

Avances en investigación de la *Jatropha Curcas*

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Biocombustibles de Guatemala S.A. y BIONOR España



Porque es importante *Jatropha curcas*?



Uso y mejoramiento en tierras marginales?



Altas expectativas para Jatropha

- Bajar la dependencia a los combustibles fosiles
- Reducción de gases invernadero (cambio climatico)
- Uso de tierras marginales (aridas y semiaridas)
- Biodiesel
- Creditos de Carbono
- Desarrollo local para generación de electricidad atraves del aceite

Sistemas de producción sostenible para la jatropha

- monocultivo
- Asocio con otros cultivos
- Cosecha de cercos



Variedades apropiadas para cada sistema!!!!!!

Que buscamos para el cultivo de la Jatropha?

- Rendimientos altos en condiciones apropiadas de cultivo.
- Sobreviva y tenga altos rendimientos en condiciones marginales (ideal).
- Cosecha sincronizada
- Resistencia a plagas y enfermedades
- Alto contenido de aceite y compocion de acidos grasos
- Destoxificación de la semilla (60% proteina en la semilla)
- Etc....etc....etc.....

Como se encuentra la Jatropha ahora?

- Todavía se encuentre en su infancia como cultivo para la producción de aceite.
- Plantaciones se han dejado debido a bajos rendimientos
- Reportes de baja diversidad a nivel mundial.
- Fuentes de diversidad estan en Mesoamerica

Consorsio de investigacion Jatropha

- Wageningen University and Research Centre
 - PRI Plant Breeding (E.N. van Loo, Robert)
 - PhD research Jatropha curcas breeding
 - PRI Agro-systems research (Raymond Jongschaap)
 - Global Jatropha curcas Evaluation Program
- Biocombustibles de Guatemala S. A. y Bionor.
- Facultad de Agronomía Universidad de San Carlos, Guatemala
 - Programa de Phd para mejoramiento

www.jatropt.eu

JATROPT Consortium

Last Updated on Wednesday, 19 January 2011 12:06



PLANT RESEARCH INTERNATIONAL
WAGENINGEN UR



QUINVITA
THE AGRICULTURAL INNOVATION

CNAP

CENTRE FOR NOVEL AGRICULTURAL PRODUCTS

BIOLOGY TO BENEFIT SOCIETY



THE UNIVERSITY of York



cirad



BIOCOMBUSTIBLES
DE GUATEMALA, S.A.



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Estudio de diversidad genética con materiales de Centro America, Africa, Asia y Sur America

Estudio de diversidad genetica

- Resultados finales: 30 paises, accesiones evaluadas. Asia, Africa, Meso-America y Sur America
- Se utilizaron SSR, TRAPs y AFLPs
- Evaluaciones fenotícapas en invernadero.
- Análisis de Aceite
- Composición de ácidos grasos

Programa Global de evaluación de la Jatropha

■ Colectas, Caracterización y Mantenimiento

- Recursos Geneticos.
- Datos de pasaporte

■ Website

www.jatropha.wur.nl

- Volantes del proyecto
- Cuestionario
- Instrucciones (muestras)
- Kit de preparación muestras



Volantes de proyecto y los reportes

General project flyer

Jatropha curcas evaluation, breeding and propagation programme (JEP)



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www.jatropha.wur.nl

The *Jatropha curcas* evaluation, breeding and propagation programme (JEP) is carried out by Wageningen University and Research centre, Plant Research International, the Netherlands.

Rationale

Jatropha curcas is a multi-purpose tree, growing naturally in countries of the equatorial Americas, whereas it has been spread to other tropical countries as well. *Jatropha* seeds are rich in oil and when extracted, pure plant oil can be used directly or as biodiesel in engines. For this reason, *Jatropha curcas* is an attractive crop and it is being introduced rapidly in various rural programmes, as it may contribute to rural development by income generation and increasing the efficiency of rural and agricultural processes. However, *Jatropha curcas* production varies greatly and profitable claims are made without well-founded proof nor with reliable sources of information. Being an uncultivated wild-species, it is not known what the environmental and the genetic influence is on oilseed production.

This information is critical to increase the chances of *Jatropha curcas* development programs with appropriate knowledge on how to cultivate what line of *Jatropha curcas* under which environmental and agronomic conditions.

Objective

The objective of this programme is to minimize risks involved in the introduction of *Jatropha curcas* as oil producing crop in developing countries, where it concerns productivity in relation to environmental settings and crop management.

Approach

Cultivated and wild-lines of *Jatropha curcas* are collected globally with associated 'passport data'. The required data include information on productivity, oil contents, growth conditions, agronomic practices, propagation methods and sensitivity to pests and diseases. Living gene pools are maintained in their originating countries. Young leaf and seed material is sampled from natural and commercial *Jatropha curcas* stands. Analysis of these data allows distinguishing more or less promising lines in relation to their growing environments. Finger-printing of the collected material and some preliminary research using biotechnological approaches will prepare for future breeding and propagation programmes. Cross-breeding and agronomic experiments will be initiated with selected lines.

Programme duration and reach

This first phase of the *Jatropha curcas* evaluation, breeding and propagation programme runs from 2006 until 2010. The programme is embedded in a larger framework of stakeholders dealing with all aspects of renewable energy and is not restricted to agronomic production goals only.

Participation

The *Jatropha curcas* evaluation, breeding and propagation programme is open for participation. You can supply information on your *Jatropha curcas* collection through a questionnaire and by supplying young leaf material that will be integrated in the various analyses. We will provide analysis results of your collection and update progress and on special stakeholder workshops you may want to participate findings will be made.

Participate with
collection: contribute
world wide evaluation
www.jatropha.wur.nl

To participate in the programme you may contact the project collection kit and for the questionnaire. You are a well-founded global *Jatropha curcas*.

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Claims and Facts on *Jatropha curcas* L.

Global *Jatropha curcas* evaluation, breeding and propagation programme

R.E.E. Jongschaap, W.J. Corré, P.S. Bindraban & W.A. Brandenburg



© 5 October 2006

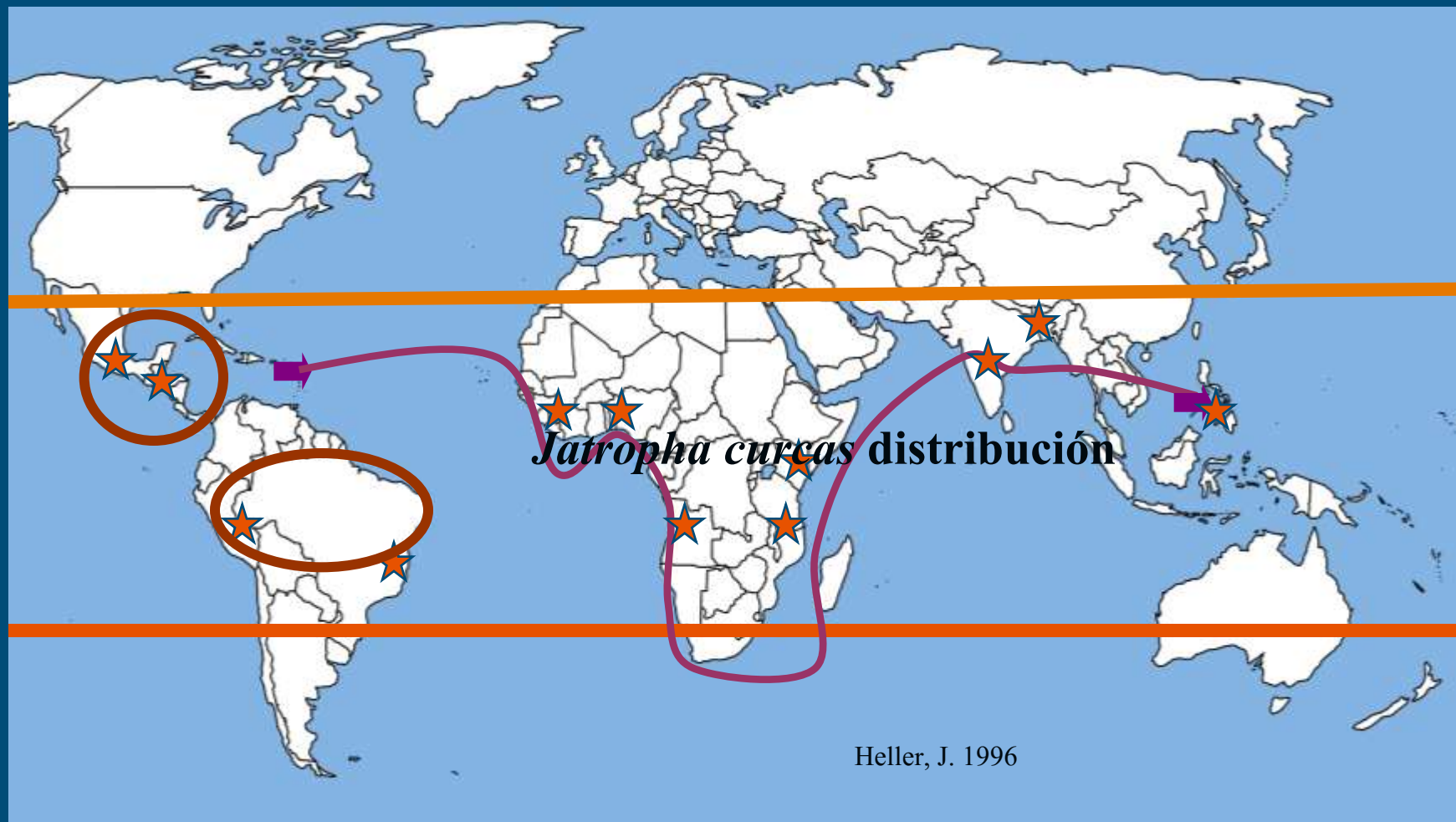
Stichting Het Groene Woud, Laren

Report 158



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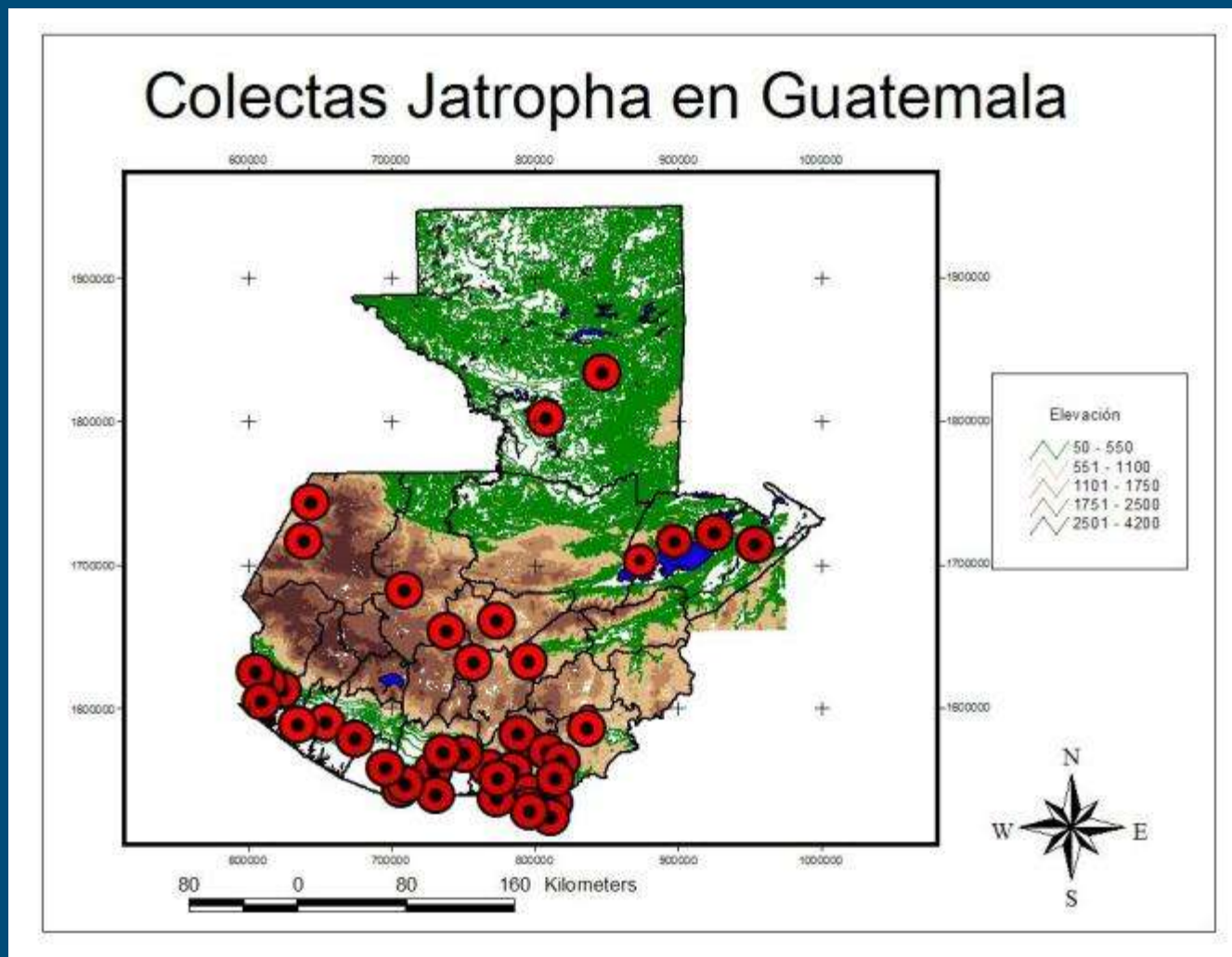
Jatropha curcas distribution



Variacion Genetica en *Jatropha curcas*

- Toxica y no toxica (Mexico y Guatemala)
- ‘Cabo verde’ ampliamente distribuida
- Programa de evaluación global en *Jatropha curcas*
 - 200 entradas de 30 países colectadas en el campo
 - 60 muestras colectadas en Guatemala

Lugares de colecta muestras en Guatemala



Variación Fenotípica



Diferencias entre *Jatropha curcas* toxica y no toxica



Toxica



No Toxica

Susceptibles a enfermedades y plagas



Diferencias morfológicas



Diferencias morfológicas





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Evaluación en los invernaderos de los diferentes materiales

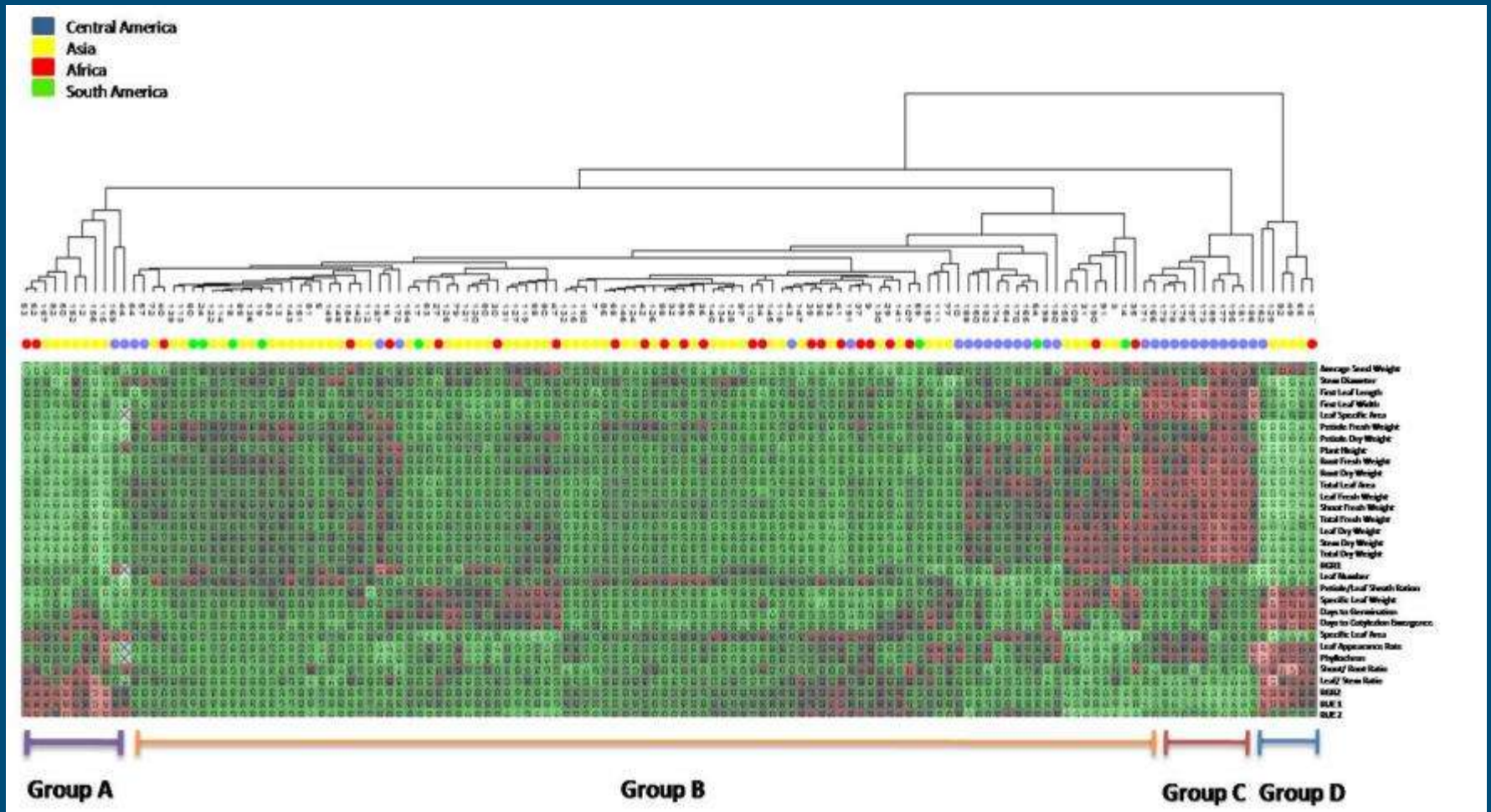
Característica	Date of measurement
Días a la germinación	2-4 semanas
Días para la emergencia de los cotiledones	2-4 semanas
Número de cotiledones	2-4 semaas
Alto de planta	30 DDG
Diametro	30 DDG
Largo de la primera hoja	30 DDG
Ancho de la primera hoja	30 DDG
Número de hojas	60 DDG

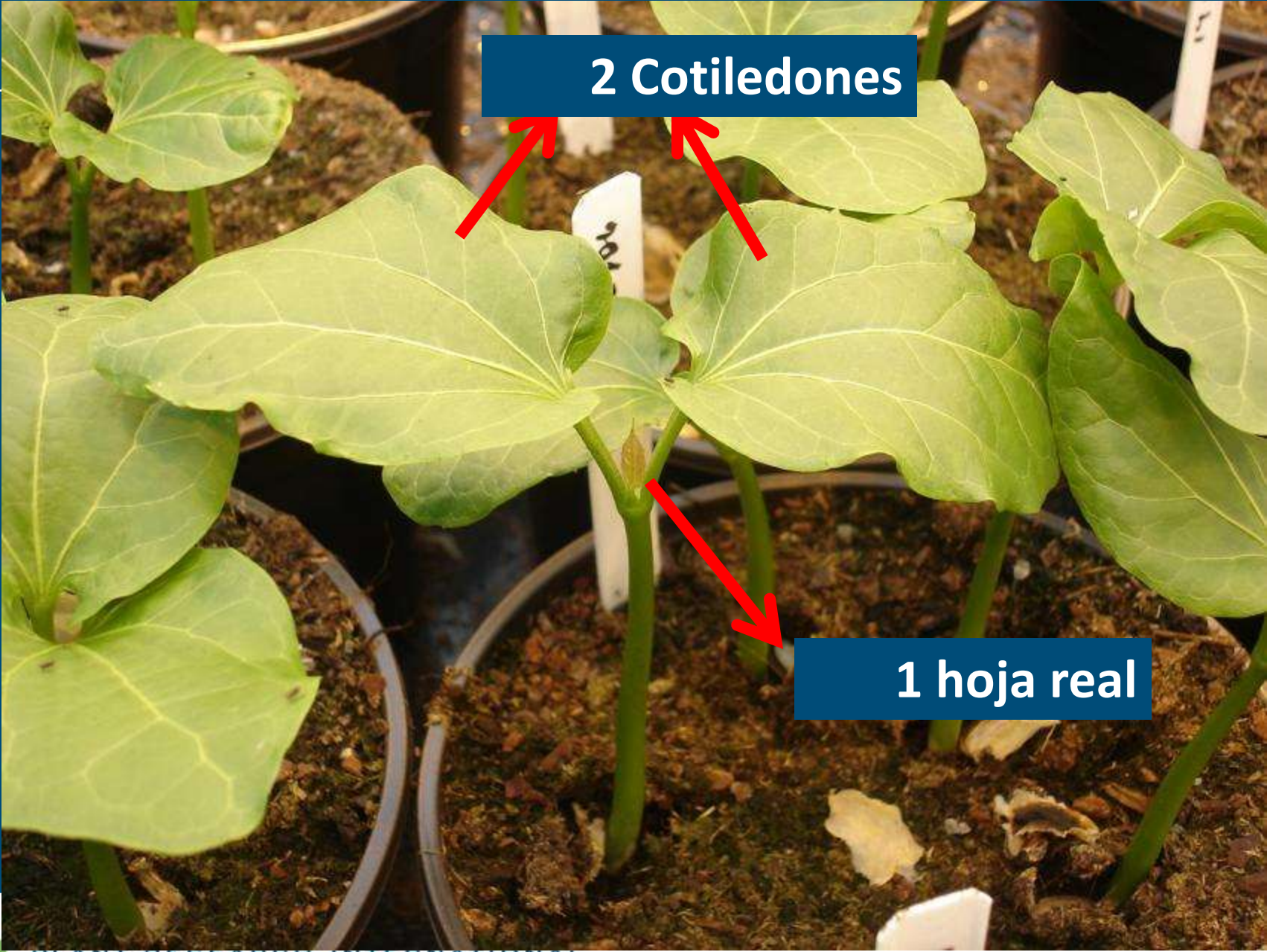
Otras Características
Peso fresco total
Peso seco Total
Realcion tallo-raiz
Relacion hojas-tallo
Área foliar promedio
Peso espficio hoja
Area específica
Tasa de crecimiento

Diferencias morfológicas



Diferencias morfológicas





2 Cotiledones

1 hoja real



3 Cotyledons

3 Cotyledons



Variación en la composición de ácidos grasos

A. Fatty acid percentage range				
Fatty acids	Asia	Africa	South America	Central America
C16:0*	20.3-14.8*	17.0-15.0*	17.3-15.4*	16.8-13.6*
C16:1*	1.1-0.4*	1.0-0.6*	0.9-0.5*	0.9-0.4*
C18:0 ^(ns)	11.4-8.2 ^(ns)	13.6-8.0 ^(ns)	10.4-8.6 ^(ns)	10.8-8.4 ^(ns)
C18:1*	54.2-46.1*	52.7-42.0*	49.7-42.9*	51.3-34.5*
C18:2*	43.9-30.5*	43.6-34.6*	40.6-33.1*	52.3-43.1*
C18:3 ^(ns)	0.1-0.3 ^(ns)	0.1-0.4 ^(ns)	0.2-0.3 ^(ns)	0.1-0.3 ^(ns)
*Variation between accessions is statistically significant at $p < 0.05$				
(ns) no significant differences at $p > 0.05$				

Evaluación molecular

Evaluación molecular

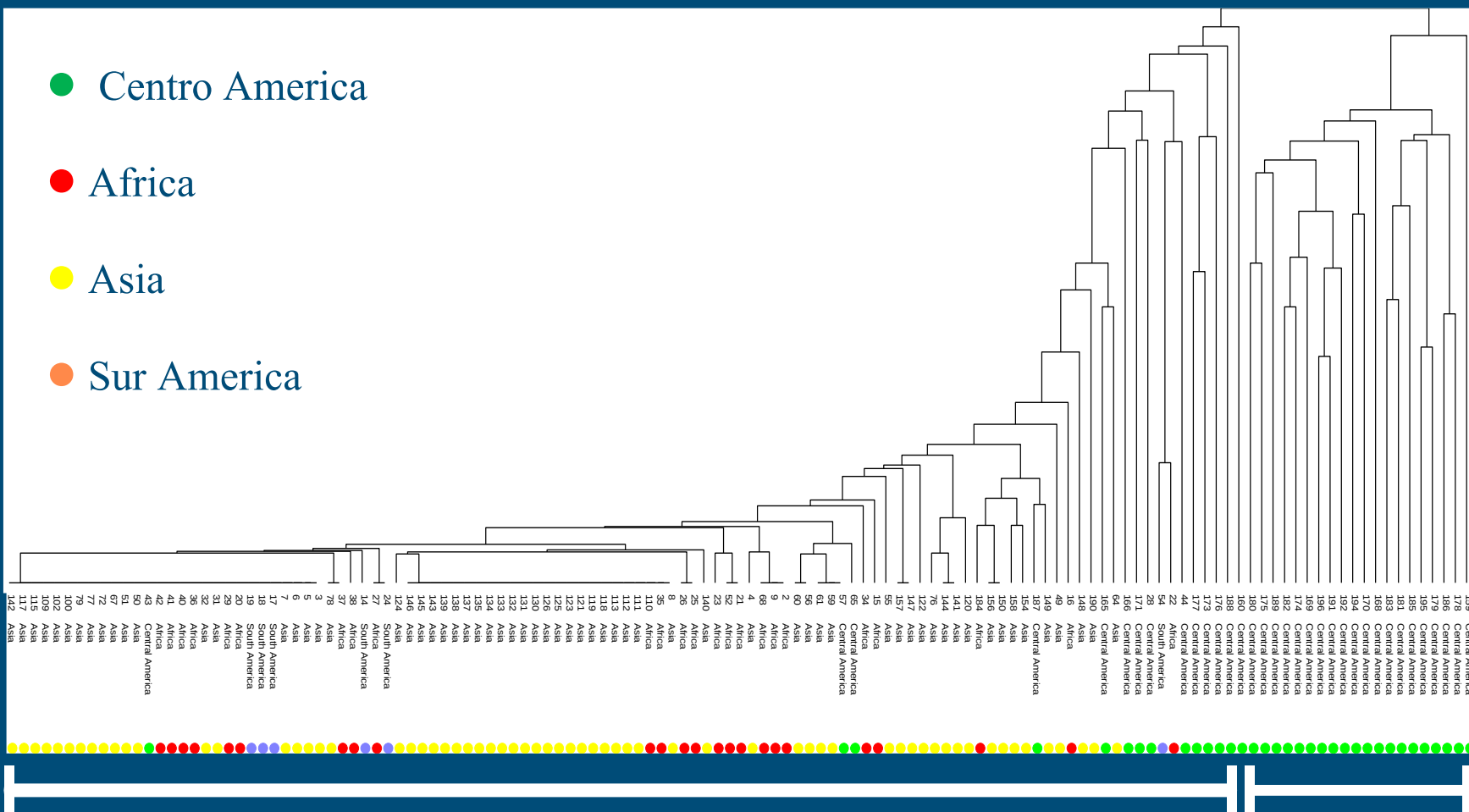
Characteristic	SSR	TRAP	AFLP
Número de marcadores evaluados	29	13	20
Marcadores polimorficos	14	6	2
Total de polimorfismos	73	31	86

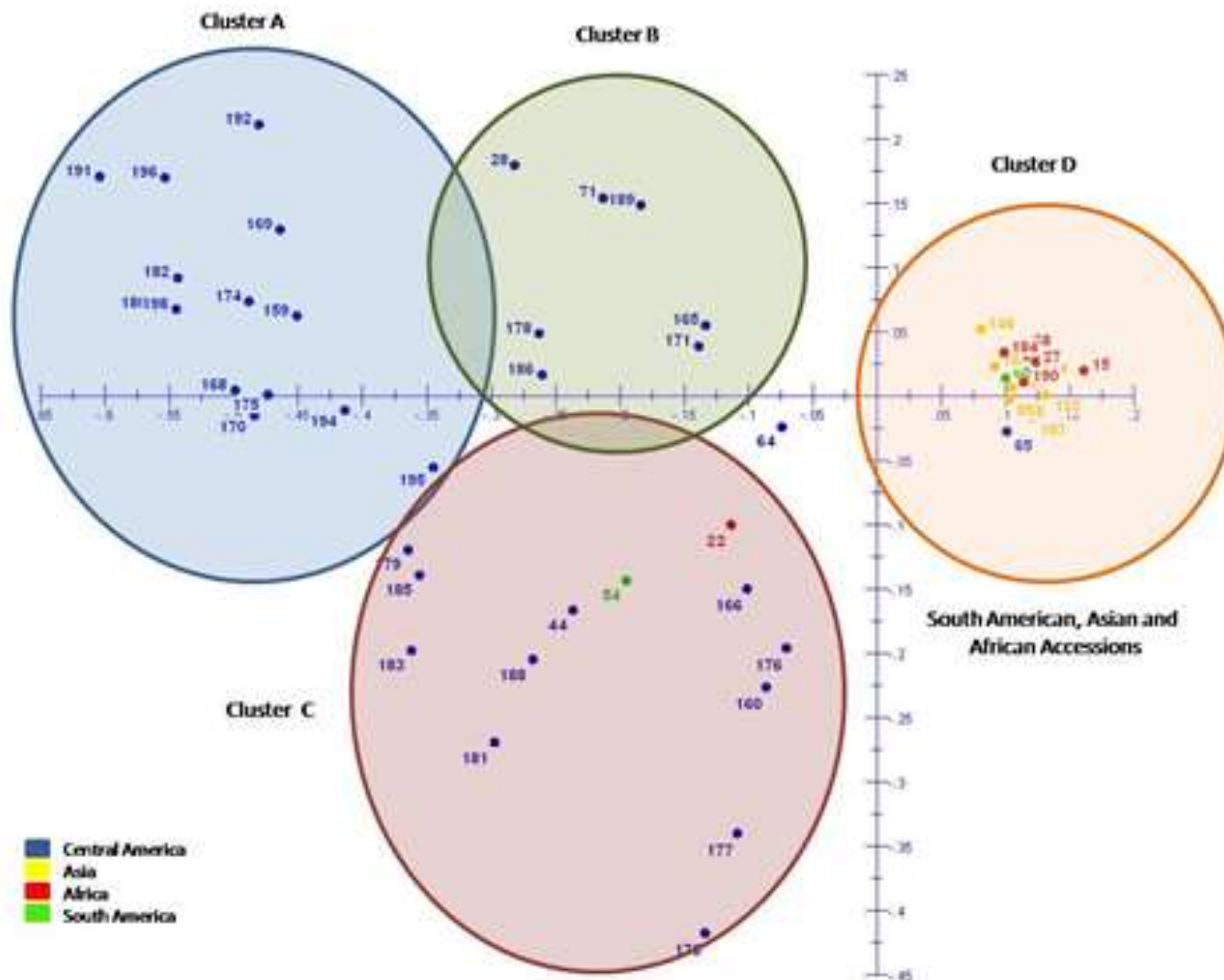
● Centro America

● Africa

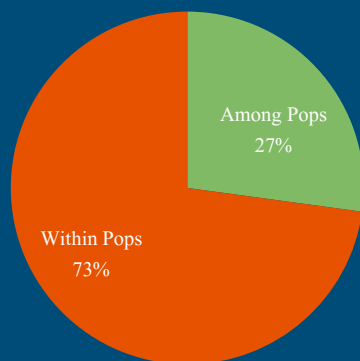
● Asia

● Sur America

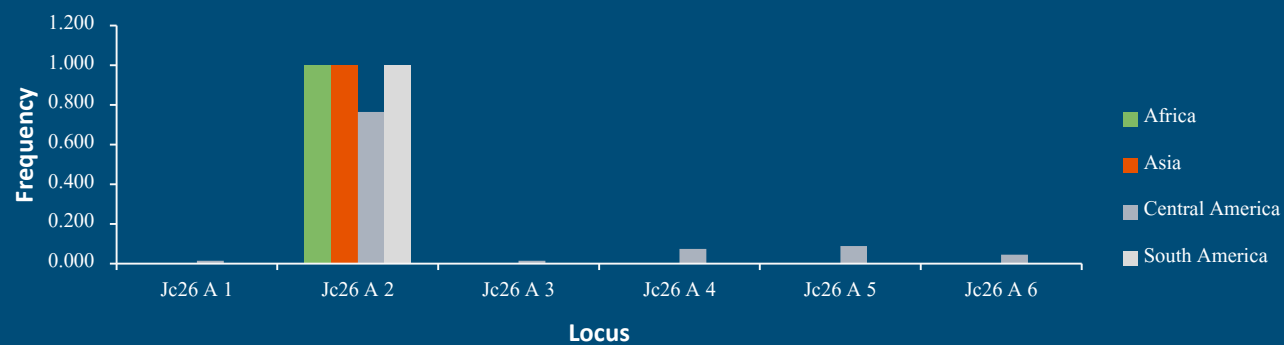


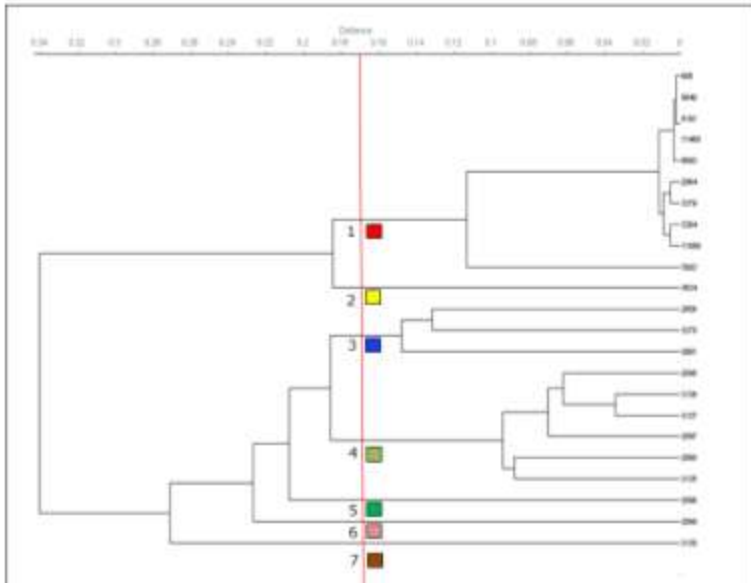


Percentages of Molecular Variance

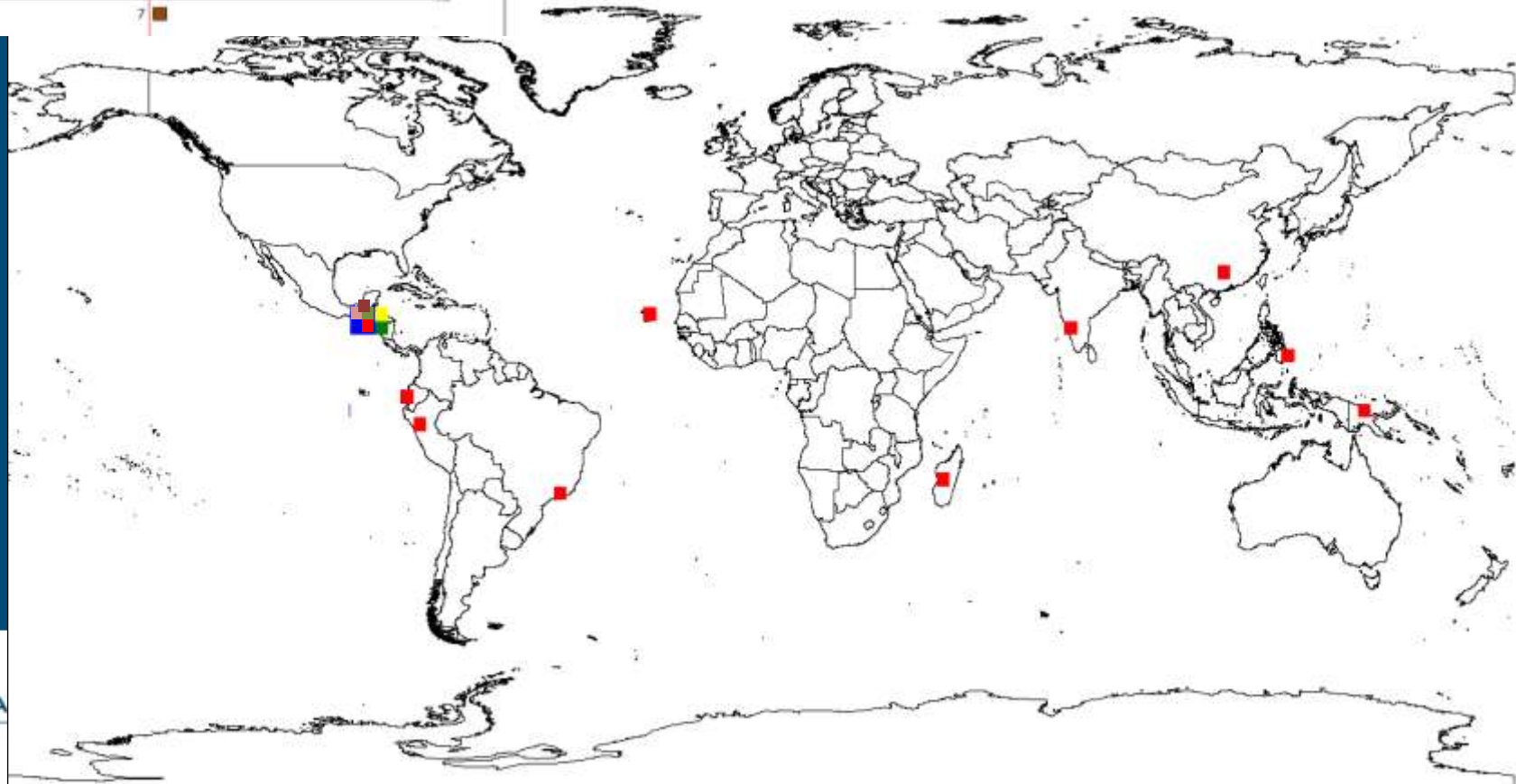


Allele Frequency for Jc26 A

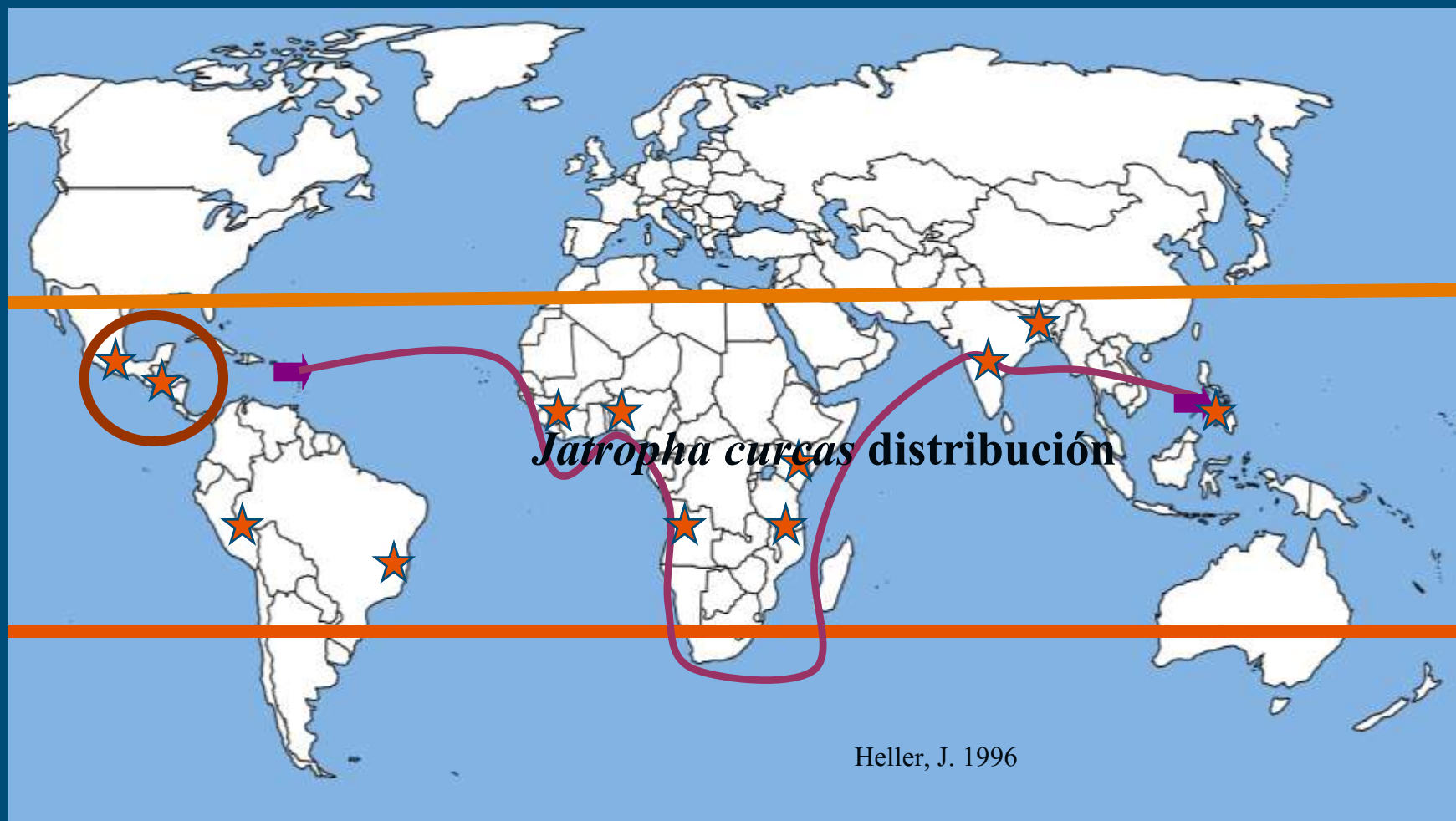




Analisis con SNP



Jatropha curcas distribution



Conclusiones

- Alta variación en materiales Centroamericanos (Mesoamerica)
- Baja diversidad en materiales de Africa, Asia y Sur America.
- Existe variacion morfologica a pesar de que no existe variacion molecular posible Epistasis? Metilación de ADN?
- Fuente de variacion y Centro de Origen para *Jatropha curca*
Mesoamerica

Como utilizar esta variación?

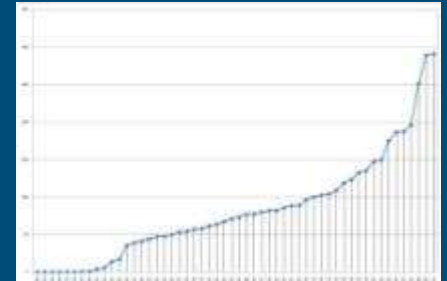
Selección de los mejores materiales

Mejoramiento utilizando marcadores moleculares

Desarrollo de poblaciones de mapeo

Desarrollo de la *Jatropha curcas*

- Cruces entre diferentes materiales
- Número de semillas
- Toxicidad
 - Plantas no tóxicas
(60% proteína en la semilla)
- Arquitectura



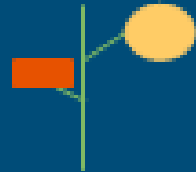
Cruses entre diferentes materiales



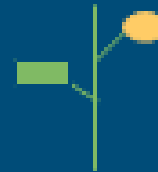
Female

Ovule

(flower)



X



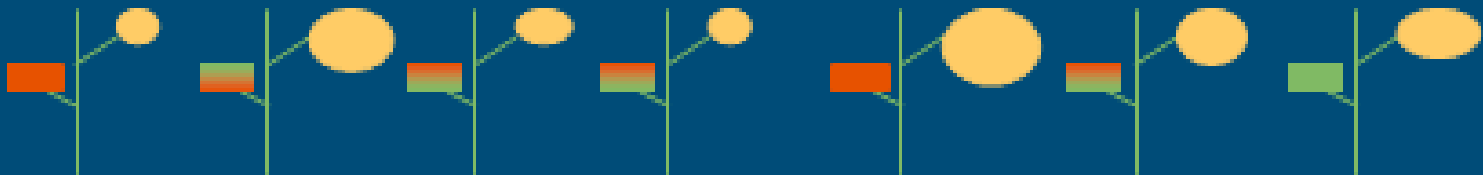
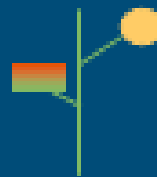
Male

Pollen



Parent

F1

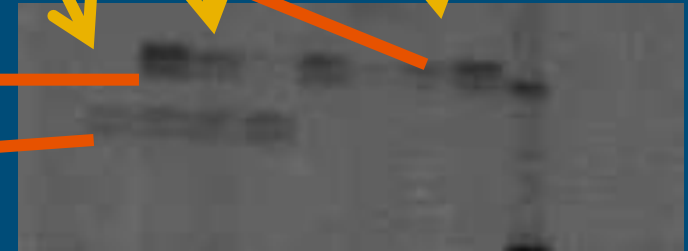
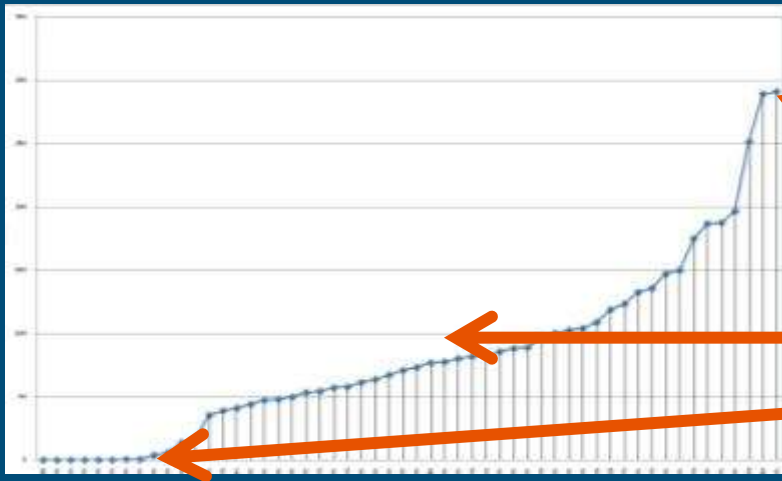
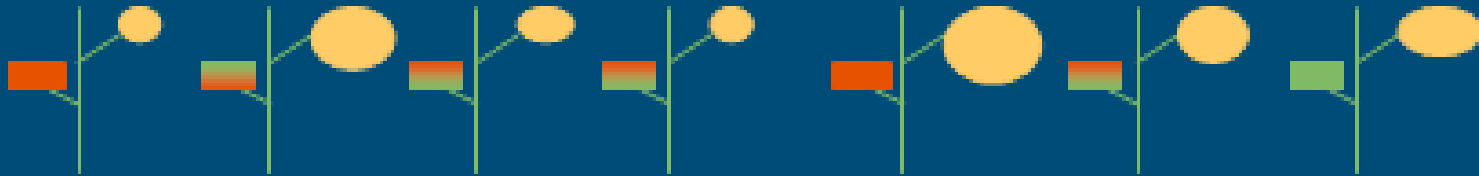


F1x F1-offspring



Segregation population (Number of fruit)

F2



Molecular assisted selection (MAS): Herramienta en programas de mejoramiento genetico

Primeros resultados

Linkage mapping in the oilseed crop *Jatropha curcas* L. reveals a locus controlling the biosynthesis of phorbol esters which cause seed toxicity

Andrew J. King¹, Luis R. Montes^{2,5}, Jasper G. Clarke¹, Julie Affleck¹, Yi Li¹, Hanneke Witsenboer³, Edwin van der Vossen³, Piet van der Linde⁴, Yogendra Tripathi⁴, Evanilda Tavares^{4,†}, Parul Shukla⁴, Thirunavukkarasu Rajasekaran⁴, Eibertus N. van Loo⁵ and Ian A. Graham^{1,*}

¹Centre for Novel Agricultural Products, Department of Biology, University of York, York, UK

²Biocombustibles de Guatemala, Guatemala Ciudad, Guatemala

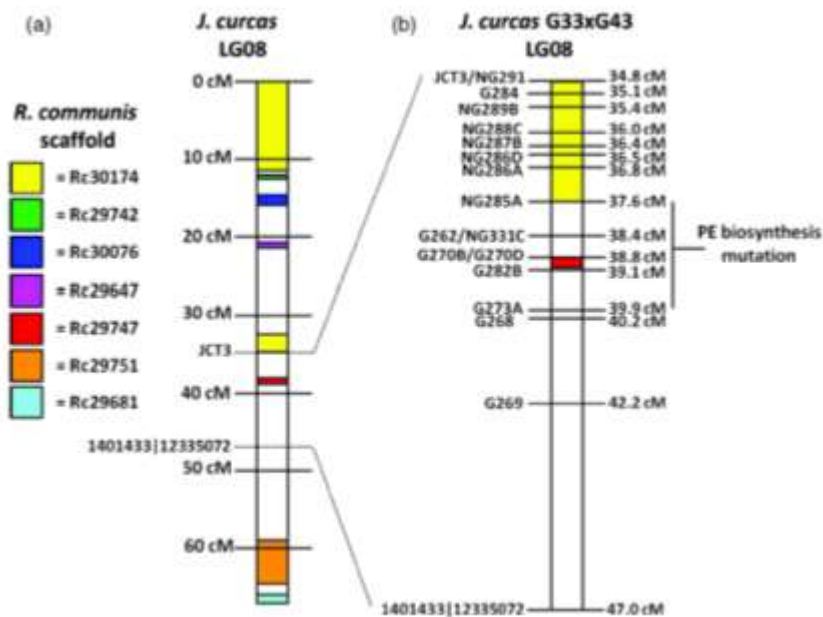
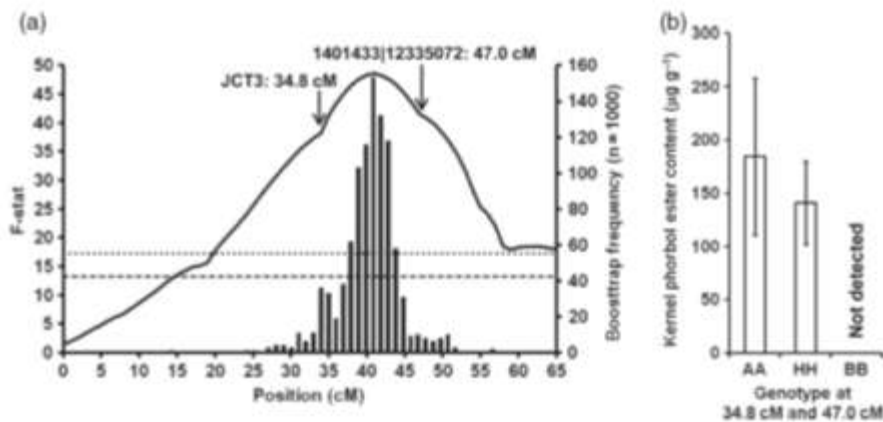
³Keygene N.V., Wageningen, The Netherlands

⁴Quinvita Group, Ghent, Belgium

⁵Plant Breeding Wageningen UR, Wageningen, The Netherlands

Mapa genético de la *Jatropha curcas*





Conclusiones finales y recomendaciones

- Selección de materiales para cada sistema productivo
- Toda la variación genética está presente en Mesoamérica
- Los marcadores moleculares pueden ayudar al análisis de la variación y selección asistida con marcadores (acelerar el proceso de mejoramiento)

Agradecimientos

- Organizadores de este evento
- Biocombustibles de Guatemala S.A.
- Bionor
- FAUSAC, Universidad de San Carlos
- Fundación de ‘Stichting het Groene Woudt’
- Wageningen UR
- Wageningen Plant Research