

Comparative assessment of agronomical performances of six commercial cocoa varieties in on farm progeny trials in Cameroon

O. Sounigo¹, L. Feumba de Tchoua², R. Bourgoing ¹, F. Nsouga², D. Abolo²,
I.B. Efombagn³, C. Cilas¹

1 = CIRAD Montpellier France

2 = IRAD Nkolbisson, Cameroon

3 = IRAD Ekona Cameroon



2017 International Symposium on Cocoa Research (ISCR), Lima, Peru, 13-17 November 2017

INTRODUCTION

Three types of varieties currently found in farmers' cocoa plots in Cameroon, usually mixed in the same plots:

commercial varieties : full-sib progenies selected by IRAD in the 1960s, then released to farmers from **seed-gardens** established and managed by official extension agencies since the early 1970s

“modern” farmers’ varieties : progenies issued from pods harvested on cocoa **trees in farmers’ cocoa plots**, which were formerly established using commercial varieties. These varieties are thus **half-sib progenies generated by commercial varieties**

traditional cocoa varieties : German cocoa = **amelonado**, introduced in Cameroon at the end of the 19th century

A program of participatory breeding started in 2006, consisting in the setting up of **on farm experimental plots** designed for the comparison between the performances of:
the three types of varieties
six commercial varieties

MATERIAL AND METHOD

Sites of the study



MATERIAL AND METHOD

Sites of the study

Village	Bakoa	Kedia	Edou	Lekie Assy
Administrative district	Mbam et Inoubou	Mbam et Inoubou	Mefou et Afamba	Lekie
Landscape	Forest/savanah	Forest/savanah	forest	forest
Annual rainfall (mm)	1,300	1,280	1,470	1,280
Rainfall (days)	84	85	90	84
Type of soil	SAND/silt	SAND/clay	CLAY/sand	SAND/clay
PH	6.71	6.01	5.18	5.75
organic matter/clay ratio	0.16	0.12	0.1	0.07

MATERIAL AND METHOD

Plot management

Plots set up on fallow and savannah : **no deforestation**

Intercropping with a high number of fruit/oil palm/coconut trees : **income diversification**

Complete clearing of the plots before planting cocoa and shade plants:

- **Temporary shade:** maize (during the first two years) and plantain (during the first four years)
- **Permanent shade:** provided by fruit, coconut or oil palm trees, planted simultaneously or one year after the cocoa trees, thus starting to provide shade six years after plot setting-up



MATERIAL AND METHOD

Compared varieties

Plots set up in 2006

Six **commercial varieties** = six **full-sib progenies** issued from **seed-gardens**, compared in **eleven on farm trial plots**, set up near the villages of Kedia and Bakoa. (Number of trees in brackets)

IMC 67 x SNK 64 (464) IMC 67 x SNK 109 + reciprocal (519) SCA 12 x SNK 16 and reciprocal (379)
T 79/501 x SNK 109 + reciprocal (428) T 79/501 x SNK 13 (208) UPA 143 x SNK 64 (339)

Plots set up in 2007

Three types of varieties compared in **six on farm trial plots** set up in Bakoa, Edou and Lekie Assy (numbers of trees in brackets):

Mixed commercial varieties: mixture of full sib progenies issued from biclonal seed-gardens (205)

Farmers modern varieties, issued from pods harvested in on farm plots, which were set up with commercial varieties (85)

Traditional farmers' variety issued from pods collected in old farmers' cocoa plots set up with amelonado type cocoa trees (149)

In addition, **two commercial progenies**, which were also assessed in the plots set up in 2006:

IMC 67 x SNK 64 and UPA 143 x SNK 64

MATERIAL AND METHOD

Yield assessment

Unripe but mature pods (NP) were counted on every cocoa tree, every two months during the period 2011-15

The average weight of dry cocoa per pod (BP) was assessed for each variety by weighting the fermented and dry cocoa from a sample of at least 50 pods, collected on at least 20 trees

NP and BP values were used to calculate the **weight of cocoa produced per tree (WC)**

$$\text{WC (kg/tree)} = \text{NP} \times \text{BP}$$

These data were used for two factor (plot and variety) ANOVA performed on the **weight of cocoa /tree (WC)** values

The **mean weight of cocoa /tree values (MW)** calculated for **each variety** were then turned into:

potential yield = mean weight of cocoa /ha/year, calculated for a **final** 1,100 trees/ha density, (density recommended in Cameroon)

actual yield = mean weight of cocoa /ha/year, calculated for a **corrected density (Dc)**

$$\text{Dc} = 1,100 * \text{Ps}$$

Ps = mean proportion of surviving trees, calculated for each variety, across all the plots

RESULTS

Plots set up in 2006

		Potential yield per tree (PYt) during 2011-15 period (g)				Potential annual yield per hectare (PYh) (kg cocoa/ha/year)		
Factor	F value	significance level	mean value	minimal value	maximal value	mean value	minimal value	maximal value
plot	30.3	p < 0.001	4195	2815	6280	1154	774	1727
variety	31.6	p < 0.001	4022	3275	5257	1106	901	1512

Variety	potential yield		N.K 5%	% survival	actual yield (kg/ha/year)
	g/tree (2011-15)	kg/ha/year			
IMC 67 * SNK 109 + Reciprocal	5500	1512	a	85	1285
IMC 67 * SNK 64	4379	1204	b	85	1023
T 79/501 * SNK 109 + Reciprocal	4159	1144	c	75	858
T 79/501 * SNK 13	3411	938	c	79	741
SCA 12 * SNK 16 + Reciprocal	3408	937	c	77	721
UPA 143 * SNK 64	3275	901	c	81	730

RESULTS

Plots set up in 2007

		yield per tree (g) during 2011-15 period				Potential yield (kg cocoa/ha/year)		
Factor	F value	significance level	mean value	minimal value	maximal value	mean value	minimal value	maximal value
plot	8.1	p < 0.001	3515	2745	4506	967	755	1239
variety	31.6	p < 0.001	3365	1797	4682	925	494	1288

variety	potential yield		N.K 5%	% survival	actual yield kg/ha/year
	g/tree (2011-15)	kg/ha/year			
IMC 67 * SNK 64	4682	1288	a	62	799
farmer modern varieties	3562	980	b	66	647
UPA 143 * SNK 64	3532	971	b	71	689
Mixed commercial varieties	3251	894	b	67	599
traditional farmers variety	1797	494	c	51	252

DISCUSSION

The analysis of the data obtained in our on farm progeny trials, showed:

A **high level of variation** among the six assessed commercial varieties, resulting in their mixture **failing to yield more** than the “modern” farmers’ varieties

A **higher level of yield** for the two commercial varieties: IMC 67 x SNK 64 and IMC 67 x SNK 109 (+ reciprocal)

➔ These two varieties should be produced at **higher scale**

The same type of assessment is currently being performed on eight other commercial varieties

A **low level of survival and yield** for the **traditional variety** (German cocoa), contrasting with the high level of yield that can be observed with this variety in **shaded plots**

➔ German cocoa = amelonado requires a **sufficient level of shade** for its cultivation

SPECIAL THANKS

The authors wish to thank the farmers who took part to the Participatory Breeding Program

The authors wish to thank PSCC and SODECAO for releasing the commercial varieties assessed in our study

The Cocoa Participatory Breeding Program started in the frame of a CFC/ICCO/Bioversity project, and it continued thank to the funding of the following bodies/companies: Mars Inc., USDA, world cocoa foundation and French Ministry of Foreign Affairs