GCQRI Research Planning Workshop

Working Document

GCQRI Research Planning Committee

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April 4-5 Salva Negra, Nicaragua

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GCQRI Research Planning: Committee Working Document

The object of this paper is to lay out a framework to build the GCQRI 5 year Strategic Research Plan and to begin that plan's elaboration. In order to do so, we are using the research themes, direction and guidance taken directly from our industry and research participants at the GCQRI Texas congress as a starting place.

General research planning philosophy

The overall philosophy of the first 5 years of GCQRI research program, as expressed by participants at the Texas GCQRI Congress, will be to focus on 'low hanging fruit' in the short and medium terms and to prepare the foundation to reach the higher hanging fruits in the long term. This philosophy keeps us focused on delivering impactful results on supplies and quality of specialty coffees in the short term, and at the same time allows the GCQRI to lay the groundwork for transformational research impacts in the longer term.

Research mandates:

Within the context of 'lower fruit picking', the following mandates or research targets that were articulated by industry, (our industry marching orders) will guide us in the development and formulation of research projects. They are summarized in the 6 bullets below which mandate that GCQRI projects must be able to:

- Increase supplies of quality coffees available for the specialty coffee market
- Increase quality and quality differentiation potentialof specialty coffees
- Increase practical, industry-desired scientific knowledge on coffee and cup quality
- Increase producer revenue and improve their livelihoods
- Be environmentally sound and positive
- Sustain long-term supplies of quality coffees

GCQRI research projects must be able to show how the proposed research will impact these criteria. They will be used as a sort of litmus test for prioritizing the research that comes from this planning session.

Research Project Dynamics and Structure:

In addition to meeting the above research mandates and focusing on fast-impact, low hanging fruits, the GCQRI research program will be structured in a business-like, results-oriented manner. Research projects will be categorized and arranged by:

1) Project expected results on SUPPLY of quality coffees or QUALITY per se;
2) Project time estimated to deliver the expected results (short, mid, long), and
3) Project ability to impact other industry mandates as stated above.

Following this logic, the main projects are listed in the following tables by Supply and Quality, then by time required to execute and then by type of research. Each project is then described individually in a one-page format. This approach and these projects will be the main discussion focus at this workshop. The projects have not been overly elaborated at this point since it is your job at this workshop to agree on the projects, including themes that may not be present, prioritize them and suggest likely lead and host research institutions for their execution. Afterwards, we will elaborate the projects as RFPs for closed bidding.

#	Project Description	Supply target (tons/year)	Financial resources required	Ability to enhance current quality	Ability to produce new and useful scientific knowledge	Ability to Increase producer revenue	Environmental Footprint
Projects aimed at increasing supply of quality coffees **While preserving or increasing quality**							
S1.0 S1.1	Promotion, conception and implementation of coffee development projects in challenged origin countries	Cumulative total of development projects in tons/per	GCQRI-leveraged activity: no cost to industry.	Moderate to High	Moderate	High	Neutral
S1.2	Sudan Coffee Development component of USAID Project	Starting in 2015: 5,000t	Buy-in at $150K/year	High	High	High	Positive
S1.3	Indonesia Coffee R&D component of USAID project	Starting in 2015: 20,000t	Bidding stage	Moderate	Moderate	High	Positive
	South Africa Arabica coffee development project: Howard Buffet	Unknown	Buy-in at $50K in 2011 for prelim trial	High	Low	High	Neutral
S2.0 S2.1	**Accelerated technology transfer projects and GAP diffusion:**	2-5% annual increases in target countries	High but can be shared with other donors	High	Low	High	Neutral
S2.1	**Enhancing modern varieties diffusion capacities**	Adoption of new varieties: 10% Increase in volumes at 5%	Moderate	High	High	High	Moderate
S2.2	[Multi location variety trials](#) and Farmer demonstration		Moderate	High	Moderate	High	Neutral
S3.1	Development of high yielding pest and disease resistant Germplasm and varieties: CBD, Nematodes, CBB, Rust...	10%-25% increases in supply volumes	High	High	High	High	Positive
S3.2	The determination of physiological and genetic mechanisms to avoid climate effects on yield and quality	Prevents GW arabica supply disaster	High	High	High	High	Highly positive
#	Project Description	Supply target (tons/year)	Financial resources required	Ability to enhance current quality	Ability to produce new and useful scientific	Ability to Increase producer	Environmental Footprint

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#	Project Description	Supply target (tons/year)	Financial resources required	Ability to enhance current quality	Ability to produce new and useful scientific knowledge	Ability to Increase producer revenue	Environmental Footprint
S4.1	Baseline monitoring matrix for arabica coffee production and supply trends	No direct effect	Low	N/A	High	N/A	N/A
S4.2	Varietal Baseline Study	No direct effect	Low	High	High	N/A	N/A
S4.3/ Q1.4	Germplasm screening and development for quality, disease and climate-change tolerance traits	No direct effect	Moderate	High	High	N/A	N/A

Projects aimed at increasing supply of quality coffees While preserving or increasing quality

Projects aimed at increasing quality of specialty coffees While preserving or increasing productivity

#	Project description	Ability to increase current quality levels	Financial resources required	Ability to maintain or increase productivity	Ability to produce new and useful scientific knowledge	Ability to increase producer revenue	Environmental footprint
Q1.1	Effects of agronomic, geographic and processing factors on coffee cup quality	High	Moderate	High	Very high	Moderate to high	Neutral
Q1.2	The effect of coffee production systems on coffee cup quality and on environmental footprint	High	Moderate	High	Very high	Moderate	High
Q1.3	Effect of specific micro-organisms impacting quality through fermentation	Moderate	Moderate	Low	High	Moderate	Neutral
Q1.4	Development of Next-Gen sensory evaluation methods	High	Moderate to High	Low	High	Low	Neutral
Q2.1	Main factors impacting green coffee degradation during storage and transport	Moderate	Moderate	Low	High	Low to moderate	Neutral

#	Project description	Ability to increase current quality levels	Financial resources required	Ability to maintain or increase productivity	Ability to produce new and useful scientific knowledge	Ability to increase producer revenue	Environmental footprint
Q2.2	Elimination of coffee quality defects: e.g. Potato taste	High	Low to moderate	Moderate	Moderate	Low to moderate	Neutral
Q2.3	Coffee NIRS database	N/A	Moderate	N/A	Very high	Low	Neutral
Q2.4	Appellation Development and causal factors explain major market desirable taste attributes	High	Moderate	Neutral	High	High	Neutral
Q3.1	Main green coffee candidate molecules strongly impacting quality	Very high	Moderate to high	N/A	Very high	Low	Neutral
Q4.1 S4.3	Germplasm screening and development for quality, disease and climate-change tolerance traits	Very high	Moderate	High	Moderate	High	Very positive
Q4.2	A wiki-coffee quality information reference platform	N/A	Low	N/A	Very high		N/A

Project Area S1.0: Promotion, conception and implementation of coffee development projects in challenged origin countries

Problem / Background:
Some important arabica producing countries are just recovering from several years or even decades of political disorder like the Democratic Republic of Congo, Angola or Southern Sudan. Other countries like Thailand, Laos and China are brand new origins. Finally, there are many current Arabica origins that are challenged. All of them represent a great source rapid supply impact for the market. In these countries, coffee is a known socio-economic motor for rural reconstruction, social reinsertion, and economic development.

As such, the GCQRI will work at government, donor, foundation and NGO levels to promote, conceive and implement coffee development projects or respond to requests for proposals to do the same.   The GCQRI is a network of coffee professionals from industry, origin, marketing, science, business, and development. We therefore possess the ideal skill-set and platform to increase coffee supplies and quality through the execution development projects that may be advertised for open bidding by other governments, the World Bank, B&M Gates Foundation, USAID, and many more.
This project has special merit in that it costs the specialty coffee industry very little but has huge potential to affect supplies short and mid-term. In addition, it provides the industry with another platform to positively interface with supply countries since it will concomitantly build the capacity of those countries in all links along the value chain.

Objectives
Increase volumes of quality coffee through optimal use of modern coffee technologies and technical assistance know-how to ignite or re-boost coffee production in selected countries.

Activities
Develop solicited and non-solicited proposals to capitalize on current and future specialty coffee market opportunities through the development of vibrant quality coffee sectors in post-conflict, challenged, and new coffee origins.

Expected results / Deliverables
New and new-old origin countries producing increasing volumes of specialty coffee.
500,000 sacks per year starting in 2015 and increasing annually.

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Project S1.1: South Sudan coffee development component of the Borlaug-led John Garang Memorial Agricultural University Capacity Enhancing Project

Problem / Background:
The Borlaug Institute has been working for a couple of years with the new South Sudan government and with USAID to provide assistance to build the capacity of South Sudan's agricultural institutions in a hands-on way. There are very few economically viable agricultural sectors in South Sudan today yet the country is huge and has great potential. In order to grow the South Sudan's rural economy, income revenue generating projects must be implemented in complete partnership with Government, the NGOs and the private sector in order to have an impact. The project begins in May this year and will go on for 5 years.

Objectives
To assist the Government of South Sudan transform the country into an important arabica producing country over the next 20 years.

Activities
-Organize Germplasm collection expeditions into the Boma Plateau and Imatong Forests of South Sudan with John Garang students and taxonomically categorize and assess the new accessions for agronomic and quality characters.

-Assist local populations in Boma and especially in the Imatong form coffee cooperatives and begin to produce high quality arabica coffees to generate income.

Deliverable: New arabica origin with great potential for expansion.

Target: 50,000 sacks per year starting in 2015 and increasing annually.

Other relevant information: Southern Sudan project on coffee development currently in the works as a buy-in to the GCQRI. Starting May 2011

Project S1.2: Indonesia Coffee Development component of the USAID AMARTA project RFP.

Problem / Background:

Texas A&M and the Borlaug Institute have a long history working in Indonesia in many different areas and sectors. We have recently partnered with Winrock International on their bid for the AMARTA project to provide the coffee development services.

Objectives

Increase volumes of quality coffee through optimal use of modern coffee technologies and technical assistance know-how boost coffee production in selected countries.

Activities

Technology transfer, training in coffee business skills, CWS design and management, credit and micro-credit, and quality assessment.

Expected results / Deliverables

Greater supplies of quality coffee from Indonesia.

Target: 100,000 more sacks per year starting in 2015 and increasing annually.

Project S1.3: South African coffee development initiative.
Back to S matrix
Back to Q matrix

Problem / Background:
South Africa attempted to build an arabica coffee sector twenty years ago without great success. Most of the constraints were due to the economics of arabica coffee in the late nineties. They were doing the right thing at the wrong time. Now, there is new interest in coffee production as small holders search for higher value, income generating activities and coffee prices are very attractive and look like they'll be high over the long term.

The Borlaug Institute has taken stewardship of the 5,000 hectare Howard Buffet Ukulima Farm in South Africa. The farm and excellent infrastructure will play an increasingly important role in research and training in Agriculture Sciences for the Southern African region. With an altitude of 1,300m, loamy soils, and protection from frosts, the Borlaug team has partnered with the GCQRI to test new F1 hybrids and other newer, higher quality, disease resistant materials at small commercial scale on the Ukulima farm.

Objectives
Assess the performance of new hybrids and varieties, inputs, processing and storage technologies on a small commercial scale. Depending on results after 2-3 years, the variety, agronomy practices and processing methods could be ramped up on the farm and extended throughout the large South African region around Johannesburg.

Activities
Hybrid and variety trials on small commercial scale. Testing of fertilizers and other inputs. Assessment of processing equipment and methods.

Expected results / Deliverables
Deliverable: A new, old origin with great production potential.

Target: 1,000 sacks in 2015 and increasing annually.

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Project Area S2.0: Accelerated technology transfer projects including farm and processing business management skills enhancement
Back to S matrix
Back to Q matrix

Problem / Background:
In many arabica producing countries, productivity is below 500 Kg / Ha, which is barely economically sustainable for coffee growers. Many technologies and agricultural practices that increase yields and or quality remain on the shelves of libraries and in offices in Ministries and Research institutes. Others are well known simple agricultural practices that producers many times find laborious without obvious and quick pay back and therefore are reluctant to do them. Finally, many technologies are known by producers to increase yields, quality and income but access to the technology is lacking, e.g. fertilizers, new varieties, IPM strategies....Some modern and directly transferable technologies might impact drastically the productivity. Training sessions would accompany technology transfer. This project is quite generic but might be applied according to different situations. The project would be tailored to the country.

Objectives
Increase volumes of quality coffee and/or quality of volumes of coffee through optimal use of modern coffee technologies and technical assistance know-how to ignite or re-boost coffee production in selected countries.

Activities
Develop solicited and non-solicited proposals to capitalize on current and future specialty coffee market opportunities through the development of vibrant quality coffee sectors in post-conflict, challenged, and new coffee origins. Activities may include:
- Fertilizer research, development and distribution
- Wet processing technologies
- Good Agricultural Practices: proper pruning, mulching, IPM, picking, transporting, etc.

- Communication of GAPs and technologies
   - Radio
   - Technical bulletins
   - Demonstration plots
   - Farmer field days
- Business education for cooperatives and farmer groups
- Development of incentive programs where applicable

Expected results / Deliverables
New and new-old origin countries producing increasing volumes of specialty coffee.

Target: 500,000 sacs per year starting in 2015 and increasing annually.

Other relevant information: These projects could be funded by outside donors like USAID, Gates, etc., or by country governments using IMF funds, and/or directly by GCQRI industry funds.

Project S2.1: Enhancing modern variety diffusion capacity
Back to S matrix
Back to Q matrix

Problem / Background:
Although there are many newer, modern varieties with excellent disease and productivity, and some with good quality traits as well, there is very little capacity in most arabica producing countries to get those varieties into the hands of the producer. This is a huge global production constraint for fine arabica coffees.

Objectives:
Develop a performing and professional "seed" sector where by producers have access to the most modern varieties, ensuring genetic conformity, physiological and phytosanitary status of acquired plants.

Activities:
Assist governments work with private and NGO sectors to ensure the establishment of an economically viable, mass production capacity either through seeds or in-vitro-plants of the latest varieties. Depending on the target country, activities could entail:
- Simple technology transfer on setting up seed multiplication farms and services
- Advice and training in the area of setting up in-vitro F1 plantlet multiplication and diffusion centers
- Training of key country actors in the seed sector or coffee boards, ministries, or private platforms
- Multi-location variety trials with new, diverse genetic origins, current varieties and new F1 hybrids
- Demonstration farms showing farmers new variety performance next to their current variety performance

Expected results / Deliverables:
The overall access of producers to latest varieties is increased, and in turn favors productivity and cost reduction in order to increase the producers revenue
The specialty coffee volume is increased as a result of the use of modern varieties.

Deliverable : 5 new productions laboratory over different continents
Improve 10 % the use of improved varieties within 5 years

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Project S2.2: Installation of an International Multi-location trial & Farmer demonstration plots
Back to S matrix
Back to Q matrix

Problem / Background:
A common tool used in other commodities to assess the performance of a variety compared to local material and other new materials from around the world is the "International and Regional Multi-location Variety Trial". This tool allows scientists, privates, government agencies and producers to assess the performance of a given set of varieties in great array of different environmental conditions. In doing so, it allows that country's office that is responsible for coffee variety diffusion an opportunity to assess new genetic material compared to their current varieties to make better informed decisions on what varieties they should be multiplying and diffusing. It is also a great too to examine new material for their tolerance to climate change and global warming.

Again, we can kill many birds with one stone by choosing locations experiencing difficulties for various diseases, insect pests, farming systems, geography, etc.. Finally, cup quality will also be assessed by variety across environments using new, next-gen standard sensory methods which will advance understanding of 'quality' and at the same time provide key data to producer organizations, governments and private seed companies.

The GCQRI Multi-location Variety Trial project is a very basic fundamental low hanging fruit project because:
- It sets the very basis of a great range of studies: heat tolerance, disease resistance, genetic x environment interactions for quality, etc...
- It provides invaluable design for further physiological seed study
- Beyond research issues, it has proven to be a fantastic scientific "team building" tool in multi-partner projects

Objectives:
To provide important 'variety intelligence' to producers and variety decision-makers on important characteristics like disease resistance, yield, maturity, cup quality and climate change of newer varieties compared to their current 'stable' of varieties.
To advance scientific knowledge on the interaction of the Genotype (variety) with the Environment where the environment will encompass all common production and quality constraints. This knowledge can then be used to breed better, higher yielding, higher quality, pest and heat tolerant varieties for the 'next generation' of genetic material

Activities:
Identify the set of varieties to evaluate in the multi-location trial
Identify the locations: continent / countries / regions and corresponding partners
Prepare vegetal material and install the trial in each location and monitor establishment and progress.

Expected results / Deliverables: International Multi-location variety trial data and analyses on annual basis. Solidification of GCQRI research network. Accelerated improved variety adoption and diffusion.

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Project S3.1: Development of high yielding, pest and disease resistant germplasm and varieties: CBD, Nematodes, CBB, Rust…
Back to S matrix
Back to Q matrix

Problem / Background:

Most of the cultivated varieties around the coffee production world are old, low yielding, and of mediocre quality. They are not ready to tolerate anticipated climate change and new disease and insect pressures. A new generation of F1 hybrids is available. Selected in Mesoamerica, these varieties should be validated in other continents (See S3.2). Given that the new, modern varieties, including the F1 hybrids were created between 5 and 20 years ago, in order to protect the supplies of arabica in the long term from other climatic and biologic disasters, a dynamic of continuous genetic progress must be initiated in order to have fresh, newer and better genetic material ready for the new wave varieties in the coming decades.

For this to happen, coordinated breeding efforts must be organized. The first step is of course germplasm screening addressed in project S4.3. Once new and desirable genetic material has been identified from the germplasm screening, those traits need to be evaluated for their most optimum utilization. It is unlikely that a 'wild species' will be able to perform on its own, and therefore in order for breeding programs to use the materials, it is often necessary to transfer the desirable genes identified to adapted, high quality varieties that could be used rapidly in accelerated breeding programs. This operation of pre-breeding of improved populations shall be shared among world breeders. Each country / company making its own final breeding according to specific local or industrial constraints.

Objectives

Set-up a pre-breeding world community exchanging pre-competitive information and materials mainly based on disease resistance.

Activities
- Set-up a common code of conduct regarding pre-breeding populations' evaluation, information and vegetal material exchange.
- Set-up an operational coffee pre-breeding international body

Additional information: These kinds of structures are common in different species. Benchmarking would be an important activity of this project.

Expected results / Deliverables
- Find a consensus among the coffee breeding world about common pre-breeding activities
- Have an operational coffee pre-breeding international body.

Contribute to a 10-25 % increase in volume in the coming 10-20 years

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Project S3.2: The determination of physiological and genetic mechanisms to avoid climate effects on yield and quality
Back to S matrix
Back to Q matrix

Problem / Background:
The probability of temperature increases between 1-3 degrees Celsius in the tropics over the next twenty years is high and significant (IPPC, 2007). The effects of this climate change on arabica coffee production has been estimated to be as much as 10% of total production in 20 years (Laderach 2008) and could vary between 5 and 50%. These production losses will severely impact supplies of arabica coffee and the livelihoods of over 50 million coffee farm families who grow it. A primary mitigating approach to climate disaster is through the development of heat tolerant, high quality varieties and/or F1 hybrids. And in order to breed for the 'heat tolerance' we must first understand the physiological mechanisms so we can screen for a compound and/or pathway.

Objectives:
Identify the key metabolic pathways governing coffee response to extreme temperatures and severe drought.
In particular, find out key enzymes and corresponding genes or set of genes.

Activities:
- Perform some basic studies (see Q3.1) taking advantage of results obtained on model plants such as Arabidopsis, rice or maize
- Take advantage of multi-local trials (see 4.3) to test physiological and genetic hypothesis
- Set up one to three coffee reference excellence centers for these studies

Expected results / Deliverables
- Get solid physiological and genetic basis for genetic improvement towards abiotic stresses and quality
- Identify target metabolic pathways to be studied.

Contribute to a 10-25 % increase in volume in the coming 10-20 years specially in climate change impacted areas.

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Project S4.1: Baseline monitoring matrix for arabica coffee production and supply trends
Back to S matrix
Back to Q matrix

Problem / Background:

The coffee producing world is very diverse. In order to assess the possible impact of projects and/or orientate the choice of the geographic location of projects, a decision making tool is needing as far as the potential of specialty coffee increase.

Objectives:

Develop a database for all arabica producing countries that allows GCQRI management, BOD, industry and researchers to estimate research impact on supplies, quality, and on producers. It would also assist us in determining 2nd wave research priorities and in prioritizing research themes and projects. This tool will provide a wealth of information to research and industry. Some variables measured would include:

1. production
2. yield
3. varieties grown/estimate of coverage
4. available land for arabica development
5. host country gov plans for coffee
6. coffee farming systems and areas
7. coffee development project mandates
8. research institution capabilities/assessment
9. extension capabilities/assessment
10. fertilizer use, pesticide use: type, volumes

Activities

This project will require that the implementing partner have a strong network of coffee professionals in many, if not most, arabica producing countries to reduce travel costs and increase 'ground truth' for data. For example, importing companies generally know a lot about the coffee sector in some/most coffee origins. The implementer would methodically work country by country to collect the baseline data. The strength and power of this database will be proportional to the' intelligence gathering ability' of the implementing partner.

Expected results / Deliverables

The matrix is available and serves as a compass for GCQRI decision makings on fund allocation.

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Project S4.2: Varietal Baseline Study
Back to S matrix
Back to Q matrix

Problem / Background:

Apart from few coffee producing countries, little is known about the kind of varieties that are grown, in what regions of the country, what kind of yield, quality and constraints exists and in what proportions a country's varieties are grown. Also, very little is known on seed distribution channels in the origin countries and what types of genetic material the country has in their 'genetic pipeline'. Without intelligence on this base-level, country specific information, efforts to affect supply and quality via varietal improvement will be slower. This information will allow the GCQRI to tailor varietal improvement efforts to the specific country concerned.

Objectives

Describe the landscape of i) coffee varieties grown in specialty producing countries and ii) the actual distribution channels and their efficiency

Activities

A consultant will use their network to make credible surveys in producing countries.

Expected results / Deliverables

A varietal baseline study is available and helps GCQRI assess the possible impact of breeding and varietal diffusion. GCQRI can make sound decisions and focus on high-impact targeted countries.

Project S4.3 / Q4.1: Germplasm collection screening for quality / Heat tolerance / disease resistance traits
Back to S matrix
Back to Q matrix

Problem / Background:
Any genetic improvement program is based on the available genetic variability. Arabica coffee varieties grown around the world has a very narrow genetic basis. We need to expand and diversify the commercial arabica genetic base. We must find out whether there are existing materials that would bear the positive characteristics we're looking for: specific high quality, heat tolerance, CBD and nematode resistance.

Objectives
Identify among currently unused coffee germplasm reservoir, a set of varieties that might be of interest for quality, heat tolerance or disease resistant traits.

Activities
Identify germplasm field collections well maintained and containing a lot of diverse accessions
Screen these collections for quality / heat tolerance / disease resistance with solid protocols and with use of next-gen sensory evaluation methods.

Expected results / Deliverables
A set of well characterized accessions/varieties proven interesting for Quality / Heat tolerance / Disease resistance is available and ready to be used in breeding programs.

Project Area Q1.1: Effect of agronomic, geographic and post harvest factors on coffee cup quality and environmental blueprint
Back to S matrix
Back to Q matrix

Problem / Background:
Very little peer-reviewed research has been conducted and published on agronomic factors affecting coffee cup quality. On one hand, this is a result of lag-time between the emerging specialty coffee where quality premiums are paid and the ability/interest/capacity of coffee research institutions to organize, build cupping labs, find resources, conceive and execute research on the subject. On the other hand, a major constraint exists even when research institutes have conducted trials on agronomic factors affecting coffee cup quality because current sensory evaluation methods are highly variable and subjective resulting in large statistical errors and many non-significant treatment results in analyses. The GCQRI will pioneer a new wave of coffee quality research to understand and improve quality attributes in coffee through the funding of research on factors affecting coffee cup quality across regions, countries, and different environments including post-harvest factors.

Objective: To study the effect of agronomic, geographic and post-harvest factors on coffee cup quality

Activities: Setting up experiments in a many different countries, using different varieties, soil types, production systems, processing and storage systems.

Expected Result: An accumulation of scientifically valid information on the major factors affecting coffee cup quality and many 'producer field books' on the best agricultural practices available for increasing producer income through increased quality husbandry.

Project Q1.2: The effect of coffee production systems on coffee cup quality and on the environmental footprint
Back to S matrix
Back to Q matrix

Background: As far as coffee agronomy is concerned, there are two main coffee growing systems:
- The intensive system where coffee is grown in full sun, using high inputs, high plant densities, and high performing varieties. This system was conceived in the 1970's and is often associated with the "Catimors" varietal family. Catimors have "Robusta blood" conferring resistance to main diseases but often exhibiting some Robusta taste attributes lowering cup quality. The driving force of this system was productivity.
- The "traditional system", on the other hand, is where coffee is grown under shade, using older, traditional tall varieties and few inputs. This system has overall low productivity but often produces higher quality coffees, and is often said to be more eco-friendly. This system is often also referred as Coffee Agroforestry System (CAS). This system accounts for a great part of total coffee produced.

Factors influencing quality must be studied considering the specificity of both systems. Post-harvest methods shall be applicable to both systems once coffee has been harvested. However, the specific socio-economic environment of each system has to be taken into account to offer optimal solutions.

Objectives
- To determine the major factors contributing to the quality of coffee produced in each of the systems and to further extrapolate to assess each system's environmental footprint

Activities
- Identify 2 to 3 excellence research centers where specific scientific activities would be led to cumulate relevant knowledge (different centers dedicated to GR and CAS systems).
- Implement relevant research about the impact of GAP on quality and environmental blueprint in both GR and CAS systems.

Expected results / Deliverables
- Documents and internet database on GAP and influence on quality / environmental blueprint in both GR and CAS systems
- Training manual based on research findings
- Improve quality and decrease coffee growing environmental blueprint

Note: A Fontagro project led by CATIE and CIRAD is on the way for CAS systems

Project Q1.3: Effect and Identification of specific fermentation micro-organisms positively affecting affect coffee cup quality
Back to S matrix
Back to Q matrix

Problem / Background:

In agro-industries dealing with at least one fermentation step (beer, wine, yogurts…), the micro-flora involved in fermentation is well studied and controlled. Almost nothing is known on micro-flora during coffee fermentation however, a few preliminary studies are quite promising.

Objectives

Validate the hypothesis of the importance of micro-flora composition during coffee fermentation in relation with quality.
Compare different micro-flora in fermentation on the cup quality and identify and describe taste attributes affected

Activities
- Run few straightforward trials to validate the hypothesis of the importance of micro-flora during coffee fermentation.
- Identify micro-flora responsible for changing certain key, market responsive taste attributes

Expected results / Deliverables
- Knowledge on the impact of micro-flora during coffee fermentation is enhanced.
- Recommendations are made to make an optimal use of this knowledge towards quality improvement and diversification.
- Develop a set of important micro-organisms for coffee fermentation and their major influences on specific taste attributes.

Project Q1.4: Next-gen sensory evaluation methods
Back to S matrix
Back to Q matrix

Problem / Background:

An accurate, repeatable and statistically powerful CCQ sensory analysis method/protocol is lacking in the coffee industry and in the coffee research community. To date, most of coffee quality evaluations are based on either sensory evaluation, which is highly variable or chemical evaluations, which are usually not commercially applicable. Conventional chemical and sensory analysis can miss the key _marker_ compounds defining coffee quality.

Objectives

Define and develop a next generation coffee cup quality sensory evaluation method that is precise, rapid and cost-effective method for immediate use in GCQRI research and for long term use by science and industry for CCQ evaluation.

Activities

To date, most of coffee quality evaluations are based on either sensory or chemical evaluations with fewer attempts to synergistically combine the two approaches. As such, this research will focus on the development of a new 'hybrid' approach that will improve the current sensory evaluation of coffee quality using descriptive analyses, an industry sensory expert panel (ISEP) and robust statistical designs and methods and then define and correlate key sensory results to key marker compounds defining coffee quality.

Expected results / Deliverables

A Nextgen sensory evaluation method is available and shared by the industry and R&D players. This method will be used in all quality assessments performed under GCQRI funded research.

Project Q2.1: Main factors impacting coffee degradation during storage and transport
Back to S matrix
Back to Q matrix

Problem / Background:
It is well known that quality can be seriously degraded during shipping and storage as a result of water and oxygen movement in the green bean. Advances in this area of research could result in extended shelf life for specialty coffees through new technologies and practices.

Objectives
- To conduct accelerated scientific investigations into quality loss during shipping and storage through lab simulation
- Identify key seed processes controlling quality degradation and conceive and test mitigating technologies and practices to reduce quality degradation
- Update practical knowledge on coffee storage and transportation to be shared along the coffee chain.

Activities
- Conduct comprehensive bibliographical review highlighting the soundest and most valid results known to date in all seed crops and investigate possibility of using newer methods in coffee
- Run simple and straightforward experiments to validate some strong hypothesis in lab and in situ
- Compile results in a storage and transport good practices manual to be shared along the coffee chain
- Explore potential of nanotechnologies for the conservation of green coffee

Expected results / Deliverables
A storage and transport good practices manual is available and shared along the coffee chain

Project Q2.2: Elimination of coffee quality defects: The potato taste
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Background:

Rwanda, Burundi, and Eastern Congo are all afflicted by a flavor defect causing a putrid raw potato flavor in the cup. This defect is the result of a toxin excreted by a bacterium that enters into the seed during its seed development. It is known that the bacterium enters through any type of opening in the cherry wall. Furthermore, the toxin has recently been identified and confirmed in the green bean. The elimination of this defect would greatly increase the comfort zone for roasting companies seeking defect-free, single origin, specialty coffees for consumer sales. Value lost through this quality defect could be as much as $1M per year in Rwanda alone in some years. Value lost to roasting companies is also important and considerable.

Objective: To significantly reduce frequency of the potato defect in African Great Lake region coffees

Activities:
1) To identify a 'potato pyrazine' signature in the green bean using a method that could be incorporated into dry processing 'light' or 'digital' sorting machinery
2) Identify large enough volumes in samples of 'infected' green beans for comprehensive laboratory signature detection work
3) Identify progressive and high-tech food industry detection-sorting machinery manufacturer
4) Work to refine methodology for commercial scale
5) Support agronomic and production efforts to reduce infection including decreasing insect populations that open cherry walls

Deliverable: Negligible frequency of potato defect in fully washed coffees from African Great Lake region

Other information: Preliminary work has been done in Rwanda through the Iowa State air pollution laboratory and shows great promise. USAID Rwanda has shown interest in supporting continued work on this defect.

Project Q2.3: Development of a coffee NIRS database
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Problem / Background:
The Near Infrared Spectrophotometry is a very powerful tool allowing rapid and cost effective means of evaluating a coffee signature attributes within the universe of known coffees for geographical origin, main quality characteristics…
It is also powerful to measure some basic chemical compounds concentration: caffeine, sugar, lipids, chlorogenic acid…

The usefulness of this tool is dependent on the construction of a solid and representative database of characteristics for different coffees and environments

Objectives
Build a NIRS database within the GCQRI framework and offer the service of providing basic information on a coffee sample on demand.

Activities
A consultant will be in charge of designing and constructing the database.
He will also propose a logistic network for the service.

Expected results / Deliverables
A NIRS platform is available to the coffee chain (and most of all roasters) in order to get rapid and cost effectively relevant basic information on coffee samples.

Project 2.4: Appellation development and identification of causal factors determining taste attributes.
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Background: Geographical indication can leads to higher value-added products through product differentiation based on guaranteed quality; it protects consumers because it provides officially certified information regarding product attributes; and it enhances and preserves the identity and cultural heritage of the region. It also provides a wealth of information and a uniform platform for roasting companies for use in marketing.

Coffee is being increasingly cherished for its diverse and unique taste profiles by connoisseurs and consumers alike. Although light years away from the wine industry, as a beverage, coffee, is remarkably similar to wine and thus well suited for appellation development. It is also through appellation development that research on taste attribute determination can be logically conducted and applied in order to better understand the factors and interactions that produce certain taste attributes. Appellation development also provides a high degree of traceability, back to the farmer, for food safety and quality remuneration purposes. Finally, this research venue will provide detailed information for roasters to use in their marketing campaigns as well as result in increased understanding of underlying causal factors determining coffee's taste attributes. Some of the possible topics to illustrate how this research might be oriented and conducted include:

Objectives:

To develop of appellation models using GIS, descriptive cupping techniques and new sensory techniques

To fund continued work work on the Global Coffee Appellation project

To develop taste attribute geographic boundary determination methods

Activities:

Continue advanced work in Rwanda on appellation development as a private-public project with the USAID SPREAD Project II coffee R&D activities.

Expected result:

Produce Rwandan appellation system for one or more coffees and use methodology in other interested countries.

Project Q3.1: Main green coffee candidate molecules strongly impacting quality
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Problem / Background:
Very little is known about the biochemical basis of coffee quality. However, modern techniques allow the rapid screening of huge amounts of metabolites as either solid or volatile compounds. The identification of key molecules affecting the main market-desirable taste attributes would rapidly accelerate both quality evaluation, standards and green buying methods.

Objectives
To screen major green coffee volatile compounds and correlate them to specific taste attributes.

Activities
Work with industry to determine those flavor attributes important to the market and then identify the set a candidate molecules strongly related to them. Design a simple but powerful method to screen thousands of metabolites for few contrasting coffee qualities. Sort out a set of metabolites (molecules) correlated to coffee quality

Expected results / Deliverables
Knowledge on the biochemical basis of coffee quality is improved
A first set of candidate molecules is available in order to further in depth studies

Project Q4.1/S4.3: Germplasm collection screening for quality / Heat tolerance / disease resistance traits
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Problem / Background:
Any genetic improvement program is based on the available genetic variability. Arabica coffee varieties grown around the world has a very narrow genetic basis. We need to expand and diversify the commercial arabica genetic base. We must find out whether there are existing materials that would bear the positive characteristics we're looking for: specific high quality, heat tolerance, CBD and nematode resistance.

Objectives
Identify among currently unused coffee germplasm reservoir, a set of varieties that might be of interest for quality, heat tolerance or disease resistant traits.

Activities
Identify germplasm field collections well maintained and containing a lot of diverse accessions
Screen these collections for quality / heat tolerance / disease resistance with solid protocols and with use of next-gen sensory evaluation methods.

Expected results / Deliverables
A set of well characterized accessions/varieties proven interesting for Quality / Heat tolerance / Disease resistance is available and ready to be used in breeding programs. Protection of arabica coffee long term supplies through the diversification of commercially available genotypes, populations, varieties, and hybrids.

Project Q4.2: A dynamic and friendly coffee quality research literature review platform
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Problem / Background:
There is a limited amount of research available on subjects concerning coffee quality. At the same time, there are no easily accessible sites that make coffee research results available for industry professionals.

Objectives
Develop an online platform where coffee industry professionals can easily access all past and current research results in coffee.

Activities
Create a 'coffee-pedia' that would work like the Wikipedia using wiki-source code. This 'coffeepedia' would contain references from all research ever conducted on coffee but it would be summarized in layman language for easy access and understanding by the Coffee Industry. Possibilities to make such a resource into an iPhone application would further enhance its use. Possible link with the ICO Coffee Club Network (www.coffeeclubnetwork.com)

Expected results / Deliverables
A dynamic and friendly coffee research literature review platform is available to the coffee industry (and beyond).
Roasters are more aware of the state of the art of coffee research.