21ª CONFERENCIA INTERNACIONAL SOBRE PALMA DE ACEITE

21st International Oil Palm Conference

History of the spread of oil palm Bud Rot in the Americas and genetic response to this disease

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History of the spread of oil palm Bud Rot in the Americas and genetic response to this disease

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Fedepalma 21st International Oil Palm Conference

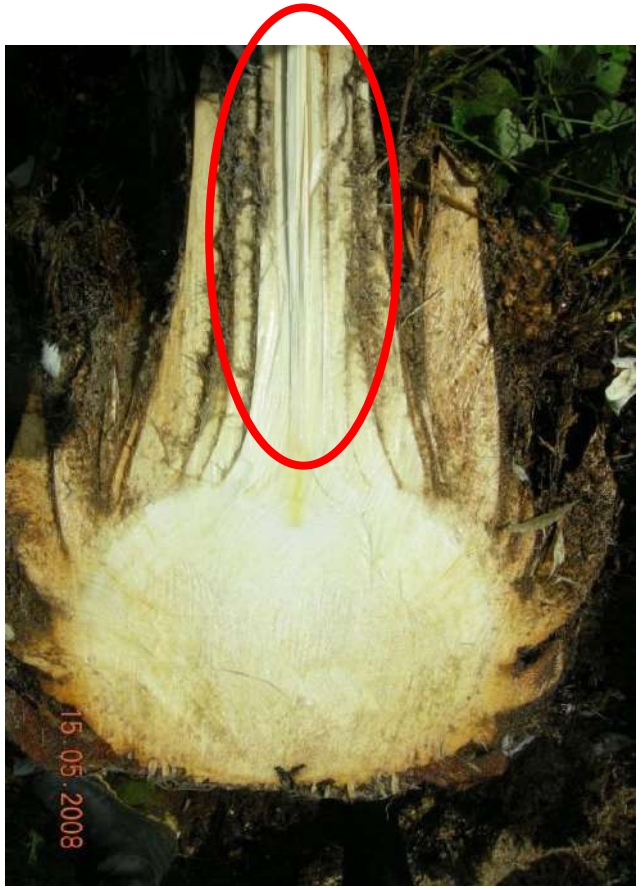
History of the spread of oil palm Bud Rot in the Americas and genetic response to this disease

In tribute to :

Gerardo Martinez

and Hubert de Franqueville

Bud rot : a diverse symptomatology
One name ?



A variation of names:

Pudrición de flecha de los Llanos
Pudrición del Cogollo (PC)
Pudriçion del Cogollo des Oriente
PC Descendante
Amarelecimento Fatal
ENI (Enfermedad no Identifica)

BR o PC
(Bud rot o Pudrición del Cogollo)

Note : In America Asia and Africa, it exist many other diseases that cause spear rot or bud rot : anillo rojo, marchitez sorpresiva, marchitez lethal, dry bud rot, Spear rot like syndrome, bud rot of Congo etc…

EXPANSIÓN DEL COMPLEJO PC

Panama the very first evidence of Bud Rot ?

From Richarson 1995

Serdang Avenue

January 1926 : selected Deli (Serdang avenue) oil palm seeds are sent to Panama. (Reinking)

1928 : 6,100 Deli palms from the 1926 shipment had been planted.

Richarson reports that **by this early age some phytosanitary problems were already present : a severe bud rot problem could not be managed.** By October 31, 1928, this problem had killed 27% of the palms.

O.A. Reinking name this disease "Heart rot" and write the following :

"The disease in oil palm apparently began as a rotting of the tips and margins of unopened leaves (arrows). This rot progressed within the bud until the meristem died. In severe cases, the older arrows turned brown. Older leaves frequently yellowed, giving the entire plant an unhealthy appearance."

From the rots he isolate many microorgansms....including a Phytophthora-like fungus ....

Very likely it is the first report of lethal bud rot in oil palms

EXPANSIÓN DEL COMPLEJO PC

In Colombia the first evidence of Bud Rot apears in Uraba

Arenosa estate was planted in 1960 and 1961 (Franqueville, 2003) its belong to the Coldesa company, located in the Turbo region of northern Colombia Uraba.

In 1965, substantial losses were reported at that plantation.

Within a few years, almost the entire *Elaeis guineensis* population had been destroyed by BR (Cortinez et al. 2010) :

- In 1968 and 1969, BR destroyed 49,000 oil palms or almost 20%.
- By 1973, only 850 hectares remained, of the initial 2,800 hectares.
- By 1975, nothing remained.

 Efforts to replant with *E. guineensis*, in 1971, had failed.

In Surinam Bud Rot outbreak apears in the 70's

Bud rot in Victoria estate (Surinam)

Surinam : the first commercial plantation of oil palm, Victoria, was initiated in 1969. Then Phedra estate followed by Patamacca plantation (1981). 6200ha in total.

Bud Rot (Spear Rot) was found for the first time around 1976 in a 4 y old planting of Victoria.
It occurred incidentally in a few blocks, but six years later, in 1982, focal development of the disease was encountered, and despite elimination it became exponential in several blocks.

In 1992, over 85% of the planted palms of Victoria estate were affected irrespective of the provenance of the material and of soil types.

See more in Hanny L. van de Lande, 1993. Studies on the epidemiology of spear rot in oil palm (Elaeis guineensis Jacq.) in Suriname.

Two Important observations : Hybrid OxG presents resistances

- In Colombia (La Arenosa)

Foto: Vergara Pinto.

Figura 2.—Híbridos F_1 de **Elaeis melanococca x Elaeis guineensis Jacq.** en producción.
Palmeras de 6 años que empezaron a florecer a los 2 y medio.
Cereté — Finca El Cedro, Colombia 1969.

- MsC thesis UN Palmira. Hurtado, 1972
- In Surinam (Victoria Estate)

Two Important observations : Hybrid OxG presents resistances

Colombia :

The interspecific hybrids OxG (*E. oleifera x E. guineensis)* planted in 1968 had **resisted to Bud Rot**

Coldesa converted 1,945 hectares to hybrid plantations between 1973 and 1976. Due to social and political events, Coldesa went into liquidation in 1981.
(Cortinez et al. 2010)

Surinam

Hanny L. van de Lande (1993) :
The hybrid of *Elaeis oleifera* and *E. guineensis* descending from crossings of Colombian and Surinamese *oleifera* and planted in a one hectare plot in north Victoria in 1978, appears to be **resistant to spear rot**. In all blocks surrounding this plot most palms are either affected or killed by spear

Highlights on Hybrid breeding

Three major initial chalenges :

1. It is an Hybrid between two different species : We may encounter **chromosome pairing problems**.
2. **Pollination** : Viability of pollen, transport of pollen
3. Agronomic : it is a different palm compare to guineensis ; **agronomic practices** needs to be rethink.

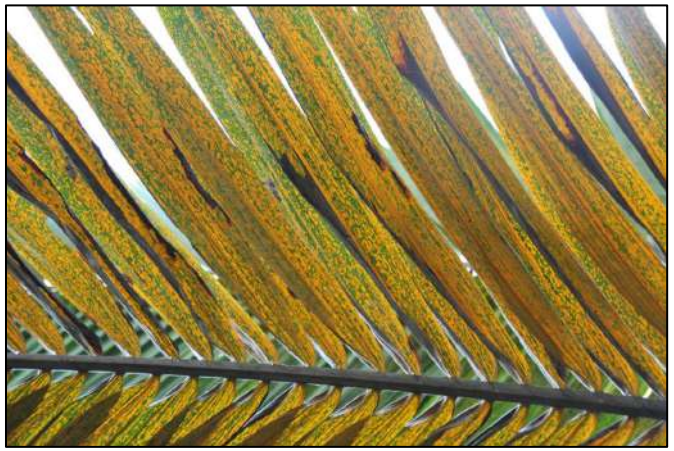
Huge space to breed Hybrids :

1. For resistance to Bud Rot
2. For yield

Chromosome pairing problems (Late Yellowing)

It is impossible to eliminate this problem from the nursery because **it only appears after several years** in the field.

Chromosome pairing problems (Chlorophyll Deficiency)



Different from Late Yellowing.

Chlorophyl deficiency can appear in nursery but also later in the field (after more than 10 years)

Specific to population of Central America.

Not present with most of amazonian populations

Chromosome pairing problems (Fertility)

Despite hand pollination some genetic combination does not match

From unfertile to almost fertile with hand pollination

Most
Yangambi's
Some Nigeria,
…

To be revisited with ANA ?

Most la Mé
Some Yangambi,
Some Nigeria
…

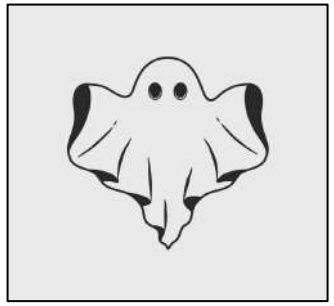
Pollination of OxG hybrids

Elaeis oleifera

Grasidius hybridus
(O' Brien & Beserra, 2004)
(from Ponce et al 2015)

E. oleifera x
E. guineensis

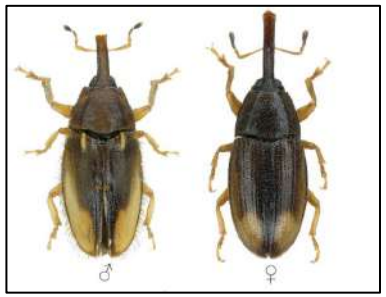
In addition pollen viability of hybrids is low



Almost no specific visitors

(from C. Louise)

Elaeis guineensis



Elaeidobius Kamerunicus
(Faust)
(from Haran et al 2020)

Pollination of OxG hybrids

Assisted pollination with
POLLEN

Artificial “pollination” with
ANA
(Plant growth regulator)
(Romero et al 2022)

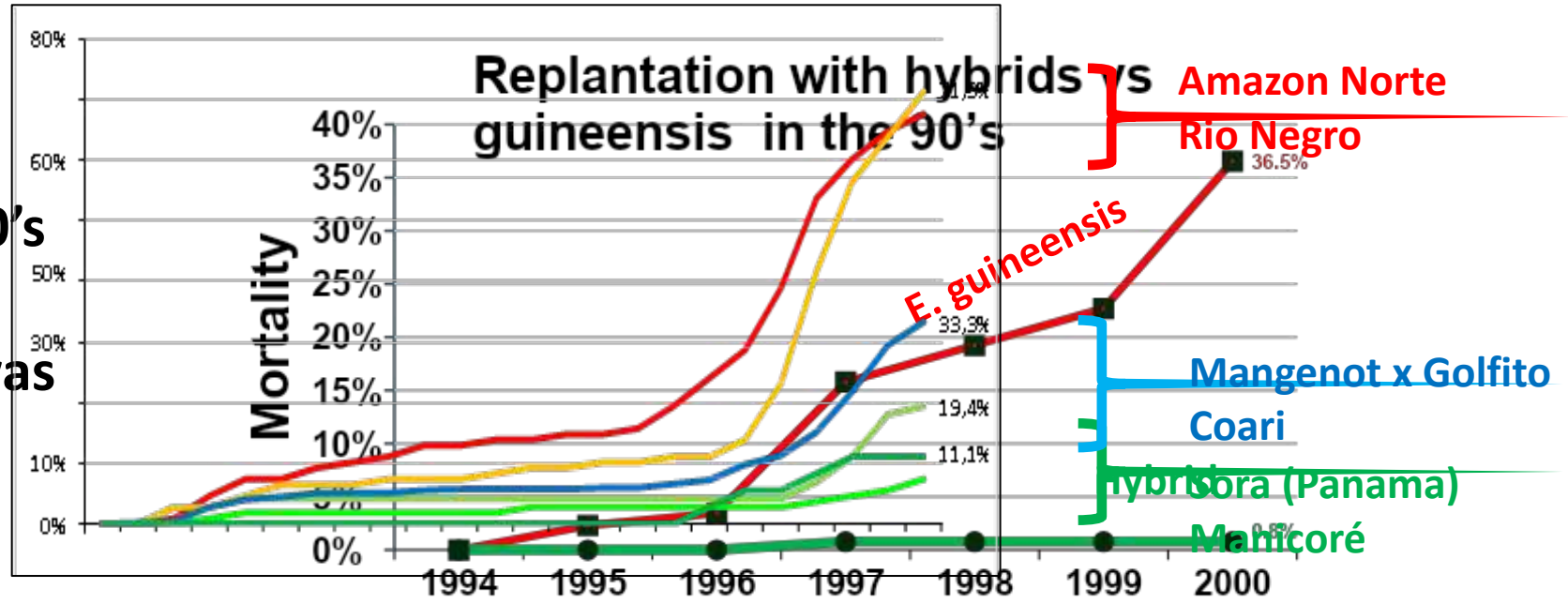
Agronomic practices…

Plantation density (110, 128, 135,...)

Nutrition (NPK... And others)

Variability in resistance to Bud rot
Among oleifera populations

From the the 80's to 2010's
Later it appears that
one can consider that
there are differences
replanting with hybrids was
between oleifera origins
the only solution

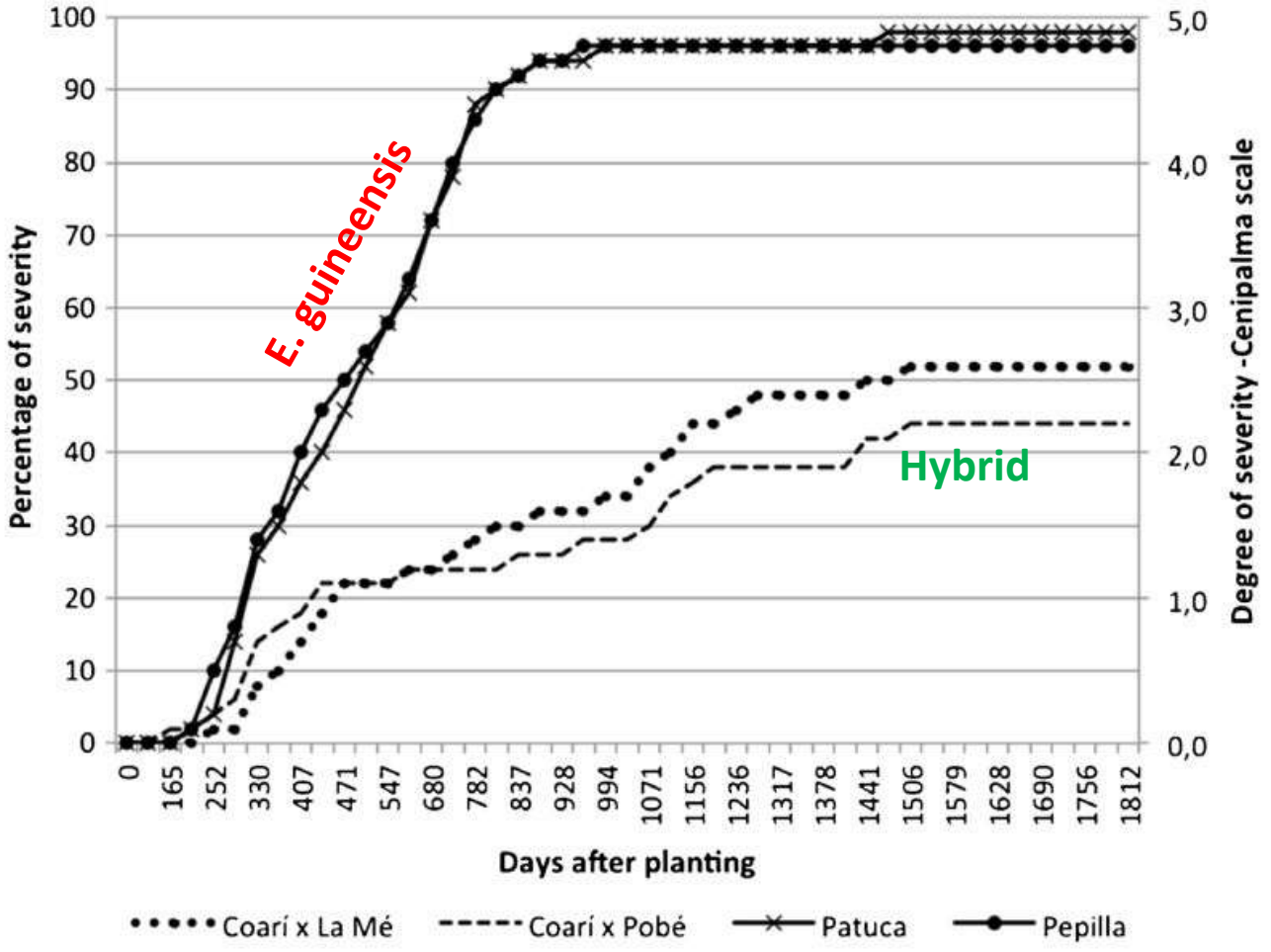


Caution: The origins may be represented by **only a single** palm. This is therefore not a comparison between origins, but rather an **illustration of the variability of resistance to Bud Rot within the oleifera origin**. (From C. Louise / Danec Ecuador)

Variability in resistance to Bud rot Among *E. oleifera* populations

Cenipalma has done subsequent observations in Tumaco (Palmas del Mira)

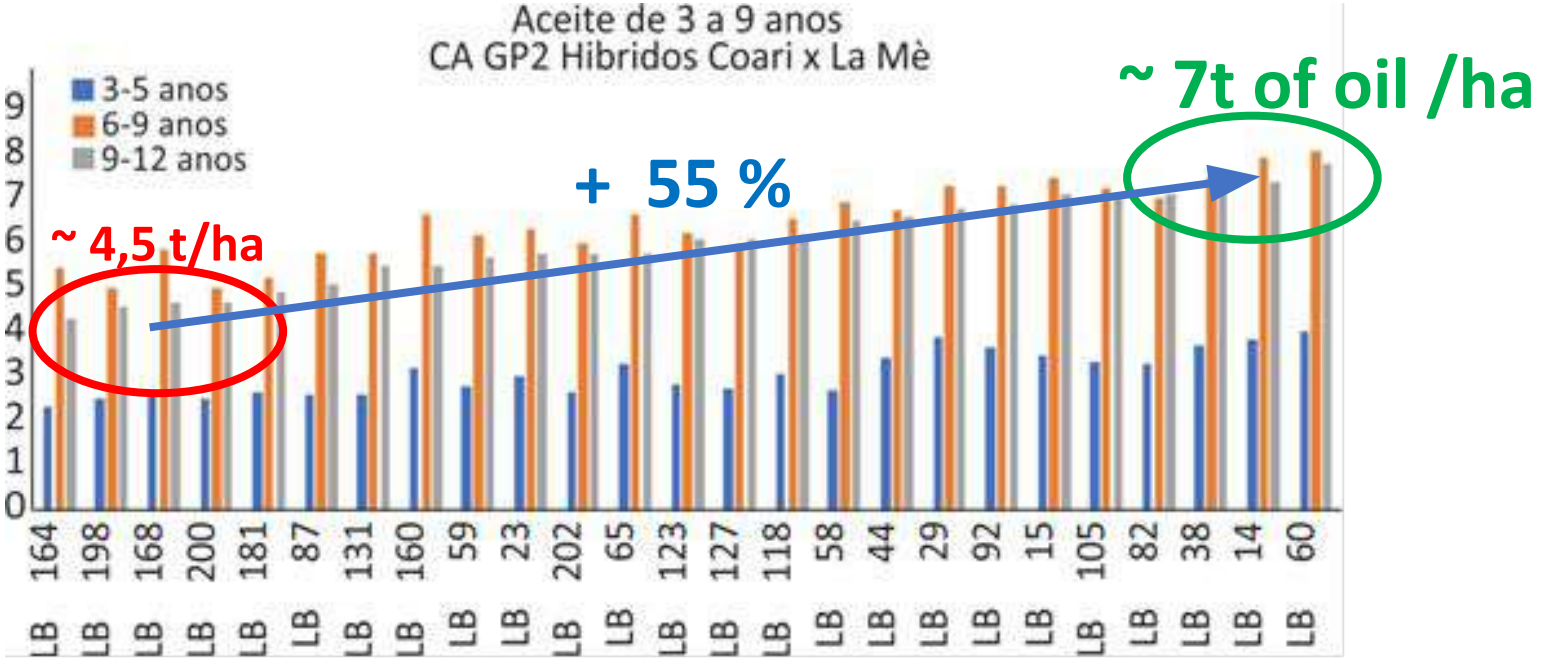
(Navia et al., 2014)



Yield of interspecific Hybrids

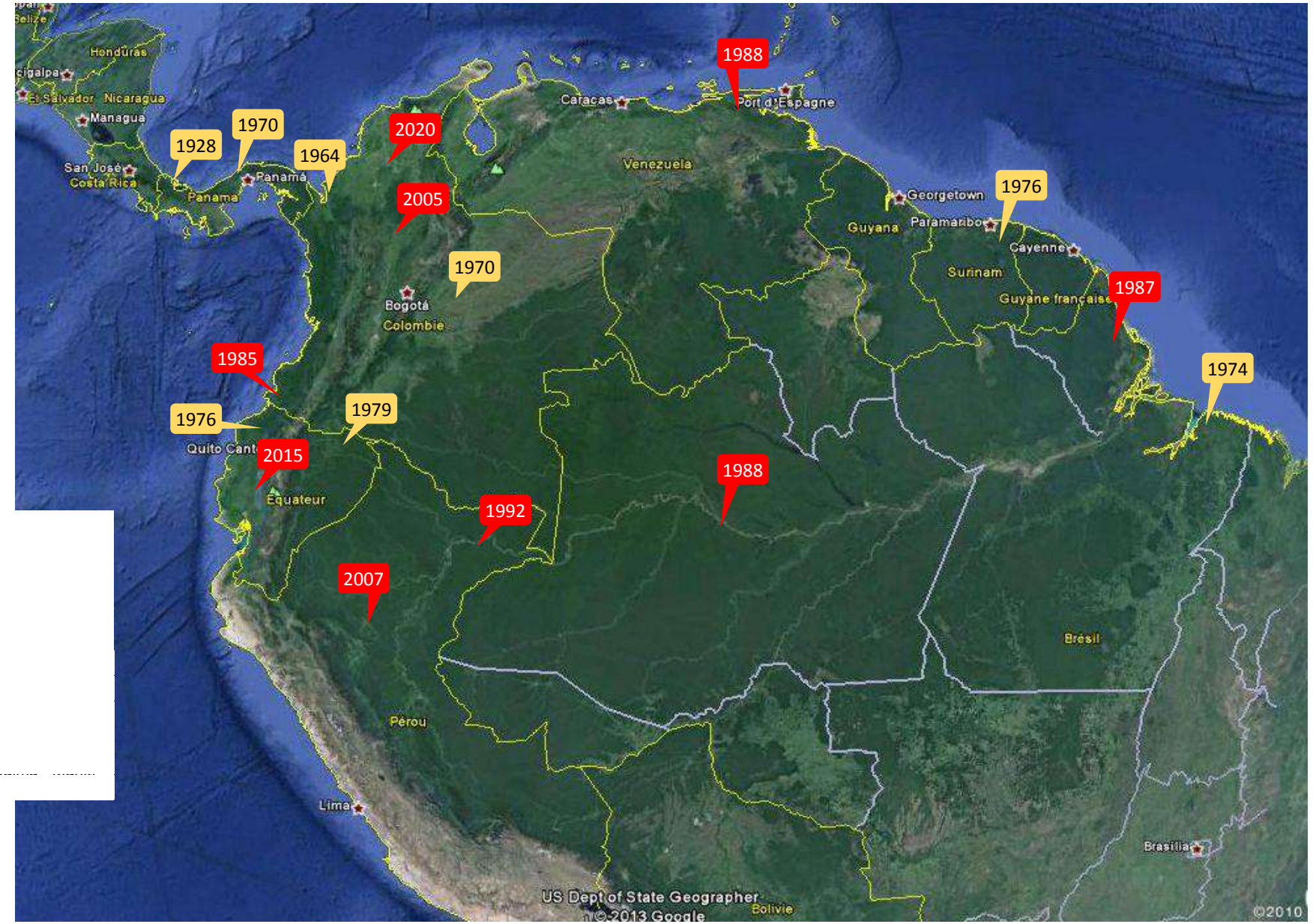
Variability of yield is huge within a single type of hybrid (Here Coari x LM)

Both parent are responsible of the yield gain.

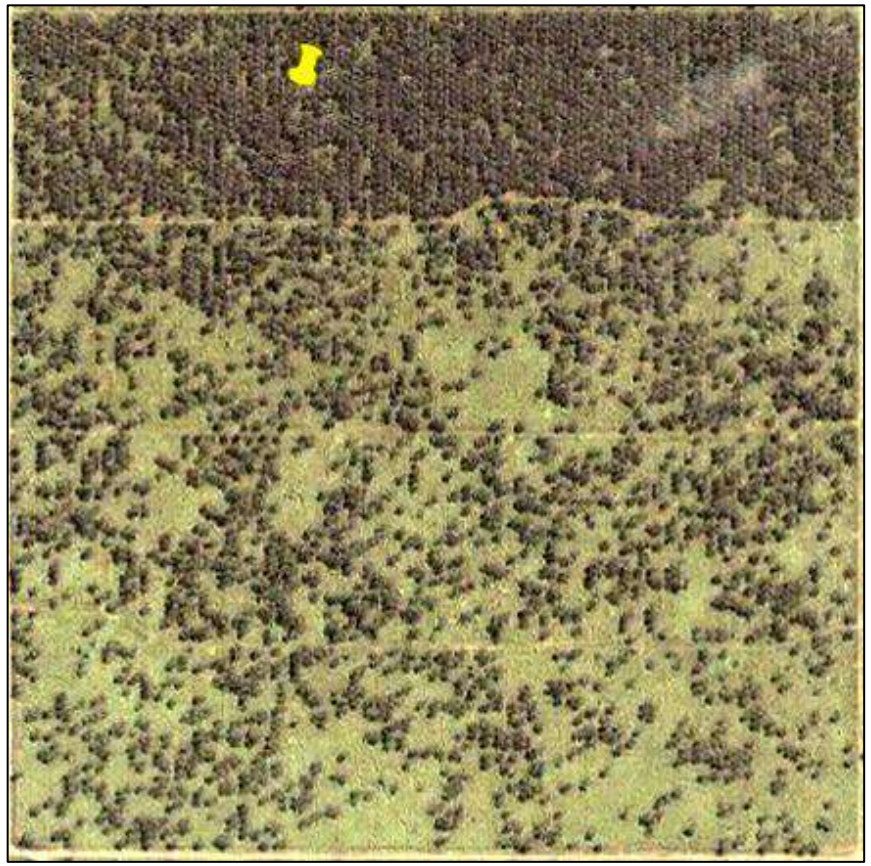


Artificial « pollination » with ANA has modified the expected yield

EXPANSIÓN DEL COMPLEJO PC



Variability in resistance to Bud rot among *E. guineensis* populations

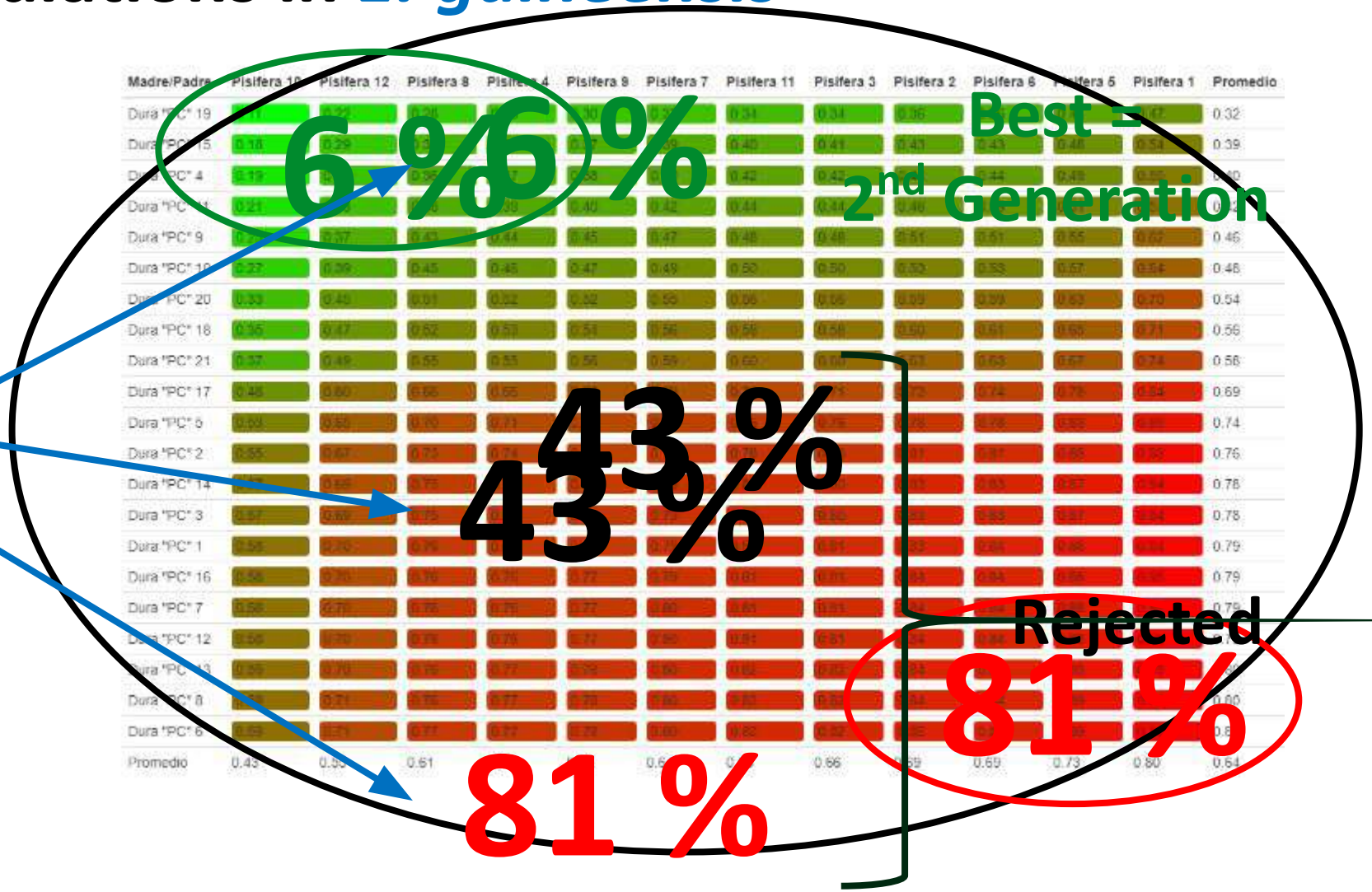


Identification of one source of resistance in *E. guineensis* (2000's)

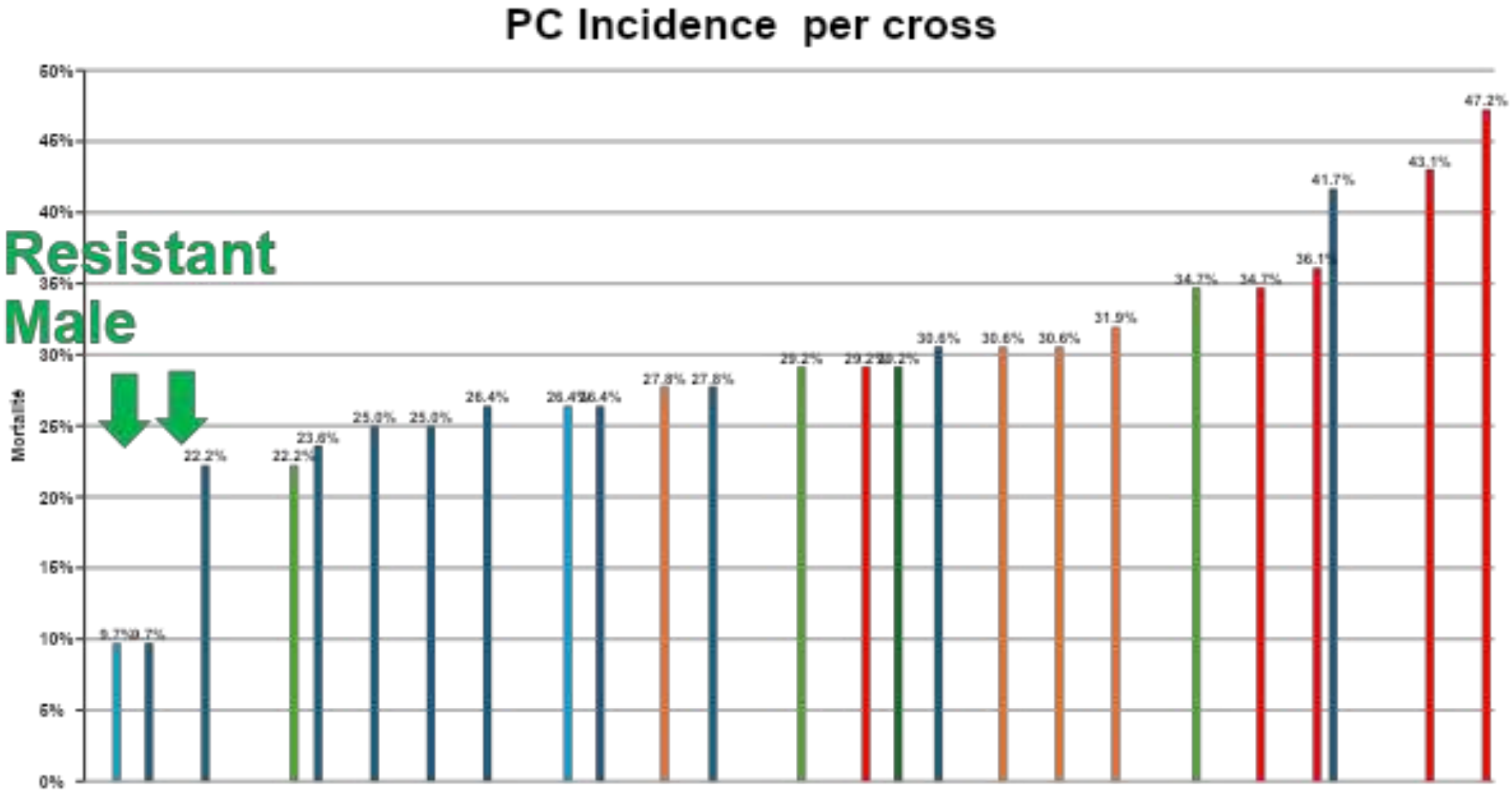
Confirmation 10 years later (P. Amblard, Danec Ecuador)

Resistances existe in both Female and Male populations in *E. guineensis*

Plantation 2012
Observation 2020
(Hacienda la Cabaña
Colombia)



Resistances existe in both Female and Male populations in *E. guineensis*



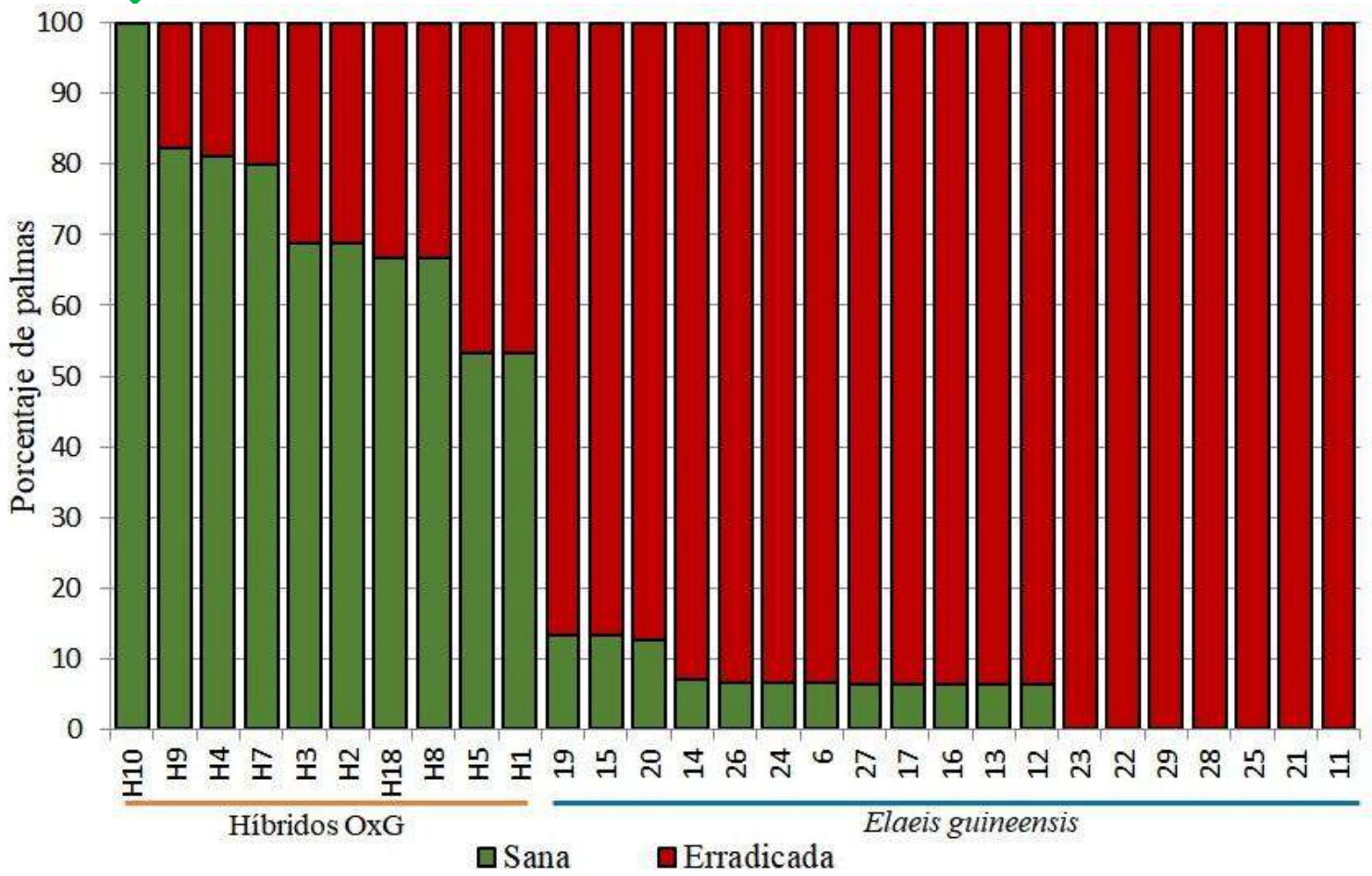
Example for Male résistance (C. Louise, Danec Ecuador)

Effect of *E. guineensis* as male parent in Hybrids

Preliminary results

Resistant

Male



(Avila-Diazgranados et A. Cenipalma, 2016)

Yield of E. guineensis resistant to But Rot

Each seed producer will continue to improve yields…
Business as usual.

From our experience, there will be no cost on yield : **resistant material are also high producer**

Conclusion

Bud Rot :

1. The disease **still spread**
2. The disease seems to be more and **more aggressive** (Tumaco, Urabá, Quininde,…)

Breeding for resistance :

1. Strong resistance from *E. oleifera* exist
2. Strong resistance in *E. guineensis* (female) exist
3. Resistance in *E guineensis* (male) exist

- Resistance for only one parent is no longer sufficient
- **Breeders have to combine the two in Hybrids and guineensis and … no cost on yield.**
- **Molecular markers will help a lot**

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MUCHAS GRACIAS

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