

Fusarium wilt or Panama disease: the disease, historic overview, current situation and potential impact of TR4 in Latin American and the Caribbean - LAC



Miguel Angel Dita Rodriguez- PhD
miguel.dita@embrapa.br



Outline

- The disease
- A brief history
- Causal agent and races
- Global distribution of Fusarium wilt of banana
- Current Impact of Foc TR4 on relevant production areas
- Potential impact for LAC
- How to move forward ?



A bit of History

RECEIVING A SHIPLOAD OF BANANAS
GALVESTON, TEXAS



The banana export trades began in tropical America with 'Gros Michel' highly susceptible to race 1 of Foc... [Slide from R. Ploetz]

By the 1960s, 'Gros Michel' had been replaced in export production by cultivars of the Cavendish subgroup



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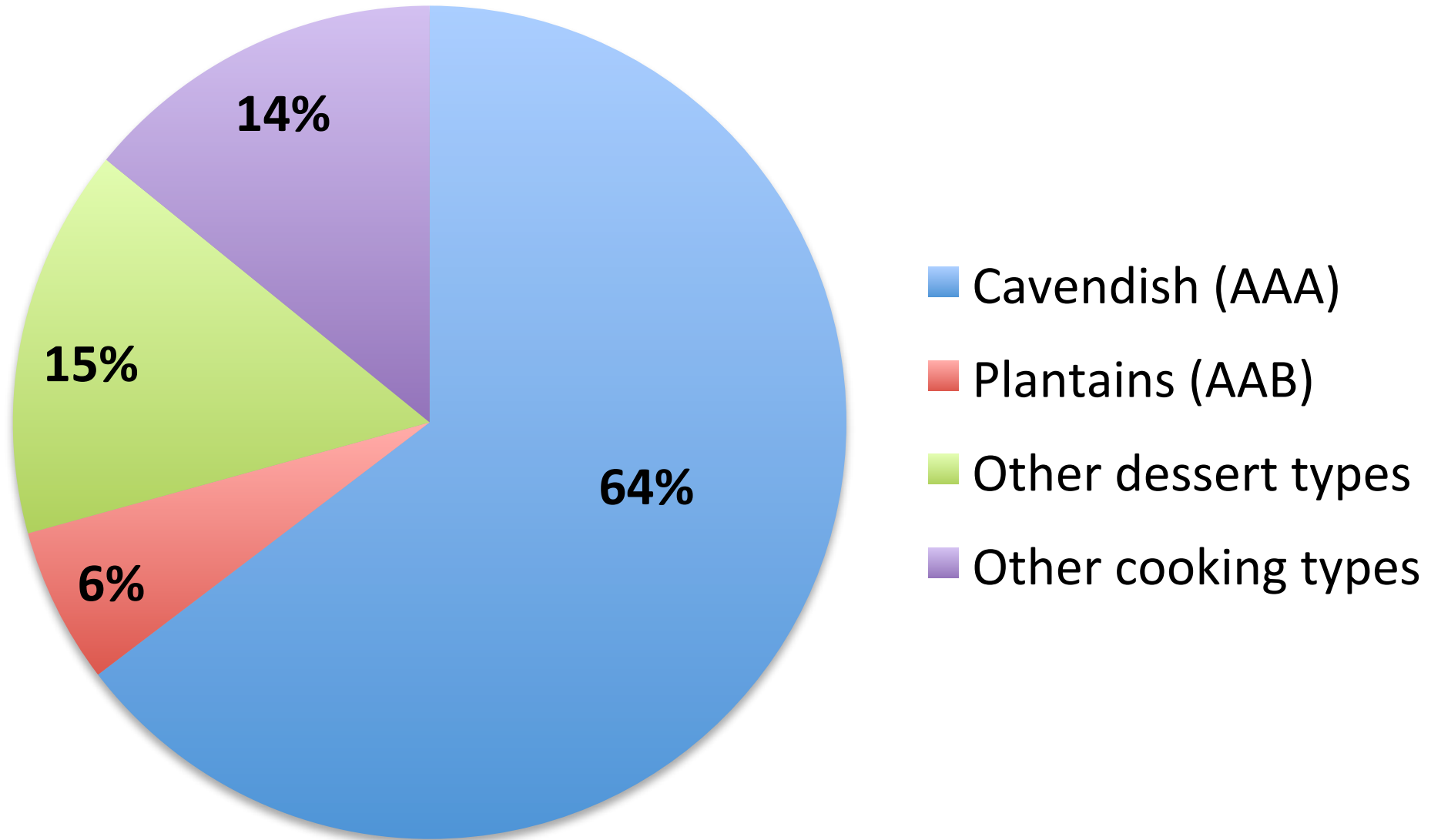


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'Gros Michel' learns his fate [R. Ploetz]

Cavendish varieties comprises 41% of all bananas grown worldwide and > 60 % in Top 10 producing countries



The current banana industry is 'Cavendish' Ocean



Fusarium wilt vs. Export bananas



ay

TR4?



454 - seq

~ 60 years ago



Fusarium wilt of banana: a brief history

- 1876: First report : Queensland. 1874 Silk banana (Bancroft, 1876)
- 1880 : Spreading to the many producing regions in the world
- 1950 -: Few regions remained free of the disease
- 1900-1960 : > 100 000 ha in Central America were destroyed
- 1950 -: Banana companies were forced to change Gros Michel by Cavendish varieties ("resistant")
- 1970 : Damage reported in Cavendish in the subtropics (subtropical race 4)
- 1990 : Damage was reported in Cavendish in the tropics (tropical race 4)



The disease

Fusarium wilt of banana

External symptoms



**** Symptoms of Race 1, 2 and TR4 are similar**



TR4 –Cavendish ,Taiwan



R1 – Gros Michel, Costa Rica

**** Symptoms of Race 1, 2 and TR4 are similar**



Wayne O'Neil

TR4 –Cavendish, Australia



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R2 – Monthan (ABB), Brazil

Fusarium wilt of banana

Internal symptoms





Affected plants are no longer productive



Which symptoms look like Fusarium wilt ?



Photos: Miguel Dita

MOKO

Which symptoms looks like Fusarium wilt ?



Photos: M.A. Dita

MOKO

Which symptoms looks like Fusarium wilt ?



Fusarium



Moko

Which symptoms looks like Fusarium wilt ?

Fusarium wilt symptoms are no frequent on young plants, but that is not a rule!



Fusarium wilt

Cv. Bluggoe, Nicaragua 2013



Moko



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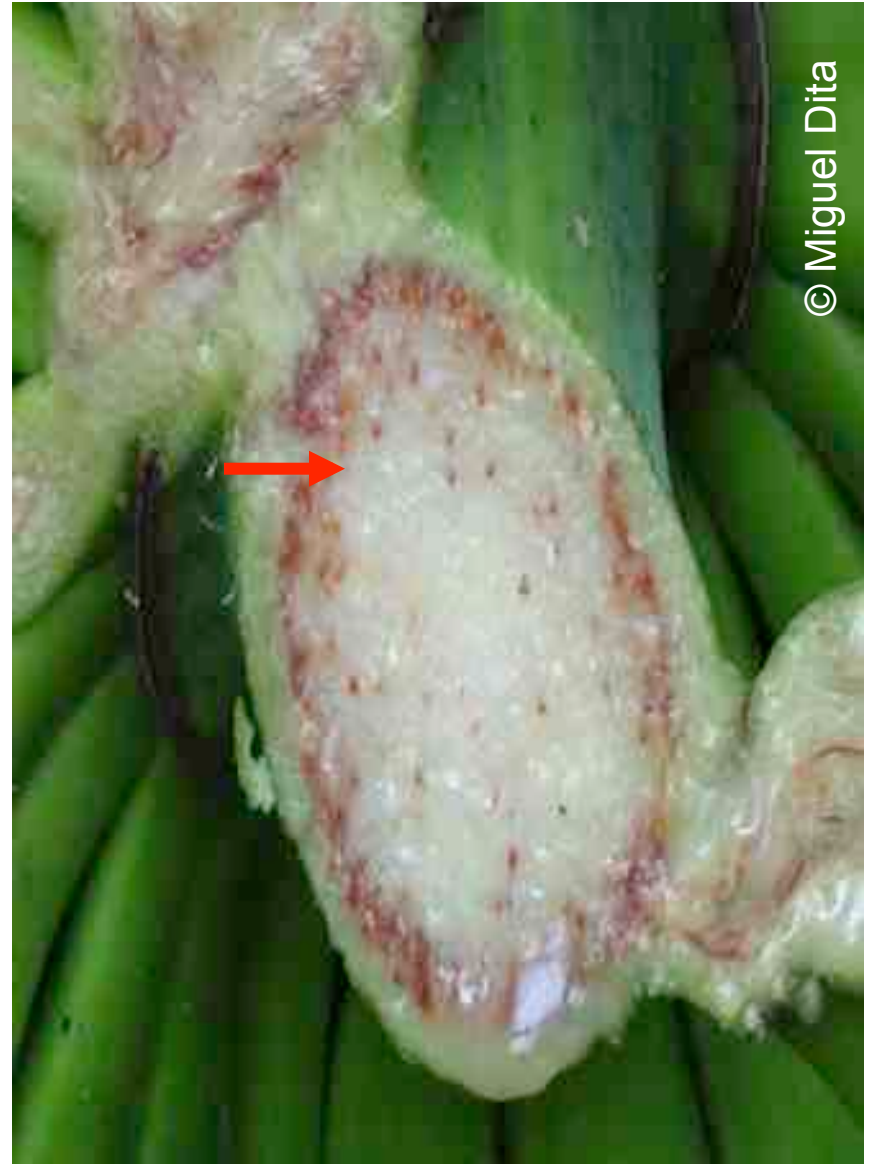
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Foc TR4 – Young plants of Cavendish – Taiwan, 2012

Moko



Symptoms in fruits



Internal symptoms

Getting familiar with the Causal Agent

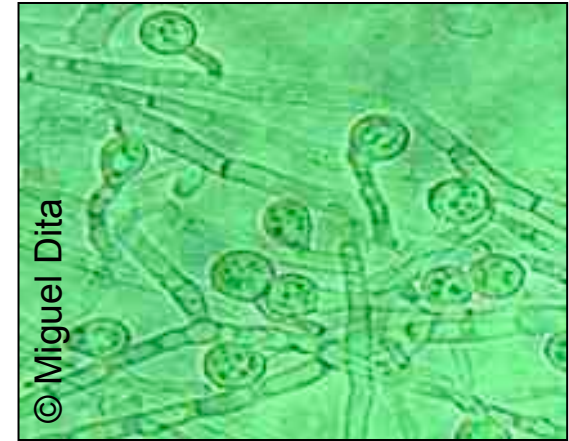
Structures of Fusarium oxysporum f. sp. cubense



- **Microconidiq:** 5 - 16 x 2.4 - 3.5 μm ,



- **Macroconidiq:** 27 - 55 x 3.3 - 5.5 μm ,.



- **Chlamydiospores:** 7 - 11 μm diameter

Foc can survives in the soil without susceptible host at least for up to > 30 years

Races de *Fusarium oxysporum* f. sp. *cubense*



**Gros Michel
(AAA)**



R1 – the ‘famous’ one
VCG0120 – 01224 (except 01213/16)



**Bluggoe
(ABB)**



R2 ~ also infects R1 susceptibles?!
VCG0120, -8, others? (except 01213/16)



**Cavendish
(AAA)**



R4

SR4 ~ 1977 – Subtropics
Associate to Stress-Cold, Waterlogging
VCG- 0120, -1, -2, -9, -10, -11, -15 = 7

TR4 ~ 1990's – Tropics
Both tropics & subtropics
VCG01213, (01213/16 , -16)


Races de *Fusarium oxysporum* f. sp. *cubense*

Race 1: Gross Michel (also Maçã (Silk), Pisang Awak)

Race 2: Bluggoe (and cooking bananas)

Race 3: *Heliconia* spp. (new specie?)

Race 4: Cavendish (subtropical-ST4 and Tropical-TR4)

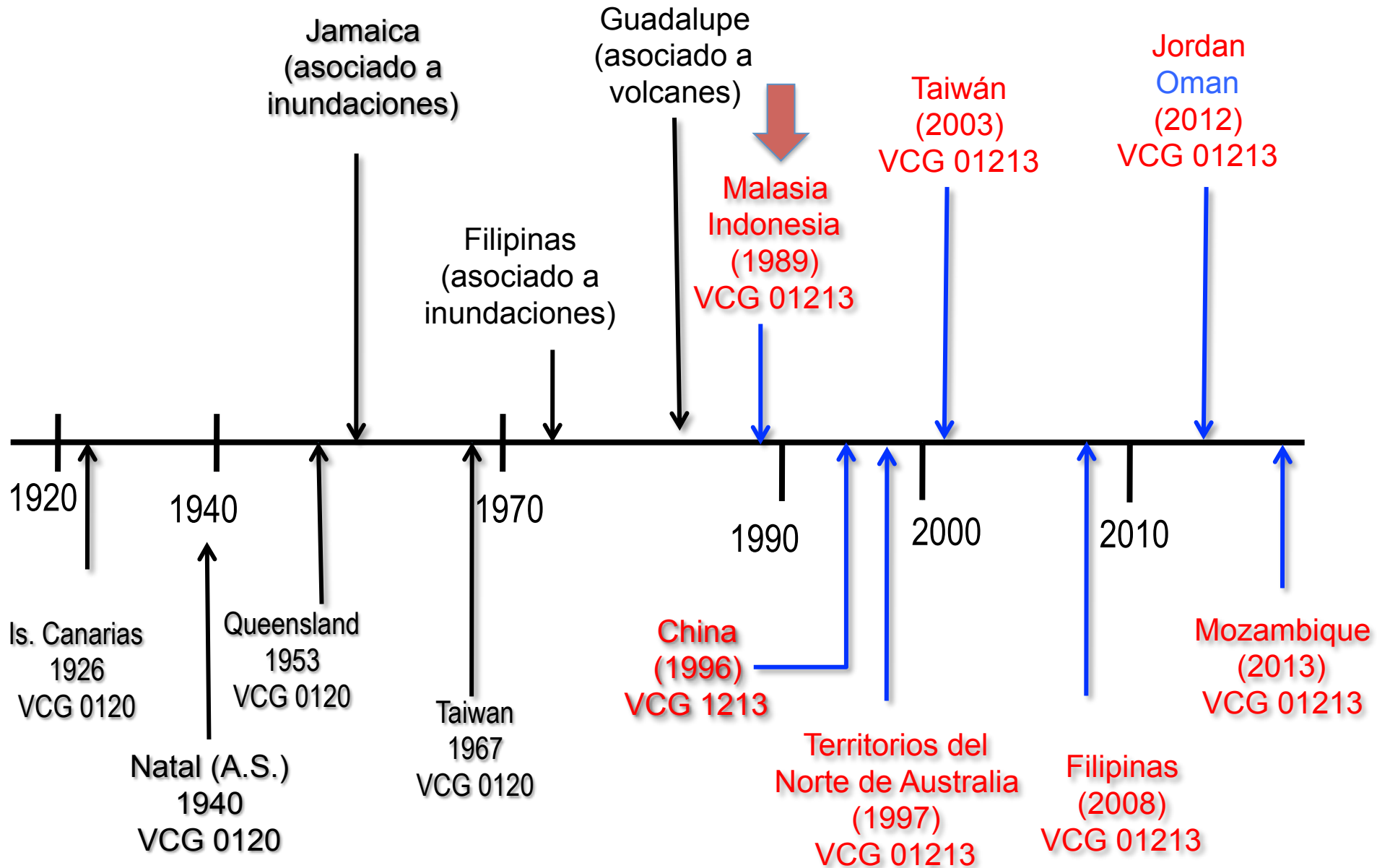


Variety	R1	R2	R3	R4
Gross Michel	S	R	R	S
Bluggoe	R	S	R	S
Heliconia	R	R	S	?
Cavendish	R	R	R	S

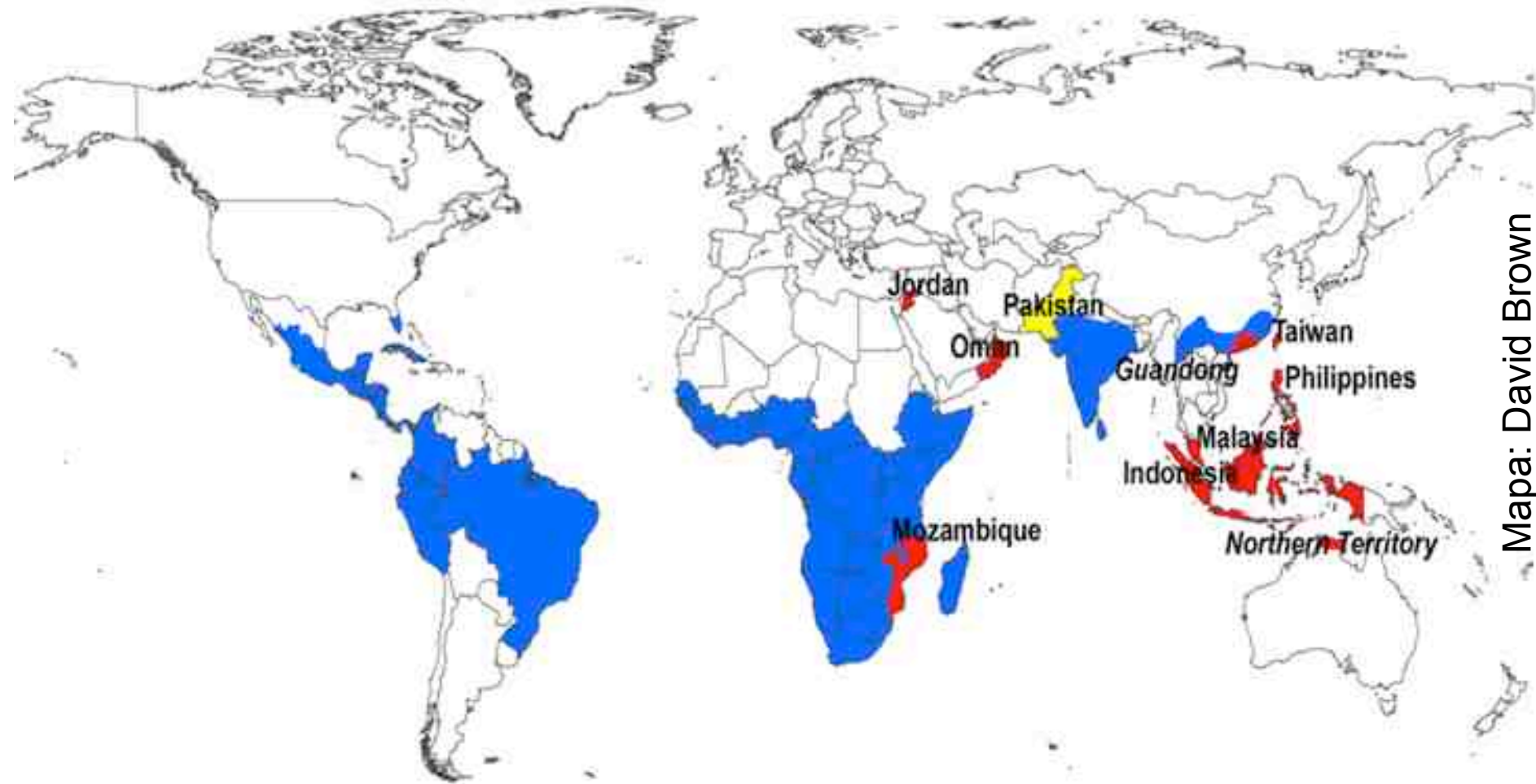
Tropical race 4 is the most destructive as also affects varieties susceptible to R1 and R2

~80 % of banana and plantains globally produced come from TR40susceptible varieties




Short History of FOC race 4 in Cavendish



Fusarium wilt of banana: Distribution of races

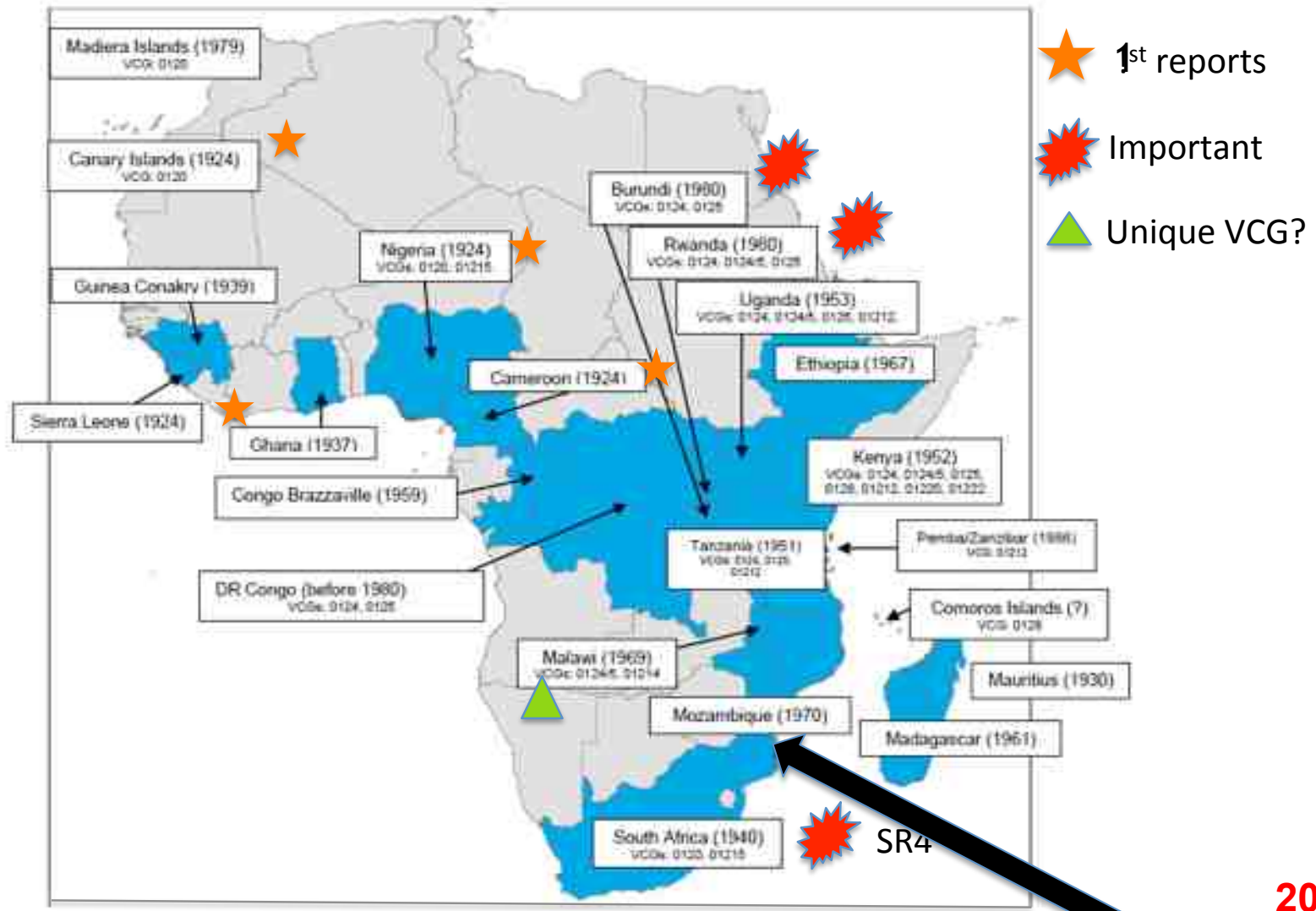


Mapa: David Brown

-  Races 1, 2
-  Tropical race 4, 1, 2
-  Under evaluation for Tropical race 4

This MAP is only a tentative approximation of the distribution of Foc to be used for academic purposes. It is not based on any scientific studies and should not be used by authorities for decision making purposes.

Fusarium oxysporum f. sp. *cubense*: Africa



Adapted from Viljoen, 2013

Blomme *et al.*, (2012)

Karangwa *et al.*, 2012

2013

TR4

NEWS IN FOCUS

OSLOGY Mapping project opens way to sinkhole predictions p.186

AGRICULTURE Fungi offer fresh take on additives to improve crops p.198

PHYSICS Big Bang aftermath may have offered right conditions for life p.201



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Banana plantations are at risk from a disease known as Fusarium wilt.

AGRICULTURE

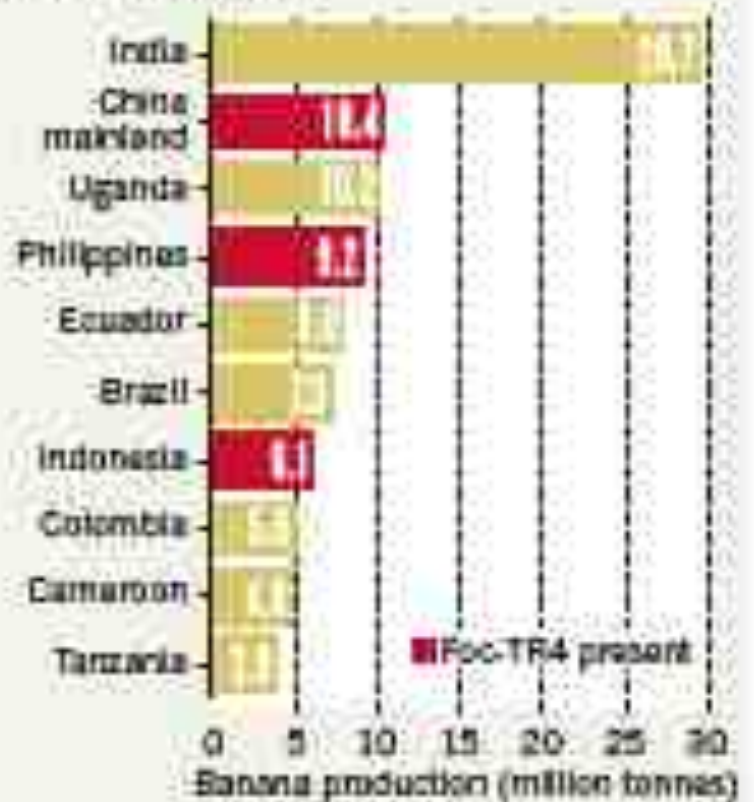
Fungus threatens top banana

Fears rise for Latin American industry as devastating disease hits leading variety in Africa and Middle East.

SOURCE: IRII

FRUIT THREAT

A fungus strain that kills banana plants has been detected in three of the world's top producers of the fruit.



Impact on the int'l media: just the momentous, forgettable?

THE INDEPENDENT MONDAY 07 APRIL 2014



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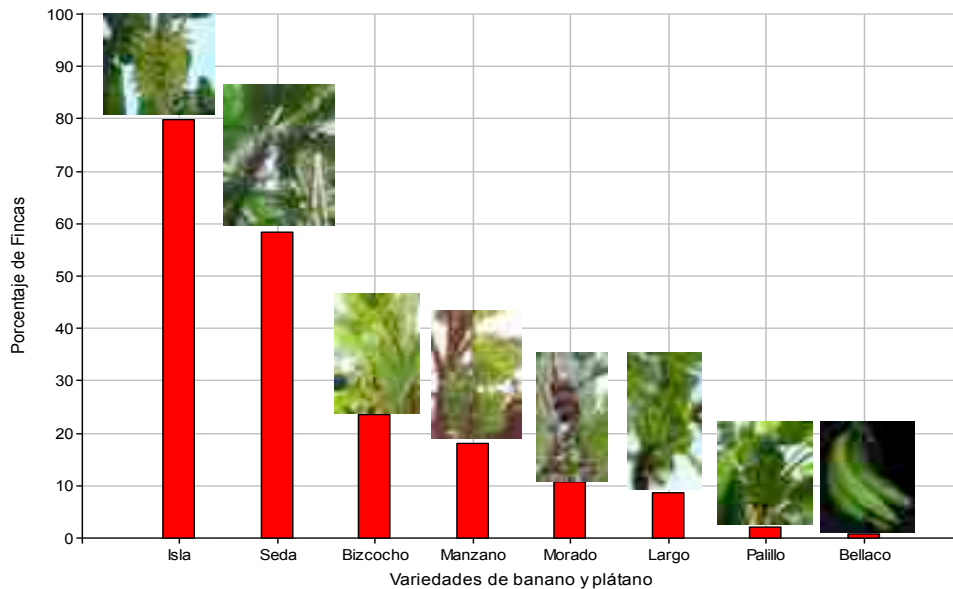
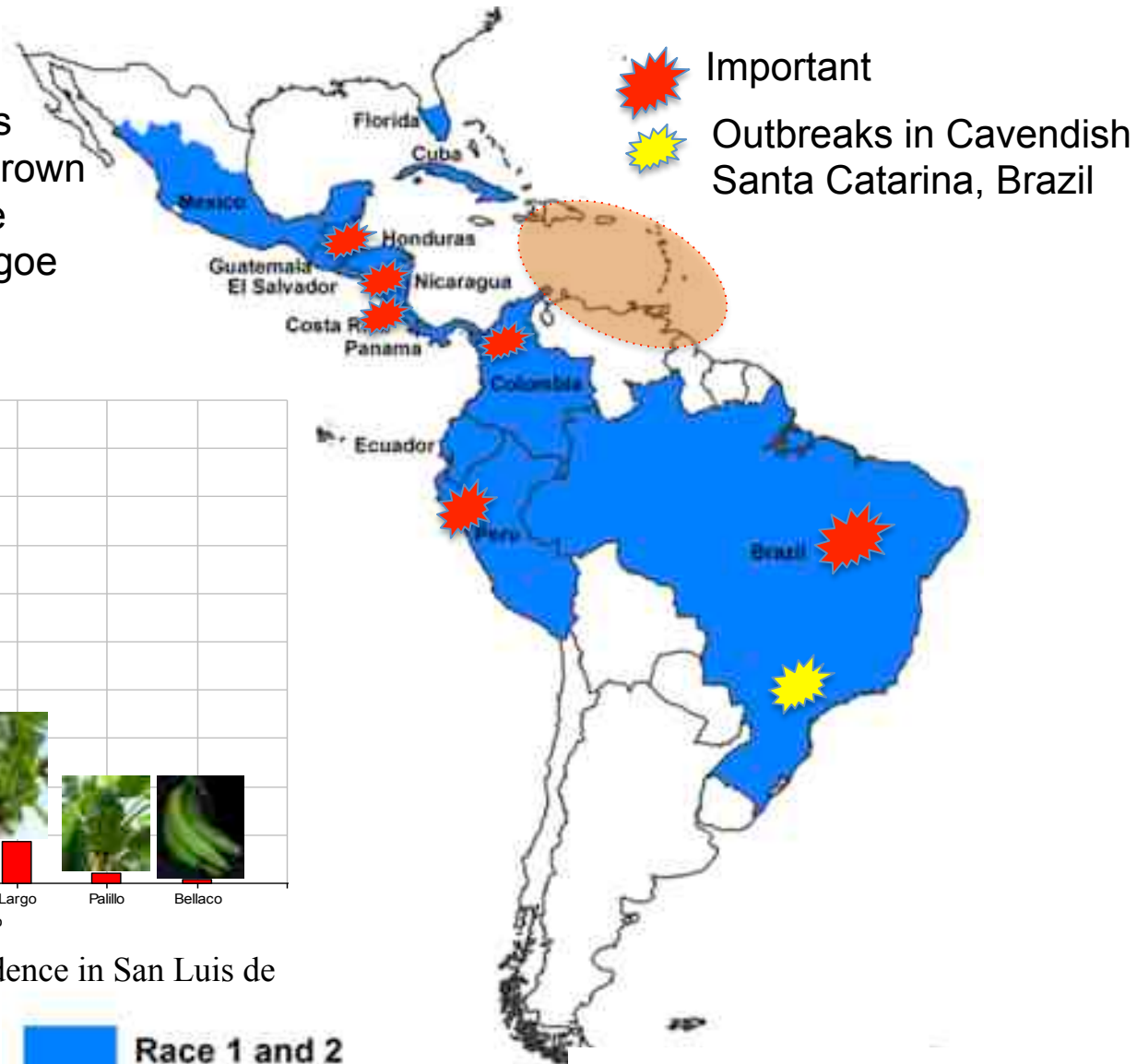
Bananageddon: Millions face hunger as deadly fungus Panama disease decimates global banana crop



Disease spreads from Asia to Africa and may already have jumped to crucial plantations in Latin America

Foc: Latin American and the Caribbean

Central America and Colombia is mostly important for Gros Michel grown in agroforestry systems with coffee
Nicaragua: also problems in Bluggoe



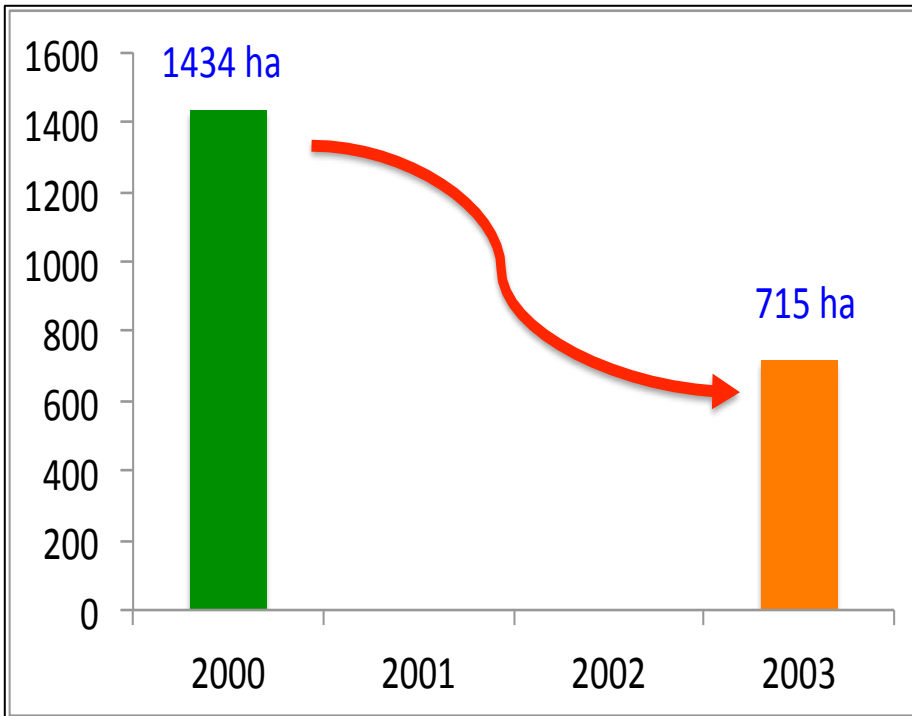
Banana varieties and Fusarium wilt incidence in San Luis de Shuaro, Peru - Roman et al (2012)

Race 1 and 2

Brazil: Mostly in Prata-type varieties

Impact of Foc TR4 in Asia: A global threat

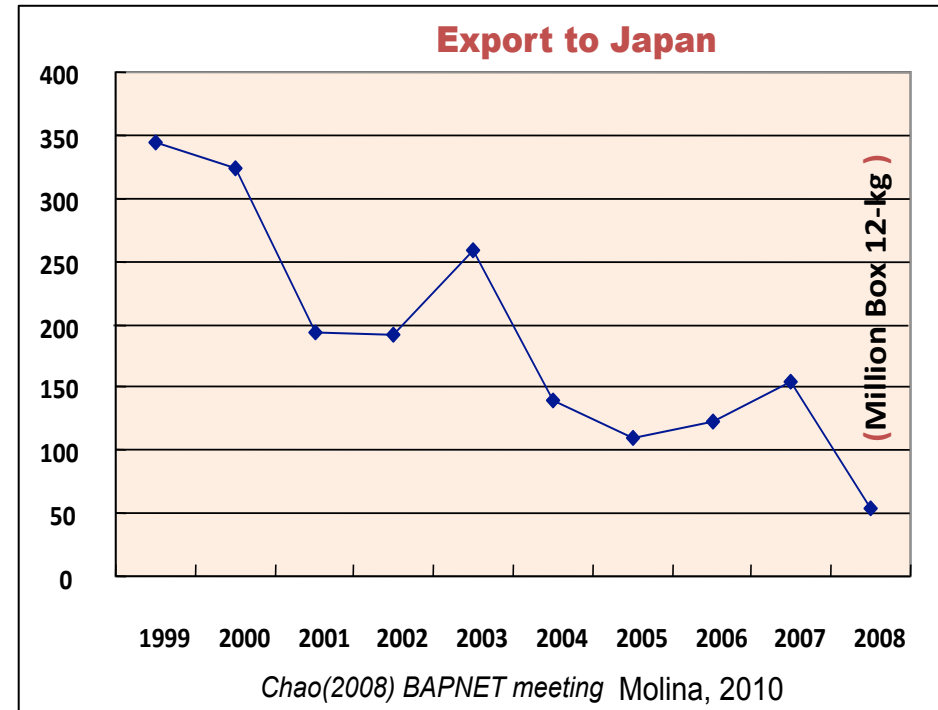
Indonesia



West Sumatra

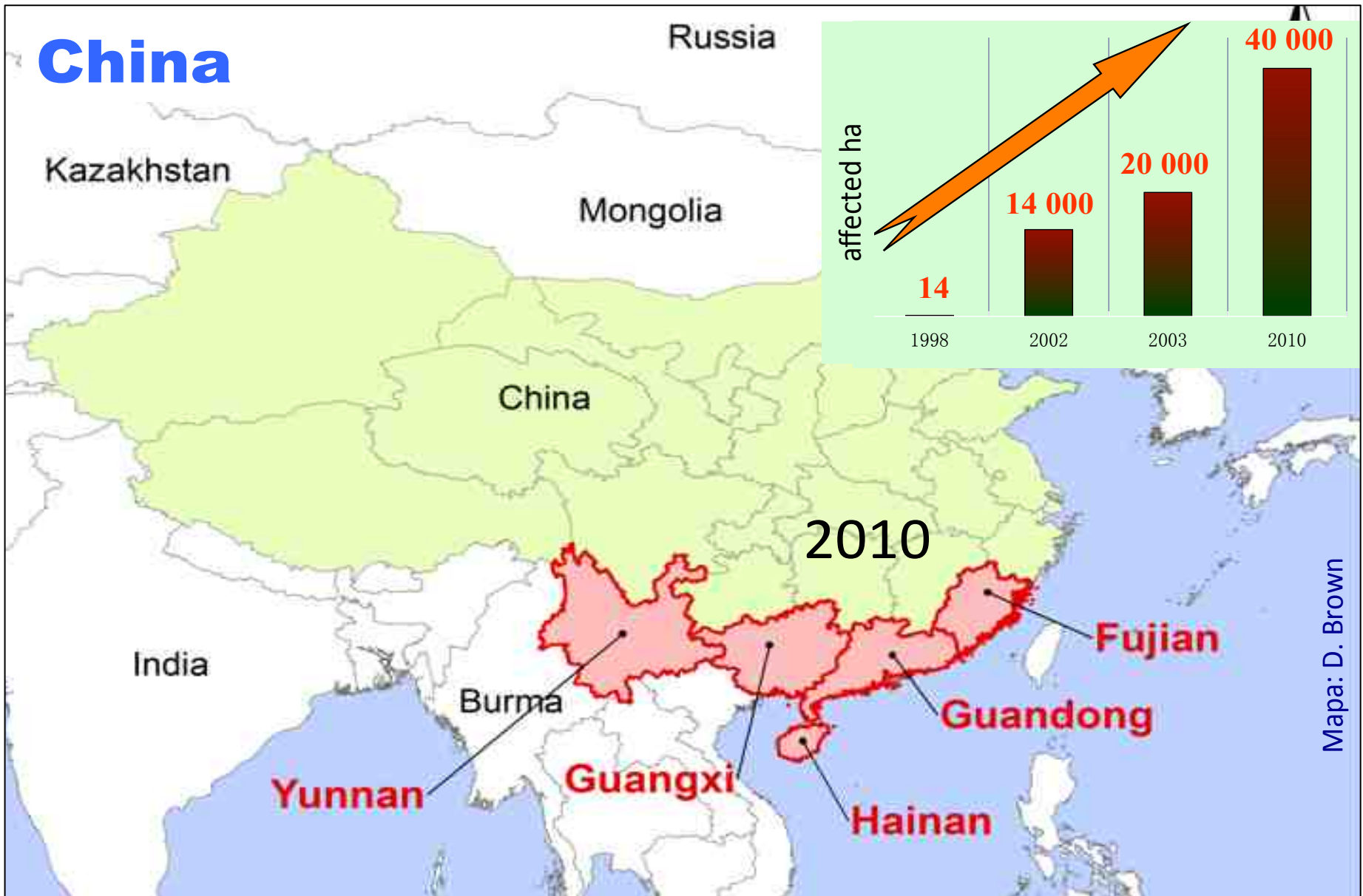
(Horticulture Processing and Marketing Department, 2005)

Taiwan

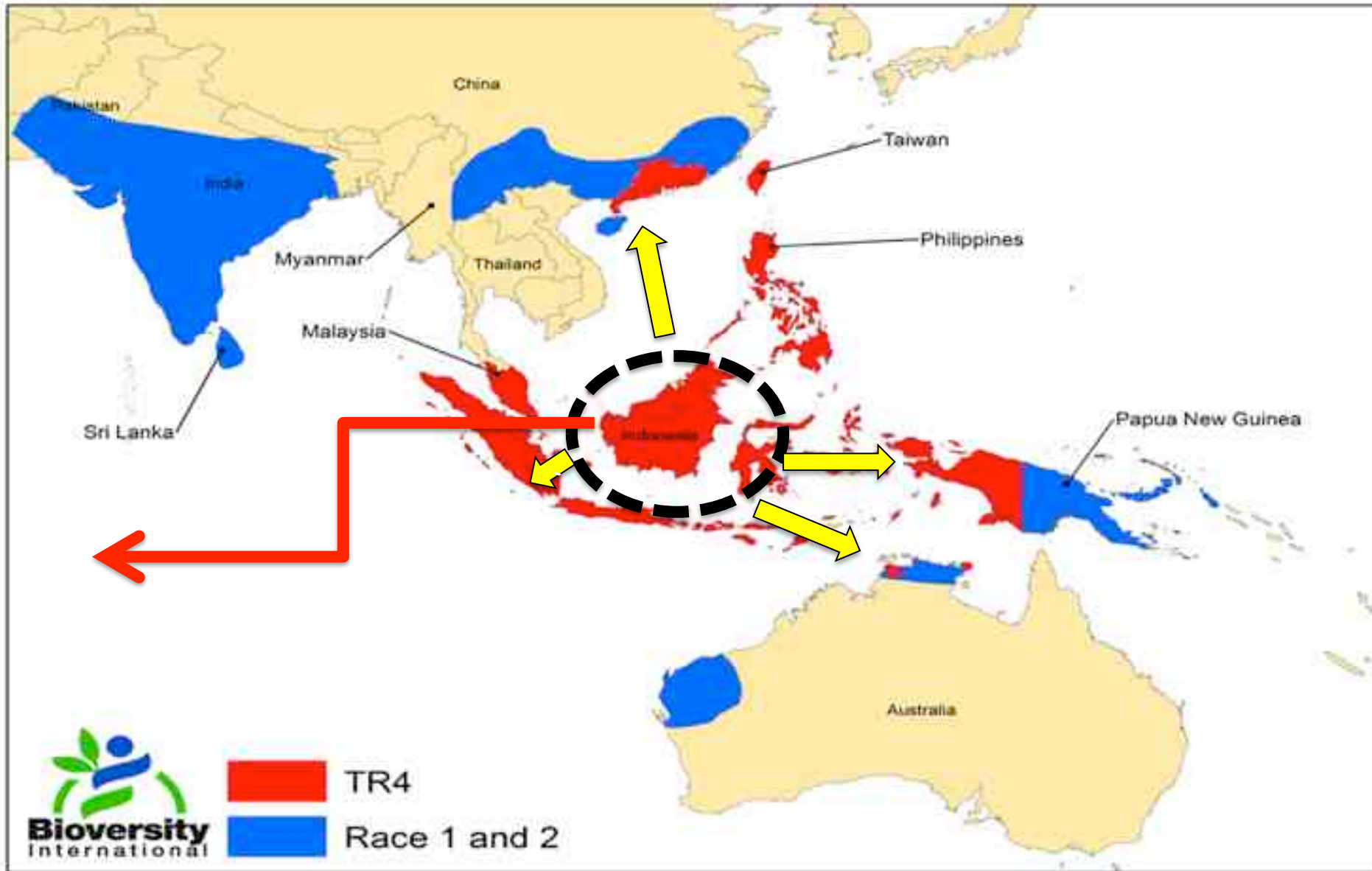


Impact of Foc TR4 in Asia: A global threat

[Data Yi Ganyun, 2012]



Rapid spreading of tropical race 4 of Foc



This MAP is an attempt to show the global distribution of Foc races. It should not be considered as a reference by authorities



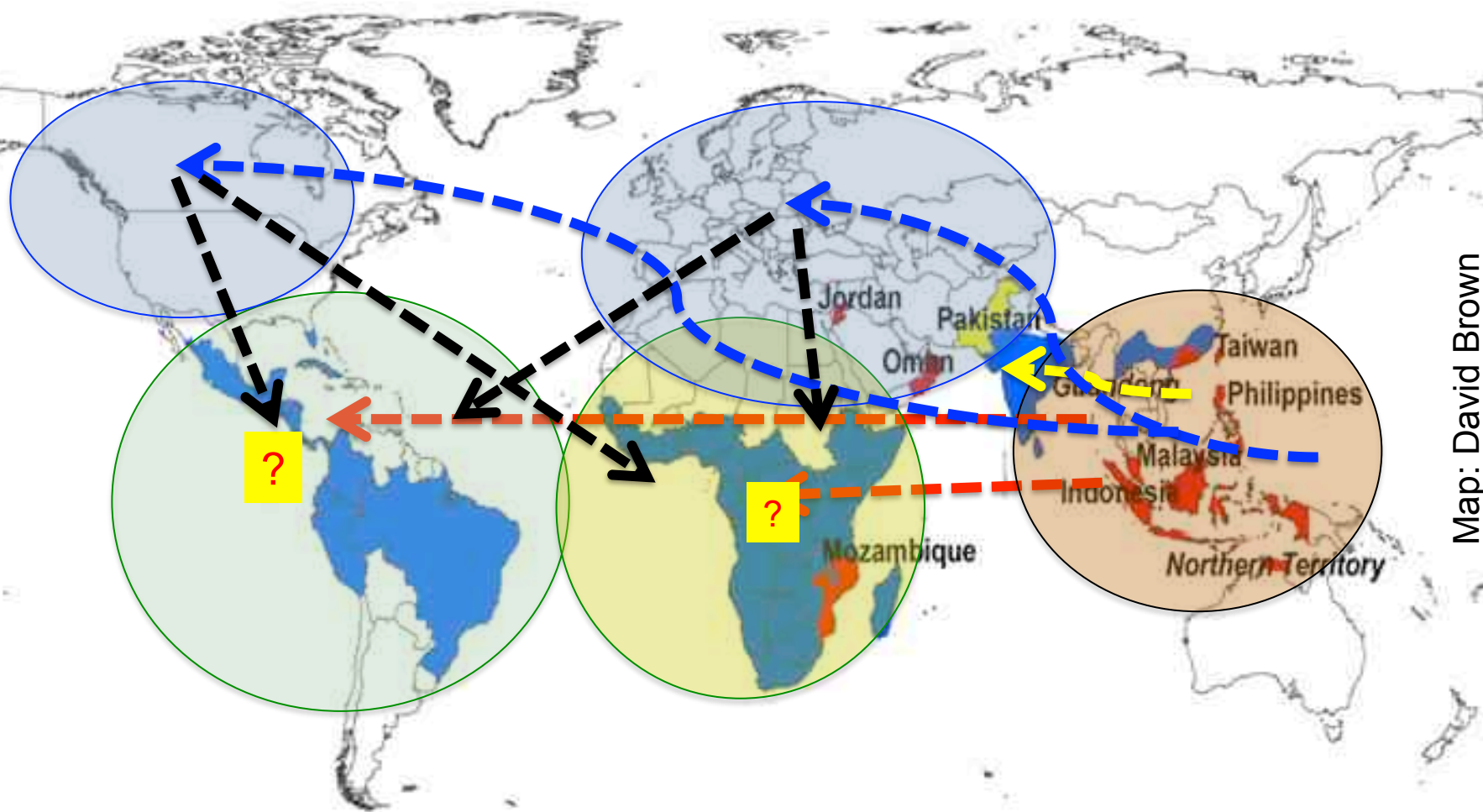
**The question is not if TR4 will arrives in LAC or How?
....It is when and where will be the first incursion / report?**

What has been done so far ?




What need to be done to minimize the TR4 impact?

Fusarium wilt of banana: Global distribution

Possible scenarios for global spreading



Map: David Brown

-  Races 1, 2
-  Tropical race 4, 1, 2
-  Under evaluation for Tropical race 4

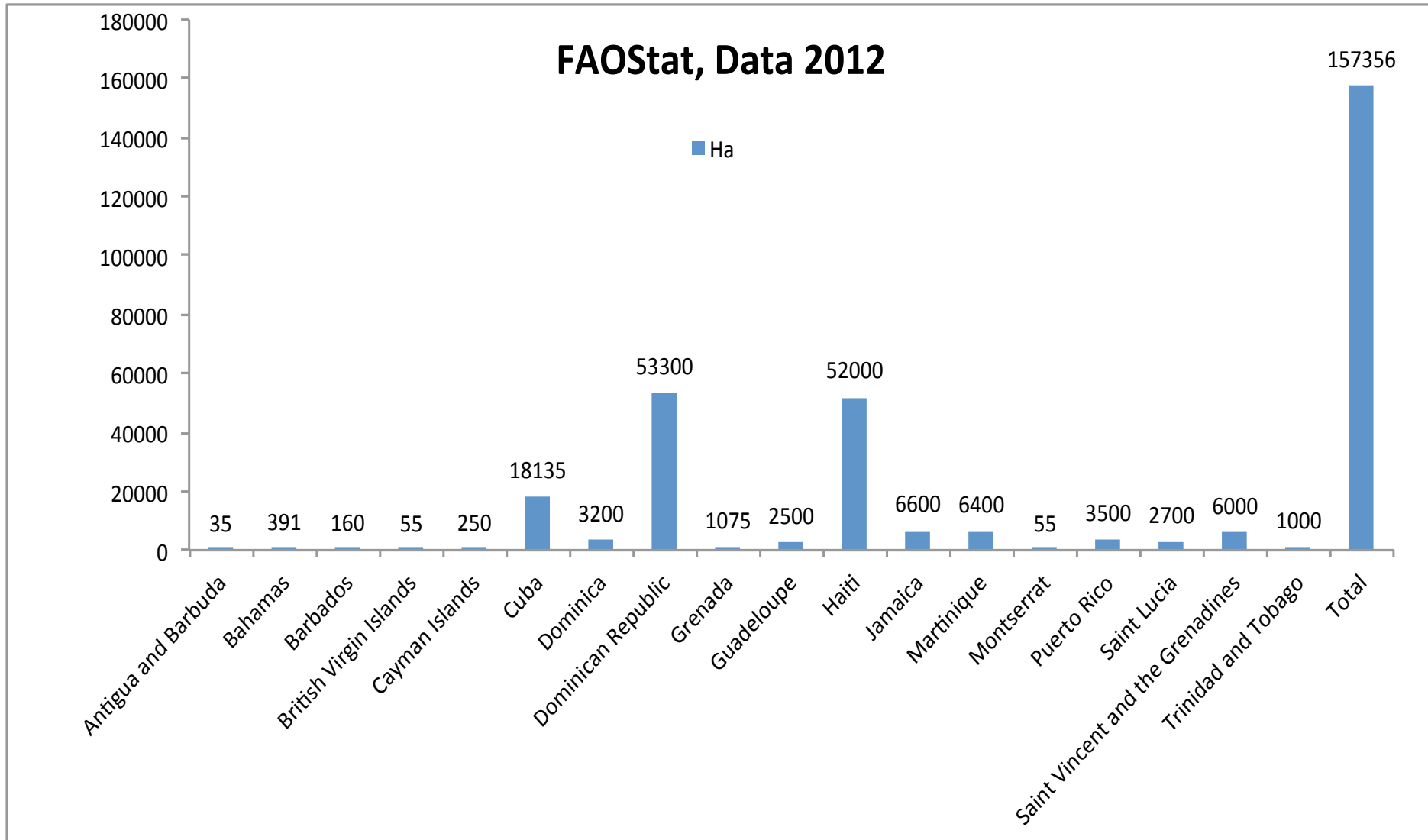
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Impact for Latin America and the Caribbean

Banana sector: some figures

- The 4th food most important in developing countries and the 8th globally
- It is produced on 135 countries along the tropics and subtropics
- Annual production > 130 MT
- The Fruit more commercialized in the world
- ~ Only 15% (17 MT) are for exports
- ~ 85% goes to domestic markets and direct consumption.
- ~ 41% of cultivated banana globally are Cavendish, but in the top ten exporters it goes to 64%
- **Conclusion:** Foc TR4 is a critical food security issue. Therefore, it is of public interest and governmental responsibility

Impact for Latin America and the Caribbean



In the Caribbean ~ 63% of 2,856,394 t produced in 2009 were from TR4-susceptible varieties
(Data: Lescot, 2010)



Three different scenarios to consider



Production areas (regions) where TR4 is already present and disseminated everywhere (Countries of South Asia)

[In these areas research on phenotyping for resistance and management options can be done].



Areas where TR4 is already present, but it still restricted to some territories (i.e Mozambique - Africa) – (Pest – A2, according FAO) *[Evaluate containment options and quarantine protocols]*



TR4-free areas [Latin American and the Caribbean - (Pest – A1, according FAO)]. *Prevention, preparedness, contingency plans.*

Every situation deserves a tailored reaction always complemented with awareness, preparedness, capacity building and research ,

Foc TR4 – Three options



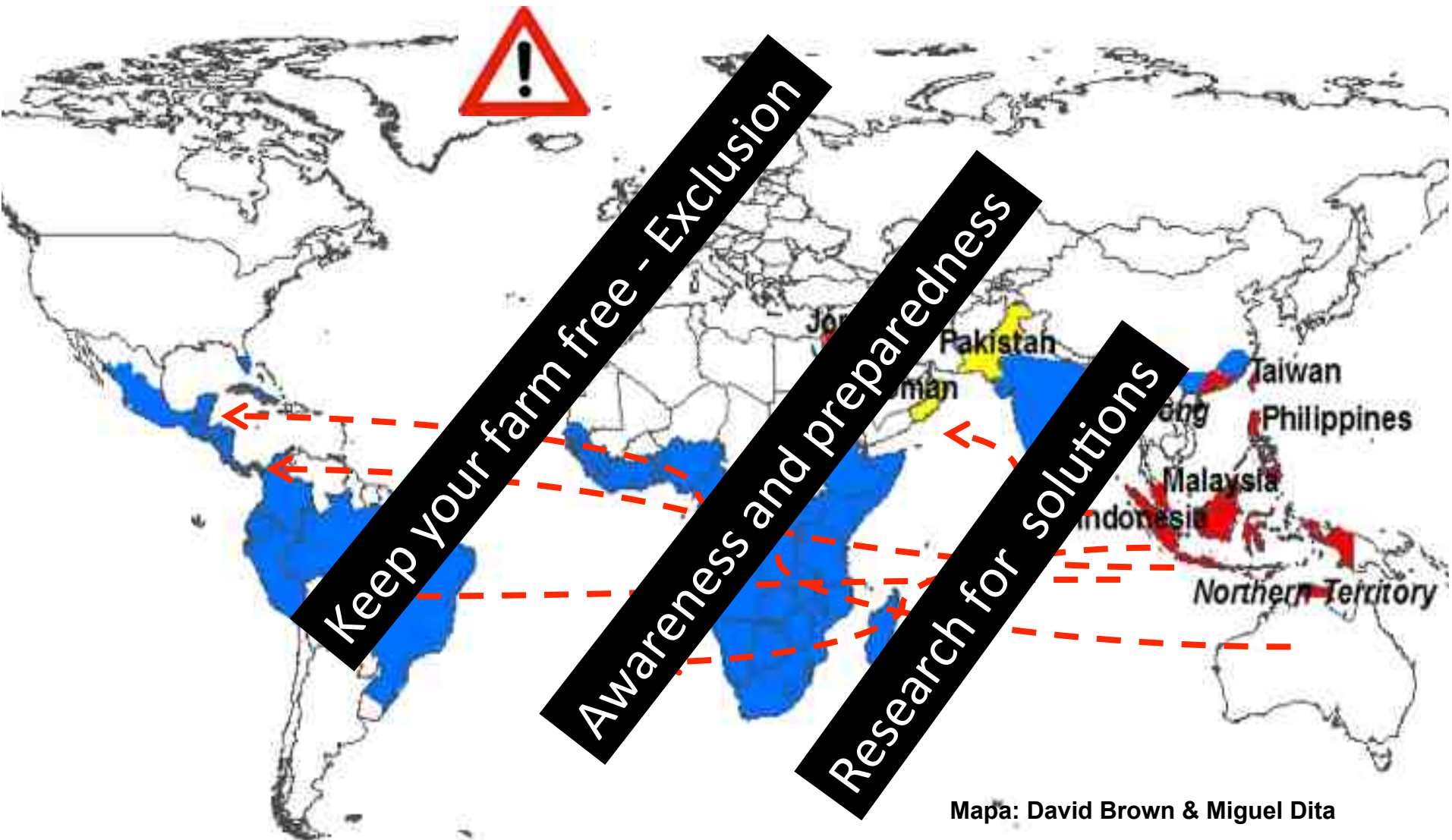
1. “Business as usual”. No actions “finger crossed”. Fusarium wilt continues it spreading **threatening millions farmers**.
2. Foc TR4 reach more and more countries, continents and the situation becomes out of control. Production areas decreasing, prices increasing and big losses at many levels reported. **A nightmare becomes reality**.
3. Contingency plans are implemented, prevention measures properly in place. A concerted and well-implemented strategy runs quarantine measures in regions where TR4 is present. A global system on surveillance and containment is working. Research institutes, industry and governments are collaborating under a **constructive engagement approach** to find **long-term and sustainable** solutions. There is a fair price distribution along the value chain to cover protection measures. The impact of the disease is mitigated

Ending up ...

- **This is an epidemic, and there is not much time.**
- Are the people that should be informed, aware on TR4? - Producers, small-holders, extension workers, government officials..
- What country is well prepared to face an outbreak of TR4?
- There are no resistant varieties to replace Cavendish in LAC.
- There are no mechanisms or effective control methods available (except from prevention and quarantine).

Conclusion:

We need a comprehensive, concerted and long-term action plan with stakeholders: industry, small farmers, governments, NGOs, associations, research institutions, international organizations



Mapa: David Brown & Miguel Dita

- Races 1, 2
- Tropical race 4, 1, 2
- Under evaluation for Tropical race 4

*Este MAPA es un intento aproximado de la distribución de Foc realizado para fines académicos, no está basado en estudios científicos y **no debe ser tomado** como referencia por las autoridades*

GRACIAS

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miguel.dita@embrapa.org

