I.N.I.A.P

ESTACION EXPERIMENTAL TROPICAL PICHILINGUE
COCOA RESEARCH AND TECHNOLOGY TRANSFER TEAM

SPECIFIC COOPERATIVE AGREEMENT INIAP-USDA (ARS): 58-6631-2-F077

PROJECT: GERMPLASM EVALUATION, BREEDING AND PHYTOPATHOLOGICAL STUDIES FOR OBTAINING IMPROVED COCOA VARIETIES

Miss Veronica Aguilar (technical assistant of the project) grafts a rootstock as part of the process of clonal multiplication of cocoa seedlings which have proved to be resistant to Witches´ broom.

TECHNICAL PROGRESS REPORT
YEAR 4 (April 1/2005 – March 31/2006)

QUEVEDO – ECUADOR
May 2006

Table 1. Average number per tree of healthy pods, diseased pods, moniliasis pods, fresh bean weight and dry bean weight registered in each of 77 accessions available in the collection CGN of Nacional type genotypes during 2005. Pod and seed index values are also included for most clones to support a better data interpretation.

Genotype	Nº Healthy pods/tree	Nº Diseased pods/tree	Fresh bean weight Kg/tree	Dry bean weight Kg/tree	Pod index	Seed index
CCAT-4668 (9)*	58	20	6,0	2,4	28	0,8
CCAT-02 (1119) (1)	50	12	5,7	2,3		
CCAT-4998 (9)	32	8	5,1	2,0	19	1,2
CCAT-4583(10)	38	12	4,4	1,8	27	1,0
CCAT-2664 (10)	37	14	3,2	1,3	32	0,8
CCAT-05 (1)	31	7	3	1,2		
CCAT-1119 (10)	32	24	2,8	1,1	22	1,0
EB-2237 (8)	16	6	2,7	1,1	22	1,2
CCAT-01(4668) (1)	29	7	2,7	1,1		
CCAT-3050 (10)	37	18	2,6	1,1	27	0,8
CCAT-2564 (10)	25	12	2,5	1,0	24	1,1
CCAT-4265 (10)	25	21	2,5	1,0	24	1,0
EB-1011 (8)	38	10	2,4	1,0	35	0,9
EB-2250 (1)	28	9	2,4	1,0		
CCAT-2143 (10)	23	11	2,2	0,9	21	1,5
FIDENCIO (9)	12	6	2,1	0,8	20	1,3
CCAT-2341 (10)	17	7	1,9	0,8	22	1,2
CCAT-1858 A (8)	21	9	1,9	0,8	19	1,3
CCAT-3260 (10)	26	8	1,9	0,8	29	0,9
CCAT-5064 (10)	24	10	1,9	0,7	30	1,0
EB-2003 (2)	25	8	1,8	0,7	25	1,1
CCAT-4688 (9)	17	6	1,8	0,7	19	1,4
CCAT-3345 (10)	17	5	1,8	0,7	23	1,1
CCAT-5212 (2)	14	11	1,8	0,7	23	1,1
CCAT-3050A (3)	23	7	1,8	0,7		
CCAT-2240 (10)	29	13	1,7	0,7	30	1
CCAT-1858 (10)	16	7	1,7	0,7	19	1,3
CCAT-3061 (10)	18	14	1,7	0,7	25	1,0
EB-1915 (10)	14	5	1,6	0,6	24	1,1
CCAT-4675 (10)	18	9	1,6	0,6	23	1,1
CCAT-4584 (10)	16	15	1,5	0,6		0,8
EB-2233 (10)	14	3	1,5	0,6	23	1,3
CCAT-1934 (9)	18	5	1,5	0,6	25	1,4
EET-387 (3)	15	3	1,5	0,6		
EB-0402 (10)	18	9	1,4	0,6	27	1,1
EB-1203 (8)	26	10	1,3	0,5	34	0,8
EB-2009 (7)	14	7	1,3	0,5	25	1,3

* The number in parenthesis corresponds to the number of trees evaluated per each accession

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Genotype	Nº Healthy pods/tree	Nº Diseased pods/tree	Fresh bean weight Kg/tree	Dry bean weight Kg/tree	Pod index	Seed index
EB-1010 (10)*	14	7	1,2	0,5	26	1,3
EB-2236 (9)	11	9	1,2	0,5	22	1,2
CCAT-4260 (10)	9	3	1,1	0,4	22	1,2
CCAT-5206 (10)	9	5	1,0	0,4		0,9
CCAT-4668 (1)	13	17	1,0	0,4		
CCAT-1915 (2)	10	13	1,0	0,4		
CCAT-5477 (5)	13	8	0,9	0,4	33	0,7
BCH-14 (9)	10	4	0,9	0,4		
CCAT-1916 (10)	8	7	0,8	0,3		
CCAT-2349 (9)	9	7	0,8	0,3		
EB-2222 (9)	8	3	0,8	0,3		
CCAT-1928 (9)	8	6	0,7	0,3		
CCAT-5136 (9)	10	4	0,7	0,3		
EB-1516 (10)	8	3	0,7	0,3	20	1,4
EB-2225 (8)	7	4	0,7	0,3		
CCAT-2363 (3)	9	4	0,7	0,3		
CCAT-1201 (10)	5	3	0,6	0,3	22	1,1
EB-1013 (3)	7	4	0,5	0,2	22	1,2
CCAT-5212 (10)	6	5	0,5	0,2	23	1,1
CCAT-4650 (3)	5	1	0,5	0,2		
CCAT-1930 (10)	5	2	0,4	0,2	28	0,8
SA-8 (10)	4	3	0,4	0,2		
EB-1922 (8)	7	2	0,4	0,2	27	1,1
BCH-9 (10)	5	4	0,4	0,1		
EB-1617 (9)	4	1	0,4	0,1		
EB-0501 (7)	3	2	0,3	0,1		
L34-H07 (9)	3	3	0,3	0,1		
EB-2229 (2)	3	2	0,3	0,1		
CCAT-4364 (10)	2	2	0,2	0,1	22	1,3
CCAT-1817 (9)	2	0	0,2	0,1		
CCAT-1914 (8)	2	0	0,2	0,1		
EB-0401 (7)	2	1	0,1	0,04		
EB-2102 (7)	2	0	0,1	0,04		
BETANIA (4)	1	1	0,1	0,04		
EB-0104 (10)	1	0	0,1	0,04		
EET-233 (1)	0	0	0,0	0,0		

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Table 2. Average number of vegetative brooms, cushion brooms and chirimoyas fruits per tree registered in each of 77 cocoa accessions in the Collection CGN of Nacional type genotypes during year 2005.

Genotype	Number of symptoms per tree		
	Vegetative brooms	Cushion brooms	Chirimoyas fruits
CCAT-01 (4668) (1)*	0	0	0
CCAT 02 (1119) (1)	0	0	0
FIDENCIO (9)	1	0	0
EB-1011 (8)	1	0	0
CCAT-5212 (2)	1	0	0
EET-233 (1)	1	0	0
CCAT-4584 (10)	1	1	0
EB-1013 (3)	1	1	1
CCAT-1934 (9)	1	1	1
EB-1203 (8)	2	0	0
CCAT-5212 (10)	2	0	0
SA-8 (10)	2	0	0
EB-1617 (9)	2	0	0
EB-2225 (8)	2	0	0
CCAT-2564 (10)	2	1	1
CCAT-3061 (10)	2	1	1
CCAT-4668 (9)	3	0	0
CCAT-5206 (10)	3	0	0
CCAT-5136 (9)	3	0	0
CCAT-4583(10)	3	1	2
CCAT-2664(10)	3	2	1
EB-0501 (7)	4	0	0
EB-1915 (10)	4	0	0
CCAT-1119 (10)	4	0	0
CCAT-1915 (2)	4	0	0
EET-387 (3)	4	0	0
EB-2237 (8)	5	0	0
CCAT-1858 (10)	5	0	0
BETANIA (4)	5	0	0
EB-2009 (7)	5	0	0
CCAT-1858 A (8)	6	0	0
EB-2233 (10)	6	0	0
CCAT-1914 (8)	6	0	0
CCAT-05 (1)	6	0	0
CCAT-1930 (10)	6	1	0
CCAT-2363 (3)	6	1	0
EB-1516 (10)	6	1	1

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Continues.....

Genotype	Number of symptoms per tree		
	Vegetative brooms	Cushion brooms	Chirimoyas fruits
CCAT-4265 (10)*	6	3	2
EB-1922 (8)	7	0	0
EB-2229 (2)	7	0	0
EB-0401 (7)	7	2	1
EB-2102 (7)	8	1	0
CCAT-5064 (10)	8	3	2
CCAT-1928 (9)	9	0	0
CCAT-3260 (10)	9	0	0
CCAT-2349 (9)	9	1	0
EB-2222 (9)	9	2	1
BCH-14 (9)	10	1	0
EB-0104 (10)	10	4	0
CCAT-1817 (9)	11	0	1
EB-1010 (10)	11	2	1
CCAT-2240 (10)	12	3	2
CCAT-4998 (9)	12	8	4
BCH-9 (10)	12	12	1
CCAT-2341 (10)	13	1	1
CCAT-1916 (10)	13	2	0
CCAT-4650 (3)	13	2	1
CCAT-4364 (10)	14	1	0
CCAT-2143 (10)	14	3	2
EB-2236 (9)	15	1	0
CCAT-3050 (10)	17	4	2
CCAT-3345 (10)	19	2	0
CCAT-5477 (5)	20	4	1
CCAT-4260 (10)	21	2	0
CCAT-3050A (3)	22	1	0
CCAT-4675 (10)	22	5	2
EB-2003 (2)	23	2	1
CCAT-4688 (9)	23	5	3
CCAT-4668 (1)	23	7	0
EB-0402 (10)	25	1	1
CCAT-3407 (9)	36	7	1
CCAT-1201 (10)	40	1	0
EB-2250 (1)	40	12	7

* The number in parenthesis corresponds to the number of trees evaluated per each accession.

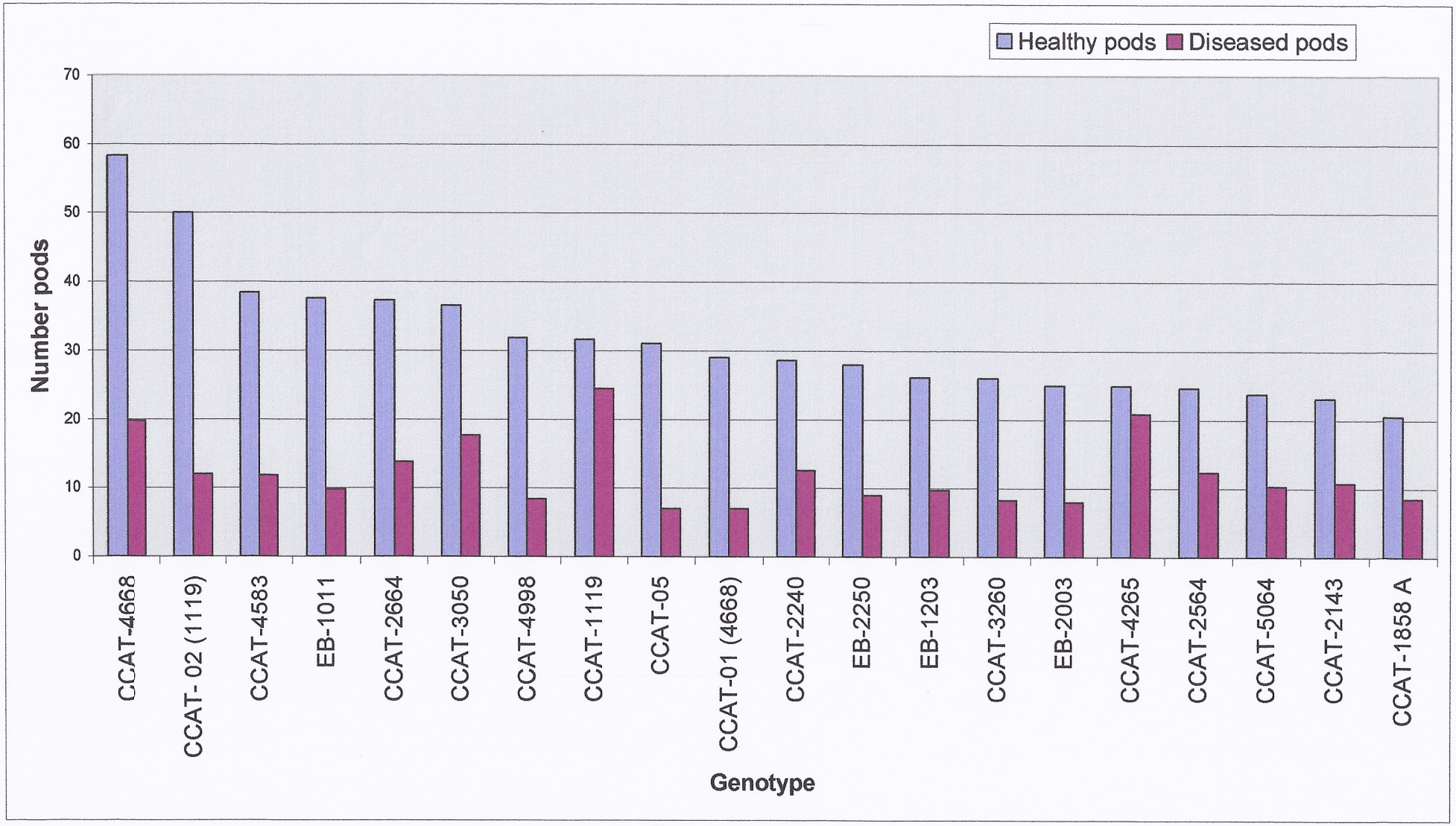

Figure 1. Number of healthy and diseased pods per tree for the 20 more productive Nacional type accessions available in the collection CGN during 2005.

Table 3. Descriptive analysis based on the number of healthy pods of the best 20 clones available in the collection CGN of Nacional type genotypes.

Genotype	Number of years	Number healthy pods/tree	Standard deviation	Standard error	Coefficient of Variation	Number healthy pods		Relative variability
						Mín.	Máx.	
CCAT-4668	3	44	14,5	8,4	33,2	29	58	19,2
EB-1011	3	38	19,6	11,3	51,9	19	58	30,0
CCAT-05	3	34	9,5	5,5	27,5	27	45	15,9
CCAT-2664	3	34	9,2	5,3	27,0	24	42	15,6
CCAT-4583	3	33	13,2	7,6	40,1	18	43	23,2
CCAT-3260	3	32	15,9	9,2	49,6	20	50	28,7
CCAT-3050	3	30	10,7	6,2	35,3	18	37	20,3
EB-1203	3	30	21,0	12,1	69,2	14	54	40,0
CCAT-4265	3	30	14,6	8,4	49,1	18	46	28,3
CCAT-1119	3	28	5,1	3,0	18,6	22	32	10,7
CCAT-2240	3	28	13,1	7,5	47,2	14	40	27,3
CCAT-4998	3	28	3,2	1,9	11,6	24	30	6,7
CCAT-4675	3	26	14,7	8,5	56,7	17	43	32,7
CCAT-1858 (A)	3	25	17,9	10,3	70,7	10	45	40,8
CCAT-1934	3	25	14,5	8,4	57,1	16	42	33,0
CCAT-3345	3	25	10,4	6,0	41,1	17	37	23,7
EB-2003	3	25	5,5	3,2	21,7	20	31	12,6
CCAT-1858	3	25	15,6	9,0	62,4	16	43	36,0
CCAT-2564	3	25	12,0	6,9	48,0	13	37	27,7
CCAT-2143	3	25	3,8	2,2	15,4	22	29	8,9
MEDIA		**30**	**12,0**	**7,0**	**41,7**	**19**	**42**	**24,1**

Table 4. Descriptive analysis based on the of dry bean weight (Kg /tree) of the best 20 cocoa clones available in the collection CGN.

Genotype	Number of years	Dry bean weight Kg/tree	Standard deviation	Standard error	Coefficient of Variation	Dry bean weight Kg		Relative variability
						Mín	Máx	
CCAT-4668	3	1,9	0,6	0,3	29,8	1,29	2,41	17,4
CCAT-4998	3	1,53	0,3	0,2	19,9	1,22	1,83	11,8
CCAT-05	3	1,49	0,7	0,4	45,5	1,01	2,27	26,2
CCAT-4583	3	1,47	0,5	0,3	32,3	0,92	1,77	18,4
CCAT-2664	3	1,32	0,5	0,3	37,8	0,86	1,85	22,0
CCAT-2143	3	1,24	0,5	0,3	40,1	0,87	1,81	23,4
CCAT-4675	3	1,24	0,9	0,5	70,8	0,63	2,24	41,1
CCAT-3345	3	1,23	0,8	0,4	61,6	0,72	2,10	35,8
CCAT-4265	3	1,19	0,6	0,4	52,6	0,70	1,90	30,3
CCAT-1119	3	1,17	0,3	0,2	23,1	0,94	1,47	13,7
EB-1011	3	1,16	0,8	0,5	67,0	0,52	2,02	38,8
CCAT-3260	3	1,1	0,7	0,4	59,1	0,69	1,85	34,5
CCAT-01	3	1,09	0,4	0,3	39,4	0,68	1,54	22,9
CCAT-1858	3	1,07	0,6	0,4	56,1	0,67	1,76	32,7
CCAT-2564	3	1,05	0,5	0,3	51,7	0,54	1,62	29,5
CCAT-3061	3	1,02	0,5	0,3	44,3	0,69	1,54	25,5
CCAT-3050	3	0,97	0,3	0,2	28,8	0,66	1,20	16,5
CCAT-1858 (A)	3	0,9	0,5	0,3	54,7	0,49	1,45	32,2
CCAT-2	3	0,89	1,2	0,7	133,9	0,04	2,26	77,5
CCAT-2240	3	0,89	0,4	0,3	49,9	0,59	1,40	29,2
MEDIA		**1,2**	**0,6**	**0,3**	**49,9**	**0,7**	**1,8**	**29,0**

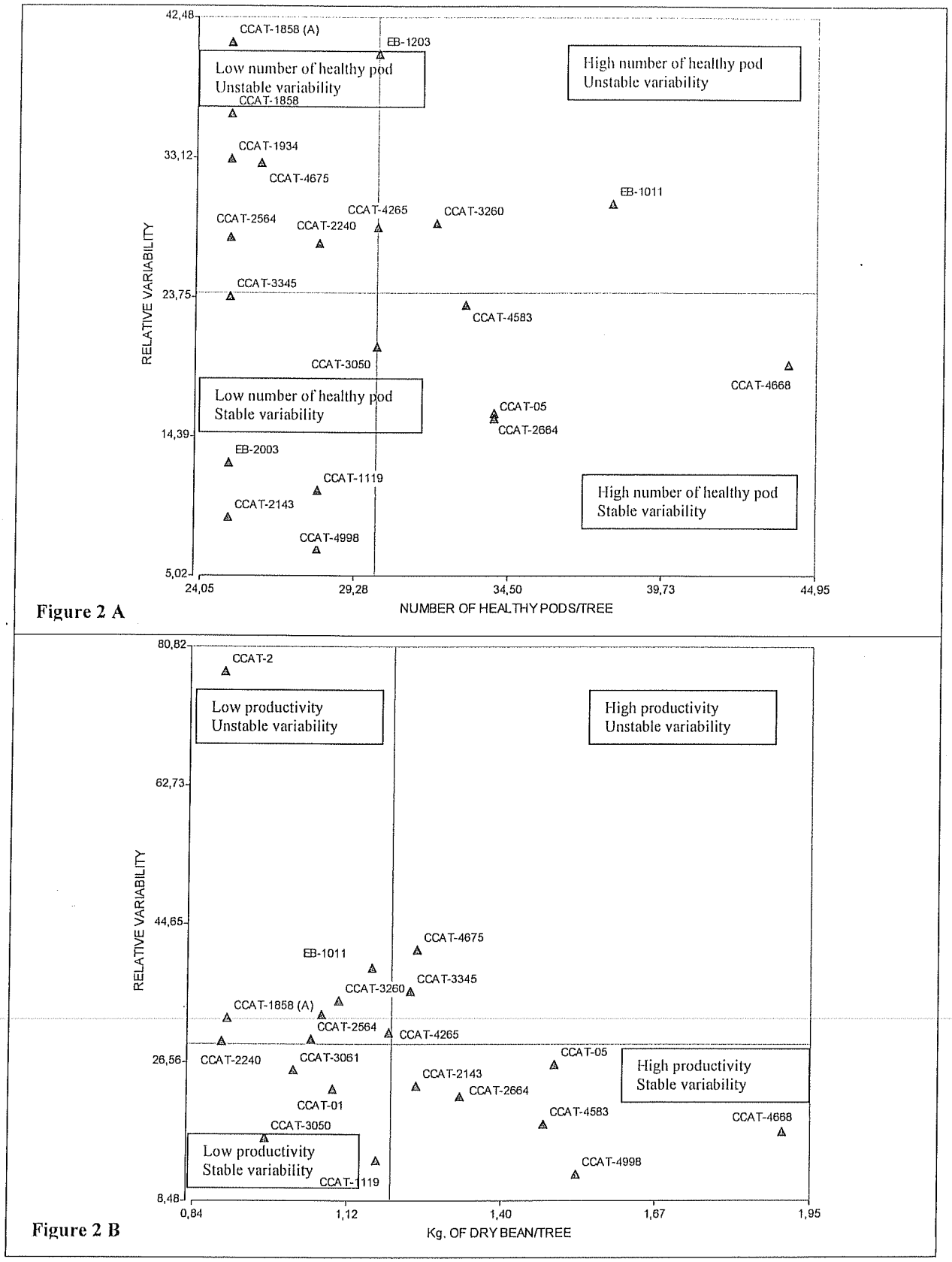

Figure 2. **A.** Analysis of stability of the relationship between number of healthy pods / tree and relative variability of the best 20 clones of cocoa in the Nacional type clone collection. **B.** Analysis of stability of the relationship between weight of dry bean (Kg) / tree and relative variability of the best 20 clones of cocoa in the Nacional type clone collection.

Maintenance activities for this collection included clonal multiplication and replanting of empty spaces within accessions rows, introduction of new Nacional germplasm from farmer's fields, tree rehabilitation and planting of shade trees.

2) Sabor Nacional Arriba Collection (SNA)

During 2005 data for fresh bean weight, healthy pods, diseased pods, number of vegetative, cushion and chirimoyas brooms were registered for all the accessions making up this collection; results are shown in Tables 5 and 6. Clones SNA-0602, SNA-0405 and SNA-0106 achieved the highest values for fresh bean weight. It is important to note that the level of diseased pods shown by these clones was less than 20%; this figure is lower than the average pod infection levels found in commercial clones distributed by INIAP and also in cocoa fields present in nearby areas. From the 97 accessions under evaluation some 27% presented from 0 to 1 vegetative Witches brooms per tree only. Almost 50% of the accessions had less than five Witches' broom per tree; it suggests the importance of this collection as a source of interesting levels of resistance to this disease in Cacao Nacional.

3) "Población Nacional" Collection (PN)

Efforts to characterize a new collection of Nacional germplasm formed by seedlings produced from seeds collected in an old cocoa planting (more than 80 years old) in the zone of Chone, started in 2005. This collection was field planted on August 2004 and so far plants coded as PN N-17 and PN N-28 have showed precocity. PN N-17 also showed absence of Witches' broom. Detailed results on these and other variables will be presented in next annual report. A total of 237 leaf samples (for each plant a sample made of one leaf was taken) were sent to the USDA lab at Miami, Fl, for DNA analysis to determine the level of homozygosis (See Table 1 in the Annex). This information is aimed to be used as a base to select plants for future breeding programs leading to the obtention of homogeneous Nacional populations for sexual propagation. The finding of plants with good productivity for commercial multiplication through cloning is not excluded as an outcome.

Amazonian type germplasm.

1) Allen Collection at E. E. Napo-Payamino

Out of 152 clonal accessions available in the collection Allen at E. E. Napo Payamino (only 122 were actually evaluated), 15 clones showed the highest values for dry bean weight and other traits according to results shown in Table 7. It is interesting to note that one clone produces beans with completely white nibs while a few others show variable numbers of pale nibs (red clear). Clone LCT-EEN 002 shows one of the highest values for dry weight of beans (60.1 g), a quite low pod index (16), a surprisingly high seed index (2.1 g) and 29 beans per pod. The highest yield was actually reached by the clone LCT-EEN 28. According to Table 8 the clone LCT-EEN 181 showed absence of vegetative and cushion Witches' brooms. The clones LCT-EEN 373, LCT-EEN 33, LCT-EEN 401 also showed absence of vegetative brooms but presented a few cushion brooms.

From the 122 clones reported in Table 8 some 29 % showed less than 10 vegetative brooms per tree suggesting interesting levels of resistance in members of this collection and which can be exploited in future breeding efforts.

Table 5. Average numbers of healthy pods, diseased pods, Moniliasis pods and fresh bean weight (Kg) per tree registered in each of 95 accessions available in the collection Sabor Nacional Arriba (SNA) during 2005.

Genotype	Nº Healthy pods/tree	Nº Diseased pods/tree	Fresh bean weight Kg /tree
SNA-0602 (3)*	30	5	1,6
SNA-0405 (5)	21	5	1,5
SNA-0106 (2)	7	0	1,1
SNA-0701 (5)	10	5	1,0
EB-0501 (4)	14	1	0,9
SNA-0611 (1)	4	1	0,9
SNA-0512 (5)	14	2	0,8
SNA-1009 (4)	11	2	0,8
SNA-0425 (2)	9	3	0,6
SNA-0438 (5)	6	3	0,6
SNA-0906 (4)	6	1	0,6
SNA-0204 (5)	13	2	0,6
SNA-0102 (4)	3	2	0,6
SNA-0104 (5)	4	3	0,6
SNA-0604 (5)	8	3	0,6
SNA-0112 (1)	5	3	0,5
SNA-0201 (1)	4	3	0,5
SNA-0418 (4)	11	8	0,4
SNA-0609 (5)	5	1	0,4
SNA-0401 (5)	3	1	0,4
SNA-0407 (5)	5	3	0,4
SNA-0105 (2)	3	1	0,4
SNA-0428 (4)	5	1	0,3
SNA-0704 (3)	4	3	0,3
SNA-0101 (4)	6	5	0,3
SNA-0107 (3)	5	1	0,3
SNA-0305 (5)	4	5	0,3
SNA-0905 (3)	2	1	0,3
SNA-0607 (5)	3	1	0,3
SA-16 (2)	4	2	0,3
SNA-0203 (5)	8	2	0,3
SNA-0904 (5)	3	0	0,3
SNA-1001 (5)	3	1	0,3
SNA-0424 (1)	2	0	0,3
SNA-0504 (5)	7	4	0,2
SNA-0907 (4)	3	2	0,2
SNA-0403 (4)	3	1	0,2
SNA-0614 (5)	7	0	0,2
SNA-0419 (5)	4	4	0,2
SNA-0433 (4)	5	3	0,2
SNA-0903 (5)	1	2	0,2
SNA-0707 (5)	3	5	0,2
SNA-0901 (5)	2	1	0,2
SNA-0505 (4)	3	2	0,2
SNA-0603 (3)	2	0	0,2
SNA-1002 (5)	3	1	0,1

* The number in parenthesis corresponds to the number of trees evaluated per each accession

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Genotype	Nº Healthy pods/tree	Nº Diseased pods/tree	Fresh bean weight Kg /tree
SNA-0708 (5)*	1	1	0,1
SNA-0412 (3)	9	3	0,1
SNA-0718 (5)	1	1	0,1
SNA-0720 (5)	1	1	0,1
SNA-0422 (3)	1	0	0,1
SNA-0605 (1)	1	0	0,1
SNA-0406 (4)	1	0	0,1
SNA-0421 (4)	1	0	0,1
SNA-0610 (5)	5	1	0,1
SNA-0902 (3)	1	1	0,1
SNA-0417 (3)	1	0	0,1
SNA-0302 (5)	1	2	0,1
SNA-0205 (3)	1	0	0,1
SNA-0202 (1)	2	0	0,1
SNA-1003 (4)	1	0	0,1
SNA-0303 (4)	1	1	0,1
SNA-0429 (1)	1	0	0,1
SNA-0608 (2)	10	1	0,1
SNA-0432 (2)	1	2	0,1
SNA-1006 (3)	1	0	0,1
SNA0423 (5)	1	0	0,1
SNA-0709 (4)	1	0	0
SNA-0503 (4)	4	2	0
SNA-0430 (4)	1	1	0
SNA-0407 (3)	6	2	0
EB-0402 (4)	0	0	0
SNA-0808 (4)	0	0	0
SNA-0419 (3)	0	0	0
SA-15 (3)	1	0	0
SNA-0613 (3)	0	1	0
SNA-0103 (2)	0	2	0
SNA-0709 (4)	0	0	0
SNA-0409A (4)	4	1	0
SNA-0415 (3)	0	0	0
SNA-0301 (4)	0	0	0
SNA-0711 (4)	0	0	0
SNA-0703 (1)	0	0	0
SNA-1005 (3)	0	0	0
SNA-0420 (4)	0	0	0
SNA-0410 (1)	0	0	0
SNA-0426 (1)	0	0	0
SNA-0436 (5)	0	0	0
SNA-0612 (2)	0	0	0
SNA-0411 (1)	0	0	0
SNA-0404 (1)	0	0	0
SNA-0437 (1)	0	0	0
SNA-0427 (1)	0	0	0
SNA-0111 (1)	0	0	0

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Table 6. Average number of vegetative brooms, cushion brooms, chirimoya fruits per tree registered in each of 97 cocoa accessions available in the Sabor Nacional Arriba (SNA) collection during 2005.

Genotype	Number of symptoms per tree		
	Vegetative brooms	Cushion brooms	Chirimoya fruits
SNA-0301 (4)*	0	0	0
SNA-0504 (5)	0	0	0
SNA-0605 (1)	0	0	0
SNA-0411 (1)	0	0	0
SNA-0205 (3)	0	0	0
SNA-0106 (2)	0	0	0
SNA-0424 (1)	0	0	0
SNA-0430 (4)	0	0	0
EB-0501 (4)	0	0	0
SNA-1003 (4)	1	0	0
SNA-0505 (4)	1	1	0
SNA-0512 (5)	1	0	0
SNA-1005 (3)	1	0	0
SNA-0101 (4)	1	0	0
SNA-0703 (1)	1	0	0
SNA-0410 (1)	1	0	0
SNA-0426 (1)	1	0	0
SNA-0611 (1)	1	0	0
SNA-0103 (2)	1	0	0
SNA-0903 (5)	1	0	0
SNA-0407 (3)	1	0	0
SNA-0709 (4)	1	0	0
SA-15 (3)	1	0	0
SNA-0420 (4)	1	0	0
SNA-0808 (4)	1	0	0
SNA-0102 (4)	1	0	0
SA-16 (2)	2	0	0
SNA-0303 (4)	2	0	0
SNA-0407 (5)	2	1	0
SNA-0704 (3)	2	0	0
SNA-0202 (1)	2	0	0
SNA-0609 (5)	2	0	0
SNA-0203 (5)	2	0	0
SNA-0422 (3)	2	0	0
SNA-0707 (5)	2	12	1
SNA-0608 (2)	3	0	0
SNA-0613 (3)	3	1	1
SNA-1002 (5)	3	0	0
SNA-0419 (3)	3	0	0
SNA-0905 (3)	3	0	0
SNA-0436 (5)	3	0	0
SNA-0603 (3)	3	0	0
SNA-0709 (4)	3	1	0
SNA-0612 (2)	4	0	0
SNA-0406 (4)	4	6	0
SNA-0401 (5)	4	4	0
SNA-0417 (3)	4	0	0

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Continues.....

Genotype	Number of symptoms per tree		
	Vegetative brooms	Cushion brooms	Cherimoya fruits
EB-0402 (4)*	4	0	0
SNA-0604 (5)	4	1	0
SNA-0907 (4)	5	0	0
SNA-0105 (2)	5	0	0
SNA-0610 (5)	5	0	0
SNA-0614 (5)	6	0	0
SNA-0611 (1)	6	0	0
SNA-0711 (4)	6	0	0
SNA-0614 (5)	6	0	0
SNA-0111 (1)	6	0	0
SNA-0112 (1)	6	0	0
SNA-1009 (4)	6	0	0
SNA-0433 (4)	6	1	0
SNA-0612 (2)	6	2	0
SNA-0427 (1)	7	2	1
SNA-0418 (4)	7	0	0
SNA-0701 (5)	7	0	0
SNA-0409A (4)	7	0	0
SNA-1006 (3)	8	0	0
SNA-0428 (4)	8	0	0
SNA-0404 (1)	8	0	0
SNA-0437 (1)	8	0	0
SNA-0201 (1)	8	0	0
SNA-1001 (5)	8	0	0
SNA-0107 (3)	8	0	0
SNA-0412 (3)	8	1	0
SNA-0602 (3)	9	1	0
SNA-0503 (4)	9	2	0
SNA-0720 (5)	10	0	0
SNA-0708 (5)	10	3	1
SNA-0405 (5)	10	0	0
SNA-0904 (5)	10	0	0
SNA-0415 (3)	11	0	0
SNA-0421 (4)	12	6	1
SNA-0419 (5)	13	3	0
SNA-0104 (5)	14	0	0
SNA-0425 (2)	14	0	0
SNA-0906 (4)	16	0	0
SNA0423 (5)	17	0	0
SNA-0403 (4)	18	0	0
SNA-0432 (2)	18	1	0
SNA-0438 (5)	19	5	1
SNA-0429 (1)	20	2	0
SNA-0901 (5)	24	10	4
SNA-0302 (5)	30	2	1
SNA-0718 (5)	35	9	0
SNA-0305 (5)	4	0	0
SNA-0902 (3)	35	9	0
SNA-0907 (4)	4	0	0

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Table 7. Results of pod and bean characteristics for each clonal accession in the Allen collection at E. E. Napo-Payamino (Data recorded during the period 2004-2005).

Genotype	Characteristic of the pods*						Characteristic of the beans*			Bean color (%) **			Index	
	Pod weight, g	Pod length, cm	Pod Breadth, cm	N° beans/pod	Humid weight of beans	Dry weight of bean, g	Bean Length, cm	Pod Breadth, cm	Bean Thickness, cm	White	Red clear	Red dark	Pods	Beans
LCT-EEN-28	764,6	19,7	9,6	36	184,1	64,8	2,5	1,5	0,9	0	0	100	15	1,8
LCT-EEN-002	1010,8	19,5	10,8	29	173,8	60,8	2,7	1,4	1,0	100	0	0	16	2,1
LCT-EEN-74	527,5	14,1	8,8	26	80,0	58,7	2,4	1,2	1,8	10	50	40	17	2,3
LCT-EEN-151	631,0	17,8	9,5	32	158,2	55,4	2,3	1,2	0,9	0	45	55	18	1,7
LCT-EEN-251	728,1	18,8	10,1	40	147,4	54,3	2,6	1,3	0,7	50	50	0	18	1,4
LCT-EEN-259	977,0	22,0	11,2	39	151,3	53,0	2,4	1,3	1,0	0	100	0	19	1,4
LCT-EEN-258	810,7	17,9	9,5	31	151,0	52,8	2,3	1,1	0,9	0	100	0	19	1,7
LCT-EEN-57	793,4	17,6	11,0	32	149,0	52,2	2,5	1,3	0,9	50	50	0	19	1,7
LCT-EEN-38	975,0	19,3	10,6	27	155,5	52,0	2,7	1,3	1,0	40	50	10	19	2,0
LCT-EEN-217	1201,7	19,7	11,3	22	141,6	50,6	2,7	1,5	1,2	33	67	0	20	2,3
LCT-EEN-250	791,9	15,2	10,6	37	168,7	49,5	2,6	2,3	0,8	0	50	50	20	1,4
LCT-EEN-257	932,3	21,4	10,0	30	140,9	49,3	2,7	1,4	1,0	17	33	50	20	1,6
LCT-EEN-81	761,0	18,6	9,6	32	154,6	47,0	2,4	1,3	0,9	8	25	67	21	1,5
LCT-EEN-60	981,1	19,5	10,7	30	155,5	46,4	2,3	1,3	1,0	50	25	25	22	1,5
LCT-EEN-255	1034,5	19,3	10,9	30	144,2	46,2	2,3	1,3	0,9	33	60	7	22	1,5

* Results were obtained averaging 20 pods and 100 beans.
**The number 100 means 100% of beans with a given colour.

Table 8. Average number of vegetative brooms, cushion brooms and weight of witches' broom (g) per tree registered in each of 122 clonal accessions in the Allen's collection at the Estación Experimental Napo-Payamino.

Genotype	Number of symptoms per tree		Weight of brooms, grams per tree
	Vegetative brooms	Cushion brooms	
LCT-EEN-181	0	0	0,0
LCT-EEN-33	0	3	10,1
LCT-EEN-401	0	12	61,9
LCT-EEN-373	0	2	9,1
LCT-EEN-38	1	0	12,5
LCT-EEN-37	2	2	8,5
LCT-EEN-36	2	0	3,6
LCT-EEN-46	2	1	16,8
LCT-EEN-250	3	4	63,8
LCT-EEN-31	3	0	7,9
LCT-EEN-94	3	1	8,8
LCT-EEN-124	3	2	12,5
LCT-EEN-254	3	5	87,3
LCT-EEN-369	3	11	43,9
LCT-EEN-107	3	0	13,0
LCT-EEN-249	4	13	58,5
LCT-EEN-30	4	1	10,5
LCT-EEN-91	5	1	41,6
LCT-EEN-81	5	1	26,9
LCT-EEN-367	5	0	14,0
LCT-EEN-2	5	0	31,0
LCT-EEN-124	6	0	0,6
LCT-EEN-251	6	14	71,6
LCT-EEN-371	6	3	13,4
LCT-EEN-382	7	0	25,3
LCT-EEN-60	7	11	25,5
LCT-EEN-73	8	0	48,5
LCT-EEN-46	8	1	9,1
LCT-EEN-259	8	11	36,3
LCT-EEN-258	8	2	13,7
LCT-EEN-123	9	0	20,0
LCT-EEN-141	9	0	20,3
LCT-EEN-153	9	0	59,0
LCT-EEN-121	9	2	15,1
LCT-EEN-163	10	3	55,8
LCT-EEN-155	10	5	26,3
LCT-EEN-178	11	1	63,2
LCT-EEN-49	11	3	143,8
NAP - 27	11	12	101,2
LCT-EEN-267	12	7	98,6
LCT-EEN-47	12	0	174,5
LCT-EEN-157	12	6	168,6
LCT-EEN-172	13	0	44,8

Continues.....

Genotype	Number of symptoms per tree		Weight of brooms, grams per tree
	Vegetative brooms	Cushion brooms	
NAP - 29	13	2	82,7
LCT-EEN-403	13	24	119,3
LCT-EEN-193	13	9	117,5
LCT-EEN-217	14	0	52,9
LCT-EEN-238	14	4	45,3
LCT-EEN-280	14	2	94,4
LCT-EEN-333	14	0	41,2
LCT-EEN-133	14	1	120,0
LCT-EEN-57	14	5	121,3
LCT-EEN-264	15	14	79,4
LCT-EEN-80	16	4	187,1
LCT-EEN-362	16	0	39,5
LCT-EEN-32	16	3	128,5
NAP - 24	16	8	149,6
LCT-EEN-269	16	15	179,5
LCT-EEN-370	19	0	95,2
LCT-EEN-257	19	21	96,7
LCT-EEN-327	20	0	40,3
LCT-EEN-166	20	5	357,2
LCT-EEN-368	22	0	57,2
LCT-EEN-253	22	10	295,2
LCT-EEN-152	22	29	311,1
LCT-EEN-122	24	0	352,5
LCT-EEN-222	24	0	120,7
LCT-EEN-232	25	1	514,6
LCT-EEN-162	25	16	451,1
LCT-EEN-65	27	0	224,1
LCT-EEN-63	29	1	400,4
LCT-EEN-144	29	10	305,0
LCT-EEN-221	30	0	576,9
LCT-EEN-165	31	6	540,0
LCT-EEN-241	31	4	354,8
LCT-EEN-188	31	124	984,5
LCT-EEN-108	32	0	182,7
LCT-EEN-164	32	0	858,4
LCT-EEN-255	32	20	305,4
LCT-EEN-228	33	4	288,4
LCT-EEN-195	33	15	229,0
LCT-EEN-142	34	3	149,5
LCT-EEN-146	37	5	327,2
LCT-EEN-126	37	21	379,5
LCT-EEN-300	38	6	138,7
LCT-EEN-364	38	2	196,7
LCT-EEN-74	39	6	326,0
LCT-EEN-218	39	5	340,9
LCT-EEN-169	40	7	324,2
LCT-EEN-2	40	5	236,1
LCT-EEN-148	41	14	250,0

Continues.....

Genotype	Number of symptoms per tree		Weight of brooms, grams per tree
	Vegetative brooms	Cushion brooms	
LCT-EEN-312	41	6	305,4
LCT-EEN-374	43	0	255,5
LCT-EEN-151	43	48	433,3
LCT-EEN-154	44	4	256,7
LCT-EEN-220	45	4	337,6
LCT-EEN-32	48	10	166,2
LCT-EEN-52	55	0	566,0
AGU-31	57	2	841,3
LCT-EEN-281	57	10	311,0
LCT-EEN-219	58	24	716,9
LCT-EEN-278	62	21	524,1
LCT-EEN-283	63	5	617,3
LCT-EEN-216	72	9	655,1
LCT-EEN-366	74	2	240,0
NAP-24	75	5	1018,4
LCT-EEN-376	75	0	344,3
LCT-EEN-156	76	5	585,1
LCT-EEN-223	77	14	675,7
LCT-EEN-237	83	13	367,8
LCT-EEN-379	94	17	459,2
LCT-EEN-227	95	13	1611,6
LCT-EEN-234	97	36	1665,9
CUR - 6	109	171	1742,7
LCT-EEN-378	123	8	521,3
LCT-EEN-231	136	10	1678,0
LCT-EEN-374	43	0	255,5

Table 9 presents results for pod and bean evaluation in 15 hybrid trees originated by seeds. Data were recorded during the period 2004-2005. A total of 20 ripe pods per tree were harvested and opened to count the beans and register fresh weight, dry weight, and other characteristics. Results were obtained averaging 20 pods and 100 beans (five beans per pod were taken). The tree coded as LCT-EEN-205-7 showed the lowest pod index (20) and highest bean index, followed by LCT-EEN-26-3 and LCT-EEN-214-5. These figures are coherent with the highest values obtained by the same trees regarding fresh and dry weight of the beans (values are averages of 20 pods). Most of the trees produced pale (red clear) beans suggesting the possibility of finding interesting flavour profiles. Based on these results future studies may focus in this direction.

The results of Witches´ broom evaluation for 153 trees are presented in Table 10. Many more trees (910 trees) were evaluated but only those showing the lowest numbers for vegetative brooms were included. The number of vegetative broom varied from 0 to 5 per tree. Those trees with no Witches´ broom at all made up 17% of the total number of hybrid trees available in this collection. This result strongly suggests the presence of a good source for Witches´ broom genetic resistance available for future breeding initiatives to improve this crop. A effort to multiply, move and establish a duplicate of this germplasm in the Estación Experimental Pichilingue is ongoing. Some 60% of it has already been moved to this place.

Table 9. Pod and bean characteristics for each hybrid accession in the Allen collection at E. E. Napo-Payamino (Data were recorded during the period 2004-2005).

Genotype	Characteristic of the pods*						Characteristic of the beans*			Bean color (%) **			Index	
	Pod weight, g	Pod length, cm	Pod Breadth, cm	N° beans/pod	Humid weight of beans, g	Dry weight of bean, g	Bean Length, cm	Pod Breadth, cm	Bean Thickness, cm	White	Red clear	Red dark	Pods	Beans
LCT-EEN-205-7	597,0	16,6	9,0	25	152,0	50,5	2,4	1,1	0,8	0	0	100	20	2,0
LCT-EEN- 26-3	684,3	18,3	9,3	39	150,9	50,2	2,3	1,2	0,8	13	31	56	20	1,3
LCT-EEN-214-5	532,7	16,7	8,6	33	110,4	48,2	2,2	1,3	0,9	0	20	80	21	1,5
LCT-EEN-6-5	383,4	18,4	9,1	47	133,3	45,7	1,6	0,7	0,5	0	100	0	22	1,0
LCT-EEN- 202-3	720,2	19,7	8,9	38	160,3	45,3	2,5	1,2	0,8	5	35	60	22	1,2
LCT-EEN- 132-4	564,9	17,4	9,4	31	126,6	38,9	2,3	1,3	0,9	0	27	73	26	1,3
LCT-EEN- 214-4	488,6	17,3	8,5	39	121,3	38,1	2,1	1,2	0,8	0	50	50	26	1,0
LCT-EEN- 202-5	632,5	17,2	9,0	39	157,0	37,7	5,9	1,2	1,5	0	44	56	27	1,0
LCT-EEN- 202-2	541,3	16,6	9,3	35	134,7	37,1	2,5	1,2	0,7	0	45	55	27	1,0
LCT-EEN-11-9	967,6	20,9	8,1	22	104,7	36,4	2,5	1,3	1,1	0	100	0	27	1,6
LCT-EEN- 27-2	542,8	18,4	8,5	41	116,4	36,2	2,1	1,2	1,6	0	0	100	28	0,9
LCT-EEN- 205-6	436,7	17,1	8,2	32	97,4	33,0	2,2	1,1	0,8	0	0	100	30	1,0
LCT-EEN- 214-3	625,5	19,6	8,5	41	134,9	32,4	2,1	1,1	0,9	0	12	88	31	0,8
LCT-EEN- 27-1	492,3	18,0	8,2	43	124,3	32,2	2,0	1,1	0,7	0	30	70	31	0,8
LCT-EEN-10-6	760,5	18,7	9,5	27	131,3	29,2	2,5	2,8	1,0	0	47	53	34	1,1

* Results were obtained averaging 20 pods and 100 beans.

** The number 100 means 100% of beans with a given colour.

Table 10. Average number of vegetative brooms, cushion brooms and weight of witches' broom (g) per tree registered in each of 153 hybrids accessions available in the Allen's collection at the Estación Experimental Napo-Payamino.

Genotype	Tree #	Number of symptoms per tree		Weight of brooms, grams per tree
		Vegetative brooms	Cushion brooms	
LCT-EEN-340	2	0	0	0
LCT-EEN-340	4	0	0	0
LCT-EEN-340	5	0	0	0
LCT-EEN-339	9	0	0	0
LCT-EEN-337	4	0	0	0
LCT-EEN-337	6	0	0	0
LCT-EEN-337	7	0	0	0
LCT-EEN-337	9	0	0	0
LCT-EEN-337	10	0	0	0
LCT-EEN-336	5	0	0	0
LCT-EEN-336	7	0	0	0
LCT-EEN-336	8	0	0	0
LCT-EEN-335	8	0	0	0
LCT-EEN-335	9	0	0	0
LCT-EEN-326	8	0	0	0
HIBRIDO: EET - 400(block C)	12	0	0	0
HIBRIDO: EET - 400(block C)	13	0	0	0
HIBRIDO: EET - 400(block C)	18	0	0	0
LCT-EEN-321	3	0	0	0
LCT-EEN-136	6	0	0	0
LCT-EEN-131	4	0	0	0
IMC-67	16	0	0	0
LCT-EEN-1	5	0	0	0
LCT-EEN-4	1	0	0	0
LCT-EEN-5	1	0	0	0
LCT-EEN-179	1	0	0	0
LCT-EEN-179	2	0	0	0
LCT-EEN-399	2	0	0	0
LCT-EEN-399	5	0	0	0
LCT-EEN-399	6	0	0	0
LCT-EEN-399	9	0	0	0
LCT-EEN-399	12	0	0	0
LCT-EEN-399	16	0	0	0
EET-400 (Block G)	2	0	0	0
EET-400 (Block G)	3	0	0	0
EET-400 (Block G)	5	0	0	0
EET-400 (Block G)	8	0	0	0
EET-400 (Block G)	9	0	0	0
EET-400 (Block G)	13	0	0	0
EET-400 (Block G)	15	0	0	0
EET-400 (Block G)	17	0	0	0
EET-400 (Block G)	18	0	0	0
EET-400 (Block G)	19	0	0	0
LCT-EEN-86	8	0	0	0
LCT-EEN-93	1	0	0	0
POUND-12 (Block F)	17	0	0	0
POUND-12 (Block B)	20	0	0	0

Continues.....

Genotype	Tree #	Number of symptoms per tree		Weight of brooms, grams per tree
		Vegetative brooms	Cushion brooms	
LCT-EEN-179	3	0	0	0
LCT-EEN-179	4	0	0	0
LCT-EEN-179	5	0	0	0
HIBRIDO: EET - 400(block C)	9	0	3	66,8
LCT-EEN-399	8	1	0	0,7
LCT-EEN-11	3	1	0	3
IMC-67 (Block I)	8	1	0	4,5
EBC-123	2	1	0	6,3
POUND-12 (Block B)	8	1	0	.6,7
LCT-EEN-11	4	1	0	7,6
LCT-EEN-349	3	1	0	10,2
LCT-EEN-337	3	1	0	11,1
LCT-EEN-90	3	1	0	18,9
HIBRIDO: EET - 400(block C)	17	1	0	21,2
LCT-EEN-345	9	1	1	20,5
HIBRIDO: EET - 400(block C)	15	1	2	15,6
LCT-EEN-399	11	1	2	18,6
POUND-12 (Block B)	11	1	3	18,8
LCT-EEN-336	6	1	4	13,2
LCT-EEN-399	13	1	5	40,16
EBC-125	2	2	0	3,1
POUND-12 (Block B)	15	2	0	4,2
LCT-EEN-59	8	2	0	4,5
POUND-12 (Block B)	3	2	0	5,8
LCT-EEN-336	9	2	0	6,5
IMC-67 (Block I)	6	2	0	6,6
IMC-67 (Block I)	25	2	0	6,6
POUND-12 (Block F)	16	2	0	7
LCT-EEN-90	2	2	0	7,8
POUND-12 (Block F)	11	2	0	9,1
IMC-67 (Block I)	30	2	0	9,5
LCT-EEN-72	6	2	0	10,2
LCT-EEN-78	10	2	0	10,6
HIBRIDO: EET - 400(block C)	19	2	0	13,4
IMC-67 (Block I)	21	2	0	15,6
IMC-67 (Block I)	13	2	0	19,1
EET-400 (Block G)	11	2	0	20
IMC-67 (Block I)	4	2	0	20
LCT-EEN-349	1	2	0	28,2
IMC-67 (Block I)	11	2	0	34,1
LCT-EEN-23	9	2	0	58,8
IMC-67	19	2	1	0,7
IMC-67	3	2	1	3,5
POUND-12 (Block F)	19	2	1	11,4
IMC-67 (Block I)	14	2	2	7,8
LCT-EEN-342	8	2	2	24,4
HIBRIDO: EET - 400(block C)	16	2	3	23,1
LCT-EEN-300	9	2	5	32,5
HIBRIDO: EET - 400(block C)	8	2	13	86,6
EBC-30	2	3	0	2,4
POUND-12 (Block F)	12	3	0	3,5
LCT-EEN-131	1	3	0	3,9

Continues.....

Genotype Hybrids	Tree #	Number of symptoms per tree		Weight of brooms, grams per tree
		Vegetative brooms	Cushion brooms	
LCT-EEN-199	5	3	0	5,6
POUND-12 (Block F)	15	3	0	6,2
LCT-EEN-87	7	3	0	6,3
POUND-12 (Block B)	7	3	0	6,3
POUND-12 (Block F)	7	3	0	6,5
EET-399	7	3	0	6,6
LCT-EEN-71	10	3	0	6,7
LCT-EEN-61	4	3	0	7,2
IMC-67	17	3	0	7,6
EBC-5	3	3	0	8
LCT-EEN-70	7	3	0	8,2
EBC-30	3	3	0	8,5
LCT-EEN-24	8	3	0	9,3
LCT-EEN-90	1	3	0	10,3
POUND-12 (Block B)	4	3	0	10,5
LCT-EEN-86	9	3	0	11,5
EET-399	4	3	0	11,9
LCT-EEN-1	4	3	0	14,5
HIBRIDO: EET - 400(block C)	11	3	0	16,2
LCT-EEN-357	9	3	0	22,2
LCT-EEN-215	7	3	0	23,9
LCT-EEN-340	3	3	0	26,4
EET-400 (Block G)	20	3	0	32,5
EET-399	14	3	0	102,7
LCT-EEN-22	5	3	1	52,2
POUND-12 (Block F)	13	3	2	13,2
LCT-EEN-24	9	3	2	16,5
HIBRIDO: LCT-EEN-356	10	3	4	24,7
LCT-EEN-399	17	3	12	42,95
EET-399	20	4	0	4,9
EET-399	16	4	0	8,8
LCT-EEN-203	8	4	0	10,2
LCT-EEN-131	5	4	0	10,4
EBC-6	4	4	0	10,4
POUND-12 (Block B)	5	4	0	11,3
EBC-10	3	4	0	11,4
IMC-67 (Block I)	24	4	0	12,5
IMC-67	14	4	0	15,7
POUND-12 (Block F)	5	4	0	18,5
LCT-EEN-24	1	4	0	18,7
LCT-EEN-79	10	4	0	19,3
EBC-9	8	4	0	25,4
IMC-67 (Block I)	15	4	0	26,5
EET-400 (Block G)	16	4	2	20,2
EET-400 (Block G)	12	4	5	39,7
LCT-EEN-10	6	4	14	133,2
IMC-67	5	5	0	3,9
IMC-67	13	5	0	5,1
LCT-EEN-160	4	5	0	5,8
LCT-EEN-160	6	5	0	6,4
LCT-EEN-199	9	5	0	9,1
EBC-5	6	5	0	11

2) Chalmers Collection at E. E. Pichilingue

Evaluation of the accessions making up the Chalmers' collection at E. Pichilingue continued during 2005. Data on fresh weight, dry weight, healthy pods, diseased pods, cherelle wilt, and pods with Moniliasis were recorded for the period January to May 2005. Until April 2005 data have been accumulated for three complete years and the next step will be to conduct stability analysis mainly for disease resistance and yield traits. Next report will contain information on the outputs from this analysis. According to Table 11 the clones SIL-1, NAP-25, TIP-2, BOB-3 and UNAP-1 were the most productive with dry bean weight values ranging between 1.3 and 2.8 Kg. per tree per year. Almost 80 % of the 44 accessions under evaluation yielded less than 1 Kg. of dry bean weight per tree per year. TAP 12 was the lowest yielding clone.

Nearly 30% of all the accessions under evaluation presented less than five diseased pods and 4% presented just diseased pod per tree. It is highly interesting to note that 16 % of the accessions showed absence of pods infected with Moniliasis. The accession SIL-1, even though is made up of only one tree, showed no diseased pods along the year while still producing the highest number of healthy pods which explains its highest dry bean weight. Additionally, this accession did not produce a single cherelle wilt fruit either, even though it achieved the highest number of pods per tree suggesting a balanced distribution of photosyntates within the tree. The empty spaces in this particular accession's row are being currently replanted to complete 10 plants in the row.

Pod and seed indexes, color of the beans and other traits also add up to the variability found among accessions in this particular collection as shown in Table 12. This contains results for 11 parameters measured in 40 clonal accessions during 2004 and which are presented here as a reference for comparison. From comparing Table 11 and Table 12 it can be clearly seen that clones COCA-3328, COCA-3325, COCA-3338 are among the ones showing the highest seed and pod index but definitively are not high yielders.

In order to identify mislabeled plants within accession's rows a total of 403 leaf samples were taken and sent to the USDA molecular biology lab in Miami, Florida, on September 2005 (see Table 2 in the Annex). A total of twenty seven bud sticks from each of the clones AMAZ-11, TAP-10, TIP-1, LCT-368, UNAP-2, CUR-3, CCN-51, EET-387 and EBC-148 were sent (March 2006) to CATIE in Costa Rica for long term collaborative Moniliasis research.

3) Allen Collection at E.E. Pichilingue

Several productive and sanitary variables were recorded on 51 accessions from January to May 2005. Until April 2005 data have been accumulated for three complete years and the following step is to conduct stability analysis mainly for disease resistance and yield traits. Next report will contain information on the outputs of this analysis. Results for the 2005 data are presented in Tables 13 and 14 and from these it can be observed that clone LCT 278 achieved the highest dry bean weight and number of healthy pods as well as well as showing a total absence of Witches brooms' symptoms. In general most of the clones showed a modest or low yielding capacity but 35% of them presented one or less vegetative Witches' brooms per tree and also absence of other symptoms for this disease.

Since January 2006 a new student has undertaken a more detailed characterization (more morphological traits have been included in the study) of the germplasm in this collection. This is being done considering that several accessions were planted late and are just entering into bearing pods. This new information will be used to reinforce earlier findings on the genetic variability and strengthen the value of this genetic resource for breeding.

Table 11. Average number of healthy pods, diseased pods, Moniliasis pods, Cherelles and fresh bean weight (Kg) registered during the period January to May of 2005 in each of 44 genotypes available in the Chalmers collection established at the Estación Experimental Pichilingue.

Genotype	Nº Healthy pods/tree	Nº Witches broom diseased pods	Nº Moniliasis pods/tree	Total diseased pods/tree	Nº Cherelle wilt /tree	Fresh bean weight, Kg /tree	Dry bean weight, Kg /tree
SIL-1 (1)*	42	0	0	0	0	6,9	2,8
NAP-25 (3)	33	9	1	10	27	3,8	1,5
TIP-2 (4)	37	1	1	2	17	3,7	1,5
BOB-3 (5)	22	4	5	9	2	3,2	1,3
UNAP-1 (8)	22	8	2	10	1	3,1	1,3
CUR-3 (8)	22	6	5	11	4	3,0	1,2
TAP-21 (3)	30	1	0	1	3	2,8	1,1
AGU-5 (4)	28	2	1	3	22	2,7	1,1
AMA-4 (7)	26	4	2	6	10	2,5	1,0
AMA-11 (10)	20	6	6	12	4	2,3	0,9
AMA-9 (6)	19	3	2	5	10	2,0	0,8
TAP-5 (8)	24	7	1	8	10	1,9	0,8
NAP-34 (2)	17	11	3	14	10	1,9	0,8
NAP-23 (5)	12	4	2	6	0	1,9	0,8
NAP-3 (7)	28	6	1	7	23	1,7	0,7
TIP-1 (4)	19	7	0	7	11	1,7	0,7
BOB-8 (7)	11	8	5	13	6	1,6	0,7
SM-9 (7)	18	3	9	12	5	1,5	0,6
UNAP-2 (4)	11	3	12	15	4	1,5	0,6
COC-3335 (4)	14	9	3	12	7	1,4	0,6
TAP-3 (10)	13	5	1	6	2	1,4	0,6
NAP-30 (4)	12	6	0	6	1	1,4	0,5
CUR-15 (2)	13	4	19	23	37	1,3	0,5
TAP-7 (5)	14	1	0	1	7	1,2	0,5
AMA-14 (7)	9	5	4	9	4	1,2	0,5
AMA-1 (10)	8	3	3	6	4	1,2	0,5
COC-3338 (6)	12	4	1	5	1	1,2	0,5
AMA-2 (3)	9	3	2	5	11	1,1	0,4
AMA-10 (8)	14	3	3	6	10	1,1	0,4
COC-3328 (6)	8	4	2	6	4	1,1	0,4
TAP-1 (6)	14	4	1	5	14	1,0	0,4
TAP-10 (10)	10	3	1	4	7	1,0	0,4
NAP-41 (5)	9	1	1	2	1	0,9	0,4
AGU-17 (9)	10	3	0	3	8	0,9	0,4
TAP-2 (10)	10	2	2	4	10	0,8	0,3
AMA-12 (10)	6	2	2	4	7	0,8	0,3
TAP-6 (10)	9	4	1	5	5	0,7	0,3
VILL-6 (7)	8	3	3	6	7	0,7	0,3
TIP-4 (9)	9	11	0	11	3	0,7	0,3
VILL-2 (2)	5	1	2	3	7	0,7	0,3
NAP-1 (7)	5	5	1	6	0	0,6	0,2
TAP-1 (6)	9	5	0	5	9	0,6	0,2
SM-8 (7)	5	2	1	3	5	0,5	0,2
TAP-12 (10)	4	3	1	4	2	0,4	0,1

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Table 12. Pod and bean characterization for cocoa accessions in the Chalmers collection at E. Pichilingue.

Genotype	Morphology characteristic of bean and pod										
	Fresh bean weight, g*	Dry bean weight, g*	Seed index	Pod index	Bean color**	Pod length, cm	Pod breath, cm	N° seed/pod	Bean length cm	Bean breath, cm	Bean thickness, cm
COCA-3328	29,3	8,7	2,2	16	2	18,5	11,1	32	2,7	1,6	0,8
COCA-3335	26,2	8,4	2,0	19	2	17,4	10,1	32	2,6	1,4	1,0
NAP-23	25,1	7,3	1,8	25	2	18,9	10,4	30	2,5	1,4	0,9
COCA-3338	21,9	7,3	1,9	21	2	17,7	9,7	28	2,4	1,3	0,9
NAP-30	23,6	7,2	1,6	22	2	17,4	10,5	35	2,5	1;4	0,8
NAP-1	26,7	7,2	1,7	27	2	17,7	10,0	30	2,6	1,4	1,0
AGU-5	24,9	7,1	1,9	21	2	19,8	10,4	27	2,5	1,3	1,0
BOB-8	21,5	6,7	1,5	24	2	18,8	10,3	33	2,3	1,3	0,9
AGU-17	22,6	6,7	1,6	24	2	17,6	9,3	32	2,3	1,3	0,9
EET-103	22,1	6,4	1,5	16	2	22,2	10,2	46	2,4	1,3	0,9
NAP-41	20,8	6,3	1,5	29	2	14,2	8,3	33	2,3	1,4	0,8
VILL-6	19,8	6,0	1,5	40	2	16,1	8,6	36	2,2	1,3	0,8
SM-8	19,6	6,0	1,5	28	2	18,3	9,1	30	2,4	1,2	0,9
EET-48	17,6	5,9	1,4	30	2	18,5	9,7	35	2,4	1,3	0,8
CUR-3	19,9	5,9	1,6	25	2	20,0	10,1	34	2,3	1,3	0,8
SM-9	19,1	5,8	1,4	34	2	15,7	8,2	29	2,2	1,2	0,9
BOB-3	19,4	5,7	1,4	23	2	18,0	9,3	40	2,3	1,3	0,8
AMA-1	16,7	5,7	1,4	25	2	17,3	9,3	39	2,3	1,2	0,8
CCN-51	19,3	5,6	1,4	21	3	19,1	9,3	43	1,9	1,0	0,5
UNAP-2	15,2	5,5	1,3	24	2	15,5	8,9	41	2,4	1,2	0,9
AMA-14	17,0	5,3	1,3	29	2	17,4	9,5	36	2,4	1,2	0,8
TIP-1	15,5	5,3	1,3	26	2	16,7	9,7	33	2,1	1,2	0,8
TAP-11	15,1	5,3	1,2	30	3	21,4	9,4	34	2,1	1,1	0,8
TAP-6	16,6	5,3	1,2	31	3	22,3	9,2	34	2,2	1,1	0,9
TIP-4	15,2	5,2	1,3	29	2	17,4	10,6	32	2,1	1,2	0,8
UNAP-1	16,5	5,1	1,3	21	2	16,5	9,2	46	2,4	1,2	0,8
TAP-2	15,4	5,0	1,3	23	2	18,5	9,1	43	2,2	1,2	0,8
AMA-4	16,3	5,0	1,1	22	2	16,0	8,5	37	2,3	1,2	0,8
AMA-12	14,8	5,0	1,3	22	2	17,9	9,6	43	2,2	1,1	0,8
TAP-10	15,4	4,9	1,9	33	3	22,0	8,6	37	2,1	1,1	0,8
TAP-12	15,3	4,8	1,2	36	3	20,1	9,2	31	2,1	1,1	0,9
AMA-11	14,8	4,7	1,1	22	2	18,6	8,5	45	2,2	1,2	0,7
TIP-2	17,0	4,6	1,1	40	2	17,4	8,6	39	2,4	1,1	0,8
TAP-5	4,0	4,2	1,0	31	3	18,0	8,9	39	2,0	1,1	0,8
NAP-3	15,4	4,2	1,1	100	2	12,7	8,5	20	2,2	1,2	0,8
AMA-10	13,9	4,1	0,9	29	2	15,5	9,0	42	2,2	1,2	0,7
TAP-7	12,5	3,9	1,0	27	3	17,3	8,5	50	2,0	1,2	0,7
TAP-1	11,7	3,8	0,9	38	3	16,3	8,3	41	2,0	1,1	0,7
TAP-3	11,8	3,6	0,9	38	3	17,0	8,6	40	1,9	0,9	0,7
AMA-9	9,5	3,3	1,5	41	2	21,5	8,2	39	1,9	1,0	0,7

* Mean weight of five beans (grams)

** 1 = White beans
2 = Pale red beans
3 = Red dark beans

Table 13. Average number of healthy pods, diseased pods, Moniliasis pods, Cherelles and fresh bean weight (Kg) registered during the period January to May of 2005 in each of 51 accessions available in the Allen collection at the Estación Experimental Pichilingue.

Genotype	N° Healthy pods/tree	N° Witches broom diseased pods	N° Moniliasis pods/tree	Total diseased pods/tree	N° Cherelles wilt /tree	Fresh bean weight Kg /tree	Dry bean weight Kg /tree
LCT 278 (2)	23	4	1	5	13	3,1	1,2
LCT 73 (2)	20	1	0	1	4	2,0	0,8
LCT 30 (2)	22	2	1	3	0	1,8	0,7
LCT 227 (2)	11	2	0	2	1	1,7	0,7
LCT 326 (1)	19	2	0	2	0	1,4	0,5
LCT 121 (5)	8	2	1	3	0	1,1	0,4
EBC 126 (1)	12	6	0	6	5	0,9	0,4
EBC 122 (2)	8	0	0	0	11	0,8	0,3
LCT 26 (1)	8	2	1	3	9	0,8	0,3
LCT 146 (3)	9	1	0	1	18	0,6	0,3
LCT 87 (2)	6	1	1	2	1	0,6	0,2
LCT 81 (5)	7	1	0	1	5	0,6	0,2
LCT 329 (4)	15	0	0	0	5	0,5	0,2
EBC 142 (3)	12	3	2	5	2	0,5	0,2
LCT 334 (2)	6	3	0	3	6	0,5	0,2
LCT 347 (5)	20	5	3	8	4	0,4	0,2
LCT 254 (4)	4	6	1	7	0	0,4	0,2
EBC 138 (4)	18	3	2	5	0	0,4	0,2
EBC 148 (4)	11	0	0	0	1	0,4	0,1
LCT 249 (3)	3	0	1	1	0	0,4	0,1
LCT 255 (4)	3	5	4	9	0	0,3	0,1
LCT 77 (3)	2	0	1	1	1	0,3	0,1
LCT 250 (3)	3	2	0	2	3	0,3	0,1
LCT 142 (3)	5	3	3	6	1	0,3	0,1
LCT 237 (5)	3	2	1	3	0	0,3	0,1
LCT 91 (1)	3	0	0	0	0	0,3	0,1
LCT 57 (2)	4	2	0	2	0	0,3	0,1
LCT 325 (2)	2	4	2	6	0	0,2	0,1
LCT 219 (2)	2	1	0	1	6	0,2	0,1
LCT 258 (3)	2	0	0	0	0	0,2	0,1
LCT 154 (3)	5	2	1	3	0	0,1	0,1
LCT 257 (4)	4	25	9	34	6	0,1	0,1
LCT 134 (2)	1	0	0	0	0	0,1	0,1
LCT 188 (3)	3	1	0	1	1	0,1	0,0
LCT 125 (2)	1	2	0	2	1	0,1	0,0
LCT 33 (3)	2	0	0	0	3	0,1	0,0
LCT 368 (4)	5	2	0	2	1	0,1	0,0
LCT 195 (3)	2	0	0	0	0	0,1	0,0
LCT 36 (1)	1	0	0	0	0	0,1	0,0
LCT 156 (2)	1	1	0	1	0	0,0	0,0
LCT 180 (4)	1	1	0	1	0	0,0	0,0
LCT 253 (4)	0	2	2	4	7	0,0	0,0
LCT 414 (2)	1	1	0	1	0	0,0	0,0
LCT 232 (3)	0	5	2	7	0	0,0	0,0
LCT 234 (1)	0	1	0	1	19	0,0	0,0
LCT 312 (3)	0	0	0	0	1	0,0	0,0
LCT 264 (1)	0	2	2	4	0	0,0	0,0
LCT 223 (1)	0	0	0	0	0	0,0	0,0
LCT 46 (1)	0	1	0	1	0	0,0	0,0
LCT 94 (1)	0	0	0	0	0	0,0	0,0
LCT 180 (1)	0	0	0	0	0	0,0	0,0

* The number in parenthesis corresponds to the number of trees evaluated per each accession.

Table 14. Number of vegetative brooms, cushion brooms and chirimoya fruits per tree registered in 59 cocoa accessions available in the Allen collections at the Estación Experimental Pichilingue. 2005.

Genotype	Number of symptoms per tree		
	Vegetative brooms	Cushion brooms	Chirimoya fruits
LCT-278 (2)	0	0	0
LCT-141 (1)	0	0	0
LCT-91 (1)	0	2	0
EBC-142 (3)	0	0	0
LCT-156 (2)	0	0	0
LCT-189 (3)	0	0	0
LCT-249 (3)	0	0	0
LCT-195 (3)	0	0	0
LCT-121 (5)	1	0	0
LCT-146 (3)	1	0	0
LCT-368 (4)	1	0	0
EBC-138 (4)	1	0	0
LCT-409 (2)	1	0	0
LCT-46 (2)	1	0	0
LCT-411 (1)	1	0	0
LCT-33 (3)	1	0	0
LCT-36 (1)	1	1	0
LCT-254 (4)	1	0	0
LCT-434 (1)	2	0	0
LCT-52 (5)	2	0	0
LCT-81 (5)	2	0	0
LCT-264 (1)	2	0	0
LCT-449 (1)	2	0	0
LCT-73 (2)	2	1	0
LCT-30 (2)	2	4	1
LCT-227 (2)	2	0	0
LCT-257 (4)	3	0	0
LCT-413 (1)	3	0	0
LCT-415 (1)	3	0	0
LCT-403 (1)	3	0	0
EBC-122 (2)	4	0	0
LCT-188 (3)	4	0	0
LCT-232 (3)	4	0	0
LCT-125 (2)	4	0	0
LCT-258 (3)	4	0	0
EBC-148 (4)	4	0	0
LCT-312 (3)	4	0	0
LCT-255 (4)	5	0	0
LCT334 (2)	5	0	0
LCT-223 (1)	5	1	0
LCT-326 (1)	5	0	0
LCT-253 (4)	5	4	0
LCT-57 (2)	6	0	0
LCT-250 (3)	6	0	0
LCT-142 (3)	7	0	0
LCT-329 (4)	7	0	0
LCT-154 (3)	8	0	0
LCT-219 (2)	8	1	1
LCT-180 (4)	10	0	0
LCT-234 (1)	10	0	0
LCT-237 (5)	10	0	0
LCT-87 (2)	11	0	0
LCT-134 (2)	11	0	0
LCT-26 (1)	11	1	0
LCT-77 (3)	13	0	0
LCT-382 (1)	13	0	0
LCT-325 (2)	16	0	0
EBC-126 (1)	17	0	0
LCT-347 (5)	17	1	0

* The number in parenthesis corresponds to the number of trees evaluated per each accession

Others activities included clonal multiplication and re-planting of empty spaces within accessions rows to complete five plants per accession. Cocoa shading is also being improved through planting of shade trees.

Evaluation of old hybrid cocoa progenies

1) Old hybrid population established in the field named as "Lote 2 A"

Sanitary and yield traits were recorded from June 2004 to May 2005 in 54 trees selected from a population made up of several hybrid families and which was field planted some sixty years ago. Three years of accumulated data have been completed so far and stability analysis is planned as a next step. As observed in Table 15 during the reported period the highest yield (11.8 Kg.) was achieved by the tree coded as 2634. Dry bean weight values higher than 7 Kg. per tree were achieved by 16 trees. The tree with the lowest dry bean weight (2 Kg) was coded as 2327. In general the number of healthy pods corresponds closely to the behavior of the dry bean weight for the clones under evaluation.

Trees coded as 2367 and 2076 presented the lowest number of pods affected by Moniliasis which is coherent with results found earlier and suggests a possible source for genetic resistance regarding this disease. The tree coded as 2250 produced as much as 579 total healthy pods but at the same time showed the highest number of diseased pods totaling 880 pods adding both healthy and diseased pods. The tree coded as 2367 as mentioned earlier showed the lowest Moniliasis incidence but also presented the least number of total diseased pods. It should be noted that some of these trees are currently participating as parents in breeding blocks designed to produce segregating progenies to make selections for productivity, disease resistance and "Arriba" flavor.

From the 54 trees selected initially from this population the 15 highest yielding trees were subsequently selected for physical and sensorial (organoleptic) analysis. Known cocoa genotypes were included as controls. Physical data were subjected to traditional analysis of variance and treatment separation (Duncan 5%). Multivariate analysis techniques were applied to the sensorial data. Tables16 and 17 as well as Figures 3, 4, 5 and 6 show some outcomes of this piece of research. An important variability was detected for all parameters of characterization.

Multivariate analysis allowed a clear organoleptic differentiation and formation of three different groups of trees and control genotypes. The trees in the first group (2634, 2361, 2748, 2184, 2248, 2126, EET 95 and including Farm Las Brisas) showed interesting organoleptic profiles because of the presence of floral, fruity and sensorial notes with moderate levels of intensity. They were also accompanied by moderate levels of acidity, bitterness and astringency. It should be noted that the sample from the farm Las Brisas usually owns an organoleptic profile typical of Nacional cocoa suggesting that the trees in the first group share its profile or part of it. The tree coded as 2634 also happens to be highest yielder of all trees selected from the population under study even though its seed index is not superior to any of the genotypes used as controls.

An additional activity for this population was the preparation of 92 leaf samples collected from different trees belonging to the families EET-1 x SCA 6 (26 samples), EET 250 x SCA 6 (47 samples) and SIL-1 x SCA 6 (19 samples). These were sent to the USDA molecular biology Lab in Miami, Florida, USA with the aim of looking for useful molecular markers to monitor Witches´ broom resistance linked to the use of SCA-6 as parental in these families. More details are found in Table 3 of the Annex.

Table 15. Number of healthy pods, diseased pods, Moniliasis pods, Cherelles wilt fruits and fresh bean weight (Kg) registered from June 2004 - May 2005 in each of 54 superior tress selected in an old hybrid population established in a field named as "Lote 2 A" at Estación Experimental Pichilingue.

Tree code	N° Healthy pods/tree	N° Witches broom diseased pods	N° Moniliasis pods/tree	Total diseased pods/tree	N° Cherelles /tree	Fresh bean weight, Kg/tree	Dry bean weight, Kg / tree
2634	246	7	39	46	435	29,6	11,8
2690	178	18	42	60	255	24,0	9,6
2726	307	28	108	136	332	23,6	9,4
2744	211	41	135	176	540	22,1 .	8,9
2674	275	25	23	48	347	22,1	8,8
2126	173	6	27	33	538	21,2	8,5
2758	276	34	92	126	228	21,0	8,4
2184	229	37	62	99	166	20,9	8,4
2250	579	108	193	301	785	19,7	7,9
2747	154	16	29	45	809	19,5	7,8
2228	203	33	58	91	432	19,2	7,7
2511	166	39	62	101	514	19,0	7,6
2396	132	42	195	237	1496	18,9	7,5
2769	180	54	68	122	440	18,8	7,5
2748	199	11	11	22	1487	17,8	7,1
2696	281	48	72	120	938	17,8	7,1
2507	132	19	60	79	764	17,1	6,8
2416	134	11	25	36	130	16,9	6,7
2787	114	31	35	66	168	16,5	6,6
2181	115	6	15	21	148	15,9	6,4
2361	138	19	24	43	55	15,2	6,1
2717	165	28	86	114	80	15,0	6,0
2679	147	29	34	63	98	14,9	6,0
2175	145	23	61	84	445	14,5	5,8
2367	142	6	6	12	101	14,5	5,8
2584	177	25	73	98	498	14,1	5,7
2248	133	40	111	151	105	14,0	5,6
2197	199	37	33	70	211	13,8	5,5
2699	223	17	10	27	2109	13,3	5,3
2029	149	29	46	75	235	12,6	5,0
2195	120	14	53	67	264	12,2	4,9
2707	142	6	16	22	94	12,1	4,9
2743	89	8	64	72	294	12,0	4,8
2217	110	20	28	48	465	11,6	4,6
2734	84	17	53	70	87	11,5	4,6
2534	115	27	54	81	112	11,0	4,4
2078	90	13	19	32	2362	10,9	4,4
2128	102	39	61	100	379	10,7	4,3
2174	68	24	23	47	380	10,1	4,0
2735	93	23	100	123	85	10,1	4,0
2196	93	18	82	100	491	10,1	4,0
2213	93	45	47	92	65	9,8	3,9
2076	118	21	7	28	2412	9,5	3,8

Continues.....

Tree code	N° Healthy pods/tree	N° Witches´ broom diseased pods	N° Moniliasis pods/tree	Total diseased pods/tree	N° Cherelles wilt/tree	Fresh bean weight Kg/tree	Dry bean weight, Kg / tree
2244	79	41	101	142	301	8,7	3,5
2650	69	58	48	106	532	8,5	3,4
2607	91	41	75	116	284	8,2	3,3
2057	71	3	11	14	105	7,8	3,1
2675	87	13	21	34	495	7,3	2,9
2136	79	34	68	102	67	7,3	2,9
2080	70	15	52	67	535	6,1	2,4
2506	62	33	51	84	248	5,7	2,3
2258	64	12	36	48	210	5,5	2,2
2570	49	50	122	172	91	5,1	2,0
2327	42	45	96	141	48	4,9	2,0

Table 16. Average pH values for shell and cotyledon at the beginning of fermentation, end of fermentation and end of drying in bean samples from trees selected in the field named as "Lote 2 A".

Tree code	pH at starting fermentation		pH at the end of fermentation		pH at the end of drying	
	Shell	Cotyledon	Shell	Cotyledon	Shell	Cotyledon
2076	4,01 ef **	6,54 a	4,58 a	4,66 abc	6,02 cde	5,49 cde
2078	4,71 ab	6,89 bcd	4,53 a	4,70 abc	5,15 a	4,72 ab
2126	4,31 abcde	6,77 abcd	4,48 a	4,90 bcd	5,68 bc	5,22 bcd
2184	4,51 cdef	6,84 bcd	4,43 a	4,72 abc	5,57 abc	5,05 bc
2248	4,56 cdef	6,84 bcd	4,50 a	4,92 bcd	5,82 bcd	5,54 cde
2361	4,51 cdef	6,91 bcd	4,47 a	4,66 ab	5,62 abc	5,60 cde
2506	3,99 ab	6,83 bcd	4,41 a	5,12 d	5,80 bcd	5,74 de
2507	4,20 abcd	6,99 cd	4,60 a	4,73 abc	5,67 bc	5,35 cd
2607	4,47 bcdef	6,64 ab	4,40 a	4,56 a	5,86 bcd	5,08 bc
2634	4,64 def	6,78 abcd	4,54 a	4,68 abc	6,02 cde	5,47 cde
2717	3,96 ab	6,86 bcd	4,56 a	4,95 cd	5,63 abc	5,28 bcd
2735	4,39 abcdef	6,84 bcd	4,43 a	4,92 bcd	5,86 bcd	5,45 cde
2744	4,53 cdef	6,88 bcd	4,54 a	4,85 bcd	5,37 ab	5,51 cde
2748	4,62 def	6,71 abc	4,53 a	4,71 abc	6,38 e	5,49 cde
2787	4,81 f	6,87 ab	4,44 a	4,64 ab	5,93 cde	5,64 cde
Clone CCN - 51*	4,34 abcdef	6,97 cd	4,32 a	4,76 abc	5,59 abc	4,43 a
Clone EET - 103 *	4,53 cdef	6,85 bcd	4,53 a	4,70 abc	5,94 cde	5,64 cde
Clone EET - 95 *	4,49 bcdef	6,87 bcd	4,65 a	4,87 bcd	6,23 de	6,07 e
Clone EET - 96 *	4,26 abcde	6,71 abc	5,50 b	4,88 bcd	6,26 de	5,68 cde
Clone IMC - 67 *	4,59 cdef	7,03 d	4,81 a	5,13 d	5,62 abc	5,38 cd
Finca Las Brisas *	4,10 abc	6,76 abcd	4,50 a	4,71 abc	5,58 abc	5,42 cd

*Control clones

**Similar letters attached to treatments in the same column stands for lack of statistical differences ($p <= 0, 05$).

Table 17. Physical characterization of beans from trees selected from the field named as "Lote 2A".

Tree code	Seed index (IS)	Beans in 100 grams	CV (%) for bean weight	Shell percentage
2076	1.0 bcd	114 fghi	18,3	21,3 h
2078	1,1 defgh	94 bcdef	20,7	15,9 cde
2126	1,2 efgh	93 efg	21,6	18,4 g
2184	1,0 bcd	112 hij	20,7	17,4 efg
2248	1,0 bcd	115 hij	13,3	17,9 fg
2361	1,1 defgh	95 efg	25,9	16,1 def
2506	1,0 cdef	108 ij	23,4	19,1 g
2507	0,9 ab	131 jk	26,4	15,7 cde
2607	0,9 abc	117 jk	22,6	15,5 cde
2634	1,2 fghi	90 def	14,5	21,3 h
2717	0,8 a	113 jk	20,6	18,7 g
2735	1,2 cdefg	95 fgh	19,5	18,1 fg
744	1,1 defgh	95 ef	16,9	18,8 g
2748	1,0 bcde	110 ghij	22,9	14,5 bcd
2787	0,9 ab	131 k	16,8	19,5 gh
Clon CCN - 51*	1,4 k	70 ab	17,9	12,5 ab
Clon EET - 103 *	1,3 ijk	79 abcde	21,6	12,2 a
Clon EET - 95 *	1,4 k	72 abc	19,3	13,0 ab
Clon EET - 96 *	1,2 ghij	86 a	18,5	14,1 abcd
Clon IMC - 67 *	1,3 jk	76 abcd	23,4	16,2 def
Finca Las Brisas *	1,2 hij	85 cdef	19,5	13,8 abc

* Control clones

** Similar letters attached to treatments in the same column stands for lack of statistical differences ($p <= 0, 05$).

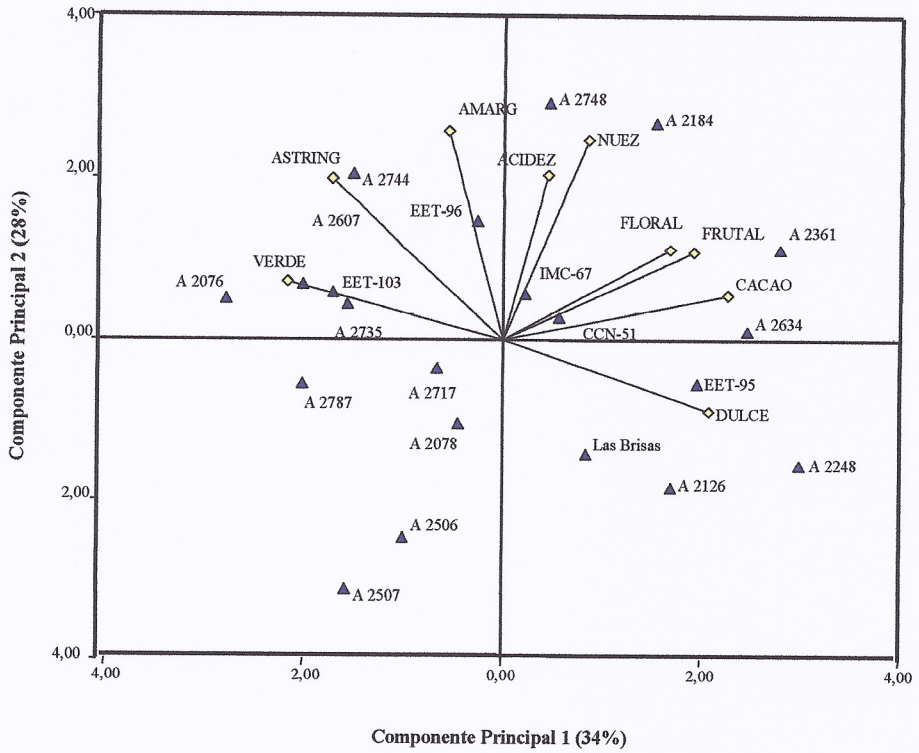


Figure 3. Distribution of trees and organoleptic variables in the plane defined by the first two principal components.

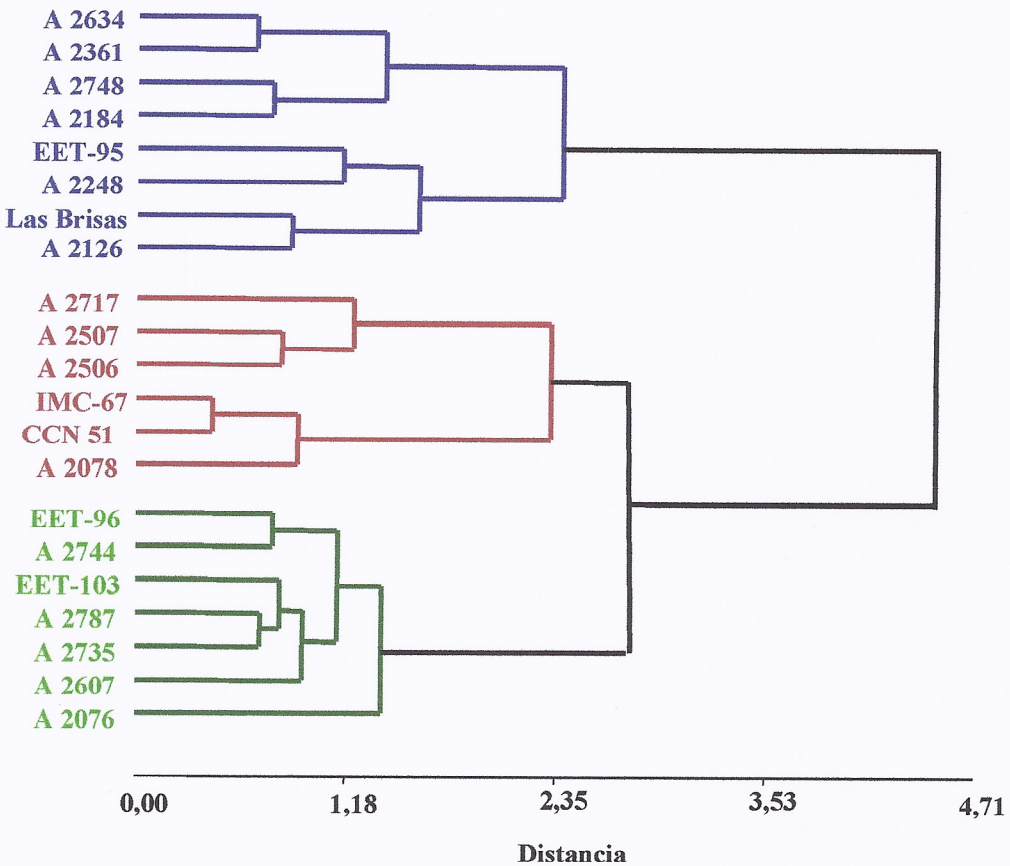


Figure 4. Dendrogram showing the structure of the groups formed considering selected 15 trees and controls and taking into account all organoleptic variables.

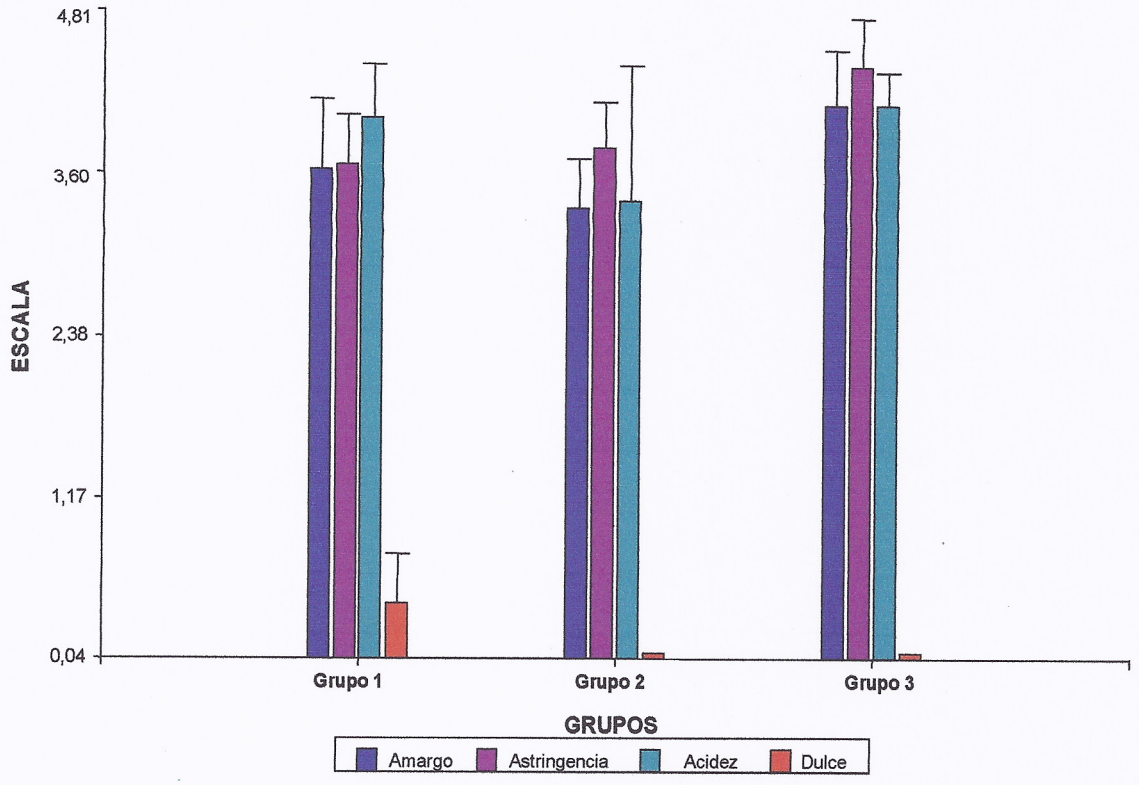


Figure 5. Average values for basic flavours of the 3 groups formed according to the Ward's Dendrogram.

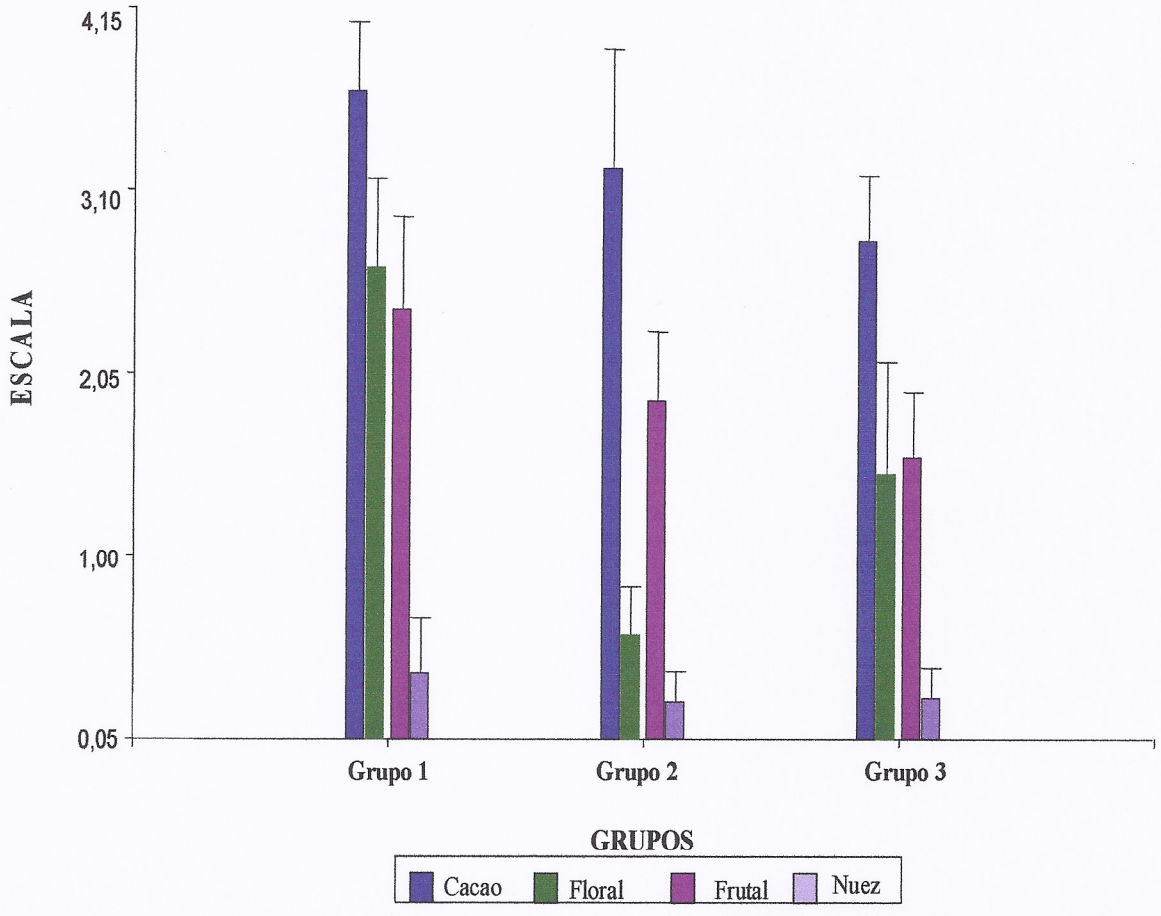


Figure 6. Average values for specific flavours of the 3 groups formed according to the Ward's Dendrogram.

2) Old Hybrid population established in the field named as "Lote 7A"

Data on number of healthy pods, diseased pods, cherelles wilt pods, Moniliasis pods and fresh bean weight continues to be registered to characterize the productive and sanitary behavior of each of four hybrid families (SCA 12 x Unknown; SCA-6 x SIL 1; SCA-6 x SIL 5; EET-95 x SIL 1; SCA-12 x SIL 5) making up this cocoa population planted in the period 1968-1971. Evaluation is carried out every 15 days during the rainy season and every month during the dry season. Recorded data for the years 2004 and 2005 are being digitalized to become part of the available historical and recent data base for the field named as "Lote 7A". Integral statistical analysis will be undertaken soon in search for superior trees with economic traits (and potential to become commercial clones) or parents to become part of new breeding schemes. Outcomes from this analysis will be presented in the next report.

A total of 497 leaf samples of three families (SCA-12 x Unknown, SCA-6 x SIL 1, and SCA 6 x SIL 5) were also collected and sent to the USDA molecular biology Lab in Miami, Florida, USA on June 2005, July 2005 and January 2006. The objective of this analysis is the same as for Lote 2A, that is to look for molecular markers linked to Witches' broom resistance. More details are shown in Table 4 of the Annex.

3) Old Hybrid Family population established in the field named as "Lote Hiler"

This population is made up of approximately 140 hybrid families which were field planted in the period of 1968-1971. An inventory of the surviving trees and families has been completed. The next step is to select a representative sample for characterization of the sanitary and productive behavior to measure the potential of the whole population as a source of superior trees with breeding and / or commercial values (a new student will be recruited for this purpose). More details will be found in Table 5 of the Annex.

Multilocal evaluation trials

1) Clonal evaluation of superior cocoa selections in the Amazonía region

In 2004 after 18 months of evaluation a total 15 trees were selected based on productivity and sanitary merits from an old cocoa population established in the field known as "Lote 2A" at Estación Pichilingue. This is made up of several hybrid families as described earlier in this report. During late 2004 and early 2005 these trees were cloned and field planted in five different locations in the Amazonía region for evaluation purposes. Some commercial and other known clones were included as controls in the trials. The objective of these trials is to obtain superior clones to form polyclonal varieties adapted to each of several zones in the Amazonía with conditions to grow cocoa.

First trials were planted on August 6 and 12 / 2004 near the towns of Lago Agrio and Shusufindi in the Province of Sucumbíos. On April 29 and June 23, 2005, two additional tests were planted near the towns of Tena in the Province of Napo and Mendez in the Province of Morona Santiago. The last test was planted on October 2005 near the town of Coca (within the Estación Experimental Napo-Payamino of INIAP) in the Province of Orellana. The treatments were distributed at random in the field under a Complete Randomized Block Design with 4 replications and 9 plants per plot; planting distance is 3 m x 3 m. Each trial covers a surface of 1.05 ha except that the trial located in the Estación Experimental Napo-Payamino that has 25 plants per plot and covers 2.3 ha. Table 6 and Figure 1 both in the Annex show a list of the clonal genotypes under evaluation and a map with the approximate geographic distribution of the trials. Some of the clones have already begun to bear pods. More information on the performance of the clones in this trial will be provided in the next annual Report.

2) Clonal evaluation of superior cocoa selections in the Coastal region

Since 2002 a multilocal evaluation experiment is being conducted in several sites along the main traditional cocoa areas in the coastal region. The purpose of this research is to evaluate the productivity and sanitary performance of several superior Nacional type clones selected from the germplasm available and characterized at the Estación experimental Tropical Pichilingue of INIAP. The locations of the trials are: Estate "La Roma" in the zone of Naranjal, Province of Guayas; Experimental farm of CEDEGE in the zone of Chongon, also in the Province of Guayas; Experimental farm of the Superior Polytechnic School of Manabí in the zone of Calceta, Province of Manabí; Farm "Maria Veronica" in the zone of Bourbon, Province of Esmeraldas; and Estate "El Chollo" in the zone of Valencia, Province of Los Rios (see Figure 2 in the Annex for the geographical distribution of the experimental sites).

Figure 7 presents some yield results accumulated until December 2005 for all sites. Clones EET-544 and EET-558 in the zone of Chongon, clone EET-103 in the zone of Calceta and clones EET-575 and EET-103 in the zone of Esmeraldas, have achieved so far yields that are similar to that obtained by CCN 51 so far. This last clone shows higher productivity than the Nacional clones in the two remaining sites. Evaluation will continue for two additional years to gather enough data to conduct stability analysis for final selection of adapted clones in each zone. More information on the performance of the clones in all trials will be provided in the next annual Report.

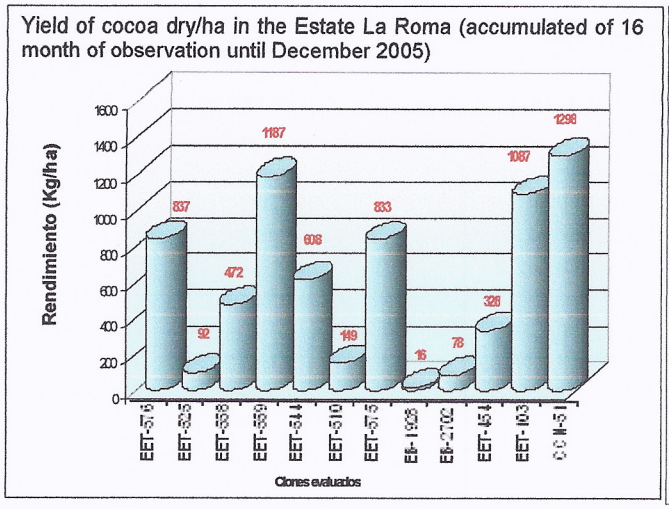
Breeding for improvement of Witches´ broom resistance

Evaluation of progenies segregating for Witches´ broom resistance under natural high inoculum's pressure

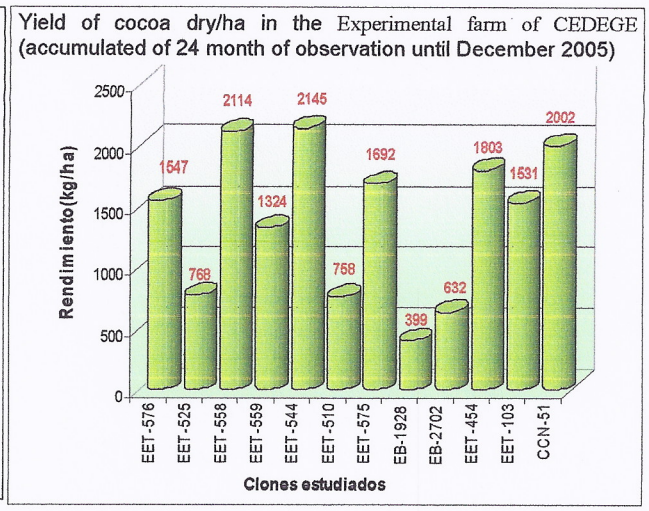
The main objective of this project is to select plants for Witches' broom resistance. Three segregating populations were planned. Since there was not possible to get all crosses at the same time for the three populations, for ease of evaluation the crosses were assigned to four different groups as they were obtained. Consequently each of these groups was made up of crosses coming from different populations.

1. Population A: This is made up of progenies obtained by crossing Wild x Wild cocoa genotypes. A half diallel crossing design with 14 parents was applied. The parents are: AMAZ-11, AMAZ-14, CCN-51, CUR-3, EBC-148, LCT-368, LCT-37, LCT-46, TAP-10, TAP-12, TAP-3, TAP-6, TIP-1 and UNAP-2. Out of the total 91 possible crosses planned, 76 were effective and allowed to produce progenies which were taken to the field (26 progenies in group 1; 12 progenies in group 2; 23 progenies in group 3; and 15 progenies in group 4).
2. Population B: This is made up of progenies obtained by crossing Known clones x Known cocoa genotypes. This is a 5 x 6 Factorial Cross Design, 5 females: CCN-51, EET-233, EET-387, EET-58 and SIL-1 and 6 males: N° 2416 (EET-161 x EET-166), N° 2367 (EET-6 x EET-6), N° 645 (EET-95 x SIL1), N° 2057 (EPC x EET-196), N° 60 (SCA-12 x Unknown) and N° 147 (SCA-12 x SIL5). Out of the total 30 possible crosses, 22 were effective and allowed to produce progenies which were taken to the field (8 progenies in group 1; 9 progenies in group 2; 1 progeny in group 3; and 4 progenies in group 4.
3. Population C: This is made up of progenies obtained by crossing Nacional x Nacional genotypes. A 6 x 6 Factorial Cross Design was applied with 6 Females parents: Brisas-13, Brisas-16, Brisas-30, Gloria-1, Gloria-17 and Gloria-3, and 6 Males parents: CCAT-1858, CCAT-4688, EB-1013, EB-2237, SNA-0707 and SNA-0708. Out of the total 36 possible crosses, 26 were effective and allowed the development of progenies which were finally taken to the field (5 progenies in group 1; 14 progenies in group 2; 0 progenies in group 3; and 7 progenies in group 4).

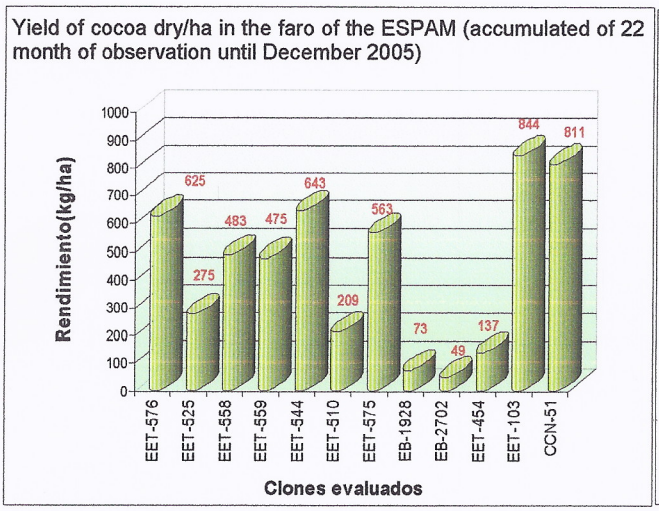
Zone of Naranjal, Guayas



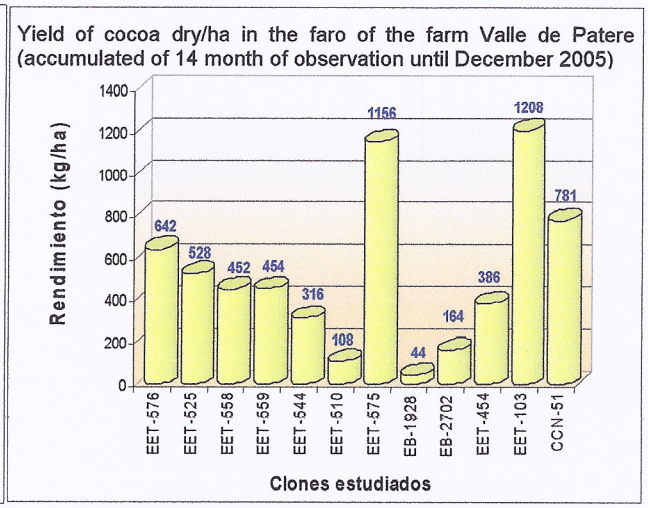
Zone of Chongón, Guayas



Zone of Calceta, Manabí



Zone of Borbon, Esmeraldas



Zone of Valencia, Los Ríos

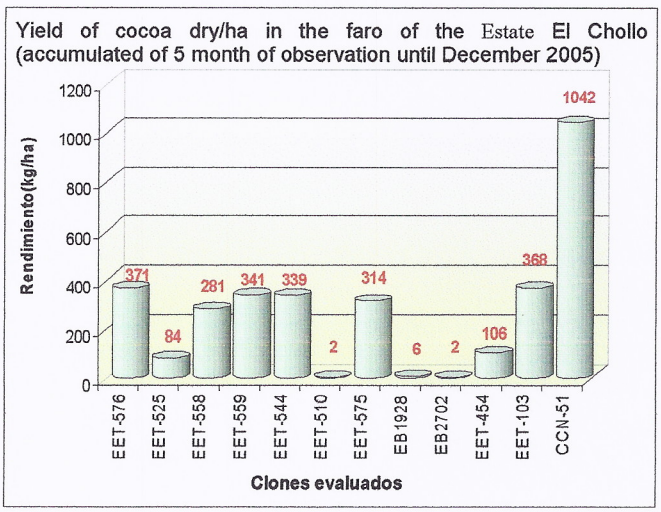


Figure 7. Accumulated yield performance of a number of Nacional type clones compared with CCN-51 currently tested in the zones of Naranjal, Chongon, Calceta, Bourbon and Valencia in the coastal region.

As the crosses were obtained seeds were planted in large plastic bags. These were kept in the nursery for at least three months before they were sent to a cocoa field under high inoculum's pressure for Witches' broom (an old cacao field with trees heavily infected by *Crinipellis perniciosa* due to their high susceptibility to this disease).

1. Group 1: 1950 plants in a total of 39 treatments (crosses); 26 progenies from Population A; 8 progenies from Population B and 5 progenies from Population C. These treatments were arranged in a Randomized Complete Block Design with 5 replicates and 10 plants of each treatment (progeny) by replicate, for a total of 50 plants per progeny. This group was placed in the field on May 2004 and has been evaluated three times; two evaluations were made during the dry season (July- December) and one during the rainy season (January-June).
2. Group 2: 1750 plants in a total of 35 different crosses; 12 progenies from Population A; 9 progenies from Population B and 14 progenies from Population C. As in group 1 the 35 treatments were arranged in a Randomized Complete Block Design with 5 replicates and 10 plants of each treatment (cross) by replicate, for a total of 50 plants per cross. This group was put in the field on August 2004 and has been evaluated two times, one evaluation during the dry season and one during the rainy season.
3. Group 3: 1200 plants, in a total of 24 different crosses; 23 progenies from Population A; 1 progeny from Population B and 0 progenies from Population C. This group of crosses were set in the field, in a Randomized Complete Block Design with 5 replicates and 10 plants of each treatment (cross) by replicate, for a total of fifty 50 plants per cross. This group of crosses was placed in the field on April 2005 and has one evaluation during the 2005 dry season. The evaluation for the 2006 rainy season was recently completed.
4. Group 4: 1300 plants, in a total of 26 different crosses; 15 progenies from Population A; 4 progenies from Population B and 7 progenies from Population C. These crosses were set in the field on July 2005 and had one evaluation during the 2005 dry season. The evaluation for the 2006 rainy season was recently completed. Not all crosses in this group have 50 plants because a decision was made to send all remaining crosses with at least 30 plants per cross to the field. The objective was to include as many progenies as possible in the evaluation.

Correlation analysis between evaluations during dry season and rainy season were made; results showed no significant association between evaluations ($r = 0.14$). Since during the rainy season the natural inoculums is higher than in the dry season a decision was made to use mainly the data from the rainy season to select the most tolerant plants. Six variables were recorded during the evaluation of Witches broom resistance in each group:

- IEB: Incidence o f Witches´ Broom (1 absence, 2 present)
- NPTOINF: Number of infected points
- TIPOBRINF: Type of infected bud (1: Lateral and 2: Terminal)
- TESCOBA: Broom Size (1 small, 2 medium, 3 large)
- DIAM: Diameter of the branch below the broom (in cm)
- BDIAM: Diameter of the broom (in cm)

The diameter of the branch below the broom (DIAM) and the ratio Broom diameter (BDIAM): Branch diameter (DIAM) which in this case is represented by BD were included as new variables from the third evaluation of group 1 and second evaluation of group 2.

The third evaluation of Group 1 and the second evaluation of Group 2 were also carried out during the 2005 rainy season. That was the reason why groups 1 and 2 were analyzed together

considering they had one common evaluation. The calculated variables RD and percentage of infection were also included as part of the analysis.

By putting together groups 1 and 2 we ended with 38 progenies (1900 plants) from Population A; 17 progenies (850 plants) from Population B and 19 progenies (950 plants) from Population C. The purpose of this grouping was to select individual plants showing resistance/tolerance to Witches' broom. The selected plants and the best parents are being cloned and will become inputs for another field experiment. The best parents will be also used in the designing of new crossing schemes.

The applied selection criteria are described as follows: 1) Selection of those plants that ranked first for all variables and 2) Choose parents of plants selected according the first criteria giving priority to those participating in more that one family (cross). Additionally GCA (General Combining Ability) and SCA (Specific Combining Ability) analysis were performed for the variables percentage of infection and RD (Ratio between diameter of the broom and diameter of the base). See Tables 18 to 29 for more information on statistical analysis outputs.

Three evaluations were completed for plants in Group 1. All plants that did not show Witches' broom symptoms in any of evaluations were selected. Those plants which were infected in the first evaluation but not in the second and third evaluation were also selected. Furthermore, those plants with a ratio (RD) of less than 0.6 were also selected among the infected plants.

Two evaluations were completed for group two. Again those plants that did not show Witches´ brooms symptoms in any of those evaluations were selected. Those plants that became infected in the first evaluation and show no infection in the second evaluation were also selected. Among the infected ones those with a ratio RD < 0.6 were selected too.

Table 18. ANOVA for variable RD measured in progenies related to the Amazonian Population.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	4	0.0860038	0.021501	1.32	0.2643
TRT	37	1.0082659	0.0272504	1.68	0.0165
FEMALE	10	0.2295385	0.0229539	1.37	0.1988
MALE	12	0.3579686	0.0298307	1.78	0.0559
FEMALE*MALE	15	0.3934902	0.0262327	1.57	0.0894
Error	148	2.4064109	0.0162595		
Corrected Total	189	3.5006806			

Table 19. ANOVA for variable NPTOINF measured in progenies related to the Amazonian Population.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	4	0.0463874	0.0115968	0.61	0.653
TRT	37	3.5391516	0.0956528	5.07	<.0001
FEMALE	10	1.4705497	0.147055	7.6	<.0001
MALE	12	1.5437731	0.1286478	6.65	<.0001
FEMALE*MALE	15	0.6987844	0.0465856	2.41	0.0038
Error	148	2.7939326	0.0188779		
Corrected Total	189	6.3794716			

Table 20. General Combining Ability and Specific Combining Ability for the variable RD measured in progenies related to the Amazonian Population.

LRD	Males																
Females	AMAZ-11	AMAZ-14	CUR-3	EBC-148	LCT-368	LCT-37	LCT-46	TAP-10	TAP-12	TAP-3	TAP-6	TIP-1	UNAP-2	Families	**Mean**	**GCA**	**Rank**
AMAZ-11			0.5766	0.5557	0.5087			0.5047	0.3652	0.6225		0.4062	0.5497	8	**0.5112**	**0.0259**	**10**
AMAZ-14				0.5629	0.5434							0.3657	0.5290	4	**0.5002**	**0.0150**	**7**
CCN-51	0.4773	0.5858		0.5082		0.5859	0.4861	0.6015		0.3041	0.5801			8	**0.5161**	**0.0309**	**11**
CUR-3												0.5001		1	**0.5001**	**0.0149**	**9**
EBC-148					0.4466									1	**0.4466**	**-0.0387**	**3**
TAP-10			0.4286	0.5439	0.3939								0.4622	4	**0.4571**	**-0.0281**	**4**
TAP-12				0.3867									0.4344	2	**0.4105**	**-0.0747**	**1**
TAP-3			0.4514		0.4649							0.4784	0.4434	4	**0.4595**	**-0.0257**	**5**
TAP-6				0.4036	0.4854							0.4452		3	**0.4447**	**-0.0405**	**2**
TIP-1				0.5064	0.4720									2	**0.4892**	**0.0039**	**7**
UNAP-2				0.4731										1	**0.4731**	**-0.0121**	**6**
Families	1	1	3	8	7	1	1	2	1	2	1	5	5				
Mean	**0.4773**	**0.5858**	**0.4855**	**0.4926**	**0.4735**	**0.5859**	**0.4861**	**0.5531**	**0.3652**	**0.4633**	**0.5801**	**0.4391**	**0.4837**		**0.4852**		
GCA	**-0.0079**	**0.1005**	**0.0003**	**0.0073**	**-0.0117**	**0.1007**	**0.0008**	**0.0679**	**-0.1200**	**-0.0220**	**0.0949**	**-0.0461**	**-0.0015**				
Rank	**5**	**12**	**7**	**9**	**4**	**13**	**8**	**10**	**1**	**3**	**11**	**2**	**6**				

Table 21. General Combining Ability and Specific Combining Ability for the variable NPTOINF in the Amazonian Population

PINF	Males																
Females	AMAZ-11	AMAZ-14	CUR-3	EBC-148	LCT-368	LCT-37	LCT-46	TAP-10	TAP-12	TAP-3	TAP-6	TIP-1	UNAP-2	Families	**Mean**	**GCA**	**Rank**
AMAZ-11			0.6400	0.8000	0.7000			0.7600	0.8000	0.7800		0.6000	0.7	8	**0.723**	**-0.0797**	**2**
AMAZ-14				0.9600	0.9720							0.6600	0.74	4	**0.833**	**0.0308**	**7**
CCN-51	0.6400	0.9960		0.8000		0.9600	0.8000	0.5200		0.6400	0.9600			8	**0.790**	**-0.0127**	**5**
CUR-3												0.9320		1	**0.932**	**0.1298**	**10**
EBC-148					0.8400									1	**0.840**	**0.0378**	**8**
TAP-10			0.8800	0.8400	0.7600								0.62	4	**0.775**	**-0.0272**	**3**
TAP-12				0.8200									0.78	2	**0.800**	**-0.0022**	**6**
TAP-3			0.9680		0.9920							0.9880	0.64	4	**0.897**	**0.0948**	**9**
TAP-6				0.9840	0.9800							0.9520		3	**0.972**	**0.1698**	**11**
TIP-1				0.6400	0.6600									2	**0.650**	**-0.1522**	**1**
UNAP-2				0.7800										1	**0.780**	**-0.0222**	**4**
Families	1	1	3	8	7	1	1	2	1	2	1	5	5				
Mean	**0.6400**	**0.9960**	**0.8293**	**0.8280**	**0.8434**	**0.9600**	**0.8000**	**0.6400**	**0.8000**	**0.7100**	**0.9600**	**0.8264**	**0.696**		**0.802**		
GCA	**-0.1622**	**0.1938**	**0.0271**	**0.0258**	**0.0412**	**0.1578**	**-0.0022**	**-0.1622**	**-0.0022**	**-0.0922**	**0.1578**	**0.0242**	**-0.1062105**				
Rank	**5**	**12**	**7**	**9**	**4**	**13**	**8**	**10**	**1**	**3**	**11**	**2**					

Sig. 1% Sig. 5%

Table 22. ANOVA for variable RD measured in progenies related to the Known Population.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	4	0.1299067	0.0324767	0.69	0.6016
TRT	16	0.7003057	0.0437691	0.93	0.5405
FEMALE	4	0.1048196	0.0262049	0.56	0.6948
MALE	5	0.2809664	0.0561933	1.19	0.3222
FEMALE*MALE	7	0.256456	0.0366366	0.78	0.6077
Error	64	3.0124003	0.0470688		
Corrected Total	84	3.8426126			

Table 23. ANOVA for variable NPTOINF measured in progenies related to the Known Population.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	4	0.03824	0.00956	0.65	0.6256
TRT	16	2.0299953	0.1268747	8.69	<.0001
FEMALE	4	0.7380594	0.1845148	12.64	<.0001
MALE	5	0.4785621	0.0957124	6.56	<.0001
FEMALE*MALE	7	0.450458	0.0643511	4.41	0.0005
Error	64	0.93424	0.0145975		
Corrected Total	84	3.0024753			

Table 24. General Combining Ability and Specific Combining Ability for the variable RD measured in progenies related to the Known Population.

RD	**Males**									
Females	2057	2367	2416	A-645	B-60	D-147	Families	**Means**	**GCA**	**Rank**
CCN-51		1.4164		1.1016	1.1598	1.2644	4	**1.23555**	**0.055**	**5**
EET-233	1.1742	1.235		1.1277	1.2028		4	**1.184925**	**0.004**	**2**
EET-387	0.9639		1.2379	1.1815	1.0999	1.1132	5	**1.11928**	**-0.061**	**1**
EET-58					1.2158		1	**1.2158**	**0.035**	**4**
SIL-1	1.1947		1.2182		1.163		3	**1.1919667**	**0.011**	**3**
Families	3	2	2	3	5	2				
Means	**1.1109333**	**1.3257**	**1.22805**	**1.1369333**	**1.16826**	**1.1888**		**1.1805882**		
GCA	**-0.0696549**	**0.1451118**	**0.0474618**	**-0.0436549**	**-0.0123282**	**0.0082118**				
Rank	**1**	**6**	**5**	**2**	**3**	**4**				

Table 25. General Combining Ability and Specific Combining Ability for the variable NPTOINF measured in progenies related to the Known Population

PINF	**Males**									
Females	2057	2367	2416	A-645	B-60	D-147	Families	**Means**	**GCA**	**Rank**
CCN-51		0.992		0.68	0.52	0.74	4	**0.733**	**-0.115**	**1**
EET-233	0.996	1		0.964	0.992		4	**0.988**	**0.14**	**5**
EET-387	0.78		0.98	0.64	0.76	0.68	5	**0.768**	**-0.08**	**3**
EET-58					0.76		1	**0.76**	**-0.088**	**2**
SIL-1	0.972		0.992		0.964		3	**0.976**	**0.128**	**4**
Families	3	2	2	3	5	2				
Means	**0.916**	**0.996**	**0.986**	**0.7613333**	**0.7992**	**0.71**		**0.8477647**		
GCA	**0.0682353**	**0.1482353**	**0.1382353**	**-0.0864314**	**-0.0485647**	**-0.1377647**				
Rank	**4**	**6**	**5**	**2**	**3**	**1**				

	Sig. 1%
	Sig. 5%

Table 26. ANOVA for the variable RD measured in progenies related to the Nacional Population

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	4	0.0860616	0.0215154	0.9	0.4703
TRT	18	1.1833399	0.0657411	2.74	0.0013
FEMALE	4	0.3221728	0.0805432	3.36	0.0141
MALE	5	0.1369112	0.0273822	1.14	0.3464
FEMALE*MALE	9	0.6444761	0.0716085	2.99	0.0045
Error	72	1.7267966	0.0239833		
Corrected Total	94	2.9961981			

Table 27. ANOVA for the variable NPTOINF measures in progenies related to the Nacional Population

Source	DF	Type III SS	Mean Square	F Value	Pr > F
REP	4	0.0145853	0.0036463	1.01	0.4085
TRT	18	0.3416758	0.018982	5.25	<.0001
FEMALE	4	0.0689733	0.0172433	4.77	0.0018
MALE	5	0.0491	0.00982	2.72	0.0263
FEMALE*MALE	9	0.1561267	0.0173474	4.8	<.0001
Error	72	0.2601347	0.003613		
Corrected Total	94	0.6163958			

Table 28. General Combining Ability and Specific Combining Ability for the variable RD measured in progenies related to the Nacional Population

RD	Males									
Females	CCAT-1858	CCAT-4688	EB-1013	EB-2237	SNA-0707	SNA-0708	Families	**Means**	**GCA**	**Rank**
Brisas-13	1.1026		0.96642		0.94644	0.98374	4	**0.9998**	**-0.0977**	**1**
Brisas-30	1.22886						1	**1.2289**	**0.1314**	**5**
Gloria-1	0.98062	1.2565	1.1738	1.32232	1.0706	0.94648	6	**1.1251**	**0.0276**	**3**
Gloria-17	1.0894			1.00694	0.97134	1.17262	4	**1.0601**	**-0.0374**	**2**
Gloria-3		1.1499		1.13408	1.14472	1.20458	4	**1.1583**	**0.0608**	**4**
Families	4	2	2	3	4	4				
Means	**1.1004**	**1.2032**	**1.0701**	**1.1544**	**1.0333**	**1.0769**		**1.0975**		
GCA	**0.0029**	**0.1057**	**-0.0274**	**0.0570**	**-0.0642**	**-0.0206**				
Rank	**4**	**6**	**2**	**5**	**1**	**3**				

Table 29. General Combining Ability and Specific Combining Ability for the variable NPTOINF measured in progenies related to the Nacional Population

PINF	Males									
Females	**CCAT-1858**	**CCAT-4688**	**EB-1013**	**EB-2237**	**SNA-0707**	**SNA-0708**	Families	**Means**	**GCA**	**Rank**
Brisas-13	0.9760		0.9000		0.9840	1.0000	4	**0.9650**	**0.0132**	**4**
Brisas-30	0.8000						1	**0.8000**	**-0.1518**	**1**
Gloria-1	0.8600	0.9920	0.9880	0.9880	0.9960	0.8600	6	**0.9473**	**-0.0045**	**2**
Gloria-17	0.9760			0.9920	0.9880	0.9680	4	**0.9810**	**0.0292**	**5**
Gloria-3		0.9880		0.9800	0.8600	0.9880	4	**0.9540**	**0.0022**	**3**
Families	4	2	2	3	4	4				
Means	**0.9030**	**0.9900**	**0.9440**	**0.9867**	**0.9570**	**0.9540**		**0.9518**		
GCA	**-0.0488**	**0.0382**	**-0.0078**	**0.0349**	**0.0052**	**0.0022**				
Rank	**1**	**6**	**2**	**5**	**4**	**3**				

	Sig. 1%
	Sig. 5%

A total of 3700 plants have gone through this selection process so far. It ended up with the selection of 437 plants which did not show Witches broom symptoms and 151 which showed symptoms only during the firs evaluation event. Additionally, 226 plants which presented a RD value of less than 0.6 were also selected for further evaluation (See Figures 3 and 4 in the Annex). This procedure was followed to secure the presence of several levels of resistance in the field allowing a better validation of the initial results. Adding up all this selections a total of 814 plants, that is 22% of all the plants that started the process, are currently being cloned to set up a field experiment for further evaluation. This trial will be established through a Complete Randomized Block Design with 4 replicates, 3 plants of each clone by replicate. This experiment will also include as treatments the parents (clones) from those families that produced al least 15 selected plants. The parents selected for inclusion in this new experiment are: A-645, AMAZ-11, AMAZ-14, B-60, Brisas-13, CCN-51, CUR-3, D-147, EBC-148, EET-233, EET-387, LCT-368, SIL-1, TAP-10, TAP-3, TAP-6, TIP-1, and UNAP-2.

A fourth group of hybrid progenies has been recently placed in the natural high infection field completing all the crosses planned for the first phase of the project. Table 7 in the Annex shows a list of the treatments and controls for this group. With the setting up of this group a total of 124 hybrid families have been produced and placed in the natural inoculation field for evaluation regarding Witches broom resistance. Tables 30 and 31 show the first evaluation's results regarding Witches broom resistance for groups third and fourth. Results from new rounds of evaluations will be presented in the next annual report.

2) Cloning of plants and land preparation

A total of 1440 grafted clones from selected plants, including best parents and controls, and which were chosen due to their capacity to transmit Witches´ brooms resistance genes to their progenies (See Tables 32 and 33 for more information) are currently kept in new nursery facilities built with this purpose. They are ready for field planting in the next few weeks once irrigations events are secured.

More than eight hectares planted with plantain as temporary shade are ready for the setting up of the experiment. A Randomized Complete Block design will be used for this trial with 4 replications, 3 plants per treatment per replication, utilizing a planting distance of 2.5 m x 2.5 m. A natural pond is available nearby as a source of water to provide irrigation of the plants during the dry period of the year.

3) Obtention of new segregating cocoa progenies for disease resistance and productivity

A new crossing scheme block has been designed to produce segregating progenies for the second phase of the project. Parents were selected considering their resistance to Witches' broom and Moniliasis as well as productivity. GCA and SCA analysis outputs according to Tables presented earlier also contributed to this selection process. The selected parents came from the trials on Witches' broom resistance and other yield and sanitary evaluation trials conducted by the Programa of cacao at Estación Experimental Pichilingue.

A total of 34 parents will be used in the new crossing scheme, including 15 Females and 19 Males for a total of 285 crosses. A factorial crossing design will be applied for field distribution and analysis of the treatments. Six percent of the crosses have been completed so far (See Tables 34 and 35 for more information).

Table 30. Percentage of Witches broom infected plants taken to the field after their first evaluation and corresponding to the Third Group of hybrid families.

Cross	Nº Totals Plants	Nº infected plants	Nº Healthy plants	Infection (%)
UNAP-2 x TIP-1	41	6	35	14,6
TESTIGO SCA-12	33	5	28	15,2
LCT-46 x UNAP-2	38	7	31	18,4
TAP-3 x LCT-368	42	8	34	19,0
AMA-14 x TAP-12	27	7	20	25,9
CCN-51 x UNAP-2	46	12	34	26,1
TAP-3 x TAP-12	36	10	26	27,8
TAP-6 x UNAP-2	36	10	26	27,8
CCN-51 x TIP-1	44	13	31	29,5
TAP-3 x TAP-6	37	11	26	29,7
TESTIGO EET-19 (AUT)	23	7	16	30,4
TAP-10 x TIP-1	38	12	26	31,6
GLORIA-1 x EB-22-37	25	8	17	32,0
TAP-12 x TIP-1	38	13	25	34,2
TAP-6 x CUR-3	40	14	26	35,0
TAP-10 x TAP-3	34	12	22	35,3
CUR-3 x UNAP-2	42	15	27	35,7
AMA-11 x TAP-6	43	16	27	37,2
CCN-51 x CUR-3	37	14	23	37,8
CCN-51 x 2057	26	10	16	38,5
TAP-12 x CUR-3	28	11	17	39,3
TESTIGO SCA-6	35	14	21	40,0
UNAP-2 x LCT-368	47	19	28	40,4
GLORIA-1 x EB-10-13	28	12	16	42,9
CUR-3 x LCT-368	35	15	20	42,9
AMA-14 x CUR-3	37	16	21	43,2
TAP-12 x LCT-368	35	16	19	45,7
CCN-51 x TAP-12	30	14	16	46,7
TAP-3 x EBC-148	42	21	21	50,0
CUR-3 x EBC-148	43	22	21	51,2

Table 31. Percentage of Witches broom infected plants taken to the field after their first evaluation and corresponding to the fourth group of hybrid families.

Cross	Nº Totals Plants	Nº infected plants	Nº Healthy plants	Infection (%)
LCT-46 x TAP-10	20	0	20	0,0
LCT-37 x AMAZ-11	49	1	48	2,0
LCT-46 x LCT-37	27	1	26	3,7
EET-58 x 2416	49	2	47	4,1
EET-58 x 2057	49	3	46	6,1
Brisas-13 x EB-2237	47	3	44	6,4
LCT-37-TIP-1	48	4	44	8,3
Brisas-30 x EB-2237	48	4	44	8,3
LCT-46 x TAP-12	44	4	40	9,1
TESTIGO EET-19 (AUT)	33	3	30	9,1
LCT-37 x UNAP-2	49	5	44	10,2
LCT-37 x LCT-368	39	4	35	10,3
SIL-1 x D.147	48	5	43	10,4
LCT-37 x CUR-3	48	5	43	10,4
EET-233 x D.147	48	5	43	10,4
Gloria-3 x EB-10-13	48	6	42	12,5
LCT-37 x TAP-3	47	6	41	12,8
LCT-37 x EBC-148	47	6	41	12,8
TESTIGO SCA-12	28	4	24	14,3
LCT-37 x AMAZ-14	50	8	42	16,0
Brisas-16 x CCAT-4688	49	8	41	16,3
LCT-46 x CUR-3	49	8	41	16,3
LCT-46 x TIP-1	42	7	35	16,7
CCN-51 x LCT-368	50	10	40	20,0
LCT-46 x AMAZ-14	44	9	35	20,5
Gloria-3 x CCAT-1858	38	10	28	26,3
TESTIGO SCA-6	33	9	24	27,3

Table 32. Number of grafted plants from seedlings selected because of their resistance to Witches broom and corresponding to the group one.

Code	Grafting date	Number of grafted plants
RI-T25-A7*	17/11/2005	1
RI-T3-A4	28/11/2005	1
RI-T39-A8	28/11/2005	13
RI-T34-A7	28/11/2005	14
RII-T13-A4	29/11/2005	3
RII-T18-A7	29/11/2005	1
RI-T5-A5	29/11/2005	1
RII-T34-A9	05/12/2005	1
RIV-T13-A3	06/12/2005	1
RIV-T34-A5	06/12/2005	1
RIV-T23-A4	06/12/2005	1
RIV-T4-A5	06/12/2005	1
RIV-T31-A5	06/12/2005	2
RIV-T31-A5	06/12/2005	2
RIV-T13-A8	06/12/2005	6
RV-T4-A5	07/12/2005	2
RV-T22-A1	07/12/2005	3
RV-T4-A2	07/12/2005	2
RV-T21-A3	07/12/2005	2
RIV-T29-A3	07/12/2005	2
RI-T13-A4	13/12/2005	7
RII-T4-A3	13/12/2005	1
RIII-T35-A2	13/12/2005	1
RI-T36-A4	13/12/2005	3
RI-T38-A6	13/12/2005	5
RI-T18-A1	13/12/2005	3
RIV-T39-A5	13/12/2005	4
RIV-T39-A5	17/01/2006	3
RII-T26-A6	13/12/2005	3
RIII-T20-A6	15/12/2005	4
RIV-T17-A5	21/12/2005	3
RV-T28-A9	21/12/2005	6
RV-T6-A2	21/12/2005	5
RI-T18-A3	21/12/2005	5
RI-T29-A4	21/12/2005	7
RV-T5-A5	21/12/2005	8
RV-T12-A3	21/12/2005	2
RIII-T28-A2	21/12/2005	2
RV-T29-A6	21/12/2005	3
RI-T30-A9	11/01/2006	4
RII-T9-A5	11/01/2006	1
RII-T37-A5	11/01/2006	2
RI-T25-A4	11/01/2006	2
RII-T38-A2	11/01/2006	1
RI-T28-A9	11/01/2006	13

Continues.....

Code	Grafting data	Grafting number
RIII-T17-A6	11/01/2006	5
RI-T16-A3	11/01/2006	3
RII-T15-A6	12/01/2006	9
RI-T13-A10	12/01/2006	5
RI-T13-A4	12/01/2006	1
RII-T32-A8	12/01/2006	3
RIII-T38-A6	17/01/2006	2
RV-T5-A1	17/01/2006	3
RIV-T17-A7	17/01/2006	4
RIII-T31-A7	17/01/2006	9
RIV-T28-A10	17/01/2006	3
RII-T31-A7	17/01/2006	1
RIII-T31-A6	17/01/2006	2
RIV-T29-A5	17/01/2006	5
RIV-T27-A1	17/01/2006	2
RV-T8-A2	17/01/2006	13
RV-T31-A5	17/01/2006	4
RIV-T30-A6	17/01/2006	1
RII-T35-A6	03/02/2006	2
RIII-T37-A10	03/02/2006	3
RIII-T13-A6	03/02/2006	3
RII-T30-A10	13/02/2006	2
RI-T17-A6	15/02/2006	6
RI-T33-A4	15/02/2006	6
RI-T39-A3	15/02/2006	9
RI-T39-A4	15/02/2006	6
RI-T31-A8	15/02/2006	4
RI-T22-A8	15/02/2006	7
RI-T8-A1	15/02/2006	6
RIII-T16-A9	22/02/2006	4
RII-T39-A5	22/02/2006	7
RII-T34-A2	22/02/2006	9
RI-T25-A10	22/02/2006	5
RIII-T30-A10	02/03/2006	7
RIV-T15-A1	02/03/2006	10
RIII-T28-A2	02/03/2006	9
RIII-T16-A4	02/03/2006	4
RIII-T7-A5	02/03/2006	4
RIII-T14-A3	02/03/2006	2
RIII-T37-A10	03/03/2006	8
RII-T30-A5	06/03/2006	3
RII-T18-A6	06/03/2006	3
RIII-T10-A1	06/03/2006	5
RIII-T31-A2	06/03/2006	6
RV-T34-A6	08/03/2006	10

* Code assigned to the selected plants R= Number Replicates; T= Number of Treatment and A= Number of plant selected inside the of Treatment (cross)

Continues.....

Code	Grafting date	Number of grafted plants
RV-T9-A10	08/03/2006	4
RV-T13-A3	08/03/2006	9
RV-T27-A2	08/03/2006	3
RV-T34-A8	08/03/2006	10
RIV-T4-A4	14/03/2006	5
RIV-T39-A5	14/03/2006	10
RV-T20-A10	14/03/2006	3
RIV-T33-A4	14/03/2006	10
RI-T13-A10	14/03/2006	7
RI-T15-A2	14/03/2006	9
RI-T5-A5	21/03/2006	11
RI-T8-A6	21/03/2006	7
RI-T28-A9	21/03/2006	16
RI-T39-A3	21/03/2006	4
RII-T9-A2	21/03/2006	14
RI-T30-A7	21/03/2006	7
RI-T25-A10	21/03/2006	5
RI-T5-A8	21/03/2006	3
RI-T13-A1	21/03/2006	3
RI-T39-A4	21/03/2006	3
RII-T20-A6	21/03/2006	6
RIV-T34-A4	21/03/2006	4
RI-T35-A5	21/03/2006	6
RI-T15-A8	21/03/2006	14
RIII-T13-A3	21/03/2006	6

* Code assigned to the selected plants R= Number Replicates; T= Number of Treatment and A= Number of plant selected inside the of Treatment (cross)

Table 33. Number of grafted plants from seedlings selected because of their resistance to Witches`s broom and corresponding to the group two.

Code	Grafting date	Number of grafted plants	Group
RI-T33-A8	06/01/2006	12	2
RII-T26-A9	06/01/2006	16	2
RII-T30-A10	06/01/2006	6	2
RII-T14-A8	06/01/2006	8	2
RII-T31-A3	06/01/2006	8	2
RIV-T30-A8	11/01/2006	1	2
RIV-T21-A5	11/01/2006	5	2
RI-T28-A10	11/01/2006	1	2
RII-T26-A9	07/02/2006	8	2
RI-T1-A10	07/02/2006	8	2
RI-T1-A10	07/02/2006	8	2
RIII-T10-A5	07/02/2006	19	2
RI-T12-A7	07/02/2006	2	2
RIII-T9-A5	07/02/2006	7	2
RII-T8-A10	07/02/2006	8	2

Continues.....

Code	Grafting date	Number of grafted plants	Group
RI-T30-A10	07/02/2006	9	2
RII-T27-A2	07/02/2006	5	2
RIV-T15-A10	08/02/2006	8	2
RIV-T21-A3	08/02/2006	4	2
RIII-T18-A6	08/02/2006	7	2
RV-T29-A1	08/02/2006	3	2
RIV-T10-A10	08/02/2006	4	2
RIV-T5-A4	08/02/2006	10	2
RIII-T16-A5	08/02/2006	4	2
RIII-T17-A3	08/02/2006	6	2
RV-T23-A4	08/02/2006	9	2
RIV-T18-A9	08/02/2006	13	2
RIV-T5-A7	08/02/2006	4	2
RIII-T19-A3	08/02/2006	17	2
RIII-T27-A4	08/02/2006	10	2
RI-T4-A9	10/02/2006	11	2
RIII-T6-A8	10/02/2006	8	2
RIV-T11-A5	10/02/2006	12	2
RIII-T24-A1	10/02/2006	9	2
RIII-T26-A4	10/02/2006	8	2
RIII-T26-A4	10/02/2006	8	2
RIII-T4-A2	13/02/2006	5	2
RII-T31-A8	13/02/2006	3	2
RII-T3-A7	13/02/2006	7	2
RI-T3-A10	13/02/2006	5	2
RI-T13-A2	13/02/2006	4	2
RI-T18-A1	15/02/2006	12	2
RII-T1-A5	22/02/2006	10	2
RII-T13-A4	22/02/2006	4	2
RIII-T20-A1	22/02/2006	12	2
RII-T34-A2	22/02/2006	5	2
RII-T9-A5	22/02/2006	8	2
RII-T21-A7	22/02/2006	3	2
RI-T10-A6	14/03/2006	5	2
RI-T13-A5	14/03/2006	15	2
RIII-T25-A10	15/03/2006	9	2
RIV-T21-A5	15/03/2006	6	2
RIV-T23-A6	15/03/2006	5	2
RIII-T27-A5	15/03/2006	11	2
RIV-T2-A4	15/03/2006	10	2
RIV-T30-A2	15/03/2006	8	2
RIII-T30-A8	15/03/2006	9	2
RIV-T20-A4	15/03/2006	4	2
RIV-T2-A9	15/03/2006	10	2
RIII-T29-A6	15/03/2006	4	2
RII-T24-A1	27/03/2006	8	2
RI-T13-A2	27/03/2006	5	2
RIV-T22-A1	27/03/2006	10	2
RI-T32-A10	27/03/2006	3	2
RIII-T9-A5	27/03/2006	4	2

Continues.....

Code	Grafting date	Number of grafted plants	Group
RV-T27-A3	27/03/2006	7	2
RV-T18-A6	27/03/2006	5	2
RI-T4-A1	27/03/2006	4	2
RIII-T29-A6	27/03/2006	4	2
RIII-T25-A6	27/03/2006	4	2
RIII-T10-A1	27/03/2006	4	2
RIV-T22-A4	27/03/2006	9	2
RIII-T7-A8	27/03/2006	10	2
SCA-12	07/12/2005	8	Parentales
D-147	14/12/2005	6	Parentales
A-645	14/12/2005	2	Parentales
TIP-1	14/12/2005	22	Parentales
B-60	14/12/2005	4	Parentales
CCN-51	22/12/2005	9	Parentales
SIL-1	22/12/2005	14	Parentales
Brisas-13	30/12/2005	7	Parentales
EET-19	30/12/2005	12	Parentales
TAP-10	21/03/2006	32	Parentales
TAP-12	21/03/2006	18	Parentales
TAP-6	21/03/2006	30	Parentales
UNAP-2	21/03/2006	20	Parentales
TAP-3	27/03/2006	23	Parentales
CUR-3	27/03/2006	25	Parentales
AMA-11	27/03/2006	26	Parentales
AMA-14	27/03/2006	27	Parentales
EBC-148	28/03/2006	25	Parentales
LCT-368	28/03/2006	31	Parentales

* Code assigned to the selected plants R= Number Replicates; T= Number Treatment and A= Number of plant selected inside the of Treatment (cross)

Table 34. Data of crosses and number of pods in the process of obtaining new segregating cocoa progenies for Witches broom resistance

Hybrids	N° of pods	Data of pollination
TIP-1 x B.60	1	08/12/2005
TIP-1 x PA-107	9	08/12/2005
TIP-1 x A-2748	4	08/12/2005
AMA-11 x B.60	1	08/12/2005
TAP-3 x B.60	2	08/12/2005
TAP-3 x A-2748	1	08/12/2005
TAP-3 x A-645	3	08/12/2005
TIP-1 x A-645	3	08/12/2005
CUR-3 x B-60	3	09/12/2005
CUR-3 x PA-107	1	09/12/2005
CUR-3 x A-645	1	09/12/2005
TIP-1 x EET-95	5	04/01/2006
TAP-6 x B.60	2	04/01/2006
TAP-6 x A.645	1	04/01/2006
TIP-1 x a-2126	4	05/01/2006
TIP-1 x LCT-368	7	05/01/2006
TIP-1 x EBC-148	5	05/01/2006
TAP-3 x EBC-148	5	05/01/2006
TAP-3 x A-2699	1	05/01/2006
CUR-3 x EET-95	2	05/01/2006
CUR-3 x LCT-368	2	05/01/2006
TOTAL	**63**	

Table 35. Advanced crosses of new segregating cocoa progenies for disease resistance

	Males																		
Females	(N° 60)	(N° 645)	A-2076	A-2126	A-2462	A-2634	A-2699	A-2748	D-147	EBC-148	EET-416	EET-446	EET-450	EET-462	EET-95	IMC-57	LCT-368	PA-107	PA-150
AMAZ-11	1																		
AMAZ-14																			
CUR-3	3	1													2		2	1	
TAP-3	2	3					1	1		5									
TAP-6	2	4																	
TIP-1	1	3		4				1		5					5		7		9
UNAP-2																			
EET-233																			
EET-387																			
EET-400																			
SIL-1																			
CCN-51																			
SNA-0707																			
SNA-0708																			
CCAT-1858																			

Phytopathological Studies

1) Early testing to evaluate disease resistance

a) Witches´ broom

Concurrent with the necessity of identifying an efficient methodology for early selection of Witches´ broom resistance in cocoa, the present project was executed to reach the following objectives: a) to develop methodological capacity for the early discrimination of disease resistance; b) To select the most efficient method for early evaluation of disease resistance; c) To describe the protocols of the methods that are selected. The study was carried out in the greenhouse and lab facilities at the Estación Experimental Tropical Pichingue. Six methods for early evaluation of disease resistance were compared through the following variables: germination of spores of ***C. perniciosa*** in leaf disks and watery extracts; seedlings inoculation applying the test of Holliday; seedling inoculation applying a modified test Holliday; semiautomatic system of inoculation or SAI; and field inoculation of young cocoa buds. Open pollination seeds and vegetative material of the clones SCA 6, SCA 12 (resistant), CCAT 4675 (tolerant), BE 10 and EET 95 (susceptible) were used. The inoculums consisted of an aqueous solution made up of 1 x 104 basidiosporas/ml.

See Table 36 for results. The germination percentage of spores in leaf disk varied between 4 and 8% in all materials. On the contrary, spore germination was above 85% in the watery extract from cocoa buds. However, both methods showed statistical differences among cultivars. When seedlings were inoculated and kept under a shelter the level of Witches´ broom incidence reached 100%. The variable cotyledon's permanency on the stem showed a good discriminatory power for resistance among the tested clones when the SAI was applied. Low infection percentages were observed when seedlings were field inoculated however statistical differences were detected for the variable period of incubation. The percentage of spore germination showed a high correlation (0.7 to 0.9) with infection percentage in branches suggesting that it would be enough to record the data of germination percentage to predict field resistance of cocoa cultivars. However the applicability of this method is questionable due to the laborious counting of spores.

The period the cotyledons stayed attached on the stem was identified as an important indicator associated with levels of Witches´ broom resistance in the SAI inoculated plants and hence with power to discriminate among clones tested in the study. This variable was highly correlated with infection percentage of plants in the field suggesting its value as predictor of disease resistance in the field. The simplicity, practicality and precision of this method make it more valuable

The study showed that although the clone SCA is not immune to Witches´ broom like it had been suggested earlier, its reaction to the disease is still important. Although the applied spore concentration is in the range that allowed distinguishing infection levels in previous studies, in this case it did not produce strong differences among clones for most variables in the study. Percentage of germination in the disks as well as in watery extracts, the permanency of the cotyledons following the SAI methodology, infection percentages of branches, infection percentages of plants; and period of incubation of cocoa buds as a reaction to field inoculation are variables showing discriminatory capacity to separate resistant from susceptible clones. The methodologies based on the counting of germinated spores to discriminate for resistance did not fulfilled requirements of simplicity and hence are limited as a discrimination tool. The best performing method was the SAI.

Table 36. Comparison of variables registered in the methods for early evaluation of resistance to *C. perniciosa*.

CLON	Methods of Early Evaluation										
	GEDH	GEEA	Test de Holliday		Test of Modified Holliday		SAI		IPC		
	% de Ger.	% de Ger.	P. I	P.C	P. I	P.C	P. I	P.C	% of infection		P.I
									Branch	Plant	
	Chi2: 10.67 *	Chi2: 18.43 **	Chi^2: 2.70 ns	Chi^2: 1.73 ns	Chi^2: 2.30 ns	Chi^2: 2.88 ns	Chi^2: 2.27 ns	Chi^2: 18.97 **	Chi^2 : 10.64 *	Chi^2 : 15.33 **	Chi^2 : 9.95 **
SCA6	4.83	88.64	17.86	84.40	17.71	68.38	18.39	42.67	0.45	0.16	71.00
SCA12	4.87	89.89	16.60	81.31	17.75	78.14	19.43	41.36	3.16	2.07	42.39
CCAT4675	7.91	92.58	17.25	81.84	18.34	79.34	18.55	54.69	3.17	4.11	45.38
BE10	5.58	95.05	18.80	69.92	17.52	84.20	19.79	49.36	4.91	5.09	49.04
EET95	5.19	95.39	16.34	80.74	17.14	74.94	17.72	70.48	3.40	3.59	44.63

* **GEDH**: Germination of spores in leaf disk; **GEEA**: Germination of spores in watery extracts for buds of cocoa; **IPC:** Inoculation of plants of Cocoa in field; **Ger:** Germination; **P.I**: Period of Incubation; **PC:** Permanency of the Cotyledons.

b) Frosty Pod Rot (Moniliasis)

A study to evaluate Moniliasis 's incidence is currently ongoing. The purpose of this piece of research is to test the hypothesis about the presence in an old hybrid population of trees showing low percentages of Moniliasis' pods due to genetic resistance. In fact, earlier field observations have shown that some trees in this population had less than 15% and some as low of 6% of fruits injured by Moniliasis as compared to the total number of fruits (healthy and diseased pods), while the average percentage for the whole population was nearly 50%.

Twelve selected trees with low to moderate levels of resistance to Moniliasis, three susceptible clones (EET 19, EET 48 y EET 103) and two relatively resistant clones (SCA 12 y EET 387) are participating in the study. The pollen for artificial pollination came from the clone IMC-67. Artificial inoculations with spores of *Moniliophtora roreri* were conducted utilizing a suspension of 50,000 spores/ml of sterilized water and applying 1 ml of this suspension on pods obtained by artificial pollination. Pods are protected from the beginning to avoid the natural infection with the pathogen. Inoculation starts when these become 6 weeks old; pods continue to be protected after inoculation. Weekly observations are carried out after fruit inoculations to monitor the period of incubation. Once fruits become ripe are harvested and the extent and intensity of the disease is evaluated applying scales to measure the severity of external and internal injure of the pods.

So far one tree has not shown a reaction to inoculations, two have presented levels of infection which are quite below 30%. The clone SCA 12 reached 70 % of infection and all other trees have levels of infection which are around the expected average (> 50%). New rounds of artificial inoculations will be conducted in the next few months and more detailed results will be described in the following annual report.

c) Ceratocystis wilt

Twenty two Amazonian genotypes were chosen from the Chalmers collection. Field inoculations with *Ceratocystis fimbriata* were carried out in four trees per accession and a total of 22 accessions. Eight branches were chosen (1.5 a 2.0 cm diameter) and opened up longitudinally with a knife. Next a suspension of 30,000 infective units per milliliter was applied. Observations to monitor the reaction to the inoculation and development of the disease were made at 15 and 30 days. Results are presented in Table 37.

In a parallel study pieces of branches from four trees of each of the same genotypes (diameter 1.5 cm and 4 cm long) were inoculated with a suspension of 30,000 infective units per milliliter. These were left in a humid chamber during four days. At the forth day the mycelium and perithecium development were evaluated applying a scale ranging from 0 to 4. Results are shown in Tables 38, 39 and 40. A number of genotypes showed little development for both mycelium and Perithecium suggesting low vulnerability to the disease. A few were moderately resistant but most were susceptible.

Inoculations with *C. fimbriata* were also carried out on clonal accessions from the CGN and SNA collections both made up of Nacional genotypes. Results are shown in Tables 41 to 44. Clones EET 551 and EET 587 from the CGN collection showed some resistance to the disease in terms of mycelium and perithecium development. The clone SNA 0106 from the SNA collection showed a clear level of resistance to this disease. Most accessions in both collections were susceptible to highly susceptible.

Table 37. Volume of the necrosis caused *by Ceratocystis fimbriata* at the 15 and 30 days evaluation in Chalmers collection

GENOTYPE	Vol. E1	GENOTIPO	Vol. E2
IMC 67	0,10	**IMC 67**	0,43
ICS 95	2,61	**ICS 95**	16,64
TIP 2-5	0,09	AMAZ 10-2	0,50
AMAZ 14-3	0,12	AMAZ 9-1	0,63
TIP 2-4	0,13	TIP 2-3	0,75
AMAZ 14-4	0,14	AMAZ 4-9	0,79
AMAZ 11-6	0,17	TIP 2-4	0,84
AMAZ 1-3	0,20	AMAZ 14-2	0,92
CUR 3-5	0,23	CUR 3-4	0,99
TIP 2-10	0,23	AMAZ 1-3	1,01
TAP 3-5	0,25	AMAZ 11-4	1,04
TAP 11-1	0,25	TIP 2-10	1,06
TIP 2-3	0,25	AMAZ 10-6	1,11
AMAZ 4-10	0,28	TAP 3-5	1,15
TAP 3-7	0,29	AMA 9-4	1,21
AMAZ 11-5	0,31	AMAZ 1-1	1,29
TIP 1-2	0,31	AMAZ 14-3	1,36
AMA 9-4	0,32	AMAZ 11-6	1,38
CUR 3-4	0,33	AMAZ 1-2	1,38
AMAZ 11-4	0,34	CUR 3-2	1,45
UNAP 1-6	0,35	AMAZ 4-10	1,62
UNAP 2-8	0,35	AMAZ 11-5	1,63
AMAZ 14-2	0,36	TAP 11-1	1,63
TAP 11-5	0,37	TIP 2-5	1,77
AMAZ 11-10	0,37	AMAZ 9-7	1,79
NAP 3-6	0,38	TAP 3-9	1,89
TAP 3-9	0,38	AMAZ 14-4	1,90
AMAZ 1-2	0,39	CUR 3-5	2,03
AMAZ 4-8	0,40	TIP 1-2	2,08
TIP 4-8	0,42	TAP 10-5	2,10
AGU 17-2	0,43	TIP 4-8	2,16
AMAZ 4-9	0,43	AMAZ 10-8	2,17
AMAZ 4-3	0,44	TIP 4-1	2,22
TAP 10-7	0,46	UNAP 2-3	2,36
TIP 4-3	0,49	NAP 3-2	2,40
COC3338-4	0,51	UNAP 1-9	2,43
AMAZ 1-1	0,53	NAP 3-6	2,44
CUR 3-8	0,55	AMAZ 4-3	2,48
TAP 3-2	0,56	AMAZ 9-6	2,49
UNAP 2-3	0,57	TAP 11-4	2,58
CUR 3-2	0,59	TAP 10-2	2,69
NAP 3-3	0,59	TAP 10-7	2,83
TAP 10-3	0,61	AMAZ 4-8	2,95
AMAZ 9-7	0,62	AMAZ 11-10	3,06
UNAP 2-2	0,62	COC 3338-8	3,14

Continues.....

GENOTYPE	Vol. E1	GENOTIPO	Vol. E2
TAP 2-1	0,67	TAP 2-1	3,21
AMAZ 9-1	0,67	TIP 4-7	3,33
TIP 1-3	0,69	TAP 3-7	3,33
AGU 17-9	0,69	TAP 10-3	3,35
COC 3335-2	0,70	UNAP 2-2	3,37
AMAZ 10-2	0,71	TIP 1-3	3,38
TAP 10-2	0,73	AGU 17-6	3,40
UNAP 1-9	0,73	TAP 11-5	3,66
NAP 3-9	0,74	AMAZ 1-10	3,75
TAP 11-4	0,74	TIP 4-3	3,81
AMAZ 1-10	0,75	TAP 2-9	3,97
AGU 17-6	0,75	UNAP 2-8	3,99
TAP 11-8	0,77	COC 3335-4	4,34
COC 3338-7	0,81	AMAZ 10-4	4,34
TAP 2-3	0,82	COC3338-6	4,35
TIP 4-1	0,82	COC3338-4	4,42
NAP 3-2	0,84	NAP 3-3	5,25
TIP 1-4	0,84	UNAP 1-5	5,47
UNAP 1-2	0,88	TAP 3-2	5,59
TIP 4-7	0,91	AGU 17-3	5,92
AMAZ 10-6	0,98	UNAP 1-6	6,19
AGU 17-3	0,99	TIP 1-4	6,24
TAP 10-5	0,99	COC 3335-6	6,42
UNAP 1-5	1,04	TAP 2-3	6,44
BOB 8-6	1,04	TAP 11-8	6,46
AMAZ 9-6	1,07	SM 9-5	6,75
BOB 8-4	1,09	AGU 17-9	6,83
AMAZ 10-4	1,10	AGU 17-2	6,94
TAP 2-9	1,11	BOB 8-4	6,98
COC3338-6	1,12	UNAP 2-1	7,06
AMAZ 10-8	1,13	NAP 3-9	7,95
AMAZ 14-7	1,22	SM 9-7	8,26
COC 3338-8	1,24	COC 3335-1	8,75
COC 3335-4	1,32	COC 3338-7	9,21
BOB 8-9	1,34	SM 9-3	9,59
COC 3335-1	1,40	TAP 2-6	9,86
TIP 1-1	1,49	CUR 3-8	9,92
SM 9-9	1,70	AMAZ 14-7	10,00
UNAP 2-1	1,77	SM 9-9	10,09
SM 9-5	1,80	TIP 1-1	10,33
COC 3335-6	1,82	BOB 8-9	10,47
BOB 8-3	2,04	UNAP 1-2	10,59
TAP 2-6	2,35	BOB 8-3	12,87
SM 9-7	3,07	BOB 8-6	13,36
SM 9-3	3,19	COC 3335-2	13,40
AGU 17-9	0,69	TAP 10-3	3,35

Table 38. Mycelium development in the Amazonian clones available in the collection Chalmers at Estación Pichilingue in reaction to inoculation with C. *fimbriata.*

Reaction	Clone	Frequency
R	IMC47,IMC67-1,IMC67-2,IMC67-3,IMC67-4, AMAZ4-3,AMAZ4-8,AMAZ4-9,AMAZ4-10,AMAZ9-1,AMAZ9-4,AMAZ10-2,AMAZ10-4,AMAZ10-6,AMAZ8,AMAZ14-2,AMAZ14-3,AMAZ14-4,CUR3-5,TIP2-3,TIP2-4,TIP2-10,	22
MR	CUR3-2,CUR3-4,TIP2-5,	3
S	AMAZ1-10,AMAZ11-6,AMAZ11-1,COC3335-4,COC3338-4,COC3338-6,COC3338-8,NAP3-6,TAP2-6,TAP2-9,TAP3-7,TAP10-2,TAP10-3,TAP11-1,UNAP1-5,NAP3-9,TAP2-3,	17
HS	AGU17-2,AGU17-3,AGU17-6,AGU17-9,AMAZ1-1,AMAZ12,AMAZ1-3,AMAZ9-6,AMAZ9-7,AMAZ11-4,AMAZ11-5,AMAZ14-7,BOB8-3,BOB8-4,BOB8-6,BOB8-9,COC3335-1,COC3335-2,COC3335-6,COC3338-7,CUR3-8,NAP3-2,NAP3-3,SM9-3,SM9-5,SM9-7,SM9-9,TAP2-1,TAP3-2,TAP3-5,TAP3-9,TAP10-5,TAP10-7,TAP11-5,TAP11-4,TAP11-8,TIP1-1,TIP1-2,TIP1-3,TIP1-4,TIP4-1,TIP4-3,TIP4-7,TIP4-8,UNAP1-2,UNAP1-6,UNAP1-9,UNAP2-1,UNAP2-2,UNAP2-3,UNAP2-8, ICS95-2, ICS95, ICS-95-6,ICS-95-8,ICS-1	56

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S)= 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Table 39. Perithecium development in the Amazonian clones available in the collection Chalmers at Estación Pichilingue in reaction to inoculation with C. *fimbriata* (Laboratory).

Reaction	Clone	Frequency
R	IMC47,IMC67-1,IMC67-2,IMC67-3,IMC67-4, AMAZ4-3,AMAZ4-9,AMAZ4-10,AMAZ9-1,AMAZ9-4,AMAZ10-4,AMAZ10-6,AMAZ10-8,AMAZ14-2,AMAZ14-4,CUR3-2,CUR3-5,TIP2-3,TIP2-4,TIP2-10	20
MR	AMAZ4-8 ,AMAZ10-2,AMAZ14-3,CUR3-4,TIP2-5,	5
S	AMAZ1-10,AMAZ11-4,AMAZ11-6,AMAZ11-1,COC3335-1,COC3335-2,COC3335-4,COC3335-6,COC3338-4,COC33386,COC3338-8,CUR3-8,NAP3-2,,NAP3-6,NAP3-9,TAP2-3,TAP2-6,TAP2-9,TAP3-7,TAP3-9,TAP10-2,TAP10-3,TAP10-5,TAP11-1,TAP11-5,TAP11-8,TIP4-8,UNAP1-5,UNAP1-6,UNAP1-9,UNAP2-8,AMAZ9-7, ICS95-4ICS95-8	34
HS	AGU17-2,AGU17-3,AGU17-6,AGU17-9,AMAZ1-1,AMAZ1-2,AMAZ1-3,AMAZ9-6,AMAZ11-5,AMAZ14-7,BOB8-3,BOB8-4,BOB8-6,BOB8-9,COC3338-7,NAP3-3,SM9-3,SM9-5,SM9-7,SM9-9,TAP2-1,TAP3-2,TAP3-5,TAP10-7,TAP11-4,TIP1-1,TIP1-2,TIP1-3,TIP1-4,TIP4-1,TIP4-3,TIP4-7,UNAP1-2,UNAP2-1,UNAP2-2,UNAP2-3, ICS95-2,ICS95-6,ICS1	39

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S)= 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Table 40. Reaction to inoculation with C fimbriata of the Amazonian clones available at Estación Pichilingue in the Chalmers collection (average of mycelium and Perithecium developments).

Reaction	Clone	Frequency
R	IMC47,IMC67-1,IMC67-2,IMC67-3,IMC67-4, AMAZ10-8, AMAZ4-9,TIP2-3,AMAZ14-4,TIP2-10,AMAZ14-2,AMAZ4-3,AMAZ10-6,AMAZ9-4,AMAZ10-4,AMAZ10-2,CUR3-5,TIP2-4,AMAZ4-10,AMAZ9-1,AMAZ14-3,	21
MR	TIP2-5,CUR3-2,AMAZ4-8,CUR3-4	4
S	AMAZ1-10, AMAZ11-6,UNAP1-5,TAP2-9,AMAZ11-4,COC3338-4, COC3338-8,NAP3-6,TAP3-7,TAP10-2,AMAZ11-1,COC3335-4,COC3338-6,TAP2-6,TAP10-3,TAP11-1,NAP3-9,AP2-3, TAP3-9,	19
HS	COC3335-1,NAP3-2,TIP4-8UNAP1-6,TAP11-5,TAP118,COC3335-2,COC3335-6,CUR3-8,TAP10-5,UNAP1-9,AMAZ9-7,COC3338-7,NAP3-3,TAP3-2,UNAP2-8,AGU17-9,SM9-7,TAP2-1,TAP10-7,AMAZ11-5,UNAP2-1,BOB8-4,TAP11-4,TIP4-1,TIP1-1,UNAP1-2,AMAZ1-1,AGU17-6,AMAZ9-6,BOB8-6,TIP1-3,TIP4- 3,BOB8-9, UNAP2-2,UNAP2-3,AGU17-2,AGU17-3,AMAZ14-7,SM9-9,TIP1-2,AMAZ1-2,AMAZ1-3,BOB8-3,TAP3-5,TIP4-7,TIP1-4,SM9-5, ICS95-2,ICS95-4,ICS95-6,ICS95-8,ICS1	54

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S)= 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Table 41. Mycelium development in the clones of cacao Nacional available in the collection CGN at Estación Pichilingue in reaction to inoculation with C. *fimbriata.*

Reaction	Clone	Frequency
R	IMC 47	1
MR	EET 587, IMC 67, EET 551	3
S	EET 233, EET 527, L18 H 17	3
HS	EET 520, EET 543, EET 577,CCN 51, EET 513, EET 556, L19 H14, EET 525, EET 529, EET 555, EET 558, EET 564, EET 566, EET 510, EET 534, EET 553, EET 560, EET 572,EET 574,EET 583,ICS 1,EET 503,EET 547,EET 568, EET 582,BETANIA, EET 387, EET 507, EET 509,EET 511, EET 512,EET 516, EET 517,EET 518, EET 519, EET 521, EET 522, EET 533, EET 535,EET 536, EET 537,EET 538,EET 544,EET 545,EET 548, EET 550,EET 552, EET 559, EET 561, EET 562, EET 563, EET 567, EET 571, EET 573,EET 575, EET 576, EET 578, EET 580,EET 581, L19 H 34	60

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S)= 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Table 42. Perithecium development in the clones of cacao Nacional available in the collection CGN at Estación Pichilingue in reaction to inoculation with C. fimbriata.

Reaction	Clone	Frequency
R	IMC 47, EET 587	2
MR	EET 551, EET 233, IMC 67	3
S	CCN 51, L18 H 17, EET 525, EET 527, EET 543, EET 556, L19 H14, EET 513, EET 529, EET 566, EET 577, BETANIA, EET 511, EET 518, EET 520, EET 538, EET 544, EET 552, EET 553, EET 555, EET 558, EET 572, EET 573, EET 583, ICS 1	25
HS	EET 510, EET 519, EET 535, EET 547, EET 559, EET 564, EET 576, EET 578, EET 580,EET 387, EET 512, EET 522,EET 536,EET 537, EET 561,EET 574,L19 H 34,EET 507, EET 509, EET 517, EET 545,EET 550,EET 560, EET 563,EET 568,EET 571, EET 582, EET 534, EET 562, EET 575,EET 503, EET 521, EET 533,EET 548,EET 567, EET 516, EET 581	37

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S)= 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Table 43. Mycelium development in the clones of cacao Nacional available in the collection SNA in reaction to inoculation with C. *fimbriata.* (Laboratory).

Reaction	Clone	Frequency
R	SNA 0106	1
MR	IMC 67	1
S	SNA 0905, SNA 0437, SNA 0205, SNA 0301, SNA 0425, SNA 0430, CCN 51, SNA 0101, SNA 0407, SNA 0107, SNA 0302, SNA 1009	12
HS	SNA 0203, SNA 0428, SNA 0503, SNA 0604, SNA 0907, SNA 0410, SNA 0607, SNA 0614, SNA 0105, SNA 0204, SNA 0405, SNA 0432, SNA 0433, SNA 0436, SNA 0602, SNA 0720, SNA 0903, SNA 1005, SNA 16, SA 15, SNA 0103, SNA 0201, SNA 0412, SNA 0438, SNA 0708, SNA 0709, SNA 0719, SNA 0808, SNA 1006, SNA 0112, SNA 0202, SNA 0406, SNA 0418, SNA 0421, SNA 0422, SNA 0505, SNA 0603, SNA 0611, SNA 0701, SNA 0704, SNA 0707, SNA 0711, SNA 0902, SNA 0904, ICS 1, SNA 0102, SNA 0104, SNA 011, SNA 0303, SNA 0305, SNA 0402, SNA 0403, SNA 0408, SNA 0409, SNA 0415, SNA 0417, SNA 0419, SNA 0420, SNA 0423, SNA 0424, SNA 0501, SNA 0504, SNA 0512, SNA 0608, SNA 0609, SNA 0610, SNA 0612, SNA 0613, SNA 0703, SNA 0718, SNA 0901, SNA 0906, SNA 1001, SNA 1002, SNA 1003	75

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S)= 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Table 44. Perithecium development in the clones of cacao Nacional available in the collection SNA in reaction to inoculation with C. fimbriata.

Reaction	Clone	Frequency
R	SNA 0106, SNA 0905, SNA 0430, SNA 0101, IMC 67, CCN 51, SNA 0205	7
MR	SNA 0301, SNA 0604, SNA 0607, SNA 0437, SNA 0302, SNA 0611, SNA 1009, SNA 0425, SNA 0436, SNA 0503, SNA 0808, SNA 0902, SNA 0203, SNA 0432, SNA 0720, SNA 0907, SNA 0407, SNA 0406, SNA 0428, SNA 0433, SNA 0701	21
S	SNA 0107, SNA 0201, SNA 0602, SNA 0707, SNA 1005, SNA 1006, SNA 0105, SNA 0204, SNA 0410, SNA 0412, SNA 0420, SNA 0409, SNA 0415, SNA 0501, SNA 0612, SNA 0613, SNA 0614, SNA 0708, SNA 0709, SNA 0711, SNA 0103, SNA 0112, SNA 0305, SNA 0418, SNA 0421, SNA 0423, SNA 0424, SNA 0438, SNA 0505, SNA 0704, SNA 0719, SNA 0104, SNA 0202, SNA 0303, SNA 0402, SNA 0408, SNA 0417, SNA 0419, SNA 0422, SNA 0603, SNA 0609, SNA 0610, SNA 0703, SNA 0901, SNA 0903, SNA 0906, SNA 1001, SNA 1002, SNA 1003, SNA 16	50
HS	ICS 1, SNA 011, SNA 0405, SNA 0504, SNA 0512, SNA 0608, SNA 0403, SNA 0718, SNA 0904, SNA 0102	10

Resistant (R) = 0-1.0; Moderately Resistant (MR) = 1.1-2.0; Susceptible (S) = 2.1-3.0; Highly Susceptible (HS)= 3.1-4.0.

Finally, Photos 1 to 12 in the Annex provide an overview of some of the processes and activities carried out in the frame of the project and duly approved year's work plan.

ANNEXES

Table 1. Leaf samples collected from plants making up the collection named as "Población Nacional" and sent (September 7/2005) to the USDA (Miami) lab for DNA analysis.

Plant code	Plant code	Plant code	Plant code	Plant code	Plant code
PN -A-1	PN-C-44	PN-E-33	PN-I-9	PN-N-8	PN-Ñ-28
PN -A-4	PN-C-45	PN-E-34	PN-I-10	PN-N-9	PN-Ñ-29
PN -A-7	PN-C-46	PN-E-35	PN-I-11	PN-N-10	PN-Ñ-30
PN -A-8	PN-C-47	PN-F-1	PN-I-12	PN-N-11	PN-Ñ-32
PN-A-9	PN-D-2	PN-F-2	PN-J-1	PN-N-12	PN-Ñ-33
PN-A-10	PN-D-3	PN-F-3	PN-J-2	PN-N-13	PN-Ñ-34
PN-A-11	PN-D-6	PN-F-4	PN-J-3	PN-N-15	PN-Ñ-35
PN-B-1	PN-D-7	PN-F-5	PN-J-4	PN-N-16	
PN-B-2	PN-D-8	PN-F-7	PN-J-5	PN-N-17	
PN-B-3	PN-D-9	PN-F-8	PN-K-1	PN-N-18	
PN-B-4	PN-D-10	PN-F-9	PN-K-2	PN-N-19	
PN-B-5	PN-D-11	PN-F-10	PN-K-3	PN-N-20	
PN-B-6	PN-D-12	PN-F-11	PN-K-4	PN-N-21	
PN-B-7	PN-D-13	PN-G-1	PN-K-6	PN-N-22	
PN-B-8	PN-D-14	PN-G-2	PN-K-7	PN-N-23	
PN-B-9	PN-D-15	PN-G-3	PN-K-8	PN-N-25	
PN-B-10	PN-D-16	PN-G-4	PN-K-10	PN-N-26	
PN-B-12	PN-D-18	PN-G-6	PN-K-11	PN-N-27	
PN-B-14	PN-D-19	PN-G-7	PN-K-14	PN-N-28	
PN-C-1	PN-E-1	PN-G-8	PN-K-17	PN-N-29	
PN-C-2	PN-E-3	PN-G-9	PN-K-18	PN-N-30	
PN-C-4	PN-E-4	PN-G-11	PN-K-19	PN-N-31	
PN-C-5	PN-E-5	PN-G-12	PN-L-2	PN-N-32	
PN-C-7	PN-E-6	PN-G-13	PN-L-3	PN-N-33	
PN-C-8	PN-E-8	PN-G-14	PN-L-8	PN-N-34	
PN-C-10	PN-E-9	PN-G-16	PN-L-9	PN-N-35	
PN-C-15	PN-E-10	PN-G-17	PN-L-13	PN-N-36	
PN-C-16	PN-E-11	PN-G-18	PN-L-15	PN-N-37	
PN-C-17	PN-E-12	PN-G-19	PN-L-16	PN-N-39	
PN-C-18	PN-E-13	PN-G-20	PN-L-18	PN-N-40	
PN-C-19	PN-E-14	PN-G-21	PN-L-19	PN-N-41	
PN-C-20	PN-E-15	PN-H-2	PN-L-20	PN-N-43	
PN-C-21	PN-E-17	PN-H-3	PN-L-21	PN-N-44	
PN-C-22	PN-E-18	PN-H-7	PN-L-24	PN-Ñ-1	
PN-C-23	PN-E-19	PN-H-9	PN-M-1	PN-Ñ-2	
PN-C-24	PN-E-20	PN-H-10	PN-M-2	PN-Ñ-3	
PN-C-25	PN-E-21	PN-H-12	PN-M-3	PN-Ñ-5	
PN-C-26	PN-E-22	PN-H-15	PN-M-4	PN-Ñ-6	
PN-C-27	PN-E-24	PN-H-18	PN-M-8	PN-Ñ-9	
PN-C-29	PN-E-25	PN-I-2	PN-N-1	PN-Ñ-10	
PN-C-31	PN-E-27	PN-I-3	PN-N-2	PN-Ñ-18	
PN-C-34	PN-E-28	PN-I-4	PN-N-3	PN-Ñ-19	
PN-C-36	PN-E-29	PN-I-5	PN-N-4	PN-Ñ-20	
PN-C-40	PN-E-30	PN-I-6	PN-N-5	PN-Ñ-21	
PN-C-41	PN-E-31	PN-I-7	PN-N-6	PN-Ñ-22	
PN-C-42	PN-E-32	PN-I-8	PN-N-7	PN-Ñ-23	

Table 2. Leaf samples collected from all trees in each of the accessions available in the Chalmers collection at the Estación Pichilingue and sent (September 7 / 2005) to the USDA (Miami) lab. for DNA analysis.

Genotype	Tree N°	Replanted plant N
TAP-11	1,2,3,4,5,6,7,8,9	10
AGU-5	1,4,5,8	2,6,7,9,10
TAP-21	1,3,8	2,4,5,6,9,10
TIP-1	1,2,3,4	5,6,7,9
COCA-3338	1,2,4,6,7,8	3,10
BOB-3	1,2,4,7,8	3,5,6,9,10
TIP-2	3,4,5,10	1,2,6,7,8,9
SM-8	2,4,5,6,7,9	1,3,10
NAP-1	3,4,6,7,8,9,10	1,2,5
CUR-15	1,4,6	3,5,10,8
AMAZ-10	1,2,3,4,5,6,7,8	9,10
UNAP-2	1,2,3,8	4.5,6,7,9,10
TAP-12	1,2,3,4,5,6,7,8,9,10	
TAP-6	1,2,3,4,5,6,7,8,9,10	
TAP-2	1,2,3,4,5,6,7,8,9,10	
VILL-2	3,8	1,2,4,5,6,7,9
AGU-17	1,2,3,4,5,6,7,8,9	10
SM-9	1,3,4,5,7,8,9	2,6,10
TAP-10	1,2,3,4,5,6,7,8,9,10	
COCA-3328	1,4,5,7,8,9	6
UNAP-1	1,2,4,5,6,8,9,10	3
NAP-41	1,2,59,10	3,8,4,6
COCA-3335	1,2,4,6	3,5,7,8,9,10
AMAZ-12	1,2,3,4,5,6,7,8,9,10	
AMAZ-2	1,2,4	3,5,6,7,8,9,10
VILL-6	1,2,4,5,7,10	6,8
TAP-7	1,2,3,4,7	5,6,8,9,10
NAP-30	1,2,3,4	5,6,7,8,10
TIP-4	1,2,3,4,5,6,7,8,9,	10
NAP-25	2,4,9	1,5,6,10
BOB-8	2,3,4,5,6,8,9	1,7
TAP-5	1,2,3,4,5,6,7,8,	9,10
TAP-3	1,2,3,4,5,6,7,8,9,10	
AMAZ-9	1,2,4,5,6,7,9	3,8,10
NAP-34	6,8,10	1,2,3,4,7,9
TAP-1	1,2,3,4,5,8	6,7,9,10
NAP-3	1,2,3,5,6,8,9	4,7,10
AMAZ-14	1,2,3,4,5,6,7,8,9,10	
NAP-23	1,5,78,9	2,10
AMAZ-11	1,2,3,4,5,6,7,8,9,10	
CUR-3	1,2,3,4,5,6,8,10	7
AMAZ-4	2,3,5,6,9,10	1,4,7
AMAZ-1	1,2,3,4,5,6,7,8,9,10	
SIL-1	6	

Table 3. Leaf samples collected from trees in selected families within cocoa field named as "Lote 2A" and sent to the USDA (Miami Fl) lab for DNA analysis (January 5/ 2005).

Family			
EET-1 x SCA-6	**EET-250 x SCA-6**		**SIL-1 x SCA-6**
2689	2529	2540	2285
2690	2528	2539	2284
2691	2527	2534	2283
2692	2526	2535	2282
2693	2525	2536	2281
2694	2524	2537	2280
2695	2523	2538	2279
2696	2522	2544	2278
2697	2521	2546	2277
2698	2520	2547	2276
2699	2519	2552	2275
2700	2518	2531	2274
2701	2556	2530	2286
2702	2555	2517	2273
2703	2554	1516	2272
2704	2553	2515	2271
2706	2551	2514	2270
2707	2550	2513	2266
2708	2549	2512	2267
2709	2548	2511	
2712	2545	2510	
2714	2543	2029	
2715	2542	2529	
2716	2541		
2717			

Table 4. Leaf samples collected from selected trees in the cocoa field named as "Lote 7A" and sent (Jun 7 and July 7 2005) to the USDA (Miami, Fl) lab for DNA analysis Section B (SCA-12 x UNKNOWN).

TREE CODE	TREE CODE	TREE CODE
B-1	B-46	B-92
B-2	B-47	B-93
B-3	B-49	B-94
B-4	B-50	B-95
B-5	B-51	B-96
B-6	B-52	B-97
B-7	B-53	B-101
B-8	B-54	B-102
B-9	B-57	B-103
B-10	B-59	B-104
B-12	B-60	B-105
B-13	B-61	B-106
B-14	B-62	B-107
B-15	B-63	B-108
B-16	B-64	B-109
B-17	B-65	B-110
B-18	B-66	B-111
B-19	B-67	B-112
B-20	B-68	B-113
B-21	B-69	B-114
B-22	B-70	B-115
B-23	B-71	B-116
B-24	B-72	B-117
B-25	B-73	B-118
B-26	B-74	B-119
B-27	B-75	B-121
B-29	B-76	B-122
B-30	B-77	B-123
B-31	B-78	B-125
B-33	B-79	B-126
B-35	B-80	B-127
B-36	B-81	B-128
B-37	B-82	
B-38	B-83	
B-39	B-84	
B-40	B-86	
B-41	B-87	
B-42	B-88	
B-43	B-89	
B-44	B-90	
B-45	B-91	

Continues.....

TREE CODE	TREE CODE	TREE CODE
B – 129	B – 184	B – 260
B – 130	B – 185	B – 261
B – 131	B – 187	B – 262
B – 132	B – 189	B – 264
B – 134	B – 191	B – 267
B – 135	B – 193	B – 269
B – 136	B – 194	B – 270
B – 137	B – 198	B – 271
B – 138	B – 199	B – 272
B – 139	B – 203	B – 273
B – 140	B – 204	B – 274
B – 141	B – 205	B – 275
B – 142	B – 206	B – 277
B – 143	B – 207	B – 278
B – 144	B – 209	B – 279
B – 145	B – 210	B – 280
B – 146	B – 211	B – 281
B – 147	B – 213	B – 283
B – 148	B – 216	B – 284
B – 149	B – 217	B – 285
B – 150	B – 218	B – 291
B – 151	B – 219	B – 293
B – 154	B – 224	B – 295
B – 155	B – 225	B – 296
B – 156	B – 226	B – 297
B – 157	B – 227	B – 298
B – 159	B – 228	B – 300
B – 160	B – 230	B – 301
B – 161	B – 231	B – 303
B – 162	B – 232	B – 304
B – 165	B – 233	B – 305
B – 167	B – 234	B – 306
B – 168	B – 236	B – 308
B – 169	B – 237	B – 309
B – 170	B – 239	B – 310
B – 171	B – 242	B – 311
B – 172	B – 245	B – 312
B – 173	B – 247	B – 313
B – 174	B – 248	B – 314
B – 175	B – 250	B – 315
B – 177	B – 254	B – 316
B – 179	B – 255	B – 317
B – 180	B – 256	B – 318
B – 181	B – 257	B – 319
B – 182	B – 259	B – 320
B – 183		

Continues.....

Leaf samples collected in selected trees of Section C (SCA-6 x SIL-1) were sent on January 5 of 2006

TREE CODE	TREE CODE	TREE CODE	TREE CODE
C1	C59	C122	C182
C2	C60	C123	C183
C3	C61	C124	C184
C4	C62	C125	C185
C5	C63	C126	C186
C6	C64	C127	C187
C7	C65	C128	C188
C8	C66	C129	C189
C9	C67	C131	C190
C10	C68	C132	C191
C11	C69	C133	C192
C12	C70	C134	C193
C13	C71	C136	C195
C14	C72	C137	C196
C15	C73	C138	C197
C16	C74	C139	C198
C17	C75	C141	C199
C18	C76	C142	C200
C19	C78	C143	C201
C20	C80	C144	C202
C21	C81	C145	
C22	C82	C146	
C23	C83	C147	
C24	C85	C148	
C25	C86	C149	
C26	C87	C150	
C28	C88	C151	
C29	C89	C152	
C30	C90	C153	
C31	C91	C154	
C32	C92	C155	
C33	C93	C156	
C35	C94	C157	
C36	C95	C158	
C37	C96	C159	
C38	C98	C160	
C39	C99	C161	
C40	C100	C162	
C42	C102	C163	
C43	C103	C164	
C44	C106	C165	
C45	C107	C166	
C46	C108	C168	
C47	C109	C170	
C48	C110	C171	
C49	C111	C172	
C50	C112	C173	
C51	C113	C174	
C52	C114	C175	
C53	C115	C176	
C54	C116	C177	
C55	C117	C178	
C56	C118	C179	
C57	C120	C180	
C58	C121	C181	

Continues.....

Leaf samples collected from selected trees of Section F (SCA-6 x SIL-5) were sent on January 5/2006.

TREE CODE	TREE CODE
F 1	F 42
F 2	F 45
F 5	F 46
F 6	F 47
F 8	F 48
F 9	F 49
F 10	F 50
F 11	F 53
F 12	F 54
F 13	F 60
F 14	F 62
F 15	F 63
F 16	F 64
F 17	F 65
F 20	F 67
F 21	F 68
F 22	F 69
F 23	F 70
F 24	F 72
F 25	F 73
F 26	F 74
F 27	F 75
F 28	F 76
F 30	F 79
F 31	F 80
F 32	F 81
F 33	F 83
F 34	F 84
F 35	F 85
F 36	F 86
F 37	F 88
F 38	F 89
F 39	

Table 5. Updating of the surviving plants in the cocoa field named as "Lote Hiler" made up of several hybrid families produced in early 1970 to study segregation for Ceratocystis fimbriata resistance.

CROSSES	Planting date	Original Population	Updated number of plants	Dead Plants
SCA-6 x Silecia 1	1968-69	29	11	18
5683 polinizacion libre	1968-69	8	3	5
EET-184 x EET-400	1971	9	7	2
X2 mezcla de varios cruces	1968-69	16	10	6
IMC-67 x EET-228	1971	9	6	3
IMC-67 x EET-400	1968	34	30	4
IMC-51 x EET-400	1969	8	8	0
IMC-67 x EET-236	1968-69	45	21	24
(SCA-6 x ICS-6)x(IMC-67 x SCA-6)	1971	7	6	1
IMC-67 x EET-121	1968-69	61	24	37
(EET-103xEET-387)x(IMC-67 x SCA-6)	1971	7	4	3
IMC-67 x EET-129	1968-69	104	73	31
(SCA-6 xEET-62)x(IMC-67 x SCA-6)	1971	8	7	1
EET-400 x IMC-67	1968-69	231	207	24
EET-400 x EET-399	1971	13	12	1
EET-399 x IMC-67	1968-69-71	318	264	54
(SCA-6 x EET-95)x(IMC-67 x SCA-6)	1971	17	8	9
IMC-67 x EET-407	1969	38	17	21
IMC-67 x EET-121	1971	20	18	2
IMC-67 x EET-409	1969-1971	20	13	7
X2 (Varios cruces)	1969-1971	21	16	5
(ICS-6 x SCA-12) x (IMC-67 x SCA-6)	1971	22	14	8
X1 (Varios cruces)	1969-71	44	23	21
IMC-67 x EET-236	1969-71	22	19	3
Árbol 5723 x EET-400	1971	22	19	3
EET-400 x IMC-67	1971	62	51	11
Árbol 176 x EET-399	1971	20	16	4
IMC-67 x EET-400	1971	76	54	22
Árbol 176 pol. libre	1971	19	10	9
IMC-67 x EET-399	1968-69	54	46	8
Árbol 143	1968-69	17	9	8
Árbol 176	1968-69	17	16	1
Árbol 277	1968-69	17	14	3
Árbol 5604	1968-69	17	13	4
Árbol 5715	1968-69	17	13	4
Árbol 5723	1968-69	17	14	3
SPA-9	1968-69	17	8	9
Poud 12	1968-69	17	10	7
EET-399	1968-69	17	14	3
EET-400	1968-69	17	11	6
IMC-67	1968-69	34	23	11
EET-369	1968-69	16	0	16
EET-400	1968-69	16	10	6
Árbol 32 (132)	1968-69	16	9	7
Árbol Hiler	1968-69	17	8	9
SCA-6	1968-69	16	2	14
SCA-12	1968-69	16	2	14
Silecia-1	1968-69	15	5	10

Continues.....

CROSSES	Planting	Original Population	Updated number of plants	Dead Plants
ICS-1	1968-69	13	7	6
ICS-95	1968-69	13	11	2
Silecia 8 (en álgunas notas)	1968-69	12	0	12
IMC-67x EET -236	1968-69	11	3	8
EET-400 x Árbol 176	1968-69	6	2	8
IMC-67 x Árbol 277	1968-69	22	20	2
ICS-95 x IMC-67	1968-69	4	3	1
IMC-67 x EET-400	1968-69	75	54	21
EET-400 x IMC-67	1968-69	46	32	14
IMC-67 x EET- 399	1968-69	60	44	16
EET-399 x IMC-67	1968-69	144	87	57
Árbol 5723 x Árbol 143	1968-69	8	5	3
Árbol 277 x IMC-67	1968-69	9	8	1
(IMC-67 x SCA-6) x EET-19	1968-69	8	3	5
5604	1968-69	2	2	0
(IMC-67 x SCA-6) x EET-400	1968-69	110	71	39
(IMC-67 x SCA-6) x (ICS-6 x SCA-12)	1968-69	27	17	10
(EET-96 x SCA-6)x (IMC-67 x SCA-6)	1968-69	17	10	7
(EET-19 x IMC-67)x SCA-12	1968-69	19	7	12
IMC-67 x Árbol 5600	1968-69	33	14	19
(IMC-67 x SCA-6) x EET-62	1968-69	20	13	7
(SCA-6 x EET-95) x EET-400	1968-69	10	4	6
IMC-67 x EET-162	1968-69	23	14	9
IMC-67 x EET-399	1968-69	87	75	12
ICS-1 x EET-400	1971	21	9	12
EET-399 x IMC-67	1971	540	439	191
Varios cruces (X3)	1971	9	4	5
EET-60 x EET-400	1971	9	5	4
(EET-400 x IMC-67) x SCA-6	1971	8	4	4
Árbol 5723 x EET-400	1971	9	2	7
EET-400 x (ICS-6 x SCA-6)	1971	9	4	5
SCA-6 x SCA-12	1970	9	1	8
EET-399 x EET-397	1971	9	2	7
SCA-6 x Silecia-8	Ene/69-70	9	4	5
Árbol 277 x EET-400	1971	10	6	4
Árbol 5653 polinización libre	1970	10	0	10
Árblo 5715 x Árbol 277	1971	10	6	4
Árblo 5715 x Silecia-8	1970	10	5	5
IMC-67 x EET-407	1971	10	3	7
SCA-12 x Silecia-1	Ene/69-70	11	8	3
IMC-67 x SCA-6	1971	11	7	4
Árbol 5683 polinización libre	1970	23	11	12
Pound 12 polinización libre	1971	13	7	6
EET-140 x EET-400	1971	13	9	4
SCA-6 x Silecia-1	1970	43	27	16
IMC-67 x Árbol 5715	1970	16	7	9
SCA-12 x SCA-12	1970	107	82	25

Continues.....

CROSSES	Planting date	Original Population	Updated number of plants	Dead Plants
EET-369 x Árbol 277	1971	20	16	4
Árbol 5715 (polinización libre)	Ene/69-70	41	25	16
EET-369 x Árbol 176	1971	21	14	7
EET-61 x IMC-67	1970	5	0	5
EET-272 x IMC-67	1970	65	50	15
IMC-67 x EET-19	1970	22	8	14
IMC-67 x EET-59	1970	45	9	36
EET-48 x IMC-67	1970	23	12	11
EET-19 x EET.399	1970	46	25	21
EET-58 x IMC-67	1970	23	14	9
IMC-67 x EET-114	1970	23	4	19
(IMC-67 x SCA-6)x(EET-103 x EET-387)	1971	23	9	14
IMC-67 x ICS-95	1971	124	71	53
IMC-67 x EET-369	1971	26	19	7
IMC-67 x Árbol 277	1971	26	21	5
IMC-67 x Árbol 5715	1971	26	22	4
IMC-67 (libre polinización)	1971	27	17	10
Árbol 277 x Árbol 143	1971	27	20	7
EET-399 x Árbol 5715	1971	26	24	2
EET-369 x IMC-67	1971	26	11	15
Árbol 277 x IMC-67	1971	26	19	7
EET-400 x Árbol 176	1971	26	21	4
EET-399 x Árbol 143	1971	25	20	5
EET-400 x Árbol 5715	1971	23	19	4
EET-399 x Árbol 176	1971	64	50	14
Árbol 5723 x IMC-67	1971	95	73	22
IMC-67 x Árbol 5723	1971	73	48	25
Árbol 5723 x Pound 12	1971	54	44	10
(IMC-67 x SCA-6)x EET-19	1971	35	28	7
IMC-67 x ICS-1	1971	50	29	21
ICS-95 x EET-400	1971	47	30	17
EET-399 x EET-409	1971	16	10	6
Árblo 176 x Árbol 5723	1971	15	12	3
Árblo 176 polinización libre	1971	14	9	5
IMC-67 x EET-121	1971	15	6	9
ICS-1 x EET-400	1971	27	15	12
(IMC-67 x SCA-6)x ICS-6	1971	27	14	13
EET-369 x Árbol 5715	1971	47	21	26
(SCA-6 x EET-95) x EET-400	1971	30	18	12
EET-399 x EET-369	1971	59	27	32
Árblo 5723 x Árbol 277	1971	48	37	11
Árblo 5715 x Silecia-8	1971	33	23	10
EET-369 (plinización libre)	1971	12	8	4
EET- 409 x EET-400	1971	12	9	3
TSH-644 (plinización libre)	1971	22	17	5
EET- 400 x EET-392	1971	11	8	3
EET- 96 x IMC-67	1971	20	8	12
EET-369 x EET-399	1971	9	3	6
EET-369 x Árbol 143	1971	7	5	2
Total		**4985**	**3378**	**1700**

Table 6. Characteristics of superior tress selected in an old hybrid population planted in a field named as "Lote 2 A" and which are currently being tested as clones in multisite trials in the Ecuadorian Amazonía.

Genotype	Code		Seed Index	Pod Index	Nº Witches brooms*	Nº of pods**		Disease pods**	
	Tree	EET				Totals	Healthy	Nº pods Monilia	Nº pods Brooms
EET 313 x SCA 12	2507	600	1.33	16.49	20	369	253	69	47
EET 313 x SCA 12	2506	601	1.11	18.75	0	306	177	78	51
H 89 x EET 166	2361	602	1.35	18.99	24	344	249	49	46
EET 166 x EET 84	2248	603	1.3	26.6	25	592	247	220	125
EET 238 x SCA12	2184	604	1.2	25.24	80	260	475	107	87
EET 48 x EET195	2126	605	1.17	23.72	3	433	362	39	32
EET 192 x EET 237	2078	606	1.36	23.57	11	249	187	45	17
EET 192 x EET 237	2076	607	1.10	22.72	32	390	308	30	52
EET 252 x EET 174	2607	608	1.10	24.07	13	430	250	121	59
EET 252 x EET 174	2634	609	1.39	28.7	78	548	436	80	32
EET 1 x EET 11	2699	610	1.16	33.80	17	456	413	18	25
EET 1 x EET 11	2717	611	1.02	25.00	19	544	282	199	63
EET 280 x EET 274	2735	612	1.32	19.12	25	369	143	175	51
EET 280 x EET 274	2744	613	1.22	20.5	18	728	439	211	78
DESCONOCIDA	2748	614	1.23	23.43	28	389	339	32	18
DESCONOCIDA	2787	615	1.03	24.1	7	353	213	71	69

* Evaluated in June of 2003

**Accumulated data (period July 2003 to June 2004)

Geografic location of the multisite trials in the Amazonia region.

Figure. 1 Location of the multisite trials to evaluate the adaptation of new cocoa clones in the Amazon region.

Geographic location of the multisite trials in the Ecuadorian coast

Figure 2. Geographic location of the experiments to evaluate the adaptation of new cocoa clones along the coastal region.

Table 7. Fourth group of progenies placed within the cocoa field with natural high inoculum pressure to test early resistance for Witches´ broom.

Treatment	Families	Treatment	Families
1	Brisas-16 x CCAT-4688	15	CCN-51 x LCT-368
2	LCT-46 x LCT-37	16	LCT-37 x UNAP-2
3	Gloria-3 x CCAT-1858	17	Gloria-3 x EB-10-13
4	SIL-1 x D.147	18	LCT-37 x CUR-3
5	LCT-46 x TAP-10	19	Brisas-13 x EB-2237
6	LCT-37 x AMAZ-11	20	LCT-37 x AMAZ-14
7	EET-58 x 2057	21	LCT-37 x TAP-3
8	Brisas-30 x EB-2237	22	LCT-46 x CUR-3
9	EET-58 x 2416	23	LCT-37 x EBC-148
10	LCT-37-TIP-1	24	LCT-46 x AMAZ-14
11	LCT-46 x TAP-12	25	**TESTIGO SCA-6**
12	LCT-46 x TIP-1	26	**TESTIGO SCA-12**
13	EET-233 x D.147	27	**TESTIGO EET-19 (AUT)**
14	LCT-37 x LCT-368		

Figure 3. Map showing the field distribution of seedlings as well as distribution of selected plants corresponding to first group of families placed in the in the cocoa field with high natural infection inoculum (to test Witches´ broom resistance)

Figure 4. Map showing the field distribution of seedlings as well as distribution of selected plants corresponding to second group of families placed in the in the cocoa field with high natural infection inoculum (Witches´ broom resistance)

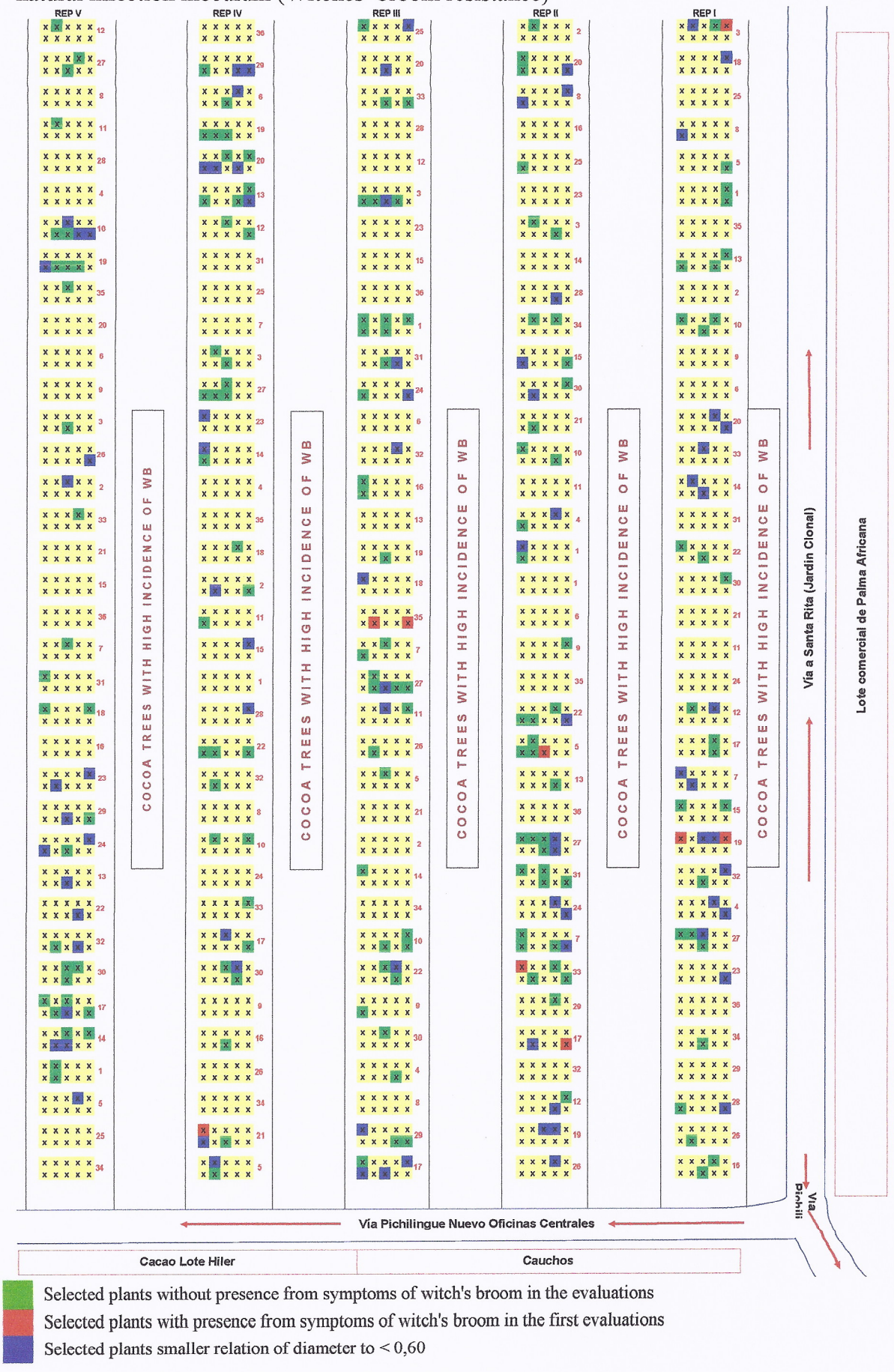


Photo 1. Cocoa seedlings showing resistance and susceptibility to Witches´broom.






Photo 2. Steps followed in the process of cloning the Witches´broom resistant seedlings

Photo 3. Steps followed in the process of setting up new nursery facilities for the clones obtained from selected Witches´broom resistant seedlings.

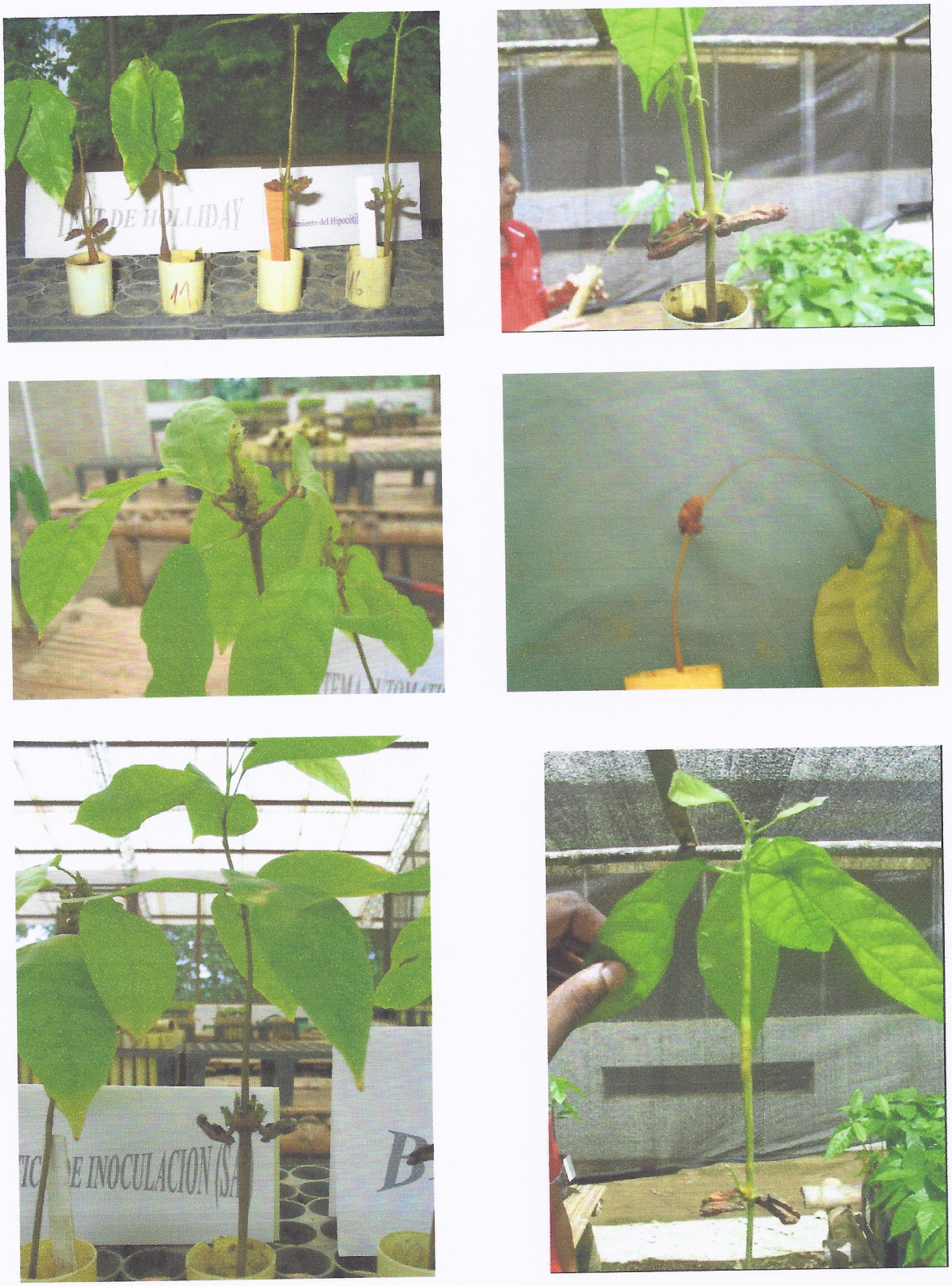


Photo 4. Witches broom symptoms in artificially inoculated cocoa seedlings as part of the study to develop early testing methods for disease resistance.

Photo 5. Steps followed in the preparation, storing and conservation of Witches´broom inoculums for artificial inoculations of cocoa seedlings.

Photo 6. Some views of the SAI system for artificial Witches´broom inoculation of cocoa seedlings

Photo 7. Overview of the process followed to test resistance to *Ceratocystis fimbriata* through artificial inoculation in accessions of the Chalmers collection.

Photo 8. MASTERFOOD and USDA staff visitors discussing and observing some of the ongoing project activities.

Photo 9. An overview of the process of fermentation and obtention of cocoa liquor samples from superior trees selected in the field named as "Lote 2A".

Photo 10. An overview of some plots in the multisite trials established in the Amazonía region to evaluate adaptation of the clones obtained from the superior cocoa trees selected in the field named as "Lote 2A" at Estación Pichilingue.






Photo 11. USDA/ARS and INIAP staff member visiting E. Napo-Payamino and multilocal trials in the Amazonía region.






Photo 12. USDA/ARS and INIAP staff member visiting and evaluating project activities at EET.Pichilingue.