Manihot genetic resources: strategies for long-term conservation

Wrap-up of GRU tour: criteria for decision-making for *Manihot* conservation

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Cassava germplasm at the crossroads

1. Acquisition

2. Different ways at conserving germplasm

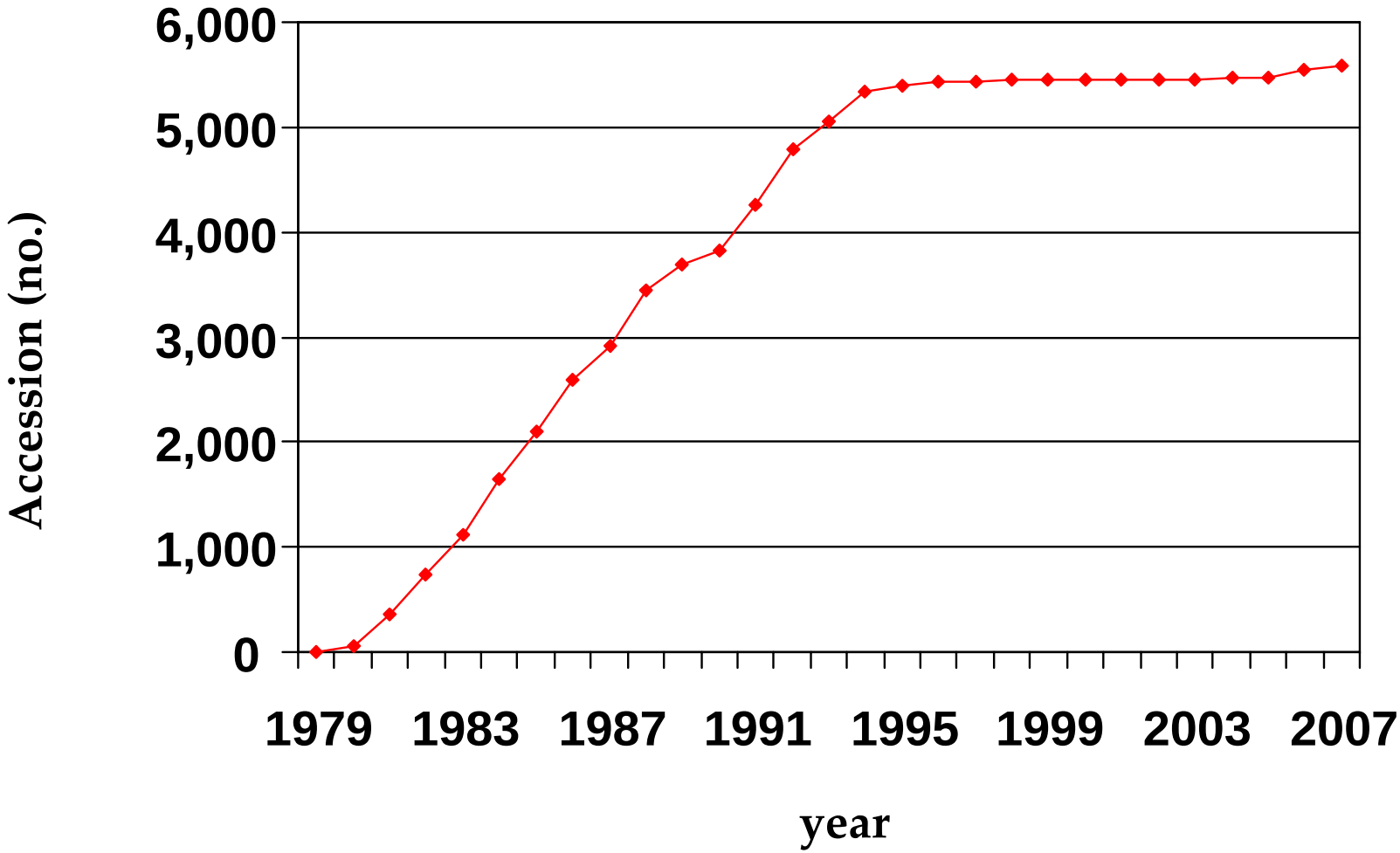
3. Making our calculations

4. Research that enhances conservation and availability

5. Criteria for decision-making in *Manihot* conservation and . . .

6. . . . a few urgent tasks

Acquisition of cassava germplasm



source: CIAT, GRU, 2008

no acquisition during the years of legal uncertainties (1993-2006) ?!

Composition of the *Manihot* collection

Accessions registered into the Multilateral System of the International Treaty

Source regions	Accessions Nos. / %
Colombia	2,000 / 38.5
Brazil	1,281 / 24.7
Other countries South America	1,127 / 21.7
Others, Central America and Caribbean	384 / 7.4
Asia	257 / 4.9
Other countries	135 / 2.6

(5,184 landraces; 28 countries)

source: CIAT, GRU, 2008

Composition of the *Manihot* collection

Accessions registered into the Multilateral System of the International Treaty

Source regions	Accessions Nos. / %
Venezuela (Colombia: 2,000)	241 / 4.6
Ecuador (Peru: 421)	116 / 2.2
Bolivia (Paraguay: 208)	7 / 0.1
Nicaragua (Honduras: 27)	3 / 0.1
Nigeria (Indonesia: 136)	19 / 0.4

source: CIAT, GRU, 2008

Priorities for exploration: Bolivia, Venezuela, Nicaragua, several countries of Africa

Different strategies for conservation and distribution of cassava GR

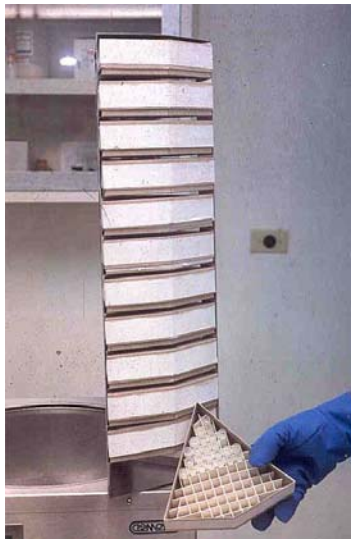
Field genebank:

- allows evaluation, but needs periodical planting
- risk of infections in primary centers of diversity
- so international distribution is restricted

in vitro ***genebank:***

- germplasm can be certified clean
- so international distribution is continued
- needs periodical subculturing
  even under slow-growth

Different strategies for conservation and distribution of cassava GR



Cryo genebank:

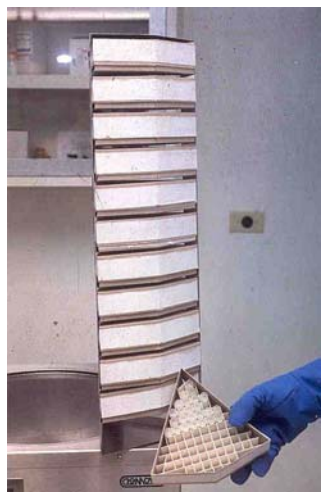
- allows long-term conservation (institutional perspective !)
- needs periodical subculturing, although infrequent
- unfit for international distribution
- investment in personnel and in equipment

Seed genebank:

- allows long-term conservation
- needs periodical regeneration, although infrequent
- not all *Manihot* species tested; orthodox behaviour ?!
- conserves genes, not genotypes ! unfit for cassava ?
- suitable for conservation and distribution of *Manihot* species

Average annual cost of conservation and distribution

Conservation as	Space /1 copy	No. samples/ accession	Viability testing (year)	Cost (US$)
Field genebank	4.5-6 Ha	6 plants	1.5	7.18
In vitro	42m^2	6 plants	1-1.5	11.98
Cryopreservation	1m^3	80-100 beads	10	1.23
with regeneration				40.31
Distribution as *in vitro*		5 plants/ clone		22.88



in cooperation with IFPRI and SGRP

after Koo et al. 2004

Three examples of research that pay for itself !

1. Slow-growth in vitro

2. Tracking of genetic copies

3. PCR based diagnostic of viruses of quarantine importance

Maintaining the *in vitro* collection ready for distribution

6 subcultures in normal 8S

BENEFITS :

cost-saving of 30%

increase the collection by 30%

send a back-up to CIP (2005)

or

Number of regenerations cut by half !

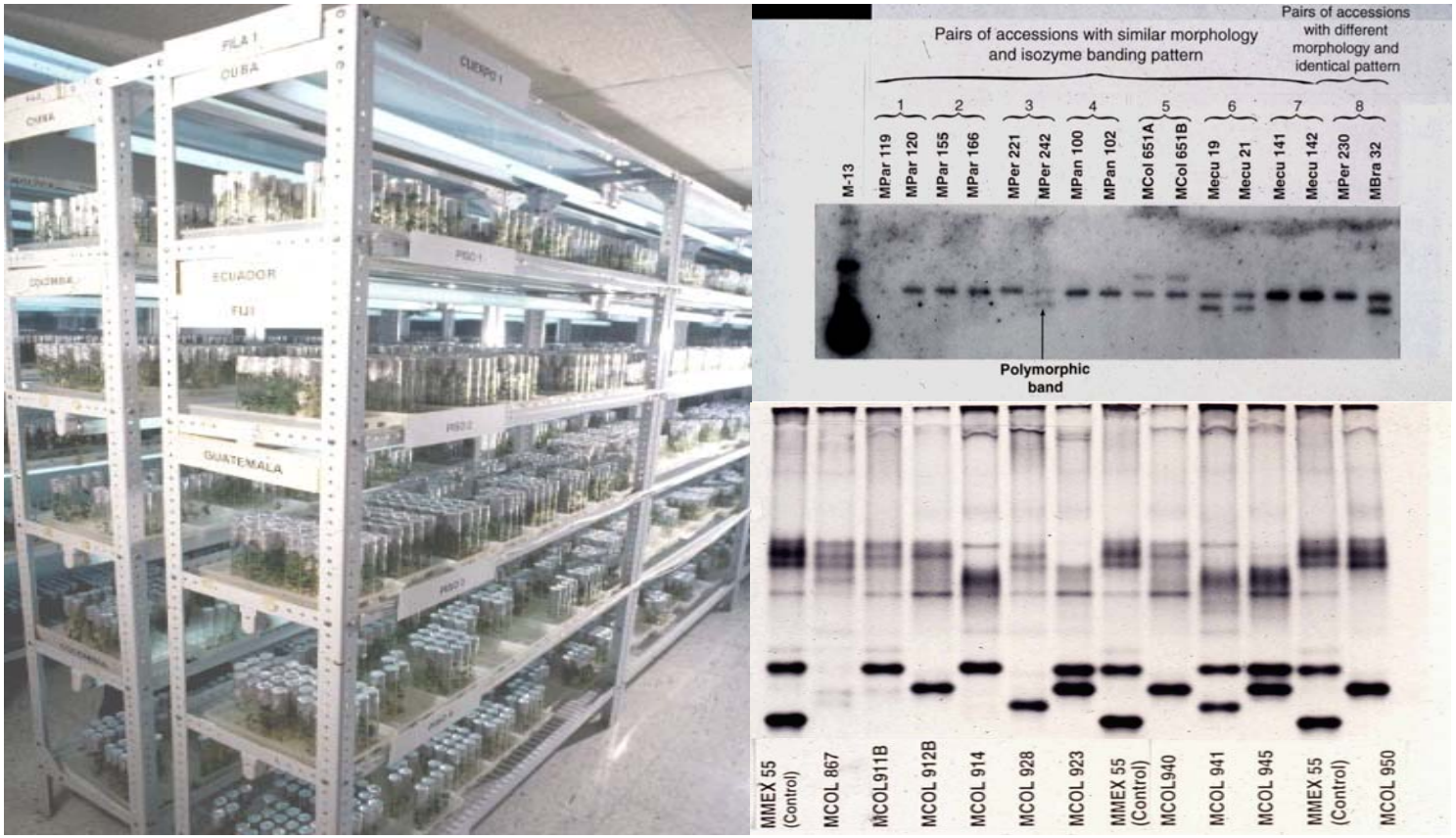
3 subcultures in SN

"slow-growth" *in vitro* established in 2004

genetic stability checked through AFLPs in 2004

after Mafla et al. 2004

Identification of genetic copies for efficient conservation *in vitro*



Results obtained on the collection from Colombia (1,986 clones):

10% redundancy or 202 materials which can be merged

annual saving of US$ 2,088

source: Ocampo et al. 2008

Improvement of Indexing Methods for Frogskin Disease in Cassava

Time to diagnostic

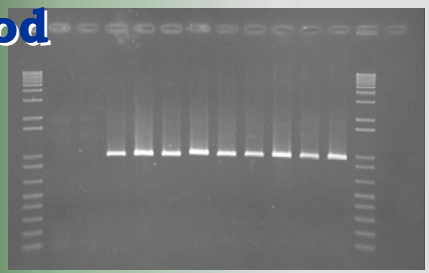
Classic Grafting Test
(1984-1998)

⇨ **72 weeks**

Revised Grafting Test
(1999-2007)

⇨ **21 weeks**

Molecular Method (rt-PCR)
(2007-)



⇨ **0.7 week**

283 matchings/ 285; 9 countries

after Cuervo et al. 2008

Criteria for decision-making for *Manihot*

- The field genebank is not obsolete, but not permanent !

  because evaluation is no longer permanent, but not yet finished !

- If we wish safe distribution, *in vitro* conservation is an obliged step

- Distribution of genetic information, cheaper option = DNA bank

  Bonsai has been the base for the DNA bank

  DNA bank can be a landmark for genetic stability studies

- If we wish long-term conservation, cryoconservation seems unavoidable

  Limits with on-going agreement with CIP ? Working well for 40% of clones ?

- Do we need to conserve genotypes? Legally yes

if we have a cheap marker technology to identify traits of agronomic importance

conservation of botanic seeds, extending to *Manihot*, if all orthodox

A few urgent tasks . . .

- Legal issues 'solved' for *esculenta*; access under CBD conditions for wild *Manihot*

  (documentation of cases of benefit sharing; e-platform of SMTAs !)

- Collecting for cassava: urgent in Central America, Bolivia, other countries of LAC

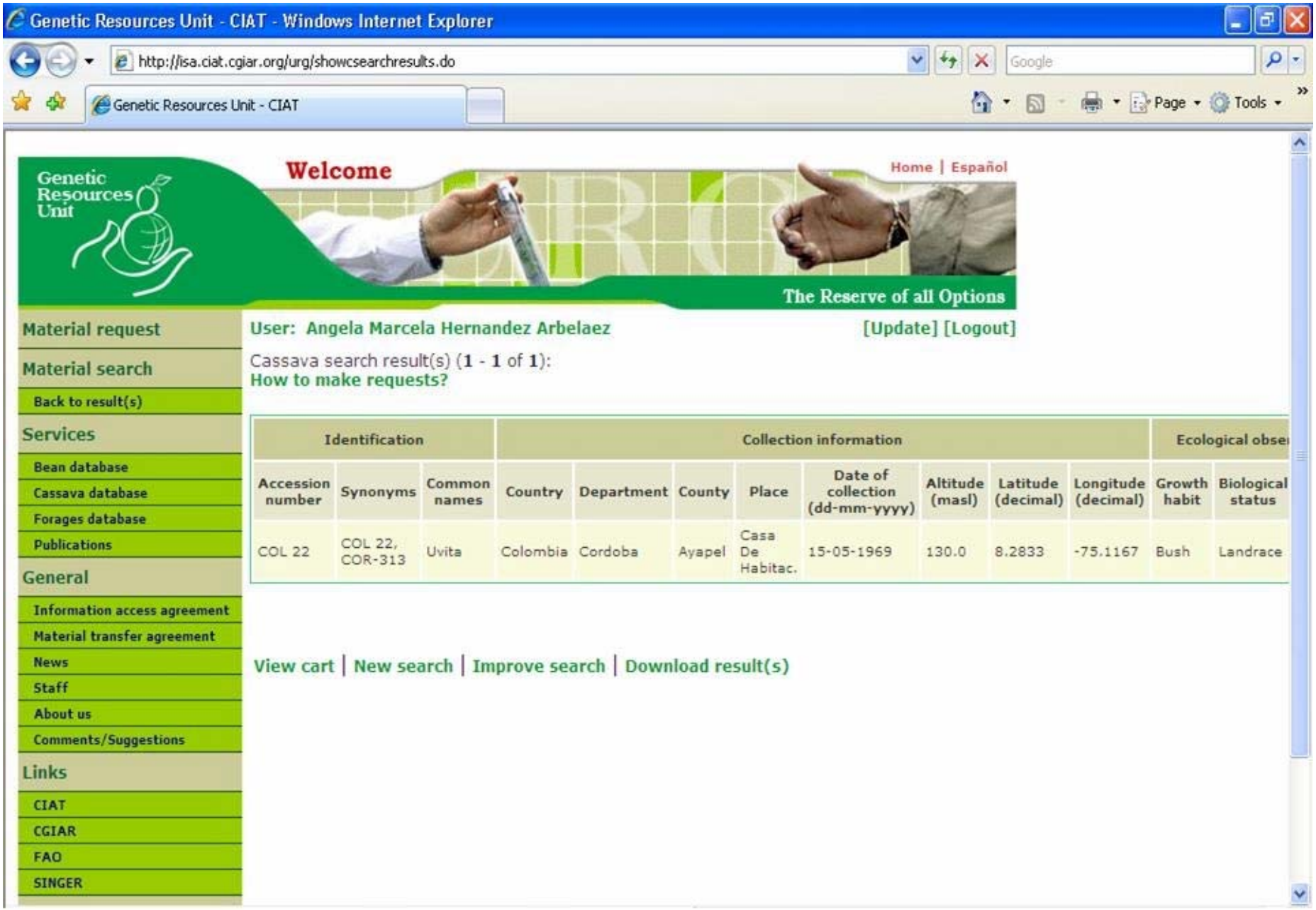
- Collecting: desirable in Central Africa: Congo, Cameroon, Angola, Mozambique

- Collecting for wild *Manihot* species:
  critical around urban areas, in lands prone of land use changes in C and S America
  endemics: six populations of *M. walkerae* (extreme N of Tamaulipas, S of Texas)

- Research in virology : African virus (CMD, CBSD)

- Research in fingerprinting to identify early on genotypes not yet present in collections

  DNA kit to carry to the field ?!



On-line request for cassava germplasm limited to too few agronomic descriptors !

A few urgent tasks . . .

- Documentation

  Documenting the 'institutional memory'

  Common cassava registry: CIAT, EMBRAPA, IITA

  Linking sequence data with phenotypical traits

- Cryoconservation

  A push for the positively responding clones (possible agreement CIAT-INIBAP)

  Research on the 'difficult' cases (CIAT-USDA-EMBRAPA)

Needs in Capacities and Human Resources

Taxonomy and biology of *Manihot* : 15-20 years

Germplasm exploration for *Manihot* species : continuing ?

Seed physiology of *Manihot* species : 15 years

Virology of *Manihot* species : continuing ?

Pathology of *Manihot* species : continuing ?

Entomology of *Manihot* species : continuing ?

Documentation specialist

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Thank you !