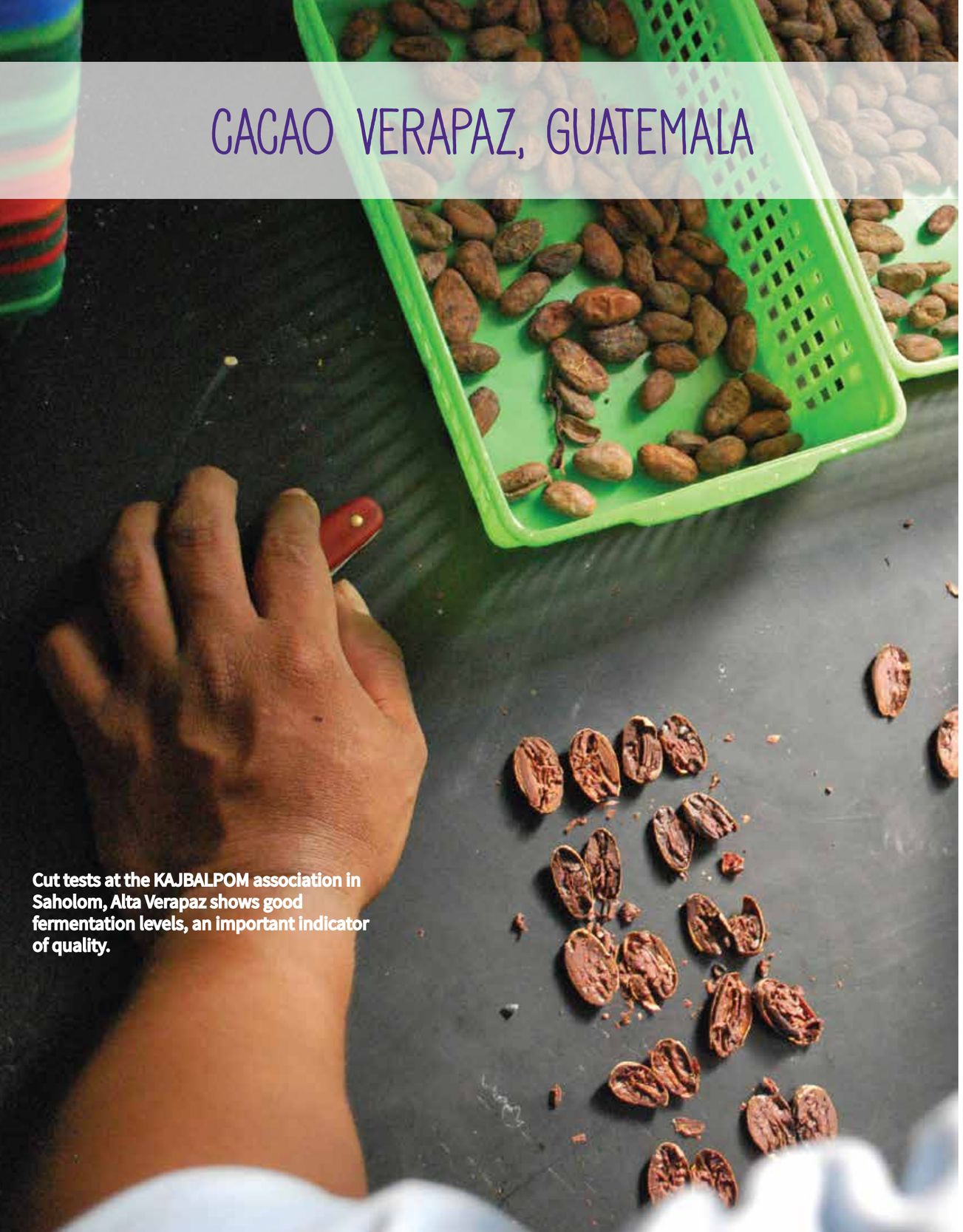
So what makes Belize cacao taste so good? There are many factors that contribute to the flavor of cacao. The complex interactions between genetics, climate, and soil – referred to as terroir - are poorly understood, but Belize has several unique factors that may be partly responsible for the excellent flavor of its cacao. The country extends into the northern bounds of commercial cacao cultivation and experiences especially cool weather during winter months. Southern Belize is also known for its unique soils and especially high levels of rainfall.

SEEDLINGS

In an effort to assist farmers in expanding their cacao production, MMC implemented a seedling initiative in 2014 with funding from the Argidius Foundation to help subsidize the price of seedlings for farmers. **MMC grew 82,000 seedlings in four nurseries, staffed by 6 local community members.** Over the course of the year, MMC sold and distributed 58,998 seedlings at US$1.00 per seedling. Fifty farmers who purchased seedlings in 2014 were first-time cacao farmers.

MMC created four nurseries in 2014 to provide seedlings to farmers in an effort to meet farmer demand .

CACAO VERAPAZ, GUATEMALA



Cut tests at the KAJBALPOM association in Saholom, Alta Verapaz shows good fermentation levels, an important indicator of quality.

LETTER FROM THE DIRECTOR

Marlon Ac, Managing Director of Cacao Verapaz, Guatemala

Dear friends, customers, and supporters:

As this report goes to print, Cacao Verapaz is on the verge of its first anniversary of operations in Guatemala. Founded in April 2014 as a sister company to Maya Mountain Cacao in neighboring Belize, Cacao Verapaz (CV) has in a very short time catalyzed significant advances and improvements in the fine cocoa industry of Guatemala.

It all started in 2013, when the specialty chocolate maker Lake Champlain Chocolates of Vermont hired Emily Stone, co-founder of Maya Mountain Cacao to advise on quality and sourcing with a new cluster of three Q'eqchi Maya farmer associations in Alta Verapaz, Guatemala. The associations had never before interacted with international buyers and did not clearly understand quality standards, the extent of global demand for cacao, or how to price and sell their cacao. Lake Champlain Chocolates hired Emily to run the first export of cacao from the farmers in Alta Verapaz to the U.S.; and after that first successful export in August 2013, the excitement around cacao in Guatemala became contagious.

With financial and strategic support from Lake Champlain Chocolates, Taza Chocolate, and the Dutch Private Sector Investment (PSI) program, Emily founded Cacao Verapaz as the first 100% fine cacao-focused smallholder-oriented export enterprise in Guatemala. Since officially incorporating in April 2014, Cacao Verapaz has hired three full-time staff, including myself, grown from three farmer associations to nine associations and three independent farmers, and exported from four associations to four specialty chocolate makers in the U.S.

Personally, I come from a small family of cacao farmers, from a Maya Q'eqchi community in the Laguna Lachua region of Alta Verapaz. Cacao Verapaz opens to us for the first time an important opportunity to improve our cacao production and commercialization. I believe strongly in connecting farmer associations with chocolate makers to ensure meaningful direct trade, high quality cacao, transparent processes and thus a successful future for the chain. Together we must work to grow the cacao value chain in Guatemala, because if it grows, our Maya Q'eqchi communities will grow as well.

In this year's report we are including a baseline of information about the communities in which we work in Alta Verapaz, and some of our company's goals for improvements we would like to catalyze. We look forward to reporting on our progress in future years, and building alongside our partners and customers a vibrant, high-impact, and high-quality fine cacao industry in the stunning country of Guatemala.

B'antyox aawe,

Marlon Ac
Gerente General

CACAO VERAPAZ
CACAO SELECCIONADO DE GUATEMALA

Emily Stone talks with farmers from the ADIOESMAC association in Tzalamtun, Cahabon about their drying techniques.

CACAO VERAPAZ VALUE CHAIN

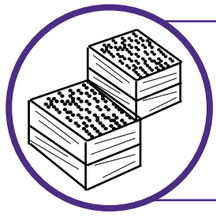
Cacao Verapaz's business model differs slightly from that of MMC, as it trains and equips community-level associations, instead of individual farmers, to ferment and dry cacao centrally. Cacao Verapaz then purchases the dried cacao from associations based on quality standards and incentives.

1. PARTNERSHIPS

CV identifies farmer organizations and private estates that are transparent, participatory, and that have existing cacao farms. CV signs an MOU with the associations to clarify quality standards and CV's commitment to technical assistance.

2. NEEDS ASSESSMENT

CV assesses the needs of the associations. Do they need infrastructure? Do they need organizational development help? We make sure they are connected with training and capacity building.



3. FERMENTATION AND DRYING

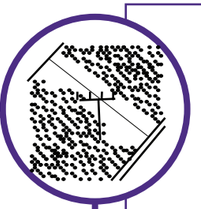
Each association handles their own fermentation and drying to the quality standard set by CV.

4. QUALITY CONTROL

To ensure a consistent and reliable quality, CV conducts technical assistance and quality control visits to associations throughout the season.

5. BUY DRY CACAO

CV purchases dry cacao from associations at frequent intervals to ensure cash flow to the associations and farmers.



6. RE-DRY CACAO

CV dries all cacao at our pre-export drying facility in central Guatemala then sorts and organizes cacao by lot for export.

7. EXPORT

CV sells to specialty chocolate makers who are then able to work on an ongoing basis with cacao from the same association.

Brisli, from the village of Rocja Pomtila, has been a grafter in the nurseries of the ASODIRP association for the last two years.

BASELINE IMPACT

As a new company, Cacao Verapaz has worked diligently to establish a baseline for all impact metrics: social, environmental and product. This is the first report that will begin to track the impact of Cacao Verapaz and we are looking forward to see year-to-year progress moving forward.

SOCIAL

The baseline for Guatemala family income from cacao is US $267.29 per year. This is based on pre-Cacao Verapaz figures, collected in 2014. The study was done in the Laguna Lachua region but is characteristic of the various areas in Alta Verapaz where we work. We aim to increase farmer income by providing a stable, fair, and competitive price for purchasing their cacao and assisting them in increasing their yields. Currently only four farmer associations are connected to global markets, with the majority of Guatemala's 2,000+ cacao farming families selling independently to intermediaries ("coyotes") who in turn sell to domestic industrial chocolate processors. We believe helping farmers organize into community associations and successfully engage in long-term, high-value market connections will be a powerful force for economic development in rural Guatemala.

ENVIRONMENTAL

Currently none of the farmers we are working with are certified organic. **Over the course of 2015 we will be working with farmers and associations with a goal of certifying 60 farmers organic**. Certified organic acreage of farmers selling to CV is currently at zero, **our goal is to reach 180 by 2016**.

PRODUCT

The Alta Verapaz region of Guatemala has shown potential for enormous cacao production. Over the past year alone, **11 metric tonnes were purchased by CV and we hope to more than triple that by the end of 2015** reaching 40 metric tonnes. In order to ensure quality cacao beans we are working to track the fermentation levels. The **average fermentation level of cacao is currently 71%, the goal is to reach 80% by 2015**.

Marlon Ac (in orange) and Emily pose with the ASODIRP association in Rocja Pomtila after signing a purchase contract for the 2015 harvest.

2014 KPI ASSESSMENT

The Uncommon Cocoa Group assesses its progress every year by reviewing mission-related Key Performance Indicators.

Metric	Misson	2012	2013	2014
Farmer Income Average Annual per Farmer	SOCIAL	$161 (MMC)	$201 (MMC)	$389 (MMC) $267 (CV)
Farmer Sales (lbs) Average Annual per Farmer	SOCIAL	498 (MMC)	579 (MMC)	684 (MMC)
Staff Permanent Full Time	SOCIAL	5 (MMC)	9 (MMC)	16 (MMC) 1 (CV)
Kiva Loan Disbursments	SOCIAL	n/a	$21,263 (MMC)	$133,625 (MMC)
Direct Beneficiaries	SOCIAL	476 (MMC)	983 (MMC)	1,242 (MMC)
Certified Organic Farmers	ENVIRONMENTAL	119 (MMC)	275 (MMC)	309 (MMC)
Certified Organic Acreage	ENVIRONMENTAL	165 (MMC)	542 (MMC)	1,175 (MMC)
Cacao Seedlings Planted	ENVIRONMENTAL	50,000 (MMC)	0 (MMC)	82,000 (MMC)
Cacao Purchased Metric Tonnes	PRODUCT	23.1 (MMC)	21.6 (MMC)	45 (MMC) 10 (CV)
Incoming Request for Product	PRODUCT	n/a	25 (MMC)	110 (MMC)

LOOKING FORWARD

The Uncommon Cocoa Group envisions a world in which cacao farmers, chocolate makers, and the environment prosper and thrive together. We are very proud of our progress so far, and excited to report on the growth of our business, but we also deeply recognize that we are only at the beginning of much work that lies ahead. We want to make it easy and fun for chocolate makers to access the best cacao from unique origins, transparently delivering long-term value to all of the actors throughout the chain. Scaling and improving meaningful market access for a better chocolate supply chain depends heavily on collaboration, as it has throughout our history, and we look forward to making new friends as we grow while also cultivating and growing the important partnerships that we already have in place. We'll have an update for you on our progress next year!

PARTNER AND CUSTOMER RECOGNITION

CHOCOLATE MAKERS:

Anahata Cacao
Animas Chocolate
Brazen Chocolate/Newfangled Labs
Charm School Chocolate
Cotton Tree Chocolate
Dandelion Chocolate
Del Sol Chocolate
Dick Taylor Chocolate
Dulcinea Chocolate
E3 Artisan
Firefly Chocolate
Heidi Boyd
It's Chocolate
Izard Chocolate
Lake Champlain Chocolates
Letterpress Chocolate
Madre Chocolate
Mast Brothers Chocolate
Maverick Chocolate
Middlebury Chocolate
Moho Chocolate
Nathan Miller Chocolate
Organic Fair Inc.
Parliament Chocolate
Raaka Chocolate
Ritual Chocolate
Roni-Sue Chocolates
Somerville Chocolate
Taza Chocolate
Tejas Chocolate
Terroir Chocolate
Valrhona
Videri Chocolate
Zak's Chocolate

FIELD PARTNERS:

Cacao Services Inc.
FUNDALACHUA
FundaSistemas
Institute of Marketecology (IMO)
International Union for the Conservation of Nature (IUCN)
Kiva
Maya Mountain Research Farm
ProPeten
TADA (Toledo Agriculture Development Alliance)
Ya'axche Conservation Trust

INTERNATIONAL PARTNERS:

Agora Partnerships
Ashoka
Dutch Private Sector Investment Program
Ecom Trading/Atlantic Cocoa/ExportCafe
Pi Investments
Pomona Impact
Santa Clara University Impact Capital Program
The Argidius Foundation
The Eleos Foundation
USAID
Wealth Plus Inc.

A SPECIAL THANK YOU

Report Production:
Lee Stroman

Photographs:
Eric Lampman and Erik Hammar

Eric and Nick from Lake Champlain Chocolates deliver chocolate bars they made with cacao from ASODIRP to the board of directors of the association, in front of the association's office.

Appendix F

HCP Protocols

Appendix F HCP Protocols

HEIRLOOM CACAO PRESERVATION

PROTOCOLS FOR SUBMISSION OF BEANS THROUGH SITE VISIT FOR GENETIC TESTING

HEIRLOOM CACAO PRESERVATION

BEAN SUBMISSION DIRECTIONS AND REQUIREMENTS FOR PROCESSING AND EVALUATION

HCP IDENTIFICATION NUMBER

Upon paying the application fee, registering on the USDA site, and completing the application, the Heirloom Cacao Preservation Initiative (HCP) Applicant receives an HCP Identification Number. This number and bean information will be the ONLY information the HCP Lab sees when performing the blind processing and evaluation procedures for the Tasting Panel.

QUANTITY OF BEANS NEEDED FOR EVALUATION

The HCP requires **three (3) kilograms of cocoa beans** – cleaned and dried weight – representing the population of trees and commercial shipment quantity proposed Heirloom designation. The HCP defines “cleaned” as having all broken beans and foreign material removed. For those Applicants who normally wash and polish beans after drying, the HCP considers washing and polishing part of the cleaning process.

WHAT KIND OF BEANS SHOULD BE SUBMITTED

Fully mature, ripe, un-diseased beans harvested during the normal crop cycle so as to be fully representative of long-term production. Three kilograms of clean, dried beans will require beans from 20-60 pods (depending on bean weight and bean count per pod) from 20-60 bearing trees representing the population being assessed. Trees should be marked or tagged so they can be assessed for genetic diversity at a later time. (Genetic evaluation is done after the HCP designates the flavor of the beans as Heirloom.) If less than 3kg of clean, dried beans are available, the Applicant must receive agreement in advance from the HCP.

WHY WE NEED THREE KILOGRAMS OF BEANS

We ask for 3 kg of beans to ensure sufficient beans for the primary Lab tasks, provide spare beans in case of preparation or shipment problems, and allow for retained samples and returning liquor and chocolate samples to the Applicants. We assume the beans will be clean with no cleaning losses, and the yield of cleaned, roasted nibs from raw beans will be 65%. Thus, 3kg of beans are needed to cover the following HCP Lab tasks for evaluation:

Physical tests	175 g
Liquor for liquor evaluations	875 g
Liquor for chocolate evaluation	900 g
Total beans needed	**1950 g** 1.95kg (65% of 3kg)

FERMENTATION & DRYING REQUIREMENTS

- Fermentation and drying must be done in a manner that is consistent with the larger scale (commercial) production of this bean type. The HCP does not specify fermentation or drying practices.
- **NO fruit, fruit pulps, juices, spices, flavors, or any substance may be used to alter, enhance, add, or "spice up" the flavor of the beans during fermentation.**
- Drying should be completed until the moisture content of the beans is 6.5 to 7.9%. The ideal moisture content of the beans is 7.0 to 7.5%.
- **Following the completion of drying, samples must be stored for a minimum of six (6) weeks to allow the flavor to equilibrate and be representative of commercial shipments.**

STORAGE REQUIREMENTS

It is recommended that Applicants store a minimum of 6kg of beans in the following ideal storage conditions, retaining 3kg as an insurance against possible loss of sample during shipment or problems with the initial shipment.

- Beans should be stored in a breathable bag such as new, clean, odor-free burlap, jute, or cotton. Any material used should be smelled prior to its use as a storage bag for the beans to insure that it is free from any odor taint that would impart an off odor or flavor to the beans as a result of storage. Care should be taken to ensure this does not happen.
- Storage should be at ambient conditions but protected from excessive moisture or any possible off odors in the storage area. Care must be taken to avoid exposure to any conditions that will cause re-wetting or re-humidification of the beans and resulting mold growth on the beans. Mold present in a cut test above United States FDA standards (4% internal mold) will be grounds for immediate rejection of the sample. Care should be taken to ensure this does not happen.
- Bagged samples should be stored in screened but breathable containers that will protect them from insect infestation. The mesh size of the screen

should be small enough (like mosquito netting) to prevent the entry of moths and larvae. The presence of any insect infestation in the cut test will be grounds for immediate rejection of the sample. Care should be taken to ensure this does not happen.

PRE-SHIPPING REQUIREMENTS

Applicants will need to confirm the details of the farm from the first part of the HCP Application and email the following additional information to the HCP prior to shipping:

- Date of harvest
- Date of Drying Completion
- Bean Type/Tree/Clone Information (necessary to determine the proper roasting conditions for each sample without un-blinding the application)

Applicants will also need to agree in that email that they utilized commercial practices for the fermenting and drying of the beans and all other Submission Protocol conditions.

Applicants MUST ensure that all necessary paperwork including bill of lading, commercial invoices, customs declarations, and any required United States FDA Prior Notice requirements are met. If you do not have an account for Prior Notice you can create an account in less than ten minutes on the FDA Site: http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/PriorNoticeofImportedFoods/default.htm

Prior to shipment of the cocoa beans, the Applicant should assemble and then enclose all this paperwork as well as a copy of the application information provided at the end of the Submission portion of the HCP Application with the Applicant's HCP Identification Number.

SHIPPING REQUIREMENTS

Beans should be shipped in the same breathable bags that they were stored in and not any other bag, like plastic Ziploc bags – applicants accustomed to shipping samples in plastic Ziploc bags should take care to note this point.

Bags should NOT have any markings aside from the HCP Identification Number. Multiple samples must be shipped separately and require individual applications for each sample being submitted.

Samples will be sent to the FCIA, which will immediately remove the bags of beans from Applicant's box, log them in, place them in a new, anonymous shipping box, and send them to the HCP Lab for processing. This ensures the Applicant's HCP number and bean type are the only information the Lab sees when performing the blind processing and evaluation procedures for the Tasting Panel.

SHIPPING INFORMATION

Paperwork and unmarked bags of beans should be sent to the HCP LAB. ADDRESS IS DISCLOSED WHEN USDA APPLICATION IS COMPLETED.

The HCP Lab will log the receipt of the beans by their HCP Identification Number. Applicant and HCP Tasting Panel will receive notification when this shipment is logged as received.

While at the HCP Lab, prior to evaluations, beans will be stored in a temperature and humidity controlled environment to ensure their stability. Beans will be stored separately from all other cocoa beans to minimize the opportunity for any infestation.

Following receipt at the HCP Lab, beans will be scheduled for bean counting, cut tests, and raw bean moisture content test and prepared for processing into liquor and chocolate covered in the next protocols.

You will soon be able to track your application in the HCP Database once it is received by the FCIA.

PROTOCOLS FOR HCP LAB TESTS & RAW BEAN CHARACTERIZATION PRE-LIQUOR PREPARATION & ANALYSIS

The following protocol covers what happens after the HCP Lab logs the receipt of the beans by their HCP Identification Number and bean information that will allow determination of the proper roasting conditions. While at the HCP Lab, prior to these tests, beans will be stored in a temperature and humidity controlled environment to ensure their stability.

Raw Bean Characterization Tests

Upon receipt, the HCP Lab will conduct the following tests on the Applicant's beans as they are prepared for processing into liquor and chocolate (covered in the following set of protocols):

- Bean Count (Beans/100g)
- Cut Test (2x 50 beans)
- Raw Bean Moisture by Mettler loss in weight moisture balance calibrated to vacuum oven moistures

There is no *a priori* requirement for the Cut Test evaluation with the exception of the internal mold and infested categories. The Cut Test simply documents the characteristics of the Applicant's beans. Mold and insect infestation must comply with the Proposed ISO Standard ISO/TC 34/SC "Cocoa Beans – Specification" (01/12/2012): maximum 3% moldy; maximum 3% infested.

The HCP Lab will also photograph the cut tests. Photos will include a (MacBeth) ColorChecker or equivalent to allow standardization of the colors due to lighting differences.

In the Unlikely Event Beans Fail Cut Tests

If all tests are passed, the HCP Lab will mark the tests as passed. Should a sample fail a Cut Test in the HCP Lab, the HCP Lab will mark the test as failed, and the Applicant and Tasting panel will be notified. 110 beans will then be sent to two HCP Tasting Panel members who have labs and can perform additional Cut Tests of 2 x 50 beans and photograph them. The new Cut Test information will be entered into the HCP Database.

- If the result of the Cut Tests on the combined 6 x 50 beans passes the standard, the HCP Lab will mark the Cut Test as passed in the HCP Database and continue with the processing.

- If the result of the Cut Test still fails the standard, the HCP Lab will mark that bean as rejected in the HCP Database, which will email the Applicant to resubmit the beans at the Applicant's cost.

Once the beans are resubmitted following the standard HCP Submission Protocols, all tests will be performed again by the HCP Lab and if necessary the two additional Tasting Panel labs.

- If the results of the Cut Tests on the 2 x 50 or combined 6 x 50 beans pass the standard at any point, the HCP Lab will mark the Cut Test as passed in the HCP Database and continue with the processing.
- If the result of the Cut Test fails the standard a second time, the HCP Lab will again mark that bean as rejected in the HCP Database.

If rejected a second time, the HCP Tasting Panel will review the data of all the tests performed and provide their final recommendation. If the consensus of the panel agrees with the Cut Test determinations then the HCP Lab will mark the beans as rejected. The HCP will then follow up with the Applicant to discuss the failure of the sample and any next steps.

Beans that pass the Cut Test are now processed into Liquor and Chocolate using the following Protocol.

PROTOCOLS FOR HCP LAB
LIQUOR AND CHOCOLATE PREPARATION AND ANALYSIS

Processing of beans by the HCP has been standardized to ensure consistency for all submissions for Roasting, Liquor Milling, Chocolate Making, and Analyses of Liquor and Chocolate. Bean type information from the Applicant is essential to avoid delays in this protocol.

A. ROASTING, CRACKING, AND WINNOWING

Oven Specification

High efficiency convection ovens are required: Binder laboratory convection oven Model 111G-06-01 (800 gm full load of beans) or FD 23-UL (200 gm full load of beans), ThermoScientific LabLine Imperial series laboratory convection oven, or equivalent.

Ovens are loaded with a single, wide mesh screen tray. Beans are loaded single bean depth across the loading area. (Filler beans will be used as necessary to ensure the same loading for all roasts.)

Roasting Conditions

Specific roasting conditions for the beans are designed to maximize the flavor potential for each type of cocoa bean. Conditions are consistent with the Cocoa of Excellence roasting conditions used by CIRAD and Mars and international project evaluation conditions across a wide range of clones, geographical locations, and bean types:

- Trinitario Type (expected for most samples): 120°C for 25 minutes
- Forastero Type (typical of Amelonado types): 130°C for 25 minutes
- Ancient Criollo Types (eg. Porcelana, Guasare, etc.): 112°C for 25 minutes

All times are measured from -2°C of set point on oven recovery after insertion of the tray of beans into the oven. (Note: Binder ovens have a recovery time of 4.5 minutes for first model above and 2.5 min for the second model, which has a smaller cavity.)

In most cases, beans will follow the Trinitario protocol, as most beans will fall into the fruity/floral category. Modern Criollo types will primarily be roasted at Trinitario conditions as they are generally much closer genetically and processing wise to traditional Trinitario beans. Ancient Criollos are distinguished from the needs of the Modern Criollos (i.e., Criollo leaning Trinitarios) by the requirement for much lower temperatures to best express

the nutty/caramel notes. The Forastero protocol is specified to bring out the maximum chocolate intensity in this type of sample. While referred to as “bulk” or “base” beans, the Forastero contribution to the chocolate flavor profile is critical and we encourage the work of the Cocoa of Excellence program, which awards this category of bean.

If necessary, based on the Lab raw bean tests and information available from the Applicant, the HCP Lab and Tasting Panel Chair may discuss the sample beans and what they know of them before roasting the quantity needed for liquor and chocolate evaluation. Then, if necessary, the Lab and Chair may elect to do a quick, small pilot roast of 30-50g to make liquor for the Lab and Panel Chair to taste if need be to determine the proper roasting conditions.

Bean type information from the Applicant is essential to avoid delays in this protocol. If necessary, in Applications in which the bean type is not provided or is unknown, the HCP Lab will consult with an HCP Tasting Panel member with access to a lab who will receive a 150g sample of the beans for cut test evaluation and roast recommendation. If that cut test is not sufficient in the judgments of the HCP Lab, the HCP will allocate an additional 175g of beans and do small scale roasting and liquor milling on 50g samples at all recommended roasting conditions in this protocol to determine the proper roasting condition based on flavor of the samples. The HCP Lab will then use the selected condition to produce the liquor for liquor and chocolate evaluations by the Panel.

Roasting Needs

Amounts needed are based on supplying liquor to the HCP Tasting Panel for liquor flavor evaluation and the USDA for analytical flavor profiling, returning a sample to the Applicant, retaining a sample by the HCP Lab, and providing sufficient nibs and therefore liquor for the preparation of the chocolate samples.

Total liquor required for Panelists	260g
Liquor Retained Sample	150g
Liquor for returning to Applicant	50g
Liquor loss in preparation (milling)	85g
Total nib clean, shell free required	505g
Raw beans roasted at 65% yield	775g
Total chocolate required for Panelists	910g
Chocolate making loss	50g
Chocolate tempering loss	50g
Liquor needs at 61% liquor recipe	540g
(liquor losses included in liquor milling above)	
Raw beans roasted at 65% yield	835g

Unless absolutely necessary, roasting and liquor preparation will be done in several batches run at the same time to create a uniform batch of liquor. This

would entail roasting 1.8 kg of raw beans. Depending on the roaster used, this will entail 3-5 roasting batches.

Winnowing

Following roasting, beans are cracked and winnowed. Cracking can be accomplished in any suitable device (e.g., Limprimita breaker by Capco Test Equipment, UK) or by hand. Following cracking, beans are winnowed using typical winnowing equipment such as a John Gordon or Capco Test Equipment Winnower or equivalent.

Following winnowing, all nibs are combined and well mixed. All nibs will be handpicked to remove all traces of shell—both free shell and shell still stuck to the nibs. Winnowing and handpicking will be performed in an area governed by GMP practices and with an HACCP program in place to ensure the wholesomeness of the product.

After winnowing, nibs will be stored in a sealed bag. Every effort will be made to convert nibs into liquor within 48 hours of roasting. If the nibs cannot be liquor milled within 24 hours of roasting, they will be stored in a tightly sealed bag, preferably a multi-layer, barrier film vacuum seal type to provide barrier film protection without vacuuming. Nibs will not be stored longer than seven (7) calendar days (even in a sealed bag) prior to liquor milling

Storage temperature should be 10-24°C (50-75°F). If nibs are stored at temperatures less than 18°C (64°F), they must be allowed to warm to room temperature prior to opening the bag.

The expected yield of cleaned roasted nibs from uniformly fermented and dried cocoa beans will be 70%. The HCP has calculated its needs based on 65% to provide added insurance against loss.

B. LIQUOR MILLING

Liquor milling may be accomplished in any suitable slow rotating stone or porcelain grinding mill. Metal milling (e.g., ball mills) or high-speed mills are not to be used. Milling will be performed in an area free of other odors and protected from environmental influences. GMP practices will be in place as well as an active HACCP program to insure wholesomeness of the product.

During milling, the mill will be held at warm room conditions to insure that the liquor will not solidify during the milling process. The mill may be pre-warmed to operating conditions to facilitate milling.

Milling temperature will not exceed 55°C (130°F).

Exact milling times CANNOT be specified as this is dependent on a number of factors such as fat content of the nibs, degree of fermentation of the beans, specific mill used, condition of the stones in the mill, etc. But milling will be accomplished gently and without the addition of significant external mechanical pressure. The objective is to produce liquor that will have no discernible grit to the HCP Tasting Panel in their evaluation without being excessive. The balance between fineness and time will be determined by the HCP Lab, which has extensive experience in this process.

C. CHOCOLATE MAKING

The HCP Lab will use a standard 68% cacao, semisweet chocolate recipe for all evaluations:

Chocolate Liquor	65.10%
Deodorized Cocoa Butter[1]	3.00%
Sugar[2]	31.55%
Soya Lecithin[3]	0.35%

[1] Cocoa butter used in this formulation will be neutral tasting so as to not shift the flavor inherent in the liquor. The HCP Lab will verify by taste the use of neutral butter.
[2] Prior to use, the sugar must be assessed to ensure that it is neutral in taste and smell by placing 2-4 ounces of sugar in a jar twice that size, securely capping the jar, and holding for at least one hour. The sugar will then be uncapped and immediately smelled to determine that it has no inherent odor.
[3] Soya lecithin used should be double bleached and also verified to ensure that it will not alter the flavor of the chocolate.

The same protocol steps for liquor milling then apply to chocolate making:

- Chocolate milling may be accomplished in any suitable slow rotating stone or porcelain grinding mill. Metal milling (e.g., ball mills) or high-speed mills are not to be used.
- Milling will be performed in an area free of other odors and protected from environmental influences. GMP practices will be in place as well as an active HACCP program to insure wholesomeness of the product.
- During milling, the mill will be held at warm room conditions to insure that the liquor will not solidify during the milling process. The mill may be pre-warmed to operating conditions to facilitate milling.
- Milling temperature will not exceed 55°C (130°F).

Like liquor milling, exact chocolate milling times CANNOT be specified. However, in the case of chocolate, finished fineness is critically important so priority is given to achieving the fineness. The required fineness is less than 17 microns (6.7 10,000ths inches). This will be verified by micrometer (AACT method or equivalent) as an average of five independent measurements of a sample of the mass being milled.

Once the requisite fineness is reached, milling is concluded.

D. ANALYSES OF LIQUOR AND CHOCOLATE AND HOLDING OF SAMPLES

Following liquor milling, liquor will be checked either by PNMR or by NIR for total fat content. This data and the fineness of the chocolate will be provided to the HCP Tasting Panel with their evaluation samples.

Following all analytical tests on the beans and processing into liquor and chocolate, the remainder of the beans will be stored in a temperature and humidity controlled environment until the HCP completes all its analyses, including genetic sampling and ensure sufficient time for all parties, including the Applicant, to review the HCP results, Once it is determined that no further sampling of these beans is needed, the beans may be discarded or the HCP will provide the HCP Lab with other directions.

NOTE: The HCP IS aware that chocolate and in particular semisweet chocolate will change flavor profile—particularly mellowing—with long term storage. While this is understood, it is not practical to hold chocolate 2-4 months to provide a response the Applicant within a suitable time frame. Thus, HCP Tasting Panel samples will be stored one (1) week prior to flavor evaluation, which is covered in the following protocol.

PROTOCOLS FOR HCP LAB
SAMPLING, STORAGE, & SHIPPING OF SAMPLES AND PANELIST RECEIVING & STORAGE OF SAMPLES

LIQUOR AND CHOCOLATE SAMPLING AND STORAGE

Samples - Liquor

The HCP Lab will pour melted and homogenized liquor into sample containers (VWR Polypropylene Wide Mouth Bottle, 30 ml (Cat No. 414004-122) or equivalent and tightly capped. Each sample bottle will be evaluated to insure they are free of any off odors.

Liquor samples will be prepared in the following amounts for the HCP Tasting Panel, USDA Applicant, which can change based on the needs of the HCP Tasting Panelists and the USDA:

HCP Tasting Panel and USDA

- 6 (FOUR) 20g containers — 120g total
- 3 (THREE) 30g containers — 90g total
- 2 (TWO) 25g containers — 50g total

To Return to Applicant

- 2 (TWO) 25g containers — 50g total

Retained by HCP Lab

- 2 (TWO) 75g samples in 4oz non-sterile polypropylene specimen jars — 150g total

All samples will be labeled with the HCP Application Number and the date of liquor milling.

Storage – Liquor (Pre-Shipping)

Liquor will be stored at chocolate warehouse temperatures (17-21°C, 62-70°F) until shipped to the HCP Tasting Panel or returned to the Applicant.

Samples – Chocolate

Following milling, all chocolate for evaluation will be homogenized, hand tempered, and molded into the HCP Lab's standard molds of approximately 10g each. Tempered bars will be allowed to equilibrate over night and will then be vacuum-sealed in multi-layer, barrier film vacuum seal bags (e.g., FoodSaver or equivalent) allocated as follows:

Chocolate for HCP Tasting Panel (60g x 9 Panelists)	540g
USDA	20g
Chocolate for returning to Applicant	100g
Chocolate for retained sample	250g

All samples will be labeled with the HCP Blind Code and the date of chocolate milling and molding.

Storage – Chocolate (Pre-Shipping)

At all times, chocolate will be stored at chocolate warehouse temperatures (17-21°C, 62-70°F) until shipped to the HCP Tasting Panel or returned to the Applicant. Storage will be at least two days but is not expected to be more than four days from date of molding.

LIQUOR AND CHOCOLATE SHIPPING AND LONG TERM STORAGE

Liquor and Chocolate Shipping for Evaluation

The HCP Lab will use overnight shipping with heat protection, frozen packs, and/or any other methods deemed appropriate by the Lab to send samples to the Tasting panel and the USDA. (The HCP Lab based on the location of the Panelists will determine the best carrier. For shipments to Venezuela and Trinidad, FedEx is the preferred carrier due to delivery logistics within those countries.) For international shipments, packages will be labeled “research samples for evaluation” or something similar to avoid being held at customs or charged any duties.

Prior to shipping the HCP Lab or the chair of the HCP Tasting will verify that Panelists are available to receive the sample shipment and to conduct the sensory evaluations in a timely manner.

Storage of Liquor and Chocolate (Following Shipping of Samples)

Following the shipment of liquor and chocolate samples to the HCP Tasting Panel and the USDA, all liquor and chocolate (for returning to Applicant and the retained sample) will be placed at refrigerator temperatures in an odor-free cooler at less than 13°C (50°F) until the HCP Tasting Panel completes its evaluation and samples are returned to the Applicant. (Retained liquor and chocolate samples may be disposed of following the same steps as beans in the previous protocol.)

If storage longer than 2 (TWO) months from date of milling is expected, samples will be transferred to odor-free frozen storage for long term holding. Any sample stored under these long-term conditions will be equilibrated to room temperature prior to opening the container/vacuum-sealed bag.

HCP TASTING PANEL RECEIVING AND STORAGE OF SAMPLES

Upon receipt of samples, if samples have been shipped with frozen packs, the HCP Panelist will opened the package and remove the samples BUT keep them in their sealed containers and allowed to equilibrate to room temperature. No sample will be opened when cold temperatures would allow any moisture condensation.

Panelists will store samples during this time at ambient conditions (air conditioned room temperature). If ambient conditions are too warm for the chocolate and pose risk of melting or bloom, then an odor-free refrigerator or wine cooler will be used to store the chocolate.

Panelist evaluation MUST BEGIN AT LEAST ONE WEEK from the completion of chocolate milling. Panelists determine their own schedule for the evaluation of the samples but will attempt to provide turn around of the evaluations within four weeks of receipt of the samples.

HCP Tasting Panel Evaluation Procedures are covered in the next protocol.

HCP TASTING PANEL EVALUATION PROTOCOLS FOR EVALUATION AND HEIRLOOM DESIGNATION

The international HCP Tasting Panel is currently made up of nine experts from six countries with a minimum of 15 years' experience in chocolate—all of whom have all served as professional evaluators of cacao bean flavor and give a wide field view of the cacaos of the world, the cocoa supply, and fine chocolate production across the globe. Since these Panelists have established approaches to evaluating liquor and chocolate made from that liquor, the HCP Tasting Panel evaluation protocol initially retains the uniqueness of these approaches.

EVALUATION

The HCP Tasting Panel's initial sensory evaluations of liquor and chocolate samples will be in the format they currently use. Panelists will then translate their evaluations into HCP global scores for flavor, write short written evaluations of the liquor and chocolate IN ENGLISH, and make a Yes/No vote for Heirloom designation based on this scoring and evaluation.

HCP Panelists will enter their scores, written evaluations, and recommendations in the HCP Database. (If the Database is unavailable or offline, the Chair of the HCP Tasting Panel will compile the results into a single review and circulate it to the Panel.)

Panelists will conduct all evaluations independently and only discuss each other's assessments after the entire Panel's evaluations are complete. While the names of the HCP Tasting Panel are public, Panelists' scores, evaluations, and recommendations will be blinded; Applicants will only be able to see unattributed individual scores, chocolate and liquor flavor and evaluations, and recommendations.

GLOBAL SCORING

In addition to a written Sensory Evaluation of Liquor and Chocolate, Panelists will make two standard attribute evaluations from 1-10 (10=maximum) for:

- Overall Flavor (Quality and Balance); and
- Unique Flavor (distinctive or unusual flavor profile of long term value to the community of cacao worthy of preservation).

HCP RECOMMENDATION – YES/NO

Based on scoring and evaluation, each Panelist will cast a Yes/No vote for Heirloom designation.

While individual scores should play a part in making that designation, Panelists are NOT required to correlate their recommendations to a score (i.e., one Panelist could score a sample a “5” and another a “9” and both could vote yes, no, or split on Heirloom designation).

DETERMINATION OF HCP STATUS/NOTIFICATION

AFTER the evaluations are received, the Panel Chair will schedule a conference call to review the results with the Panel and prepare a final report. Full Panel participation in this call is preferable but not mandatory. Upon completion of this call and report, the Panel Chair will notify the HCP and the HCP office will notify the Applicant.

Supermajority Vote FOR Heirloom Designation
If a supermajority (70% or more) of the HCP Tasting Panelists vote yes, the sample will receive HCP designation as Heirloom flavor.

Majority but not Supermajority Vote FOR Heirloom Designation
If a majority but not a supermajority recommendation is made for Heirloom designation or the Panel is split, the HCP Tasting Panel Chair will take one or both of the following steps:

- If any Panelists were unavailable for the initial evaluation but are now available in a reasonable time frame to make an evaluation, the Panel Chair can hold the final result until one or more of those Panelists make an evaluation. If the recommendation(s) create(s) a supermajority or minority vote for Heirloom designation, the Panel Chair will follow the steps outlined above.
- If no Panelist is missing or missing Panelists are unavailable, **AFTER the evaluations are received, the Panel Chair will schedule a conference call to review the results with the Panel and prepare a final report.** The Panel Chair during the Panel discussion will see if any Panelist wants to re-taste the beans based on the discussion. If a re-tasting results in a Panelist vote for designation that creates a supermajority, the Panel Chair will follow the steps outlined for the supermajority. (Only the final consensus of the Panel will be made public.) If the Panel remains unchanged, the Panel Chair will take the steps in that follow.

Simple Majority, Tie, or Minority Vote Against Heirloom Designation
If a simple majority of the HCP Tasting Panel votes yes, the Panel is tied, or a minority vote for Heirloom designation, the sample will NOT receive HCP designation as Heirloom flavor but will receive a score from the Panel.

IF the Panel perceives that the beans display the POTENTIAL for heirloom, regardless of whether there are any processing issues, the Panel may vote to allow the Applicant to re-submit the beans for re-evaluation under the rules under "Evaluation Troubleshooting."

Upon completion of this call and report, the Panel will notify the HCP and the HCP office will notify the Applicant.

OFFICIAL DESIGNATION OF HCP STATUS/NOTIFICATION

While Heirloom designation by the HCP is not contingent on genetics (unless a problem with the beans is detected – see "Troubleshooting" section that follows), **official designation as Heirloom flavor IS CONTINGENT on a field visit by the USDA or its representative to gather leaf material from the marked trees and verification/review of the fermentation process.** Ideally, this will be done during production but always in a reasonable amount of time to not unnecessarily delay the announcement of the designation or Applicant's production and marketing of those beans.

IF upon site visit, any beans are found or suspected to be in violation of any of the HCP Submission Protocols at any time during or after this field visit, the HCP will withhold HCP Heirloom designation pending further discussion by the Tasting Panel, Lab, and Board.

EVALUATION TROUBLESHOOTING

Perceived Postharvest Processing Problem/Vote for Resubmission

IF the HCP Lab or Panelists perceive a failure in the sample due to postharvest processing AND feel that the liquor and chocolate display some desired attributes, the Panel will recommend the beans be resubmitted for re-evaluation by the Applicant as soon as new beans are available.

The HCP will allow for ONE resubmission per Application – provided the Applicant wants to have its beans re-evaluated by the HCP. Regardless of the Applicant's decision, it will still receive a full report of the original evaluation.

Applicant will be responsible for submitting the beans for re-evaluation, but the HCP will NOT require an additional application fee. **Re-submitted beans**

must come from the same trees as the original submission. If the Applicant decides not to re-submit, the evaluation of the beans by the Panel will be submitted to the HCP as the final evaluation.

Perceived HCP Lab Processing Problem

IF in the unlikely event Panelists perceive a failure in the sample due to the processing of the beans into liquor and chocolate by the HCP Lab AND feel that the liquor and chocolate have reasonable potential for displaying HCP desired attributes, those Panelists will immediately inform the Panel Chair and may request another sample of liquor and chocolate along with the beans be re-sent for evaluation, if needed, to make a final recommendation. If after re-evaluation Panelist(s) detect the same problems, the Chair will review the comments and rationale and convene a Panel discussion as appropriate.

IF a Panelist perceives a failure in the sample due to processing of the beans into liquor and chocolate BUT feels that the sample DOES NOT have Heirloom potential, no action will be taken and the Panelist will vote NO.

Perceived Fermentation Alteration

IF the HCP Lab or any Panelist perceives a sample has been altered in any way during fermentation – a direct violation of the HCP Submission protocols – AND feels that the liquor and chocolate display HCP desired attributes, the Panelist will immediately inform the Chair and the HCP Lab and the Chair will convene a Panel discussion as appropriate and decide what, if any, action to take. The HCP Tasting Panel Chair may recommend Heirloom designation be withheld pending a site visit AND genetic testing.

IF the Lab or a Panelist perceives the sample has been altered in any way AND feels that the sample DOES NOT have Heirloom potential, no action will be taken and the Panelist will vote NO.

HCP Panelist Unavailable

The HCP strives to have all Panelists provide evaluation input but recognizes there may be times when, due to travel, holidays, or emergencies, Panelists may not be available for an extended period of time.

The HCP Tasting Panel Chair will be responsible for determining whether a panel will proceed at these times or whether it will wait to send out samples. If the decision is made to wait, all samples whether at the HCP Lab or in the hands of Panelists will be frozen.

In no case will the panel proceed with fewer than five Panelists.

HCP PROTOCOLS FOR FIELD SITE VISIT & COLLECTION OF SAMPLES FOR GENETIC ANALYSIS

Official designation as Heirloom or fine flavor by the HCP IS CONTINGENT on a visit to the Applicant's field site by a USDA/ARS representative to gather leaf material from the marked trees that produced the HCP sample to determine their genetic makeup, supplemental data on those trees, and verification/review of the fermentation process. The HCP will coordinate this visit as soon as designation is final. Ideally, this visit will be done during production but most importantly in a reasonable amount of time to not unnecessarily delay the announcement of the HCP designation. The USDA will provide all materials for sampling and send them to the representative prior to his/her visit.

IF at any point during the site visit, the Applicant is found or suspected to be in violation of any of the HCP Submission Protocols or the representative has any concerns about the sampled trees, the representative will document them and inform the USDA/ARS and HCP immediately. If a violation is suspected that would affect designation and cannot be resolved during the site visit, the HCP will terminate the visit and withhold Heirloom designation pending further discussion by the Tasting Panel, Lab, and Board.

FIELD SITE VISIT PROCESS FOR TREE SAMPLING

When the Applicant takes the representative to the trees used for the HCP bean samples, a sample will be collected for genetic analysis from the most recent fully expanded leaf from no more than 46 trees. Data will be taken for each sampled tree and if trees are not marked or clearly marked, the Applicant will mark them with the number 1-46 corresponding to the number of each leaf sample.

- Only leaves that appear to have no browning or any signs of disease or pests will be taken.
- Only half of one leaf from each tree will be harvested and that leaf will be placed into a Ziploc type plastic bag with a desiccant. (Leaf samples will be completely dry in less than 24 hours and will remain green.)
- Trees sampled will be assigned a code and the sample bags will be labeled to indicate the tree's code.

The representative will also gather supplemental data about each tree (tree height, pod characteristics, bean color, yield, tree age, tree origin, disease resistance/susceptibility, etc.) and submit this information along with the leaf

samples using the HCP data sheet.

FIELD SITE VISIT PROCESS – POSTHARVEST PROCESSING

The Applicant will show the representative all aspects of the postharvest processing used to process the beans submitted to the HCP.

The representative will gather basic information regarding the processing (fermentation times/temperatures, drying methods, etc.), as well as production and agronomic data (fertilizer use, soil characteristics, topography, climate, etc.). A list of basic information to collect in addition to other observations will be provided to the representative.

Photos of the process, unless proprietary, should be taken. FIELD REPRESENTATIVE WILL ASK IF ANY PART OF THE PROCESS IS PROPRIETARY BEFORE TAKING PICTURES. GPS of the farm (not the cooperative) must be taken.

SHIPPING OF SAMPLES

United States Animal and Plant Health Inspection Services (APHIS) guidelines will be followed to prevent the importation and release of plant pathogens.

The healthy dried leaf samples will be prepared for shipment to the USDA by the representative, including the APHIS permit (provided by the USDA) that will be placed in the package. The Applicant will then send the package to the USDA and submit the shipping receipt to the HCP for reimbursement.

Samples should be sent to:
Lyndel W. Meinhardt
USDA/ARS Sustainable Perennial Crops Lab
Building 001 Rm 222, BARC-WEST
Beltsville, MD, 20705-2350
Tel 301 504 1995 Fax 301 504 1998

Photos and information gathered should be emailed to Dr. Lyndel Meinhardt: lyndel.meinhardt@ars.usda.gov

All submitted plant samples will be subject to quarantine and inspection upon arrival in the United States. If APHIS inspectors identify any signs of plant disease on the samples, the samples will be destroyed at the port of entry.

PROCESSING OF SAMPLES & NOTIFICATION

Once the samples arrive at the USDA, they will be processed and sent to the DNA testing facilities for analysis.

DNA will be extracted and analyzed with standard markers and compared to all known reference types. Parentage and sibling analysis will be done to determine what groups, hybrids, or clones are involved in the genetic makeup of the sampled trees.

The results of the genetic analysis will be sent to the Applicant and placed into a secure part of the HCP database for a period of five (5) years. This database will be the repository for genetic diversity population analysis, GIS population locations, bean quality traits, and flavor analysis. After that period it will be incorporated into the HCP public database. Until then, the public database will be the storage area for all of the international reference types, and after the designated time period, for all cacao types designated as Heirloom.

Once the samples are received and tested, the DNA matches (within reason) the DNA of the originally submitted beans, and Lyndel Meinhardt signs off on the report from the USDA representative, the HCP will provide the Applicant with the “Permission to Disclose” form in order to proceed with the announcement of Heirloom designation.

Appendix G

Queen Emma price list

Appendix G Queen Emma price list

Queen Emma Chocolates Company

Product Price_ List 2016.

*StockCode	Description	StockUom	Price List (Excl GST)
	MILK CHOCOLATE		
QLL22100	QUEEN EMMA GOLD 12X18X10G	CTN	160.00
QLL24400	Q-EMMA LOVINA MILK CHOCOLATE 12X18x10G	CTN	150.00
	DARK CHOCOLATE (75%)		
QLD23200	Q EMMA S/SRCE MARKHAM VALLEY 12X18X10G	CTN	150.00
QEMA	Q EMMA S/SRCE YUS KAKAO TREE KANGAROO 12X18X1(	CTN	150.00
QLD23201	Q EMMA S/SRCE TOKIALA 12X18X10G	CTN	150.00
QLD23202	Q EMMA S/SRCE SIWAI 12X18X10G	CTN	150.00
QLD23203	Q EMMA S/SRCE KOKODA 12X18X10G	CTN	150.00
QLD23205	Q EMMA S/SRCE BUIN 12X18X10G	CTN	150.00
QLD23206	Q EMMA S/SRCE KIETA 12X18X10G	CTN	150.00
QLD23204	Q EMMA S/SRCE MAITOK 12X18X10G	CTN	150.00
QLD23300	Q EMMA S/SRCE ALOTAU 12X18X10G	CTN	150.00
QLD23301	Q EMMA S/SRCE MISIMA 12X18X10G	CTN	150.00
QLD23302	Q EMMA S/SRCE GOODENOUGH 12X18X10G	CTN	150.00
QEMA	Q EMMA S/SRCE CAPE L'AVERDY (TINPUTZ KAKAO) 12X1	CTN	150.00
QLD24300	Q-EMMA STONE GROUND 12X18X10G	CTN	150.00
QLD24301	Q-EMMA CURINA RAW CHOCOLATE 12X18X10G	CTN	200.00
	QUEEN EMMA CATERING		
QLD26101	Q-EMMA BOUGAIVILLE GOURMET POWDER	CTN	84.00
QLD26121	QUEEN EMMA DARK CHOCOLATE BUTTONS 10kg	CTN	205.00
QRN27001	CURINA RAW COCOA NIBS 12X500G	CTN	108.00
QRN27011	BOUGAINVILLE ROASTED NIBS 12X500G	CTN	96.00
	CHOCOLATE BARS		
QLD28001	PIKININI PURE DARK CHOCOLATE – 75% Cocoa 48x35g	CTN	80.00
QLD28011	PURE DARK CHOCOLATE- 75% Cocoa 24x70g	CTN	72.00
QLD28021	PURE DARK CHOCOLATE- 75% Cocoa 24x140g	CTN	135.00
QLL28201	PIKININI PURE DARK CHOCOLATE – 75% Cocoa 6X48x35g	CTN	480.00
QLL28211	PURE DARK CHOCOLATE- 75% Cocoa 6X24x70g	CTN	432.00
QLL28221	PURE DARK CHOCOLATE- 75% Cocoa 3X24x140g	CTN	405.00
QLL28101	PIKININI PURE MILK CHOCOLATE 48x35g	CTN	80.00
QLL28111	MILK CHOCOLATE 24x70g	CTN	72.00
QLL28121	MILK CHOCOLATE 24x140g	CTN	135.00
QLD28301	PIKININI PURE MILK CHOCOLATE 6X48x35g	CTN	480.00
QLD28311	MILK CHOCOLATE 6X24x70g	CTN	432.00
QLD28321	MILK CHOCOLATE 3X24x140g	CTN	405.00
	COOKIES		
QLD25011	Q-EMMA CHOCOLATE COOKIES 20X100G	CTN	32.00

** Please enquire with our customer service. GST not included (10%)

Amended 06/05/2016

Price is FOB Port Moresby PNG

For Orders: ***Queen Emma Chocolate Company***
C/- Paradise Foods Limited
P.O.Box 1624
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