

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

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# 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 19<sup>th</sup> 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



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

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

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)**

$$Dc = 1,100 * Ps$$

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	<b>p &lt; 0.001</b>	4195	2815	6280	<b>1154</b>	774	1727
variety	31.6	<b>p &lt; 0.001</b>	4022	3275	5257	<b>1106</b>	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	<b>1512</b>	a	85	<b>1285</b>
IMC 67 * SNK 64	4379	<b>1204</b>	b	85	<b>1023</b>
T 79/501 * SNK 109 + Reciprocal	4159	<b>1144</b>	c	75	<b>858</b>
T 79/501 * SNK 13	3411	<b>938</b>	c	79	<b>741</b>
SCA 12 * SNK 16 + Reciprocal	3408	<b>937</b>	c	77	<b>721</b>
UPA 143 * SNK 64	3275	<b>901</b>	c	81	<b>730</b>

# 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	<b>p &lt; 0.001</b>	3515	2745	4506	<b>967</b>	755	1239
variety	31.6	<b>p &lt; 0.001</b>	3365	1797	4682	<b>925</b>	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	<b>1288</b>	a	62	<b>799</b>
farmer modern varieties	3562	<b>980</b>	b	66	<b>647</b>
UPA 143 * SNK 64	3532	<b>971</b>	b	71	<b>689</b>
Mixed commercial varieties	3251	<b>894</b>	b	67	<b>599</b>
traditional farmers variety	1797	<b>494</b>	c	51	<b>252</b>

# 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

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