



# Simposio “Cacao para la Paz” Mapeo del futuro de investigación del cacao en la Región del Caribe Colombiano

MAYO 17 - 19. BARRANQUILLA, COLOMBIA



## Summary of Presentations and Results from Priorities Survey May 18, 2017

Siela Maximova

# Main Goals of the Meeting

- Research Presentations relevant to Colombia and the Caribbean region.
- Network and get to know each other's work, expertise and future plans.
- Identify the future research priorities Colombia and the Caribbean region.
- Discuss potential collaborative projects relevant to the priorities identified.

# Summary and Conclusions from the Presentations

- Overview Presentations of CfP Partner Institutions Research Programs and Goals
- Cacao Genetic Diversity and Breeding Programs in Colombia
- Cacao Diseases and Resistance
- Issues Related to Production

# Overview Presentations of CfP Partner Institutions Research Programs and Goals

- Opening remarks Santos, Conlon, Granados and Zambrano highlighted that importance of the cacao sector for Colombia and the and the importance for research in the development of the sector
- Overview of CfP activities – Romero

# Overview Presentations of CfP Partner Institutions Research Programs and Goals

- Carlos Munoz for the Consejo: Research topics of importance
  - Selection of genetic material
  - Agronomy
  - Diseases and Pests
  - Fertilization
  - Cadmium mapping

# Overview Presentations of CfP Partner Institutions Research Programs and Goals

10 different research institutions presented overviews on their programs spanning all aspects of research related to

- Genetic diversity
- Breeding and Selection
- Soils Science
- Mapping
- Pest Management
- Agroforestry
- Harvest and Post Harvest Management
- Quality
- Plant propagation (biotech)

# Genetic Diversity and Breeding Programs in Colombia

- **ARS** - Main Goals: Improvement of accuracy of efficiency of conservations an utilization
- Evaluate the collection do more collecting using 96 SNP panel
- There is more genetic diversity that has not been discovered in the Amazon and the Inter Andean regions
- **Corpoica** – Collection consists of about 1000 accessions: in the process of characterization

# Genetic Diversity and Breeding Programs in Colombia

- Starting breeding program cadmium, diseases, quality and compatibility
- Gene discovery for resistance to Phytophthora
- Gene discovery Cadmium uptake gene
- Screening plants for Cadmium uptake
- **Fedecacao**: germplasm collection, evaluating resistance to monilia, released 8 new varieties, collected 27 criollo varieties



# Genetic Diversity and Breeding Programs in Colombia

- MARS: extensive experience in selection and breeding using molecular markers for MAS, GWAS, Genomic Selection for Breeding
- Genomic Selection for Breeding for Resistance

# Cacao Diseases and Resistance

## **ARS:**

- All major cacao pathogens are sequenced
- The center for diversity of *Monilia* is in the Magdalena valley
- Exploring the divergences in biology of *P. megakarya* and *P. palmivora*
- Pathogens are always changing

# Cacao Diseases and Resistance

## **Corpoica:**

- Objective to identify strategies to control all diseases (7 different projects with multiple strategies)
- Genetic diversity of Monilia
- Screening for plant resistance to Monilia
- Strategy for controlling the root insect Carmenta

# Cacao Diseases and Resistance

## **Penn State:**

- Genomic Approach to study plant immunity
- Large scale discovery of genes for disease resistance

# Issues Related to Production

## **ARS:**

- Cadmium regulations in EU are changing in 2019
- Urgent need to reduce cadmium accumulation in cacao beans
- Cadmium cycle in the soil: sources, accumulation, and mobility, bioavailability
- Cacao genotypes vary in their ability to accumulate cadmium
- Need of multidisciplinary team to combat the problem
- Main strategies: screening genotypes and accessing soil, reduction of bioavailability , need to look at all heavy metals

# Issues Related to Production

## **Corpoica:**

- Large team equipment availability working on cadmium
- Working on cadmium mapping
- Screening for germplasm
- Strategies for blocking uptake

# Summary and Conclusions of the Priorities Survey

## **National University**

- Research on cadmium in Nilo and Yacopi
- Cadmium accumulation from different plant tissues
- Constructing cadmium maps

## **UPRA**

- Main mapping organization in Colombia
- Creating various of maps assessing suitability to grow cacao on 1:100 000 scale
- Next steps would be: finer detail mapping

# Survey Results

<b>SPANISH</b>	<b>33</b>
<b>ENGLISH</b>	<b>3</b>
<b>TOTAL SOURVEYS</b>	<b>36</b>

<b>Priorities in Colombia</b>	<b>PRIORITIES</b>				<b>TOTAL WEIGHTED SCORE</b>
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
Cadmium & Heavy Metals in General - Mitigation, Remediation, abiotic stress	12	8	4	2	<b>82</b>
Productivity (sustainability, best practices, recommendations, postharvest, site specificites, agronomics)	9	4	4	2	<b>58</b>
Soils - Water (Irrigation, Fertilization, Nutrients, Characterization, Treatment, Evaluation)	8	2	3	3	<b>47</b>
Genetic Materials (Germoplasm Collection, Varieties, Breeding, improvement)	9	1	2	3	<b>46</b>
Tech Transfer (Innovation, tech package development, Best Practices)	3	3			<b>21</b>
Resistance to diseases	2	2	3	1	<b>21</b>
Mapping (Scale, accuracy, risk, genetic varieties)		4	4	1	<b>21</b>
Agroforestry Systems		3	2		<b>13</b>
Inventories - Germoplasm collections	2	1			<b>11</b>
Market (development, processes, networking, business model)		1	1	1	<b>6</b>
Climate (Variability, )		1			<b>3</b>
Pruning		1			<b>3</b>
Post Harvest			1		<b>2</b>
Sensory Profile			1		<b>2</b>



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Priorities in the Caribbean region of Colombia	PRIORITIES				TOTAL WEIGHTED SCORE
	1	2	3	4	
Soils - Water (Irrigation, Fertilization, Nutrients, Characterization, Treatment, Evaluation)	10	5	3	3	<b>64</b>
Genetic Materials (Germoplasm Collection, Varieties - drought-resistance, Breeding, improvement)	7	8	1	6	<b>60</b>
Productivity (sustainability, best practices, recommendations, postharvest, site specificites, agronomics)	4	6	8	4	<b>54</b>
Cadmium & Heavy Metals in General - Mitigation, Remediation, abiotic stress	4		3	1	<b>23</b>
Tech Transfer (Innovation, tech package development, Best Practices)	1	3	3	1	<b>20</b>
Farmers (Support, training, funding, profitability, training young farmers, certification, associations)	1	2	4	2	<b>20</b>
Resistance to diseases		3	3	1	<b>16</b>
Market (development, processes, networking, business model)	1	2	2	1	<b>15</b>
Agroforestry Systems (Farm surveys, technical studies, suitability)	2		2		<b>12</b>
Sensory Profile	1		2		<b>8</b>
Irrigation			3		<b>6</b>
Value added (finished product)	1				<b>4</b>

# **Instructions for Small Group Discussions:**

**Mail Goal: Discuss research priorities in more detail within your group.**

**Total time: 20 min**

**Address the following questions:**

- 1. Importance and potential impact of each research topic for Colombia and the Caribbean region.**
- 2. Key challenges to progress for each research topic**
- 3. Existing projects in progress on this topic**

**Take notes, prepare and deliver a short summary of your discussion to entire group**

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# Voting on Priority Areas

- Place one orange sticker next to your top 5 priority areas

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# Cacao for Peace Interdisciplinary Research Seed Grant Program Announcement

Andres Romero,  
USDA-FAS, Washington DC USA

# Team Building Session

- This is a brainstorming session; there is no obligation to commit your participation in the project today or to submit a proposal as a group.
- Organizations and other researchers that are not participating today, in this meeting will be able to apply for the program.

# Team Building Session Rules

## (2 sessions, 20 min each)

- Select a topic and take a place at the table
- Each group needs to address the following questions:
  1. Select a research question to be addressed  
(this could be new projects or an existing project that could be expanded with finding from CfP to bring new inter-institutional collaborations)
  2. Discuss the research objectives and research approach
  3. Discuss potential roles of collaborators  
(The projects should be inter-institutional and interdisciplinary, so you should try to develop ideas and teams that can include a wide diversity of participants and approaches)
- Select a reporter to summarize and report on the discussion
- For the second session, participants can change to new table if interested on a different topic



1. 35 Cadmium  
Cadmio
2. 28 Soil and Water  
Suelos y Agua
3. 24 Genetics  
Genetica
4. 21 Research on Tech Transfer Methods and Technology Adoption  
Investigacion Sobre Metodos de Transferencia Tecnologica y su Adopcion
5. 17 Market Research  
Investigacion de Mercados
6. 11 Disease Control  
Control de Enfermedades
7. 10 Post Harvest for Quality  
Postcosecha Pensando en Calidad
8. 8 Mapping  
Mapeo
9. 8 Integrated Crop Mangement  
Gestion Integrada de Cultivos
10. 2 Agroforestry  
Agrobosque

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# Group Reports

- Cadmium
  - In plants
  - In soils
  - In post-harvest
  - Soil-plant Cd relations
    - How does the Cd cycle effect soil-Cd relations
      - Mapping Cd hot spots in soil
      - Bioremediation (bacteria, fungi, mycorrhizae)
    - Cacao genotypes
      - Molecular basis of differential Cd uptake
    - Cd in chocolate
  - UPRA, National Geo, Fedecacao, National Univ. other univ. Corpoica, National Chocolate Co., CIAT, Casa Luker
  - How to map Cd? Need to focus area of study

# Genetics

- Farmers use old low yielding varieties, are there new clones that will perform well in Caribbean region?
  - Take top 25 new clones and do multi-locational trial in Caribbean region
  - Select 5 best (what is best? Yield, quality)
  - Demonstration trials
  - Deliver best to farmers
- ARS, CIAT, MARS PSU, CORPOICA others

# Soil and Water

- Rapid response soil fertility system
  - Nutrients
  - Cd
  - On the spot analysis and recommendations
  - Cell phones image analysis
  - Fertility diagnosis using photos
  - Ground up data delivery, farmer-farmer dialog to spread the word
  - Soil health program, minimum data set, microorgs, organic carbon content etc.

# Research on Tech Transfer

- Improve adoption of new technologies
  - What to farmers think they need and their motivators
  - Discover main limitations to adoption
  - Public and private institutions
  - Surveys, in main producing areas
  - Systems that are more feasible, less expensive
    - Knowledge networks, producer to producer projects

# Marketing

- How to position Colombia in the world-wide cacao market with specific focus in US?
  - Identify market niches
  - Incentivize consumption in Colombia and US
    - Business agendas
    - Participation in international cacao fairs
    - What niches are there and what cacao can satisfy these niches
    - Promote image of Colombian Cacao
      - Maria del Campo... strengthen this marketing effort
      - Marketing of cacao story
      - Certification of child labor
      - Post conflict era story, added value

# Disease control

- Diversity of cacao diseases
  - Linked to genetics projects
  - Sampling of pathogens and diversity analysis
- Integrated crop management
  - Many good technological packages exist, can we make a unified agreement on best practices?
  - Multilocational trials of ICM packages
  - Demo trials on best ICM packages
  - Once validated, distribute the information



# Post-harvest Issues

- Transportation of wet beans is a problem in SNSM, unfermented or under-fermented beans
  - How to improve?
  - Biochemical and genetic data to develop quantitative model to predict sensory profiles of the cacao
  - Methods to respond to different market niches
  - To reduce toxins produced by fungi (aflotoxins)
  - Developing co-products
  - Coca farmers \$3/da in loco
  - Cacao purchasing strategies to increase to same or better level than for coca

# Mapping

- Not a research issue, but need for planning purposes
- Needs for research sector
  - Cd presence (1:100,000 map of Cd, more detailed in some areas)
  - Biodiversity mapping
  - Disease presence maps
  - Underground water mapping for irrigation
- CORPOICA (lead), Agustin Codazi, IGAC, ICA, Humboldt Inst., MOA, MOE, local Universities and governments, UPRA, IDEAM? PSU Center for Environmental Informatics
- Integrate with new techniques to provide farmers with specific actionable information