



FY 2016 Food for Progress Cacao Promotion Project: KABOS



REPORT

Baseline Study Report

“Kawako bay Bourad pou Opotinite ak Sikse”

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FY 2016 Food for Progress Cacao Promotion Project: KABOS

Baseline Study Report

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Cover photo : Mr. [REDACTED], Haiti, with hurricane-damaged cacao tree in his cacao garden, December 2016.

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Baseline Evaluation Team

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List of Abbreviations

AMAGA	Association des Maires de la Grand'Anse
BRH	Banque de la République d'Haïti (Republic Bank of Haiti)
CacaoDam	Coopérative Cacaoyère de Dame Marie
CACCOMA	Coopérative Agricole Cacaoyère et de Commercialisation des Abricots.
CAUD	Coopérative Agricole Union Développement
COPCOD	Coopérative de Production et de Commercialisation de Chambellan
COPDAH	Coopérative pour le Développement Agricole de l'Anse d'Hainault
CRS	Catholic Relief Services
FACN	Federation des cooperatives cafeieres natives
FECCANO	Federation des Cooperatives Cacaoyeres du Nord
FLO	Fair Trade Organic Certification
GPS	Global Positioning System
HAP	Hillside Agriculture Project
ICCO	International Cacao Organization
KABOS	Kakawo Bay Bourad pou Opotinite ak Sikse
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural.
MEDA	Mennonite Economic Development Associates
MOCAC	La Moronaise Coopérative Cacaoyère
MT	Metric Ton
PDNA	Post Disaster Need Assessment
RECARP	Reseau des Cooperatives Cafeieres Beaumont
RECOCARNO	Reseau des Cooperatives Cafeieres du Nord
SERVICOOP	Company funded by USAID for assisting the cacao sector
SOFADES	Oxfam and Twin Holdings Support fair Trade of Haitian coffee
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
\$ or USD	US Dollars
HTG	Haitian Gourdes. Exchange rate: one USD = 68HTG

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1. Executive Summary

This is the baseline report for the USDA/CRS Cacao Promotion KABOS project, FCC-521-2016/012-00. The USDA award was signed on September 29, 2016. On October 3, 2016, at the beginning of the major harvest season of the year, Hurricane Mathew struck the project zone, destroying virtually all of the crops and severely damaging most of the farmers' homes and stored grain/seed. In this context, a traditional baseline would have set production levels near zero and would not have been useful for understanding the production system, designing project activities, and measuring results achieved by the end of the project. On a base of zero, any percentage improvement would be infinite. Accordingly, the KABOS team, in collaboration with USDA, decided to base the baseline evaluation on farmers' recall of their production and prices from the year before the hurricane. This recall information was used to set the levels of the only two performance indicators requiring measurement by the baseline. Given the extent of the hurricane damage, it is doubtful that production will return to pre-hurricane levels before the end of the project.

Given the nature of the standard performance indicators, the baseline survey was actually not needed to set the levels of the project's standard performance indicators. By contract, they are all set at zero because the standard indicators require prior USDA development activity in the target area and there was no USDA involvement prior to the start of this project. For example, performance indicator number one is "Value of sales by project beneficiaries. FFPr Standard 13; FtF: Only sales attributable to USDA involvement will be counted." Because there was no USDA involvement prior to the project, the level of the performance indicator is zero. Only the two custom performance indicators require setting by the baseline; which are:

- Custom Indicator 8: Increase in producer yields as a result of USDA assistance
- Custom Indicator 17: Reduction in post-harvest loss as a result of USDA assistance.

Data collection was conducted from January 23 to February 18, 2017. The survey team selected a random sample of 308¹ farm families from a list of 7,500 farmers prepared by KABOS project staff. The survey team visited the selected farm families and conducted a questionnaire-guided interview, noting the farmers' responses in electronic tablets/computers. During each interview, the farmer provided, from memory, the total number of farm plots (gardens) managed by the family, farm plot sizes, crop production, and price data from the multiple crops harvested the year before the recent hurricane. In consultation with the farmer, the survey team selected one of the farm plots to represent the agroforestry/cacao system. The team then collected GPS coordinates of the perimeter of the plot and calculated the area of the plot, using ARCGIS software. The team then counted the cacao, fruit, and forestry trees on the plot (in the agroforestry/cacao garden) and used this information to calculate an estimate of Custom Performance Indicator 8. The estimated yield per hectare was 385kg/ha. With an estimated average number of 316 cacao trees per hectare, an estimate of the yield per tree is 1.51kg per tree. The estimation of Custom Performance Indicator 17 was taken from a 2015-2016 crop year

¹ In the sample, 308 have cacao trees, at least 10 trees, it was a basic requirement. But one farmer, instead of selling his production (low volume), processes it into local chocolate for household consumption.

study of the records of five cooperatives in the Grand'Anse. The estimate of post-harvest losses at the cooperative level was 26%.

In addition to estimating the levels of the two Custom Performance Indicators, the baseline study also collected information on the variables listed along with their estimated values in the following section.

2. Synthesis of results in matrix form.

INDICATOR TITLE	Baseline		Notes
Indicator 1: Average per farm, normal-year, levels of production of: cacao, banana/plantain, igname, breadfruit, malanga, and one other major crop	Crop	kg/per farmer	The reference year was 2015-2016. Based on 308 farmers recall. These figures take into account production of all crops cultivated by the farmer, including the main crops retained by this study. All farmers do not grow every crop in the list.
	Yams	302.2	
	Malanga	75.4	
	Plantain	707.8	
	Cassava	54.8	
	Sweet Potato	76.6	
	Corn	93.9	
	Bean	59.1	
	Cacao	73.3	
	Breadfruit	2529.5	
	Coconut	220.9	
	Mangos	1523.7	
	Avocado	203	
Indicator 2: Average, per farm, normal-year, price levels of: cacao, banana/plantain, igname, breadfruit, malanga, and one other major crops		USD/kg	USD per kg. Farm prices based on 307 farmers recall. One of the 308 farmers in the sample did not sell cacao
	Yams	0.33	
	Malanga	0.43	
	Plantain	0.25	
	Cassava	0.13	
	Sweet Potato	0.35	
	Corn	0.29	
	Bean	1.43	
	Cacao fermented	2.91	
	Cacao dried	1.23	
	Breadfruit	0.15	
Indicator 3: Annual revenue from crop production in USD.	\$1094 Including \$588 from crop \$506 from fruit		These are crops and fruits harvested per farmer multiplied by farm prices from 308 farmers recall.

INDICATOR TITLE	Baseline			Notes
Indicator 4: Average cacao yield per hectare and per tree based on farmers’ recall	384.8 kg per hectare 1.51 kg per tree			Average estimated from the triangulation of 3 different methods.
Indicator 5: Proportion of farmers trained to improve the productivity of their cacao trees	9%			Trained by CACCOMA, AMAGA and CRS
Indicator 6: Proportion of farmers practicing the following cultural practices: nursery, direct seeding of cacao, pruning, cover trees and shade management, fertilization, weeding, intercrops and spacing.	Sapling production	8.9%		Pruning (60.8%), mainly after Matthew.
	Direct seeding	8.3%		
	Grafting	2.7%		
	Pruning	61%		
Indicator 7: Proportion of farmers practicing the following management techniques: record the number of pods per tree each season, record total sales and expenses by crop	0%			Farmers could not show evidence with documents.
Indicator 8: Proportion of farmers that had been trained and applied improved marketing techniques for cacao.	7% as proportion - Or 420 farmers			The estimation is based on the proportion of farmers from the sample that had been trained and applied “improved marketing techniques” (7%)x by 6000 targeted farmers for this project= 420 farmers.
Indicator 9: Number of farmers selling their cacao beans in wet form to an organization that ferments the beans prior to marketing them.	10% as proportion - Or 600 farmers			The estimation is based on the proportion of farmers from the sample who market their cacao beans in wet form to an organization (10%) x 6000 targeted farmers for this project= 600 farmers.
Indicator 10: Proportion of farmers who only sell dried and unfermented cacao beans	89.7%			No premium for quality.

INDICATOR TITLE	Baseline		Notes
Indicator 11: Average number of farmers receiving loans from a financial institution in a normal year.	• 2.00% as proportion • Or 120 farmers		The estimation is based on the proportion of farmers receiving loans from financial institutions in a normal year. 6/307 in 2016. (2%) x 6000 targeted farmers for this project = 120 farmers.
Indicator 12: Average value and cycle time of loans individual farmers receive in a normal year from a financial institution.	• 582 USD • 12 months		• Median value is \$294 • Duration 4 to 20 months.
Indicator 13: Estimation of survival cacao trees, fruit and forest trees, after Hurricane Matthew.	Cacao	45.50%	Status in February 2017.
	Coconut	21.70%	
	Bread fruit	43.20%	
	Mango	51.20%	
	Avocado	27.80%	
	Orange/Chadeque/Lemon	48%	
	Forest trees	49.70%	
Indicator 14: Percentage of Cacao post-harvest losses.	26.33%		Monitoring of 5 fermentation centers 2015/2016: Moron, Abricots, Chambellan, Dame Marie, and Anse d'Hainault.

3. General Framework of the Study.

3.1. *A Post Hurricane Context*

This baseline study was conducted in a post-Hurricane Matthew context that struck Haiti on October 3, 2016. The baseline concerns two states (*départements*): the Grand'Anse and the South; and concerns 10 counties (*communes*): Moron, Abricots, Jérémie, Roseaux, Corail, Pestel, Beaumont, Camp Perrin, Torbeck and Maniche. The losses caused by Matthew were estimated at over two billion dollars for the entire country. The agricultural sector alone suffered losses estimated at \$600 million. The South and Grand'Anse departments were the most devastated by gusts of wind blowing at approximately 250 km/h. Agriculture and agroforestry were specifically affected. Most of the cacao plantations were severely damaged. The Post Disaster Need Assessment 2016 (PDNA)² confirmed an environmental disaster almost unprecedented in recent history occurred in Grand'Anse and South departments.

The damages observed at the plantations after Matthew suggested a possible end of the cacao sector in these regions. However, the post-Matthew rapid assessment³ sponsored by CRS revealed that natural regeneration was ongoing. In reality, some trees resisted the storm. The winds striped the leaves from the trees and broke limbs and tree peaks, but many trees that had remained standing began regrowth immediately with the rains that followed Hurricane Matthew for more than two weeks afterwards. However, the many broken limbs and blown-down trees have severely hampered efforts by farmers to farm their plots. These plots are referred to locally as “gardens.” Simply walking in the gardens was difficult.

Results from the systematic observations of 120 plots during the rapid assessment showed that in early December 2016, 63.7% of the cacao trees were alive, 40.7% of which were still productive. 23% of the 63.7% need intervention for their survival. However, the strong winds blowing in the Grand'Anse in early January 2017 and the subsequent drought, have retarded natural regeneration and might result in the destruction of a significant percentage of cacao trees.

3.2. *Objectives*

The objectives of this baseline study are to estimate from farmer recall or prior year studies:

1. average, per farm, normal-year levels of farm production and prices of cacao, banana/plantain, igname, breadfruit, malanga, and one other major crop;
2. average cacao yield per hectare and per tree;
3. the proportion of farmers who have received training to improve the productivity of their cacao trees and ask farmers what organization provided the training;
4. the proportion of farmers who practice the following cultural practices: sapling production, direct seeding of cacao, pruning of cacao and shade trees, fertilization, weeding, spacing of intercrops, etc.;

² www.mpce.gouv.ht/.../pdna-vf-30012017_version_finale_5.02.17

³ L'OURAGAN MATTHEW ET LA FILIERE DU CACAO DANS LA GRAND'ANSE: Le producteur, la coopérative, dommages et pertes, Résilience et stratégie de relèvement, Frisner Pierre, CRS/Haiti, Décembre 2016.

5. the proportion of farmers who practice the following management practices: record the number of pods produced per tree each season, record total sales and expenses by crop;
6. the number of farmers who have received and applied training on improved marketing techniques for cacao;
7. the number of farmers who market their cacao beans in wet form to an organization that will ferment the beans prior to marketing;
8. the proportion of farmers who sell their cacao beans only in unfermented, dried form;
9. the average number of farmers receiving loans from financial institutions in a normal year;
10. the average value and cycle time of loans individual farmers receive in a normal year from a financial institution
11. the post-harvest losses occurring at the processing level.

3.3. Understanding Of Reference Terms And Objectives Of the Study.

The purpose of any baseline study is to set the value of important variables at the start of a project as a reference point for measuring progress toward achieving project objectives. In the case of the KABOS project, the levels of all of the standard performance indicators are set at zero by the USDA award, FCC-521-2016/012-00. For example, the first standard performance indicator (see the list of indicators in APPENDIX, page 65) “Value of sales by project beneficiaries. FFPr Standard 13; FtF)...Only sales attributable to USDA involvement will be counted.” Because there was no USDA involvement prior to the project, the level of the performance indicator is zero.

The essential information collected in this study relates to cacao tree productivity in the project intervention areas recently affected by Hurricane Matthew (the Grand'Anse and South departments of Haiti). Considering that the baseline study was conducted after the hurricane, during a period when no harvest was possible, and taking into account that Hurricane Matthew had changed the cacao ecosystem sustainably; the study is based, in part, on the interviewed farmers' memory: “recall data.” We were able to collect a limited amount of critical information from direct observation of the farmers agroforestry/cacao gardens. Namely, in collaboration with the farmers interviewed, the evaluators selected one of their gardens, measured its area and counted the number of cacao trees found within it.

4. Methodology.

4.1. *Guidance from the Terms of Reference*

The Consultant will be given a list of agroforestry/cacao growers in Moron, Abricots, Jeremie, Roseaux, Corail, Pestel, Beaumont, Camp Perrin, Torbeck, and Maniche communes identified for participation in the KABOS project. The list will indicate the name of the farmer, geographic location by Commune and Section of the farm, size of the farm, and contact information of the farmer. The Consultant will draw a random sample from the list provided by CRS. The sample may be stratified to minimize survey costs. The Consultant will develop a survey instrument in collaboration with CRS and use the instrument to conduct the baseline survey on the sample of the population.

The Consultant will visit each sampled farmer in their agroforestry plot/garden and: (i) capture an adequate number of GPS coordinates to enable calculation of the size of the garden; (ii) take a picture of the farmer, showing the farmer's face, head, and shoulders; (iii) count the number of cacao trees in the garden; (iv) count the number of cacao trees damaged beyond rehabilitation by the hurricane; (v) count the number of cacao trees that can continue service with or without rehabilitation (vi) observe if cacao trees have been pruned as normally recommended by cacao production specialists; (vii) observe other cultural practices (viii) implement the survey instrument

4.2. *The Study Sample of Farmers*

The population to be surveyed was provided to the consultant as a list of 7508 potential participants already identified by CRS. The list is organized by commune. Two factors were taken into consideration when choosing the sample: (i) the representativeness of each commune in the sample, (ii) a requirement that selected producers own at least 10 cacao trees. 22% of the producers in the list provided by the CRS do not have cacao.

A sample of 35 producers owning at least 10 cacao trees was randomly selected from each commune except for Corail, Pestel and Beaumont. In these three counties the sample was reduced to 20 producers per commune because the population of cacao producers is numerically low in these counties. For example, in Beaumont the population of cacao producers is less than 50. For each commune, 7 producers were added to the sample of 35 as potential replacements for sampled farmers not available for the interview. A total of 308⁴ producers were surveyed. SPSS software automatically generated the sample from the population. This is a random stratified sample per commune, where all 10 counties followed a normal distribution. As a result, the evaluators could estimate population variables with a minimal bias using the GAUSS distribution.

⁴ In the sample, 308 have cacao trees, at least 10 trees, it was a basic requirement. But one farmer, instead of selling his production (low volume), processes it into local chocolate for household consumption.

4.2.1. The formal farming survey (household-producer level)

The formal survey was conducted with the pre-cited random sample of household-producers. The interview instrument or “questionnaire” addressed aspects related to production, yield, cultural practices, cacao marketing, and access to institutional credit. At the time of the interview, the survey staff collected direct observations of one of the farmer’s agroforestry/cacao gardens. Specifically, the staff measured the area of the garden and counted the number of cacao and other trees in the garden. For this field phase of the study, 20 junior agronomists served as data collectors and 4 senior agronomists supervised the work and controlled the quality of the data.

4.2.2. Direct observation of the plots

The sample of 308 producers was used to collect the information requested at the cacao plantation level. Since CRS mandated that the survey be implemented while visiting the farmers’ gardens, the crop assessments were completed at the time of the interview with the producer. The following direct measurements were taken:

1. capturing GPS coordinates for use in calculating the actual area of the garden as compared with the area stated by the farmer;
2. photographing the farmer showing their face, head and shoulders;
3. counting the number of cacao trees in the garden;
4. counting the number of cacao trees damaged by the hurricane and recovering;
5. counting the number of cacao trees that may continue to produce with or without intervention;
6. to observe whether cacao trees have been pruned according to customary recommendations made by cacao specialists;
7. observe other cultural practices.

However, some of the information, such as production levels of the main crops and the number of pods per tree, were based on farmers’ recall. The interview was implemented in the described post-hurricane situation where there were no crops in production and no crops had been harvested after Hurricane Matthew.

4.3. *Data entry and Analysis*

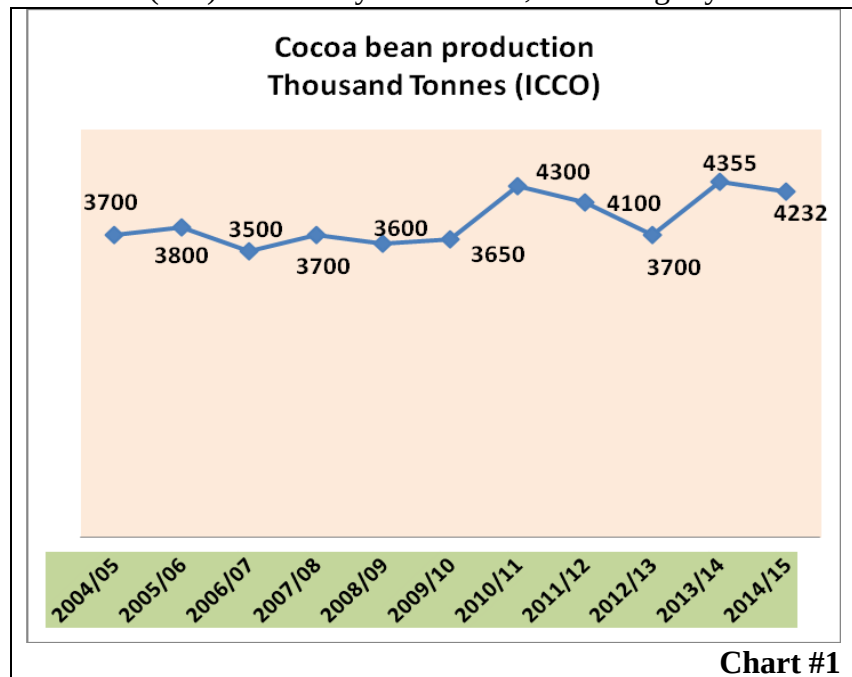
Data entry operations were conducted via the "data entry builder" module of SPSS. Data processing was carried out using the SPSS software. ARCGIS-QGIS 2.18⁵ was used to calculate the areas of the gardens, using the GPS data taken from the perimeter of the plots. Notice that the ARCGIS "line" option was used to calculate garden area, by contouring the parcel and closing the perimeter.

⁵ <http://www.esri.com/arcgis/about-arcgis>

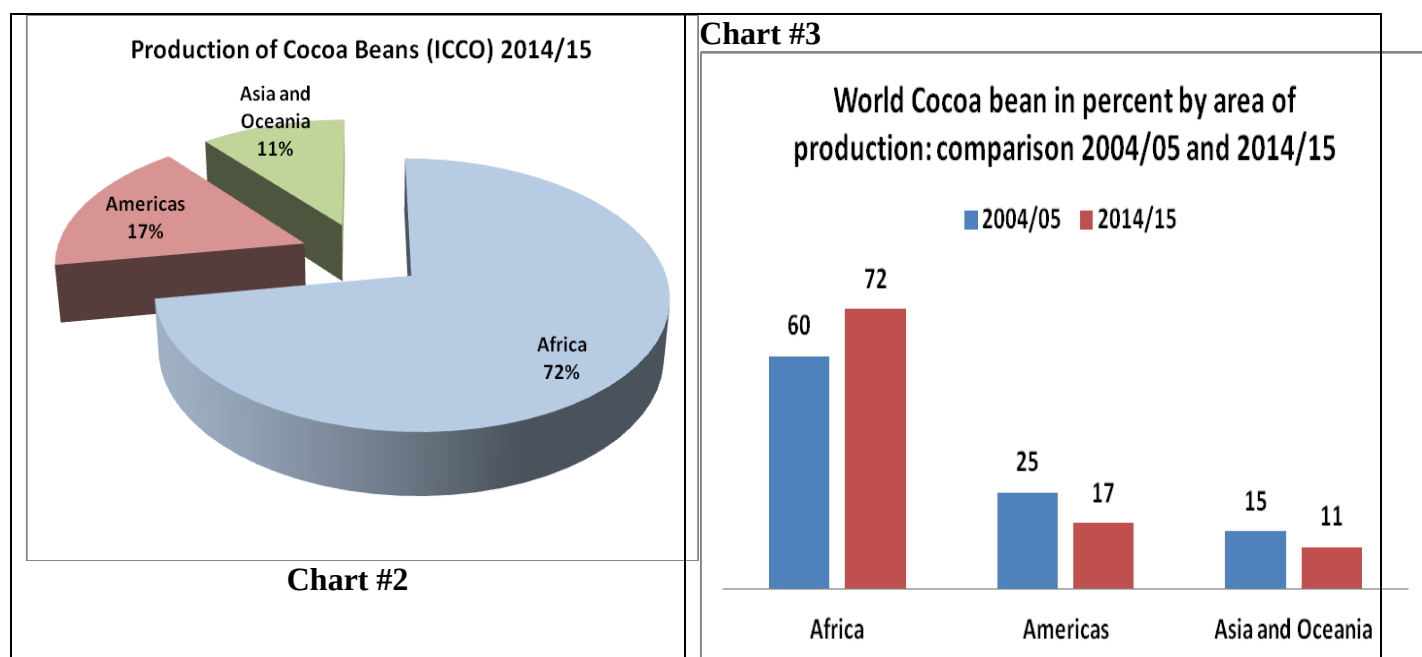
5. General information on the cacao sector.

5.1. World cacao production

Cacao production fluctuates due to climatic conditions. According to ICCO statistics⁶, the world cacao production is 4,232,000 metric tons (MT) for fiscal year 2014/15, down slightly from the previous year when production was 4,355,000 MT. From 2004/05 to 2014/2015, world production increased by 12.5%, thanks in particular to the intensification of the cacao cultivation in Cote d'Ivoire. Production was more or less stable until 2009 and started to increase significantly from 2010 onwards for the first time to reach the level of 4,000,000 MT. Production is highly concentrated; 72% of the world's crop is produced in Africa, mainly in Côte d'Ivoire with 40% of world production; 17% in Latin America and 11% in Asia. The production of Latin America, from which the cacao tree originated, is in decline; in just ten years Latin America, which used to supply 25% of the world production, decreased to just 17%; An identical finding is made for the Asia-Oceania region, where production is declining in relation to Africa, which is clearly on the rise.



⁶ www.icco.org



5.2. *World production, producing countries, and Haiti.*

Haiti contributes 0.11% of the world cacao production with 4,500 MT per year. Major producers in Africa supply 72% of the world production. Two countries, Cote d'Ivoire (39.5%) and Ghana (18.6%) produce 58% of world cacao alone. This means that two countries can significantly influence world prices. Nigeria and Cameroon with 235,000 and 205,000 MT per year, respectively, are also major producers who can strengthen this influence. In America, the two largest producers are Ecuador and Brazil, contributing 5.3% and 4.9% respectively to world production. Haiti's contribution appears insignificant in a global framework in terms of volume. Even at the regional level, its percentage contribution remains low. Production in the Dominican Republic is estimated at 72,000 MT, 16 times higher than that of the Republic of Haiti.

Despite this low level of production, cacao is expanding in Haiti. In 2002/03, national production of cacao was 3,400 MT, representing 0.09% of world production, according to statistics published by ICCO, 2002/03 Trade Map. In 2013/14, Haiti's cacao production rose to 4,500 MT, or 0.11% of world production. This relative increase in cacao production is the result of the cacao sector's effort in the early 1980s to increase cultivated areas, increase yields and improve quality. It also stems from the long-term impacts of the Mennonite Economic Development Association (MEDA)⁷ interventions, the USAID/Hillside Agricultural Project (HAP), CRS' country-wide work in agriculture, the attempts to organize the marketing of SERVICOOOP, the rise of cooperatives, and the existence of the Coffee and Cacao Institute.

⁷ <http://meda.org>

Current cacao production in Haiti, according to available data (MARNDR, Agricultural Census 2012) occupies an area of 15 thousand hectares with around 30 thousand small rural producers involved.

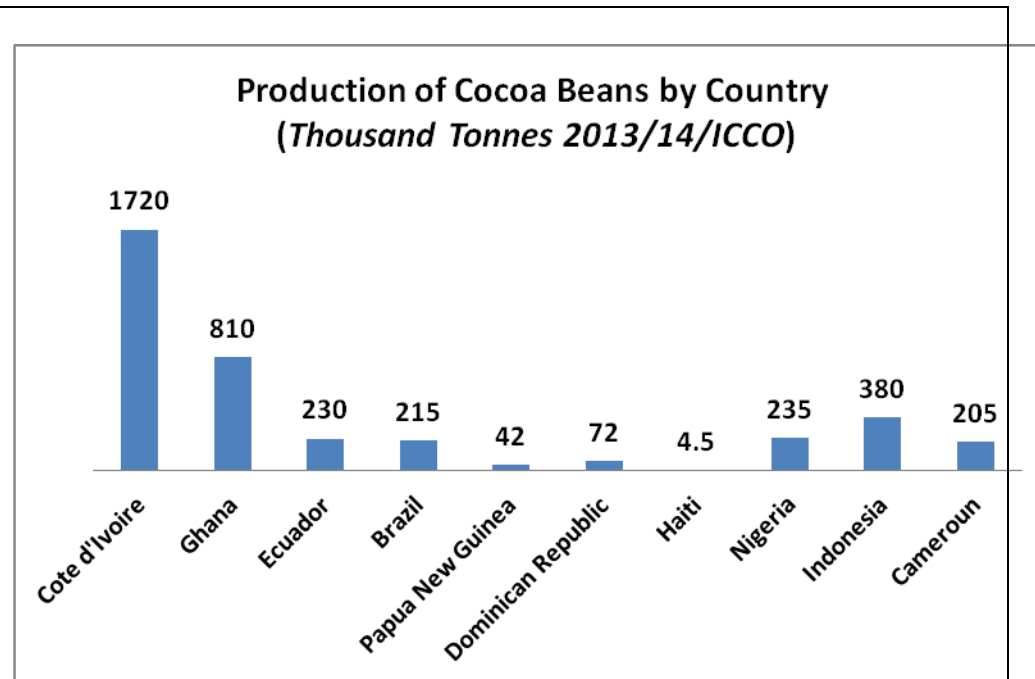


Chart #4

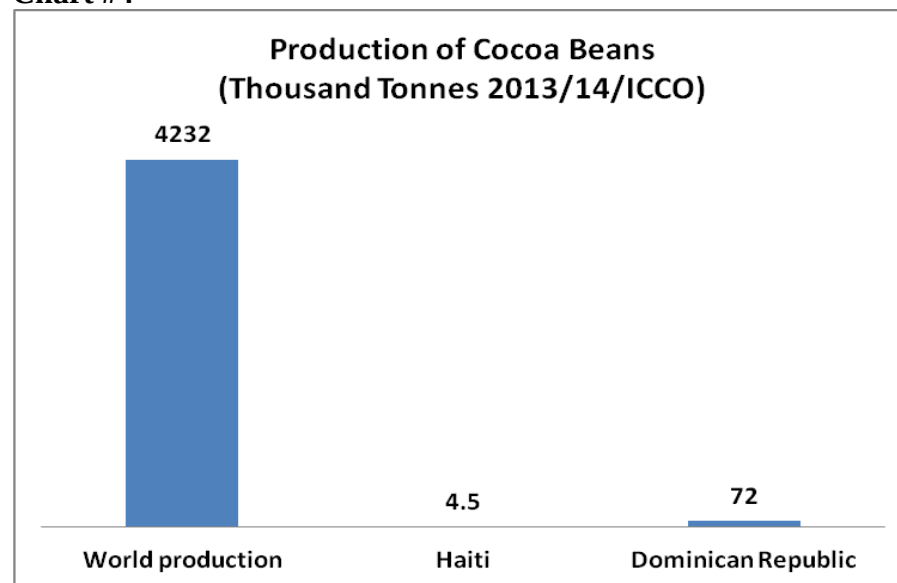
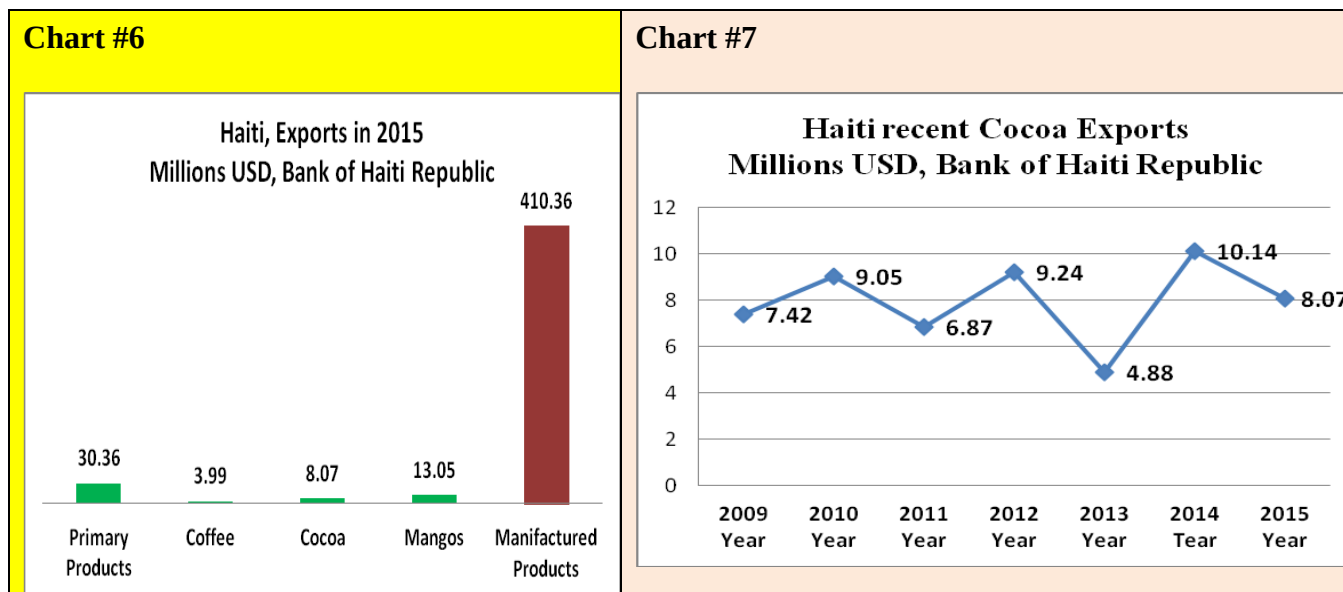


Chart # 5

5.3. Recent exports from Haiti.

According to Banque de la République d'Haïti (BRH)⁸ statistics, in 2015, cacao contributes to 1.8% of Haiti's total exports and to 26.6% of primary products exports, just after mangoes and before coffee. In 2011, according to MARNDR, cacao represents 28% of Haiti's total agricultural exports and account for a total of \$7 million. Exports of industrial products have increased in the meantime, accounting for 93% of total exports in 2015.



The value of Haiti's recent exports evolves in a saw-tooth pattern, as shown in Chart #7 above. In 2009, according to the Ministry of Commerce, Haiti exported 7.42 million USD worth of cacao, with an increase to 9.05 million USD in 2010. The lowest level is reached in 2013, with only 4.88 million, equivalent to 2,145 MT, followed by a steep rise in 2014 to 10.14 million USD of cacao for a total of 3,335 MT. For the year 2015, BRH reports that Haiti cacao exportation is valued at 8.07 million USD.

5.4. The market and quality problem.

Haitian cacao is mostly sold on the mass commodity market because, historically, 95% or more of Haitian cacao has been exported in unfermented form. High-value markets in the US and Europe demand high-quality, fermented cacao. Fermenting cacao releases the "flavor precursors" in the beans, allowing the flavors of the chocolate to be fully expressed. Prices for Haitian cacao are about 50% of the prices paid for fermented cacao from the Dominican Republic. Since the early 2000s, efforts have been made to improve the quality of Haitian cacao by fermentation. First, MEDA, continued by HAP, and now CRS, these international organizations or projects provided technical assistance to cooperatives and producers with the objective of improving cacao quality (post-harvest process) by fermentation. Currently, cacao cooperatives, like CAUD in Dame Marie, the cooperative CACCOMA in the commune of Abricots, and the network of

⁸ www.brh.ht

northern cooperatives affiliated with FECCANO, are producing fermented cacao and exporting to high-value markets, primarily, in Europe. This intrinsic quality is valued in the current sectors of fermented cacao and Haitian fermented cacao is beginning to have the reputation to reach the high-end niches markets.

Despite the problems experienced in the production of Haiti cacao in 2011, FECCANO become the first Haitian cooperative exporting certified fair trade and organic, fermented cacao. In November 2013, Haiti's cacao was voted the best in the world⁹, according to "International Cacao Awards. On October 30, 2015, it was ranked among the world's 50 excellence cacaos.

Still, the country only ferments about 5% of its production, notably with FECCANO and also with other cooperatives in the Grand'Anse, where the cacao production remains under-valued.

5.5. *The Crop System*

In Haiti, the cacao-based agroforestry system is one of the few agricultural models with both economic viability and undeniable environmental sustainability. Cacao is always produced in a complex system of semi-subsistence, diversified and adapted to each micro-ecosystem. The Creole garden with its excellent agroforestry crops, is the heart of this system. It allows the farm family to limit natural and economic risks by diversifying production to the maximum to ensure both: food (tubers, peas, bananas, etc.) and cash income through the sale of products such as cacao, bananas, yams, and fruits. In the high mountains, the Creole garden is organized around coffee; in lower altitudes, cacao is the centerpiece. This baseline study found that the farmers make about 75% of their farm product value from non-cacao production. This finding matches a similar one from the InterAmerican Development Bank (IDB) funded, CRS-implemented cacao project centered in western Grand'Anse¹⁰. Note: the IDB baseline found average income from cacao was \$134.04. Income from charcoal was \$81.70

Many food crops are found in the shade of cacao trees such as yams, plantains, cassava, beans, corn, and so on. Fruit trees associated with cacao trees (coconut trees, bread fruit trees, orange trees, avocado trees, mango trees) provide both food and income. Finally, the many forest species produce wood for lumber and energy. These trees provide shade for cacao. With the disappearance of many cover trees following Hurricane Matthew, the productivity and survival of cacao remains threatened. Progressive climate change must also be taken into account. Without the cacao, the survival of the agroforestry system will be threatened.

5.6. *Cultivated species*

Cacao plantations are mainly made up of Criollo, Trinitario and Forastero, varieties worldwide known as fine and aromatic cacao. Their beans are used mainly in high-end chocolate products. These varieties account for about 5% of world cacao production, according to Agritrade in 2011. Currently, only 15 countries are recognized by the International Cacao Organization (ICCO) as exporters of fine and aromatic cacao. Haiti, although possessing Criollo and Trinitario varieties, is unfortunately not part of this list. In sum, the problem of price for Haitian cacao is not related

⁹ Article : " Le cacao haitien est le meilleur du monde, selon " International Cacao Awards"
Publie le 2013-11-05/Le Nouvelliste

¹⁰ Haiti Cacao Impact Evaluation Baseline, T. T. Schwartz, et al., CRS, March 15, 2015.

to varieties capable to product highly-appreciated cacao¹¹. The problem is mainly at the level of post-harvest process, which is not aimed to deliver a high quality product.

5.7. Crop Areas

There are two major production areas in Haiti: the Grand South Region, which includes the departments of the Grande'Anse and the South, and is responsible for 60% of national production, and the North Region, near Cape Haitian. In the north, cacao is produced in the following counties: Grande Rivière du Nord, Acul du Nord, Port Margot, Borgne (Ti bourg), St-Raphael, Dondon and Milot. That means producers, speculators and cooperatives are found in all of these regions. In the north, there is only one exporter located in the main town of the department. In the South, the counties producing cacao are: Dame-Marie, Chambellan, Anse-d'Hainault, the Irois, the Abricots, Moron, Jeremie. Farmers in Roseaux, Camp Perrin, Maniche, and Torbeck produce smaller quantities of cacao. With global warming, agroforestry/coffee systems found in Beaumont, Pestel, and Corail are likely to become areas of cacao production. Some pockets of cacao production especially in lowlands already exist. Geo. Wiener, S.A. exports most of the cacao from the Grand'Anse in traditional, unfermented form. Maison Wiener buys traditional cacao from the 7 cooperatives in the zone and, quite likely, from all of their members. Low production is found in some marginal areas in the South East and the North West.

5.8. The rise of cacao cooperatives

The cacao cooperatives began to impose themselves on the market in the late 80s with the remarkable help of MEDA. At the same time, SERVICOOOP, a cooperative structure set up in 1997, financed by USAID's Productive Land Use System (PLUS), helped to strengthen the marketing channel for producers. SERVICOOOP proved to be unsustainable and was privatized and shortly thereafter ceased functioning. The USAID Hillside Agriculture Project (HAP) followed PLUS, strengthening cacao production and reinforcing its marketing. The impact of this project, 10 years later, is remarkable. The European Union is currently financing a cacao project, fully subsidizing the establishment of approximately 40 hectares of cacao. The European Union has also assisted cooperatives in Moron and Abricots establish fermenting structures and begin exporting fermented cacao to France. Unfortunately, these fermenting structures were severely damaged by Hurricane Matthew.

Initiatives have multiplied and the feedback from the cooperative sector are convincing. Currently, about ten recognized cooperatives are active in the market of cacao, mainly in the two major cacao regions of the country: the North and the Grand'Anse. In Dame-Marie, for example, CAUD is exporting fermented cacao to the international market. Some cooperatives produce fermented cacao and resell to CAUD. Cooperatives that have yet to establish fermenting infrastructure collect dried cacao from their members and resell to another cooperative or to an exporter. They collect unfermented "ordinary" or "traditional" cacao which has been given 1 to 2 sun-drying days from their members, finish drying the beans on concrete drying patios, and then resell them to an exporter. These cooperatives play the same role as independent intermediaries (*speculators* and *voltigeurs* in French/Creole).

¹¹ Le Monde, 04 nov 2013, Article: au salon du Chocolat, Haiti etait a l'honneur." par Anne sophie Novel/@soAnn

In 2002, SEFADES, a Haitian NGO that had already played an important role in establishing a fair trade coffee cooperative (RECOCARNO), brought together the 6 northern cacao cooperatives and established a cacao Federation named FECCANO. FECCANO obtained its fair trade certification (FLO) in 2003. Two years later, it exported unfermented cacao to Holland. Since 2010, CAUD in Grand'Anse and FECCANO in the North have been exporting fermented cacao to quality European and American markets.

6. Indicator Review and Baseline

INDICATOR TITLE:	Baseline 2016				Notes
1. Average, per farm, normal-year levels of production banana/planta in, igname, breadfruit, malanga, and one other major crop	Crop	kg/per farmer Average	95% interval of confidence		
			Lower limit	Upper limit	
	Yams	302.2	234.1	370.3	
	Malanga	75.4	57.8	93.0	
	Plantain	707.8	545.2	870.4	
	Cassava	54.8	24.8	84.8	
	Sweet Potato	76.6	60.3	92.9	
	Corn	93.9	62.3	125.5	
	Bean	59.1	33.9	84.3	
	Cacao	73.3	54.6	92.0	
	Breadfruit	2529.5	1859.4	3199.6	
	Coconut	220.9	169.5	272.3	
	Mangos	1523.7	1233.3	1814.1	
Avocado	203	158.3	247.7		
				2015-2016 is the reference year for this information. Based on 308 farmers recall. These figures take into account production of all crops mentioned crop in kg/farmer. N.B.: All farmers do not grow every crop in the list.	

6.1.1. Methodology

This indicator measures the level of production per crop per farm/farmer. It takes into account the production of all crops managed by the farmer and is not limited to cacao. In general, a producer manages several crops and may have 2-3 plots or gardens.

Production per farm is calculated according to annual or perennial crops.

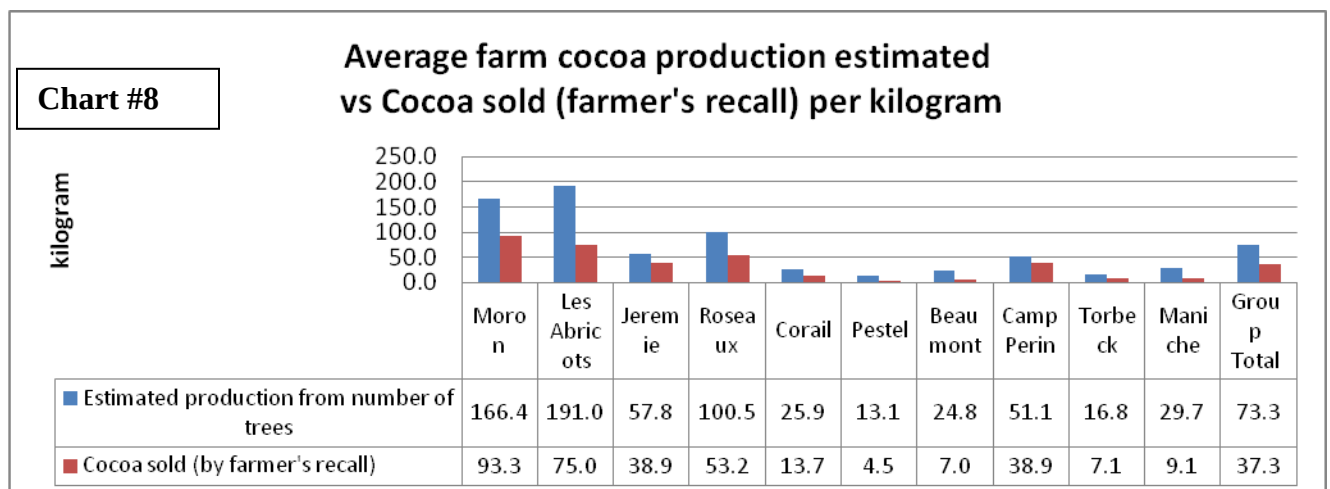
- For the cultivated species, the annual production was collected during the investigation from the harvested volumes declared by the producer, appealing to his memory. The use of producer recall data was the appropriate option since there was no current harvest.
- Standard measuring units, such as a gallon can (*marmite*) or sack, are converted into kg. In the case of non-standardized units of measurement (such as the yam basket, the regime of banana, etc.), the evaluators refer to local equivalences to transform them into standardized units and convert them into kg.
- For fruit species, the evaluators counted trees in the agroforestry/cacao system according to their species. The number of trees is multiplied by the estimated annual average production per tree, and by the average weight of one fruit. The average production per tree is estimated by the producers themselves and the evaluators use the mean value for the calculations. For example, the average number of avocado trees per producer is 5.30. Annual production is estimated at 10 dozen avocados per tree. The weight of an avocado is 1 pound on average. The calculation of the annual production of avocado per producer is: $((5.30 \text{ trees})(10\text{dz})(12\text{units/dz})(1\text{lb})/2.2)(216)$ farmers with avocado and 308 farmers

in the sample; the result is an estimated production of 203 kg of avocado per producer. There are two main points to consider:

- For the trees, the limit was the number of trees counted in cacao ecosystems;
- The production estimates are simple arithmetic averages that take into account all the producers that are concerned or not by such crops. For example, the 289 kg average is calculated for producers who have avocado in the sample, 216 producers out of 308 surveyed, but the average of the sample is $203 = ((289)(216))/308$. This detail can avoid bias in the interpretation of averages.

6.1.2. The Results

Based on this methodology, the estimated annual production of cacao per tree is 73 kg per producer. The estimated average production is higher in the counties of Moron, Abricots and Roseaux. On the other hand, the quantity of cacao sold, declared by the producer, represents only half of this level of production. This trend is almost linear when comparing statistics at commune level.



Breadfruit and mango are important food crops. Our farmer recalled producing 2,529 and 1,523 kg. The other two fruits mentioned in the graph below (avocado (203kg) and coconuts (220kg)) are less importance in terms of volume. Notice that post-harvest losses for fruits are huge particularly during the harvest period, and farmers have difficulty in selling their fruits on the markets. For example, farmers report that around 75% of harvested mangoes are lost.

For annual crop species, the average production per producer is sorted by importance (volume): plantain (707 kg), yam (302 kg), sweet potato (76 kg), cassava (54 kg), Malanga (75kg), beans (59 kg) and corn (93 kg). It should be pointed out that a producer does not have all of these species at once. More detailed information is included in the two tables that follow.

**Average, per farm, normal-year levels of farm production,
per kilogram**

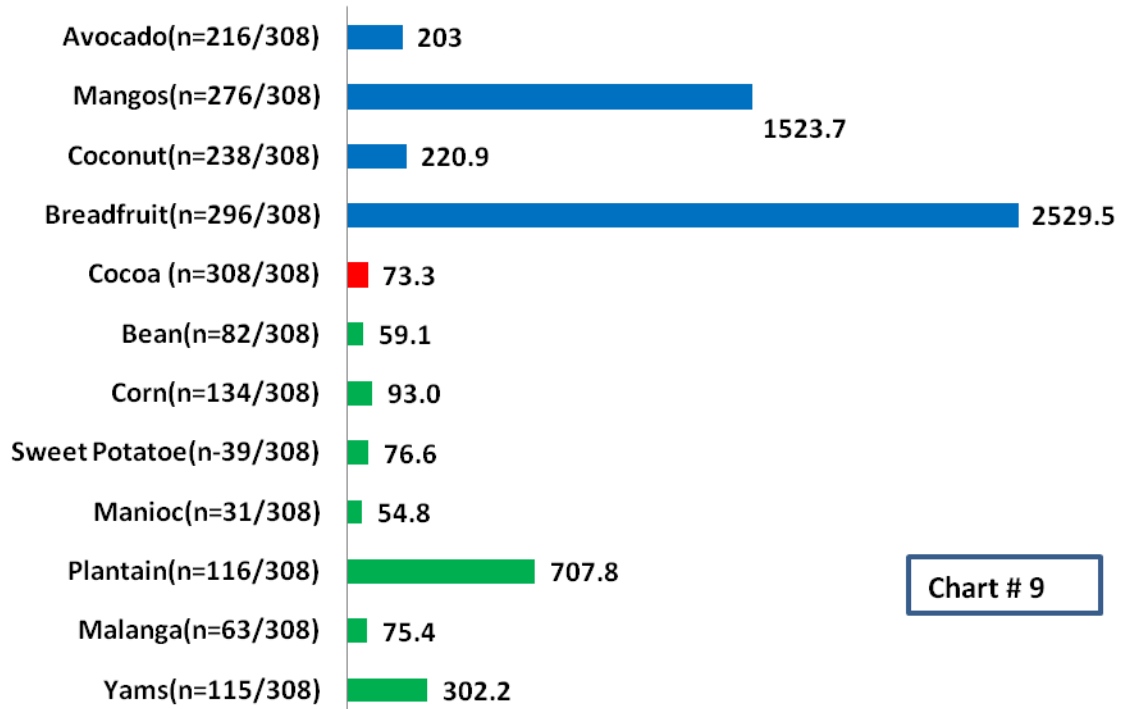


Chart # 9

Table #1: Average, per farm, normal-year levels of farm production of cacao, banana/plantain, igname, breadfruit, malanga, and one other major crop kg												
Commune	Yams	Malanga	Plantain	Manioc	Sweet Potato	Corn	Bean	Cacao	Breadfruit	Coconut	Mangos	Advocate
Moron	247.0	146.1	1751.4	64.0	62.0	28.2	31.0	166.4	4439.8	297.2	1052.0	118.4
Abricots	13.7	213.8	937.7			22.7	2.6	185.5	3198.9	217.0	1561.6	194.8
Jeremie	225.0	51.2	532.6	92.0	15.7	2.4	4.0	56.1	3522.8	177.9	2477.9	118.4
Roseaux	62.9	9.7	211.6	40.5	18.7	71.5	31.5	100.5	2730.9	266.4	1051.9	208.8
Corail	498.8	22.8	380.0	137.3	36.3	171.6	60.6	25.9	2547.0	376.2	1726.4	180.0
Pestel	850.5	0.0	265.0		14.0	52.5	102.8	13.1	738.0	79.2	621.8	150.0
Beaumont	608.4	8.9	839.3			61.4	110.9	24.8	837.4	117.4	853.8	80.6
Camp Perin	71.4	10.9	1162.9		105.1	192.5	109.4	49.6	2628.0	224.2	2220.8	405.2
Torbeck	195.1	13.1	1895.8	21.4	268.3	153.8	73.1	17.3	1355.0	259.0	1690.9	287.9
Maniche	674.8	186.4	1502.0	163.2	159.5	169.4	113.2	30.5	1918.3	157.4	1402.6	202.6
Average	302.2	75.4	707.8	54.8	76.6	93.9	59.1	73.3	2529.5	220.9	1523.7	203.0

Table #2: Valid cases using for the estimation of farm production												
Commune	Yams	Malanga	Plantain	Manioc	Sweet Potato	Corn	Bean	Cacao	Breadfruit	Coconut	Mangos	Advocate
Moron	n=18	n=13	n=16	n=4	n=4	n=17	n=4	n=35	n=35	n=23	n=28	n=22
Abricots	n=1	n=17	n=18	n=0	n=0	n=18	n=1	n=34	n=35	n=31	n=32	n=20
Jeremie	n=10	n=8	n=10	n=4	n=2	n=2	n=2	n=34	n=32	n=19	n=28	n=14
Roseaux	n=5	n=1	n=9	n=2	n=2	n=10	n=8	n=35	n=32	n=21	n=27	n=16
Corail	n=11	n=1	n=10	n=8	n=2	n=14	n=7	n=20	n=19	n=17	n=17	n=13
Pestel	n=16	n=0	n=4	n=0	n=1	n=7	n=10	n=20	n=20	n=20	n=20	n=19
Beaumont	n=15	n=1	n=13	n=0	n=0	n=10	n=11	n=23	n=17	n=12	n=19	n=11
Camp Perin	n=3	n=1	n=4	n=0	n=5	n=22	n=13	n=34	n=34	n=34	n=34	n=34
Torbeck	n=8	n=2	n=0	n=2	n=12	n=18	n=14	n=37	n=37	n=34	n=37	n=36
Maniche	n=28	n=19	n=32	n=11	n=11	n=16	n=12	n=36	n=34	n=27	n=34	n=31
Group Total	n=115	n=63	n=116	n=31	n=39	n=134	n=82	n=308	n=295	n=238	n=276	n=216

INDICATOR TITLE:	Baseline 2016				Notes
2. Average, normal-year prices of cacao, banana/plantain, igname, breadfruit, malanga, etc.	Crop	Farm prices USD/kg	95% interval of confidence		USD/kg 2016 year farm prices from 308 farmers recall.
			Lower limit	Upper limit	
	Yams	0.33	0.24	0.42	
	Malanga	0.43	0.20	0.66	
	Plantain	0.25	0.11	0.39	
	Cassava	0.13	0.09	0.17	
	Sweet Potato	0.35	0.30	0.40	
	Corn	0.29	0.25	0.33	
	Bean	1.43	1.34	1.52	
	Cacao fermented	2.91	2.33	3.49	
	Cacao dried	1.23	0.99	1.47	
	Breadfruit	0.15	0.05	0.25	

6.2.1. Evolution of cacao prices in Haiti and on the international market.

The price of cacao is very unstable on the international market. Over the past 10 years, it has ranged from US \$1,500 to \$3,400 per metric ton, with an upward trend. In the course of one year, fluctuation of prices is often observed, depending on the supply and demand situation at the global level. Peak prices were obtained in 2009 and 2010, and 2015 due to the decrease in volume on the international market, in particular the decrease in the supply of major exporting countries such as Ivory Coast, Nigeria and Cameroon. After each spike, a remarkable drop in prices was observed, followed by another increase. In 2015, the average price was \$3,380 US, fell to 2892 in 2016. In January 2017, Ivory Coast, the world's largest exporter, with 40% of world exports, is freezing its stocks to prevent the fall Prices on the international market.

Haitian cacao is sold at a significantly lower price than the world market because of its relatively poorer quality, mainly due to post-harvest processing. The Ministry of Trade and Industry has data only for the last five years; the previous statistics in 2010 were lost with the 2010 earthquake. Over the last 5 years, the price of Haitian cacao is only 73% of the world price; which represents a loss of income for all actors in the cacao sector in Haiti.

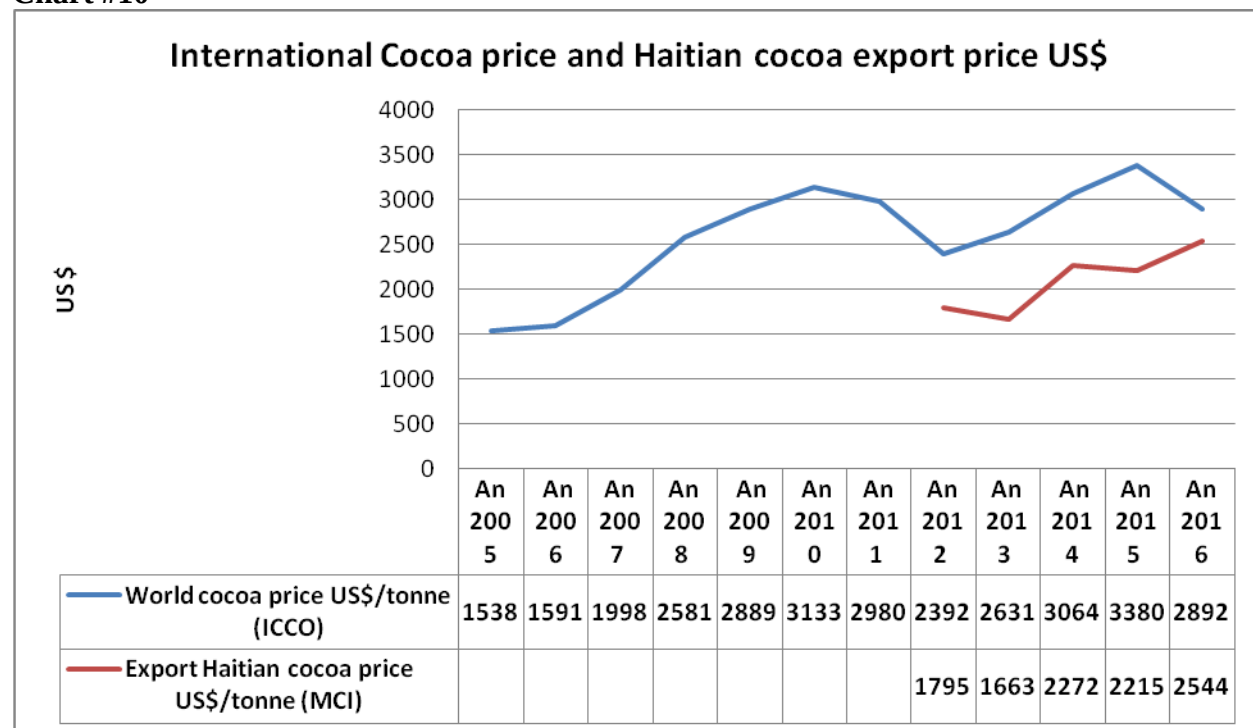
The FOB price of Haitian cacao varies according to the destination of the product. Among the four destinations, Haitian cacao is better paid in Germany and Canada, where the price practiced generally exceeds the average price. On the other hand, the price paid in the USA and in Italy is lower than the average price paid for Haitian cacao on the international market. Remember that the USA buy 75% of Haitian cacao.

Haitian cacao prices are among the lowest in the world due mainly to post harvest problems and presentation. Cacao from Jamaica and Trinidad, to mention only these neighboring countries, is

paid twice as much as that coming from Haiti. The prices paid for Dominican cacao significantly exceed those paid for Haitian cacao.

Lack of fermentation impairs the intrinsic quality of the product. Lack of drying causes the beans to become moldy. The exaggerated number of moldy beans in Haitian cacao mainly explain the loss of certain international markets. However, exports of high-quality fermented cacao are under way. So far, the volume is relatively low, at around 5%.

Chart #10



6.2.2. Cacao prices in the field

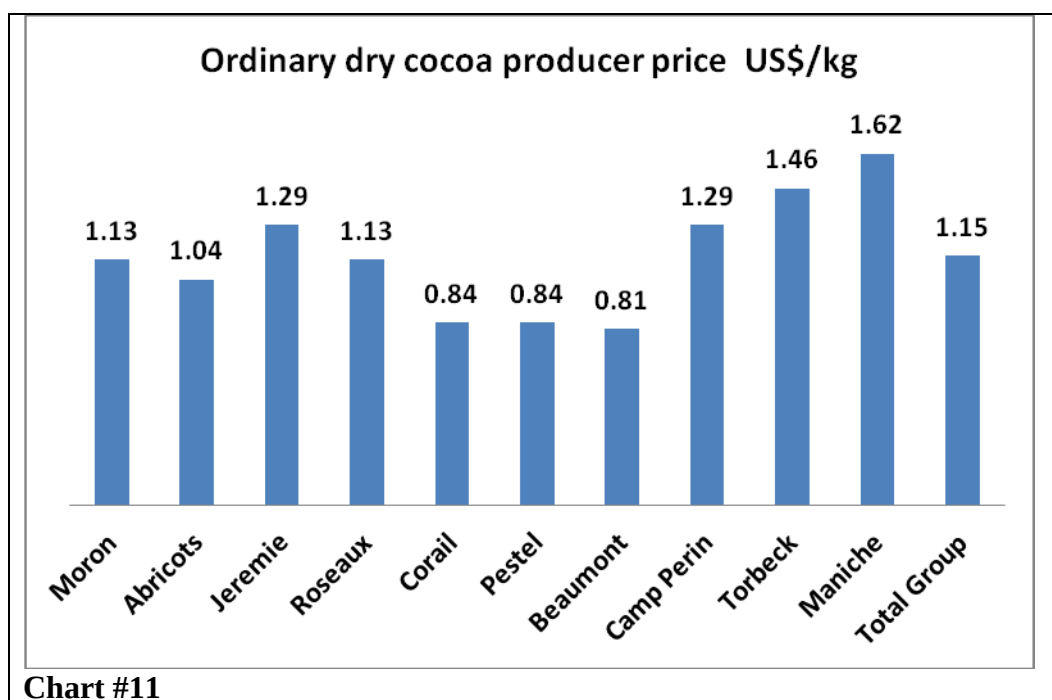
The price paid to producers varies enormously with regard to the way in which the cacao is processed, thus establishing a difference in quality but also a difference in the market. The average price per kg for dried cacao is US \$1.15 per kg, while organic fermented cacao is two-and-a-half times higher, or US \$2.94 per kg. Since cacao contributes 14% of agricultural income, it is possible to increase agricultural income by 30%, only by generalizing the preparation of organic fermented cacao.

The price of ordinary cacao varies from one county to another depending on the accessibility of the localities and the competition between buyers and intermediaries, although in the Grand'Anse Geo. Wiener, S.A. has a virtual monopoly in the cacao trade. Approximately 95% of the cacao in the export value chain is exported by through Geo. Wiener, S.A. The lowest prices (US \$/kg 0.81-0.84) are observed in the counties of Corail, Pestel and Beaumont. In these coffee-dominated counties, the dispersion of cacao plots and the low volume recorded do not encourage buyers' investment. Some farmers are obliged to sell to the regional and/or national market, by goblet or pot, to intermediaries who will resell to another intermediary. This extends the chain of

intermediaries to the detriment of producers. In these counties, RECARP, a network of coffee cooperatives, wants to start the production of cacao for the market.

An average price between \$1 US to \$1.30 US per kg is common in the counties of Moron, Abricots, Jeremie and Roseaux. These counties account for the most volume in the KABOS project zone, but, there is no competition from multiple buyers; accordingly, prices are set by a single buyer, the Wiener house. Existing cooperatives are not yet able to compete and often serve as intermediaries for this buyer.

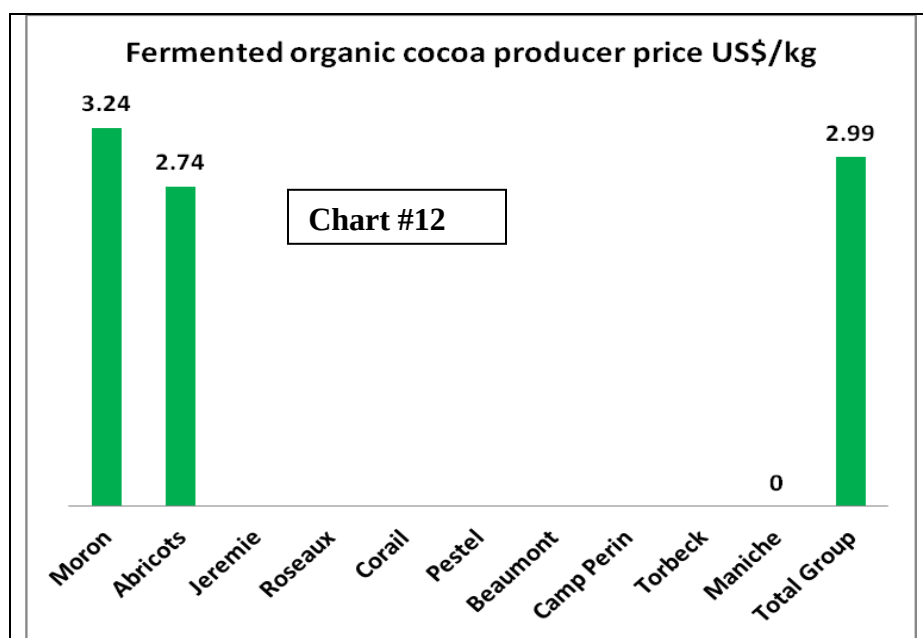
Producer prices are higher in the South due to the accessibility to other counties and the associated competition. Les Cayes is nearby and there is at least one local processor of consumer products.



The Cooperative Agricoles et Cacaoyère in County Moron and the Coopérative Agricole Cacaoyère et de la Commercialisation des Abricots (CACCOMA) in Abricots County are the only processors of export quantities of fermented cacao in the KABOS project zone.

The prices paid to the producer for fermented cacao are high compared to the ordinary cacao and the world market prices. Prices paid to the producer for fermented coca is on average US \$3 per kg, or \$3,000 US per metric ton. It is noteworthy producers selling to these two cooperatives receive at or higher than the international commodity market.

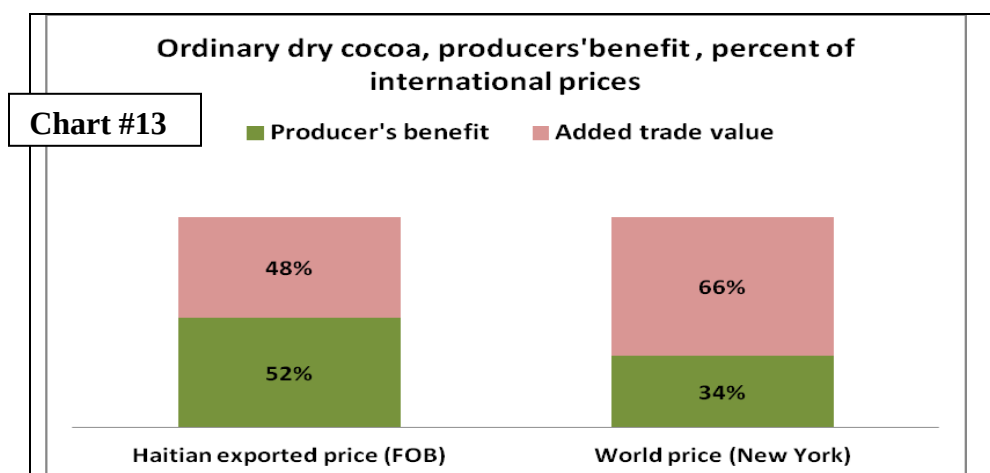
In Abricots, the fermented cacao is bought directly by a French chocolatier. The chocolatier financed the establishment of the cooperative and the first transactions (purchase of land, fencing, construction, start of purchase, organic certification, etc.) about 4 years ago. In return, the cooperative must deliver 10 tons of fermented cacao at a price higher than the international market on an annual basis. This year, because of the quality problems mainly caused by Matthew, cacao from Abricots could not be delivered to the French chocolate maker.



6.2.3. Deterioration of Cacao prices

This deterioration of cacao prices is based on the year 2015/2016 when the average FOB price per ton of cacao from Haiti was US \$2,215 and the world market price was US \$3,380. At that time, the farm level price for a kg of dried, un-fermented, Haitian cacao was US \$1.15 or 78.2 gourdes, given the exchange rate of 68 gourdes for one US dollar. This average producer price was taken from the survey using the random sample of 307 farmer-producers.

In 2015, for ordinary cacao, the producer received 52% of the cacao FOB price. If the same ratio held when selling at the international price of US \$3,380, farmers would receive 53% more for their cacao, which should encourage production if the quality of Haitian cacao would allow reaching the world price. The difference in FOB price and farm level price is shared between intermediaries and covers the costs of preparation and transport as well as losses (sorting, loss due to drying). In short, the producer receives only 34% of the world price. There have been huge gaps since Haiti cannot sell at world market prices for quality reasons, while neighboring countries such as Jamaica and Trinidad can sell twice as much cacao. The Dominican Republic also sells at a higher price than Haiti.



Increased income for the producer will come from fermented cacao which, during the reference year was purchased from the farmer at 50% more than ordinary cacao. Again, the price paid to the producer in Moron and Abricots exceeded the export price FOB of Haitian cacao and approached the average world price. Briefly, fermented cacao represents the future of Haiti's cacao, but it represents only 5% of cacao production. During the investigation, the evaluators attempted to understand why all producers do not make fermented cacao.

- Fermentation facilities do not exist in all counties;
- Producers, for the most part, are not aware of the benefits of fermented cacao;
- Farm gardens or homes are often far from fermenting centers, located in places where there is no transportation available. Perhaps, farmers find that transporting dried cacao over long distance, two or three times during the season is more economical than bringing wet, heavy cacao to the fermentation center more frequently as required to avoid spoilage.
- Household cash management also has an influence. The cacao harvest arrives at strategic moments of cash need: March, to finance the primary agricultural season and September, to finance the new school year. In practice, potential producers keep their production and sell it at times of need and adjusting to managing small, frequent income from the sale of wet cacao may be a challenge.

It would be advisable to sensitize producers to the benefits of fermented cacao, including making available more fermentation infrastructure, building wet cacao collection stations closer to producers, offering the producer the opportunity to receive his money after each sale or to leave it on deposit, etc.

6.2.4. Farm prices for major crops.

See the following table for the farm prices for major, non-cacao crops.

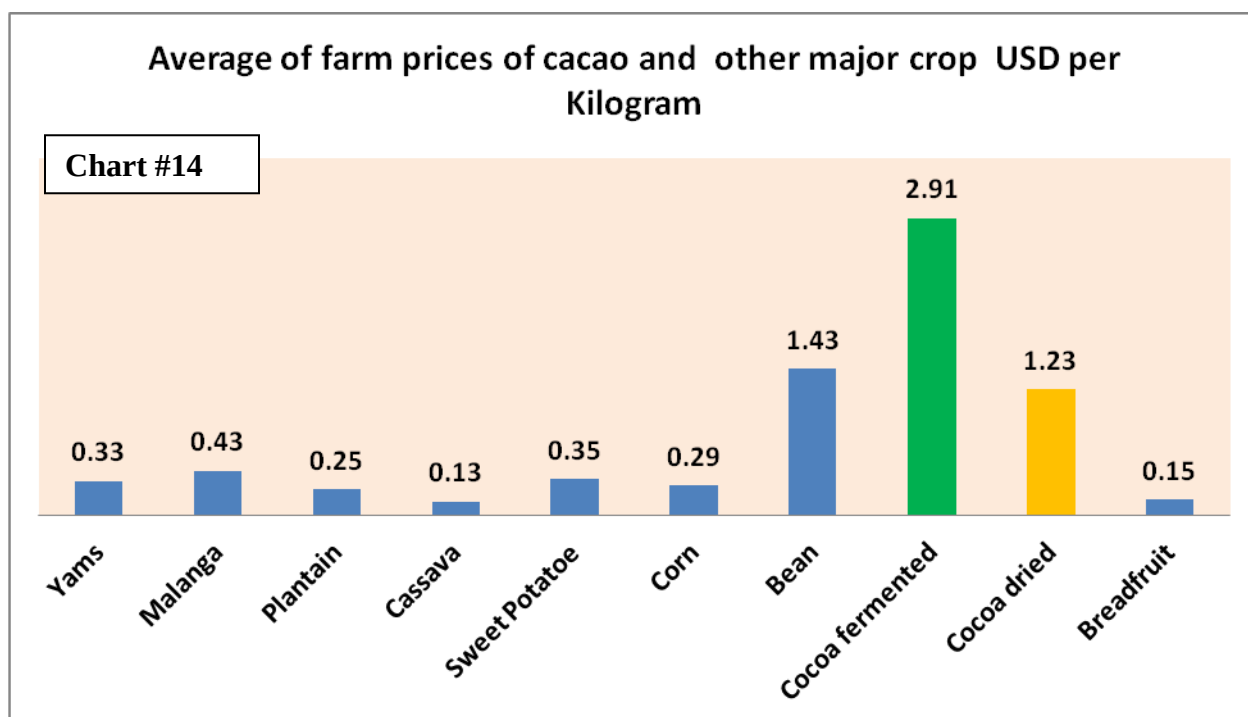


Table #3: Average of farm prices of cacao, banana/plantain, igname, breadfruit, malanga, and one other major crop in USD per kg

Commune	Yams	Malanga	Plantain	Manioc	Sweet Potato	Corn	Bean	Cacao fermented	Cacao dried	Breadfruit
Moron	0.27	0.40	0.28	0.18	0.27	0.27	1.48	3.24	1.13	0.12
Abricots	0.00	0.33	0.29	0.00	0.34	0.00	2.16	2.59	1.11	0.12
Jeremie	0.34	0.41	0.24	0.14	0.36	0.00	1.89	0.00	1.13	0.18
Roseaux	0.28	0.00	0.20	0.10	0.00	0.32	1.21	0.00	1.46	0.11
Corail	0.35	0.00	0.24	0.12	0.32	0.24	1.35	0.00	1.01	0.11
Pestel	0.29	0.00	0.26	0.00	0.31	0.32	1.21	0.00	0.81	0.13
Beaumont	0.35	0.47	0.24	0.00	0.35	0.27	1.21	0.00	1.01	0.22
Camp Perin	0.40	0.00	0.24	0.00	0.40	0.27	1.19	0.00	1.62	0.20
Torbeck	0.37	0.47	0.00	0.11	0.40	0.35	1.08	0.00	1.21	0.18
Maniche	0.35	0.48	0.26	0.11	0.39	0.30	1.48	0.00	1.78	0.15
Group Total	0.33	0.43	0.25	0.13	0.35	0.29	1.43	2.91	1.23	0.15

INDICATOR TITLE:	Baseline 2016	Notes
3. Annual revenue from crop production in USD.	\$1,094 Including \$588 from crop \$506 from fruit 95% interval of confidence Lower limit= 985 Upper limit+ 1203	These are vegetable and fruit harvested per farmer multiplied by farm prices from 308 farmers recall.

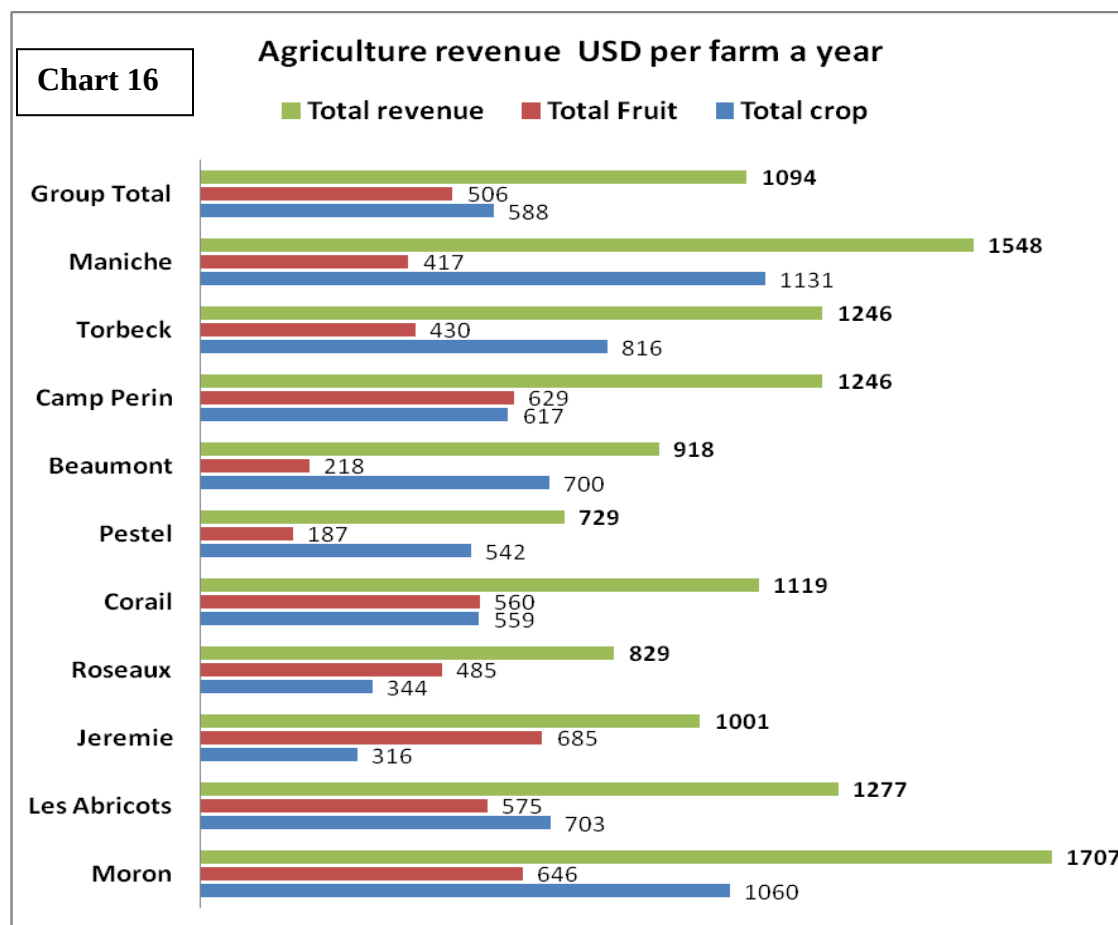
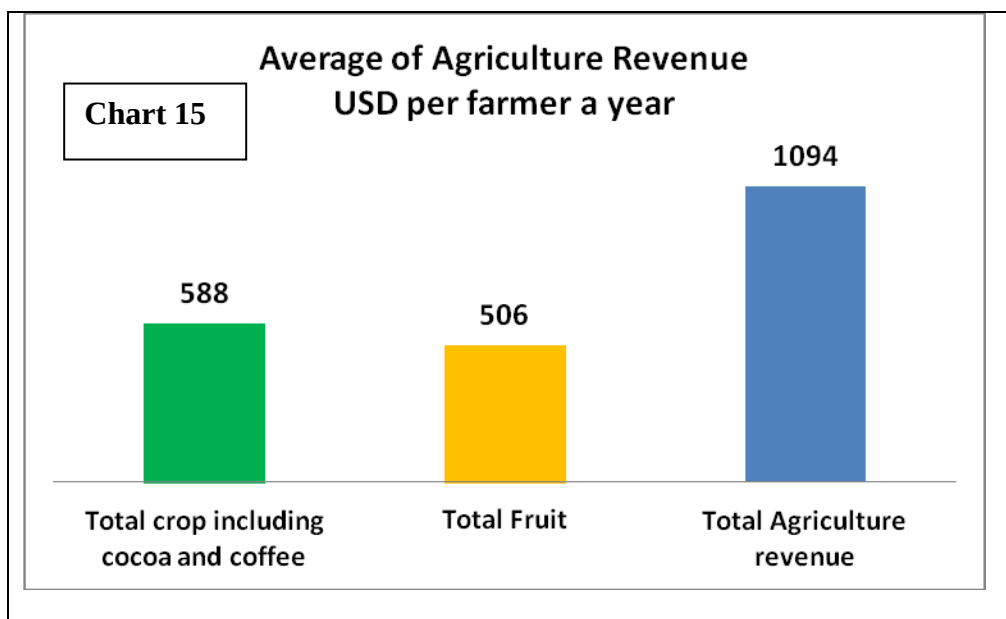
This indicator is not included in the terms of reference; but was requested as additional information. It is a question of calculating producers' income coming from the vegetable and fruit crops.

6.3.1. Calculation method.

Average annual farm income is equal to annual production per crop in kg multiplied by the average price paid to farmers. Annual production by species is estimated above. The average prices paid to producers were collected during the survey.

6.3.2. Result.

The annual value of agricultural production is \$1,094 per farmer, \$588 from cultivated species including cacao, coffee, and vegetables, and \$506 from fruit. In general, a small proportion of fruit is valued by auto-consumption. During the harvesting period, farmers struggle to sell fruits and vegetables on the market, due to the high availability on the local markets during the harvest season each year and due to the location of production/harvest areas far from urban markets. Post-harvest processing does not exist. For example, some farmers estimate losses for mango at 75%.



6.3.3. Composition of Income of Cultivated Species.

Four species are very important: plantain (30% of income from cultivated species), cacao (18%), yam (17%) and beans (14%). These 4 species contribute 80% to this income. These are strategic cultures on which really the household incomes in the region. Cacao has a place because of the significant increase in producer paid prices for fermented cacao, particularly in Moron and Apricots.

For fruit trees, the strong participation of breadfruit (50%) and mango (33%) was noted. Refer to the table below for details.

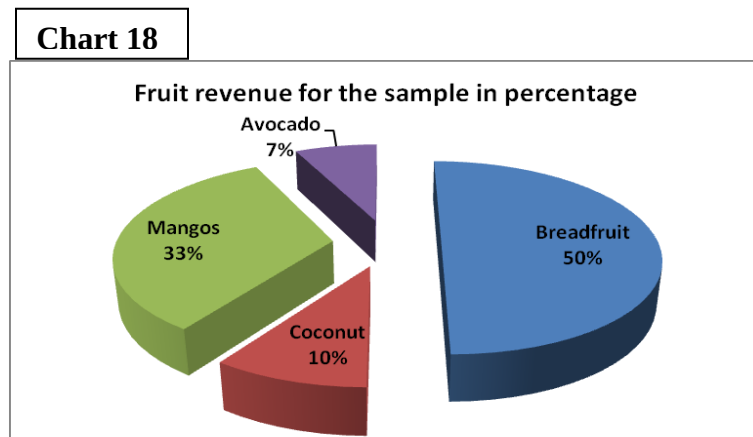
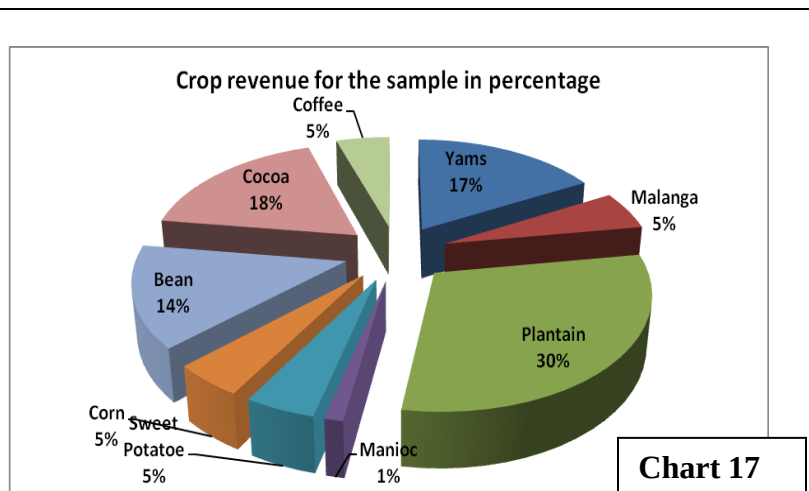


Table #4: Annual revenue from crop production per farmer in USD.																
Commune	Yams	Malanga	Plantain	Manioc	Sweet Potato	Corn	Bean	Cacao	Coffee	Total	Breadfruit	Coconut	Mangos	Avocado	Total Fruit	Total revenue
Moron	66.7	58.5	490.4	11.5	16.7	7.6	45.9	362.8	0	1060.1	444	65.4	115.7	21.3	646.4	1706.5
Abricots	4.5	70.6	271.9	0	0	6.6	5.6	343.3	0	702.5	319.9	47.7	171.8	35.1	574.5	1277
Jeremie	76.5	21	127.8	12.9	5.7	0.7	7.6	63.4	0	315.6	352.3	39.1	272.6	21.3	685.3	1000.9
Roseaux	17.6	4.2	42.3	4.1	6.6	22.9	38.2	146.7	61.7	344.3	273.1	58.6	115.7	37.6	485	829.3
Corail	174.6	9.8	91.2	16.5	11.6	41.2	81.8	26.2	105.8	558.7	254.7	82.8	189.9	32.4	559.8	1118.5
Pestel	246.6	0	68.9	0	4.3	16.8	124.3	10.6	70.5	542	73.8	17.4	68.4	27	186.6	728.6
Beaumont	212.9	4.2	201.4	0	0	16.6	134.2	25	105.8	700.1	83.7	25.8	93.9	14.5	217.9	918
Camp Perin	28.6	4.7	279.1	0	42.1	52	130.2	80.4	0	617.1	262.8	49.3	244.3	72.9	629.3	1246.4
Torbeck	72.2	6.2	474	2.4	107.3	53.8	78.9	20.9	0	815.7	135.5	57	186	51.8	430.3	1246
Maniche	236.2	89.5	390.5	18	62.2	50.8	167.6	54.4	61.7	1130.9	191.8	34.6	154.3	36.5	417.2	1548.1
Group Average	99.7	32.4	176.9	7.1	26.8	27.2	84.5	104.8	28.9	588.3	253	48.6	167.6	36.5	505.7	1094

INDICATOR TITLE:	Baseline 2016	Notes
<i>4. Average cacao yield per hectare and per tree based on farmers' recall</i>	384.8 kg per hectare 1.51 kg per tree 95% mean confidence interval ranges from 224.9 kg to 494.7 kg	Average estimated from the triangulation of 3 different methods.

6.4.1. The estimation of cacao production and yield in Haiti.

The main questions to be answered in an investigation on the estimation of agricultural production are:

- Selection of a representative sample of producers and
- Design of a reliable method of observation of the production activities for these producers.

In the present study, a comprehensive list of potential direct beneficiaries of the project was the population from which a sample of 308 farmers was drawn.

Regarding the method of observation, it should be noted that farmers are not accustomed to keeping records of farm activities so that they could easily transmit the information when interviewed. A statistical methodology to estimate production requires methods to objectively measure production parameters. The parameters measured to estimate cacao production (using objective measurements) are:

- Crop area (calculated using GPS);
- Yield in the field.

In the specific case, three methods to estimate the yield will facilitate the triangulation of the information:

1. Estimated yield from official statistics provided by the Ministry of Trade and Industry, Ministry of Agriculture of Natural Resources and Rural Development;
2. Estimation based on direct area measurements and reported production of producers;
3. Estimation based on direct area measurements and based on: Number of trees per hectare, Number of pods per tree, Number of beans per pod, and weight of 1000 beans. A productivity benchmark based only on the number of pods per tree would be an overall estimation with obvious biases as the pod size varies from small to medium to large.

6.4.2. Estimated yield based on official statistics

The 2012 MARNDR agricultural census shows a total area of 15,000 hectares planted to cacao at the national level. According to ICCO, Haitian national cacao production is 4,500 MT per year. These statistics are confirmed by the Ministry of Trade and Industry, which publishes the volume of recent Haitian cacao exports: 3,190,156 kg for 2012, 3,663,052 kg for 2013, 4,663,751 for 2014 and 3,629,558 for 2015. This gives the average exports of 3,786,629 kg per year. If the

20% post-harvest losses are added to exports, the average production over the past 4 years would be 4.544 MT, completely matching with the ICCO's estimation.

Table #5: Estimated performance based on official statistics				
Year	Cacao Exported	Post-Harvest loses (20%)	Production estimated	Yield by Hectare
2012	3190156.0	638031.2	3828187.2	255.2125
2013	3663052.0	732610.4	4395662.4	293.0442
2014	4663751.0	932750.2	5596501.2	373.1001
2015	3629558.0	725911.6	4355469.6	290.3646
Mean	3786629.3	757325.9	4543955.1	302.9
Standard Deviation	623181.5	124636.3	747817.8	49.9

From the statistics above, the yield per hectare would be (4,543,955.1 kg)/(15,000 hectares) equals 302.9 kg/hectare. This is a point average. Using the t-student distribution with the confidence level the 95% and with (4-1) degrees of freedom, the average yield per hectare would be between (302.9 + tSD)/(square root of n). As a result, the average yield of cacao per hectare at the national level would be between 224.9 kg and 380.9 kg with a confidence level 95%. The confidence interval for the average is high because of the large variation in national production of cacao over the past 4 years, which is reflected by a very high standard deviation.

Interval of confidence of the average yield of the population: 95% and degree of freedom v= (4-1), t-student: 3.182, 2 tailed test.				
Lower limit		Average		Upper limit
224.9 kg		302.9 kg		380.9 kg
Average yield per hectare for cacao using official figures.				

6.4.3. An estimation based on direct area measurements and reported production by producers;

This is a combination of measurements and estimated yields in the reference, normal year by producers. 307 cacao plantations in the 10 counties concerned by the study were measured using precision GPS. The evaluators collected data from a sufficient number of points on the perimeter of the subject gardens and calculated their areas using ARCGIS software. Then, in order to have the area estimations before leaving the parcel for quality check, the investigator walked around the parcel in "polygon"; when closing the polygon, the GPS instrument indicated the area within the perimeter in square meters. The evaluators then asked the producer for an estimate (from memory) of the harvest from the garden in a normal year: for the season from March to April and for the harvest season September to November.

From data collected on 307 plots, the average yield per hectare is 369.77 kg. The average per county does not vary enormously; The lowest (323 kg/ha) was obtained in Beaumont and the highest (450 kg/ha) from Corail. However, there is a large variation within counties, reflected by high standard deviations. However, proximity to the median (343.62 kg/ha) and the mean (369.77 kg/ha) express a trend towards a symmetric distribution of the mean. In sum, the

distribution of the mean follows the law of GAUSS. The histogram of the mean yield distribution shows a concentration around the mean with a low degree of flatness. However, the mode (281 kg/ha) is far below the average which is higher than the median. This would mean that the average is pulled up by some exceptional returns. In this case, the median would be more representative than the average.

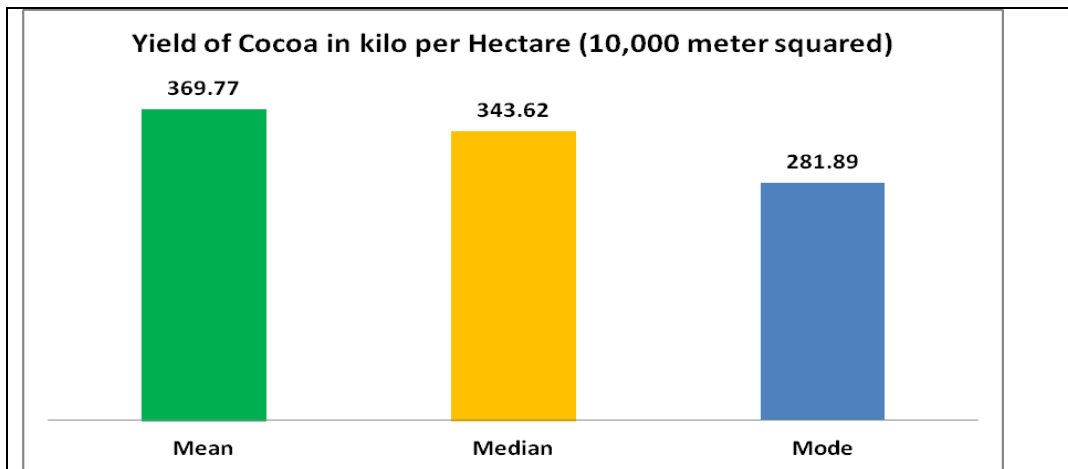


Chart #19

Mean, median, and mode are three kinds of "averages"

The "mean" is the "average" you're used to, where you add up all the numbers and then divide by the number of numbers.

The "median" is the "middle" value in the list of numbers. To find the median, your numbers have to be listed in numerical order from smallest to largest, so you may have to rewrite your list before you can find the median.

The "mode" is the value that occurs most often. If no number in the list is repeated, then there is no mode for the list.

Table #6: Yield of Cacao in kg per hectare by county						
Commune	Mean	Median	Mode	Minimum	Maximum	Std Deviation
Moron	361.23	296.28	120.44	120.44	655.94	165.86
Abricots	405.60	351.89	133.90	133.90	992.81	230.16
Jeremie	375.10	370.59	178.84	178.84	890.96	139.87
Roseaux	440.10	380.05	68.59	68.59	954.62	190.56
Corail	450.13	409.44	328.28	328.28	722.66	125.42
Pestel	407.09	356.03	135.23	135.23	997.78	212.93
Beaumont	323.76	317.12	281.89	208.64	447.09	59.56
Camp Perin	333.90	326.81	112.48	112.48	993.83	150.34

Torbeck	327.93	326.55	207.26	207.26	445.64	63.30
Maniche	324.08	338.59	132.37	132.37	432.65	77.40
Group Total	369.77	343.62	281.89	68.59	997.78	155.30

The average 369.77 kg/ha refers to the sample of 307 plots. With a 95% confidence level, the yield per hectare at the plot population level is between 352.4 kg/ha and 387.1 kg/ha. With the distribution of GAUSS, the biases are almost non-existent so that the average yield at the population level is equal to that of the sample

Interval of confidence of the average yield of the population: 95%, $z=1.96$ and $n=307$.				
Lower limit		Average		Upper limit
352.4 kg		369.77 kg		387.1 kg
Average yield per hectare for cacao using measured areas and farmers 'memory for evaluating production.				

6.4.4. A separate estimation also based on direct surface measurements

This calculation uses these variables: Number of trees per hectare, Number of pods harvested per tree, weight of 100 pods in kg.

For the calculation of the theoretical yield:

- The 307 cacao plots were delimited with a GPS and their area was calculated;
- The number of cacao trees within the delineated area was systematically counted;
- A sample of 10 cacao trees per farm was selected for direct measurements. The producer estimated for each tree the number of pods produced by the tree for the September and March seasons in the normal year. This approach remains a historical approach since the study did not take place in the harvest period to observe directly and also, Hurricane Matthew has permanently altered the cacao ecosystem so that it is better to collect historical data.
- As a working hypothesis, 30 cacao pods are needed to produce one kg of cacao at 13% humidity. In general, it takes 23 well-packed pods for one kg of dried cacao; as it comes from different sizes, small, medium, large, it would take 30 pods, any size combined for one kg. Then, the percentage of unharvested pods (immature pods, losses to rodents) is estimated at 30%.

The calculated yield of cacao is 481.8 kg per hectare. Since the distribution of yields follows the GAUSS law, at the significance level of 5%, the mean yield confidence interval ranges from 468.7 kg to 494.7 kg.

Interval of confidence of the average yield of the population: 95%, $z=1.96$ and $n=307$.				
Lower limit		Average		Upper limit
468.7 kg		481.8 kg		494.7 kg
Cacao yield calculated with measured areas, number of cacao trees counted, and number of cacao pods per tree estimated by the producer				

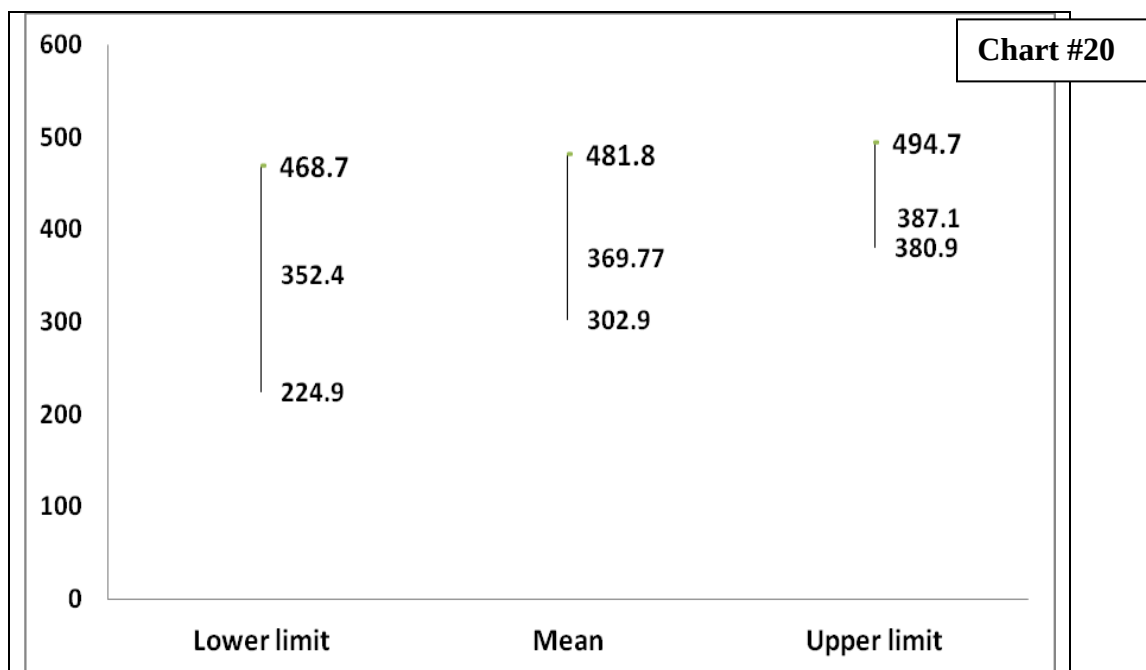
Table #7: Cacao Yield calculated with measured areas, number of cacao tree counted, and number of cacao pods per tree estimated by the producer

Commune	Average of cacao trees per hectare	Number of Pods (<i>kabos</i>) Harvested September season	Number of Pods (<i>kabos</i>) Harvested March season	Total Number of Pods (<i>kabos</i>) Harvested per year	Number of Pods (<i>kabos</i>) harvested per Hectare	Average of cacao Yield (kg/ha)
Moron	390.8	43.6	27.3	70.9	27694.7	646.2
Abricots	394.2	41.6	30.0	71.6	28240.5	658.9
Jeremie	351.8	38.4	23.5	61.9	21780.5	508.2
Roseaux	364.8	45.6	28.1	73.7	26890.6	627.4
Corail	355.4	42.4	23.7	66.1	23478.6	547.8
Pestel	327.2	38.1	21.2	59.3	19415.5	453.0
Beaumont	356.5	37.0	19.2	56.2	20053.3	467.9
Camp Perin	268.6	39.1	21.2	60.3	16203.4	378.1
Torbeck	240.5	37.0	30.2	67.2	16153.8	376.9
Maniche	205.1	43.8	20.9	64.7	13266.7	309.6
Group Total	316.1	41.1	24.2	65.3	20642.8	481.7
Standard Deviation	61.7	3.0	3.9	5.5	4978.0	116.2

6.4.5. A unique yield for cacao.

The triangulation of the three methods leads to a single yield per hectare for cacao. The average of the averages shows a yield per hectare of 384.8 kg $(481.8 + 369.77 + 302.9)/3$. However, the 95% mean confidence interval ranges from 224.9 kg to 494.7 kg. The median value is 392.4 kg.

Mean of Means: 384.8 kg/ha
Median: 392.4 kg/ha

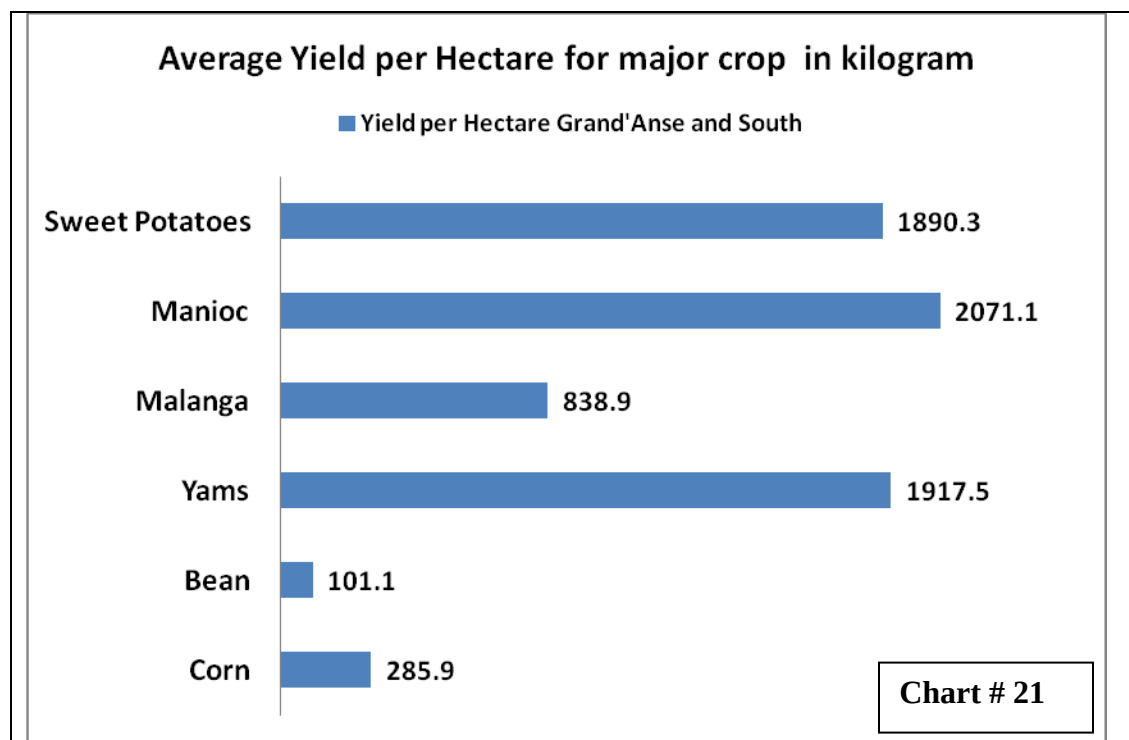


6.4.6. Estimated yield per tree

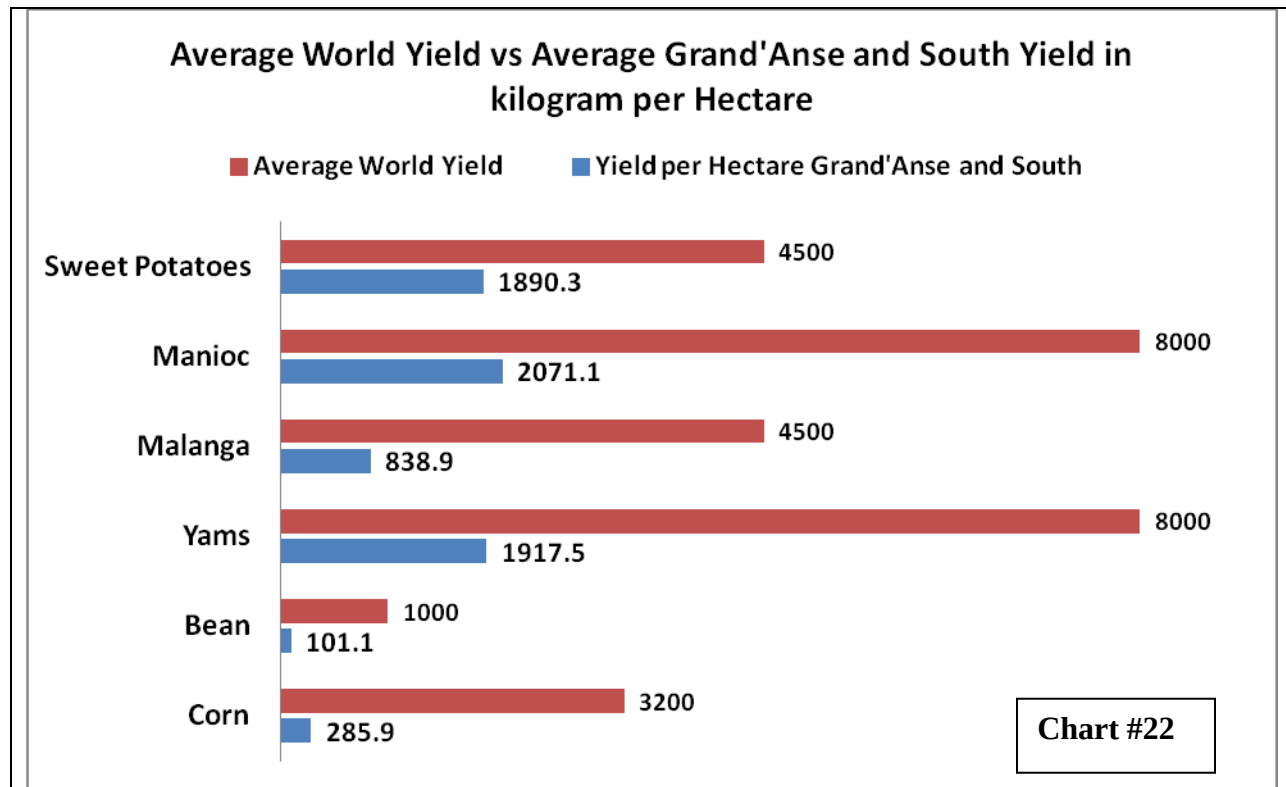
Calculation of the yield by tree is based on the average of kabos (cacao pods) per tree and the weight of 100 kabos. The calculation gives 1.51 kg, for the 2 harvested seasons of the year. In fact, the number of cacao trees per hectare is 316, but not all 316 trees are in production. A few are still young and not producing. There is some possible inherent bias as 10 trees per plot were chosen to record figures on production and presumably those 10 trees are among the most productive trees that have withstood Matthew.

See below the yield per hectare for other major crops.

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INDICATOR TITLE:	Baseline 2016	Notes
5. <i>Proportion of farmers who have received training to improve the productivity of their cacao trees.</i>	9% Lower limit=5.6% Upper limit= 12.3% 95% interval of confidence.	6% are applying training

9% of farmers received training to improve cacao productivity. 6% reported applying these trainings to their plots. Only producers in 5 of the 10 counties have received training to improve cacao productivity. These are, in order of importance, Abricots (25.7% of producers), Moron (13.3%), Torbeck (8.1%), Camp Perrin (5.7%) and Jérémie (3.1%).

The training mainly concerned the cleaning of plots, pruning, appropriate prunes of stems and trunks. This has been very helpful after Hurricane Matthew where the cleaning of cacao plots was a priority.

The names of the organizations that trained the producers in question are:

- CACCOMA, the Abricots cacao cooperative, active in the training of cooperators,
- AMAGA, the Association of Mayors of Grand'Anse, which is leading a project on cacao, funded by the European Union;
- CRS in Grand'Anse.

Proportion of farmers who have received training to improve the productivity of their cacao trees

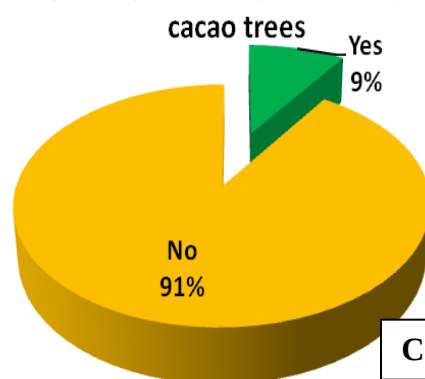


Chart #23

Proportion of farmers who have received training and applied their knowledge to improve the productivity of their cacao trees

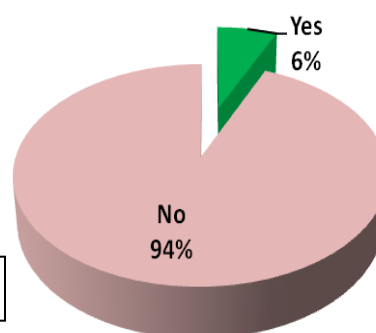


Chart #24

Table # 8: Proportion of farmers who have received training and applied their knowledge to improve the productivity of their cacao trees, per commune

Commune	Yes	No	Total
Moron	13.3	86.7	100
Abricots	25.7	74.3	100
Jeremie	3.4	96.6	100
Roseaux		100.0	100
Corail		100.0	100
Pestel		100.0	100
Beaumont		100.0	100
Camp Perin	5.7	94.3	100
Torbeck	8.1	91.9	100
Maniche		100.0	100
Group total	6.5	93.5	

Table #9: Type of training

	Yes	No
01. sapling production	4.2	95.8
02. direct seeding of cacao	2.5	97.5
03. Grafting of cacao	1.4	98.6
04. pruning of cacao and shade trees	6.3	93.7
05. organic fertilization	4.3	95.7
06. weeding	9.9	90.1
07. spacing of intercrops	4.6	95.4
09. Other	3.6	96.4

Table #10: What organizations provided training?

	Frequency of training
AMAGA	3
CACCOMA	7
CRS	1
ASERF	1
OPM	1

INDICATOR TITLE:	Baseline 2016	Notes
6. <i>Proportion of farmers who practice the following cultural practices: sapling production, direct seeding of cacao, pruning of cacao and shade trees, fertilization, weeding, spacing of intercrops, etc.</i>	62.7% Lower limit= 57.2% Upper limit= 68.2% 95% interval of confidence	Mostly pruning (60.8%), mainly after Matthew.

Cacao is considered by some producers as a crop to be taken care of and for others as a gathering activity, i.e., not managed. In general, in the cacao ecosystem, annual crops such as yam, bananas are grown and maintained while trees are only harvested. For a long time, until the year 2000, cacao, mango, breadfruit, and coconut were part of gathering-style agriculture; the plantations are old, no special care is taken to improve the productivity of the trees. Any harvest was like a gift from God or nature, the only activity related to these trees was harvest. This continues for many producers. Indeed, in the 307 cacao gardens observed in this basic study, 37.3% of the producers only harvest, that is to say do not adopt any cultural practices aimed at increasing the productivity of the cacao (apart from weeding to favor annual crops). This situation is characteristic of the counties of Camp Perrin and Beaumont, Pestel, Coral, Roseaux. Even after Hurricane Matthew, some plots are not maintained.

62.7% of farmers adopt cultural practices aimed to increasing cacao production. It is understood that these are not old habits; some practices such as sowing, pruning have become a necessity after Hurricane Matthew. Particularly in the counties of Abricots, Moron and Jeremie, there are not yet visible replanting actions to mitigate the impact of Hurricane Matthew. The problem of the availability of cacao seeds is not yet sufficiently addressed. Only clean-up operations were found to restore the plots' production.

The proportion of farmers using the following cultural practices is the following: direct seeding (8.3%), sapling production (8.9%), grafting (2.7%), pruning (60.8%), organic fertilization (26.5%) and weeding (60.5%). It should be noted that the same 62.7% of producers apply several cultivation practices. Nursery and no-till practices are more prevalent in the coffee zones (Beaumont, Pestel) where FACN has introduced know-how at the individual and collective levels.

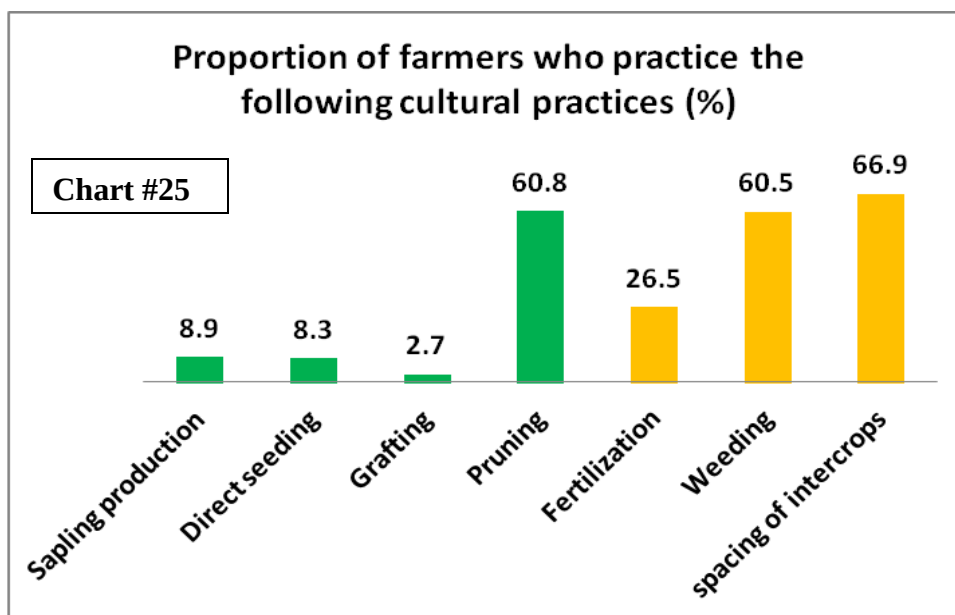


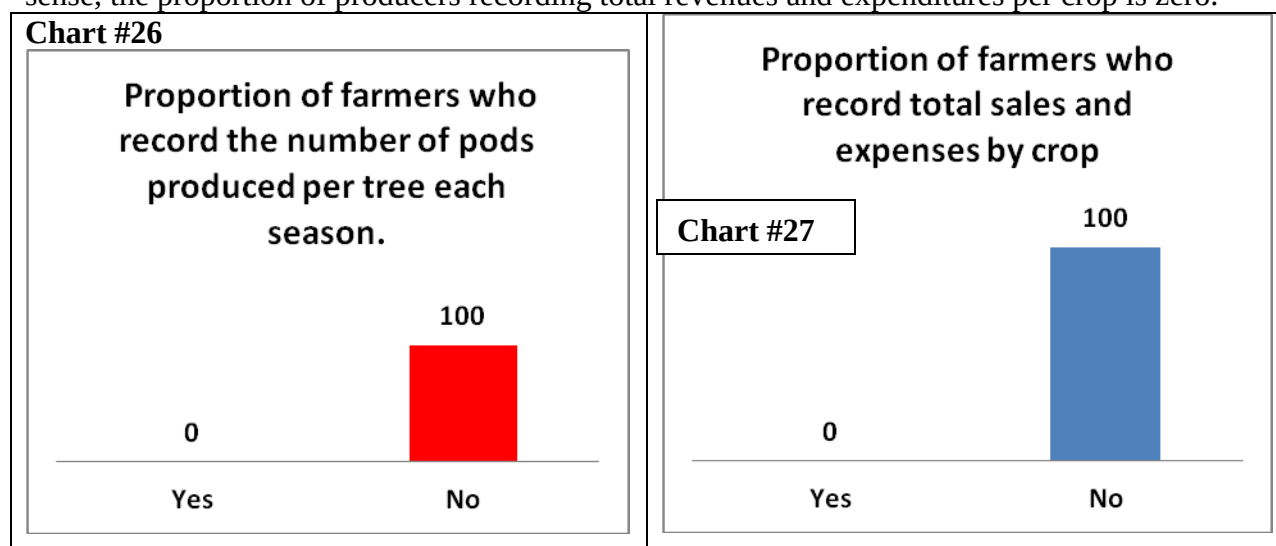
Table #11: Proportion of farmers who practice the following cultural practices (%) per commune

Commune	Sapling production	Direct seeding	Grafting	Pruning	Organic Fertilization	Weeding	spacing of intercrops
Moron		2.9	2.9	38.2	8.8	17.6	41.2
Abricots	5.9	3.0		71.4	5.7	37.9	36.4
Jeremie			6.3	36.7	14.8	57.1	79.2
Roseaux	11.8			20.6	8.8	61.8	14.7
Corail	10.0	30.0	5.3	80.0		100.0	70.0
Pestel	26.3	21.1		57.9	15.8	78.9	42.1
Beaumont	26.1	26.1	4.5	78.3	13.0	86.4	73.9
Camp Perin	20.6	20.6	8.8	94.1	91.2	97.0	93.9
Torbeck	2.7			97.3	70.3	86.5	100.0
Maniche				40.0	11.4	11.4	100.0
Group Total	8.9	8.3	2.7	60.8	26.5	60.5	66.9

INDICATOR TITLE:	Baseline 2016	Notes
7. <i>Proportion of farmers who practice the following management practices: record the number of pods produced per tree each season, record total sales and expenses by crop;</i>	0%	Farmers could not show evidence via documents.

Keeping of records by cacao farmers is not in their habit. The proportion of producers that records the number of pods harvested per tree each season is 0%. However, some producers are able to estimate the yield per tree, which was proven in this study. Others say they have numbers in mind, even if they do not pay special attention. Our investigators were unable to find evidence of the records per tree.

Similarly, the maintenance of cash management records is not carried out by interviewed producers. Some producers claim to have a memory of financial flows and can replenish them. However, they were not able to show a document of accounting or cash management. In this sense, the proportion of producers recording total revenues and expenditures per crop is zero.



The reasons for the complete lack of record keeping by cacao producers may be as follows:

- Producers are not used to and are not convinced of the benefits of keeping records. Keeping records is, for several, more work.
- The complexity of production systems would require specific training to empower producers to keep records: harvests are gradual, trees are multiple and unidentified, production is shared between trade and self-consumption, etc. Switching from gathering-style agriculture to managed agriculture would require records to monitor yields and financial flows.

The level of education of cacao producers shows that more than half do not have the capacity to keep records. In the sample, 27% are illiterate, that is to say, people completely excluded from this exercise because they do not know how to read or write; Adding the 2% that had attended literacy centers and also the 34% of producers who have not been able to complete their primary education, it follows that 63% of the current cacao producers are sub-primary and do not have the level of education sufficient to keep records on production and cash flows appropriately. It would, therefore, be advisable to introduce record keeping to younger farmers and to a sample of producers with the required level of education instead of attempting to have all farmers begin keeping written records.

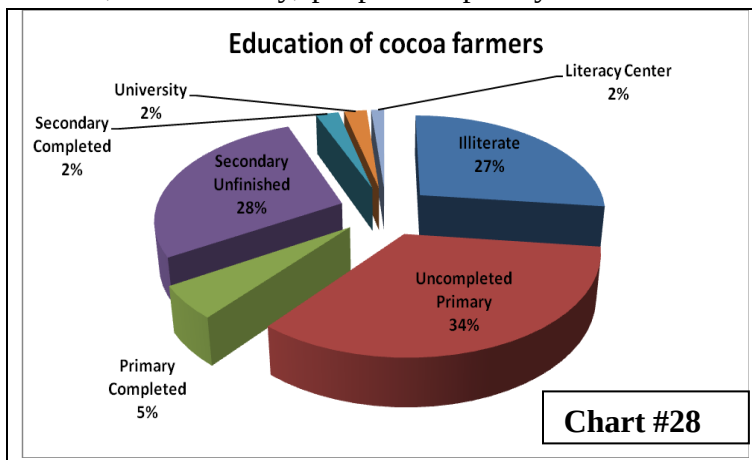


Table #12: Proportion of farmers who record the number of pods produced per tree each season per county

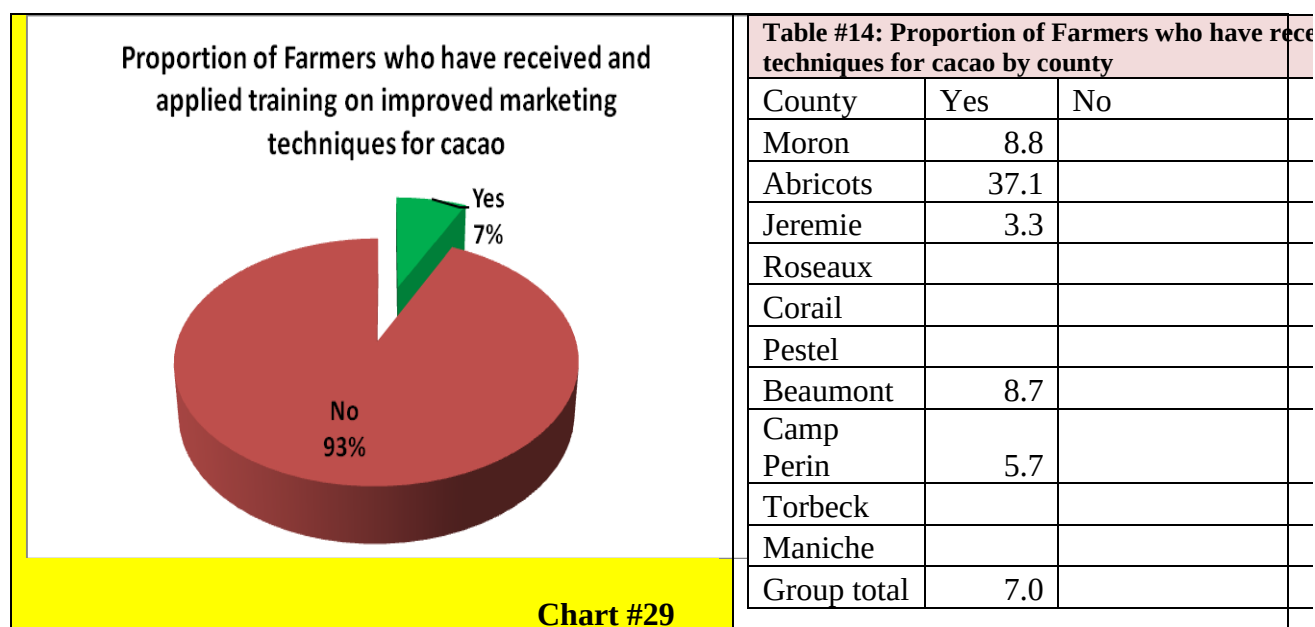
County	Yes	No
Moron	0	100
Abricots	0	100
Jeremie	0	100
Roseaux	0	100
Corail	0	100
Pestel	0	100
Beaumont	0	100
Camp Perin	0	100
Torbeck	0	100
Maniche	0	100
Group average	0	100

Table #13: Proportion of farmers who record total sales and expenses by crop, per county

County	Yes	No
Moron	0	100
Abricots	0	100
Jeremie	0	100
Roseaux	0	100
Corail	0	100
Pestel	0	100
Beaumont	0	100
Camp Perin	0	100
Torbeck	0	100
Maniche	0	100
Group average	0	100

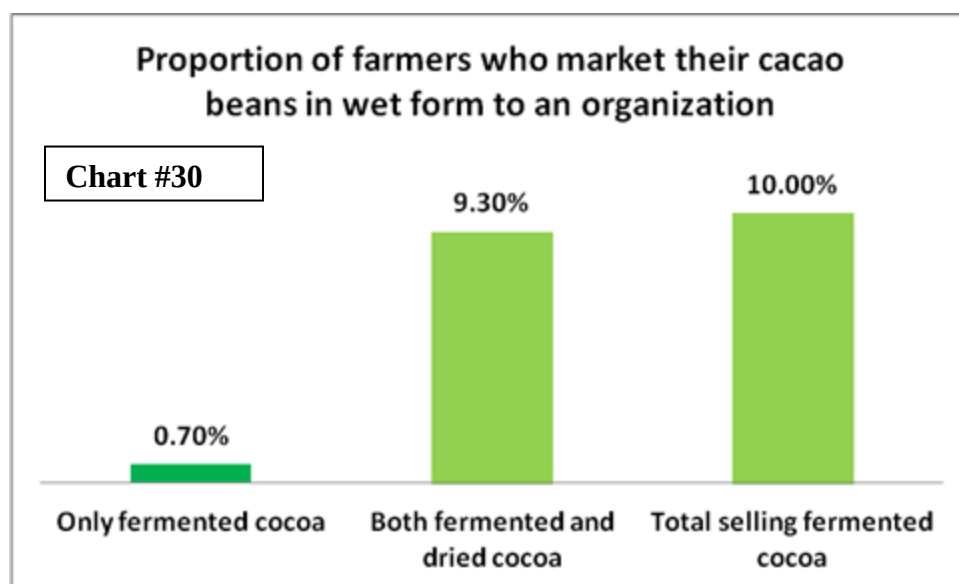
INDICATOR TITLE:	Baseline 2016	Notes
8. Number of farmers who have received and applied training on improved marketing techniques for cacao;	7% as proportion Or 420 farmers Lower limit= 4.23% Upper limit= 9.77% Range 254-586 farmers 95% interval of confidence.	The estimation is based on the proportion of farmers of the sample who have received and applied training on improved marketing techniques (7%) times 6000 targeted farmers for this project= 420 farmers.

The proportion of farmers trained in post-harvest treatment of cacao is 7%. These producers are around the existing fermentation centers at Abricots, Moron. Some producers in Beaumont (8.7%), members of the RECARP, network of coffee and cacao cooperatives, are also trained in the preparation of fermented cacao. In short, training on improved cacao marketing techniques is aimed primarily at cooperatives and individual producers. In the process of fermenting organic cacao occurs immediately after harvesting. The whole process of processing wet cacao into fermented cacao and final marketing of fermented cacao are carried out by the two cooperatives in the KABOS project zone with fermenting infrastructure and assistance from international donors.



INDICATOR TITLE:	Baseline 2016	Notes
9. <i>Number of farmers who market their cacao beans in wet form to an organization that will ferment the beans prior to marketing.</i>	10% as proportion Or 600 farmers Lower limit = 6.61% Upper limit = 13.39% Range 397-803 farmers 95% interval of confidence.	The estimation is based on the proportion of farmers of the sample who market their cacao beans in wet form to an organization (10%) times 6000 targeted farmers for this project= 600 farmers.

Only 0.7% of producers sell only wet cacao for fermentation, while 89.7% sell only dried cacao. 9.3% sell both wet cacao for fermentation and dried cacao. 10% sell their fresh cacao beans to an organization that ferments cacao. It is important to note that the option to sell wet cacao for fermentation only exists in two of the 10 counties: Moron and Abricots. A few producers in the county of Jérémie, near Moron, take advantage of the location to sell cacao wet for fermentation at Moron.



INDICATOR TITLE:**10. Proportion of farmers who sell their cacao beans only in unfermented, dried form;****Baseline 2016****89.7%****Lower limit=86.3%****Upper limit=93.1%****95% interval of confidence.****Notes****Unfermented cacao receives discounted prices at intl. level and no premium for quality.**

The percentage of farmers who sell their cacao beans only in dried form is 89.7%. The possibility of fermentation exists only in two counties: Moron and Abricots. Dried cacao is characteristic of gathering agriculture. The quality of dried cacao is often poor and there is no premium for quality. Most producers do not have drying areas. Cacao is often dried on grass, on roadsides, on galleries of dwelling houses without minimum hygienic conditions. It often happens that cacao is mixed accidentally with soil or small stones. This is troublesome in areas where cholera is still present.

Proportion of farmers who market their cacao beans in wet form or/ and in dried form

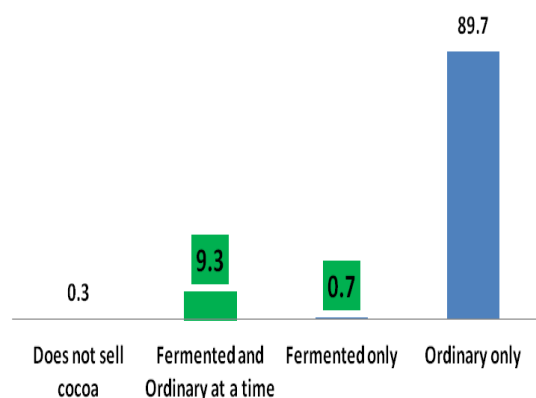
**Chart #31**

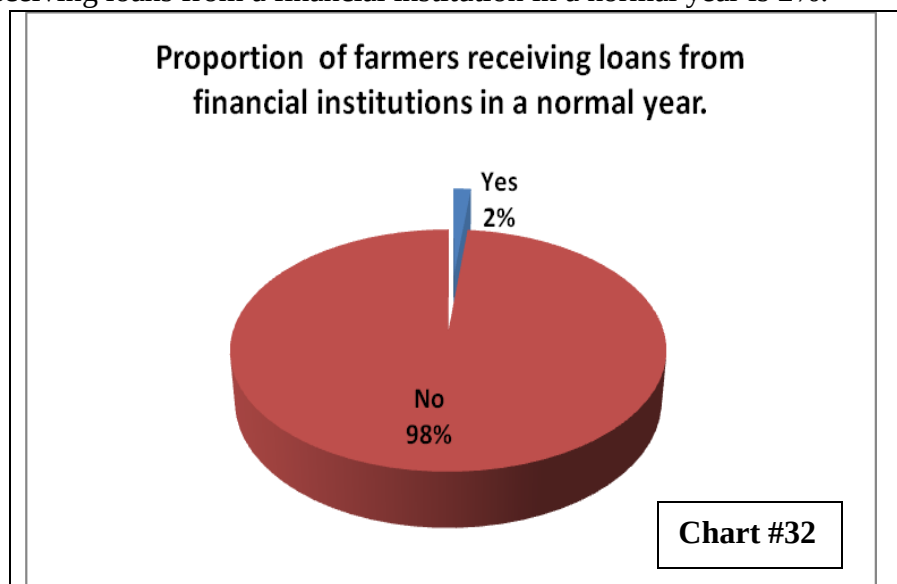
Table #15: Proportion of farmers who market their cacao beans in wet form or/ and in dried form per county

County	Does not sell cacao	Sell Fermented and Ordinary	Sell Fermented only	Sell Ordinary only
Moron		21.9	3.1	75.0
Abricots		57.1		42.9
Jeremie			3.8	96.2
Roseaux				100.0
Corail				100.0
Pestel	5.3			94.7
Beaumont				100.0
Camp Perin				100.0
Torbeck				100.0
Maniche				100.0
Group total	0.3	9.3	0.7	89.7

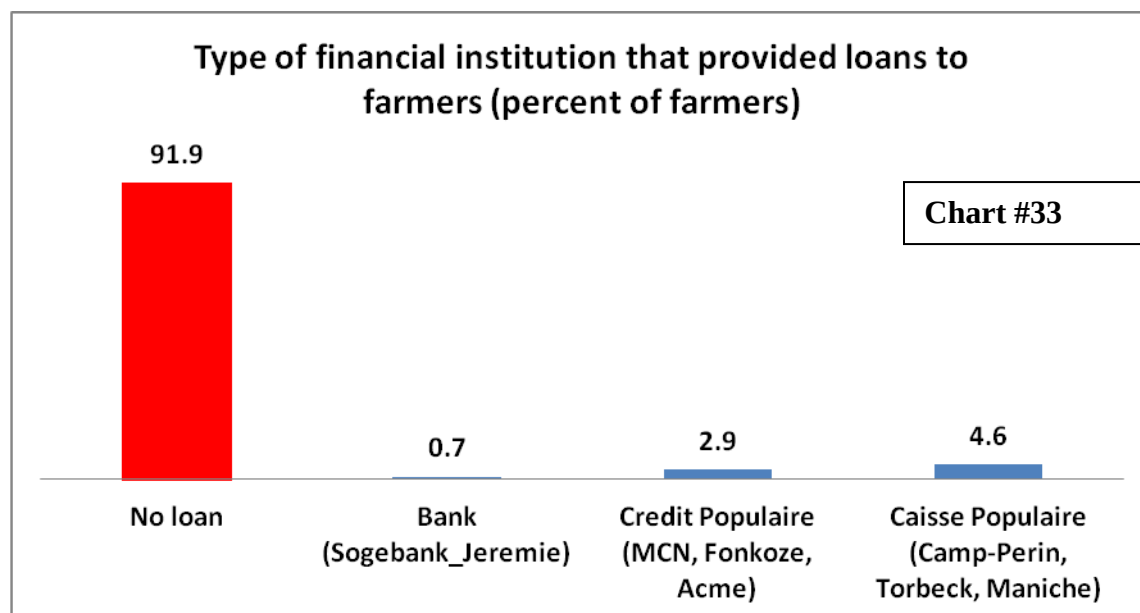
INDICATOR TITLE:	Baseline 2016	Notes
11. <i>Farmers receiving loans from financial institutions in a normal year.</i>	2.00 % as proportion or 120 farmers	The estimation is based on the proportion farmers receiving loans from financial institutions in a normal year.
	Lower limit=0.04% Upper limit= 3.96%	6/307 in 2016.
	Range 24-238 farmers 95% interval of confidence.	(2%) times 6000 targeted farmers for this project= 120 farmers.

The proportion of farmers receiving loans from a financial institution in a normal year is 2%.

For the last four years, a proportion total of 8.1% have received financial loan, of which 4.6% is a local credit union, 2.9% are institutions of small commercial credit (Micro Credit National, FONKOZE, ACME) and 0.7% of the Sogebank of Jeremie. These are usually household loans, not directly related to agricultural production.



Bank loans are granted by Sogebank of Jeremie; The other loans are mainly granted in the counties of the South: Camp Perrin, Torbeck, Maniche. It should be noted that counties with no producers receiving loans are Moron, Abricots (1 only), Beaumont, Corail and Pestel.



INDICATOR TITLE:	Baseline 2016	Notes
12. Average value and cycle time of loans individual farmers receive in a normal year from a financial institution.	\$582 12 months	Median value is \$29. Duration is 4 to 20 months.

The average amount lent is 39,575 HTG (\$582 US). The median value is 20,000 HTG (\$294) for a modal value of 15,000 gourdes (\$220). Taking into account the high standard deviation, the median (\$294) is more representative than the arithmetic average.

The duration of loans varies between 4 to 20 months. However, the average duration is 12 months.

Interest rates range from 20% to 60%. The lowest interest rates (20 to 30% per year) are charged by credit unions (*caisses populaires*). The highest interest rate (57%) is charged by FONKOZE.

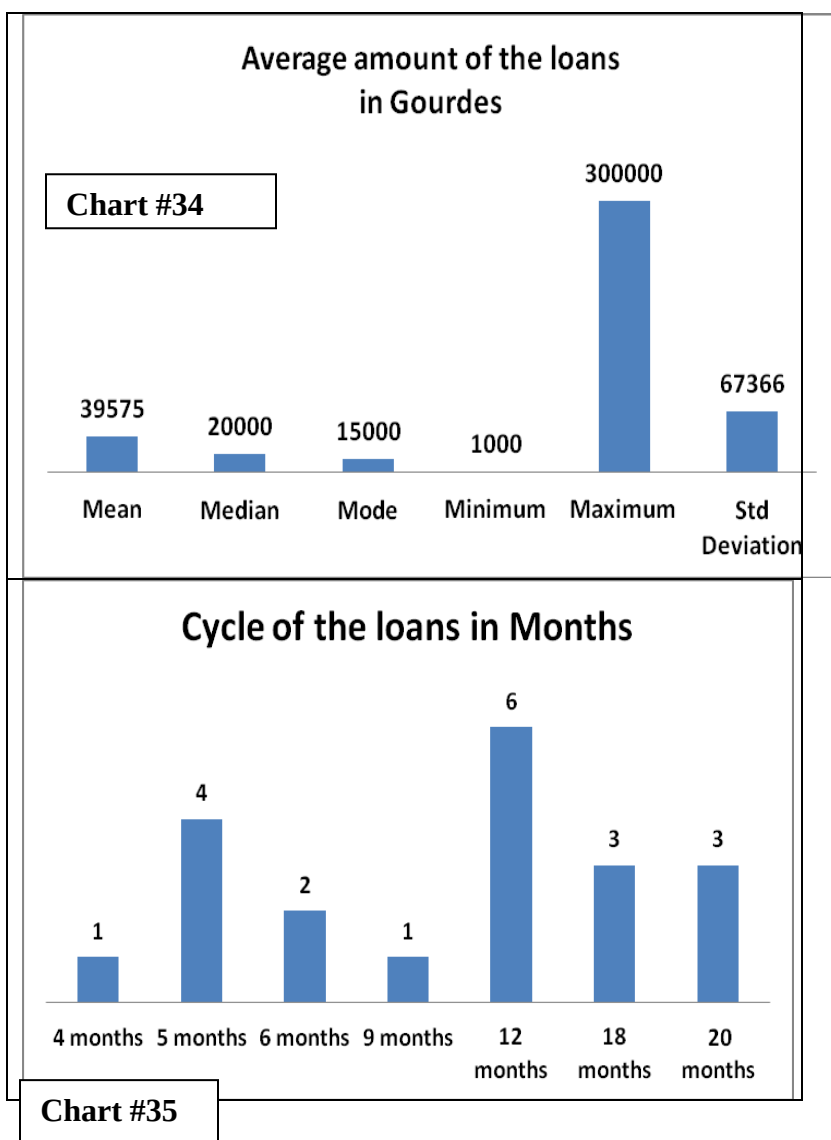


Table #16: Rates of Interest practiced

Interest per year	Bank	Institutional Microcredit	Credit Union
	Number of loans	Number of loans	Number of loans
20%		1	2
25%			6
30%		1	
32%		1	
48%		1	
57%		2	
Total		6	8

Table #17: Cycle of the loans last four years.

Number of Months	Bank	Institutional Microcredit	Credit Union	Group total
	Number of loans	Number of loans	Number of loans	Number of loans
4		1		1
5		4		4
6	1		1	2
9		1		1
12		2	4	6
18			3	3
20			3	3
Total	1	8	11	20

Table #18: Amount of the loans by type of financial institution, last four years.

Amount Gourdes	Equivalent in USD 1\$=68ht	Bank	Institutional Microcredit	Credit Union	Group total
		Number of loans	Number of loans	Number of loans	Number of loans
1000	14.7		1		1
5000	73.5		1	1	2
6500	95.6		1		1
9000	132.4		1		1
10000	147.6			1	1
15000	220.6			3	3
20000	294.1		1	1	2
25000	367.7			3	3
30000	441.2		1	1	2
40000	588.2	1			1
70000	1029.4		1		1
125000	1838.2		1		1
300000	4411.8			1	1
Total		1	8	11	20

INDICATOR TITLE:**13. Estimate survival of cacao trees, fruit and forest trees, after Hurricane Matthew.****Baseline 2016**

Cacao	45.50%
Coconut	21.70%
Bread fruit	43.20%
Mango	51.20%
Avocado	27.80%
Orange/Chadeque/Lemon	48%
Forest trees	49.70%

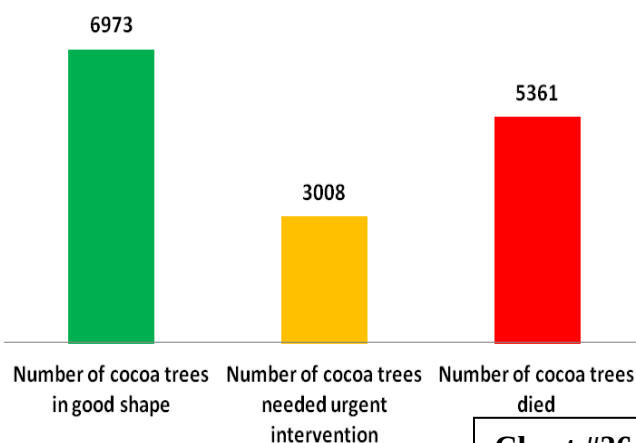
Notes**Status in February 2017.****6.13.1. Cacao Survival**

Natural regeneration is continuing 5 months after Matthew. Some trees withstood the winds; standing and re-leafing, and resuming growth with the rains that followed Hurricane Matthew for more than two weeks. However, it should be stressed that the long drought that began in December 2016 did not favor a recovery in the best conditions. Some cacao trees that survived Hurricane Matthew could not survive the drought.

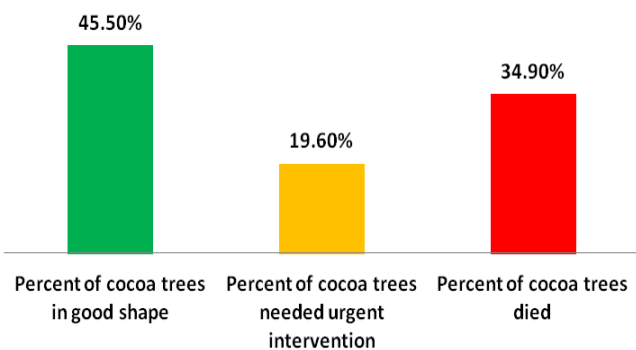
To have the actual survival rate, and not fall into speculation figures, systematic observation was performed on the 307 plots that were delineated for this baseline study. The 24 young agronomists used for this study observed tree after tree in the delimited area.

The results of the observations are as follows: 15,342 cacao trees were observed closely, 6,973 trees are in natural recovery, 3,008 are still alive, often encumbered by hurricane-downed cover trees, but can be rescued with appropriate pruning. However, 5,361 are unrecoverable. It seems that 34.9% of the cacao trees are irrecoverable, while 65.1% are alive, 45.5% of which are recovered, and 19.6% require intervention.

Cocoa gardens 5 months after Hurricane Matthew: Number of trees analyzed 15342

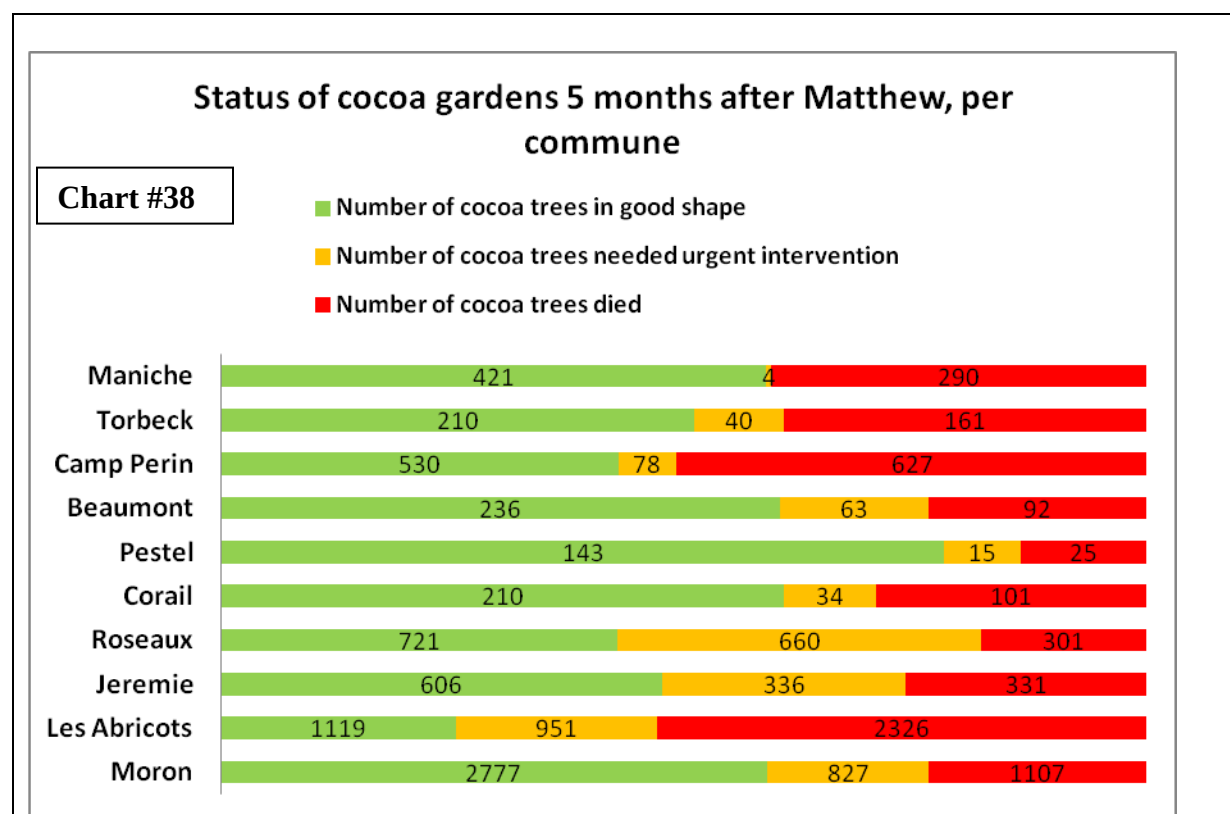


Cocoa gardens, percentage of cocoa trees survivor



Observation by county shows that the situation in Abricots is the most troublesome. Less than 25% of cacao trees have a successful recovery compared to 57% natural regeneration in the post-hurricane Matthew rapid assessment. Indeed, at the beginning of January 2017, a wind blew for a whole week, tearing the re-growing leaves. This wind was followed by a long drought that has killed many trees. This situation has also been observed in Dame Marie.

In practice, the counties with high cacao concentrations are in order of importance, Moron, Abricots, Jeremie and Roseaux. Outside of Abricots, the survival rate is over 50%. In the State of the South, Camp Perrin is more affected than the other counties: Maniche and Torbeck.



Apart from the recovery rate, concern remains about the behavior of cacao trees in a markedly modified environment. Indeed, most of the shade trees have disappeared.

Table #19: Status of cacao gardens 5 months after Matthew, percent per commune.			
	Percent of cacao trees in good shape	Percent of cacao trees needed urgent intervention	Percent of cacao trees died
Moron	58.9	17.6	23.5
Abricots	25.5	21.6	52.9
Jeremie	47.6	26.4	26.0
Roseaux	42.9	39.2	17.9

Corail	60.9	9.9	29.3
Pestel	78.1	8.2	13.7
Beaumont	60.4	16.1	23.5
Camp Perrin	42.9	6.3	50.8
Torbeck	51.1	9.7	39.2
Maniche	58.9	0.6	40.6
Group	45.5	19.6	34.9

6.13.2. The survival of fruit and forest trees in the cacao ecosystem.

Fruit and forest trees were less resistant than cacao. The systematic observation of 308 plots showed that 47.3% of adult trees are definitively irrecoverable. They are drying out (dying), being used for the production of charcoal, lumber, or simply rotting to eventually become soil. In sum, 43.9% of the trees have initiated natural recovery; certainly, because of the significant damage observed, the harvests will be reduced and delayed. Many branches and broken stems grow new stems. Some were only stripped of their leaves; With the post-hurricane rains, the leaves are re-sprouting.

The most notable losses are coconuts with 75% of trees completely destroyed and only 21.7% in natural recovery. Avocados are also very affected with 61% of deaths. The breadfruit tree, the basis of household food has been partly saved. The trunks and stems are broken, the leaves are gone; 46% of the breadfruit trees are destroyed and irrecoverable, not even for charcoal production. However, 53% of the breadfruit trees are alive and have begun natural recovery. Mango trees were also heavily affected with 37% of mango trees permanently destroyed and only 51% of mango trees in natural recovery.

Table #20: The survival of fruit and forest trees in the cacao ecosystem				
	Total trees before Matthew	Trees in good shape	Trees needed intervention	Trees died
Coconut	1890	411	65	1414
Bread fruit	4328.3	1869.3	462	1997
Mango	2868	1467	339	1062
Avocado	1146	319	121	706
Orange/Chadeque/Lemon	1876	900	183	793
Other fruits	1622	790	94	738
Forest trees	4564	2267	357	1940
Group Total	18294.3	8023.3	1621	8650
	Total trees before Matthew	Percent trees in good shape	Percent trees needed intervention	Percent Trees died
Coconut	100	21.7	3.4	74.8
Bread fruit	100	43.2	10.7	46.1
Mango	100	51.2	11.8	37.0
Avocado	100	27.8	10.6	61.6
Orange-Chadeque-Lemon	100	48.0	9.8	42.3
Other fruits	100	48.7	5.8	45.5
Forest trees	100	49.7	7.8	42.5
Group Total	100	43.9	8.9	47.3

This is a worrying situation that will affect the standard of living of households, with negative consequences for the level of education, the vulnerability of families, especially adolescent girls and survival strategies including youth migration. The urgency is undeniable.

INDICATOR TITLE:	Baseline 2016	Notes
14. Percentage of Cacao Post Harvest Losses.	26.33%	Monitoring of 5 fermentation centers
	Lower limit= 21.53%	2015/2016: Moron, Abricots, Chambellan, Dame Marie, Anse d'Hainault.
	Upper limit= 31.13%	
	95% interval of confidence.	

This indicator refers to the percentage of post-harvest losses recorded by cooperatives.

6.14.1. Calculation method :

The data used comes directly from five cooperatives of the Grand'Anse. This was a follow-up carried out for the 2015-2016 campaign, by Agr. Mikerlange Balmir. He developed the table below according to the data recorded in the archives of the five cooperatives, two of which are in the KABOS project area.

6.14.2. Results

Poor cacao preparation and inadequate storage conditions result in losses up to 26.33% of the volume of cacao marketed in the region. Indeed, in the department of Grand 'Anse, the post-harvest losses recorded in the cacao sector relate to poor drying conditions, a crucial deficiency in the packaging infrastructures in general. Specifically, the product's humidity is poorly controlled (residual water content is often around 20%, and for cacao, mold growth is possible beginning at 10% humidity).

Table 21: Cacao Post Harvest Losses in stock						
COOPERATIVES	Amount of cacao bean in stock (kg)	Amount of normal cacao beans (kg)	Bad fermentation (kg)	Lack of drying (kg)	Weight loss in stock (kg)	Cacao loss (%)
Cacoma	4642	3340	609	480	213	28,04%
Mocac	3460	2791	404	430	118	27,5%
Copcod	2092	1590	270	210	22	24%
Cacaodam	3205	2447	360	332	66	23,65%
Copdah	4512	3227	760	318	207	28,47%
TOTAL	17911	13395	2403	1770	626	
Average						26,33%
Sources: Cooperatives' records, Year 2015-2016.						

The experiments carried out by five cooperatives in Grand'Anse presented in the table above have shown that the post-harvest losses relate to:

- A deficiency of beans in the fermentation box/tank can lead to poor fermentation due to lack of heat to promote microbial activities. Losses due to poor fermentation represent an average of 13.4%.
- A lack of drying which leaves a moisture content of more than 8% in addition to the re-wetting of the beans due to bad storage conditions (absence of pallets, ventilation problems...etc.) facilitates the development of molds. Losses due to poor drying represent an average of 9.88%.
- Experiments carried out both at the cooperative level and with private exporters show that the weight of the beans decreases progressively according to the length of storage. The weight loss related to the length of storage represents an average of 3.4% for a period of three months.

To limit the three categories of losses mentioned above, it is important to:

- Strengthen the capacity of cooperatives to master post-harvest techniques (fermentation, drying and storage).
- Make some investments to improve drying and storage conditions and to equip cooperatives with quality control materials/equipment (thermometer, moisture meter and pH meter) to facilitate the operation of post-harvest care.
- Carriers/transporters must follow strict compliance programs in order to avoid losses due to re-humidification
- Initiate timely marketing efforts in the country and export to limit weight loss due to the length of storage.

7. Conclusions and Recommendations.

This study established baseline values of performance indicators prior to Hurricane Matthew. There is no doubt that baseline values have been modified according to the impact of Hurricane Matthew, but these changes cannot be apprehended due to lack of actual references and the fact that five months after the hurricane there has not yet been a complete crop season nor a harvest. In such a context, it would be strategic to make a clear difference between two groups of indicators:

- Those indicators that depend mainly on the implementation of the project, such as training, cultural practices, sale of wet cacao for fermentation, access to credit, etc. The baseline values of these indicators reflect the starting situation of the project since no structural changes were affected by Hurricane Matthew.
- Those indicators that depend on natural conditions such as cacao yields, level of production of main crops included in the cacao ecosystem. The values measured in this study are historical but not real at the time when the project was launched. Indeed, the KABOS project will start with significantly lower reference values and try first to reach the historical values before going beyond them. Given the enormous damage caused by Hurricane Matthew, and taking into account the long process of environmental

restoration, it is unlikely that the industry will achieve these historical values during the life of the project. Full recovery will be a long term process; however, the KABOS project will have the opportunity to put in place a solid foundation that will contribute to enhanced, long-term outcomes.

To complement the baseline study, the consultant recommends conducting research-development on cacao behavior in a new environment with fewer shade trees.

8. Appendix: Performance Indicators

PI #	PERFORMANCE INDICATOR	INDICATOR DEFINITION AND UNIT OF MEASUREMENT
1	Value of sales by project beneficiaries (FFPr Standard 13; FtF)	Definition: The value (in US dollars) of sales of targeted commodities by all project beneficiaries. The actual number reported will be the value of sales of a product by direct project beneficiaries in the reporting period. Only sales attributable to USDA involvement will be counted. Unit of Measurement: U.S. Dollar Disaggregation: Commodity Type
2	Volume of commodities (metric tons) sold by project beneficiaries (FFPr Standard 14; FtF)	Definition: The volume (as calculated in gross metric tons) of sales of targeted commodities by project beneficiaries. This includes the volume of all sales, not just the volume of farm-gate sales. Only the gross volume of sales attributable to USDA investment will be counted for the reporting period. Unit of Measurement: Metric Tons Disaggregation: Commodity Type
3	Number of jobs attributed to USDA assistance (FFPr Standard 15; FtF)	Definition: Jobs are all types of employment opportunities created during the reporting period. Jobs lasting less than one month are not counted. Jobs will be converted to full-time equivalents (FTE). Unit of Measurement: Number of jobs Disaggregation: Gender of Job Holder

4	Number of individuals who have received short-term agricultural sector productivity or food security training as a result of USDA assistance (FFPr Standard 16; FtF)	Definition: The number of individuals to whom significant knowledge or skills have been imparted through interactions that are intentional, structured, and purposed for imparting knowledge or skill, through formal or informal means, will be counted as trained. Individuals will be counted only once during the reporting year. Sensitization meetings or one-off information meetings will not be counted. Unit of Measurement: Individuals Disaggregation: Gender; New/Continuing; Type of Individual (if applicable)
5	Total number of individuals benefiting directly as a result of USDA assistance (FFPr Standard 17)	Definition: The number of individuals directly engaged in USDA-funded project activities. Individuals who merely come into contact with the project will not be counted. Individuals will be counted once per fiscal year. Unit of Measurement: Individuals Disaggregation: Gender; New/Continuing
6	Total number of individuals indirectly benefitting as a result of USDA assistance (FFPr Standard 18)	Definition: The number of individuals indirectly benefitting in USDA-funded project activities. The individuals will not be directly engaged with a project activity or come into direct contact with a set of interventions provided by the project. Individuals will be counted once per fiscal year. Unit of Measurement: Individuals Disaggregation: None
7	Number of agroforestry plants planted as a result of USDA assistance (Custom Indicator #1)	Definition: Number of agroforestry plants planted on producer farms as a result of the project. Unit of measure: # of plants. Disaggregated by species.
8	Increase in producer yields as a result of USDA assistance (Custom Indicator #2)	Definition: Average increase, in kg/per tree, of dry cacao beans per producer. Based on sample of producers to be conducted at baseline and bi-annually. For comparing kg/ha with other nations or regions, multiply average yield per tree by a standard, pure-stand density of 1,100 trees per hectare. Unit of Measurement: percent.

9	Number of hectares under improved techniques or technologies as a result of USDA assistance (FFPr Standard 1; FtF)	Definition: Measures the area (in hectares) of land or water first brought under improved technique(s) or technology(ies) during the current reporting year. Technologies to be counted here are agriculture-related land-based technologies and innovations including those that address climate change adaptation and mitigation. Significant improvements to existing technologies will be counted. Unit of measure: Hectares Disaggregation: New/Continuing; Technique or Technology type (if applicable); Gender
10	Number of individuals who have applied new techniques or technologies as a result of USDA assistance (FFPr Standard 2; FtF)	Definition: Measures the total number of agricultural producers that applied new techniques or technologies anywhere within the food and fiber system as a result of USDA assistance. This includes innovations in efficiency, value-addition, on-farm post-harvest management, sustainable land management, etc. Technologies to be counted here are agriculture-related technologies and innovations. Unit of measure: Individuals Disaggregation: Gender; New/Continuing; Technique or Technology type (if applicable)
11	Number of individuals receiving financial services as a result of USDA assistance. (FFPr Standard 4)	Definition: Total number of agricultural producers, cooperatives, MSMEs, business enterprises, and other entities receiving services from financial enterprises as a result of project activities. USDA assistance may include partial loan guarantee programs or any support facilitating the receipt of a loan or other equity. Unit of Measurement: Individuals Disaggregation: Gender
12	Number of loans disbursed as a result of USDA assistance (FFPr Standard 5)	Definition: Number of loans made/dispursed to agricultural producers, cooperatives, MSMEs, business enterprises, and other entities during the reporting year as a result of project activities. Loans that are merely in process but not yet disbursed are not counted. Unit of Measurement: Number of Loans Disaggregation: Gender
13	Value of loans provided as a result of USDA assistance (FFPr Standard 6; FtF)	Definition: Value (in US dollars) of loans and credit extended to agricultural producers, cooperatives, MSME, business enterprises, and other entities. Loans that are merely in process but not yet disbursed are not counted. Unit of Measurement: US Dollars Disaggregation: Gender of loan recipient

14	Number of individuals who have applied improved farm management practices (i.e. governance, administration, or financial management) as a result of USDA assistance (FFPr Standard 3)	Definition: The total number of beneficiaries who are applying the knowledge or skills received in USDA supported training in farm management practices. Unit of Measurement: Individuals Disaggregation: Gender; Type of Individual (if applicable)
15	Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied improved techniques and technologies as a result of USDA assistance (FFPr Standard 7)	Definition: The total number of beneficiaries who are applying the knowledge or skills received in USDA supported training in farm management practices. Unit of Measurement: Number of Organizations Disaggregation: New/Continuing (if applicable); Type of Organization (if applicable)
16	Total increase in installed storage capacity (dry or cold storage) as result of USDA assistance (FFPr Standard 11; FtF)	Total increase in installed storage capacity (dry or cold storage) as result of USDA assistance (FFPr Standard 11; FtF)
17	Percentage reduction in post-harvest loss as a result of USDA assistance (Custom Indicator #3)	Definition: Total cacao loss registered by cooperatives of the total cacao received by cooperatives.
18	Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied improved techniques and technologies as a result of USDA assistance (FFPr Standard 7)	This indicator measures the total number of private enterprises (processors, input dealers, storage and transport companies), producer associations, water users associations, cooperatives, women's groups, trade and business associations, and community-based organizations (CBOs), that applied improved techniques or technologies. Techniques and technologies are described in FFPr Indicator 2. Unit of Measurement: Number of Organizations Disaggregation: New/Continuing (if applicable); Type of Organization (if applicable)
19	Number of individuals receiving financial services as a result of USDA assistance. (FFPr Standard 4)	Definition: Total number of agricultural producers, cooperatives, MSMEs, business enterprises, and other entities receiving services from financial enterprises as a result of project activities. USDA assistance may include partial loan guarantee programs or any support facilitating the receipt of a loan or other equity. Unit of Measurement: Individuals Disaggregation: Gender

20	Number of loans disbursed as a result of USDA assistance (FFPr Standard 5)	Definition: Number of loans made/disbursed to agricultural producers, cooperatives, MSMEs, business enterprises, and other entities during the reporting year as a result of project activities. Loans that are merely in process but not yet disbursed are not counted. Unit of Measurement: Number of Loans Disaggregation: None
21	Value of loans provided as a result of USDA assistance (FFPr Standard 6; FtF)	Definition: Value (in US dollars) of loans and credit extended to agricultural producers, cooperatives, MSME, business enterprises, and other entities. Loans that are merely in process but not yet disbursed are not counted. Unit of Measurement: US Dollars Disaggregation: Gender of loan recipient
22	Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied improved techniques and technologies as a result of USDA assistance (FFPr Standard 7)	This indicator measures the total number of private enterprises (processors, input dealers, storage and transport companies), producer associations, water users associations, cooperatives, women's groups, trade and business associations, and community-based organizations (CBOs), that applied improved techniques or technologies. Unit of Measurement: Number of Organizations Disaggregation: New/Continuing (if applicable); Type of Organization (if applicable)
23	Number of cacao working group meetings or workshops facilitated by the Haitian government at departmental and national levels as a result of USDA assistance	Definition: Total number of workshops or meetings organized by the gov't with the support of the project to promote cacao. Unit of measurements: Number of workshops/meetings
24	Number of policies, regulations and/or administrative procedures in each of the following stages of development as a result of USDA assistance (FFPr Standard 12. FtF)	Definition: Number of agricultural enabling environment policies/regulations/administrative procedures in the areas of agricultural resource, food, market standards & regulation, public investment, natural resource or water management and climate change adaptation/mitigation as it relates to agriculture that are in the various stages of development. Unit of Measurement: Number of policies, regulations, and/or administrative procedures and supplementary narrative Disaggregation: Stages 1 through 5

25	Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied improved techniques and technologies as a result of USDA assistance (FFPr Standard 7)	Definition: The total number of beneficiaries who are applying the knowledge or skills received in USDA supported training in farm management practices. Unit of Measurement: Number of Organizations Disaggregation: New/Continuing (if applicable); Type of Organization (if applicable)
26	Number of public-private partnerships formed as a result of USDA assistance (FFPr Standard 8; FtF)	Definition: Number of public-private partnerships formed in agriculture or nutrition during the reporting year due to USDA intervention. Length of partnership is not a criterion for measurement. Partnerships with multiple partners will only be counted once. Unit of Measurement: Number of partnerships Disaggregation: Type of partnership (refer to <u>primary focus of partnership</u> if applicable)
27	Number of private enterprises, producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied improved techniques and technologies as a result of USDA assistance (FFPr Standard 7)	This indicator measures the total number of private enterprises (processors, input dealers, storage and transport companies), producer associations, water users associations, cooperatives, women's groups, trade and business associations, and community-based organizations (CBOs), that applied improved techniques or technologies. Unit of Measurement: Number of Organizations Disaggregation: New/Continuing (if applicable); Type of Organization (if applicable)

QUESTIONNAIRE

Redacted from public view.

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Formulas for the interval of confidence:

For $n < 30$

Interval of confidence of the Average

$X = \text{Average} \pm t_{\text{student}} \times \text{Standard deviation} / \text{Square root of } n$

$n = 4$

$t_{0,95}$, 2 tailed test-3,182 (table of tstudent)

Standard deviation=49.9

For $n > 30$ (that is 308)

Interval of confidence of the Average=

$X = \text{Average} \pm z \times \text{Standard deviation} / \text{Square root of } n$

$n = 308$ square root=17.55

95% interval of confidence: $z = 1.96$

For proportion:

$X = \text{Average proportion} \pm z \times \text{Square root } [p(1-p)/n]$

Z a 95%=1.96

$P = \text{proportion (between 0 to 1), that is 60\%} = 0,60$