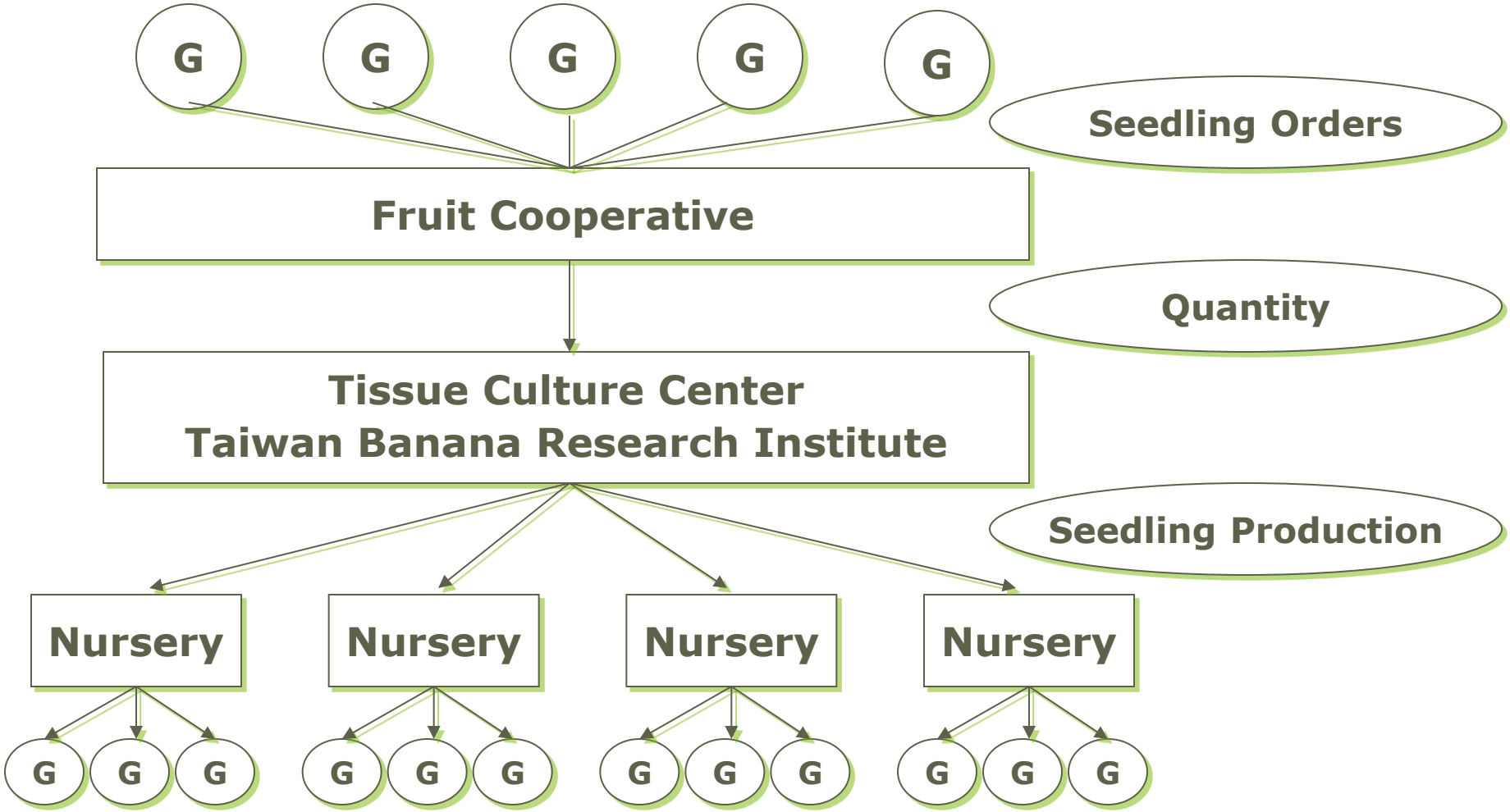
Somaclonal selections in Musa improvement

Agustin B. Molina, Chi Ping Chao, Yi Ganjun

Taiwan Banana Research Institute

In-vitro mass propagation technology used to mitigate typhoon damage and Disease epidemics

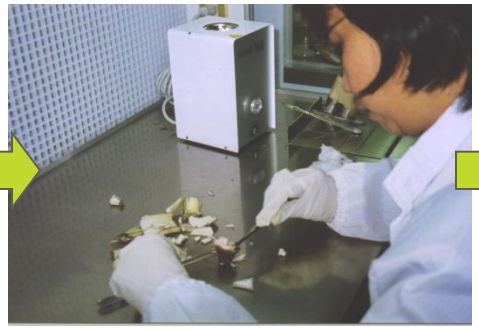
Annual cropping of TC Cavendish, in Foc infested fields provided an opportunity for farmer-participatory selection of resistant & agronomically accepted Cavendish as a result of somaclonal variantion caused by Tissue Culture



Tissue Culture Plantlets Extension System Taiwan

Development of tissue culture technology for mass propagation of disease-free planting material in 1983.

Screenhouse Foundation Stock



Tissue cutlture micropropagation

TC incubation room

Farmers' cooperative Nursery

Distribution /sale of TC

Newly planted farmer's field

Farmer's field planted with TC bananas

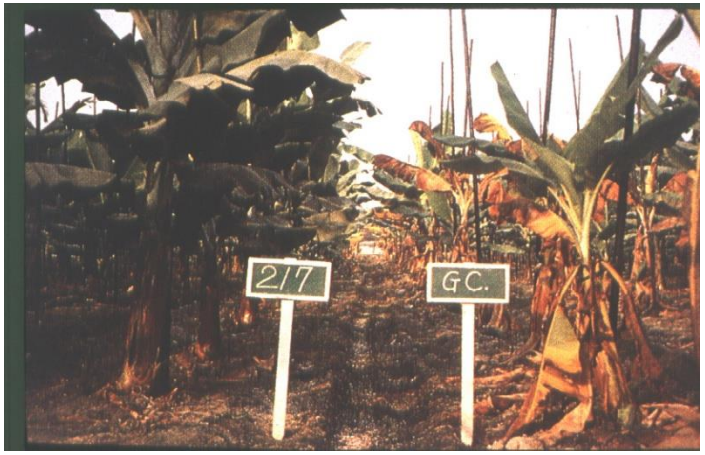
Scheme. TC Plant distribution in Taiwan.

Farmer-participatory selection

- plant survivors from *Foc* hospot field selected by farmer, and brought to TBRI for testing

- High density field screening on Foc infested soil

- Selected lines subjected to field verification for resistance yield, and agronomic traits



Pix by SC Hwang

Resistant Clones Identified in Screening Program:

Highly resistant clones	Moderately resistant clones
GCTCV-40	GCTCV-46
GCTCV-44	GCTCV-53
GCTCV-104	GCTCV-62
GCTCV-105 (1995)	GCTCV-201
GCTCV-119 (1997)	GCTCV-215 (1991)
GCTCV-217 (1998)	GCTCV-216
GCTCV-218 (2002)	

Special Features of Banana Breeding Based on Somaclonal Selection

1. The technique is simple and quick;
2. A large-scale selection can be arranged through cooperation with farmers;
3. Selected traits are genetically stable
4. It is not a 'dead end' game; further improvement can be made by recurrent selections; and
5. It produces banana clone closely the same as the original parents

Requires large populations of TC plants grown in naturally infested soil (Taiwan, China, Philippines, Indonesia)

Source: S.C. Hwang. TBRI, 1999

Improvement of resistant clone by recurrent selection

Pix by SC Hwang

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GCTCVs shared to Bioversity ITC for IMTP (2002)

Field testings in the Philippines, with Lapanday Company

Reaction of Cavendish somaclones against TR4 (Davao, Philippines - 2011-2013)

Variety	Genome	Fusarium Wilt Incidence 52weeks (%)	Fusarium Wilt Incidence 77weeks (%)
Gran Naine	AAA	57	78
GCTCV 105	AAA	2	8
GCTCV 119	AAA	0	0
GCTCV 218	AAA	6	6
GCTCV 219	AAA	1	1

GCTCV 119 vs Grand Naine field trial in a heavily infested *Foc* TR4 farm, Philippines, March 2010

Fusarium incidence on test banana cultivars, 2009-2010 (Lapuy Farm)*

Cultivar	Fusarium wilt Incidence (%)		
	Genome	Primary Crop	Ratoon Crop
Gran naine	AAA	97	n/a
Williams	AAA	94	n/a
Lakatan	AAA	100	n/a
Latundan	AAB	41	100
Cardava	BBB	0	0
GCTCV 119	AAA	1	28
FHIA 21	AAAA	81	n/a

** Paper presented during the Taiwan International Banana Symposium at Kaohsiung, Taiwan, ROC (November, 2012)*

Fusarium incidence (%) at 77 weeks after planting July 2011 – Jan 2013 Callawa, Davao , Philippines

Variety	Genome	Fusarium Wilt Incidence (%)
Lakatan	AAA	92
Latundan	AAB	60
Gran naine	AAA	78
Cardava	BBB	0
GCTCV 119	AAA	0

Bioversity International

GCTCV 219

GCTCV 219 at GEA Farm, Davao Del Norte

GCTCV 219 fruits to be shipped to Japan

Somaclonal Selections of Cavendish in China

2011

ZJ6 Moderately Resistant To TR4, Bunch 24.7 Kg

(Yi, 2014)

2014

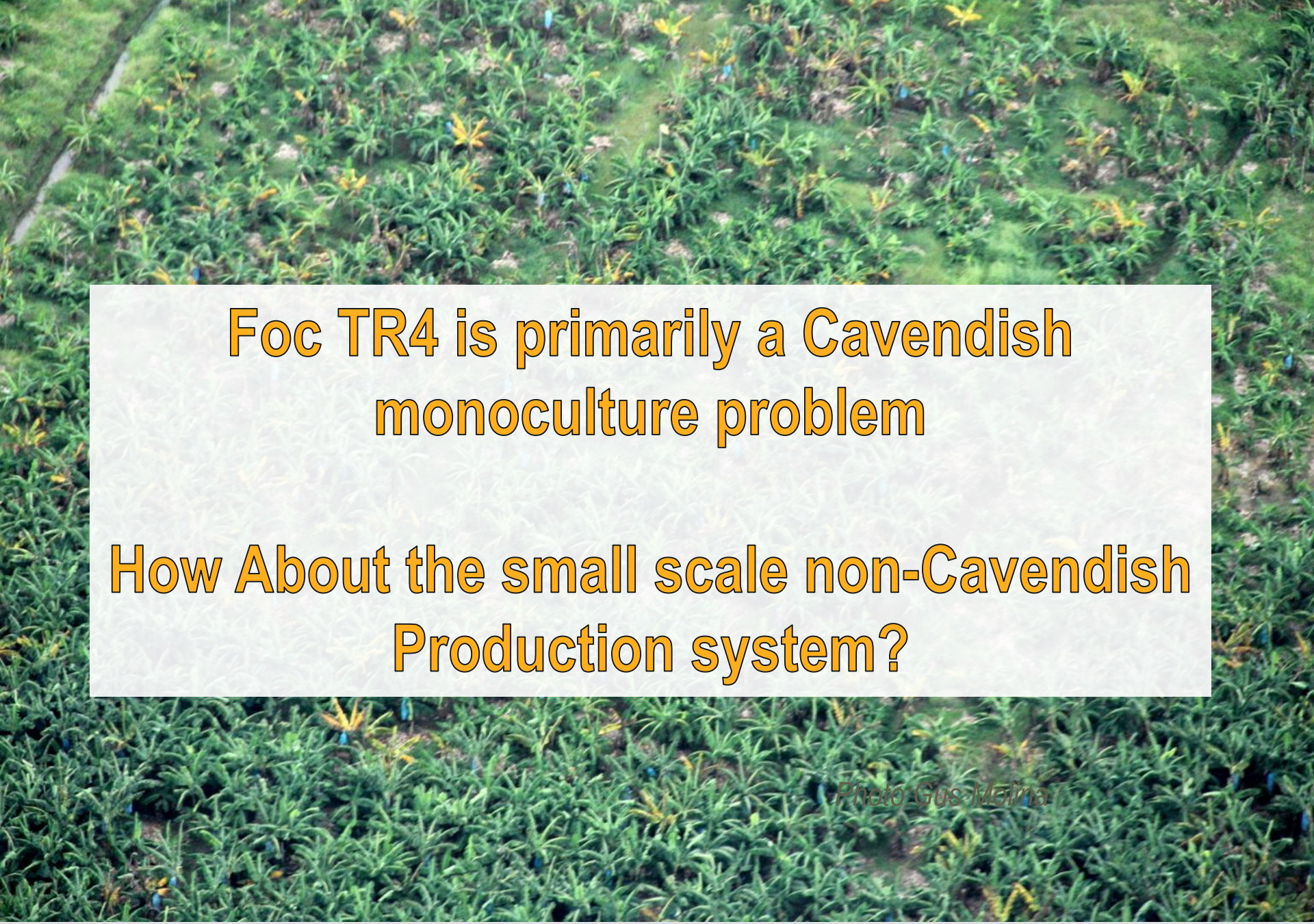
New GCTCVs from Taiwan Banana Research Institute

Tai-Chiao No.5

Tai-Chiao No.7

Pei-Chiao

Source: Dr. CP Chao



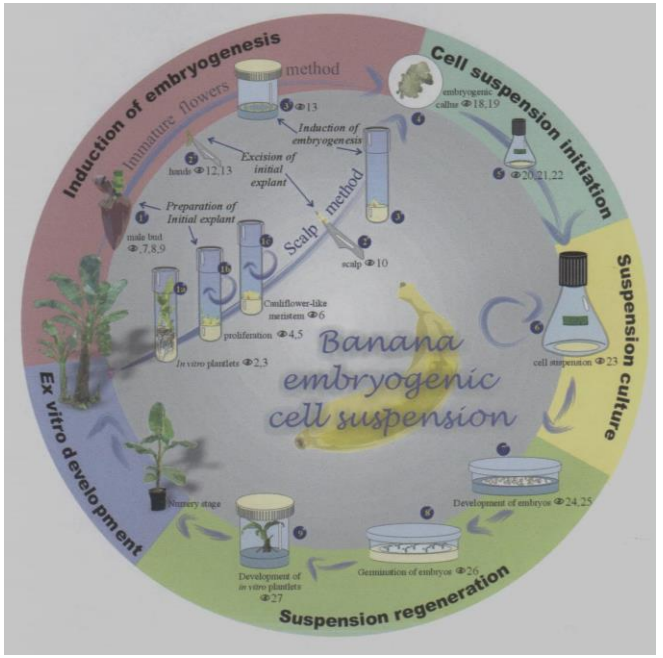
Foc TR4 is primarily a Cavendish monoculture problem

How About the small scale non-Cavendish Production system?

Photo: Gus Molina

Bioversity International

“Harvesting the low hanging fruits of Musa R&D ”



“Pie in the Sky” GMO

“Low Hanging Fruits Of Musa Diversity in crop improvement”

Clonal Selection of resistant Awak

Local cultivars against TR4

Variety	Genome	Fusarium Wilt Incidence 52weeks (%)	Fusarium Wilt Incidence 77weeks (%)
Lakatan	AAA	76	92
Latundan	AAB	40	60
Gran naine	AAA	57	78
Cardaba (Saba)	BBB	0	0
Kluai Namwa	ABB	0	1
GCTCV 119	AAA	0	0

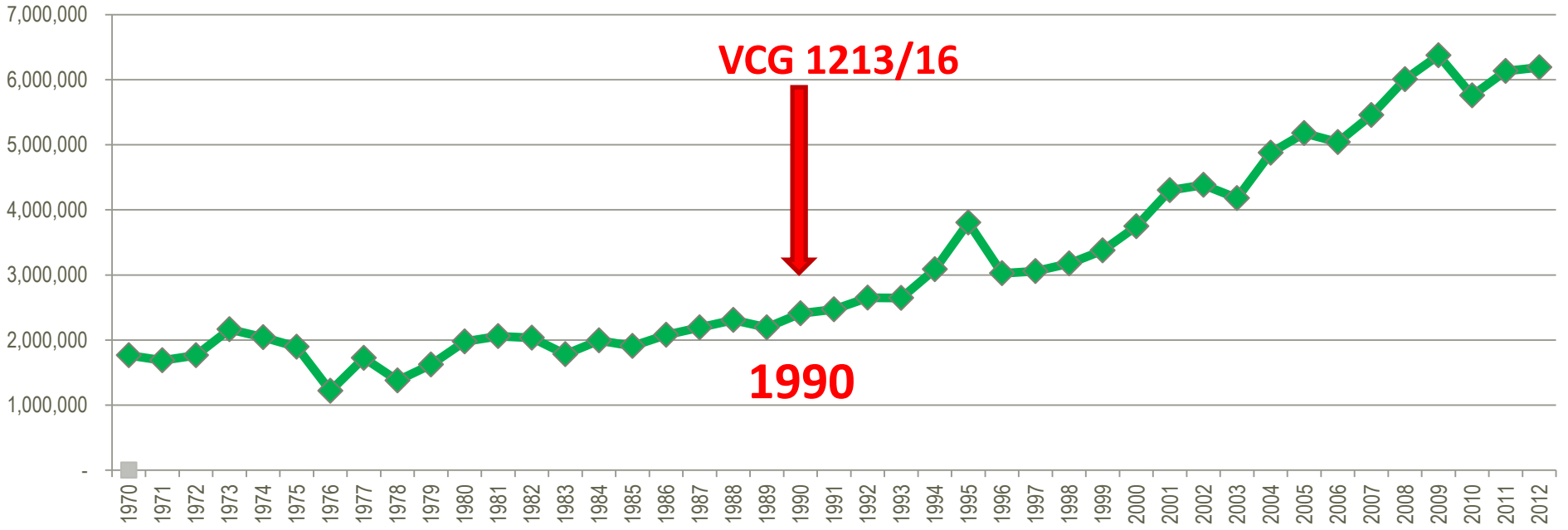
Highly resistant to Foc TR4, the most popular cooking banana in the Philippines, Indonesia and Malaysia

Bioversity International

Dwarf Pisang Awak

A clonal selection of Pisang Awak (Kluai Namwa). Pisang Awak is very popular dual purpose banana grown all over the world. Pisang Awak is known to be susceptible to Race 1. This selection was evaluated resistant to TR4 in the Philippines.

Resilience of banana production due to cultivar-copping diversity



Source: Catur Hermanto, 2012


Light at the end of the tunnel !
THANK YOU!

Host Response of 3 varieties against *Foc* TR4 under artificial inoculation un screenhouse test

(Ou Sheng, Molina A.B, and Yi G. 20014)

Baxi, AAA
Cavendish
(Susceptible)

Pahang, AA
M. acuminata
ssp malaccensis
(Immuned)

GCTCV 119
AAA
(Resistant)