Realzamiento de la Seguridad Alimentaria y la Economía con la Agrobiodiversidad Local en México

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Enhancement of Food Security and Economy with Local Agrobiodiversity in Mexico

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With SATREPS

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Mexico

Nopale in the National flag

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Agrobiodiversity in Mexico

- The 5th Mega-biodiversity country
- Origin of crop species such as : Corn, tomato, chili, beans, cacao criollo, nopale, chayote, avocado, amaranthus, flowers, etc.
- Origin of crop production and civilization in Meso-America
- Diversity in indigenous culture and people

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Global Potentials of Mexican Crops

- Support Food security under variable climate changes
- Sustainable uses
- Sharing Mexican Wisdoms with GLULAC
- Uses in other countries such at Japan
- New contribution to Asia and Africa

- Quality commodity export
- New product and industry development
- New plant variety as intellectual property
- New exotic species outside of Mexico

Dragon fruit in Asia

Nopale (Tuna)in CWANA

Amaranthus as healthy pseudo-grain

Chayote (*Sechium edule*) in Asia & Africa

International Paradigms: Drastic Global Changes

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Climate
Politics
Economy
Resources
Ownership
Rights
Conflicts
Life

Unfavorable Changes?

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Climate Change: Unavoidable

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OBVIOUS ON GLOBAL CLIMATES

LESS WATER

LESS VEGETATION

LESS ARABLE AND GRAZING LAND

LESS BIODIVERSITY (Genetic resources)

MORE DISSERTIFICATION?

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How can we make a sustainable agriculture production with food security, economic growth and employment supports?

Do we have the basic resources?

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SATREPS with CNRG

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Science and Technology Research Partnership for Sustainable Development

To envisage their outcomes being applied to the benefit of broader society as well as in the developing country

To cover topics in developing countries for which research and development to resolve an issue is particularly necessary, and for which capacity building of researchers is required

To contribute to the resolution of global issues and scientific and technological progress

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SATREPS requires components of UN Sustainable Development Goals (SDGs) made in 2015

SATREPS with Centro Nacional de Recursos Geneticos (CNRG)

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- Since 2009, GRC UT had initiated collaboration to establish CNRG.
- Consultation and human resources development during 2009–2012 among INIFAP, CNRG, UT and NIAS.
- High segment diplomatic dialogue exchanges by Mexican government and Japanese government as science and technology diplomacy agenda.
- 2012–2018, project implementation by CNRG–INIFAP, UT and NIAS (NARO)

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Purposes

Establishment of diversity evaluation methods and sustainable uses on Mexican genetic resources at CNRG

1. Diversity evaluation, conservation and management in locally important species
2. Conservation methodology
3. General genebank management
4. <u>Enhancing sustainable uses under new paradigm</u>

Main Targte species

1. Mexico origin
2. Food security
3. Importance in culinary culture and economy
4. Re3search experience and availiability of materials in Mexico
5. Put low priority on major crops with global efforts such with CGIAR
6. Under-utilized groups
7. Reproductive and genetic uniqueness (vegetative propagation, perennial, polyploidy etc)
8. Technical difficulty: recultiant

- *Amaranthus* spp.: dioecious
- *Physalis* spp.: self-incomaptibility
- *Opuntia* spp.: Vegetative growth, hard seed, polyploidy
- Cacao Crillo *(Theobroma cacao)*: outcrossing & vegetative
- *Persea americana*: hermaphoredite、outcrossing & vegetative
- *Sechium edule*: outcrossing & vegetative propagation
- *Vanilla* spp.: vegetative propagation
- Potato: model for cryoconservation and management




New generations of researchers and managers

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✓ Cacao?

- ✓ Genetic diversity studies performed in two collections (365 accessions with 11 SSR markers).
- ✓ Identification of cloned materials confirmed by MM.

	n	Na	Ne	*Ho*	*He*	F
TCH	60	6.36	2.69	**0.57**	**0.63**	0.08
TCN	60	5.18	2.27	**0.58**	**0.55**	-0.05
Mean		5.77	2.48	**0.58**	**0.59**	0.01

CRIOLLO

Avocado diversity

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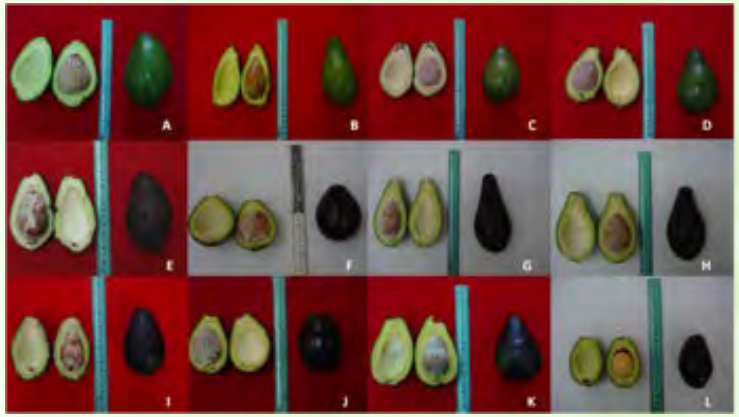
Avocado genetic characterization

- ✓ Genetic diversity studies performed (399 accessions with 28 SSR markers).
- ✓ Two collections were characterized (Uruapan and Celaya).



Colección	N	Na	Ne	I	*Ho*	*He*
Celaya	318	18.9	6.2	2.0	0.59	0.75
Uruapan	81	12.5	5.7	1.8	0.58	0.73

https://www.intechopen.com/chapters/47902

Nuevo Leon collection

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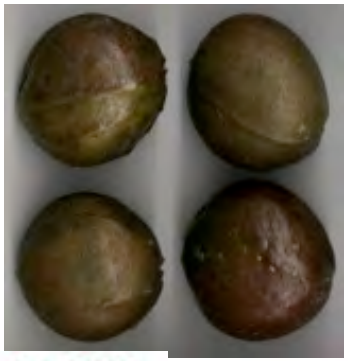

a.1 a.2 a.3 a.4 a.5 a.6 a.7

a.8 a.9 a.10 a.11 a.12

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Cryopreservation of *in vitro* shoot tips of chayote

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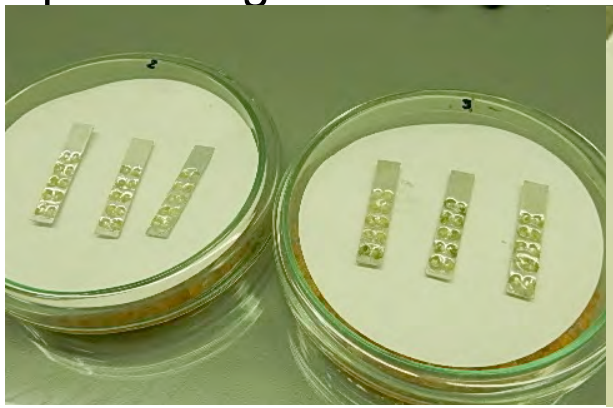
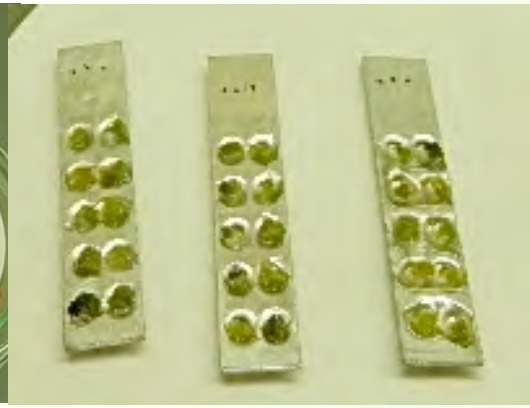
Procedure by D cryo-plate (Dehydration to LN)
with Liquid Nitrogen around – 160 C



Dehydration



Dried shoot tips

Setting the cryo-plate

Immersion to LN

Storage

Long term storage

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Field to lab conservation: choice depending on species

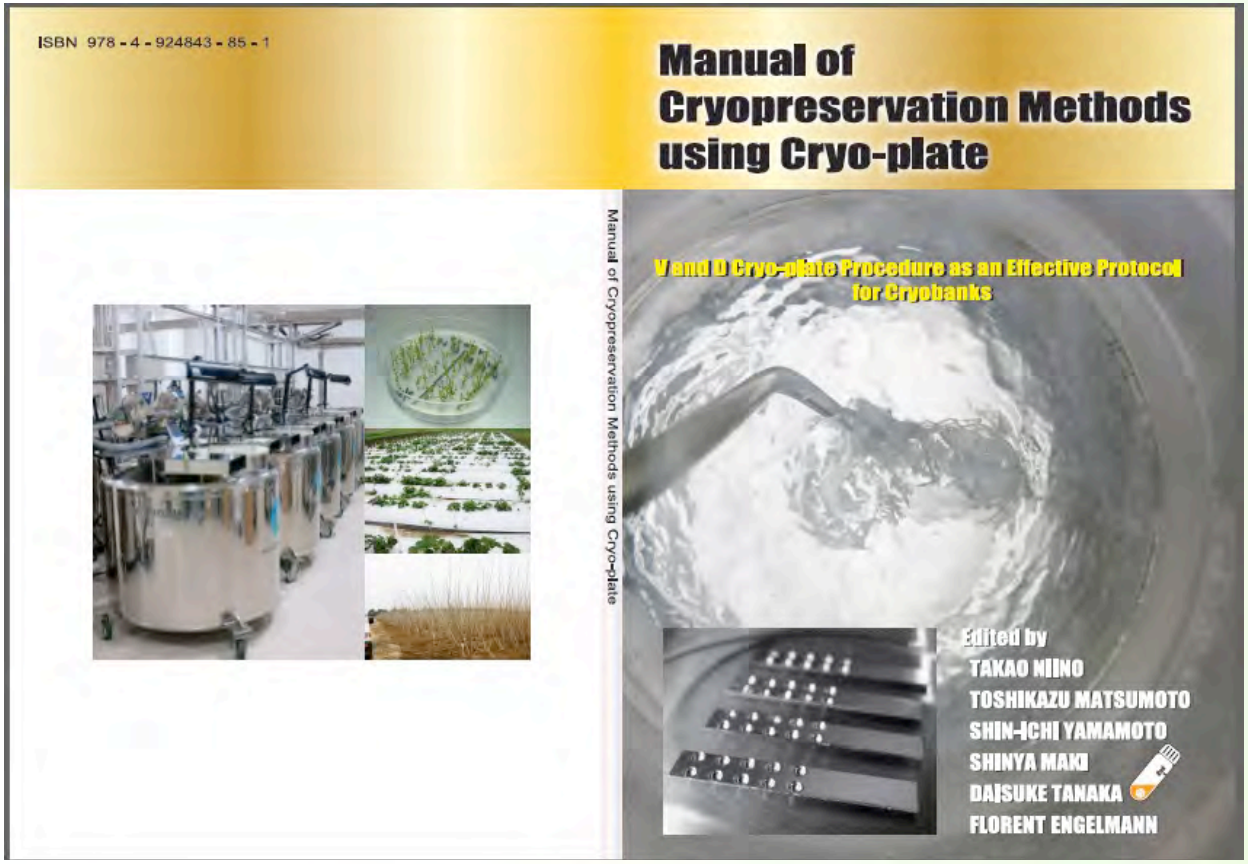
Expected Output 2:

- Establishment of long-term conservation methods for target species and preparation of relevant manuals.






The book “Manual of Cryopreservation Methods using Cryo-plate”



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Linking SATREPS Experiences and Mexican Agriculture sectors

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- INIFAP Nation-wide Network with CNRG
- SADER with SEMARNAT
- Universities such as COLPOS, Chapingo, and Guadalajara
- Experiences in local farms in different states such as Chiapas, Michoacan, Guadalajara, Guanajuato, Veracruz, Zacatecas
- Japanese private sector in Mexico such as seed and food importing companies

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Agriculture and Export Value in Mexico

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2020 first half	Value in USD Billion
Avocados	1.8
Tomatoes	1.4
Tequila and mezcal	1.04
Sugar and sweeteners	0.949
Peppers and chiles	0.873

Export to U.S., Canada, Germany, China, Brazil, Japan, Colombia, the United Kingdom, South Korea and the Netherlands.

https://www.freightwaves.com/news/mexicos-agri-food-exports-top-20-billion-in-first-half-of-2020

https://www.tractorjunction.com/blog/top-10-agricultural-producing-countries-in-the-world/

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Proven Achievements in Mass Production

- International export records: avocado, tomato, chili,, tuna fruit, daily and meats
- Tropical fruits with more potentials: pineapples, bananas, mangos, and vanilla
- Processed items: Corn syrups and Tequila
- **New opening** with: local species such as chayote, cacao criollo,
- Decent local supply chains on appropriate planting materials such as agrochemicals and seeds with scientific knowledge
- Meet with foreign (safety) requirements such as USDA-APHIS, JAS and EFSA.
- Scale up for low production cost and geographic identification
- Production integration with large enterprises.

More Opportunities with?

- Encourage domestic production rather than imports such on horticulture products (temperate zone fruits)
- Quality improvement to compete with international competitors such on citrus
- Enforcement of supply chains
- Employment stability and more wages

Challenges

- Variable climate and natural disasters such as frequent hurricanes, drought and floodings.
- Conservation of landscape architecture, not destroying the original vegetation for a scale up production such as avocado.
- Water supply: amount and quality, and global headaches
- Emerging pest and disease problems on all crops.
- Less pollinating insects and other creatures
- Large scale production: pest and disease control is essential with agrochemicals
- But appropriation of agrochemicals for sustainability
- Small scale producers do not have sufficient labor supports
- Instability of the product prices

Alleviation I: More Domestic production

- Reduction of imports by enhancing major production areas: Examples ->

  Citrus: Veracruz

  Apples : Chihuahua, Puebla, Durango

  Pear: Puebla, Michoacán, Morelos

  Cherry: Durango, Chihuahua

  Table Grapes: Sonora, Zacatecas, Aguascalientes

Alleviation II: More exports

- Increase more exports:

Strawberries: Baja California, Michoacán, Zacatecas

-> Quality control with safety appropriation

-> New national varieties (INIFAP & COLPOS) based on genetic resources

-> Incentive on workers

-> More support to Family managed farms, especially with Female owners

Alleviation III: System

- Enforcement of global supply chains and contract farming:

  Example: cacao criollo with a Japanese company

- Product promotion by major events

  Example: FOODEX in Japan

- Stewardships and labelling on the products

  => Consumer recognition on sharing resources and difficulty in production

Alleviation IV: Production

- Water :water saving technology and social system => need infrastructure
- Emerging pest and diseases: IPMs with producers' choices on what to use the technologies. => New and effective items with extension efforts, yet agrochemicals are core of the system.
- Insect pollinator protection
- New varieties from local genetic resources and variety protection

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Gracias a sus intereses y collaboraciones!

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