



Yield potential

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Introduction

One question to breeders :
*“What is the yield potential
of yours varieties ?”*
(Varieties)

The answer might be a long list of questions:

- Genetic potential ?
- Agronomic potential ?
- Soil ?
- Slope ?
- Rainfall ?
- Irrigation ?
- Sunshine ?
- Nutrition Policy ?
- What age ?
- And ...



- What is your management efficiency ?....

FFB among different locations

EXAMPLE 1 : one “old fashion”cross

Locations	BN (kg)	ABW (kg)	FFB (t/ha)	Age
North Sumatra 1	15,8	13,4	27,6	7 to 10
North Sumatra 2	18,5	12,9	31,1	6 to 10
Cameroun	11,0	11,3	16,0	6 to 10
Benin	7,1	12,1	11,4	6 to 11
Côte d’Ivoire	11,2	11,5	16,1	6-9 or 10-13

EXAMPLE 2 : one cross “last generation”

Locations	BN (kg)	ABW (kg)	FFB (t/ha)	Age
North Sumatra 1	17,3	13,6	30,3	7 to 10
Nigeria 1	13,6	12,9	23,0	6 to 9
Guatemala	17,6	17,5	40,5	6 to 9

- High variation of “potential FFB ” among locationsfrom 1 to 3
- Bunch number is the most affected factor (except Guatemala)

% OER among different locations



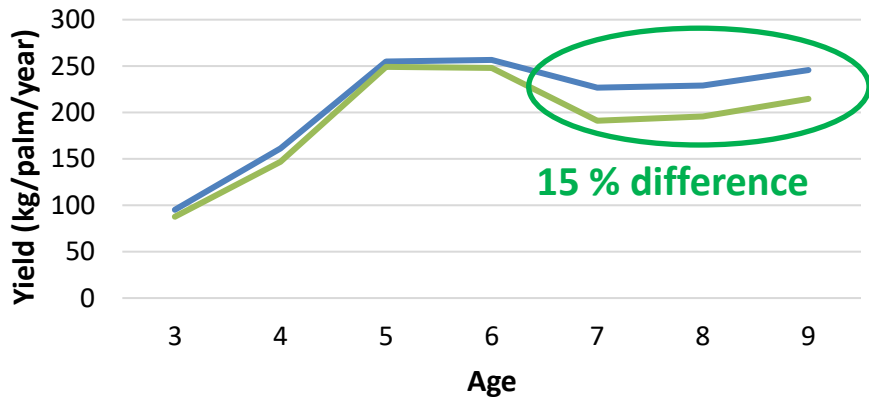
One "old fashion" cross	60's	70's	80's	90's	2000's	Avg
Indonesia (N. S.)	--	22,4	21,6	22,7	22,0	22,2
Côte d'Ivoire	20,8	20,7	20,9	21,4	--	20,9
Cameroun	21,8	21,3	22,6	22,7	--	22,0
Benin	--	22,4	20,7	22,9	--	22,1

One "new generation" cross	2000's
Indonesia (N. S.)	27,5
Nigeria	28,1
Guatemala	26,7

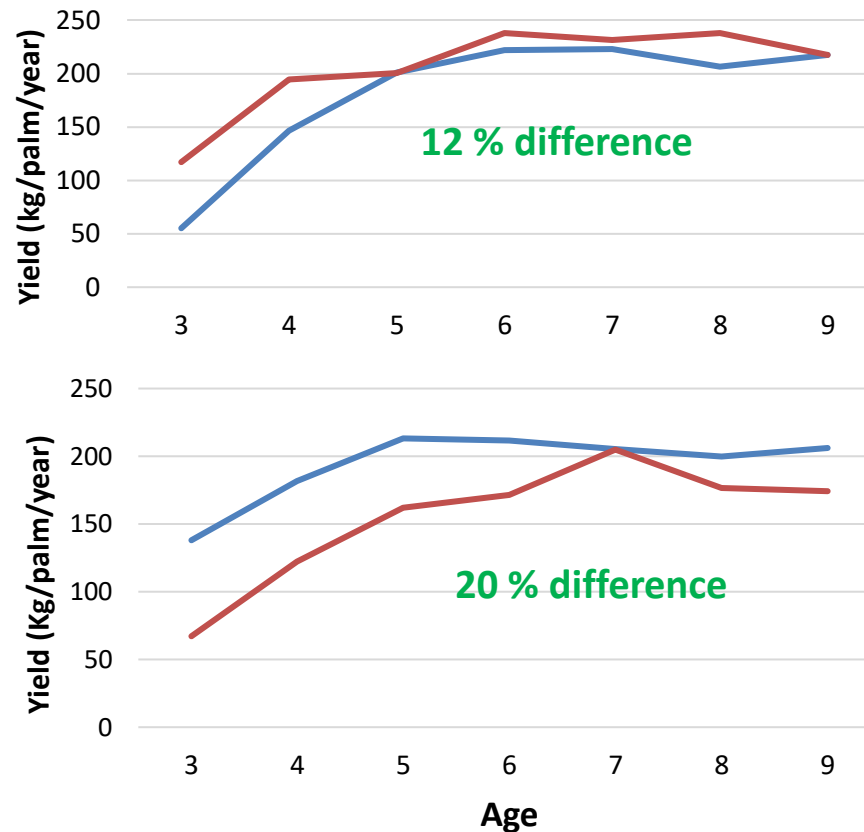
- Limite variation of "potential OER" among locations and ... time (= method).
- **OER is more stable than FFB**

FFB in different year of planting and/or plot in one location

Same cross, same year, dif. block

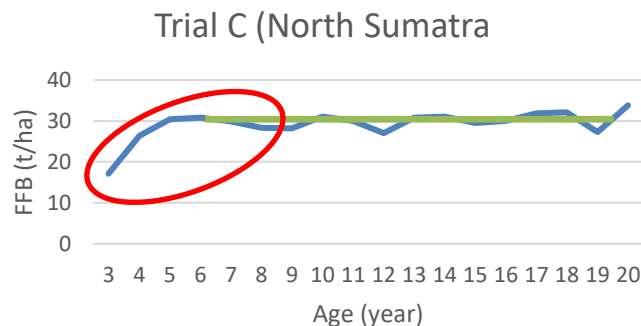
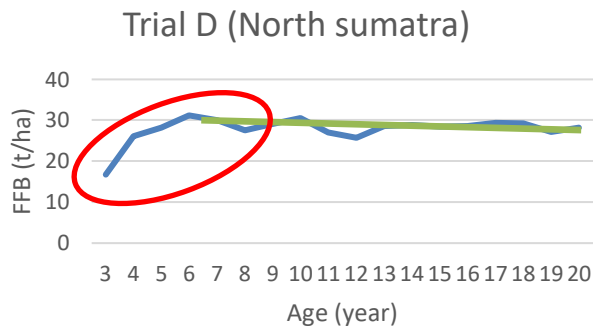
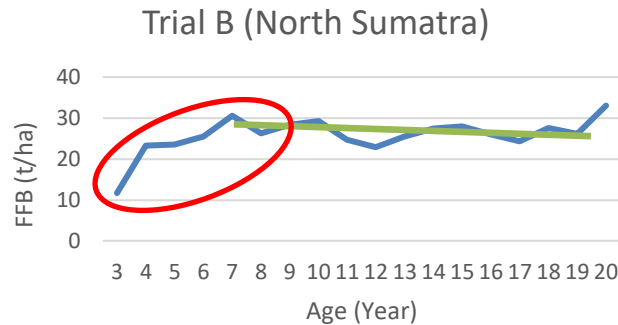
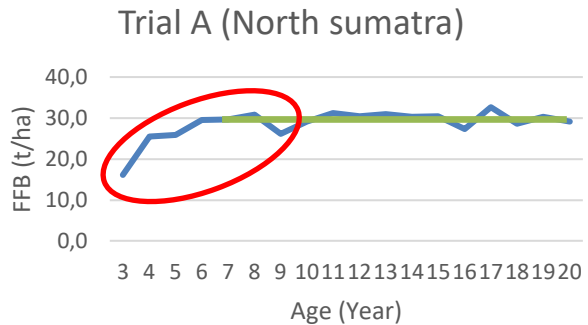


Same cross, dif. year, dif. block



➤ Even with reference to precise material (cross), precise location, same management **Huge differences** can be observed

Plantation yield profile (age and yield)



The plateau (7 to 25 years) = 85 % of the crop
(88 % up to 30 years)

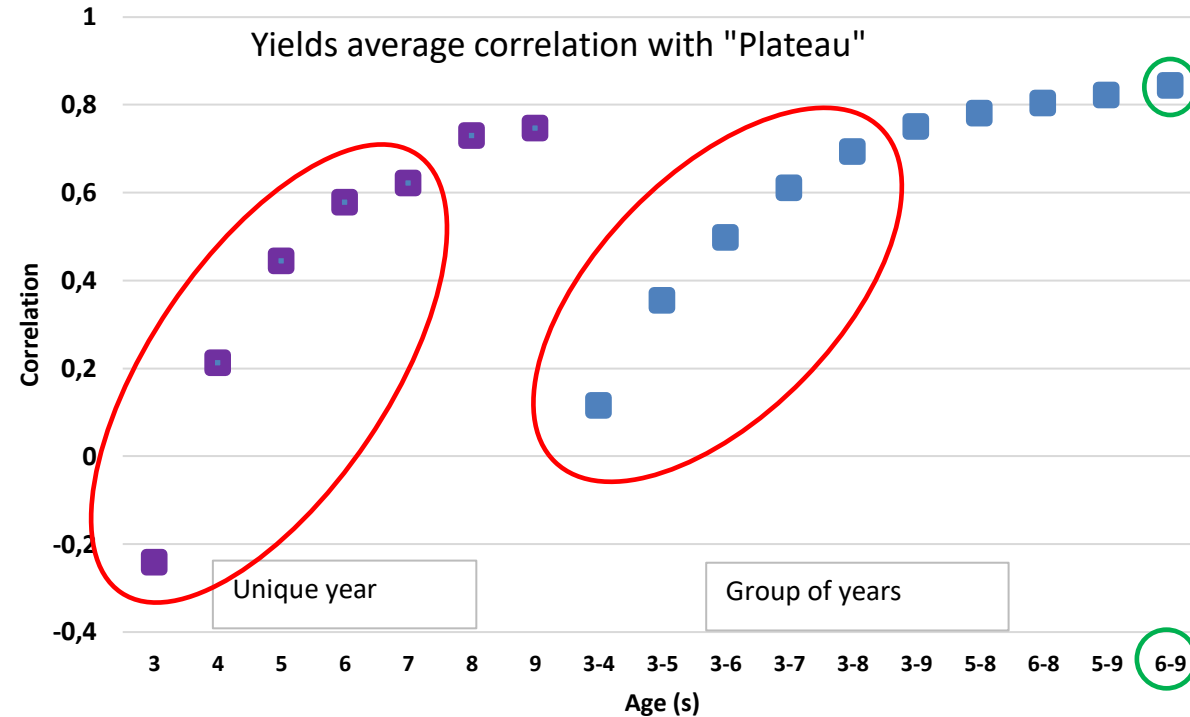
Breeders predict the plateau observing the yield from 3 to 8 (or 9 or 10)

What is the best “aggregate” to predict the plateau ?

Early age does it predict all cycle yield....

Young age is a weak indicator of adult age

FFB yield 6-9 gives the best correlation with **the plateau**



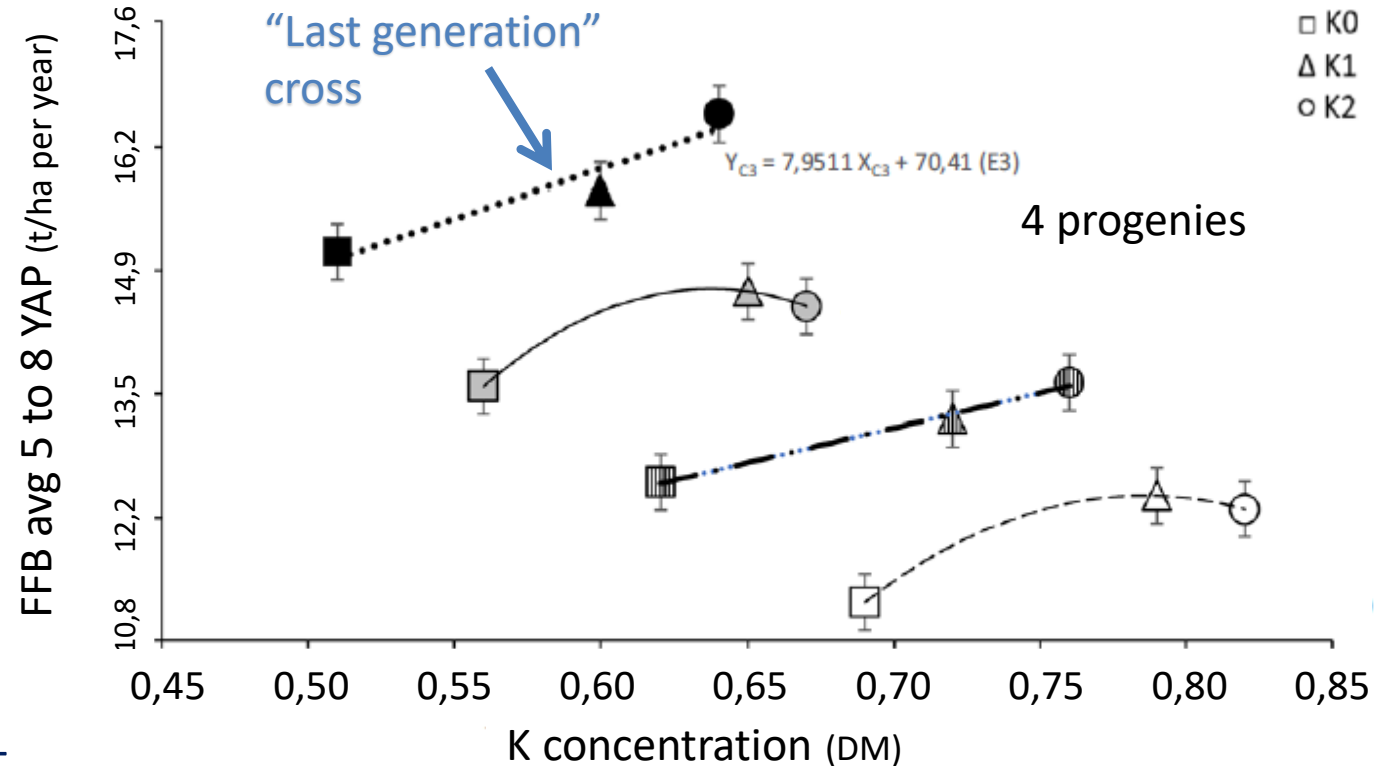
A few Word about fertilisation

Planting material (“Varieties”) are genetically more and more precise : the trend is that each of it will have a restricted genetic base.

Each one may have its own “**leaf mineral content” signature**. Here an example, for K... The best cross for yield has the poorest leaf content. (From Dassou et al 2022).

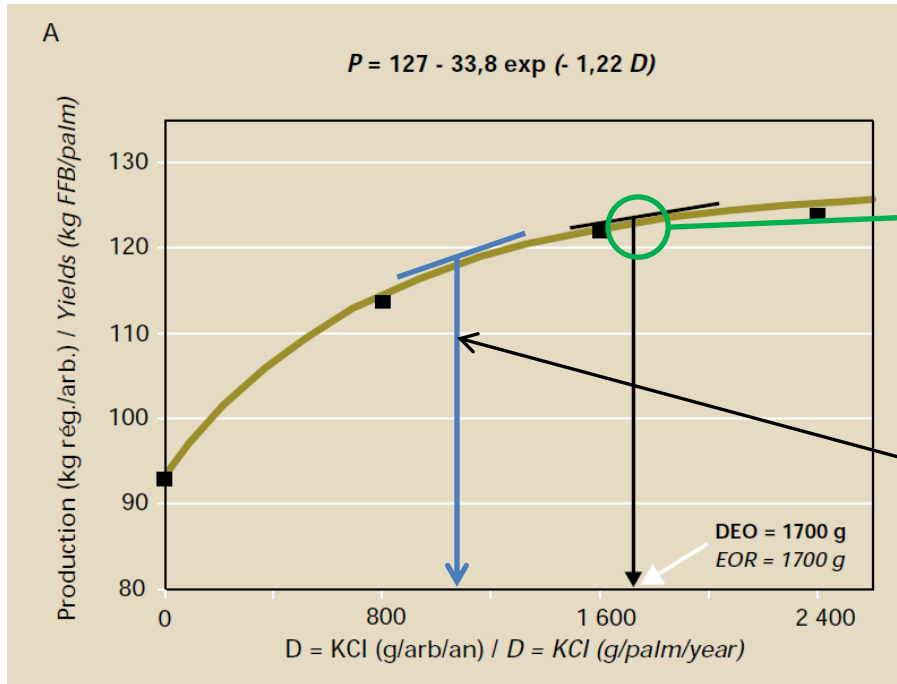
Dassou and al. to conclude that “**Our results also revealed specific optimum leaflet K content levels depending on the genetic origins of the oil palms**”

- One will no longer have to fertilize “oil palm” but specific varieties with their own requirements

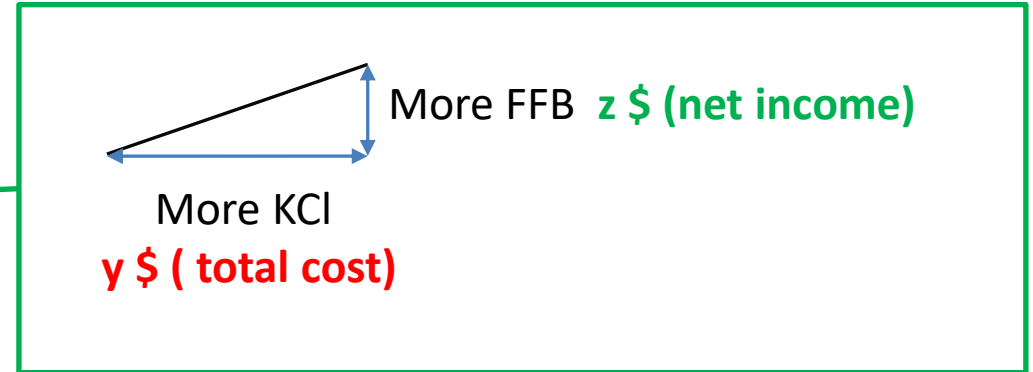


From Dassou et al. (2022) : Oil palm (*Elaeis guineensis* Jacq.) genetic differences in mineral nutrition: specific leaflet mineral concentrations of high-yielding oil palm progenies and their implications for managing K and Mg nutrition ; Plant Soil (2022) 475:279–292 ; <https://doi.org/10.1007/s11104-022-05367-8>

Nutrition policy : potential yield is obviously linked to nutrition: K example

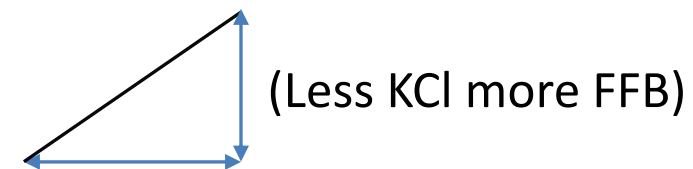


From Caliman J.P., Daniel C., Tailliez B. **Oil palm mineral nutrition Plantations, recherche, développement** Novembre – Décembre 1994



Economic efficiency if : $(z \$ / y \$) > 1$

To day the optimum is moving backwards

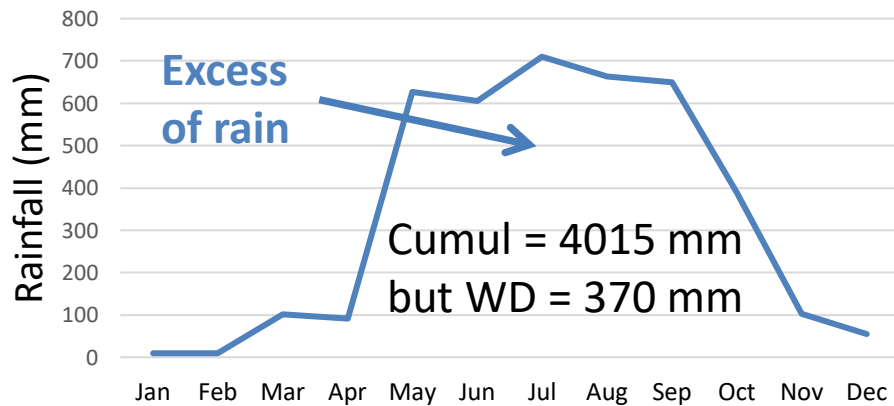


And the yield potential might be different depending on nutrition policy...

Water requirements

Theoretically : 150 mm /month = 1800 mm of rain /year.... but **well distributed**

Unbalanced rainfall regime in South Myanmar



Locations	Rain fall	Water deficit*
North Sumatra 1	2 311	50
North Sumatra 2	2 600	0
Cameroun	2 850 mm	250 mm
Benin	1 200 mm	550 mm
Côte d'Ivoire	1 800 mm	360 mm
Guatemala	Irrigation	--
Myanmar	4 015 mm	370 mm
<i>(*) Simplified method</i>		

Caliman (Oléagineux, Vol. 47. n° 5 - Mai 1992) state :
« a variation of 100 mm in the annual water deficit, within range of 0 to 500 mm, causes yields to vary by (...) 10% of potential production with no water deficit.»

Location	Hours of sunshine
Ecuador (Quininde)	< 1200
Benin	1425
Cameroun	1510
Côte d'Ivoire	1750
North Sumatra 1	1790
Guatemala	> 2800

(1 h/day \approx 2.73 MJ / m² /day)



Effect of lack of light on some progenies (Ecuador)

Tentative conclusion : **What is the yield potential?**

Having given some examples,
Having done all those comments,
It seems just impossible to give an answer...

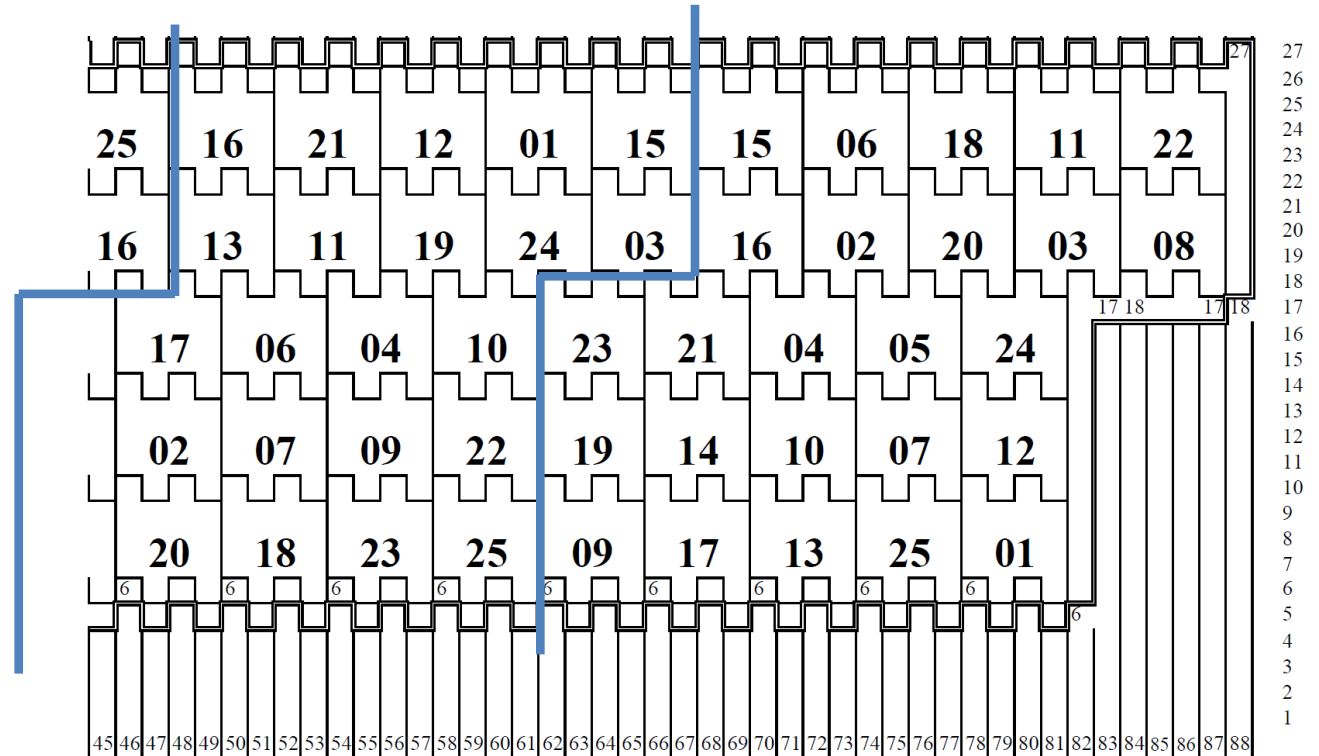
In the other hand :

- Planters needs to discuss with banks and need to predict the net income (business plan) ...
- Capacity of the mill has to be calculated...
- Etc..

The question is important and we have to answer, at least we have to **give a range of potential yield**

Need to control the environmental conditions : within a block

Each genetic trial will have replication (generally 5 to 6) ; crosses been arranged at random : part of fertility variations are controlled.



References to control differences between blocks, years and locations

Genetic network in Indonesia
 28 trials ; 490 ha ; 427 crosses & Clones

Connecting crosses within and between years

	1995	1997	1998	1999	2000
1995	3	7	0	0	4
1997		21	8	2	6
1998			6	6	5
1999				4	2
2000					2

**Between
 Location
 30 crosses**

Genetic network in Africa
 30 trials, 780 ha, 704 crosses & clones

Connecting crosses within and between years

	2010	2011	2012	2013	2014	2015	2016
2010	10	10	3	3	2	7	5
2011		4	3	1	1	5	4
2012			4	2	2	2	3
2013				5	0	2	0
2014					5	2	2
2015						8	5
2016							4

Genetic connections (i. e. palms sharing part of the same blood)
might be additional statistical connections

So.... After having collected some informations, after discussion with managers and with a lot of care, we can try to provide some guidances that will help to answer **the** question :

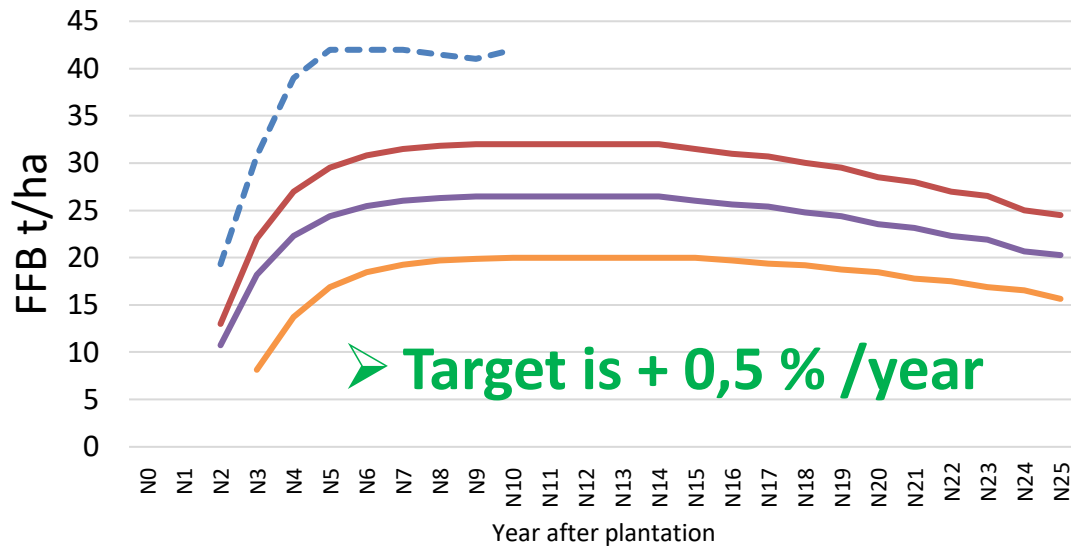


**What could be your
yield potential with
that planting material**



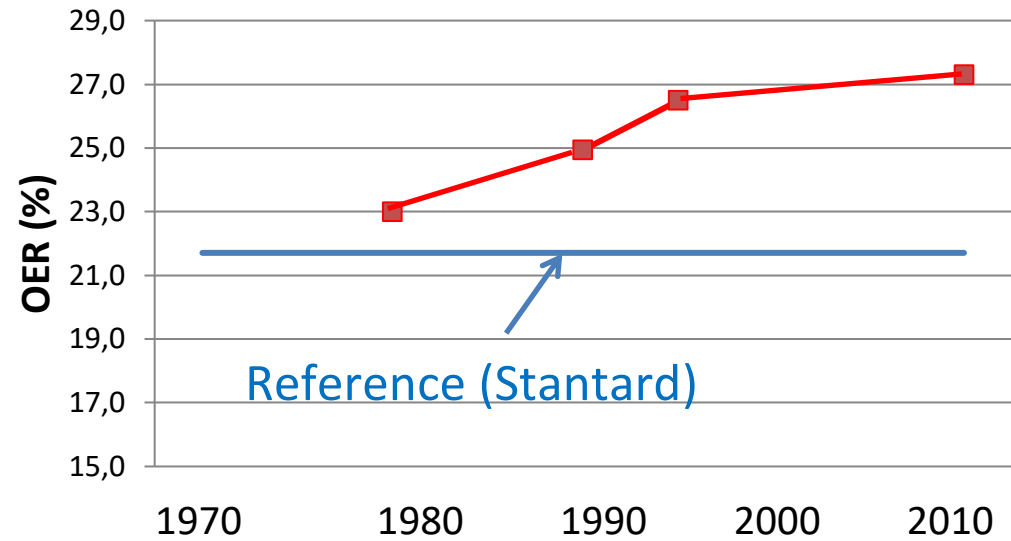
Potential FFB yield

Some yield profiles ; good soils



- Guatemala : not far from maximum potential
- North Sumatra : good soils, 4th generation
- Africa, Nigeria : moderate water deficit
- Africa, Nigeria : acute water deficit

Potential OER



Year it has been implemented in seeds

- To day EOR of 26-27 % is achievable
- Target is > 30 % (next decade)

Planting material currently being under development :

North Sumatra (Indonesia)

FFB /ha	OER (% mill)	Oil yield/ha
34,5	26,2	9,1
34,1	26,0	9,0
29,4	27,5	9,0
29,5	30,0	8,9

Nigeria (≈ 320 mm WD)

FFB /ha	OER (% mill)	Oil yield/ha
22,6	26,9	6,2
21,9	27,0	5,9
18,8 (6-7 y)	31,1	5,9
16,7 (6-7 y)	30,9	5,3

- A lot of hope for continuous yield improvements ;
- Agronomists, geneticists and breeders are working ;
- And phytopathologists also As yield will be combined with resistance to diseases....



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Conferencia
Internacional sobre
20th International Oil Palm Conference

**PALMA
DE ACEITE**

EL PODER TRANSFORMADOR DE LA PALMA DE ACEITE





THE TRANSFORMATIVE
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Thanks

