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SECOND RECURRENT COCOA SELECTION CYCLE IN CÔTE D'IVOIRE: GENETIC PARAMETERS IN THE TWO CONSTITUTIVE POPULATIONS AFTER THIRTEEN YEARS OF OBSERVATIONS

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OUTLINE OF PRESENTATION

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INTRODUCTION

Background

- In RCI, the objective of the breeding programme initiated in 1960 was to select superior hybrids for **yield, precocity** and **quality.**.

- Resistance to diseases and pests have become priority objectives later. **Since 1990**, a recurrent and reciprocal selection programme was started to ensure genetic gains in the new criteria which are yield, yield/vigour ratio, resistance to Black Pod disease and mirids, and quality trait.

- The two base populations were **UA** and **LA+T**. The first cycle of recurrent selection was ended in 1999 and the second cycle started in 2000 with establishment of two intra-population trials.

- 13 years after the beginning of second cycle recurrent selection activities, genetic parameters are evaluated in the 2 constitutives populations.

Objectives

For each population:

- Estimate genetic parameters for yield, resistance to black pod disease, vigor and pod weight
- Select the best crosses and best trees for yield respectively from 10% of crosses and 1 % of trees in each population
- Estimate expected genetic gains on each criteria in each population.

MATERIALS AND METHODS

2nd cycle (Plant material)

40 best trees selected from intra-populations crosses in the UA1 and (LA+T)1 populations were used as parents for new intra-populations crosses in order to constitute the populations UA2 and (LA+T)2 of the second cycle of recurrent selection. Each parent was involved in 4 crosses in an 20 x 20 incomplete NCII crossing design.

Population	Trial and year of planting	Number of progenies	Number of trees per progeny	Number of cropping years
UA2	E6/1 (2000)	75	15	13
(LA + T)2	E6/2 (2000)	70	16	13

UA2 = 2nd cycle of intra-population UA

(LA+T)2 = 2nd cycle de intra-population (LA+T)

Traits studied

- **Annual Potential Yield (P.Y)**

  (T0T02-15 x Pod Weight x 1333 x 0,0875/13)
- ***Phytophthora pod rot* (Ppr)**
- **Vigor (**Trunk section at 10 cm from the ground)
- **Pod weight**

Statistical analysis

Data analysed with SAS & DIOGENE

RESULTS-DISCUSSION

Analysis of the parents effects in crosses UA1 x UA1 and (LA+T)1 x (LA+T)1 for 4 selection traits

	UA1 x UA1 crosses				(LA+T)1 x (LA+T)1 crosses			
	Signifiance effects				Significance effects			
Traits	♀	♂	♀ x ♂	**VA/VG**	♀	♂	♀ x ♂	**VA/VG**
PY	HS	HS	HS	**57,2**	HS	HS	HS	41,8
Ppr	HS	HS	HS	**61,0**	NS	NS	HS	27,6
Vigor	HS	HS	HS	**77,7**	NS	NS	HS	30,4
Pod weight	HS	HS	HS	**87,8**	HS	HS	NS	**89,8**

P.Y = **Potential Yield**; Ppr = ***Phytophthora*** **pod rot**

HS = **Highly significance;** NS **= not significance**

VA/VG = **additive variance/genetic variance ratio**

Phenotypic (above diagonal) and genetic (below diagonal) correlations between traits, and narrow sens heritabilities (on the diagonal) for Potential Yield (PY), Vigor, Ppr and pod weight in two intra-populations

	UA2 Population				(LA+T)2 Population			
Critère	**PY**	**Ppr**	**Vigor**	**Pod weight**	**PY**	**Ppr**	**Vigor**	**Pod weight**
PY	0,18	- 0,99	**0,90**	-0,18	0,27	- 0,35	**0,99**	- 0,13
Ppr	- **0,10**	0,23	**- 0,99**	0,35	**0,91**	**0,08**	- 0,43	- 0,26
Vigor	0,60	0,11	0,40	- 0,35	0,55	**0,80**	0,15	0,33
Pod weig.	0,09	0,11	0,23	**0,68**	- 0,01	- 0,24	0,16	**0,68**

PY = Potential Yield

Ppr = *Phytophthora pod rot*

Crosses selected for potential yield in the intra UA2 population at the rate of 10% and expected genetic gains on each trait (Potential Yield, *Phytophthora* pod rot (Ppr), vigor and Pod weight)

		UA2 Population				
N° Fam.	Crosses	Number of trees	PY (Kg/ha)	Ppr (%)	Vigor (cm^2)	Pod w. (Kg)
33	**E43-2** x **C21-1**	15	1994,7	7	249,3	0,47
58	E41-15 x E43-1	14	1824,9	6	216,3	0,41
39	E43-3 x **IFC705**	15	1807,3	9	248	0,41
30	E41-21 x **C21-1**	15	1787,3	9	211,4	0,52
36	**E43-2** x **IFC705**	14	1771,5	7	179,6	0,45
59	**E41-15** x E41-5	15	1748,1	10	221,8	0,44
57	**E41-15** x E41-6	15	1714,3	7	182,1	0,45
18	E41-19 x BL9-2	15	1707,2	5	250,2	0,37
Mean			**1794,4**	**7,5**	**219,8**	**0,44**
CV (%)			5	22,5	13	9,1
Mean trial			**1320**	**10**	**188,2**	**0,44**
Genetic gain (%) on mean trial			**36**	**-25**	**16,8**	**0**

PY = Potential Yield **Ppr = *Phytophthora pod rot***

Crosses selected for potential yield in the intra (LA+T)2 population at the rate of 10% and expected genetic gains on each trait (Potential yield, *Phytophthora* pod rot (Ppr), vigor and Pod weight)

	(LA + T)2 population					
N° Fam.	Crosses	Number of trees	PY (Kg/ha)	Ppr (%)	Vigor (cm^2)	Pod w. (Kg)
68	E42-7 x **DCG1-1**	15	2115,5	11	260,1	0,48
75	E42-13 x E4212	13	1998	4	322,6	0,45
77	E42-29x**DCG1-1**	14	1978	7	266,2	0,49
39	E42-4 x E42-23	14	1890,1	9	228,6	0,52
61	E42-6 x IFC 10	13	1866,1	7	364,3	0,5
51	E42-16 x IFC 7	16	1851,6	6	178,5	0,6
11	E42-31xE42-27	13	1802,9	12	163,1	0,51
Mean			**1928,9**	**8**	**254,8**	**0,51**
CV (%)			5	32,7	26,4	7,8
Mean trial			**1250**	**9**	**188**	**0,5**
Genetic gains (%) on mean trial			**54,3**	**-11,1**	**35,5**	**2**

PY = Potential Yield

Ppr = *Phytophthora pod rot*

Selected trees for potential yield in UA2 population at the rate of 1% and expected genetic gains on Potential Yield, *Phytophthora* pod rot (Ppr), Vigor and the Pod weight

	UA2 Population					
N° trees	N° Fam.	Crosses	PY (Kg/ha)	Ppr (%)	Vigor (cm^2)	Pod w. (Kg)
1	60	E41-15 x C213	4719,2	7	315,8	0,45
2	24	E41-16 x **C211**	3774,7	7	299,0	0,5
3	**33**	E43-2 x **C21-1**	3650,3	6	459,6	0,5
4	**39**	**E43-3xIFC 705**	3571,3	11	264,0	0,51
5	**39**	**E43-3xIFC 705**	3302,6	5	459,6	0,42
6	**58**	**E41-15x E43-1**	3279,4	3	375,6	0,42
7	**30**	E41-21x **C21-1**	3131,3	4	336,2	0,54
8	12	E41-12 x BL92	3056,0	7	424,1	0,33
9	**58**	**E41-15 x E431**	3046,4	8	254,0	0,45
10	**59**	**E41-15 x** E415	2992,5	7	232,0	0,54
11	**57**	**E41-15 x** E416	2981,6	8	207,0	0,46
Mean			**3409,6**	**6,6**	**329,7**	**0,46**
CV (%)			15	32,7	27,2	13
Mean trial			**1320**	**10**	**188,2**	**0,44**
Genetic gains (%) on mean trial			**158,3**	**-34**	**75,2**	**4,54**

PY = Potential Yield **Ppr = *Phytophthora pod rot***

Selected trees for potential yield in (LA+T)2 population at the rate of 1% and expected genetic gains on Potential Yield, *Phytophthora* pod rot (Ppr), Vigor and the Pod weight

	(LA+T)2 population					
N° trees	N° Fam.	Crosses	PY (Kg/ha)	Ppr (%)	Vigor (cm^2)	Pod w. (Kg)
1	67	**E42-7** x E42-5	4326,6	11	364,7	0,54
2	**51**	**E42-16** x IFC 7	4308,6	5	432,2	0,54
3	50	**E42-16** x E4214	4141	12	267,7	0,58
4	**68**	**E42-7** xDCG1-1	4119	7	325,9	0,45
5	65	**E42-7** x IFC 18	3794	6	233,8	0,34
6	42	E42-9 x E42-23	3706,5	9	240,7	0,41
7	**61**	**E42-6 x IFC 10**	3654,8	9	750,3	0,56
8	**75**	E42-13 x E4212	3640,1	3	315,8	0,47
9	**61**	**E42-6 x IFC 10**	3579,3	7	447,6	0,44
Mean			**3918,9**	**7,7**	**375,4**	**0,48**
CV (%)			7,3	35,2	40,2	14,6
Mean trial			**1250**	**9**	**188**	**0,5**
Genetic gains (%) on mean trial			**213,5**	**-14,4**	**99,7**	**-4**

PY = Potential Yield **Ppr = *Phytophthora pod rot***

CONCLUSION

- **The study based on the accumulation of 13 harvesting campaigns confirmed:**

- the greater additivity part (VA/VG) of the Pod weight in the 2 populations

- the effects of dominance more important on the *Phytophthora* pod rot (Ppr) in (LA+T) population

- **Phenotypic and genetic correlations showed that:**

- in the 2 populations, the best trees for the yield are also for the vigor;

- in the UA2 population, the best trees for potential yield are also the most resistant to *P. palmivora*, whereas in the (LA+T)2 population, the best crosses for yield are also the most susceptible to *P. palmivora*.

- **Genetic gains expected** on the yield were greater in the (LA+T)2 population than in the UA2 population while the expected genetic gains on the *Phytophthora* pod rot rate (Ppr) were twice more important in the UA2 population than in the (LA+T)2 population.

PERSPECTIVES

Establishment of confirmation trials with:

- **15 candidates hybrids selected at the rate of 10%**
  (8 of the group of UA and 7 of (LA + T)**)**

- **20 clones from selected trees at the rate of 1%**
  (11 of the UA2 pop. and 9 of the (LA + T) 2 pop.**)**

in order to propose varietal outputs

THANK YOU FOR YOUR ATTENTION !