

CLAYUCA
 Centro de Investigación y Desarrollo en el Uso Racional y Sustentable de los Recursos Agrícolas y Forestales

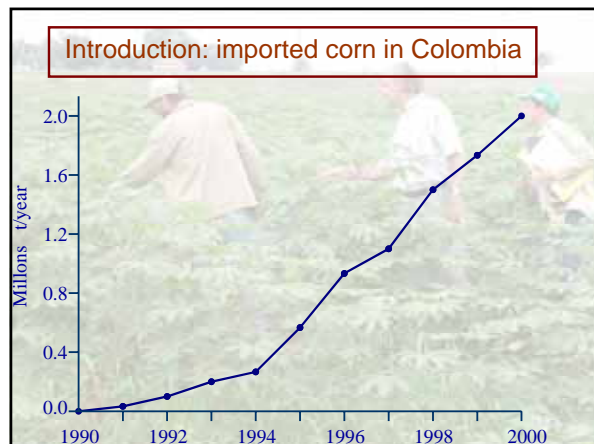
Development and identification of high-value cassava clones

Increasing incomes from cassava

High-value cassava: materials and methods

High-value cassava: results

CIAT
 Centro Internacional de Agricultura Tropical



Increasing incomes from cassava

Increasing productivity

- Clones with high and stable yields
- Disease and pests management (i.e. biological control)
- Soil management. Terraces. Adequate fertilization.

Reducing production cost

- Mechanization of planting and harvest
- Biofertilizers
- Efficient marketing

Higher value for the products of the crop

- High-value products
- Exploitation of the foliage
- High-value clones

Most processed cassava targets four end-uses

- Animal feed
- Starch
- Ethanol/bioplastics
- Processed food



Development and identification of high-value cassava clones

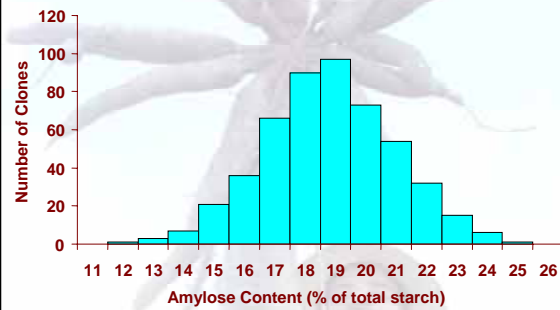
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Economic traits: amylose content

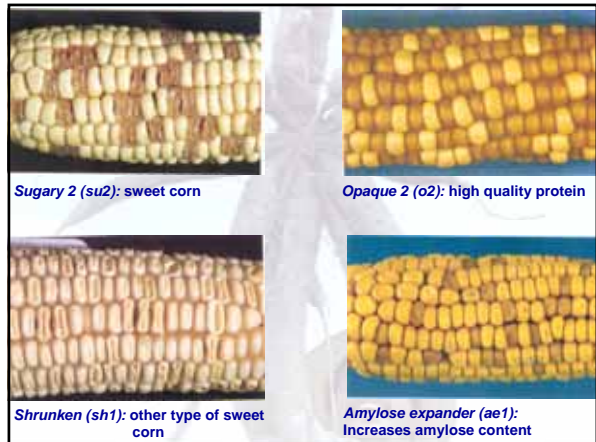


Source: Teresa Sánchez

Why don't we have useful mutants in cassava starch ?

☞ Mutations are generally recessive and therefore we have to self-pollinate cassava to find them.

☞ Even if the mutation expressed itself, it is difficult to identify those roots with useful traits.



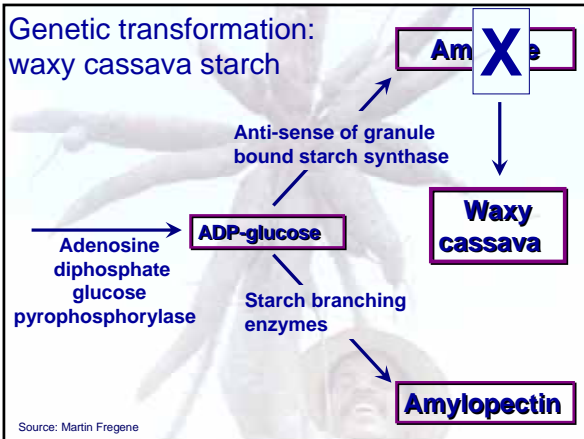
Strategies to create cassava clones with new types of starch and higher commercial value



1. "Brute force":
genetic transformation

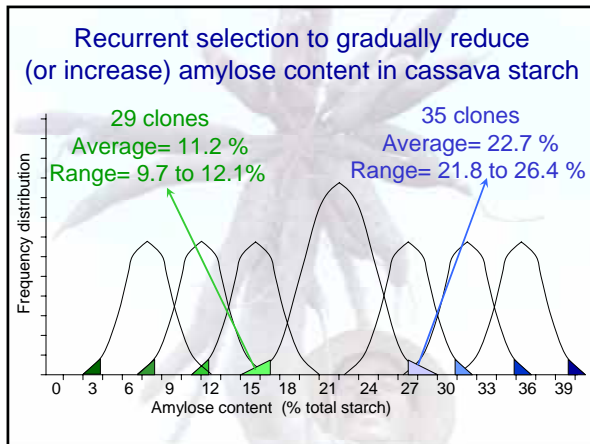


Genetic transformation:
waxy cassava starch

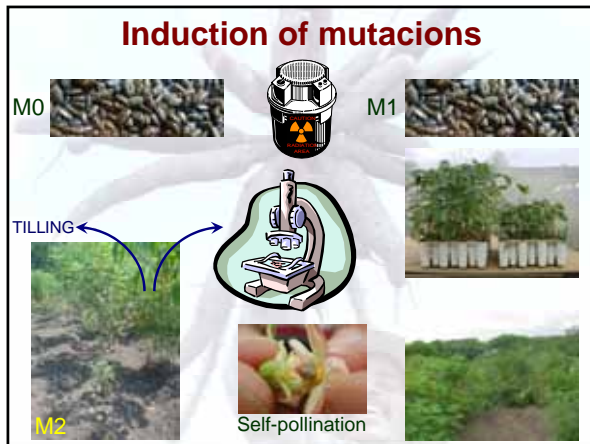


1. "Brute force":
genetic transformation
2. The persistent way:
recurrent selection





1. "Brute force":
genetic transformation
2. The persistent way:
recurrent selection
3. The gambler's way:
induced mutations & TILLING

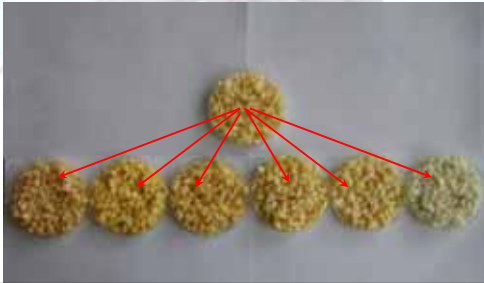


1. "Brute force":
genetic transformation
2. The persistent approach:
recurrent selection
3. The gambler's way:
induced mutations & TILLING
4. Following maize's "early fathers":
fun in the inbreeding world

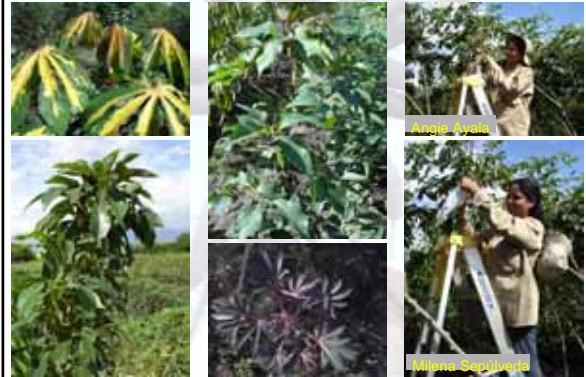


Introduction of inbreeding

Segregation in carotene contents
in roots from clone CM4919-1



Accessions from the germplasm collection are key objectives for self-pollinations



1. "Brute force":
genetic transformation
2. The persistent approach:
recurrent selection
3. The gambler's way:
induced mutations & TILLING
4. Following maize's "early fathers":
fun in the inbreeding world
5. The wild strategy:
looking at other *Manihots*



Manihot crassiseppala # 13

Waxy starch

Only three abortive flowers

Difficult to maintain vegetatively

Source: Martin Fregene

1. "Brute force":
genetic transformation
2. The persistent approach:
recurrent selection
3. The gambler's way:
induced mutations & TILLING
4. Following maize's "early fathers":
fun in the inbreeding world
5. The wild strategy:
looking at other *Manihots*
6. The boring task:
finding a needle in the haystack

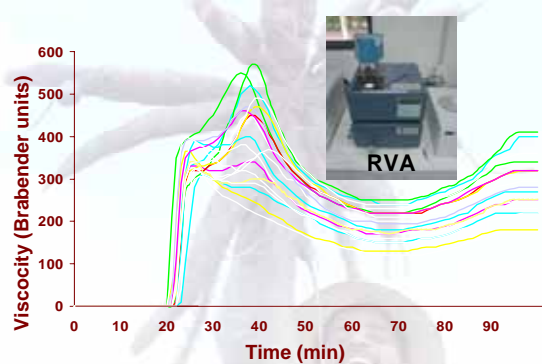


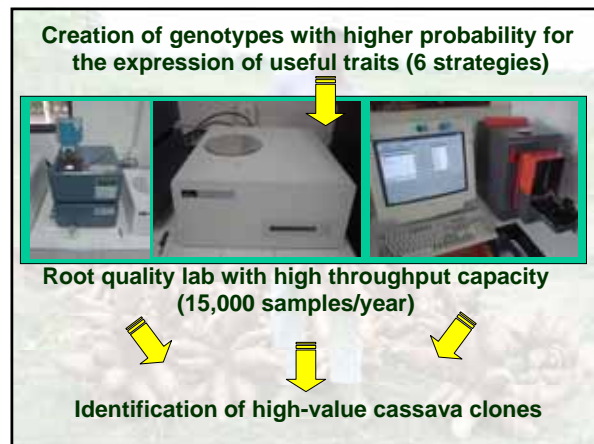
Current evaluation system	
In Palmira Elite clones are crossed and botanical seed is obtained	N° of clones ↓ 10,000 - 15,000
↓	
F1: botanical seed is germinated (1 plant)	2500
↓	
In target environment (i.e., Barranquilla) Clonal Evaluation : Row with 7-8 plants/clon	2000
↓	
Preliminary Yield Trial: 3 reps x 10 plants	300
↓	
Advanced Yield Trial : 3 reps x 20 plants	80
↓	
Regional Trial: 3 reps x 25 pl. x 3 locs	20

Approaches for identifying high-value cassava



Variation in pasting properties of starch





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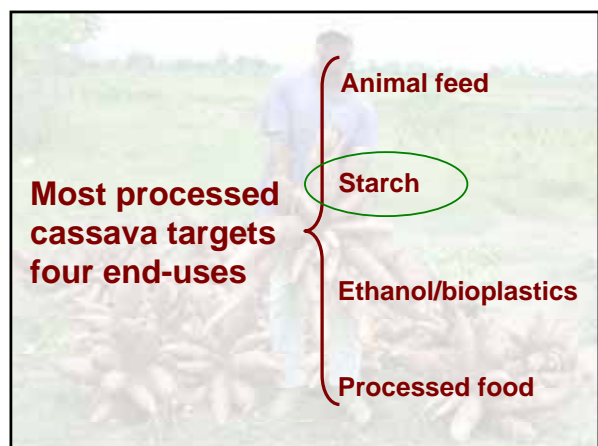
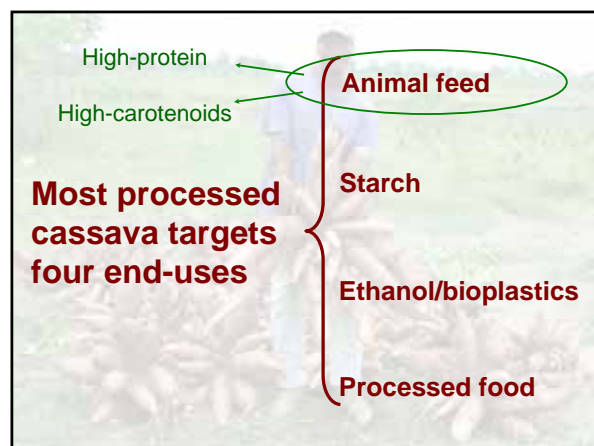
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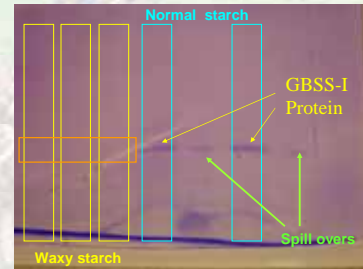


March 1st, 2006: A historic date for cassava



Source: Fernando Calle / Nelson Morante

SDS – PAGE GEL OF NORMAL AND WAXY STARCH



Source: Janeth P. Gutierrez

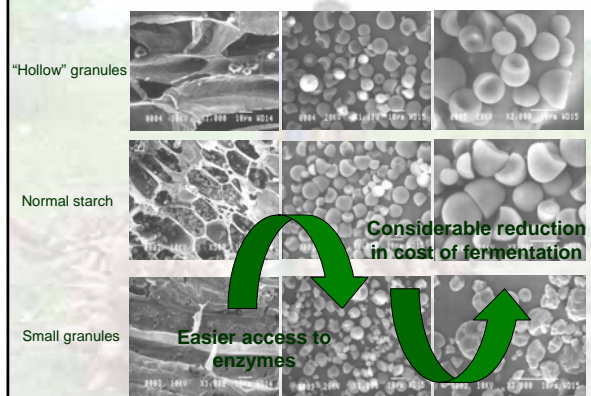
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cassava targets
four end-uses

Animal feed

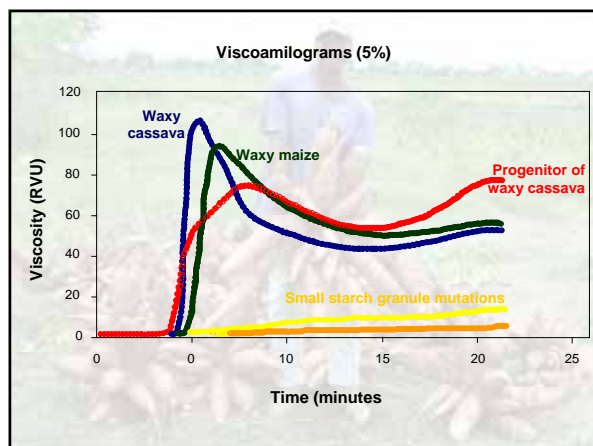
Starch

Ethanol/bioplastics

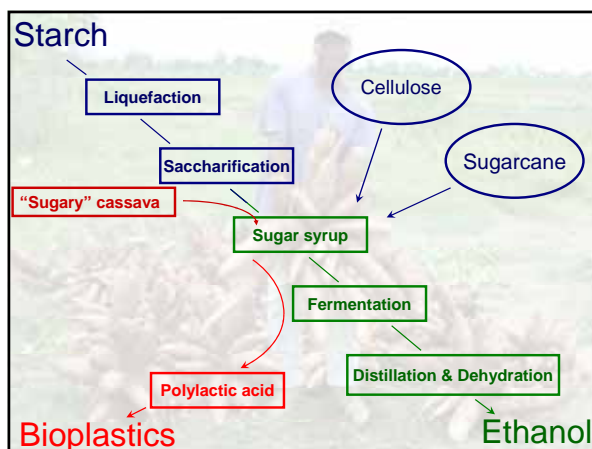
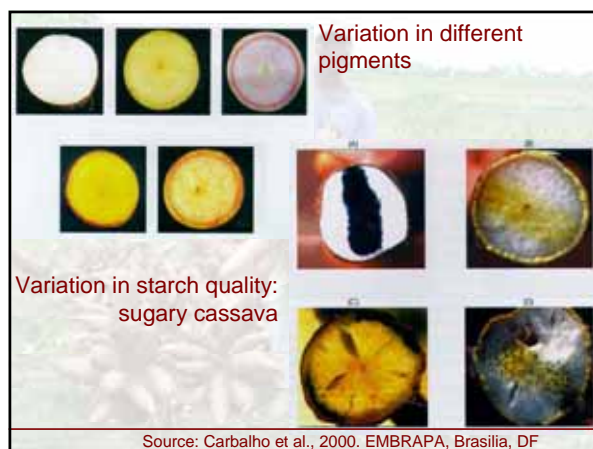
Processed food

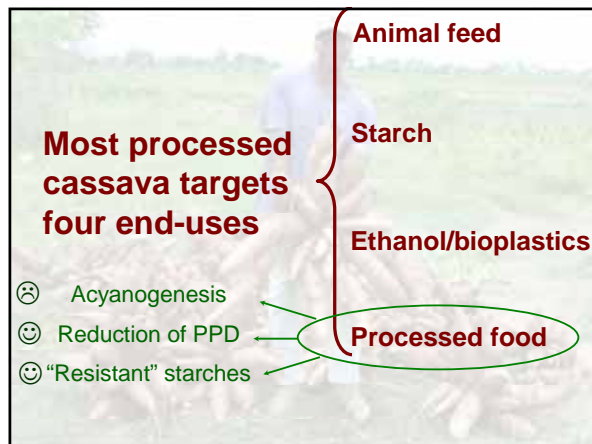


Source: José A. Arroyave



	Waxy	Waxy progenitor	Small Granules-1	Small Granules-2
DMC (%)	89.6	88.3	89.7	88.8
Onset gel (°C)	64.446	59.162	52.448	52.319
Peak gel (°C)	69.417	65.000	58.435	60.250
End gel (°C)	76.093	73.656	65.495	75.665
Delta H	19.421	14.906	7.360	11.275
End (°C)	-----	80.744	79.329	80.118
Peak (°C)	-----	84.883	83.883	84.467
Onset (°C)	-----	87.239	87.502	87.547
Delta H	-----	-5.778	-10.354	-7.639
Amylose DSC (%)	0.000	20.07	36.96	26.53
Water absorption (%)	2.23	4.97	4.95	5.03
Water solubility (%)	1.18	2.43	16.48	15.44
Swelling power (%)	2.22	4.97	4.87	4.95
Clarity	49.30	39.45	17.00	26.00
Easy cooking (min.)	3.36	5.61	3.98	6.26
Max. viscosity (RVA)	100	71	4	8
Gel instability	58.25	17.33	1.50	1.25
Gel. index	3.75	15.17	1.33	4.17





Concluding remarks

Pre-breeding provides excellent results
 Cassava still being domesticated
 New market opportunities promotes this work
 New technologies facilitate this work (i.e. NIRs, TILLING)

The introgression of traits difficult
 We need to implement the back-cross scheme
 Inbred parents would facilitate introgression
 In some cases the trait is simply inherited

The strategy for the future
 Continue breeding for high and stable productivity
 Quality also offers opportunities
 Need to interact with processing technologies



ขอขอบคุณ
 Asenti sa...
 Thank you !
 Danke !
 Obrigado !
Gracias !
 Merci !

The Rockefeller Foundation
 COLCIENCIAS
 Ministry Agriculture of Colombia
 HarvestPlus
 IAEA
 Generation Challenge Program

