



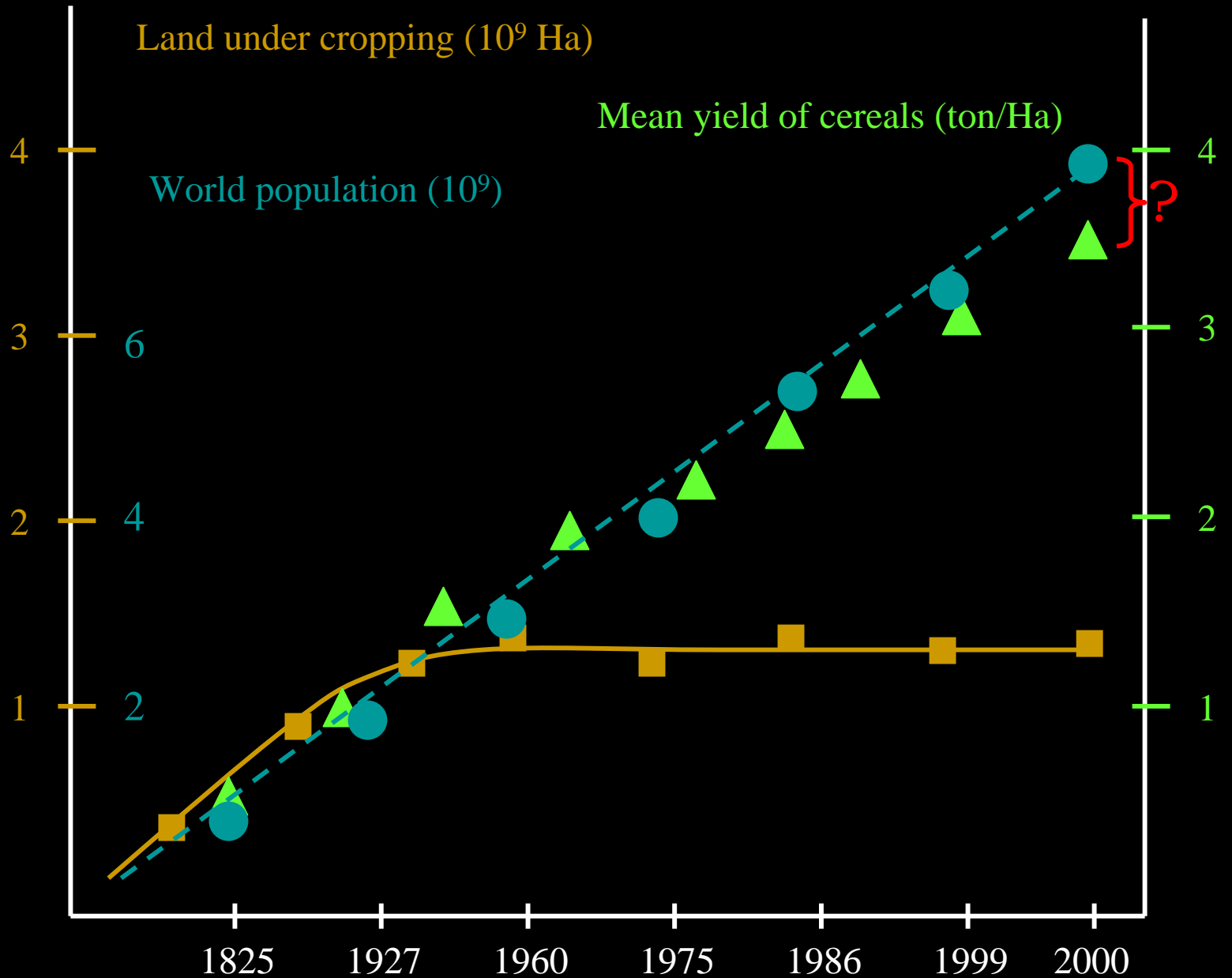
Keeping a Seed of Solutions when Energy and Climate become Unpredictable

D.G. Debouck

Palmira, 21 May 2009



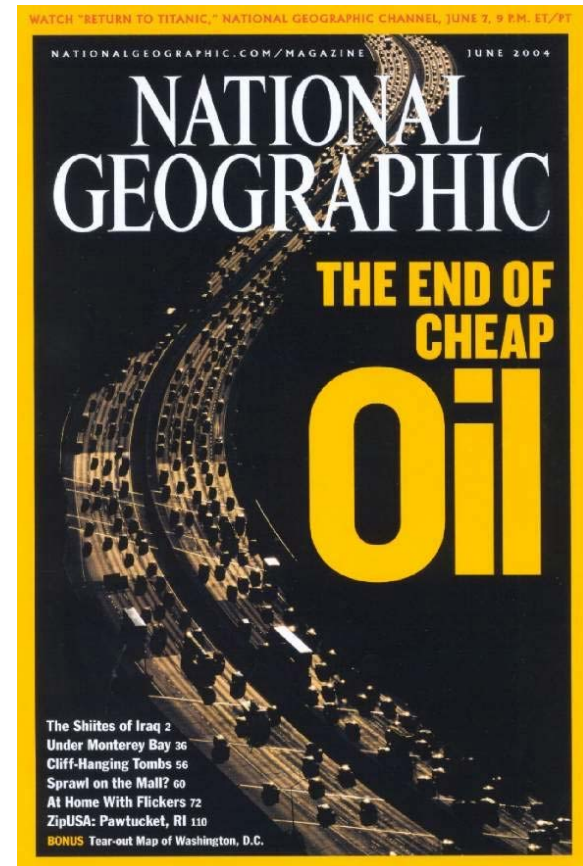
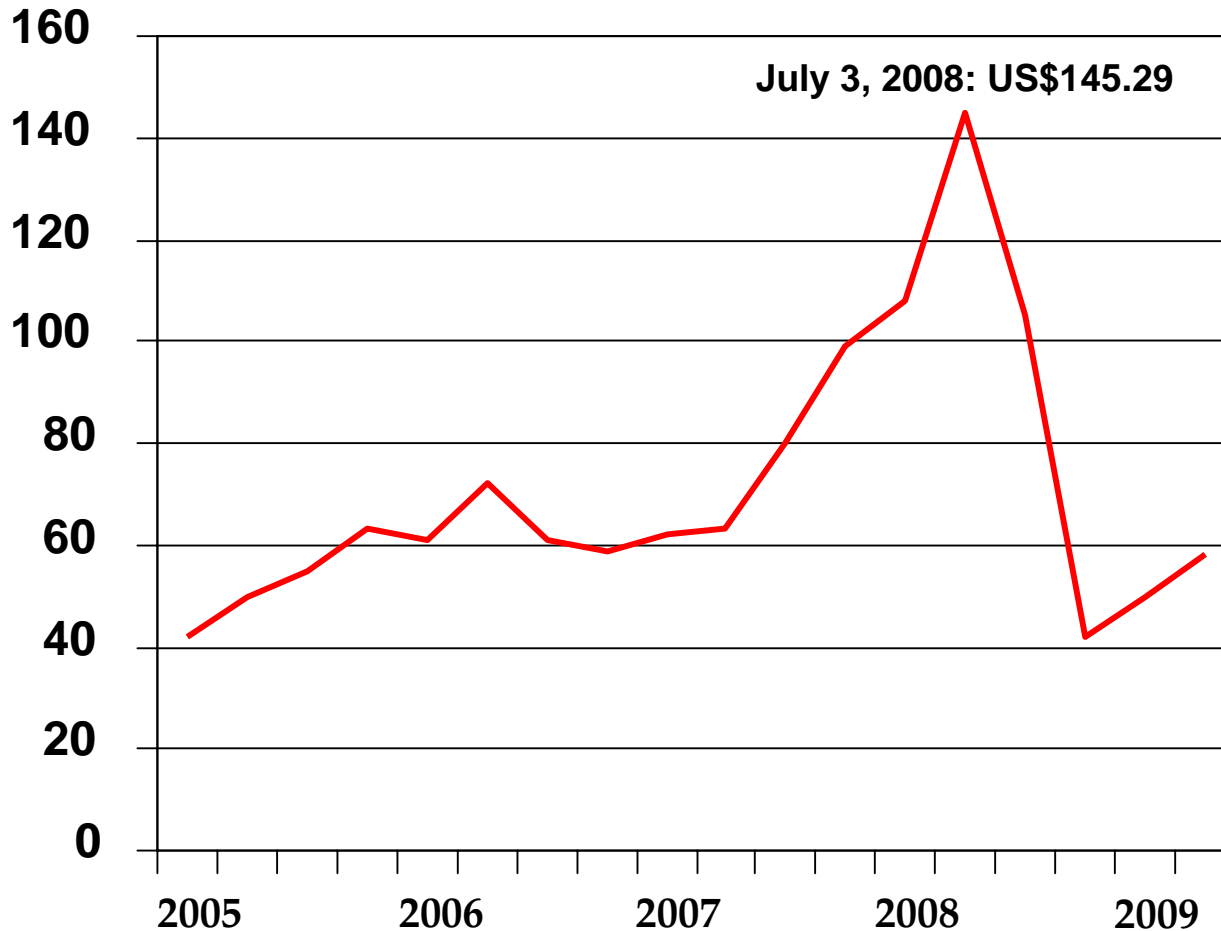
How our predecessors were able to do it ?



adapted from: Evans 1998

The new challenge of the 21st century: energy has 'caught' agriculture

When the Green Revolution was planned and developed, oil was at US\$ 8.00 !



Natl. Geogr. June 2004

source: International Agency of Energy 2009

Energy price is of concern to us because it affects :

- **food production**

"2/5 of the world population would not survive without nitrogen for the Haber-Bosch process" (over 100 million people)



today 100 million tons of nitrogen

2% total world's energy

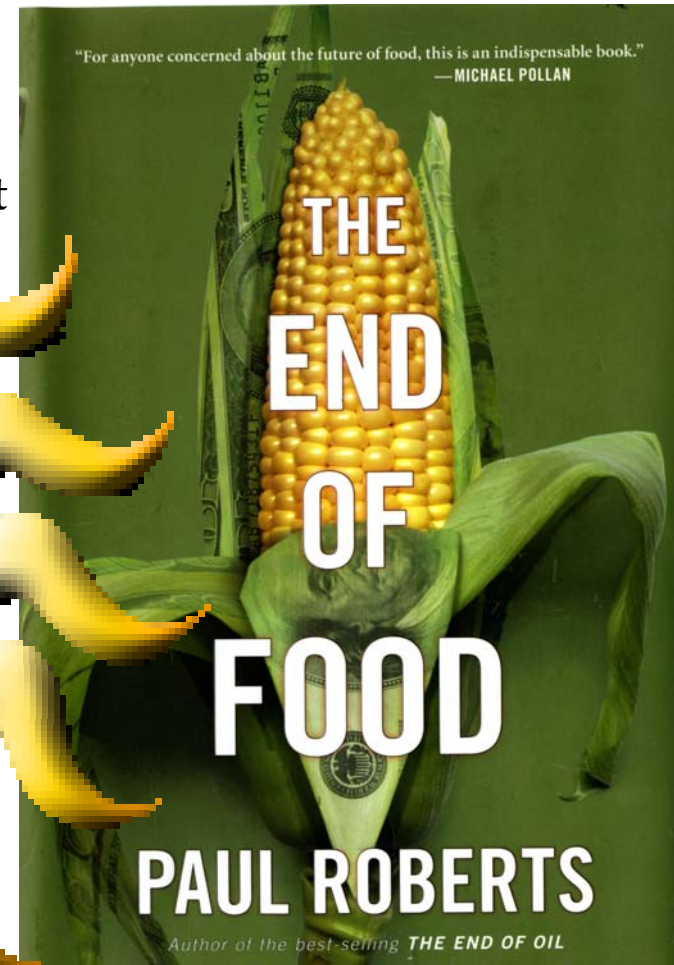
- **food transportation**

- **food processing**

the point is not about biofuels:

the point is about producing food, abundant, quality, with no fossil energy !

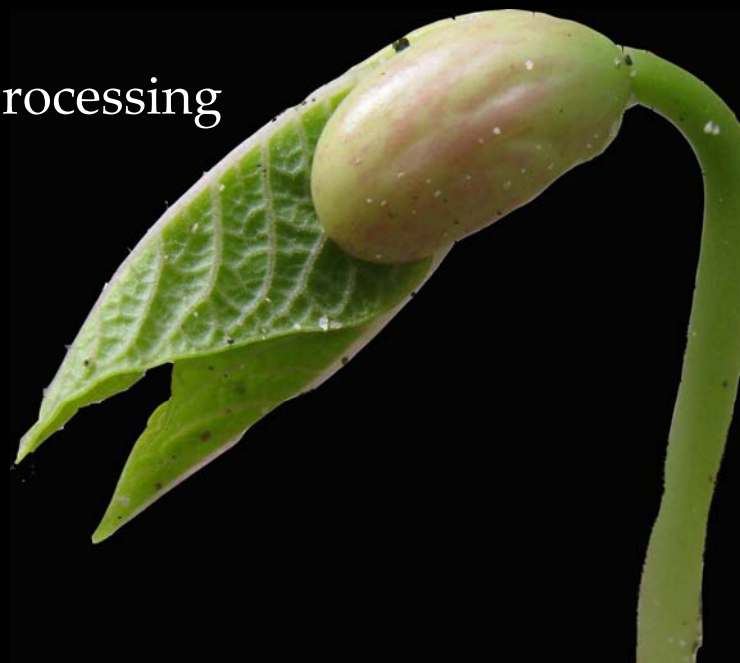
with what we are left with (solar energy, soils, and GR), can we do it ?





a Seed of Solutions along 4 Impact Pathways

- ▶ germplasm for increased food production
- ▶ germplasm in case of expensive food transportation
- ▶ germplasm in case of expensive food processing
- ▶ germplasm in case of climate change



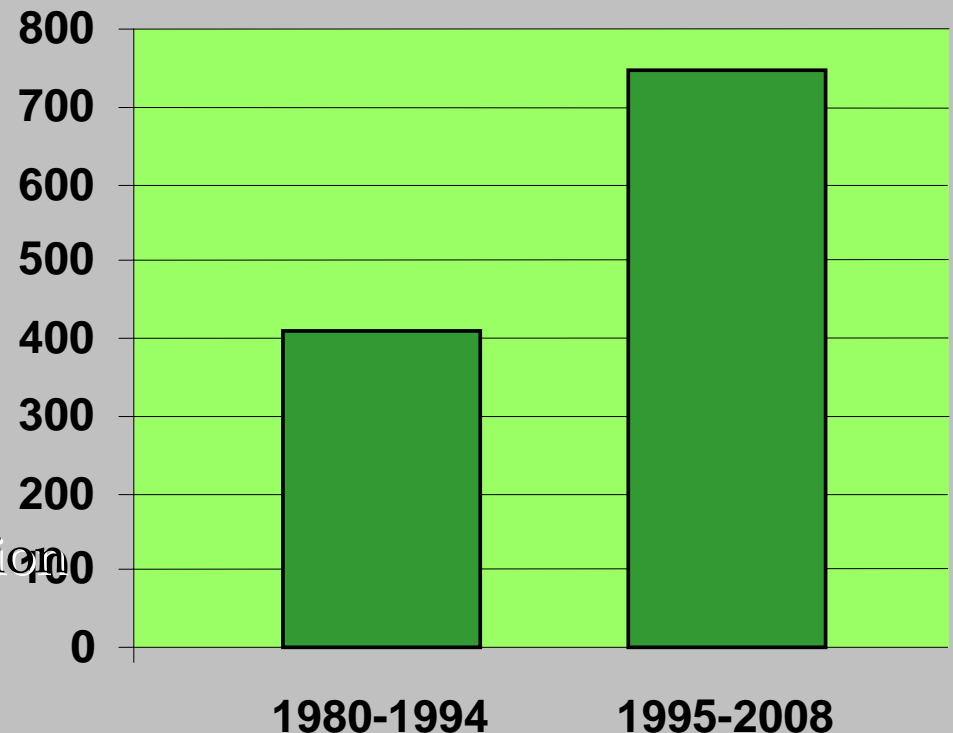
1. Challenge in food production: turning a wild plant into a crop

example: *Cratylia argentea*

- collected as *Dioclea* in 1978-1980 in the *cerrado* of Brazil
- No 1 in Central America in 1996 when the drought of 'El Niño'

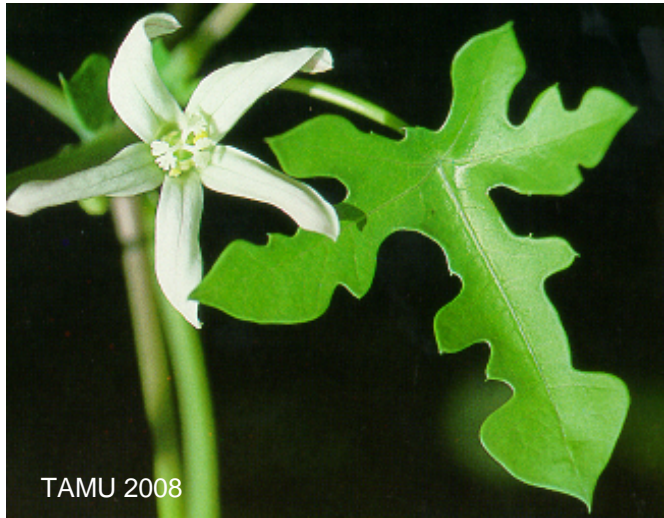


- saving in watering of pastures (water and energy)
- in all these years No 1 in distribution in Colombia and Costa Rica



2. Energy challenge : efficiency in food transportation

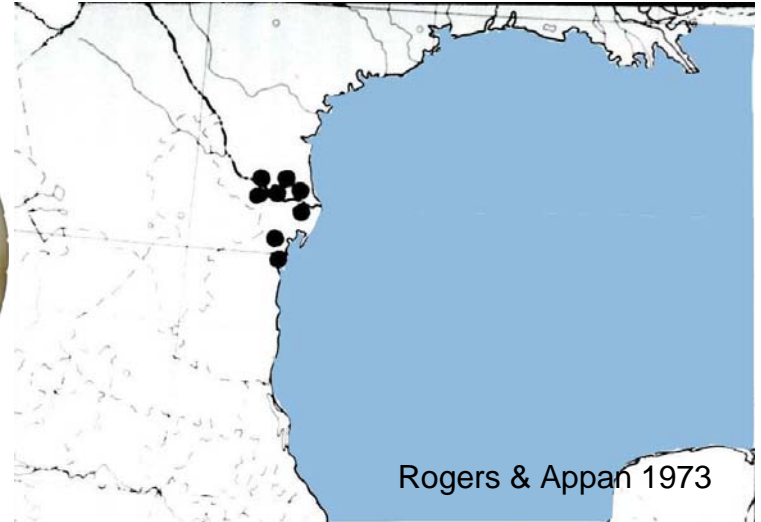
example: the use of a wild cassava



Manihot walkerae Croizat (1942)



Escobar 2005



N Tamaulipas & S Texas

- ✓ delays physiological root deterioration up to 8 days (CIAT 2003, Estevao 2007)
- ✓ saving energy in transportation/ in stores where energy is not available
- ✓ *M. walkerae* is listed in the Threatened Plants of Texas (1991)

3. Energy challenge : efficiency in food preparation

example: the popping beans

- collection assembled in the 1980s; today 300 varieties in CIAT
- eaten toasted; cooked in 10 minutes
- saving energy for cooking in highlands
- social impact if women and children have to find fuelwood
- possibility to form microenterprises in food production/ processing
- new products for mountain agricultures in a mondialized economy



Having fodder in flood prone areas (e.g. Amazon tributaries in May 2009)



Aeschynomene fluminensis (only four accessions)

Germplasm registered into the Multilateral System of the Treaty

Commodity	Rank	No. of taxa	No. of providing countries	No. of accessions
Beans (<i>Phaseolus</i>)	1	44	109	35,898
Cassava (<i>Manihot</i>)	1	33	28	6,467
Tropical forages	1	668	72	23,140

Germplasm accessions as International Public Goods : 65,505

(No. 2s: beans USDA 14,782; cassava Embrapa 3,902; forages ILRI 18,661)

source: CIAT – GRU, 2008

The first Treaty of the third millenium :

(international law since 2004, approved by 114 countries to date)

the first treaty where the CGIAR is ever mentioned (Art. 15)

for what ?

for its role in conservation and in adding value to GR

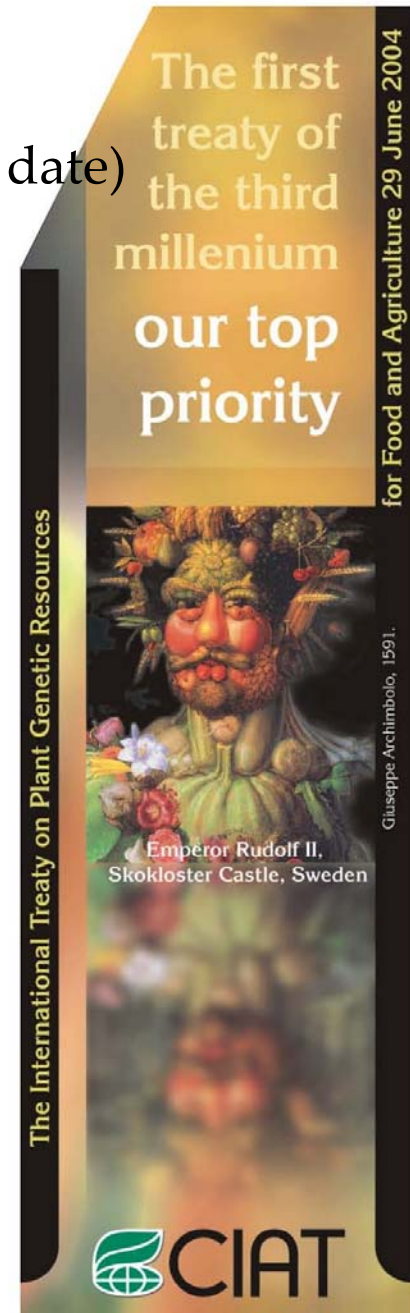
the list of Annex 1 ?

it has but to increase

why not *Arachis*, or *Rhizobium etli* on the list ?

an opportunity for the CGIAR !

because of the 'implementation deficit' !





CGIAR side event, Governing Body 3rd meeting, Tunis, 1-6 June 2009

(joint initiative Bioversity, CIAT, ICRISAT, IRRI)

Period 1998-2008	Beans	Cassava
Materials that CIAT PGR has received from Peru	3,666	421
Materials * that CIAT PGR has sent to Peru	1,341	322
Materials * with origin = Peru, sent back to Peru	693	255
Materials * with origin = NOT Peru sent to Peru	648	67
Number of countries contributing to shipments to Peru (e.g. Mexico, Brazil, Colombia, USA, Nigeria)	38	8

* = materials sent documented, characterized, cleaned, at no cost to recipients



The transverse tunnel on Feb 26, 2008

294 guests, media, VIP

an opportunity for the CGIAR !

photo: Debouck 2008

Output 1: Keeping collections up to international standards

1st output target

To “bring order into the house” after the designation process

2nd output target

To have the designated collections meeting the standards

(viability, health, genetic quality)

3rd output target

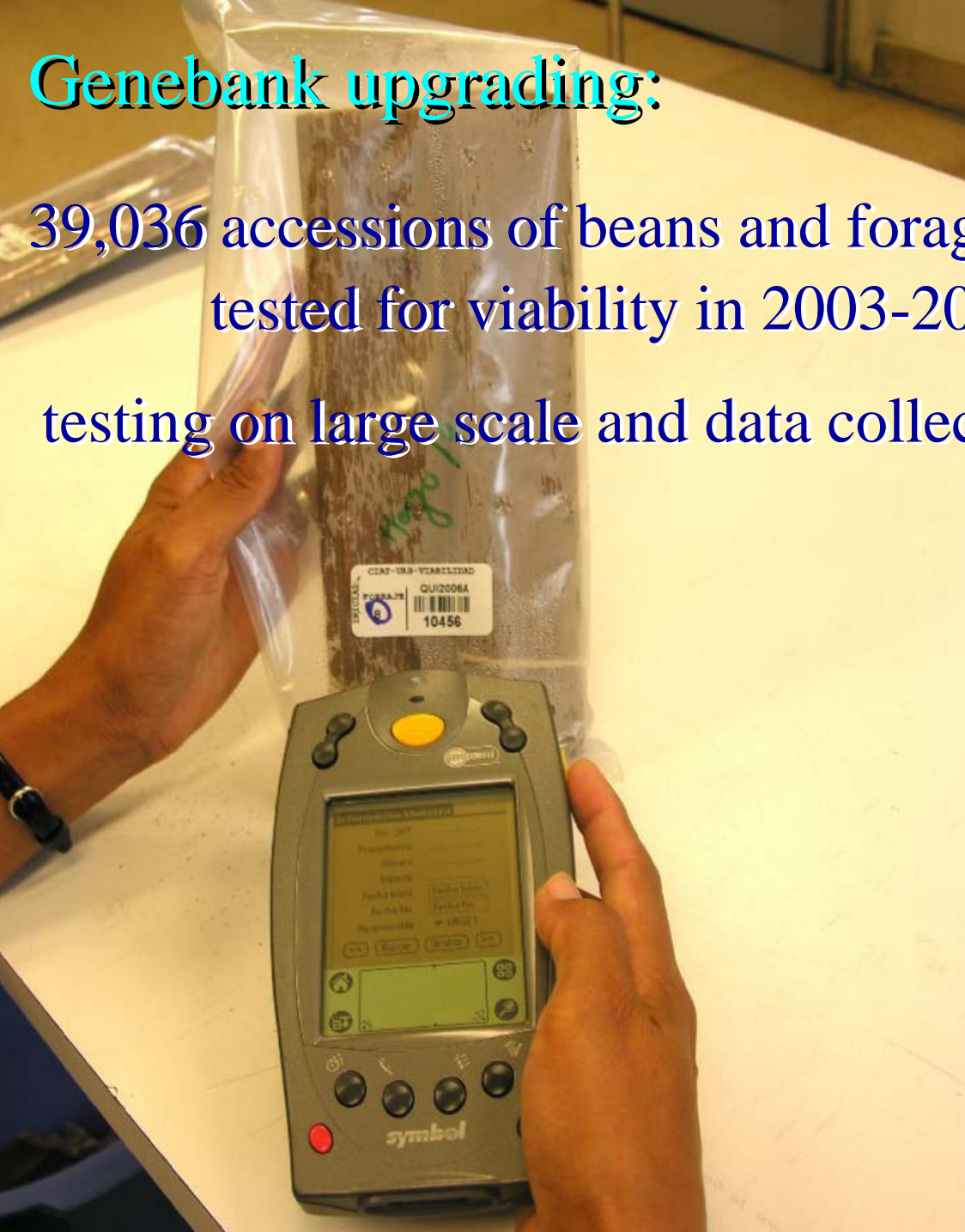
To bring efficiencies in services and in processes

(DNA banking services, tracking genetic copies)

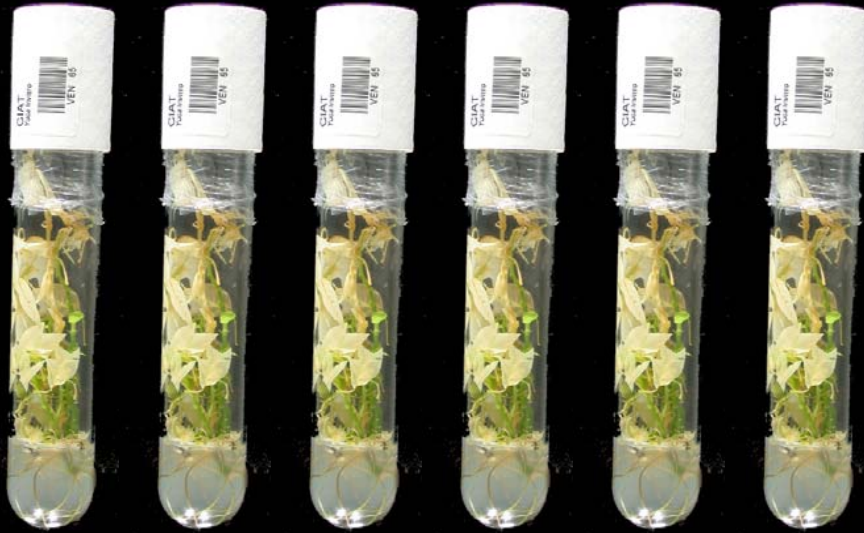
Genebank upgrading:

39,036 accessions of beans and forages
tested for viability in 2003-2008

testing on large scale and data collection improved



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)

Number of regenerations cut by half !

3 subcultures in SN

“slow-growth” *in vitro* established in 2004

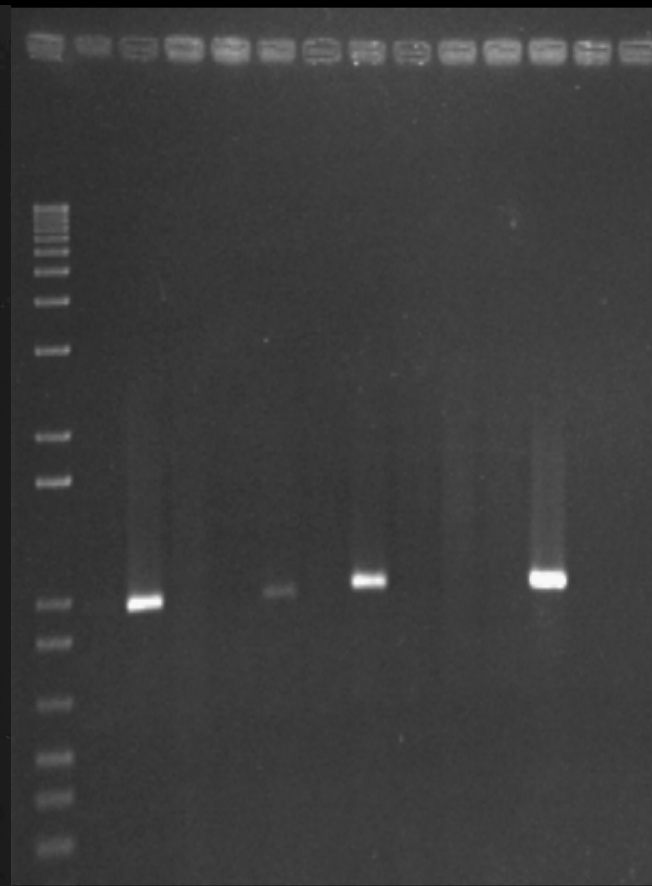
genetic stability checked through AFLPs in 2004



or

after Mafla et al. 2004

Improvement in the methodology for CFSV detection



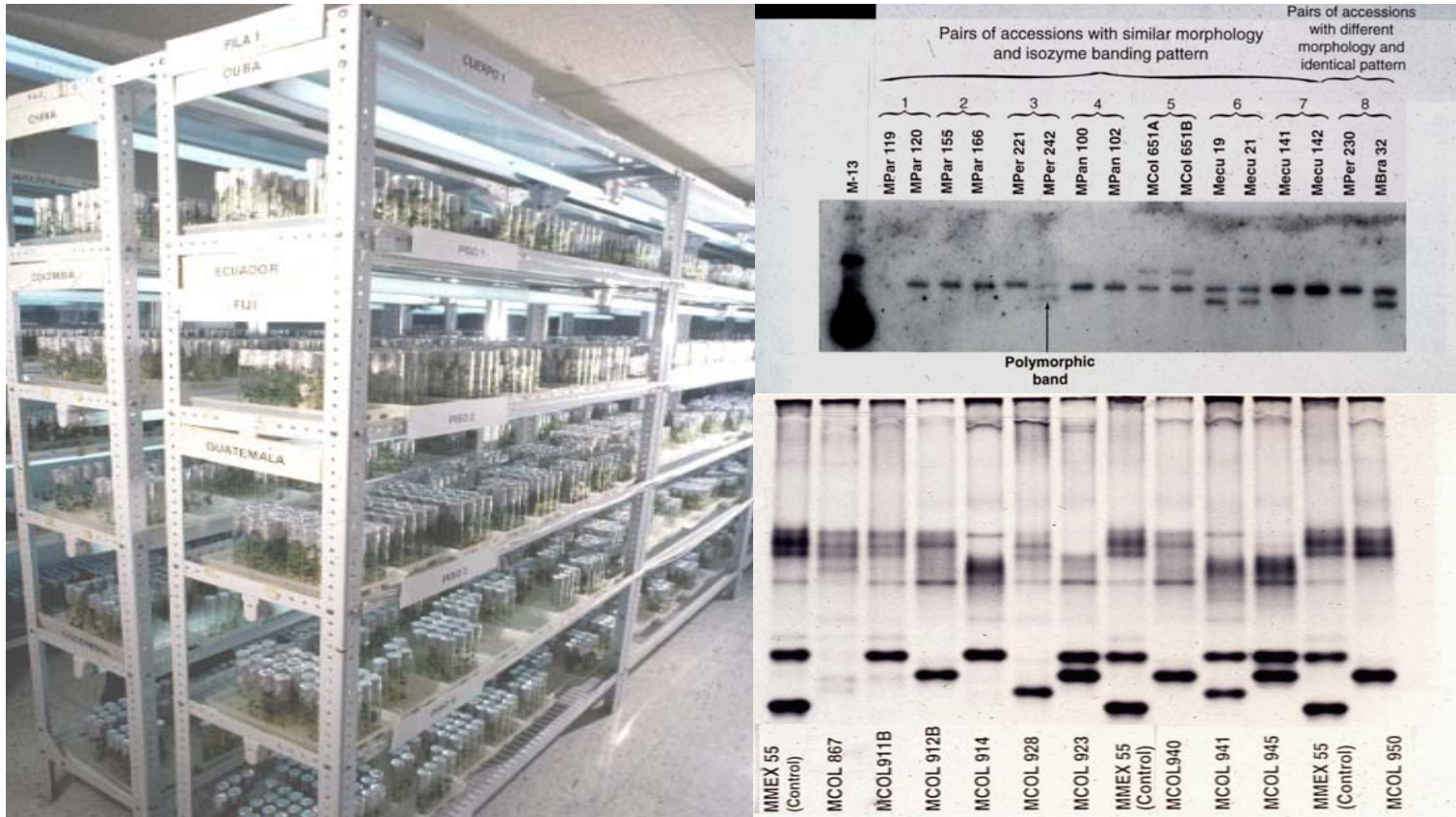
Time to diagnostic :

72 weeks

21 weeks

0.7 week

Search for genetic duplicates in the Cassava Collection



Output 2: Making in-trust germplasm available to user communities

1st output target

To continue to distribute materials and information to users

To continue to report to the Secretariat of the Treaty

To continue to improve/ increase the data fields on the web site

2008 (samples)	beans	cassava	forages	share
CIAT projects	2,629	1,173	103	53%
Users	3,091	175	229	47%



Genetic Resources Unit

Welcome




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The Reserve of all Options

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Bean search result(s) (1 - 10 of 3254):

[How to make requests?](#)

Identification			Collection information					Ecological observations					
Accession number	Synonyms	Common names	100				Date of	Altitude (masl)	Latitude (decimal)	Longitude (decimal)	Growth habit	Biological status	
G 101	ANTIOQUIA 117, PI151380	Bala Rojo									Prostrate-Indeterminate	Cultivated	
G 103	PI151394	Guarzo Rayado Arbol										Bush-Determinate	Cultivated
G 104	PI151412	Uribe De Arbol										Climbing	Cultivated
G 105	PI151414	Zarzaleño De Arbol										Bush-Determinate	Cultivated
G 916		Liborino L-7		Red	36.0	Colombia	Antioquia					Prostrate-Indeterminate	Cultivated
G 918			Brown	30.0	Colombia						Climbing	Cultivated	
G 941	PI207422	Pirola	Black	17.0	Colombia	Valle Del Cauca	Palmira	01-01-1951			Prostrate-Indeterminate	Cultivated	
G 1098		Ocañero	Cream	22.0	Colombia	Atlantico					Climbing	Cultivated	
G 1291	PI207128	Facultad	Red, Cream	76.7	Colombia	Antioquia	Medellin	01-01-1945			Climbing-Determinate	Cultivated	
G 1292	PI207134	Uribe Redondo	Cream,	39.0	Colombia	Antioquia					Bush-Determinate	Cultivated	

Output 2: Making in-trust germplasm available to user communities

2nd output target

To complete the safety duplication process (Svalbard 2013)

	2008	2009	progress
beans	21,698	2,114	66%
forages	9,213	1,086	53%
total	30,911	3,200	

Output 2: Making in-trust germplasm available to user communities

3rd output target

To continue to acquire 'novel', unique, rare, endangered germplasm

36 elite bean lines from CIAT Bean Programme ('institutional memory') (2008)

26 wild species of beans from Nicaragua (2009)

119 landraces of cassava from Indonesia (2009)

40 landraces of cassava from Central America (CATIE collection) (2009)

prospects in beans and cassava with INIA of Peru (Trust) (2010)

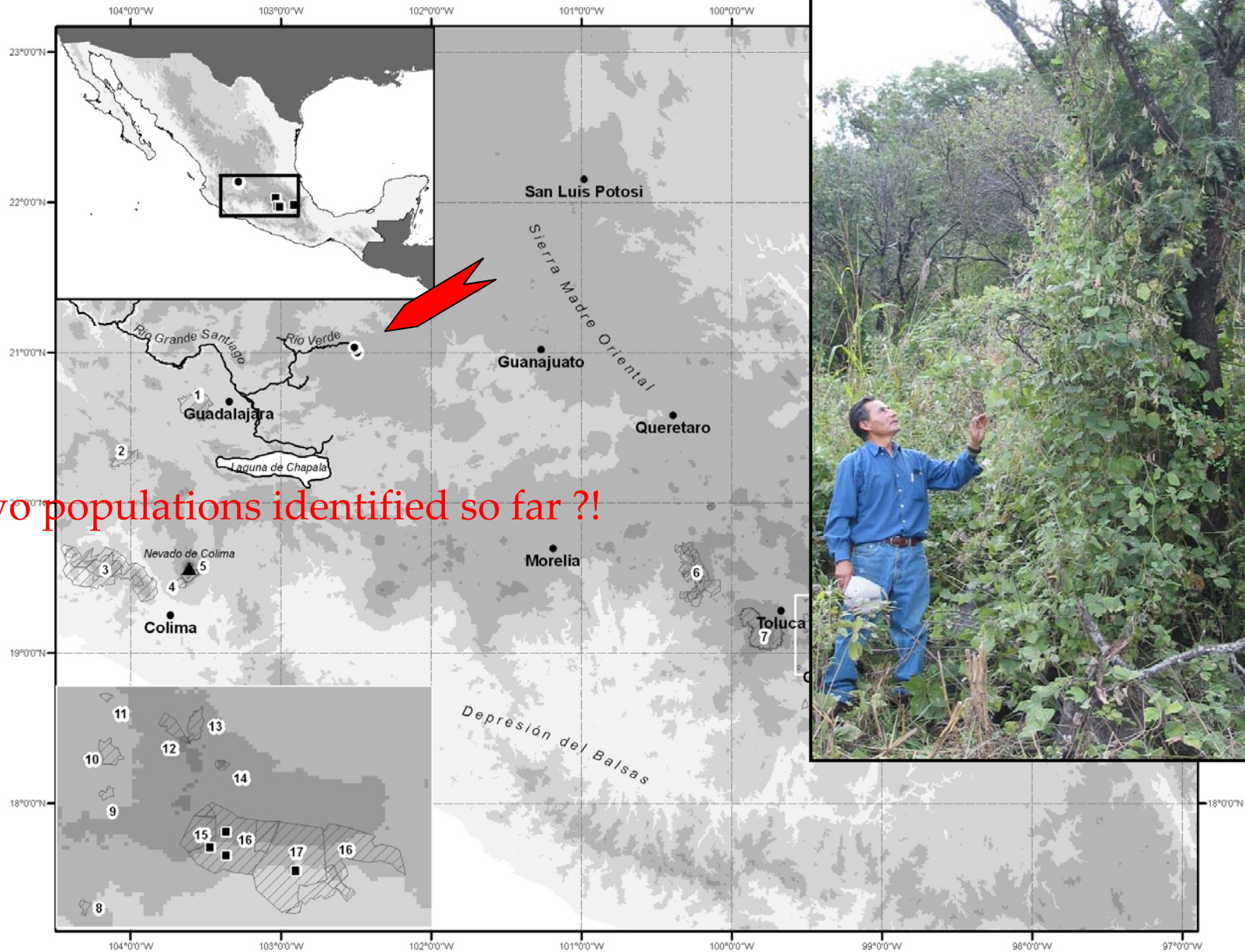
prospects in cassava with FONAIAP of Venezuela (Trust) (2011)

prospects in beans with U Guadalajara of Mexico (Trust) (2011)

Examples of unforeseen uses of conserved germplasm

Materials	Frequency in collection (%)	Trait
Eco-efficient agriculture		
<i>Manihot walkerae</i>	0.015	Shelf life longer than one week
<i>Phaseolus vulgaris</i> popping beans	0.83	10 x reduction in cooking time
Climate change		
<i>Aeschynomene fluminensis</i>	0.017	Flood
<i>Cratylia argentea</i>	0.2	Drought
<i>Phaseolus angustissimus</i>	0.014	Temperatures about freezing point
<i>Phaseolus filiformis</i>	0.097	Temperatures higher than 40°C

Phaseolus rotundatus :



source: Salcedo et al. submitted

Partnerships :

- ✓ Trust: crop strategies, regional cooperation, technical guidelines
- ✓ SGRP: Bioversity and IARCs: policy, SINGER, work with FAO CGRFA, agrobiodiversity status, evaluation, . . .
- ✓ “No 2s”: USDA and CENARGEN: reciprocal ‘duplication’, documentation, . . .
- ✓ CATIE: conservation, training, research
- ✓ Biodiversity inst.: CONABIO, INBIO: inventories, status, *in situ* conservation
- ✓ Conservation agencies: TNC, WWF: inventories, status, *in situ* conservation
- ✓ NARS GRUs: conservation, evaluation, diffusion of PGRFA
- ✓ Universities: education, specialized research, . . .

Concluding . . .

- this MTP 2010-2012 is a transition for the Program
from keeping collections up to standards (indicator = Svalbard)
to a proactive role in evaluation (comparative advantage) and conservation
- thinking is required during this transition, namely about the roles of actors
in a moving environment where the public sector has a role to play
- the Treaty has clearly opened up a unique opportunity for the CGIAR
so the Program can bring a brick to the building of a
new tropical agriculture where the energy is . . . solar and cerebral !