IPRO 333

Building Communities Through Coffee





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Project Details

Building Communities Through Coffee





Project Plan

The mission of IPRO 333 is to assist the Crop to Cup Company with the design and building of an enclosure for a temporary storage facility within the vicinity of their largest producing farming zone for robusta coffee in the Mbale region of Uganda. The sponsor, along with the team, has decided that the best method for addressing the local and global needs of the farmers is to present the research and design personally. Therefore, IPRO 333 will be fundraising to help finance the forthcoming trip to Uganda to present to the farming communities.

As a result, the IPRO 333 team has been entrusted with the design of a structure that will serve as a secure coffee storage facility for the farmers. The structure will also include a public space allowing farmers to weigh, sell, pulp, and dry their coffee.

The Research and Design Phase of the project has many considerations; taking into account the local customs of the Ugandan farmers, their ideas of security, the effectiveness of locally available materials for building, conditions at the site that may decrease the coffee's value (e.g. pests and climate) and the socio-economic impact of Crop to Cup's 2011 Plan. This will require in depth research of the culture and site which will lead to a series of designs most suitable and agreeable to the sponsor and the farmers. A systematic understanding of the production methods of coffee will yield a more efficient and suitable design. In addition, an ongoing relationship with the farmers, mediated by the sponsor through the form of emails will allow the team a greater understanding of the farming community's needs.

The Fundraising Phase of the project consists of promotion and sales of Crop to Cup Coffee to increase market exposure of the product as well as of the company's support of the Ugandan coffee farming community. These fundraising efforts will include sales of pre-packaged coffee as well as prepared coffee and other clothing items and donations at local farmers' markets within the vicinity. This provides for more awareness within the local community of the project and possibilities for collaboration and input from outside sources to enrich the team's own efforts.

Michael Erie with a customer: Brookfield Farmers Market, Brookfield Illinois. June 12, 2010.

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Team Structure

The IPRO 333 team consists of students from varying fields within the IIT community. Together, we create an interdisciplinary team of architecture students, material science majors, mechanical engineers, biology and chemistry majors as well as psychology majors. Because this project presents a myriad of challenges, from the social and ethical issues to economic concerns, and of course the structural integrity and sustainability of the Banda, every opinion is critical.

The purpose the team has set forth is primarily to gain knowledge of socio-economic conditions in both Uganda and Chicago with respect to coffee. This obtained research will inform the design of a storage facility, called a banda, for the coffee farmers in Uganda. The storage facility needs to be built to benefit both the Ugandan farmers and Crop to Cup. The company hopes to see an increase in security for the farmers, profit per activity, overall farmer income, cultural awareness for consumers and a decrease in export and import time.

Team Objectives:

- Becoming culturally aware of community in Bugisu regions of Uganda
- Researching ethical and social impact
- Forming/understanding relationships & politics with Ugandan farmers
- Investigate locally available construction materials
- Create Detailed Itinerary for trip to Uganda
- Determine site location in Uganda
- Create a plan to determine infrastructure, logistics, and business plan
- Develop a plan to engage our stake holders (CCCC)
- Develop communication with CCCC organization
- Conduct needs assessment from farmer's perspective immediately
- Advocating CCCC to American Culture through farmer's markets

(Right) The Summer 2010 Team: getting off to a great start at an IPRO team building session.

(Below) Summer 2010 Team: IPRO day.

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Team Value Statement:
The IPRO 333 Team values clear communication between members, responsible actions, respect within the team and with others during fund-raising events, attendance, punctuality, timely completion of all responsibilities, and most importantly, an optimistic outlook. Communication will be done through 'iGroups' for the duration of the semester. Each student is required to accomplish assigned tasks and take on certain leadership roles weekly. Classes are used for heated discussions and task completion so as to have all tasks completed before IPRO day.

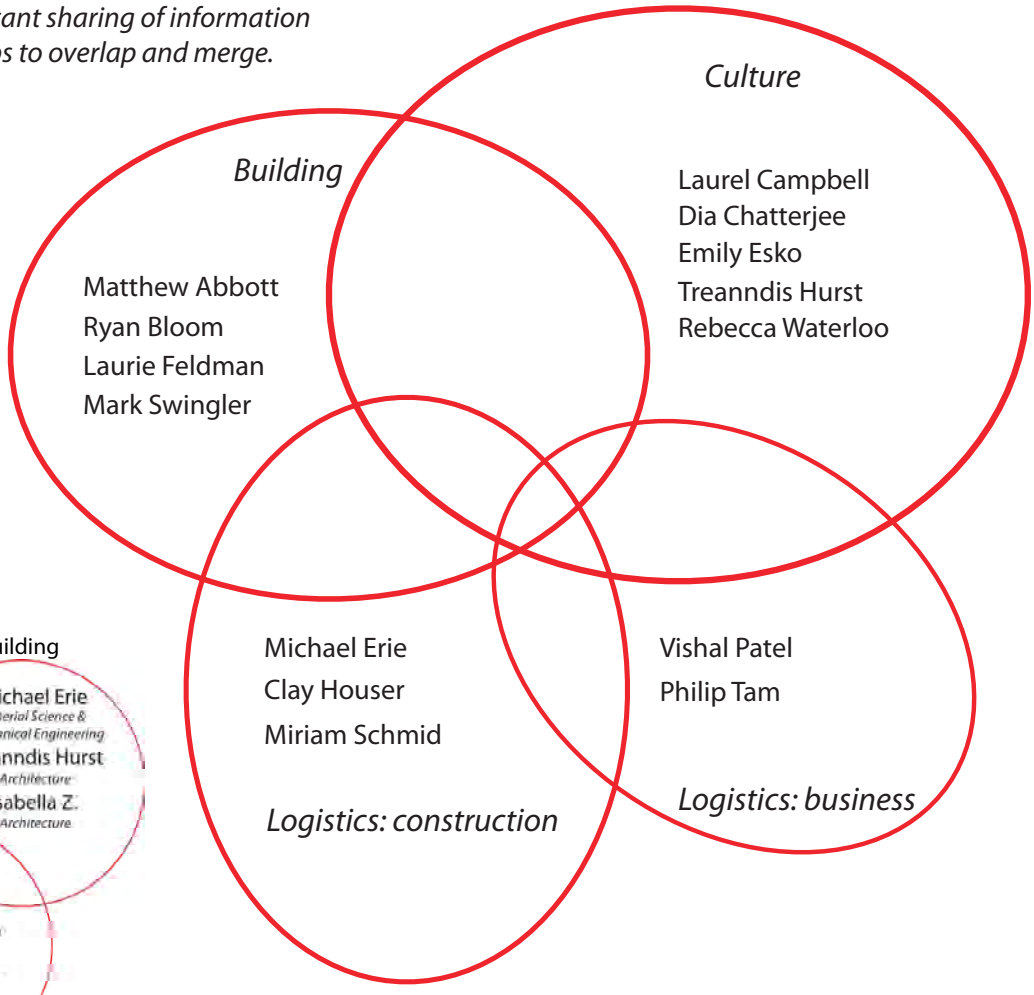
Problems will be addressed openly among the group in a respectful manner, taking all views into consideration.

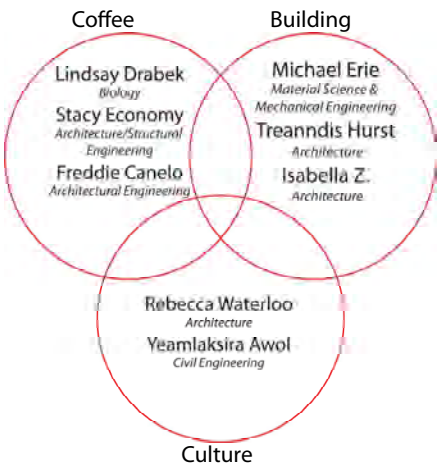
Subgroup Structure:

To yield the most thorough research, the team will divide into subgroups, covering:

- Building
- Community Impact
- Logistics: Business
- Logistics: Construction and Transportation

Subgroup Diagram: Constant sharing of information exchange cause the groups to overlap and merge.





(Right): Summer semester group structure.
Notice the difference between summer and fall semesters.

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Matthew Abbott mgabbott1@gmail.com	Architecture	IPRO experience, design skills, problem solving skills, hard worker
Ryan Bloom rmbloom10@gmail.com	Architecture	previous IPRO experience, flexibility, optimistic, creative, problem solving, presentation skills
Laurel Campbell czarsmile@gmail.com	Architecture	Time management, adaptability, humor, research savvy, speed reader, efficient
Dia Chatterjee dchatter@iit.edu	Psychology	Analytical, communication skills, organized, motivated, creative, team player
Michael Erie michael.d.erie@gmail.com	Mechanical Engineering and material science and engineering	Knowledgeable about the project, knowledgeable materials, creative, problem solver
Emily Esko emily.esko@gmail.com	Biomedical Engineering	Communication and organizational skills, versatile, hard worker, problem solving
Laurie Feldman lfeldman@iit.edu	Architecture	organizational skills, good communicator, creative, optimistic, mediator, efficient
Clay Houser clay.houser313@gmail.com	Mechanical and Materials Science Engineering	I am a hard worker dedicated to learning a lot and making this IPRO grow into something great
Trey Hurst treanndishurst@gmail.com	Architecture	Previous experience in this IPRO. Good with processing and organizing raw information.
Vishal Patel vpatel87@iit.edu	Mechanical and Physics	efficient, resourceful, great mathematical and technical skills, very excited for this project, also i have a sense of the structure of East Africa
Miriam Schmid mirm90@gmail.com	Biology	time management, team player, communication skills, problem solving skills, negotiator, adaptable
Mark Swingler mswingler12@gmail.com	Architecture	Attention to detail, creativity, presentation skills, achiever, responsibility, developer, focus
Philip Tam ptam2@iit.edu	Chemistry	Hard Worker, Team Player, Will get any task that is assigned done as soon as possible.
Becca Waterloo oolretaw@gmail.com	Architecture	time management, communication, creative, loud, efficiency, organization, knowledge of the interweb, willingness, team leader

Fall '10 , names from left : Steve Beck, Trey Hurst, Dia Chatterjee, Clay Houser, Laurel Campbell, Mike Erie, Emily Esko, Ryan Bloom, Laurie Feldman, Matt Abbott, Miriam Schmid, Mark Swingler, Becca Waterloo, Philip Tam, Vishal Patel.

Overarching Goal

The goal for our IPRO in this semester is to explore all viable options for a secure communal storage facility, or banda, that will benefit all stakeholders in the coffee process.

This overarching goal is only reached after the satisfaction of a number of other criteria such as but not limited to:

- Determine and design the proper storage environment for coffee beans.
- Establish a system for quality control.
- Facilitate traceability.
- Design for whole crop buying.
- Plan for C2C's expanded role in Uganda.
- Identify, discuss, and attempt to solve all ethical issues,
- Explore and understand the culture.
- Research local materials and labor.
- Identify and solve the logistical issues of the actual construction.

Challenges

Although we were presented with challenges during both the summer and fall semesters. The following chapters will highlight our solutions.

- Communication with farmers in Uganda.
- Lack of availible information on Uganda.
- Cancellations of our summer site visit to the Coffee farms in Uganda due to the tragic terrorist attacks in Kampala.

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Expected Deliverables:

After teambuilding sessions during the first week, the team required a starting point for research, and invited the Crop to Cup CEO, Jake Elster, to give a thorough presentation of the company's mission and the expected role for IPRO 333. This period was followed by a question and answer section which was helpful to guide the future activities of the team.

The IPRO 333 Team Deliverables:
Fundraisers to help pay for the trip to Uganda to meet with the farmers will continue throughout the summer. This is done for two reasons:

1. It will help promote Crop to Cup's activities, thus allowing consumers to be more aware of the situation farmers in Uganda are facing and hopefully support C2C in its activities
2. It will give opportunity for the IPRO 333 team to travel to Uganda in order to have personal interactions with the farmers, learning about their customs and asking questions related to the project, conduct site surveys, and inspect locally available construction materials. The fundraisers require the team to obtain market reservations, go through training with respect to setting up and making coffee and a solid understanding of Crop to Cup's mission.

Development of questions and trip itinerary to ask during the interviews with the farmers with respect to the farmers' outlooks on safety, importance of coffee, strongly held ideals, opinions of the western world, what they think their coffee is used for in the United States. This research is to become more culturally aware, to help clarify incorrect perceptions and to have a better grasp on what is truly needed for the banda to be successful.

To prepare in-depth site surveys while still in the U.S. These surveys will include physical site information, climate and soil data and any natural occurring situations to inform the team.

To research locally available materials and methods of construction, material science, economic benefits of using locally available materials versus a pre-fabricated model.

Build relationships, via email, with the farmers to personally understand their needs, as well as facilitate the design process when meeting with the farmers in Uganda.

Design Proposals of various options resulting from the research completed. These proposals will be presented in the form of sketches, drawings, renderings and simple models.
Prepare travel information and book travel flights to Uganda during the semester.

Travel to Uganda and meet with the farmers. During this time the team will follow the planned itinerary and present ideas to the clients. Designs may need to be reworked and documented to reflect changes needed to be made.

Compile research and documentation and present succinctly in a book form to pass on to the next semester IPRO working on the Crop to Cup Coffee project.

Expected Results:
The IPRO 333 team hopes to conclude the semester with full preparation for the trip to Uganda to meet with the farmers and present design proposals. The team visions this process to be a continuous reworking of designs to reflect changes requested by farmers and other issues that the team may recognize during their field research. These various designs and other new discoveries will need to be documented to allow the following IPRO class to be able to continue the process and move from a design phase to a building phase.

Budget

The full budget will go towards supplies needed in the fundraising effort for the Ugandan trip. Fundraisers will be held at various Farmers' Markets in the Chicago land area and in other commercial locations if/when the opportunity arises. The costs involved are: application fees for Farmers Market events, acquiring tents, tables, development of posters and coffee accessories for sales (e.g. sleeves, lids, stirrers, and napkins); these initial costs will be paid via the IPRO Budget. Certain items will be sold at fundraising events and donations will be accepted and all extra funds raised will go back to Illinois Institute of Technology.

Projected Budget

Projected Budget Proposal

Cost	
Camera for farmers + Shipping	$200
Publicity and Raffles	$200
Modeling and Testing	$100
Total	$500

Fundraising Goal	
Travelers	8
Approx. Cost per Traveler	$2,000
Down Payment	$200
Amount to be Fundraised	$14,400

Items to be Sold at Fundraisers

Item	Cost
Hot Coffee	$2
Cold Coffee	$3
Coffee w/ Horchata	$5
Coffee Beans (10oz)	$9
Coffee Beans (2lb)	$20
T-Shirts	$12

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Designation of Roles

This team has decided to assign roles for each team member, some shared with others. Below are the roles (some invented, some existing) assigned and hope to be maintained throughout the semester, with some adjustments always assumed.

The stationary roles are shown below:

- iGroups moderator – Ryan Bloom
- Agenda Maker – Trey Hurst, Philip Tam
- Secretary/Scribe – Dia Chatterjee, Miriam Schmid
- Farmer's Markets organizer – Mike Erie, Becca Waterloo
- Crop to Cup Liaison – Emily Esko, Visha Patel
- Team Leader – Laurie Feldman, Becca Waterloo
- Farmer Liasion – Mark Swingler, Matt Abbott, Dia Chatterjee
- Professional Researcher – Clay Houser, Laurel Campbell

The Crop to Cup Coffee Company

The Crop to Cup Coffee (C2C) imports coffee from farms in East Africa. They travel to the farm, select the best farmers and form relationships with them. The company takes pride in bringing customers closer to the coffee farmers and vice versa through the use of message boards, email, cameras, and video conferencing. C2C's mission is to connect the community of farmers and consumers in an attempt to allow them to better understand one other. The relationship C2C shares with its farmers are closer than that of the average coffee company. This allows for much higher traceability by tracking which beans are produced by which farmer. They offer biographies of the farmers they work closely with and give the consumer the opportunity to pose questions to the farmers on the C2C website. The farmers then are able to connect with the people who purchase their coffee beans.

C2C currently implements their "20, 5, 10" program, in which farmers receive 20 percent over market price for their coffee, 5 percent of their coffee's selling price in coffee consuming communities, and 10 percent of company profits. The program is designed to reward farmers for producing high quality coffee, provides funds to help gain international recognition for their communities' artists, support for community projects and training in technology.

C2C is now preparing to implement a new plan in 2011 called "Whole Crop" in which they will commit to purchasing 100 percent of the coffee produced from the farmers they currently work with, in two regions of Uganda, Gibuzaale and Kapchowra. They plan to buy the coffee at an above-market price along with committing to pay a premium to individual farmers based on coffee quality. An important part of this plan is building a storage facility for this larger amount of beans, compared to the 14 percent they currently purchase.

Current Issues:
In preparation for "Whole Crop", the community storage facility that will allow the farmers to sell their entire crop at the Crop to Cup price needs to be designed and understood as a concept by the farmers. Also, because the farmers are not used to selling their coffee all at once many issues arises, such as the question about whether the farmers would want to be paid in full for their coffee and store the money versus the current system where they store some of their coffee at a time to sell when desired. Another option could be that they set up a sort of banking system where C2C would pay the farmers for their beans in monthly or weekly installments.

C2C has determined that a small storage facility banda must be designed to accommodate farmers' security and storage needs. In addition to this requirement of secure storage, the banda will also include a public office allowing farmers to weigh, sell, pulp, and dry their coffee. The banda's goal is to increase security with respect to the farmers' chief source of income along with fostering a sense of community among all farmers who use the public space.

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Technological Considerations:
The coffee production process begins with the cherries that are handpicked from the coffee tree. Though mechanical means are available, they are not as effective. The cherries can be processed either as wet or dry. In wet processing, the outer skin is removed from the bean, and all the cherries that remain with pulp on them are placed in tanks to ferment where natural enzymes will dissolve the pulp on the coffee beans. Afterwards, the beans are washed and dried. Dry processing is the oldest method of processing coffee, in which the coffee cherries are washed and spread out to dry in the sun for a few weeks. After the beans are dry, the pulp on the beans will ferment. Fermentation affects the beans' flavor. Finally, after the coffee beans have dried completely, whatever dry outer layer that still exists on the bean is removed. A pulping machine is sometimes also used to aid the removal of the outer skin in both processes.

Previous Attempts:
Communal storage has been used throughout history in many different models in many different situations, all being beneficial to the societies that utilized the methods. There are three major models that have some importance to the project at hand.

The ancient model of agriculture is one of community farming and community storage. In this model, the community farms the land regardless of ownership and the fruits of the labor are seen as a product of the community and not the specific farmer. Most ancient peasantry through feudalism used some form of this model. Community farming lasted in Britain until the enclosure movement, which is where private farms were surrounded with fences to stop open grazing of cattle. Often, the farmers would store the crops in the same location, with the most famous being the biblical story of grain storage in Egypt.

The Grange of the Order of Patrons of Husbandry was the next major model of communal storage. This movement started with the creation of a fraternity of farmers who suffered devaluation of crops after the Second World War. The purpose of the fraternity was to provide a stronger counterforce against the market forces. The farmers who joined the organization stored their crop at the facilities known as granges, which is a derivation of granaries. The communal storage helped the farmers of the granges sell their crops at higher prices than in the normal market.
The Cooperative Business Model of farmers that grew since the 1920's is basically a non-fraternal organization that bases itself off the Grange Model by providing farmers within the cooperative access to new markets and gives them some price control. They also offer access to tools that farmers may not be able to access when acting alone. This model is the one most closely relatable to Crop to Cup. The company will be purchasing all the coffee beans from the farmers, instead of a share of their produced coffee, and bringing them to a new market with connections to the consumers that are buying their coffee. The storage facility is one
of the benefits of Crop to Cup's "Whole Crop" plan, as well as the complete sell of their crops at premium prices.


EXPLAINING YOUR DONATION
HOW AN OUNCE OF COFFEE DOES A POUND OF GOOD
CROP
WWW.CROPTOCUP.COM
FARMERS RECEIVE | 20% PREMIUMS | 5% REVENUES | 10% PROFITS
20
Crop to Cup farmers own their own land and sell into a free market. We pay 20% above prevailing market prices to make sure we get the best coffee from the best farmers. In 2008 this bonus equated to 55% more benefit as compared to selling through Fair Trade.
1
Each season, every coffee plant produces enough coffee to make about one pound of roasted coffee. So we think it proper that every pound sold plants a new seedling to help our friends in Africa against their fight on deforestation and poverty. Donations are included in the price of coffee; we track your impact throughout the year to show your customers, and your accountant, exactly how much of a difference you made with your choice of coffees.
10
We are serious about giving farmers a stake in their business; one out of every ten dollars made by Crop to Cup goes back to our farmer-suppliers through our progressive 10% profit sharing plan.

FAMILY-FARMED COFFEES
FRESH FROM THE FARMER TO US TO YOU.
THEIR STORY IS YOUR STORY, ACCESS IT ALL
FROM CROP TO CUP.

SUSTAINABLE, MADE SENSIBLE.

CUP

Real Good Coffee

Real Good Story

Real Good Service

A fresh approach to sustainable coffee.

Crop to Cup Coffee Company was founded to connect coffee farmers to coffee lovers. We do this by working alongside small family farmers to package their finest coffee in the story of its origin. Then we import this cultural product directly, making it available at a great price to coffee lovers worldwide.

This is possible because we are an importer that uses technology and traceability to build a more direct connection between your customers and their ultimate supplier; the farmer.

To us, sustainability means empowering coffee farmers to take control of their businesses and work their way out of poverty through earned income. It also means empowering conscientious consumers to exercise their preference for ethical products.

The result is what is called 'relationship coffee'. Relationship coffee provides a low-cost, feel-good alternative to traditional certified coffees. It simply means that you and your customers can meet the farmers who grew the beans you brew. If you'd like to see for yourself how much your farmer got for their crop you can - simply log online, or ask one of them yourself by writing to farmers@croptocup.com.

All of our coffee comes from family farmers who own and tend to their own land. Supporting family farmers is important because family farms are ancestral plots that have been passed down through the generations.

Ultimately, however, the reason why this coffee is special is *you* - your support makes a real impact on real people.

CROP TO CUP COFFEE CO.

These coffees are good for a good reason.

Email: askus@croptocup.com
Chicago: 773.749.2627 | New York: 646.345.6030

DON'T TAKE COFFEE FROM STRANGERS
KNOW YOUR JOE AT WWW.CROPTOCUP.COM


CROP TO CUP COFFEE COMPANY | SINGLE SERVE COFFEE POUCHES
GOURMET AFRICAN COFFEE - UGANDA BUGISU ARABICA
Good coffee can relax the body and stimulate the spirit. It can enchance an experience, making it more pleasurable and memborable. Plus, people have come to expect good coffee.
Our coffee comes from Uganda, East Africa, where coffee growing is a way of life. Uganda's coffee has a bright, bold taste touched with a soft, chocolate-toned sweetness.
This coffee comes from the farmers to our roasters, and then directly to your door Now, for the first time, this origin is available in a simple serve pouch!
CROP TO CUP POUCHES
case of 32
PRICE PER CASE = $54.99
1 box of coffee = 32 pouches
1 pouch = 1 pot of coffee
1 box = 32 pots of coffee
1 pouch = $1.72
1 pot of coffee = $1.72
1 pot of coffee = 12 cups
1 cup = $.14
SINGLE SERVE POUCHES - THREE THINGS YOU SHOULD KNOW
With Crop to Cup's 2.8 ounces of premium coffee per pouch, you get more coffee for your money than with other brands. This means stronger, better coffee.
With our simple-serve single pouches, you can enjoy fresh roasted top-notch coffees without the fuss. This means a rich and flavorful cup, any and every time you want it.
With 5% of your purchase donated to a seedling project in the farmers' community, your coffee means more too. This means that every box of coffee donates an additional $2.75 to plant over 5 new trees.
ORDERING INFORMATION ; ORDERS@CROPTOCUP.COM
SPEAK WITH A LIVE PERSON: (773) 749 2627 - JAKE, CHICAGO (646) 345 6030 - TAYLOR, NYC
DON'T TAKE COFFEE FROM STRANGERS - SUPPORT FAMILY FARMED COFFEE
CROPTOCUP.COM

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BERNARD WOLIMBWA
17 person family

- Bunanimi Village, Nambongo/Buginyanya, Sironko District, Bugisu Region, Uganda
- 6,200 ft. elevation

(photo: Bernard W. with his son, Geoffrey)

Bernard has been farming coffee for 17 tears and is currently setting up the first plantation in Eastern Uganda (there currently exists one in Rwenzori, in Western Uganda). Owns 22 hectares, and manages roughly 30,000 coffee trees. Calls his farm 'Nacofa' (Nambongo Company Farm), and expects first quality yield from the estate in 2009/2010.

Farmer Profiles

As previously mentioned. C2C builds special relationships with its coffee producers in Uganda. The following profiles describe a few farmers with whom C2C works.

SAM KAUKA
55 years old

- Buginanya Subcounty, Sironko District, Bugisu Region, Uganda
- 6,250 ft. elevation
- 01– 16.28 N x 34 – 22.95 E - Download Sam's Google Earth location

(photo: Sam and his children on the farm)

Sam has been in the coffee farming business for about 22 years now and manages an estimated 250 coffee trees. He says he grows coffee because its is the only *cash crop* – while other crops such as banana or beans can provide some income and subsistence, this cash crop allows him to truly use his land as his business.

MERESI WAGAMBALA
6 children, 10 grandchildren

- Buginyanya Subcounty, Bugisu, Uganda
- Bugisu Washed Arabica
- FARM : 5,000 trees (est.)
- 6,240 ft. elevation

MERESI began coffee farming with her husband 30 years ago. Now a widow, she manages the farm on her own and with a bit of help from her children and grandchildren. An expert in plant care, she runs a community demonstration plot to educate her fellow farmers on how to improve their coffee, improve their earnings, and improve their lives. Eucalyptus, banana trees and nearly a dozen other plants also grow on her farm. This protects the strength and nutrients of her soil and the habitat of local and migratory birds.

TOPISTA AND JOSEPH NAIMISI

6 children

- Gabagi Village, Buginyanya Subcounty, Bugisu, Uganda
- FARM : 2,000 trees (est.)
- Bugisu Washed Arabica
- 6,240 ft. elevation

TOPISTA works on the farm and is also a local elementary school teacher. She applies the principles of the classroom to her garden. *"Quality coffee begins straight away from the garden. Your garden must be smart."* Their earnings from coffee are used for school fees, growing their small shop, and buying more land for bigger and better coffee yields.

GODFREY BWAYO

34 years old • Married, 6 children

- Manafa District, Bugisu, Uganda
- FARM : 1,200 trees (est.)
- Bugisu Washed Arabica
- 4,650 ft. elevation

GODFREY'S grandfather started growing coffee, and passed this knowledge down to Godfrey's father and to Godfrey himself, who started growing coffee at the age of 20. Each generation has built its homes and schooled their children with coffee.

An early morning coffee drinker, he describes his coffee's taste as *"tastes so good.... You can take it without any sugar and feel very comfortable".*

PETER GIMUII

40 years old • married, 6 children

Vice Chairman, Bufumbo/Masira Coffee Farmers Association

- Bufumbo Parish, Masira Subcounty, Bugisu, Uganda
- FARM : 5,000 trees (est.)
- Bugisu Washed Arabica
- 6,430 ft. elevation

Peter and his wife Jennifer raise 1 cow, 2 goats, chickens, and 3 rabbits in addition to their various crops, including coffee. As a family man, Peter's coffee earnings are used to educate his six children. Peter also recently set up a small nursery to expand his farm and assist his neighbors with new coffee tree seedlings.

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BONIFACE WETEBE
55 years old

- Buginyanya Subcounty, Bugisu, Uganda
- FARM : 4,000 trees (est.)
- Bugisu Washed Arabica
- 6,200 ft. elevation

BONIFACE is, at age 55, considered a muzeh (old-timer). He reflects, *"coffee was brought here in 1924... My father and grandfathers kept [trees] and up to now I continue to keep coffee. And I also continue to help you in the knowledge of coffee."*

On coffee, Boniface adds, *"To produce good quality of coffee you must organize with your family and plant good seedlings, keep a good garden with manure. You pick only red cherry, wash and dry well."*

"To keep organic you must first have a cow. This is my cow"

STEPHEN WOBIBI

- Lead Scientist and Manager, Buginyanya Field Branch of the National Agricultural Research Organization (NARO)

(Stephen's video - larger version here)

As head of the Buginyanya Field Branch of the National Agricultural Research Organization (NARO), Stephen Wobibi has many responsibilities. He must conquer leaf rust and wilting disease, defeat pests, and convince farmers to 'stump' their trees. Of all his tasks, the last is the most challenging. For leaf rust and wilting disease, Stephen prescribes proper pruning, tree spacing, and keeping a clean garden. For pests, Stephen applies ash to keep away the ants - without ants to eat up the trees' sugary byproduct, common pests cannot live. For stumping, Stephen has not yet found a good way to explain to farmers that cutting off overgrown stalks of coffee trees (which then cuts off a tree's income for a short time), is good for the long-term.

NARO takes its knowledge to the farmers; Stephen selects and introduces new varieties of trees, and educates local farmers on how best to care for their crop.

Ethical Considerations

The goal for our IPRO this semester was to explore all viable options for a secure communal storage facility (Banda) that will benefit all stakeholders in the coffee process.

At the very onset of the project, we recognized that our efforts needed to be directed such that we did not inadvertently hurt the expectations of a marginalized population who have come to distrust promise of investment in their community. Thus, our ideas, designs, and implementation strategies often touched upon the ethical implications of the same.

Our concern to ensure that the Banda would not merely become a source of power for a privileged few, but truly represent a positive move for the community as a whole, prompted us to seek expert help. We decided to arrange an ethics round table discussion and invited professors from diverse backgrounds such as anthropology, social psychology, _____, and _____ to get a holistic critique on our direction. The ethics round table proved to be an epiphany. We realized that the innocuous and well-meaning Banda could potentially have severe, complex, and possibly dangerous implications for the community. Some of the questions/concerns and the implications that were raised were:

1. Ownership of Banda could have serious implications:
   a. If C2C owns it would they allow farmers to maintain contacts with other buyers or will this structure represent a dependency on C2C?
   b. Will the land donor (banda's site) have complete control on Banda? Will the land rights remain in his name? If so, this will give him immense power over others in the community.
   c. Can the villagers buy the banda from C2C over the course of a few years? What happens to the banda and its maintenance if C2C folds their operations in a few years?
2. How will the Banda impact the economy, power, and hierarchy in the community?
3. Does the community even want a Banda? Is this being forced upon them?
4. Legal implications, such as the structure of family need to be considered since the land is being donated:
   a. Who will inherit the land after the donor?
   b. By Ugandan law, would the inheritance also include the banda?
   c. Can women inherit land/property?
   d. What is the informal economy?
5. Other stakeholders that we had not considered such as government and competing outlets selling coffee.
6. Who represents the community?

It is thus clear that there are a lot of issues surrounding the Banda that need to be addressed before this structure could be introduced to the community.

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Context Research

Building Communities Through Coffee





The Coffee Economy

Did you know that coffee beans are the seeds of a fruit similar to a cherry? Did you know that most of the world's coffee is grown by small-scale coffee farming families? Coffee is actually the world's second most traded commodity, taking a backseat only to petroleum, with the coffee market earning nearly sixty billion dollars annually. The importance of coffee in the world cannot be denied; here are some coffee facts and statistics that coffee aficionados may not even know.

Coffee trees can only be grown where there is no winter frost. Many varieties of coffee plant exist, but only two are cultivated: the Arabica, and the Robusta. The Arabica is considered to be the best quality, but can only be grown above an altitude of 2000 feet, while the Robusta can grow below. It takes three to five years for a coffee tree to reach maturity; in one year, the average yield from a single tree is approximately one roasted pound of coffee. Coffee cherries usually contain two beans, except for the single peaberry anomaly. The peaberry is considered the 'caviar' of coffees in some regions, while other regions discard the peaberry as below-grade product.

Coffee is grown in over fifty-three countries worldwide, all of them located near the equator between the tropic of Cancer and Capricorn. Brazil is the largest coffee producing region, with around 30% of total world output of coffee. Colombia ranks second. Nearly seven million tons of green coffee beans are produced each year worldwide, and the majority of those are hand-picked beans. Coffee farmers earn as little as four cents per pound for these hand-picked beans; for every pound of gourmet coffee sold, small-coffee farmers earn just over twelve cents. The fair trade movement is aimed at redistributing profits so that these farmers receive a decent wage for their hard work. No coffee is grown in the United States or its territories except in Hawaii and Puerto Rico.

The first coffeehouse in Europe opened in Venice in 1683, though coffee had been available since 1608, mostly for the upper class. Coffeehouses have historically been a popular meeting place for

revolutionaries and political debate. In France, the revolutionists began discussion of the bourgeoisie in Parisian coffeehouses; the founding fathers of the United States formed their national policies in coffeehouses. The Boston Tea Party of 1773 convened in a coffeehouse. The heavy tea tax had

prompted Americans to switch to coffee as an expression of freedom. While coffee is thought to have been first brewed by the Arabs, it may not have reached Christians as soon as it did if not for Pope Clement VIII. When coffee first reached Rome, Christian priests believed that Satan had invented coffee as a substitute for wine which Muslims were not allowed to drink. Since wine was used in Christian practices such as Holy Communion, priests thought that coffee must then be from the Anti-Christ.

Faced with strong beliefs that coffee was the drink of Satan, Pope Clement VIII asked to try a cup before making a decision. When he did, he blessed the drink as a Christian beverage, resulting in massive imports of coffee to Italy and the Western world.

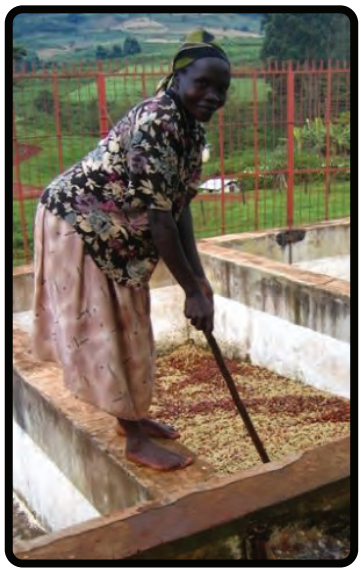
Today, US coffee drinkers consume approximately 3.1 cups per day on average, with the cup size being nine ounces. Fifty-two percent of Americans over the age of eighteen drink coffee every morning, and on top of that, thirty percent of the population drinks coffee occasionally, meaning that over eighty percent of Americans consume coffee. Sixty-five percent of consumers add sweetener. On average, coffee drinkers will spend $164.71 per year on coffee, and coffee drinkers that get a cup to go from a local coffeehouse before work will wait in line nearly forty-five hours each year! Coffee is the leading source of caffeine consumption in the United States, and is the world's second most popular drink after water. Men and women have similar coffee habits, both consuming the same amount of coffee each day, but with different reasons for doing so. While women indicate that coffee is a good way to relax, men say that coffee helps them get their job done. Generally, women are more concerned about the price of coffee than men.

Of the one hundred million US daily coffee drinkers, thirty million drink specialty beverages such as lattes, cappuccinos, and mochas. The average price for these espresso drinks is nearly twice that of a regular brewed coffee. As the consumption of these specialty drinks rises (it does each year), more and more coffee shops will begin to sprout up throughout the United States. It has been projected that there will be 50,000+ coffee shops nationwide by 2010.

The popularity of coffee products worldwide is almost astonishing; it has a universal appeal to people of different income levels, ethnicities, and religions. While many of us enjoy it each morning, we know very little about coffee facts and statistics – like where a coffee bean comes from! You now can impress your friends with your coffee trivia expertise.

Process

When coffee berries are ripe, they are handpicked.



After washed, berries are laid out to dry, becoming parchment

Parchment is removed. The the coffee is packaged and shipped with identifying lot number stenciled on the bag.

IPRO 333

Coffee Storage Requirements

The mission of IPRO 333 is to assist the Crop to Cup Company with the design and building of an enclosure for a temporary storage facility within the vicinity of their largest producing farming zone for robusta coffee in the Mbale region of Uganda. The sponsor, along with the team, has decided that the best method for addressing the local and global needs of the farmers is to present the research and design personally. Therefore, IPRO 333 will be fundraising to help finance the forthcoming trip to Uganda to present to the farming communities.

As a result, the IPRO 333 team has been entrusted with the design of a structure that will serve as a secure coffee storage facility for the farmers. The structure will also include a public space allowing farmers to weigh, sell, pulp, and dry their coffee.

The Research and Design Phase of the project has many considerations; taking into account the local customs of the Ugandan farmers, their ideas of security, the effectiveness of locally available materials for building, conditions at the site that may decrease the coffee's value (e.g. pests and climate) and the socio-economic impact of Crop to Cup's 2011 Plan. This will require in depth research of the culture and site which will lead to a series of designs most suitable and agreeable to the sponsor and the farmers. A systematic understanding of the production methods of coffee will yield a more efficient and suitable design. In addition, an ongoing relationship with the farmers, mediated by the sponsor through the form of emails will allow the team a greater understanding of the farming community's needs.

The Fundraising Phase of the project consists of promotion and sales of Crop to Cup Coffee to increase market exposure of the product as well as of the company's support of the Ugandan coffee farming community. These fundraising efforts will include sales of pre-packaged coffee as well as prepared coffee and other clothing items and donations at local farmers' markets within the vicinity. This provides for more awareness within the local community of the project and possibilities for collaboration and input from outside sources to enrich the team's own efforts.

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Preserve coffee quality during storage & container loading by controlling moisture

Processors and exporters need to store coffee parchment over longer periods before export processing and container loading can take place. For quality reasons, coffee is best stored in the form of parchment as long as possible before export processing. The parchment layer provides a good physical protection of the bean. The moment that the parchment and silverskin is removed by hulling and polishing the natural surface of the green bean itself is damaged and opened to action by micro-organisms. The 'aging' process, aided by poor ambient conditions, can be reliably measured from that point on. As a rule of thumb, green coffee should not be stored longer than 2 weeks under hot and humid conditions before export!

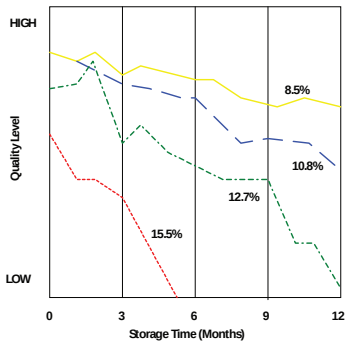
High temperatures and humid conditions are the main determinants for quality decline of both green bean and parchment and need to be kept at a minimum during storage. Applying good management practices in the warehouse and having an understanding of the interrelation between coffee beans and the storage environment will enable processors to better preserve of coffee quality during storage.

Characteristics of coffee during storage

After drying coffee, parchment coffee needs to be cooled down before the final assessment of moisture content can be done. Only when moisture content in cooled down coffee is around 11% moisture, coffee can be stored safely. Coffee grown in a high humidity environment, such as Vietnam, has a slightly softer bean structure than green bean from an arid environment, and it needs to have a slightly lower moisture content to maintain good storage qualities.

Quality tends to deteriorate during storage in close correlation with moisture content of the bean: the higher the moisture content., the quicker quality will decline! Therefore, moisture content of beans needs to be kept low and thoroughly controlled throughout the storage period!

In Vietnam, ambient conditions are wet and warm and coffee will take up moisture again if not protected and stored appropriately. The best measure to keep moisture content of coffee stable and prevent it from regaining moisture is by providing dry and cool storage conditions while limiting the contact of coffee with ambient, humid air.



Influence of bean moisture content and storage time on cup quality (Stirling, Kenya Coffee 1974)

A relatively easy measure to achieve a minimum exchange of moisture between coffee and the humid air is to store parchment coffee in bulk. This will limit the surface area of parchment coffee getting in contact with ambient air. Typically, this

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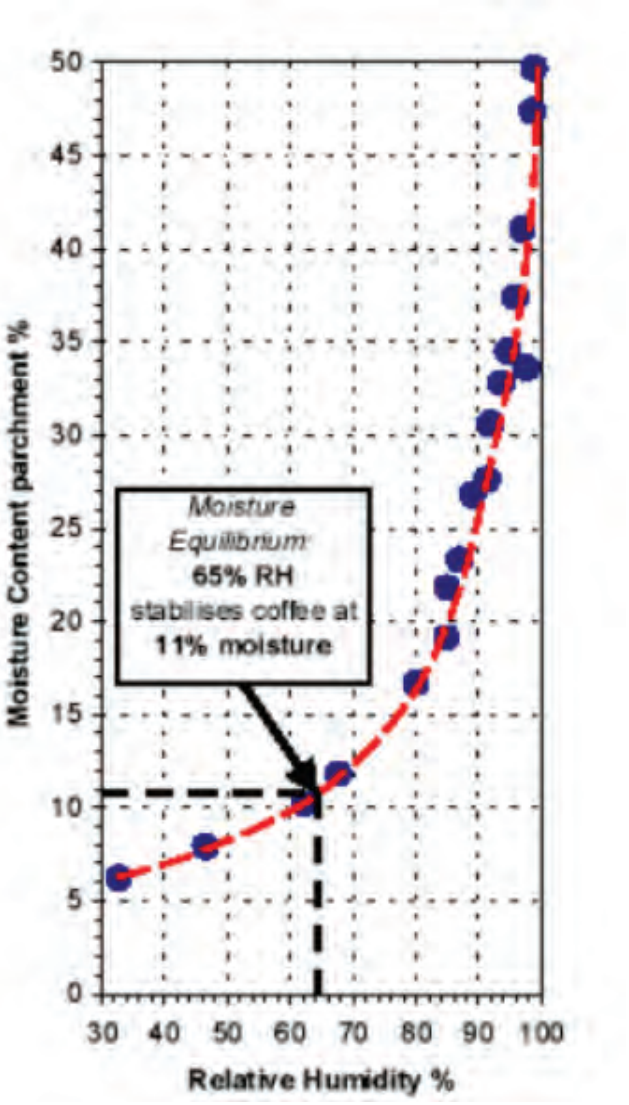
Moisture Isotherm for Parchment Coffee at 25 degrees C



Source: Stirling (1973), in: Kenya Co ee

A moisture isotherm is a line that describes at which levels of coffee moisture content an equilibrium with the ambient relative air humidity is given. Therefore, at any given point on the moisture isotherm, no exchange o moisture between the seed an the ambient air is occurring.

In this case, at around 65% relative humidity (RH) of the air, parchment coffee will stabilise at a moisture conten of a desired 11%.

Higher RH will cause rewetting, lower RH will have a drying effect. In general due to the heat of machinery an action, the relative humidity inside a dry factory is much lower than outside the building.

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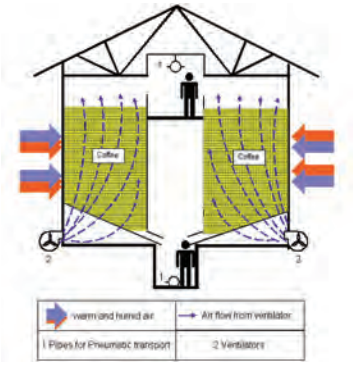
is achieved by storing coffee in large bins, silos or in organised piles of coffee bags. If parchment is stored in coffee bags, bags should be made from jute to allow coffee to "breathe". Jute bags should be covered a plastic tarpaulin as moisture protection.

Conditioning of stored parchment coffee in bulk

Conditioning is a simple but effective process for quality preservation during storage of coffee parchment. It also allows the blending of different lines of beans so as to, year by year, produce a consistent product



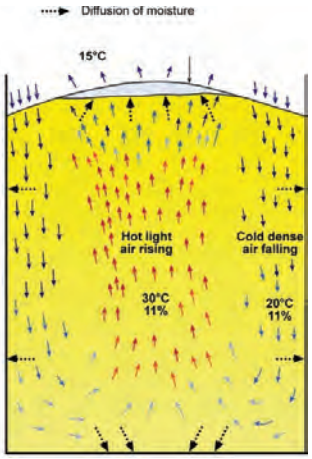
Conditioning bins allow ducting air through the stored co ee for moisture correction while protecting it from ambient humidity, Design: K. Calvert

In order to control and maintain optimum moisture in the stored coffee, air is carefully moved through coffee stored in bulk, at around 3 to 5 m/min. The air for conditioning coffee in bins or silos must be of low humidity in order not to moist coffee. This is done by monitoring the ambient relative air humidity or adapting it through careful warming. The relative humidity of the air to be blown through the coffee should be around 55 to 65% for stabilising coffee at 11 to 12% moisture (moisture sorption isotherm).

Conditioning helps to level out temperature and moisture content within and between lots of coffee and by that, controlling and preserving quality over longer periods.

In simple terms, conditioning requires:

- Bins or silos made from bricks or strong plywood
- a fan to slowly move air backwards or forwards through the stored coffee
- controlling equipment for determining coffee moisture contents and air humidity to decide when and how to take corrective measures.



Moisture migration due to temperature gradients in bulk storage. Source: http://sgrl.csiro.au/storage/moisture/moisture_damage.html

The benefits of storing and conditioning of coffee in bulk

- Limiting surface contact of coffee with humid ambient air
- Levelling out moisture content and temperature of stored coffee (green or parchment)
- Moisture adjustment of coffee through controlled ventilation (limited)
- Controlling moisture migration within stored coffee
- Reducing damage due to condensation at cold walls and floors
- Maintaining coffee quality, freshness and presentation
- Providing basis for handling coffee with pneumatic system for bulk shipment preparation

Bins should not be made from metal because it is not insulating well against outside temperature fluctuations. Metal conveys heat much quicker than other materials causing condensation inside the bins. Condensation will result in uncontrollable pockets of moisture inside the bin. Bricks or ideally thick plywood is a much better choice as insulation capacity is higher and less condensation will occur.

Ventilation fans do not need to be of high power and speed – as long as coffee bulk is at around 4 m depth, a normal fan as used in homes is sufficient to

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move enough air through the coffee for conditioning.

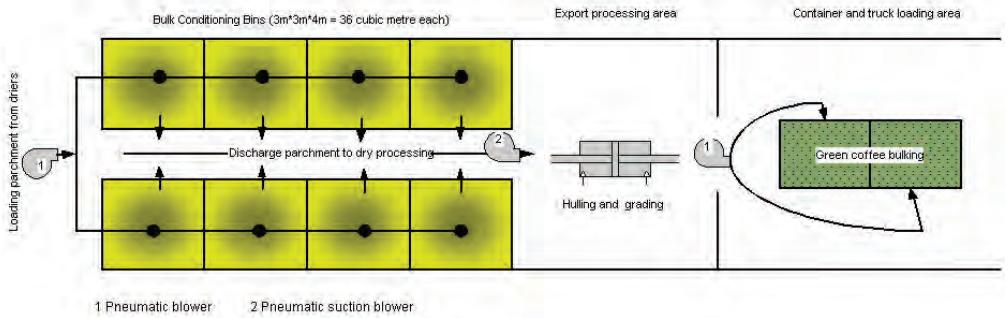
For control of moisture in the coffee, a conventional moisture meter can be used. For the control of relative humidity, an electronic wet bulb thermometer is recommended which automatically calculates the relative humidity of the air and supports the manager in the decision when to use the conditioning fan.

Pneumatic transport raw coffee handling systems

In addition to the mentioned aspects of quality control, bulk storage brings advantages in handling. By the use of a pneumatic transport system, the use of bags can be reduced. Pneumatic systems are very divers - coffee can be transported by blowing or suction action with much higher powered fans than is required for conditioning. the same equipment. Coffee is conveyed quickly and safely without the use of plastic or jute bags from one location to the other and provides the basis for preparing bulk container shipments.

Pneumatic systems ease handling of dry co ee (parchment & green bean). Pictures: www.kongskilde.com, www.conveyair.farmca.com

In a pneumatic system, coffee can be moved horizontally as well as vertically without the danger of physical damage. Screw conveyers as often used for dry parchment movement have the disadvantage of only moving coffee in straight lines and posing a danger of crushing parchment coffee and beans when overloaded. In pneumatic system, coffee is transported by air flow with a much smaller danger of damage. Disadvantages of pneumatic systems is the problem of large amounts of dust occurring and possibly electrostatic effects. However, this can all be overcome by careful planning and the inclusion



Schematic storage, dry factory and export stu ng fa ity using a pneumatic system. Design: K. Calvert

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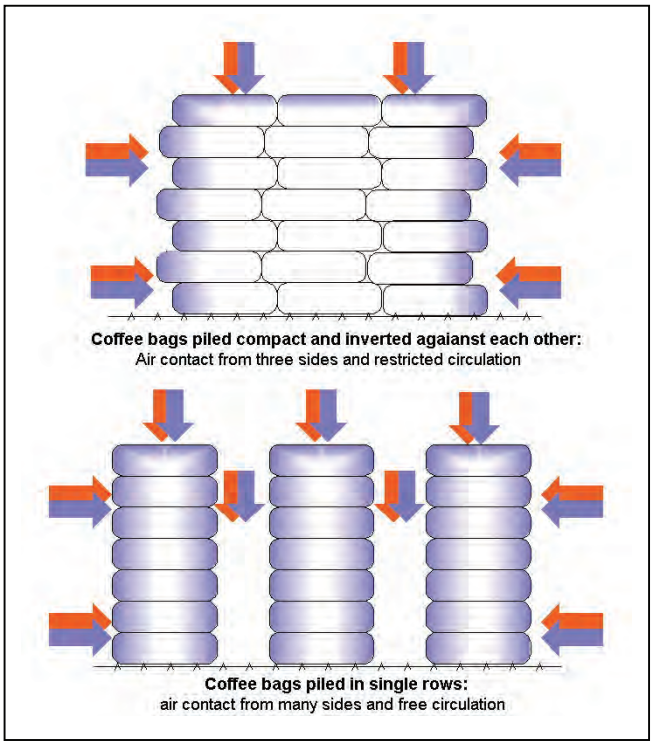

Co ee should be stored in large piles to limit contact and circulation of air

of cyclones separating coffee from light dust.

Coffee storage in bags

If a silo system is not available and coffee is stored in bags, the storage manager needs to limit the contact of coffee bags with the humid ambient air to prevent rewetting of coffee. The less humid air gets in contact with the bags, the smaller the risk of rewetting. Coffee bags should be closed stacked in organised and compact piles to limit air circulation and exposure In addition, piles should be placed on wooden pallets to avoid direct contact with the floor. In order to avoid direct contact of moist air with bags, a simple plastic tarpaulin should be placed on coffee bags for protection.

Storage management & location

In order to avoid microbial contamination of coffee in storage, storage must be kept clean and free of animals such as bugs, mice and rats. Also, smoking is not allowed in a storage and dry processing facility to reduce risk of fire as well as contamination of the product.

The storage facilities must be in good distance from processing facilities, especially from dried pulp and old dust from previous hulling and grading. as they are sources of bacteria and moulds which can contaminate the raw product and can cause OTA infections.

Portable moisture meters

Moisture control of stored coffee needs to be carried out on a regular basis for taking corrective measures. A range of portable moisture meters is commercially available.

Portable moisture meters need to be calibrated and used in a consistent manner to enable comparable results. A properly calibrated portable meter, operated under controlled conditions, can be expected to provide accurate moisture readings. For accurate readings, samples need to be prepared and presented in a consistent way.

Factors that can influence the performance of portable meters and should be kept at a minimum, include:

- Temperature differences between the test sample and measurement cell
- Temperature differences between ambient conditions and coffee to be measured
- Moisture differences between individual beans
- Moisture gradients within beans

Calibration of meters

Calibration of a portable meter is important and must

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be done before each season. It is quite difficult to achieve an accurate calibration curve because it requires a series of samples covering a range of different moisture. Well-equipped quality testing laboratories like CAFECONTROL can assist in calibration.

Container loading

Just before export, the coffee is loaded into containers either in bulk or in bags. In Vietnam, most coffee is loaded in jute bags, although bulk shipment is the preferred option due to easier handling and less danger of quality damage during transport.

Before loading coffee on a container, the container must be thoroughly checked for water leakages as well as for foreign smells from prior usage. If leakages can be found, often indicated by rusty patches, or any other damages or foreign smells are recorded which have a possible impact on the coffee, the container is to be rejected and the shipping company is to supply a new container.

Loading of containers should be done in dry conditions and not in direct sunlight. Rain will quickly rewet coffee and too much heat exposure to the container will result in condensation.

Before loading, the inside of the container needs to be fully dry. Contact from coffee bags to the container wall is to be avoided and ideally, waxed cardboard or at least water absorbent paper should be used as a protection between container wall and coffee bags.

When loading bags in containers, bags should be closed stacked similar to the recommended system for storage above to limit surface area and air circulation.

Coffee Warehouse Storage Requirements

I. Location and Physical Structure of Warehouse

Any location for the storage of coffee should be maintained on a continuing basis in accordance with the following standards:

1. The warehouse should be weather tight and rodent proof as to roof, walls, doors and windows. Any hole or opening that allows access to weather, rodents, or birds must be sealed. Floors must be free of cracks, seep holes, and crevices. Holes that are screened are considered rodent proof.

2. The warehouse should comply with all applicable federal, state and local laws, including any pertinent fire regulations and have sufficient floor load limits.

3. The warehouse should have light sufficient to permit cleaning crews to work, and weighing and sampling to be performed efficiently and to identify storage deficiencies and problems without the need for any supplemental lighting, but it need not have natural light.

4. The warehouse should have proper ventilation to the outside. Proper ventilation may include screened openings positioned to allow ventilation using prevailing winds. Windows, ventilators or other ventilating openings should be screened at all times.

5. The warehouse should not be artificially heated except to a minimum level to prevent freezing of pipes.

6. The warehouse should have (and the warehouse should maintain) a sufficient number of material handling devices (e.g., fork lift trucks, elevators, etc.), which are operable and available to perform the warehouse's duties in an orderly and efficient fashion.

7. The warehouse should be free of leaking pipes.

8. The warehouse should be equipped with operational toilet facilities, which are clean, in good repair and supplied with proper soaps, towels, etc. Alternatively, public toilet facilities must be located within 100 yards of the warehouse facility.

9. The warehouse should have signs, clearly visible in all toilets, requiring employees to wash hands after use of the toilet facilities.

10. The warehouse should have signs, clearly visible at all entrances, prohibiting smoking, eating or drinking in the warehouse except in designated areas which are closed off and separated from the storage areas.

11. The warehouse should have signs or postings, clearly visible throughout the warehouse, marking storage locations within the building.

12. The warehouse should be physically segregated from any non-coffee storage areas by walls and doors sufficient to prevent access by rodents, insects, or odors.

13. The warehouse should have a fire and theft deterrent alarm system connected to a central monitoring service.

II. Housekeeping Practices

1. The floor should be maintained broom clean at all times. Active storage areas should be swept clean at the end of each workday. Inactive storage areas, corners, ledges

2. The warehouse should inspect the warehouse on at least a weekly basis so that the walls, ceiling, overhead pipes, and beams should be maintained reasonably free of cobwebs, accumulated dirt, dust, excrete, loose foreign matter, peeling paint or damaged insulation.

3. The warehouse should store and dispose of rubbish in a manner, which will minimize the development of odor and prevent waste from becoming an attractant, harborage or breeding place for pests.

4. The warehouse should repair cracks, seep holes and crevices in floors and walls (such as around door frames, expansion joints, pipes and sills).

5. The warehouse should maintain outside areas free of conditions, which may result in buildup of pest problems, all outside loading and unloading areas as well as the grounds around the warehouse. These conditions include, but are not limited to:
A. Litter and waste should be secured in containers with tight fitting covers.
B. Uncut vegetation (higher than four inches within property line up to 30 feet perimeter).
C. Improper or inadequate drainage.

III. Basic Storage Practices

In order to ensure adequate space for sampling, inspection and effective fire protection, to assist ventilation, to aid in circulation and generally provide ample space for appropriate pest control programs:

1. Coffee should be stored on pallets that provide a minimum of 4 inches distance from the floor. In no event should any coffee bag touch the floor or overhang the edge of a pallet more than four (4) inches.

2. The pallets, including those stored for future use, must kept clean and in good repair. Before each use pallets must be cleaned of all foreign matter, including, but not limited to, dirt, dead or live insects, pupal cases, webbing, etc.

3. Coffee should be stored a minimum of 24 inches from the ceiling, and a minimum of 18 inches below any sprinkler head.

4. Coffee should be stored a minimum of 24 inches from any wall.

5. Twenty (20) inches of space should be maintained between coffee piles. The coffee piles should be stored in such a manner as to permit at least two faces (front or back and one long side) of each lot to be available for inspection and/or sampling. Coffee should not be stored higher than 5 pallets high or 100 bags high whichever is less. The equipment aisles should have at least 13.5 feet of space for equipment to operate without contacting bags of coffee.

6. Slack bags must be placed on a separate pallet in front of the pile.

7. All space requirements should be measured from the bag or the pallet; whichever is closer, to the sprinkler, ceiling, or wall, etc.

IV. Stored Coffee:

1. All coffee bags entering a warehouse should be kept clean and free from any and all foreign matter that could be detrimental to the delivery of the coffee contained therein. The owner of the coffee should be responsible for the cleaning or re-conditioning of coffee bags entering the warehouse.

2. The warehouse should be responsible to the owner for maintaining coffee bags while stored in the warehouse. The warehouse should keep stored coffee bags and beans clean, undamaged and free from any and all foreign matter (including but not limited to dirt, bird droppings, dead or live insects, pupal cases, webbing) that could be detrimental to the delivery of the coffee. The warehouse should conduct a weekly inspection of each lot of coffee to determine its condition. The warehouse should prepare and maintain a log documenting that the weekly inspections are conducted. The log should contain, but should not be limited to, the following information: the location of the warehouse, the date the inspection was conducted, the name of the individual conducting the inspection and any findings that require the warehouse to perform maintenance work on the bags and the and lot numbers of the bags that require such work.

3. Torn bags, bags from which beans are sifting, or bags, which are in peril of having coffee beans spilled there from, must be promptly repaired. The floor must be kept free of spilled beans.

4. (A) Except with respect to the prompt repair of torn bags, bags from which beans are sifting or bags which are in peril of coffee beans being spilled there from, prior to undertaking any other maintenance of coffee bags , including the re-bagging of coffee, the warehouse should notify the owner, in writing, of the maintenance to be performed.

V. Pest Control:

1. Warehouses which store coffee should cause recognized pest control companies to conduct periodic inspections of their facilities and implement effective pest control programs so that there should be no birds, rodents or other animals (including dogs and cats) in the warehouse.. (I) The warehouse should maintain a written pest control program, available for evaluation , which should include:

A. Name of key warehouse contact person

B. Name of service provider

C. Services to be performed

D. Frequency of Service

E. Conditions noted F. Provider comments (II) The warehouse should also maintain records, which reflect:

A. Fumigation dates

B. Fumigant used

C. Lots/sections fumigated

D. Owner notification

2. No ingredient used for pest or rodent control should be used in such a manner or in such places as to contaminate the coffee.

3. The warehouse should remove from the area in or around the storage facility such known bird attractions as grains, foods and similar materials.

4. The warehouse should render rodent control services at least twice per month.

5. The warehouse should maintain rodent control equipment along inside perimeter walls spaced twenty-five (25) feet, or less, apart. Rodent control equipment should also be placed on both sides of exterior entryways inside of the building at a distance not to exceed 5 feet from an entryway. Rodent control equipment can be glue boards, traps or other mechanical devices.

6. Rodent control programs should take into consideration the exterior as well as the interior conditions of the warehouse

7. Bait is to be used only on the exterior. The bait used in the warehouse should be safe and effective. Only anticoagulant poisons or their equivalent in effectiveness and safety should be used in enclosed bait stations, with no bait being used inside the warehouse

8. The warehouse should ensure pesticides (insecticides, rodenticide, avicides, etc.) used in the warehouse pest control program are registered with the appropriate government agencies and used in the appropriate manner in accordance with approved label directions. Rodent tracking dust should not be used in the warehouse.

A. If required by law, applicators are to be certified.

B. Application must be performed in such a manner as not to damage the coffee beans.

9. One full time warehouse employee should be assigned as key contract person on pest control issues/procedures.

VI. Control of Other Products Stored in Coffee Areas

The warehouse should store coffee separate from other cargo that may adversely affect the coffee such as chemicals, high fire risk materials and odorous products. No odorous products or things may be stored in such manner or place as to enable the odor to be imparted to the coffee. The odor from any odorous product or thing must not be discernible within the coffee storage area. No coffee should be stored in any area where such foreign odors prevail or where hazardous or high fire risk materials are stored.

VIII. Requirements:

All records should be kept neat, tidy, orderly and current so that auditors can verify warehouse records against physical stocks.

1. Before coffee may be placed the warehouse, the warehouse must be in possession of a copy of the delivery order (or equivalent document or information) and the following identifying information for such coffee, which should be reflected in the warehouse's records relating to such coffee:
a. Growth
b. Number of bags
c. Shipper's brand (if on the bags)
d. Crop year (if on the bags)
e. Marks and chop number (or letters) in their entirety
f. Carrier (i.e., vessel, railroad or truck transport); location (pier, etc.); and date of arrival of vessel (where appropriate)

2. When coffee is physically placed in the store, the warehouseman should record the

Identifying information for the coffee on the warehouse receiving report (or equivalent record). The warehouse should also record all exceptions—i.e., the number of stained, torn, mended, slack, short or improperly marked bags. A record of any exception noted by the warehouse should be made, and the warehouse should send a report describing such exception immediately to the storer of the coffee. If no exception is noted, a report to that effect should be sent to the storer as soon as practicable. If improperly marked bags arrive at the warehouse, the storer should be notified of such fact immediately by telephone before the delivering carrier leaves the warehouse.

3. The warehouse should compare the identifying information for the coffee set forth on the delivery order or equivalent record with the information on the coffee bags. If there is a material difference between the information supplied on the delivery order (or equivalent record) and the information on the bags, the warehouse should note such difference on the warehouse's receiving form (or equivalent record) and should notify the storer of the coffee immediately of the discrepancy. 4. The warehouse should record the identifying information for the coffee, as set forth on the coffee bags, on warehouse tags or marks stenciled on the bag, which should be affixed at all times to at least two sides of each pile of coffee bags. The tag or mark should be placed on both sides of the coffee bags.

5. The warehouse should maintain stock record cards (or equivalent records) for each chop of coffee on which should be recorded all pertinent details necessary to fulfillment of an efficient warehouseman's responsibilities, including all movements of the coffee, changes in its ownership and when the coffee has been weighed. 6. The warehouse should complete, the Warehouse Advice which should identify the number of bags comprising the chop, all markings contained on the bags (in their entirety), the specific location where the coffee is stored and the name of the carrier (i.e., vessel, railroad, or truck transport) on which the coffee arrived. Copies of, or information pertaining to, the Warehouse Advice should be distributed as follows: (i) To the storer of the coffee, and (ii) Retained in the warehouse's files. Should:
a. When a sample is drawn, the warehouse should sign three copies of the Sampling Order in the space provided.
b. By signing the Sampling Order, the warehouse should be deemed to certify that on the date the Sampling Order was signed the sampler appeared at the licensed store indicated on the Sampling Order and left the premises with samples in his possession.
c. The warehouse should retain a copy of the Sampling Order.

Using Rwanda as a Precedent for Uganda

A COMPARATIVE ANALYSIS

Uganda and Rwanda: A Background

- At a glance: Both Uganda and Rwanda suffer from low productivity, subsistence level agriculture, and low family incomes.

	UGANDA	RWANDA
Country Features	Landlocked	Landlocked
Area	241038	26338
Agricultural Area	75% of tot. area	32.7% of tot. area
Economy	Agricultural 42.1% to GDP	Agricultural
Population Density	High	One of the highest in Africa

Rwanda– Soil, Climate, Crop

•Very good productivity
•Rich volcanic soils
• Good rainfall
• Clement yearlong temp

•Unsuitable for Coffee due to very low temperature

• Central and Southern Province have Moderate Productivity

•Unsuitable for Coffee due to insufficient rainfall and longer dry season

Uganda – Soil, Climate, Crop

- Uganda's temperatures average at about 21 degrees centigrade, and range between 15 and 30 degrees centigrade.
- <u>Precipitation is fairly reliable</u>, and varies from 750 mm per year in Karamoja in the Northeast, to above 1 500 mm per year in the high-rainfall areas on the shores of Lake Victoria, and around the highlands of Mount (Mt) Elgon in the east and the Rwenzori in the southwest.
- <u>The soils are either sandy clay loams, volcanic or alluvial.</u> Most of the soils:
  - **In central region can be classified as good**
  - **Western and eastern regions as good to moderate**
  - **Northern region as moderate to poor.**

Agricultural Infrastructure

Uganda	Rwanda
• Coffee grown on small farms • Heavy dependency on rain-fed agriculture • Inadequate agricultural technologies – hand hoe predominant technology • Under developed post-harvest systems • Insufficient agricultural credit • Poor infrastructure and distribution network • Ineffective markets	• Small family farms • About 97 % dependency on rainfall • Labor intensive techniques, highly manual • 91% of rural communities have a road, but in more than a third of cases this is inaccessible for parts of the year (3.4 months on avg) • Only 14.8 percent of the communities have a weekly / daily market, and the avg distance to the market is 4.6 km.

What's Being Done

Rwanda

- Producing high-quality coffee
- Strengthening the cooperative spirit within coffee producers' associations
- Establishing washing stations, and
- Encouraging private entrepreneurs to invest in the sector (MINAGRI, 2006).

Uganda

- There has been an effort by the government to diversify the export base in order to increase the export revenue
- Reduce dependence on a few crops for foreign exchange

Building & Logistics Groups: Recommendations

- Rwanda's precedence is not only very salient for us to look into, but also very practical for the following reasons:
  - The similarities in context – topographical, economical, agricultural (infrastructure, crop, and soils), and demographical aspects of both Uganda and Rwanda – will enable us to ***consult*** Rwanda's storage spaces for designing input (building group) and for materials input (logistics group)
  - Since the Ugandans like 'anecdotal' evidence as a means for persuasion as against logical/analytical, we could use pictures from Rwanda to show them that the storing coffee away from beds actually works
    - Caveat: There are tensions between Uganda and Rwanda so mentioning that the storage spaces are from Rwanda would be counter-productive

Sources

- www.thebrokeronline.eu/en/.../Gaudiose+Mujawamariya+Thesis+FULL.pdf

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Economics

Once a strong thriving economy, Uganda shortly after attaining independence went through a period of neglect, mismanagement and political upheavals that sent the country's economy to the doldrums. The demise of the economy was catalysed not by internal factors alone but by also by certain external factors, notably the 1970s rise in price of petroleum products, the 1977 break-up of the East African Community and the 1980s slump in world coffee prices.

Since 1986, Uganda has been on a recovery path following the introduction of judicious macro-economic policy reforms that brought about fiscal discipline and led to restructuring of public expenditure and liberalisation of the economy. The reforms stabilised the economy and led to increased investments and faster economic growth. The country has maintained an average annual GDP growth rate of 6.9% since 1986 earning it praise from the IMF. Inflation has been brought down from an all time high of 200% in 1987 to an average of 5.25 since 1992. Tax revenue collection as a percentage of GDP has increased steadily from 6% in 1986 to 13.7%in the 2002/03 fiscal year. The government is working to steer the country away from an over-dependence on agriculture by increasing the contributions of industry and services to GDP. At the same time the dependence on coffee, which in the early 1990s accounted for more than 80% of Uganda's foreign earnings, is being gradually lessened by promoting investment in fish processing, horticulture and floriculture.

Uganda, despite the above impressive growth in economy, remains one of the world's poorest countries with close to 40% of her 24.7 million people living below the poverty line. The United Nations Development Programme in its Human Development Index for 2002 ranked Uganda in the 142nd position out of 162 countries evaluated. The recovery has also been less striking on the international trade scene where the country continues to experience unfavourable balances with annual trade deficits running above 500 million dollars. Poor terms of trade, a narrow export product base and export of unprocessed materials are blamed for the dismal performance.

Poverty reduction has since early 1990s been a leading objective of Uganda's development strategy. Government aspires to bring down poverty levels to 10% and 30% of the population living in absolute and relative poverty respectively by the year 2017. To guide its efforts in combating poverty, government prepared a Poverty Eradication Action Plan (PEAP) in 1997. The plan, which has since received two revisions, employs a multisectoral approach that is takes into consideration the multi-dimensional nature of poverty and the inter-linkages between influencing factors. In PEAP a four-pronged approach is pursued: poverty is brought down by a multiplicity of actions leading to

(a) the forging of a framework for economic growth and transformation,

(b) the promotion of good governance and security;

(c) the direct improvement of poor people's ability to generate income; and

(d) the direct improvement of poor people's quality of life.

The government, in keeping with PEAP tenets and strategies, makes continuous interventions in the areas of rural feeder roads, agricultural modernisation, land management, rural credit and microfinance, rural market infrastructure, rural electrification, primary health care, primary education and water supply and sanitation.

One of PEAP's critical interventions is in the modernisation of agriculture. Considering that the agricultural sector employs over 80% of Uganda's labour force and is the main stay of the economy, the intervention has the potential of affecting and bettering the lives of most Ugandans. Government has prepared a Plan for Modernisation of Agriculture (PMA) through which it has initiated programs for boosting agricultural production and the marketing and processing of agricultural produce and products.

Uganda's elaborate plans and investments to combat poverty have already paid dividends. Income poverty levels declined from 50% in 1992 to 35% in 2000. The economic recession that hit many parts of the world after 2000 slowed down the steady progress and returned poverty levels to 38% in 2002.

In recognition of the progress made by Uganda in implementing economic reforms and poverty reduction, and as an incentive for further economic growth, the international community, through the IMF Heavily Indebted Poor Countries (HIPC) Initiative and Enhanced HIPC Initiative, has cancelled a large part of Uganda's external debt. In 1998, Uganda obtained a 650 million dollars debt relief from the Heavily Indebted Poor Countries (HIPC) Initiative while in 2000,it obtain an additional 1.3 billion dollar relief from the Enhanced HIPC Programme. Total debt relief under this arrangement thus amounted to approximately US $2 billion – about three-fifths of Uganda's external debt. These measures have enabled the country to re-channel badly needed financial resources to the fight against poverty.

IOC Indicator Prices
ANNUAL AND MONTHLY AVERAGES: 1998 TO 2010
(US cents per

Annual/ monthly averages	ICO Composite price	Colombian Mil Market New York	Other Mild Ara Daily Germany	Brazilian Natu Market weighted average	Robustas Daily New York	Market Germany	Daily weighted average	Market New York	Daily Germany	weighted average	New York	France	weighted average
1998	108.95	142.83	145.58	142.83	132.25	144.09	135.23	121.81	130.8	121.81	83.93	80.81	82.67
1999	85.71	116.45	114.17	116.45	101.54	110.87	103.9	88.84	94.17	88.84	67.64	67.23	67.53
2000	64.24	102.6	99.8	102.6	85.09	92.89	87.07	79.86	83.67	79.86	42.12	40.36	41.41
2001	45.59	72.22	68.24	72.05	61.94	63.14	62.28	50.52	52.42	50.7	27.3	27.49	27.54
2002	47.74	65.26	64.78	64.9	60.43	62.31	61.52	45.09	45.92	45.23	30.83	29.76	30.01
2003	51.9	67.31	64.34	65.33	64.08	64.3	64.2	50.82	50.16	50.31	38.39	36.5	36.95
2004	62.15	84.15	79.49	81.44	80.15	80.64	80.47	68.18	69.11	68.97	37.28	35.65	35.99
2005	89.36	117.02	114.67	115.73	114.3	115.22	114.86	101.36	102.49	102.29	53.37	49.87	50.55
2006	95.75	118.36	115.7	116.8	113.95	114.8	114.4	102.89	104.19	103.92	70.28	66.98	67.55
2007	107.68	126.74	124.7	125.57	123.2	123.81	123.55	110.72	112.06	111.79	88.29	86.29	86.6
2008	124.25	145.85	143.12	144.32	138.32	140.86	139.78	122.51	127.86	126.59	106.31	105.03	105.28
January	122.33	143.37	142.14	142.66	139.1	140.49	139.86	126.26	128.46	127.93	100.68	98.91	99.21
February	138.82	161.3	158.95	159.9	158.03	156.89	157.29	142.25	144.29	143.78	117.1	115.13	115.45
March	136.17	151.48	152.72	151.64	148.07	152.08	149.89	130.45	138.93	136.41	122.44	121.8	121.92
April	126.55	142.41	141.76	142.04	138.06	142.62	140.7	123.15	129.02	127.67	112.06	111.12	111.29
May	126.76	143.51	143.63	143.6	139.32	143.84	141.95	125.18	130.81	129.52	109.58	108.75	108.88
June	130.51	150.6	148.02	149.15	144.9	147.05	146.15	130.52	134.59	133.65	112.16	111.16	111.34
July	132.78	151.59	150.58	151.18	145.13	148.67	147.36	131.1	135.9	134.88	115.09	115.3	115.23
August	131.14	154.23	148.52	151.03	146.03	146.72	146.43	131.85	133.71	133.28	113.48	112.59	112.56
September	126.69	150.2	146.65	148.36	141.5	144.29	143.27	126.82	131.18	130.26	106.67	105.04	105.38
October	108.31	133.37	128.93	130.99	122.04	124.44	123.59	104.57	111.72	110.27	89.69	88.57	88.77
November	107.88	133.4	127.93	130.45	120.76	122.58	121.89	102.74	109.56	107.96	92.81	90.19	90.76
December	103.07	134.72	127.56	130.89	116.87	120.61	118.97	95.22	106.1	103.46	83.99	81.74	82.51
2009	115.67	180.87	174.58	177.43	141.65	145.48	143.84	111.39	116.55	115.33	77.16	74.02	74.58
January	108.39	148.88	137.62	142.32	128.03	128.93	128.3	101.43	111.65	109.18	85.77	82.11	82.74
February	107.6	149.58	140.74	144.55	128.63	130.13	129.48	100.45	109.87	107.69	81.66	79.9	80.22
March	105.87	162	148	154.16	127.76	129.07	128.52	97.48	104.4	102.81	77.48	76.05	76.31
April	111.61	190.94	173.29	181.1	134.44	135.19	134.88	101.46	107.28	105.95	76.5	75.36	75.53
May	123.05	225.58	201	212.05	147.34	153.55	150.99	113.13	120.08	118.4	77	75.2	75.62
June	119.05	195.27	197.14	196.32	145.17	153.14	149.79	109.81	117.1	115.42	75.88	73.16	73.79
July	112.9	192.11	183.71	187.29	137.87	143.14	140.9	104.55	108.79	107.8	74.83	71.09	71.68
August	117.45	181.61	188.36	185.39	146.87	151.86	149.76	114.01	117.71	116.86	75.04	71.76	72.35
September	116.4	169.9	183.39	177.45	145.67	150.74	148.53	114.12	116.82	116.16	77.31	73.04	73.82
October	121.09	175.16	180.55	178.13	151.95	156.32	154.57	122.84	125.16	124.62	76.68	72.86	73.51
November	119.67	180.08	176.48	178.33	150.23	153.6	152.21	126.21	126.11	126.17	73.08	68.86	69.48
December	124.96	199.38	184.67	192.11	155.86	160.09	158.16	131.23	133.68	132.84	74.68	68.86	69.89
2010													
January	126.85	214.55	201.65	207.51	154.4	161.92	158.9	128.11	132.75	131.67	75.09	69.05	70.08
February	123.37	208.36	201.89	204.71	155.92	159	157.86	121.61	125.42	124.57	73.49	66.74	67.88
March	125.3	206.37	205.17	205.71	162.13	166.09	164.5	125.28	126.49	126.21	72.53	66.16	67.25
April	126.89	195.18	203.5	199.5	171.32	167.95	169.24	124.94	126.04	125.71	76.26	70.55	71.52
May	128.1	197.76	202.39	200.33	174.21	172.72	173.28	121.66	129.19	127.32	76.21	69.49	70.61

Note: Market shares for the calculation of the ICO composite and group indicator prices are detailed in documents EB-3776/01 Rev. 1 Add. 1 to Add. 4.
Details available from: http://www.ico.org/coffee_prices.asp

BREAKDOWN OF EXPORTS OF GREEN ARABICA AND GREEN ROBUSTA
FOR COUNTRIES EXPORTING SIGNIFICANT VOLUMES OF BOTH TYPES OF COFFEE
May-10
(60-kilo bags)

		9-Oct to 10-May	9-Jun to 10-May	8-Oct to 10-May	8-Jun to 9-May	9-May	9-May
Brazil	Total	2 211 175	18 060 539	26 889 088	2 254 031	19 866 972	27 810 152
Other Milds (W	24 360	361 193	537 967	7 420	317 047	425 351	
Brazilian Natu	2 058 774	17 238 491	25 347 753	2 062 016	18 718 190	25 518 172	
Robutas (D/W)	128 041	460 855	1 003 368	184 596	831 735	1 866 630	
Cameroon	Total	80 000	493 140	749 432	80 043	283 622	516 421
Other Milds (W)		12 683	33 328	54 741			
Robutas (D/W)		67 360	250 294	461 680			
Congo, Dem. F	Total	13 000	110 591	163 729	13 125	97 065	165 219
Other Milds (W)		6 400	43 584	75 629			
Robutas (D/W)		6 725	53 481	89 590			
Ecuador	Total	6 500	192 708	411 465	28 816	152 509	199 554
Other Milds (W)		1 316	24 328	41 651			
Brazilian Naturals (D)			0 6 342	10 137			
Robutas (D/W)		27 499	121 839	147 766			
India	Total	378 204	2 001 623	2 612 600	238 420	1 603 397	2 451 450
Other Milds (W	80 348	543 893	660 513	58 581	480 747	703 101	
Robutas (D/W)	297 856	1 457 730	1 952 087	179 839	1 122 650	1 748 349	
Indonesia	Total	425 000	3 415 000	6 772 001	560 769	3 074 272	5 501 170
Other Milds (W)			0 2 250	5 137			
Brazilian Naturals (D)		4 803	366 301	381 287			
Robutas (D/W)		555 966	2 705 721	5 114 746			
Papua New Gu	Total	54 012	587 584	1 026 929	46 688	514 485	979 490
Other Milds (W	53 726	580 187	1 016 589	46 688	505 666	966 861	
Robutas (D/W)	286	7 397	10 340	0	8 819	12 629	
Tanzania	Total	24 440	512 015	802 942	168 312	908 622	1 002 126
Colombian Mil	19 587	407 543	571 884	109 455	598 342	637 429	
Robutas (D/W)	4 853	104 472	231 058	58 858	310 279	364 696	
Uganda	Total	177 380	1 783 477	2 762 693	220 620	2 078 104	3 217 944
Other Milds (W	71 882	502 351	713 367	62 621	439 037	604 155	
Robutas (D/W)	105 498	1 281 126	2 049 326	157 999	1 639 067	2 613 789	

A blank indicates that the total volume has not been reported and, therefore, the breakdown by group is not yet know
W = wet processed
D = dry processed
D/W = dry and/or wet processed

Next update: 30 July 2010

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Crop to Cup supports the Fairtrade movement and states, "Our goal is not to compare ourselves with FairTrade". However there is no harm in having a point of reference.

1: Includes a fixed 20% premium based on farm level market price (i.e. 120% market price).
2: FT: paid when market prices drop below a set amount. C2C: Based on min. farmer pay.
Include costs such as farmer pay and transportation.
3: Consists of 5% of their coffee's selling price in coffee consuming communities and
10% of company profits as a whole.

Information from C2C and Fairtrade websites:

Fair Trade:
Fairtrade standards for coffee
Among other things, Fairtrade standards for coffee production include the following:

- Producer organizations are paid a floor price (Fairtrade Minimum Price) of US$ 125 cents per pound for Fairtrade certified washed Arabica and US$ 120 cents for unwashed Arabica, or the market price, if higher.
- For Fairtrade certified organic coffee an extra minimum differential of US$ 20 cents per pound is being applied. (not us, we don't have the certification)
- A Fairtrade Premium of US$ 10 cents per pound is added to the purchase price and is used by producer organizations for social and economic investments at the community and organizational level.
- Fairtrade coffee certification is currently only open to small farmer organizations. Small farmers must be organized in organizations which they own and govern.
- Democratic decision making is required. Everybody has equal right to vote.
- Environmental standards restrict the use of agrochemicals and encourage sustainability.
- Pre-export lines of credit are given to the producer organizations. If requested, up to 60% of the purchase price should be pre-financed to the producer organizations.

To find out more about the Fairtrade standards for coffee, please download and read the full product standard.

	Fair Trade (FT)	Crop to Cup (C2C)
Min. Farmer Pay	N/A	$1.11/lb [1]
Min. Coop/Export Partner Pay [2]	$1.25/lb	$1.48/lb
Coop/Export Partner Pay	New York Market Price + $0.10/lb	Farmer Pay + Coop/Export Costs
Investment in Community Projects	$0.10/lb premium	$0.37/lb on avg [3]

URL: http://www.fairtrade.net/coffee.html
Fairtrade Process:

Fairtrade Labelling Organizations International

In consultation with producers, traders and development experts, FLO sets and reviews the Fairtrade Standards. There are standards for small producers, hired labour, contract production and trade standards. FLO also provides business support to help producers strengthen their businesses and seize new market opportunities. There are 18 product-specific standards for small producers and eight for Hired Labour covering 20 product groups.

FLO-CERT is the only ISO 65 accredited certification body for a social label. Before sales can begin, FLO-CERT inspects, audits and certifies producers and traders. Producers are certified against social, economic and environmental standards and traders are certified against trade standards.

The Fairtrade Minimum Price and Premium are paid to the producer by whoever buys the product first, whether it is an importer, exporter or processor. The certification system makes sure that the Fairtrade Minimum Price and Premium reach the producers by providing credibility, trust and
transparency. There are now roughly 2,000 trader and producer
organizations certified by FLO-CERT in 73 countries.

Labelling Initiatives

LI's are the consumer-facing organizations that promote and market Fairtrade in their country or region. If a company wants to put the FAIRTRADE Mark on their product, a Labelling Initiative must license its use. Only then are Licensees permitted to use the FAIRTRADE Mark on their products. Labelling Initiatives can also conduct licensee trade audits. In non-LI countries, FLO is responsible for licensing.

Retailers, wholesalers or distributors can sell consumer-ready Fairtrade labelled and licensed products and do not have to register with FLO or a national organization.

By the time a consumer product bears the FAIRTRADE Mark, it has been checked all along the Fairtrade supply chain. When consumers see the Mark, they know that Fairtrade Standards have been met and because of their purchasing choice, the individual producers are receiving the benefits of Fairtrade.

[From Fairtrade annual report 2009]
URL: http://www.fairtrade.net/fileadmin/user_upload/content/2009/
resources/FLO_Annual-Report-2009_komplett_double_web.pdf

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One pound of Crop to Cup coffee provides a 20% increase in farmer wages and a 55% increase in overall community benefit.

INFO ON CROP TO CUP
Q. How much do farmers receive for their coffee?

A. On average, our farmers receive a premium of $.14 cents over market price per pound of parchment. In Uganda, 2007/2008, the farm-level price was about $.73 per pound of coffee in "parchment" form (see chart). This means that our farmers received just over $.88 per pound of parchment, $1.11 per pound of green coffee, or $1.31 per pound of roasted coffee. That is pure income for individual farmers, 20% over standard market prices.

On top of this we reinvest in farmer communities 5% of what we receive for selling their coffee. On average, this results in an average increase of $.37 per pound of roasted coffee that is reinvested in development projects benefiting entire coffee growing communities. Thus, the benefit to coffee farming communities (via individual incomes and investment in community-wide projects) totals $1.68 per pound of roasted coffee (or $1.13/lb parchment or $1.43/lb green coffee). That's a 55% increase in benefit to farming communities.

We call this our "20, 5, 10" program. Farmers receive 20% over market price for their coffee, plus 5% of their coffee's selling price in coffee consuming communities, plus 10% of company profits. C2C's payment practices are based on market prices and actual payment to individual farmers. We ensure that individual farmers receive a 20% premium over market prices. For the most recent crop, this equates to $.88/lb of parchment or $1.11/lb of green coffee.

We outsource the other in-country services (processing, transport, export, etc) on behalf of the farmer, then reinvest 5% of our roasted coffee sales and 10% of overall profits to give them a stake in the business.

While we do have a nonprofit organization associated with us (www.dnetiganga.org), this is no charity. Our coffee is specialty washed Arabica, and our relationships are packaged into value-adding marketing materials and customer loyalty functionalities so that you can get much more out of your coffee.

Coffee Prices

Ugandan Prices: July 6, 2010

Type	Grade	Price (US cents/lb)
	AA	154.3
Arabica-Bugisu	A	153.3
	PB	153.3
	B	151.3

From UCDA: Daily prices.
(Ugandan Coffee Development Authority)

ICO Prices: July 6, 2010 (US cent/lb)

	Other Mild Arabicas		
ICO Composite	Market		Daily weighted
Indicator Price	New York	Germany	Average
148.3	198.6	195.1	196.5

From ICO: Daily prices.
(International Coffee Organization)

Production in Thousand 60 Kilo Bags

Country	Year			
	2006	2007	2008	2009
Uganda (A/R)	2,700	3,250	3,200	3,000

Exports in Thousand 60 Kilo Bags

Country	2008/2009	2009/2010
Uganda (A/R)	1,857	1,606

Arabica and Robusta Production.
From ICO: Coffee market report, May 2010.

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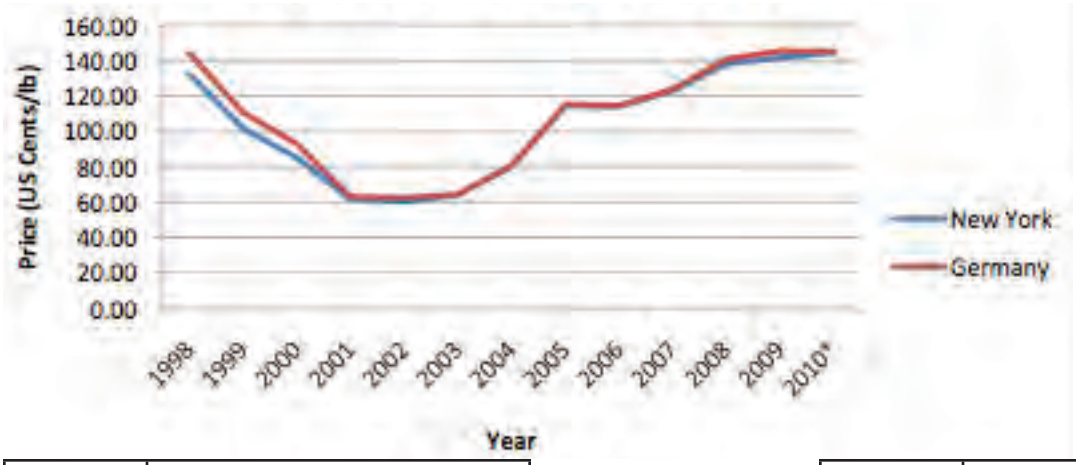
Production in Thousand 60 Kilo Bags



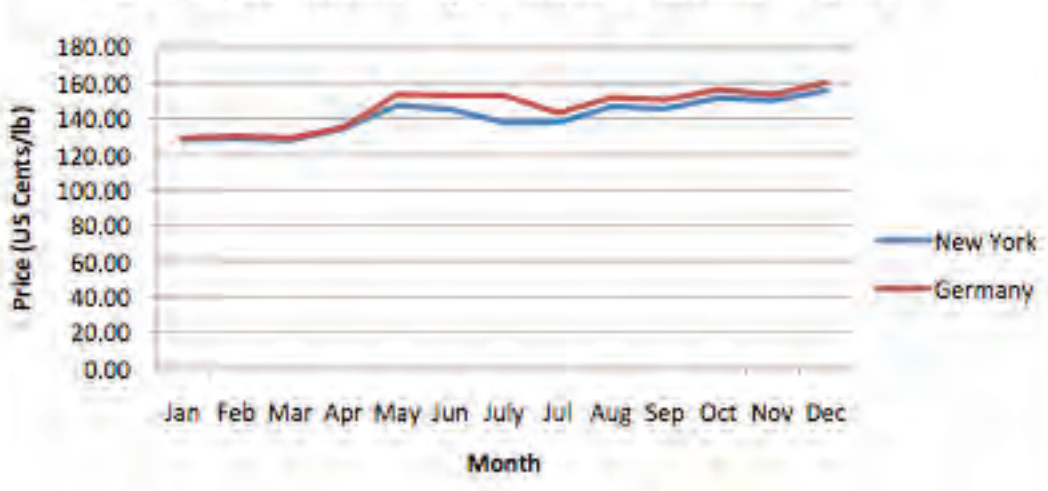
From UCDA: Daily prices. (Ugandan Coffee Development Authority)

Month	Market price US cents/lb	
	New York	Germany
Jan	128.03	128.93
Feb	128.63	130.13
Mar	127.76	129.07
Apr	134.44	135.19
May	147.34	153.55
Jun	145.17	153.14
July	137.87	153.14
Jul	137.87	143.14
Aug	146.87	151.86
Sep	145.67	150.74
Oct	151.95	156.32
Nov	150.23	153.60
Dec	155.86	160.09

From UCDA: Daily prices. (Ugandan Coffee Development Authority)

Year	Market price US cents/lb	
	New York	Germany
1998	135.25	144.09
1999	101.54	110.87
2000	85.09	92.89
2001	61.94	63.14
2002	60.43	62.31
2003	64.08	64.30
2004	80.15	80.64
2005	114.30	115.22
2006	113.95	114.80
2007	123.20	123.81
2008	138.32	140.86
2009	141.65	145.48
2010	144.50	145.26

From UCDA: Daily prices. (Ugandan Coffee Development Authority)



Culture

Current state of Uganda: recovering from the Idi Amin Regime during which over 300,000 people were murdered. Delays are inevitable because there are over 50 languages spoken and multiple translations are required. Since 1986 Yoweri Museveni who seized power has served as president, and threatened to invade the Congo's Kivi Province under the guise of pursuit of Ugandan Rebels.

Culture Categories

Family and Kinship:

- Tribe is the ultimate community and no other unit has more importance.
- All wars are fought on behalf of a tribe and the divisions lay in tribal boundaries.
- Family and Tribe provide guidelines for acceptable behavior.
- Africans feel a responsibility to support their family regardless of their location.
- Hiring practices are affected by loyalty to the family and who most needs the money.

Trust and Friendship:

- Friendship is second only to family in cultural importance
- Interpersonal relationships are based on sincerity.
- People assume you are a friend until proven otherwise.
- Before a business meeting starts it is common practice to talks about general happenings that have little or nothing to do with the business at hand.
- Once a person is accepted as a friend they are adopted into the family.
- When smiles are not seen it is a clear sign of distrust.
- Africans will reach out with friendship first, if they receive a cold response they will lose trust.
- Africans share good fortune and food with other members of the community.

Time and Time Consciousness:

- Time is flexible.
- Anyone in a hurry will be viewed with suspicion and distrust.
- Meetings are not held promptly.
- What cannot be accomplished today can always be done tomorrow.
- Punctuality is slowly becoming important in bigger cities.

Corruption:

- Corruption is related to poverty.
- Enhanced stature of city life brings a responsibility of assisting ones tribal family.
- The worker is often forced to augment in come, in ways viewed in western cultures as bribery, however in Africa it is not.
- Bribery is really viewed as a tradition of sharing continued from the village.
- Corruption also comes from inadequate compensation for work.
- Governments using political money to enrich themselves, their family and their tribe.

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Respect for Elders:

- The older one gets, the wiser one becomes.
- If the foreigner is considerably younger than the African, the African will have little confidence in the outsider. However, if sincerity, respect and empathy are shown the person will receive a positive response.
- Young Africans will not oppose the opinion of their elders.

Summary

- Be formal and respectful
- Be trustworthy and deliver what is promised
- Relax and slow down
- Do not be overly sensitive to criticism or advice
- Do not try too hard to "Go African" Remain professional
- Patience is the key to successful business in Africa

Protocol

Greetings:

- Men greeting Men – A handshake is appropriate in most situations. Handshakes tend to be energetic and very often linger a bit. To express extra deference, the hand-shaker may lightly grip his hand-shaking forearm with the opposite hand. Many times men will hold hands with other men, and often the handshake is prolonged into this hand-holding. This does not have any implication on their sexual preferences; it's just a sign of friendship and closeness.

- Women greeting Women – A handshake and/or nod of acknowledgment is appropriate in most situations. If you would like to show great respect you may also place your left hand over your right elbow/forearm when handshaking. Many times women will hold hands with other women, and often the handshake is prolonged into this hand-holding.

- Meetings between Men and Women – Appropriate greetings depend on the nature of the relationship and region. A handshake is usually appropriate but it is best to wait for the woman to extend her hand, otherwise a bow or a nod of acknowledgment will suffice.

Note: Always use your right hand when shaking hands.

Communication Style:

- Ugandans tend to communicate more in directly than directly.
- Stories, proverbs, and the like are common means of expressing a point indirectly and require the implicit knowledge of the listener.
- Greetings and a good amount of small talk almost always occur before talking about business.
- Feelings tend to not be accurately ex pressed between adults and sometimes one can get the feeling of being fawned upon with false happiness, or being lectured by a false sternness.
- Humor plays a big role in communicating and most Ugandans enjoy a good joke. However, it is best to avoid sarcasm as it may not translate well, if at all.

Personal Space and Touching:

- Personal space tends to be very minimal in Uganda. People often talk very close to each other and less than an arm's length of space is common.
- On public transportation, personal space is limited to non-existent. It is common to see people crowded into a bus or taxi with no space in between. This tends to be the case more in rural areas vs. urban.
- When two people of the same sex are talking, touching is acceptable. It is common to touch the hands, arms, and shoulders.
- When two people of the opposite sex talk there is very little to no touching. The only appropriate touch is usually a hand shake.

Eye Contact

- Generally, people prefer indirect eye contact. This does not mean you can't look at somebody directly, but continuous eye contact during conversations is not a must.
- Overly direct eye contact can be considered aggressive by some.
- Women and children often will look down or away when conversing with men or with elders.

Views of Time

- In most situations, Ugandans are not overly concerned with being punctual. People are expected to arrive within the first hour or two after the appointed time.
- The higher the status of the person, the more they are excused of lateness. Also, it tends to be that the more prestigious the event the later guests will be arriving. This usually applies to both social and business meetings.
- Punctuality tends to be more valued in business situations.

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Gender Issues

- Uganda is going through a transition when it comes to gender roles; however, it is still a male dominant society.
- In most rural areas women will most likely be housewives. They will be expected to cook, clean, do they laundry and take care of the children, as well as work their land. Once married, the woman is transferred from her original family to the man's and takes on his clan. Marriage can be at a very young (early teens), but seems most common in the late teens. Also there is a transfer of "bride wealth" from the man to the woman's family. Polygamy is generally acceptable as well.
- In most rural areas, women have to wear clothing that covers the legs. Showing too much leg can result in a woman being called the local word for "whore".
- In urban settings it is more likely to find women who work and have a career. Although opportunities are becoming more varied, salaries and room for growth tend to be limited.

Taboos

- Walking over versus around any bowls or pots (especially those containing food) is considered rude.
- Spending time in silence versus conversation is often times also interpreted as rude.
- Men almost always wear long pants, even in the hottest weather; shorts are a sign of being a child.

Law and Order

- The legal drinking age is 18 and is not heavily enforced.
- Penalties for possession, use, or trafficking in illegal drugs in are severe, and convicted offenders can expect long jail sentences and heavy fines.

Other Stuff

- Speak slowly and enunciate -- most Ugandans have difficulty understanding fast, strung-together English.
- Local greetings are a bit difficult to learn but many people in rural areas will greatly appreciate this small effort.
- If you look like a foreigner you are likely to be overcharged for most things. If you can afford this, it doesn't really matter, just pay. If you can't or would like the right price, try bargaining by at least halving the price they gave you.

Language

Sounds in Lugisu:

A sounds like ah.
I sounds like ee.
E – ay.
O – oh.
U – oo.

Ka – Kah
Kh – ch
Tsi – see
Tsa – sya
We – way
E – eh
Lyo – leo
Kii – ch
Nde – new

Numbers:

Ndwela – 1
Tsibili – 2
Tsitaru – 3
Tsine – 4
Tsirano – 5
Tsisesaba -6
Musafu – 7
Shinane
– 8 (my personal favorite – hey, shi nay nay!)
Shyenda – 9
Likhumi – 10

Good Phrases to Know:

Mazungu – unfamiliar visitor or friend (less PC – white person)
Now simili nabe – I'm very happy to see you.
Wan yala nabe – Thank you very much.
Wakhenyala – Thank you for your work or well done.
Mulembe – hello
Oriena - how are you?
Bu lyi – I'm fine, and you?
Komahoa – what's new?
Komalyi – not much thanks.
Casala – nothing new, thanks.
Komapesa kenga - how does this cost?
Inganga – give me
Wamalye bilyo – the food is finished.
Wekure (sometimes said Nekure)
– I'm satisfied or full.
Kamatore – bananas
Bilyo-bilayi – good food
Bilyo-bib – bad food
Inanasi – Pineapple
Kamachi – eggs (in Mbale they're amaggi)
Inzala – I'm hungry
How hotsa hulia bilyo – the food is ready
Mazalla – friend
Obe mulyi – goodbye
Hokena hokena – do you want to sleep?
Itsa nano – you come
Hocanis – what do you want?
Yehalowas – sit down
Holias – why are you crying?
Hakana hulia – do you want to eat?
Warulyi – welcome back
Bahalanga barunanu – what is your name?
Hotsa wye – where are you going?
Nowkohle – I'm coming back.
Wangi
– this is a respectful response when someone calls for you. It means I'm here.
Towe – no
Kale – yes
Imbawo – cold – not fine

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Banda

Building Communities Through Coffee





IPRO 333

Site information

The climate in Uganda is tropical. It is typically rainy with two dry seasons (December to February, June to August). Additionally there is a semi-arid region in the northeast.
The average temperature ranges between 70-77 degrees. Average humidity hovers around 76% humidity. Average annual rainfall is about 64in in Entebbe and 27in in the northeast.
The prevailing winds in the region blow across Kenya from the Indian Ocean located in the east. Major disasters that strike Uganda are drought, floods, and earthquakes.

The site is located on a plateau between a series of slopes. We must consider the implications of unstable soil and landslides due to this location.
Currently, we have limited information about the site. However, at the beginning of the semester, our team coordinated with the eventual land donors for the project to send a video camera to Uganda, as a way to conduct a remote site visit. After some difficulties with the international post, the video camera has made it to the site and we hope to gain more information through that venture.

Additionally, the scheduled trip for late december will serve as the perfect opportunity to survey the site.

Maps detailing the location of the farming community are availible on the first pages of the appendix.

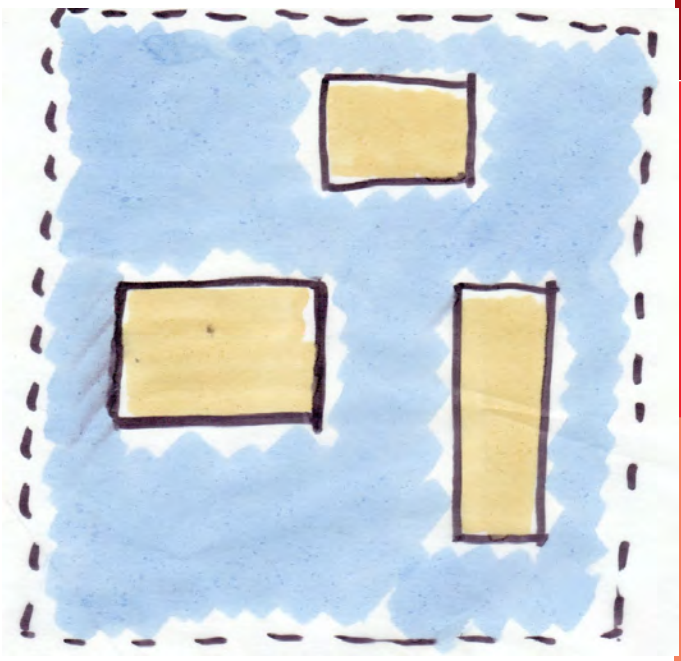
Building Program

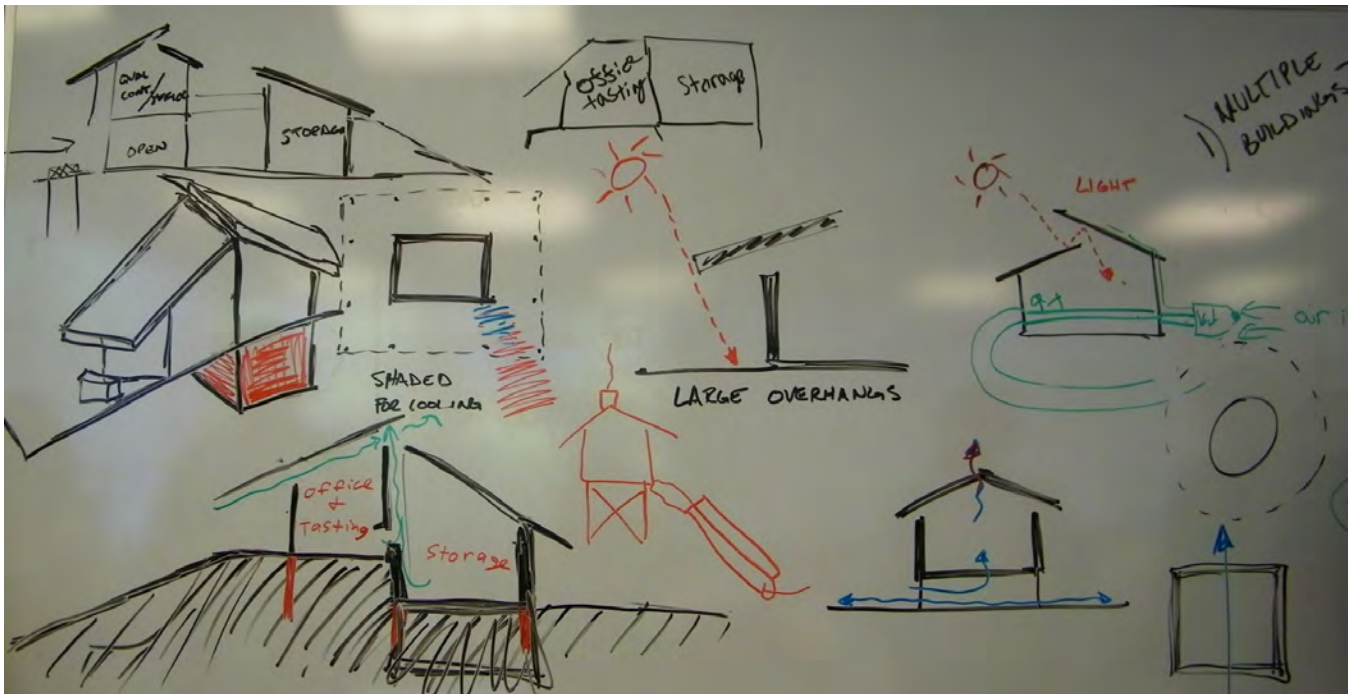
- Coffee Storage.
- Sample Storage.
- Tasting Area.
- Counter space for coffee tasting.
- "Office" for weighing and paying for coffee.
- Storage for pulping machines/drying beds.
- Outdoor space for use of drying beds and pulping equipment.
- Toilet facility + septic system.
- Community space.

Separate buildings:
Each program component would be housed in its own structure and connected by outdoor space and shade structures.

Pros:
- Cooling from shaded space.
- Airflow around buildings.
- Expansion between buildings already covered.
- Repairs/maintenance to buildings without.
- affecting other structures.

Cons
- Increase of materials and labor.
- Requires more land.
- Limit expansion.





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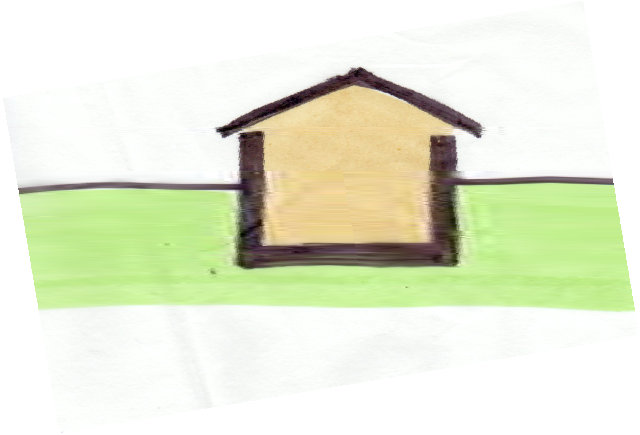
Early building considerations:
Our building group explores the pros and cons of different construction methods as they apply to the site.

Partially Recessed Structure:
Storage area built partially below ground level.

Pros:
- Earth would help cool space
- Use excavated soil for building material

Cons
- Creates avenue for flooding
- Need ramp or stairs
- Loading/unloading could be challenging



Partial Berming:
Bring earth up around building.

Pros:
- Earth cooling/temperature stabilization.
- Increased protection from mudslides.

Cons

- Stronger walls needed for lateral strength.
- Where does the soil come from?
- Cross ventilation.
- more challenging.

Raised Building:
Structure(s) raised entirely off ground level.

Pros:
- Good air ventilation possibilities
- Cooling strategy
- Protection from floods
- Less excavation?

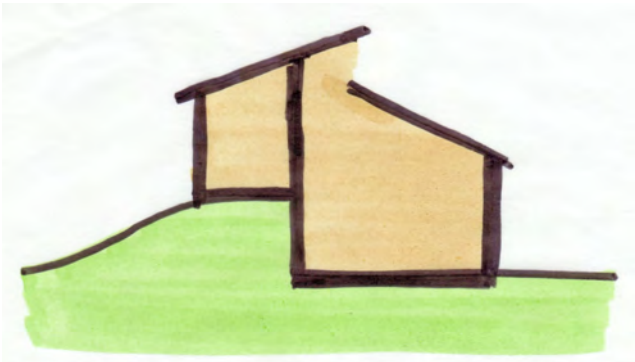
Cons
- Material constraints
- Loading/unloading becomes more challenging
- More materials/construction (Stairs, ramps, etc.)

What happens with space underneath?

Combination Berm/Raised:
Part of building raised on berm while storage at ground level.

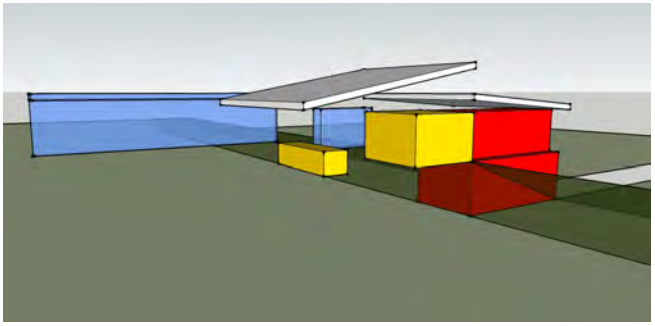
Pros:
- Gravity assists unloading into storage area.
- Partial berming helps cooling.
- Part of building on berm is protected from floods.
- Taller building helps utilize stack effect ventilation possibilities.

Cons.
- Storage are still at risk for flooding concerns.
- Where do we get the dirt for berming?
- Expansion possibilities?

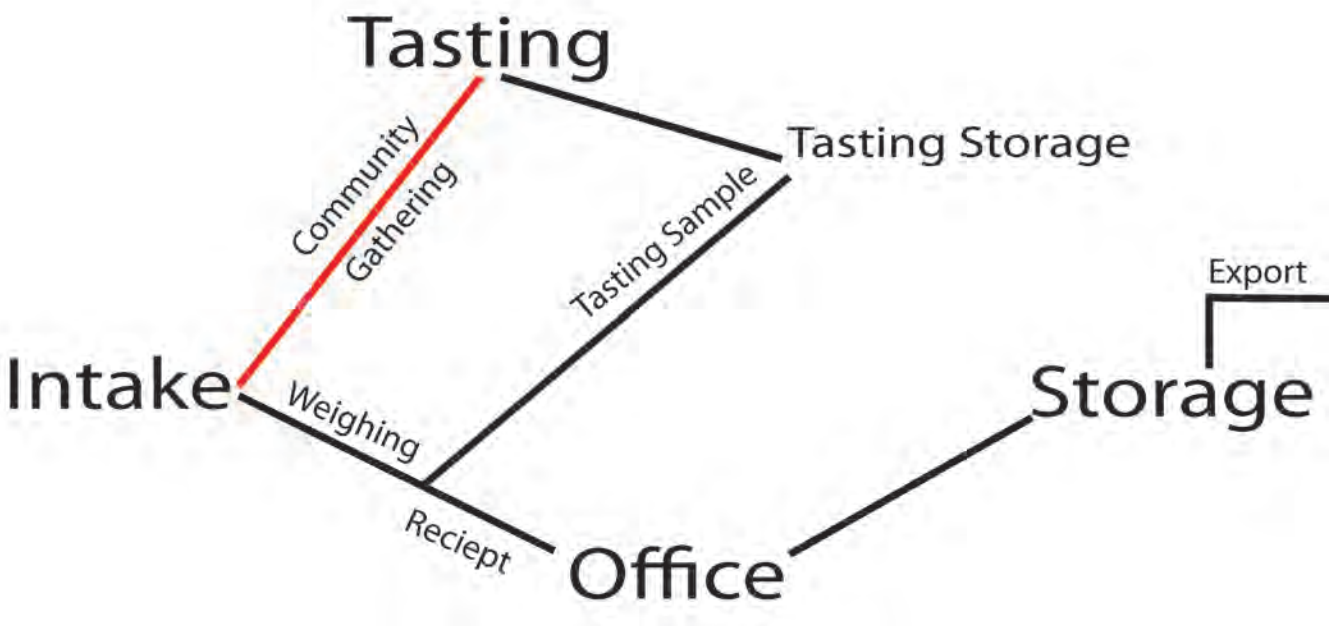


Other Design Considerations

- Clerestory windows and/or skylights.
- Light possibilities.
- Ventilation strategy.
- High thermal mass vs. Low thermal mass.
- Natural, sustainable materials vs. modern building materials.
- Concrete vs. timber vs. metal vs. combination.
- Rammed earth vs. earth bags vs. clay brick etc.
- Hybrid?
- Solar panels?



program diagrams and massing studies.



Materials matrix

The group has decided that the following four materials have the most potential for use in Uganda.

	Brick	Rammed Earth
Description	Fire-free brick, made of a mixture of clay, sand, and water mixed together with a binding material like rice husks or straw.	Man-made sedimentary rock formed by iterative compressions.
Production Time	25-30 days from forming to curing.	Ideally about 4 weeks.
Advantages	Mud bricks are a building standard in Uganda, and local farmers know how to produce them already.	Rammed earth walls are simple to construct, incombustible, thermally massive, strong, and durable. They do not negatively impact the environment, and are relatively cheap. It is Ideal for coffee storage.
Dis-advantages	Mud bricks have poor structural integrity, require an excessive amount of mortar, and do not insulate as well as other building materials.	Rammed earth is very susceptible to erosion from raining, flooding, and mudslides. Without the use of a hydraulic press, compression becomes a very time and labor intensive process.

Earthbags	ISSBs
Soil and bag construction technique that is very similar to early military bunker design.	Interlocking compressed earth blocks, formed by compressing a proper soil composition with a specific machine.
Fill and place 8-10 bags/hour.	Produce 50 blocks/hour, with a 4 Hour curing time.
Earthbag construction is naturally resilient towards flooding and mudslides; it is recommended in areas that experience earthquakes due to its flexible foundation; it is thermally massive, and ideal for coffee storage.	Wall construction extremely easy, manufacturing is very easy, very little mortar is required. A well trained workforce will produce bricks very efficiently.
The soil composition must be fairly specific to avoid rotting, expansion and contraction, and structural inconsistencies.	Every ISSB must be made very well in order to achieve uniform strength and resistance to erosion. Production calls for a very specific machine. Production

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Earthbags

Building with earthbags (sometimes called sandbags) is both old and new. Sandbags have long been used, particularly by the military, for creating strong, protective barriers, or for flood control. The same reasons that make them useful for these applications carry over to creating housing. Since the walls are so substantial, they resist all kinds of severe weather (or even bullets) and also stand up to natural calamities such as earthquakes and floods. They can be erected simply and quickly with readily available components, for very little money.

Earthbag building fills a unique niche in the quest for sustainable architecture. The bags can be filled with local, natural materials, which lowers the embodied energy commonly associated with the manufacture and transportation of building materials. The fill material is generally of mineral composition and is not subject to decomposition (even when damp), attractive to vermin, or burnable...in other word it is extremely durable. The fill material is generally completely non-toxic and will not offgas noxious fumes into the building.

Earthbags have the tremendous advantage of providing either thermal mass or insulation, depending on what the bags are filled with. When filled with soil they provide thermal mass, but when filled with lighter weight materials, such as crushed volcanic stone, perlite, vermiculite, or rice hulls, they provide insulation. The bags can even act as natural non-wicking, somewhat insulated foundations when they are filled with gravel.

Traditional mud/stick construction with thatched roof.

Because the earthbags can be stacked in a wide variety of shapes, including domes, they have the potential to virtually eliminate the need for common tensile materials in the structure, especially the wood and steel often used for roofs. This not only saves more energy (and pollution), but also helps save our forests, which are increasingly necessary for sequestering carbon.

Another aspect of sustainability is found in the economy of this method. The fill material can be literally "dirt cheap," especially if on-site soil is used. The earthbags themselves can often be purchased as misprints or recycled grain sacks, but even when new are not particularly expensive. Burlap bags were traditionally used for this purpose, and they work fine but are subject to rot. Polypropylene bags have superior strength and durability, as long as they are kept away from too much sunlight. For permanent housing the bags should be covered with some kind of plaster for protection, but this plaster can also be earthen and not particularly costly.

The ease and simplicity of building with earthbags should also be mentioned, since there is much unskilled labor available around the world that can be tapped for using this technology. One person familiar with the basics of earthbag building can easily train others to assist in the erection of a building. This not only makes the process more affordable, but also more feasible in remote areas where many common building skills are not to be found.

Earthbag construction.

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Non-Buried Storage:

Material Preferences:

- Timber Structure
- Rammed Earth
- Plywood Shingles

Material Possibilites:

- ISSB Bricks
- Traditional Clay Bricks(labor intensive to make)
- Concrete (Cast in Place)
- Earth Bags
- Clay Tiles for Roof

Advantages:

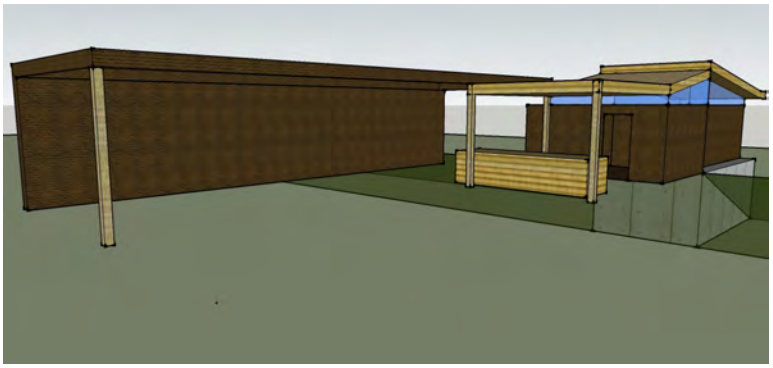
- Overall plan organization gives site of tasting a seperation from rest of facility, allows for the farmer to spread out and socialize in a more specific place with shade vs. just out in the open.
- High windows let daylight in
- Rammed Earth acts as a thermal mass (absorbs heat during the day to keep building cooler, then releases absorbed heat at night when it is colder)
- Angled roof allows for stack effect releasing hot air out of the top of the building
- Large roof area allows for shading for all

DisAdvantages

- Larger footprint means larger area of site is disturbed by construction.

IPRO 333

Buried Storage:



Material Preferences
- Timber Structure
- Rammed Earth
- Plywood Shingles
- Concrete
  (Cast in Place for Buried Storage)

Material Possibilites
- ISSB Bricks
- Traditional Clay Bricks (labor intensive to make)
- Concrete (Cast in Place)
- Earth Bags
- Clay Tiles for Roof

Advantages
- Overall plan organization gives site of tasting a seperation from rest of facility, allows for the farmer to spread out and socialize in a more specific place with shade vs. just out in the open.
- High windows let daylight in
  Rammed Earth acts as a thermal mass (absorbs heat during the day to keep building cooler, then releases absorbed heat at night when it is colder)
- Angled roof allows for stack effect releasing hot air out of the top of the building
- Large roof area allows for shading for all
- Concrete controls temperature for storage more consistently

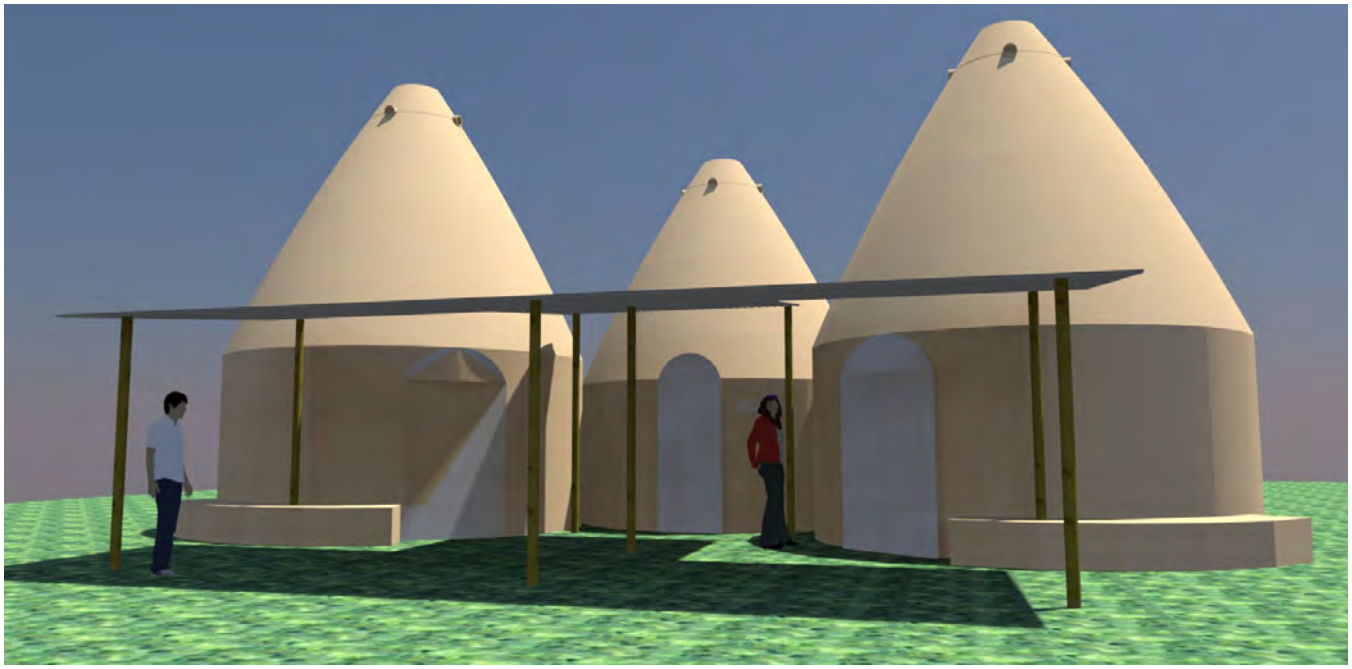
DisAdvantages
- Larger footprint means larger area of site is disturbed by construction
- Burying the storage makes process of construction more labor intensive

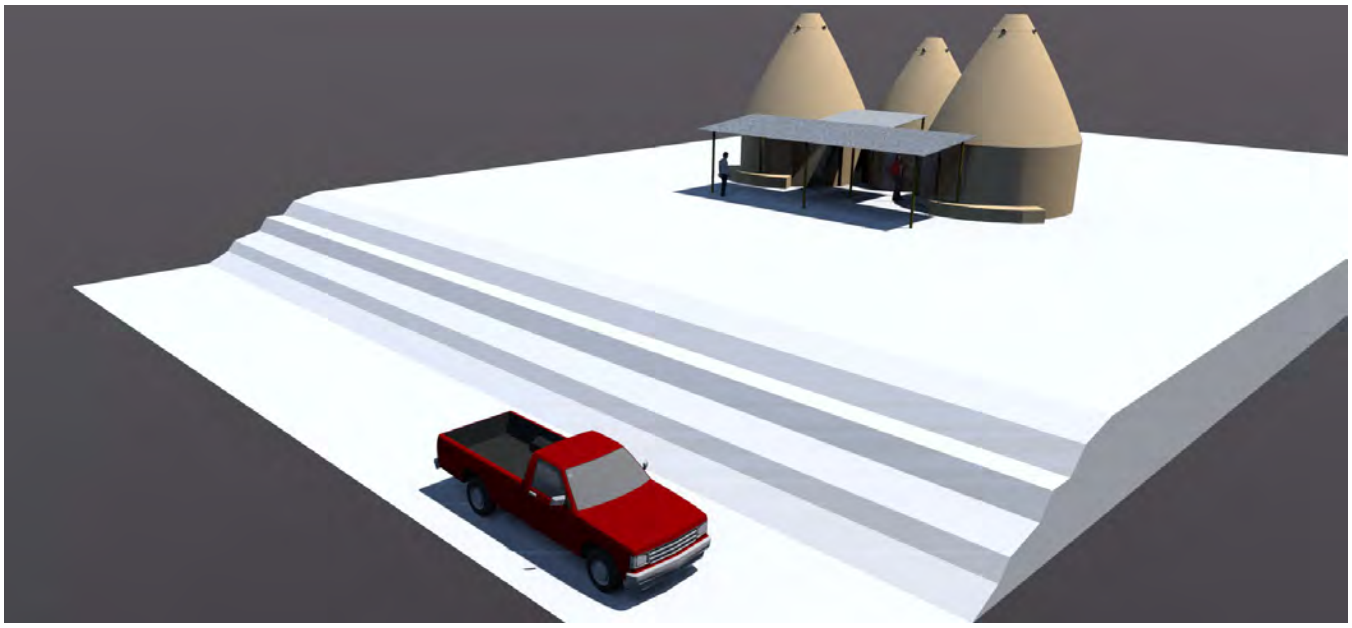
IPRO 333

Current Solutions

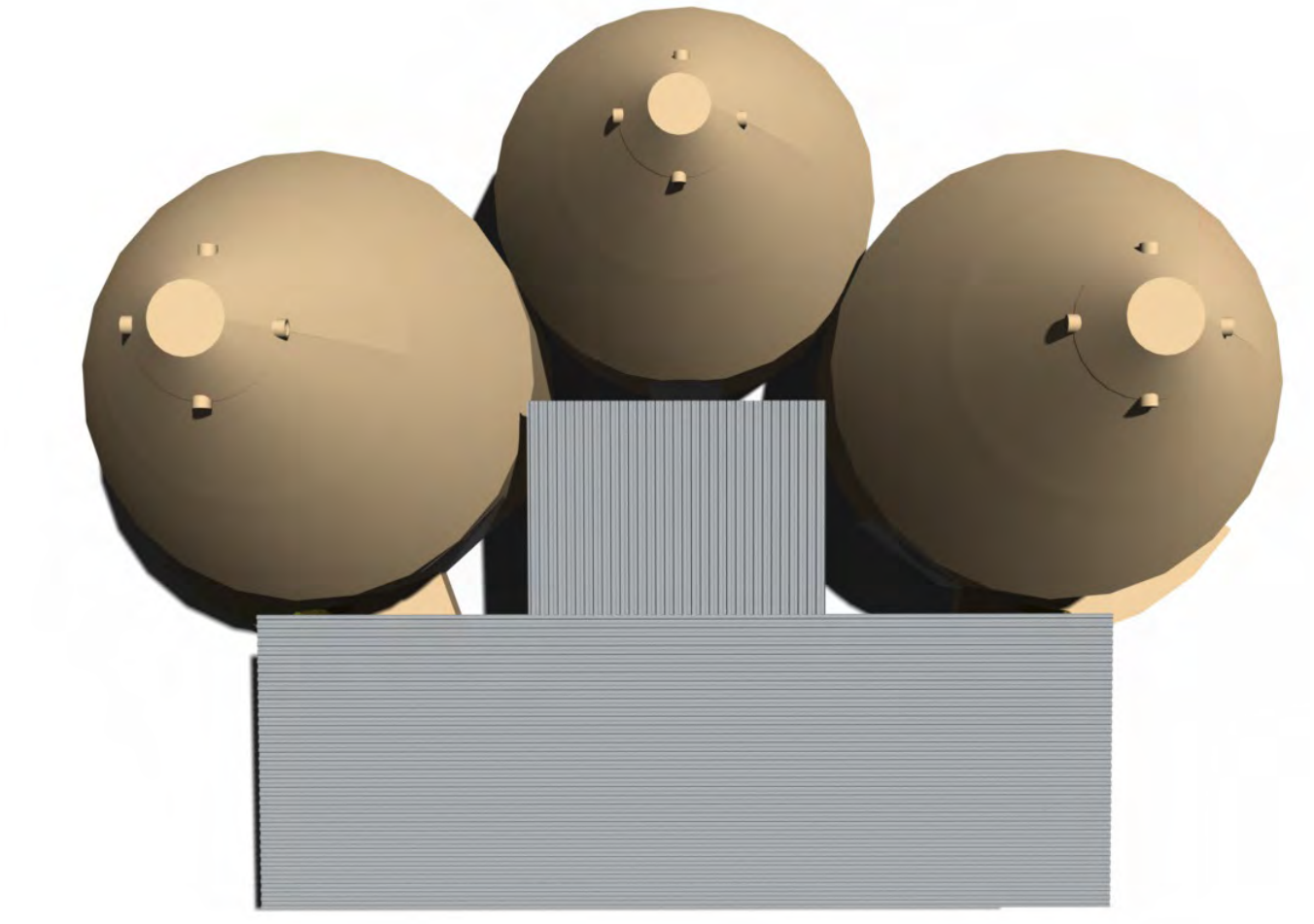
Our current solution uses the properties of earth-bag construction to create three domed building; 2 are for storage while the middle building houses office space. The configuration of three allows the occupant of the office space to control any entry into the storage buildings. In the front of the complex is an open air covered area for tasting, receiving and general gathering by the community. The thick earthbag structure will allow for optimun climate control for the coffee. Vents in the roof of the dome encourage natural ventillation.

Building perspective showing general massing, access, and outdoor circulation.





Banda as it related to site topography and elevation.



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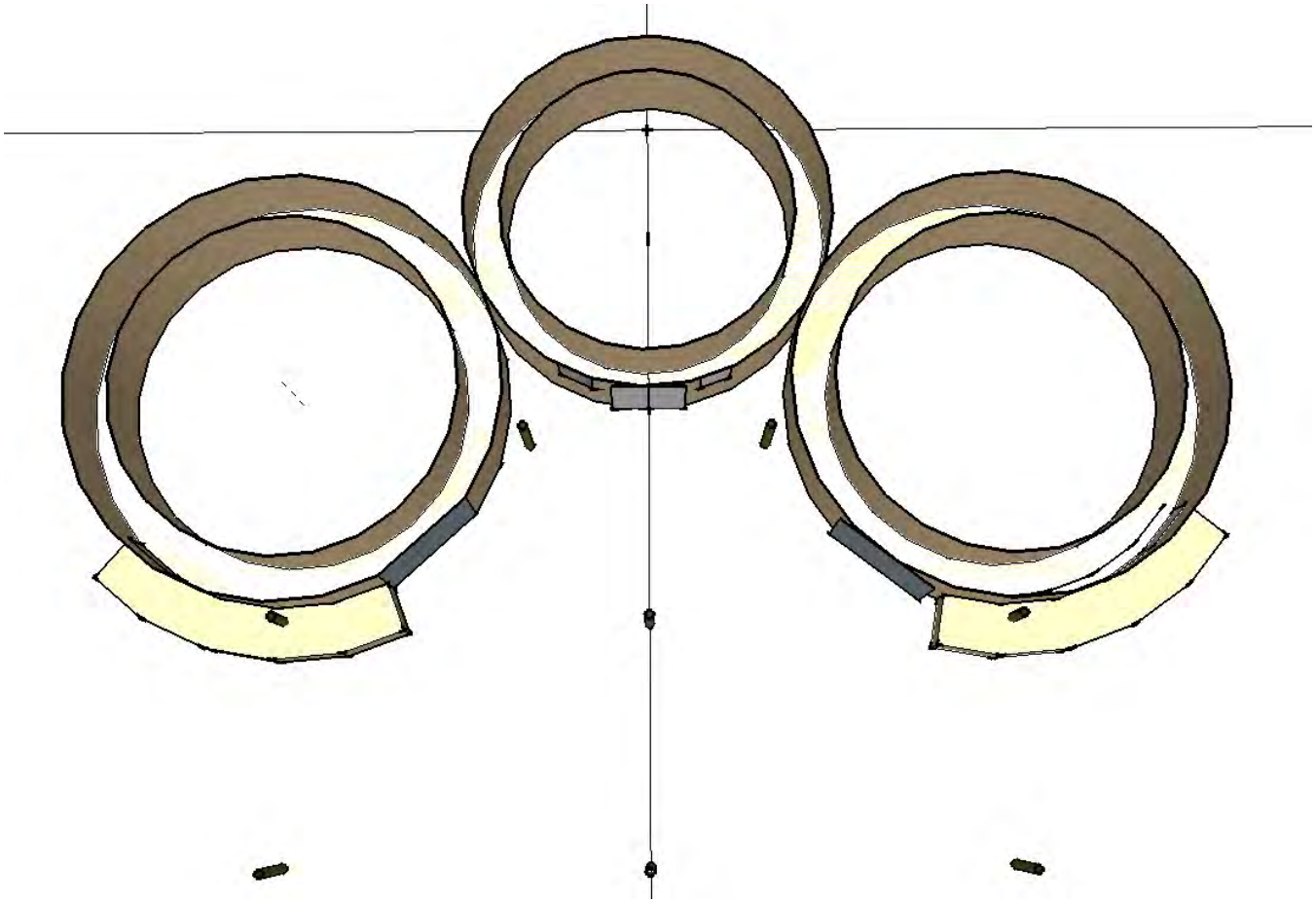
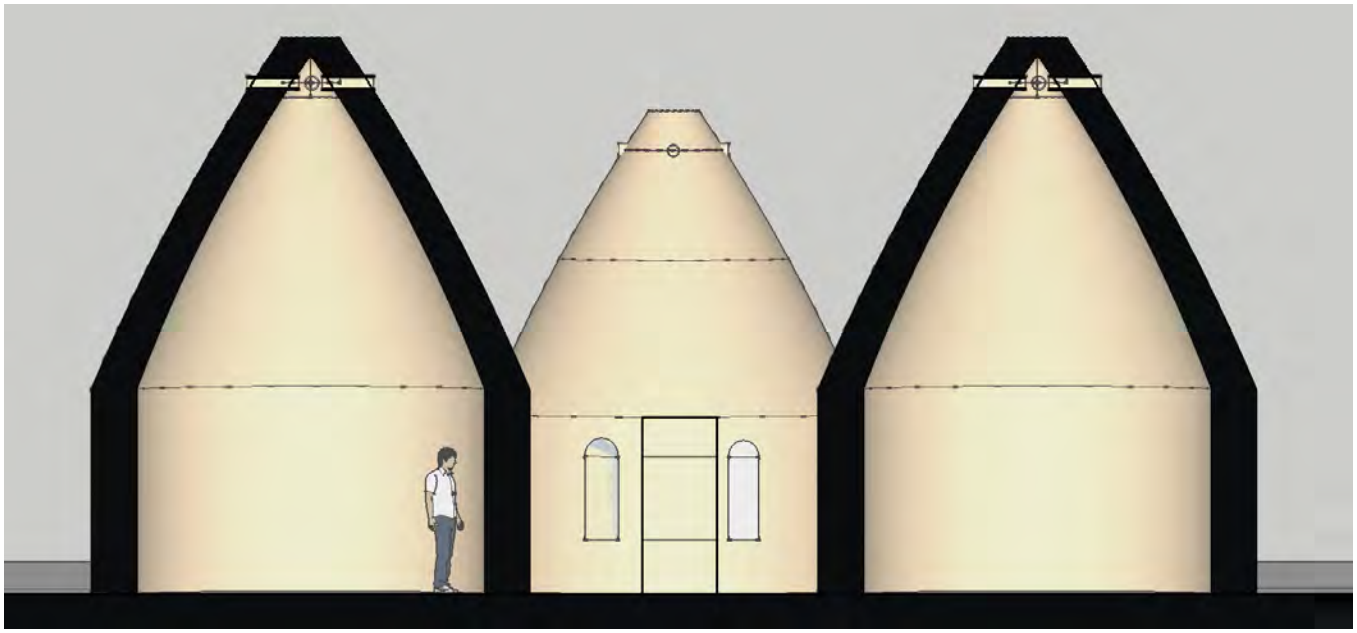


Above: Plan showing wall thickness.
Below: Section showing wall thickness and building height.



IPRO 333

Logistics

Building Communities Through Coffee





Mud brick construction

Description:
A mud brick is a fire-free brick, made of a mixture of clay, sand, and water mixed together with a binding material like rice husks or straw. This type of brick is usually found in warm regions where timber needed to fuel a kiln is not abundant.

Construction Method:
Mud bricks are formed by hand, creating a mixture with a stiff consistency and leaving to sun-dry for 25-30 days. Bricks are then mortared together to create a wall. This is a method of construction that is very easily understood and well practiced in Uganda.

Availability:
Mud bricks are readily available in Uganda. They are already used as a material for many buildings. They are so valuable that as soon as someone owns a brick, they immediately put it into a pre-existing but probably unfinished wall. This secures the brick and puts the person one small step closer to owning a home. This also displays the amount of time that it takes the average person in Uganda to build a home. With mud bricks already seeming to be such a precious resource, it seems that building would have to take place brick by brick, or at a very fast rate to deter brick theft.

Benefits to Mud Bricks:
Mud bricks are one of the building standards in Uganda. Most homeowners have made their homes out of mud bricks, so making one more building might be very easy for the farmers. Mud brick buildings are fairly thermally massive, which will assist in keeping the building cool and dry during the day and warmer than the outside temperature at night. This is critical to coffee storage; wildly varying temperatures vary the moisture content of coffee beans, which leads to mold.

Downsides to Mud Bricks:
There are many downsides to mud brick houses and one might assume that the downsides outweigh the benefits. Because mud bricks are not fired, they only have a lifespan of approximately 30 years or less. This is under ideal sun drying conditions and building construction. The quality of the mortar used may also affect the lifespan of a building. Despite this, there are things that one can do to increase the lifespan of a building. Finishing a wall with fire-dried bricks or covering walls with stucco can increase the life of mud brick walls. Also, mud bricks are fairly expensive in Uganda; it would be difficult for a group of Ugandan farmers to raise enough money to build a storage facility themselves. Even though they would not be paying for the building, this may deter farmers form wanting a building that is so expensive when they could use money for other things.

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Rammed earth construction

Description:
Rammed Earth is a building material that has existed for thousands of years. It has always been regarded as very available and durable, and it has recently gained popularity because it is a sustainable building material. It can be described as manmade sedimentary rock, because of the shape and properties the material takes on after it is constructed.

Construction Method:
Constructing a rammed earth wall is broken up into three phases: filling, compacting, and curing. The earth used for filling involves mixing together suitable proportions of sand, clay, and gravel, with added stabilizers if necessary. A mold of plywood is made, which defines the dimensions of the wall. Earth is filled at a rate of 4 to 9 inches at a time, so to ensure complete compaction. In the lower parts of the wall rebar, steel plating, and other stabilizing members may be added to increase foundation strength. The compaction phase involves either using long hand operated compaction tools or pneumatic powered tampers. Compaction will reduce the earth by about 50 % its original height. Once the wall has been built up to ideal height, it must cure. About an hour after the mold has been removed is the time when any designs or alterations to the surface must be done. Curing time should be on the same scale as concrete, with longer curing time promoting higher compressive strength. Curing will occur quicker the warmer and drier the climate is.

Availability:
It is unclear whether or not a suitable composition of earth is found in Uganda. Topographical maps of Uganda provide general soil descriptions, but a soil sample is necessary to determine if the composition needs any additives. Knowing

the composition of the soil will allow us to recreate it in order to make a prototype.

Benefits to Rammed Earth:
Rammed earth walls are simple to construct, incombustible, thermally massive, strong, and durable. They can last for centuries, provided the climate is right and erosion is minimized. Harvesting soil for use has minimal environmental impact, and extremely affordable. Unskilled labor can be used for construction, which means that families can construct their own homes.

Downsides to Rammed Earth:
If pneumatic tampers are not available, "ramming" earth becomes a very time and labor intensive process. In warm, wet climates, it may take years for rammed earth to cure. Like brick, rammed earth needs insulation to protect it in colder climates. Erosion is always an issue, with heavy rains, high speed winds, and mudslides a very big issue.

Earth bag construction

Description:
Earthbag building is an inexpensive building technique that is fast, easy to learn, and very sturdy. This building technique is very similar to the construction of early military bunkers or flood control systems, such as dams or dikes.

Construction Method:
Earthbag construction requires few materials: bags, earth, barbed wire, plaster, and tools for filing and tamping. Within that, there are some nuances to Earthbag construction that are easy to pick up but necessary to create a solid structure. First of all, bags should be of a strong material resistant to rot or tearing. Polypropylene is a very good material for this. The earth used must be of a certain mixture of clay, sand, and gravel. This mixture is very similar in composition to that suitable for rammed earth construction. Bags are filled and tamped down to create a uniform shape and density for every bag used. Bags are stacked one on top of each other, very similar to how one would make an igloo. Between each layer barbed wire is laid down to keep bags from shifting and adding strength to the construction. A trench is dug until hard mineral deposits are reached. This trench is either filled with gravel or pebbles to start a foundation. Below grade, bags are filled with gravel or another material that will not take on water to create a strong foundation. Bags can be domed to create a uniform structure or a more regular roof can be used. After the bags have been set in place, they are plastered over to add water resistance to the structure. This also adds to the structural integrity of the building.

Availability:
If the right mixture of earth is found in the area, then the majority of the material needed is readily available on site. Polypropylene bags, barbed wire, and plaster would have to be shipped to the site. All of the labor could be unskilled; the learning curve for Earthbag construction is very slight.

Benefits to Earth Bags:
Earthbag construction is a very suitable construction technique for buildings in Uganda. Because it is derived from flood management techniques, Earthbag construction is naturally resilient towards flooding and mudslides. It only requires a water resistant covering, which the plaster provides. Earthbag construction is also recommended in areas that experience many earthquakes, due to the strong and somewhat flexible foundation design. Having a building that is thermally massive will assist in controlling the moisture level of the air in the building. Moisture content is very important when considering coffee storage, as coffee has a tendency to rot when there is too much moisture in the air.

Downsides to Earth Bags:
If the composition of the soil used to fill the bags is incorrect, then there can be many different problems. If there is too much organic matter in the soil, then there can be rotting and structural integrity issues. If there is too much clay in the soil, then there will be problems with expansion due to moisture increases.

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Interlocking Stabilized Soil Blocks (ISSB)

Description:
Interlocking stabilized soil blocks or ISSBs are a building material that is quickly gaining notoriety in East Africa. They are very similar in concept to compressed earth blocks, which are formed by mixing a proper composition of soil together and compressing it into a block. ISSBs are made the same way; the difference is that the machine creates blocks that will interlock with each other so as to improve the stability of any structure compared to normal compressed earth blocks.

Construction Method:
ISSBs are made using a very specific machine. Earth of a specific composition is compressed into a specific shape. That shape will interlock with the bricks next to it, above it, and below it when a wall is formed. After the blocks are compressed into the correct shape, they are left to set for 3-4 hours. They are then set in stacks to cure for approximately 4 weeks. After this, they are placed together to form a wall. A small amount of mortar is used to join the blocks together. Depending on the machine used, ISSBs can be made to realistically any shape. The shapes that are commonly used are either bricks with a raised middle section, or curved blocks. Curved blocks are usually used to create wells, tanks, or other water-storing vessels.

Availability:
Availability depends highly on the soil found in Uganda. If the soil is of a suitable mixture, then only a small amount of additives to the soil will be necessary to create strong ISSBs. The machine used must be bought and imported, as well as any mortar used to bond the ISSBs together.

Benefits to ISSBs:
When using ISSBs, wall construction becomes very easy. ISSBs stack together very well, and require much less mortar than normal bricks. When the workforce is well-trained, making ISSBs becomes a very efficient process.

Downsides to ISSBs:
If the soil is too wet, making ISSBs becomes a very time-consuming process. Soil must be of a relatively uniform texture, meaning that the chunks of soil must be small throughout. When the soil is moist or wet this becomes very difficult to achieve. ISSB creation is the most important phase of building. Every block must be made well in order to achieve uniform strength and resistance to erosion. If blocks are well made, then they are usually water-resistant. If they are not well made, then the need for plaster arises and that only slows construction. ISSB construction also requires a very specific type of machine, and if that machine breaks, then the entire production process is slowed.

Material	General Information	Dimension (LxWxH) (cm)	Unit Volume (m^3)	Weight (kg)	# Blocks needed to make 1 cu. meter	Performance	Compressive Strength (Mpa)	Thermal Resistivity (m*C/W)	Density Kg/m^3	Avg. Density Kg/m^3
ISSB		26.5 x 14 x 10	0.004	8.0-10.0	270.3		1.0-4.0	.715-1.25	1700-2200	1950
Rammed Earth		20x10x10	0.002	*D.D.	500.0		3.5	2.04d+.12	2000-2100	2050
Earthbags		See Below		*D.D.	See Below		See Below	See Below	See Below	
Brick		20x10x10	0.002	4.0-5.0	500.0		0.5-6	0.77-1.43	1400-2400	1900
CMU		40 x 20 x 20	0.016	10.0-12.0	62.5		0.7-5.0	.6-1.0	1700-2200	1950
Earthbag Breakdown		**Weight Small (Kg)**	**Weight Med. (Kg)**	**Weight Large (Kg)**						
Granite Filled		38.94	54.78	80.85	Granite Filled		1.10-2.98	?	1650	1650
Sand Filled		44.42	62.48	92.22	Sand Filled		0.30	2.04d+.12	1682-2082	1882
Silt-Sand Mix		39.83	56.03	82.69	Topsoil Filled		2.33-2.98	2.04d+.12	1275-2100	1687.5
Clay-Sand mix		40.89	57.52	84.89	Sandy Soil Filled		2.33-2.98	2.04d+.12	1376-2089	1732.5
Rubble Filled		47.55	66.90	98.74	Rubble Filled		0.40	?	1790-2240	2015
Clay-Gravel mix		43.90	61.75	91.14	Soil Filled		2.14	2.04d+.12	1630-2090	1860
Sm. Earthbags		35.7x66.2x10	0.024	*D.D.	42.4					
Med. Earthbags		40.8x81.4x10	0.033	*D.D.	30.1					
L. Earthbags		53.5x91.6x10	0.049	*D.D.	20.4					

Note: The compressive strength is similar for all three sizes of bag.

*D.D. - Density Dependant

Material Properties

Building material cost

Cost Breakdown in UgS						
Material	**Cost to buy materials for:**					
	Office		Storage (1)		Total	
	Dome	Wall	Dome	Wall	Dome	Wall
ISSB	0.00	1,882,432.43	0.00	2,289,189.19	0.00	6,460,810.81
Rammed Earth						
Brick	0.00	1,492,500.00	0.00	1,815,000.00	0.00	5,122,500.00
CMU	0.00	186,562.50	0.00	226,875.00	0.00	640,312.50
Sm. Earthbags	120,254.24	556,525.42	148,220.34	676,779.66	416,694.92	1,910,084.75
Med. Earthbags	85,481.93	395,602.41	105,361.45	481,084.34	296,204.82	1,357,771.08
Lg. Earthbags	57,918.37	268,040.82	71,387.76	325,959.18	200,693.88	919,959.18

Cost Breakdown in U.S.D.						
Material	**Cost to buy materials for:**					
	Office		Storage (1)		Total	
	Dome	Wall	Dome	Wall	Dome	Wall
ISSB	$0.00	$818.45	$0.00	$995.30	$0.00	$2,809.05
Rammed Earth						
Brick	$0.00	$648.91	$0.00	$789.13	$0.00	$2,227.17
CMU	$0.00	$81.11	$0.00	$98.64	$0.00	$278.40
Sm. Earthbags	$52.28	$241.97	$64.44	$294.25	$181.17	$830.47
Med. Earthbags	$37.17	$172.00	$45.81	$209.17	$128.78	$590.34
Lg. Earthbags	$25.18	$116.54	$31.04	$141.72	$87.26	$399.98

Note: Overestimation, due to the larger size of the bags.

Note: the cost for earth bags will be greater than this. This is because I'm not sure how much we will pay for different types of earth.

Building specifications

Building	Part		Dimensions		Footprint	
			ft.	m	$ft.^2$	m^2
Storage	Wall	Inner Radius	7.5	2.3	176.71	26.34
		Outer Radius	9.5	2.9	283.53	26.34
		Height	8	2.4		
	Dome	Height	15	4.6		
Office	Wall	Inner Radius	6	1.8	113.10	10.18
		Outer Radius	8	2.4	201.06	18.67
		Height	8	2.4	**Total**	
	Dome	Height	12	3.7	685.65	63.68

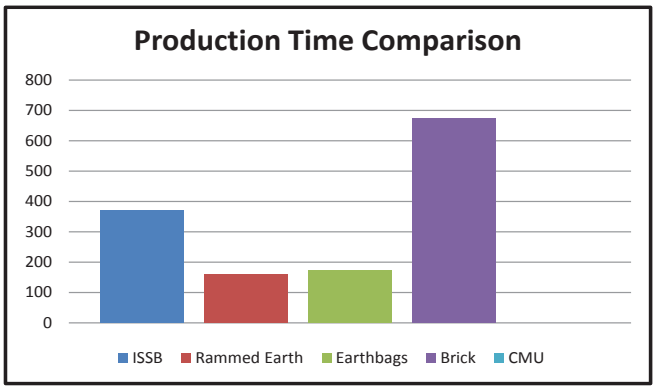
Building	Part	Volume				
		Unit		Total		
		ft^3	m^3	ft^3	yd^3	m^3
Office	Dome	152.4	4.3	2934.9	108.7	83.1
	Wall	703.7	19.9	**Total = Office + two storage buildings**		
Storage	Dome	185.4	5.3			
	Wall	854	24.2			

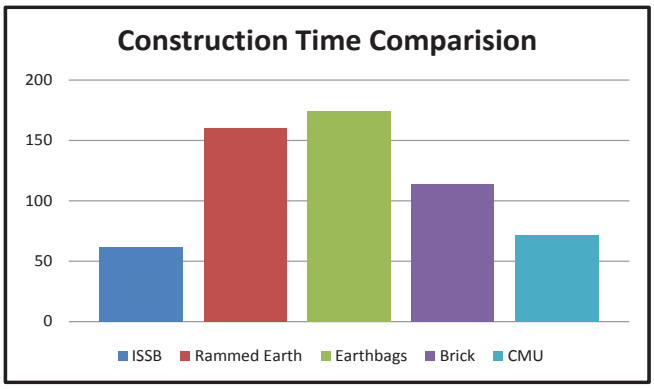
Material	# Blocks Needed to Make:					
	Office		Storage (1)		Total	
	Dome	Wall	Dome	Wall	Dome	Wall
ISSB	0.0	5378.4	0.0	6540.5	0.0	18459.5
Rammed Earth	0.0	9950.0	0.0	12100.0	0.0	34150.0
Brick	0.0	9950.0	0.0	12100.0	0.0	34150.0
CMU	0.0	1243.8	0.0	1512.5	0.0	4268.8
Sm. Earthbags	182.2	843.2	224.6	1025.4	631.4	2894.1
Med. Earthbags	129.5	599.4	159.6	728.9	448.8	2057.2
Lg. Earthbags	87.8	406.1	108.2	493.9	304.1	1393.9

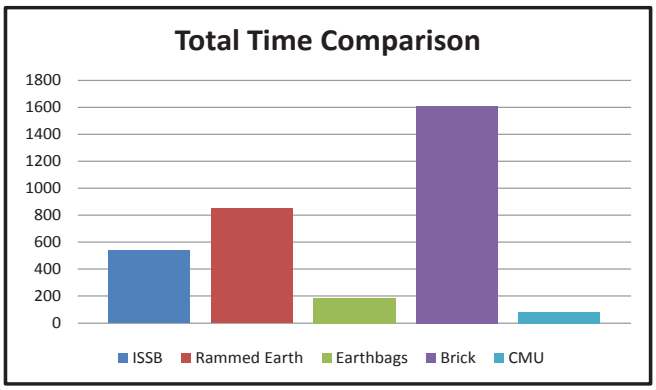
Material	Unit Volume	# Blocks needed to make 1 cu. meter	Unit Cost U.S.D.	Cost/m^3 U.S.D.	Cost/m^3 Ranking	Unit Thickness (m)	Units/Thickness	Cost/thickness	Cost/thickness Ranking
ISSB	0.004	270.3	$0.15	$41.30	3	0.14	4.357	$0.67	3
Rammed Earth	0.002	500.0	Undefined	Undefined	Unranked	0.61	1.000	Undefined	Unranked
Earthbags	0.049	20.4	$0.13	$2.55	1	0.535	1.140	$0.14	1
Brick	0.002	500.0	$0.07	$32.70	2	0.1	6.100	$0.40	2
CMU	0.016	62.5	$1.31	$81.88	4	0.2	3.050	$4.00	4

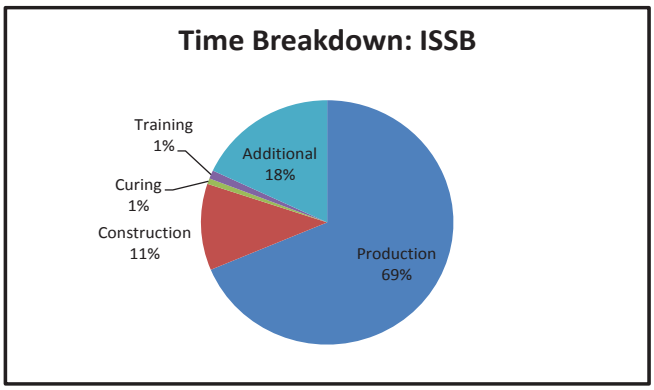
	Production Time	Total Quantity Needed	Production Time (hrs)	Production Time Ranking	Construction Time (hrs)	Construction Time Ranking	Total Time (hrs)	Total Time Ranking	Total Cost Ranking
ISSB	50 blocks/hr	18459	369	4	62	1	538	**3**	**3**
Rammed Earth	28 days before load bearing	4 days to make minimum	96	2	160	4	850	**4**	**3**
Earthbags	8 bags/hr	1394	174	3	174	5	184	**2**	**2**
Brick	28 days before placing	34150	672	5	114	3	1610	**5**	**4**
CMU	N/A	4269	0	1	71	2	81	**1**	**1**

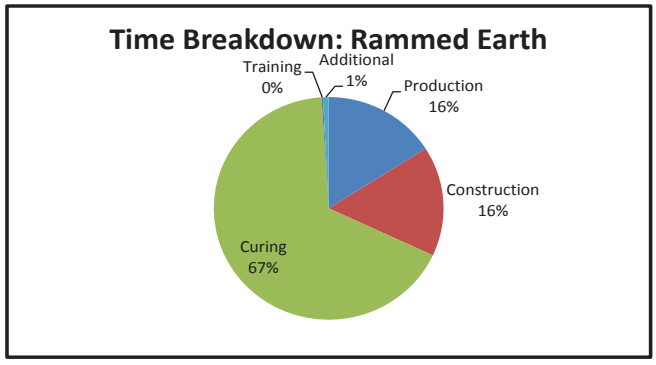
Production graphs

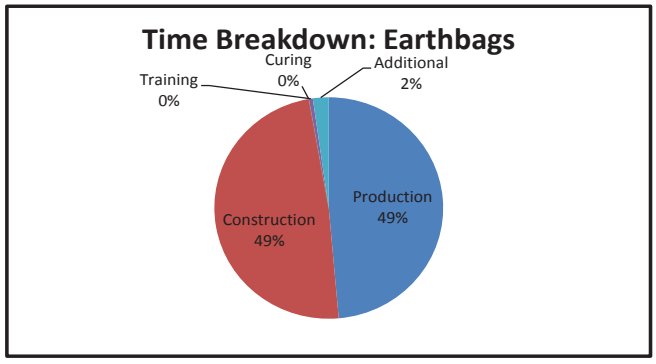


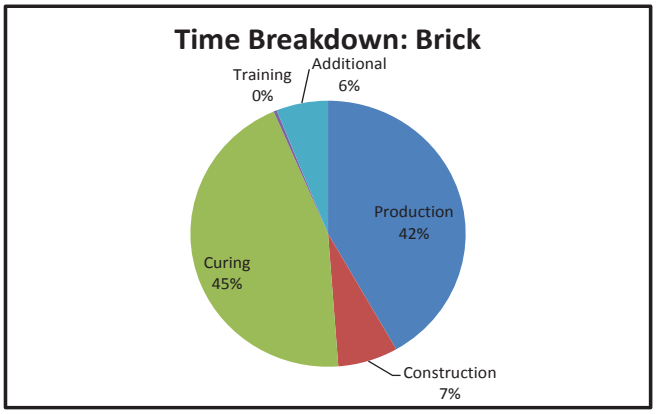


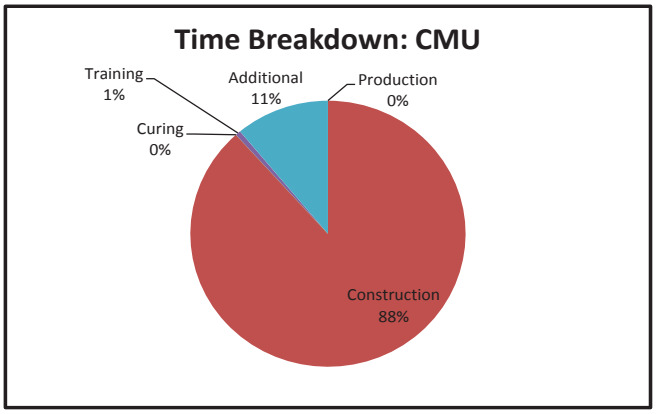












Success testimony:

On Fri, Feb 26, 2010 at 7:20 PM, Katie Gilmer/Sustainable Harvest wrote:

Dear Phil,

I hope you're doing well. I just wanted to write you to let you know about a major success we've had with the Grain Pro bag liners. A container of Kanyovu Cooperative coffee from our project in western Tanzania arrived to Seattle and nearly half of the bags had water damage. Some even looked like they had been dragged through the mud. This coffee is really expensive and is also very near and dear to our hearts, as our Africa staff has worked so hard to improve quality over the last three years.

You can imagine how afraid we were that half the container of coffee was ruined. Luckily, our customer had taken our advice and ordered the coffee in GrainPro. We ordered samples from the warehouse from both clean and damaged bags. Our cupping team in Portland tried the samples side by side, and breathed a sigh of relief. The two samples tasted exactly the same - delicious apricot and honey and a vibrant citrus acidity - just what we expect of our Tanzania coffee. GrainPro saves the day!

This was a true testament to the power of GrainPro and I wanted to say thank you to you and your team for such a great product.

Kind regards, Katie

Katie Gilmer | Communications Manager | Sustainable Harvest Coffee Importers
The Natural Capital Center, 721 NW Ninth Avenue Suite 235, Portland, OR 97209
Office: (503) 235-1119 | Fax: (503) 296-2349 | Direct: (503) 445-9947
www.sustainableharvest.com

Source: http://www.grainpro.com/whats-new.php

Two options of GrainPro Products for Storage/Shipping

Probable Shipping Option:

GrainPro Cocoons™

GrainPro Cocoons™ are airtight (hermetic), unsupported rectangular structures made of lightweight UV resistant PVC. The simple two-piece Cocoon consists of a top cover and bottom floor piece joined together with a PVC tongue-&-groove zipper similar to those used to close environmental safety suits. Insects trapped in the bagged grain expire in a matter of days as a result of an increase in carbon dioxide and reduction of oxygen. Cocoons are packed folded in a carry bag for transport and can be made ready for use in minutes.

Cocoons are designed to store bagged commodities such as:

- grains
- seeds and pulses
- cacao and coffee beans
- other dry agricultural products

Cocoon capacity based on wheat: 5 Tonne, 10 Tonne, 20 Tonne, 50 Tonne, 100 Tonne,
150 Tonne, 300 Tonne sizes, and MegaCocoon 1050 Tonnes

GrainPro Catalogue nr	Nominal* Capacity	Bushels	Volume in M^3	Length (cm)	Width (cm)	Height (cm)	Empty Weight
GPC 005	5 Tonnes	184 bu	7.5 m^3	295	170	150	33 kg
GPC 010	10 Tonnes	367 bu	15 m^3	340	295	150	45 kg
GPC 020	20 Tonnes	734 bu	29.9 m^3	440	340	200	81 kg
GPC-2-050	50 Tonnes	1,835 bu	78.3 m^3	890	440	200	170 kg
GPC-3-050	50 Tonnes	1,835 bu	78.3 m^3	600	435	300	148 kg
GPC 100	100 Tonnes	3,670 bu	150 m^3	860	580	300	240 kg
GPC 150	150 Tonnes	5,505 bu	227 m^3	890	850	300	323 kg
GPC 300	300 Tonnes	10,000 bu	414 m^3	920	750	600	340 kg
GPC 1050	1050 Tonnes	38,535 bu	1,440 m^3	2,400	1,000	600	1,314 kg

* Based on density of wheat

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Overview:

- Gas-tight and water-tight PVC liner and zipper
- At least 10-year PVC life span in direct sunlight
- Food quality PVC
- Appropriate technology
- Impermeable to water, water vapor and air
- Equipped with **GrainShade™** aluminized reflective sheeting to minimize condensation
  from temperature fluctuation
- Thickness of PVC is 0.83 mm.

Advantages:

- Can reduce storage losses to less than 1% annually without pesticides
- Easy loading and unloading
- No need for spare parts
- Sustainable development
- Increased commodity shelf life
- No need for any toxic storage pesticides and fumigants
- "Green" product, fits demands of organic growers
- Mobility: units can be assembled and disassembled within minutes
- No need for any infrastructure
- Tested under all climatic conditions
- Rodent-resistant design
- Insects die due to lack of oxygen
- Inhibits growth of fungi, which otherwise results in aflatoxins and mycotoxins

Each GrainPro Cocoon comes with:

- Bag of reinforced PVC with carrying straps for easy transfer and storage when Cocoon is not in use
- Flexible valve with fixed plug for measuring oxygen and coin groove (3/4 inch diameter)
  for verifying hermeticity, or for grain sampling
- Repair kit: glue and patching material
- 2 zipper handles (left and right)
- Silicone spray for smooth zipping
- Measuring tape to measure height
- Instruction Manual
- Instructional video on loading, zipping, unloading and caring for your Cocoon
- One **GrainShade™**(aluminized reflective sheet for protection from high temperature)

- Rope for attachment of **GrainShade™**

Loading a Grainpro Cocoon

A properly stacked Cocoon before sealing

IPRO 333

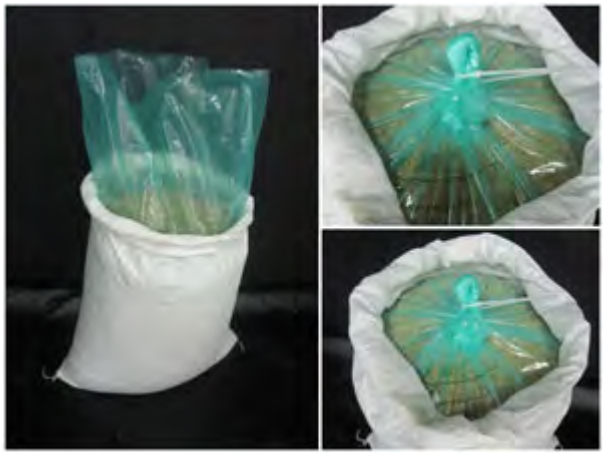
Probable Storage Option:

GrainPro SuperGrainbags™

The ultimate solution for quality preservation of agricultural commodities in bags

GrainPro has developed unique solutions for storage of agricultural commodities in airtight bags. Most agricultural commodities stored in these bags will develop a "modified atmosphere" of low oxygen and high carbon dioxide content. This "hermetic storage" is created by respiration of living organisms in the commodity such as insects and fungi.

Commodities can be stored for prolonged periods without the use of chemicals and refrigeration and without the risk of moisture ingress. The result is that aroma, color, freshness and germination are preserved, rancidity is prevented and insect infestation and fungi are controlled.



GPSBI B in protective bag

Applicable for commodities as:

- Coffee (green, parchment)
- corn, including moist corn (maize)
- paddy
- milled rice (brown and white)
- sorghum
- millet
- soybeans
- all types of seeds
- wheat
- cocoa
- beans, peas, lentils

GPSBII Z in protective bag

IPRO 333

SuperGrainbags are made of co extruded gas barrier plus PE of 78 micron and can be supplied in two versions:

- **GPSBI B**: regular bag shape to be sealed with a set of "cable ties" provided with the bags.
- **GPSBII Z** : bag with a dual groove ziplock and compatible slider

SuperGrainbag Material Specifications

- Usable temperature range: 95°C to minus 18°C
- No inherent curling
- May be surface-printed up to 6 colors
- Outstanding strength
- Excellent sealability

Standard Sizes :

Product	Size	Weight
GPSBI B 75 x 130[i]	75x130cm (30"x51")	0.13 kg (.29 lb)
GPSBII Z 72 x 100[ii]	72x100cm (28"x39")	0.12 kg (.26 lb)
GPSBII Z 50 x 80[iii]	50x80cm (20"x31")	0.06 kg (.13 lb)
GPSBII Z - XL [iv]	75x130cm (30"x43")	0.15 kg (.33 lb)
GPSBI B 65 x 110-L[v]	65x110cm (29.5"x39")	0.10 kg (.22 lb)

[i] For est. max 70 kg of coffee beans or paddy, 80 kg of wheat or corn
[ii] Same
[iii] For est. 25-30 kg
[iv] Can accomodate up to 90-100 kg of grain as common in some places in Africa
[v] Accomodates 50 kg of wheat or corn

Typical Values :

Property	Method	Values	Units
Thickness	IS 2508	0.78	µ
Weight	IS 2508	73.00	gm/m^2
Tensile Strength MD TD	 ASTM D-882 ASTM D-882	 240.00 205.00	 kg/cm^2 kg/cm2
Elongation MD	 ASTM D-882	 475.00	 %

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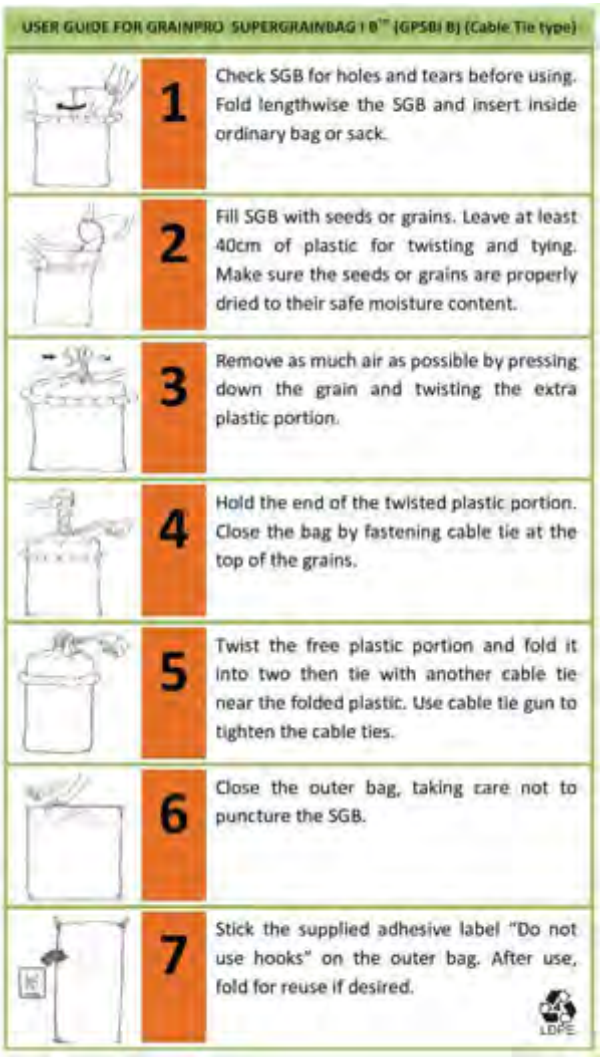
TD	ASTM D-882	525.00	%
Impact F50	ASTM D-1709	160.00	g
C.O.F. InXIn OutXOut	 ASTM D-1894 ASTM D-1894	 0.15 0.20	 film/film film/film
C.O.F. Dart size: 38.1 mm	ASTM D-1894	130.00	gf
Oxygen permeability (23°C, Dry)	ASTM D-1434	4.28	cc/m²/day
WVTR (Water Vapor) 38°C, 90% rh	ASTM E-96	2.14	g/m²/day



Already used in Uganda, but not primarily for coffee.

Region	Country:	Commodities:
EAST AFRICA	CONGO (DR)	Maize, rice
	ERITREA	Maize, wheat
	KENYA	Maize, sorghum, millet, teff
	RWANDA	Maize, seeds, sorghum, beans
	SOMALIA	Cement Mix
	SUDAN	Maize
	UGANDA	Maize, wheat

Distributors in Uganda:

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Submitted for publication, Roast Magazine, July/August 2008:

KEEPING IT REAL: STORING & PRESERVING GREEN COFFEE, PART 2 OF 2.
ROAST MAGAZINE. 2008; July/August: 31-38.

By R. Luke Harris, PhD, A. Miller*

Document #: SL2350LH0608-2

IMAGINE THIS… You cup two superb coffees at origin, on two different continents, and both coffees score in the mid-90s. You purchase lots of both green coffees and 9 weeks later they are unloaded into your warehouse. One green coffee is packed in standard jute bags and the other arrives in vacuum-packed bricks. At the cupping table, the coffee from the jute bags is still good, but it has a hint of gasoline and loses 8 points, cupping out in the high 80s. But the vacuum-packed coffee tastes as it did at origin, still in the mid-90s!

A few months ago, motivated by similar experiences, we initiated some informal investigations into improved methods for preserving green coffee quality, as described in the previous issue of Roast (May/June 2008). Specifically, we wanted see if we could minimize the impact on quality—as evaluated by cupping scores and green coffee moisture contents—of environmental variables during long-distance transportation and long-term warehouse storage. Some of these variables include temperature, relative humidity, and volatile chemicals such as gasolines that are sometimes loaded near coffee containers on marine transport ships.

WHAT SORT OF SCIENCE CAN BE HELPFUL TO IMPORTERS AND ROASTERS?

Perhaps unfortunately, much of the attention on coffee quality science over the past two decades has focused on the identification of single chemicals or small groups of compounds that lend this flavor or that aroma to the brewed cup. As recently as this year's SCAA 2008 annual conference in Minneapolis, when we told people we were conducting experiments on coffee quality the most common response was, "Have you identified any new chemicals?" Tremendous progress has been made since the 1950s in identifying over 300 volatile compounds in green coffee and over 800 flavor components in roasted coffee[3]. However, the reality is that we are still a long, long way from having a machine that can, in a matter of seconds or minutes, analyze a handful of green beans and deliver a cupping score similar to what you get at your table.

A good example of this is trigonelline, a compound first isolated from Arabica coffee in 1909 and studied in depth during the intervening decades[3]. Interestingly, although trigonelline is known to be a bittering agent on its own, higher levels of trigonelline in *green* Arabica correspond to a much higher *brewed* cup quality, and this is because trigonelline is broken down during roasting into numerous other chemicals[2,3]. So, scientific studies aimed at identifying specific compounds or groups of similar chemicals in green and roasted coffees, although they are interesting, are not likely to provide practical applications for roasters and importers in the immediate future.

It is the gap between objective, quantitative measurements and subjective, qualitative opinions that we are hoping to bridge with our preliminary experiments. In other words, we want to test coffees shipped and stored in different ways and turn our cupping scores into semi-quantitative evaluations of the transportation and packaging methods

Revolution in Green Coffee Storage

by Rolando Chacon Araya[1] and Philippe Villers[2]

(Submitted for publication to "Tea & Coffee Trade Journal")

Introduction

A recent evaluation of hermetic storage for green coffee beans was completed in Costa Rica by Icafe (Coffee Institute of Costa Rica) in December 2009, which produced similar results to the trial performed in 2008 at the Neumann Kaffee Gruppe in Costa Rica. As described in this article, these trials provided further validation as to the reasons why long-term hermetic storage of coffee, first used in 2001 at Monte de Oro Co-Op in Costa Rica, has become a widely accepted trend in the industry.

Safe storage of up to 1-year using flexible hermetic containers, for green or parchment coffee is currently used in some 13 countries. Hermetic storage is currently used by growers, processors, traders, importers and roasters in Brazil, Colombia, Costa Rica, Dominican Republic, Guatemala, El Salvador, Ethiopia, Holland, Indonesia, Jamaica, Kenya, Peru, and the US (including Hawaii and Puerto Rico).

What is the role of hermetic storage in storage of coffee?

There are three important challenges that must be overcome in storing high quality coffee whether in green or parchment state:

1. First, since coffee harvests, unlike coffee demand, do not occur throughout the year, how to provide safe storage on the farm or at the processor for periods of up to a year prior to shipment/sale without loss of quality?

2. Second, how to maintain the "quality" in quality coffee when transporting coffee from the country of origin to the country of consumption? How to avoid the all-too-frequent deterioration in color, flavor, aroma and body of the brew during transport due to either cross contamination on shipboard, in the warehouse, or exposure to high relative humidity in transit?

3. Third, how can the importer or roaster who buys coffee in batches and therefore needs to store it for months, preserve quality before selling or roasting? The objective of a proper storage is to maintain the characteristics of quality and weight of the grain after harvest and later milling. This means protecting the grain from the weather, fungi and other microorganisms, from moisture, high and destructive temperature variations, insects, rodents and birds, foul odors and other contaminating agents. This also means how to inhibit increases in the growth of Ochratoxins produced in the presence of high humidity and normal oxygen levels. It is also getting away from the need to use pesticides and fumigants in storage with their many problems.

Findings of Icafe

Icafe conducted a 5-month study of green coffee stored between June and December 2009. Icafe is Costa Rica's government-chartered, non-profit organization tasked with servicing and policing the coffee industry in that country and was founded in 1933.

In Costa Rica there is great diversity of coffee storage installations, ranging from piles of completely unprotected green or parchment coffee in jute or polypropylene bags, to bulk storage in non-hermetic wood or metal silos of many shapes, sizes and types of construction. However, an increasing number of growers and processors are using hermetic storage either in airtight PVC Cocoons™ made from a special grade of 0.83mm PVC, (Figure 1b) or coextruded SuperGrainbags™ liners (Figure 1c) of 60kg capacity inside a conventional bag, or SuperGrainbags-HC™ of 1 tonne capacity (Figure 1a).

The Application of Desiccant Dehumidification to Coffee Processing

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SUMMARY

Desiccants are hydrophilic substances, which have traditionally been used to remove moisture from the atmosphere, thereby reducing relative humidity. The technology has been widely used in controlling humidity of coffee in storage. On observation of a Bry-Air compact industrial desiccant dehumidifier, the concept of applying the technology to the coffee drying process was derived.

Drying conditions, primarily temperature can have critical impact on the volatile component of coffee and by extension, the quality of the beans It is generally agreed that the lower the drying temperature the better the quality of the green beans. The dehumidifier operates at an average temperature of 36^{o}C and depending on the size can remove moisture/water at a rate of several tons per hour.

Dried air at a temperature of 36^{o}C, generated by the desiccant dehumidifier was passed through coffee in a metal box, stacked with trays of wet coffee to dry the coffee. Three samples of parchment coffee were dried from approximately 50% moisture to 12% moisture in this manner and the drying time, weight, appearance and cup quality compared with samples of the same batch of coffee that was dried mechanically and by sun. The results showed that:

- Desiccant drying is faster.
- Desiccant dried coffee has more weight than mechanically dried coffee at the same percentage moisture.
- Desiccant dried coffee has better colour and cup quality.

The results of this research are preliminary but very encouraging and could bring great benefits to the cost and quality of coffee processing.

IPRO 333

Solar Coffee Dryer

IPRO 333