

OUTPUT 6
Development of genetic stocks and improved gene pools adapted to the sub-humid environments.

Activity 6.1. Evaluations and selections in the Mid-altitude Valleys Environment

Activities developed for the Mid-altitude Valleys environment were centralized initially in CIAT Experimental Station, in Palmira Valle del Cauca Department. Table 6.1 lists the most relevant trials, whereas the other tables show results specific to each one.

Table 6.1. Trials conducted in the Mid-altitude Valleys environment during the 2003-2004 cycle.

Type of Trial	Location	Genotypes (# plants)	Reps	Observations
Clonal evaluation trial	Palmira	882 (7)	3	Tables 6.2-6.4
F1C1 nursery	Palmira	884 (1)	1	--
Preliminary yield trial 1	Palmira	100 (10)	3	See Table 6.5
Preliminary yield trial 2	Palmira	100 (10)	3	See Table 6.6
Preliminary yield trial 3	Palmira	100 (10)	3	See Table 6.7
Preliminary yield trial 4	Palmira	36 (10)	3	See Table 6.8
Preliminary yield trial 5	Palmira	36 (10)	3	See Table 6.9
Preliminary yield trial 6	Palmira	36 (10)	3	See Table 6.10
Regional Trial	La Dolores	28 (20)	3	See Table 5.12
Regional Trial	Montelindo	20 (20)	3	See Table 6.13

To take advantage of the crosses made that resulted in F1 plants grown at Palmira that failed to produce enough stakes to be included in the **Clonal Evaluation Trial (CET)** an F1C1 trial is planted. In the case of the Mid-altitude Valleys Environment 884 genotypes were in this situation (Table 6.1) and were, therefore, planted in a trial that is actually a multiplication nursery. There is very little selection in these “trial” within the new scheme of selection and evaluation. For the Mid-altitude Valleys environment plants that show any symptom resembling those of Frog Skin Disease are discarded and stakes from them are not collected.

As mentioned in Output 3 (Table 3.5) a total of 4302 seeds were germinated and 3144 seedlings from these botanical seeds (targeting this particular environment) were transplanted at CIAT-Palmira in an isolated field. The planting of the F1 stage is isolated to reduce as much as possible infection by diseases that can be found at later stages of the evaluation process. Seedlings from botanical seed are considered to be disease-free and efforts are made to maintain this condition for as long as it can possibly be done. Enough vegetative cuttings from 1050 10-months old plants (grouped in 51 families) from the F1 nursery planted the previous year could be obtained and planted in the CET for the mid-altitude valleys (Valle del Cauca Department) on June, 2004. The trial will be harvested in April-May 2005. In addition a second CET trial with 369 clones from the F1C1 was also planted.

Table 6.2. Results from the **Clonal Evaluation Trial** divided into three blocks and conducted in CIAT Experimental Station (Valle del Cauca Department). Statistics of the 60 clones selected and all the clones evaluated in each block are presented.

	Plant type (1-5)	Fresh root yield (t/ha)	Foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry root yield (t/ha)	Selection Index
60 selected clones from Block-1							
Maximum	4.0	49.5	58.6	0.65	45.1	19.4	39.9
Minimum	1.0	22.4	12.4	0.38	28.9	9.3	8.6
Average	2.6	36.1	30.5	0.55	38.1	13.7	21.9
St. Deviation	0.8	6.6	8.8	0.06	3.2	2.3	7.4
Performance of the 294 clones evaluated in Block -1							
Maximum	5.0	49.5	59.5	0.67	46.6	19.4	39.9
Minimum	1.0	0.0	5.5	0.00	20.7	0.7	-126.2
Average	2.9	25.7	27.5	0.48	35.2	9.1	-0.2
St. Deviation	0.9	8.9	10.3	0.09	4.4	3.5	19.0
60 selected clones from Block-2							
Maximum	4.0	50.1	51.6	0.81	56.7	20.0	49.4
Minimum	1.0	26.0	10.7	0.42	31.0	10.9	7.9
Average	2.7	39.0	29.5	0.58	38.7	15.0	25.0
St. Deviation	0.7	6.5	9.2	0.07	4.0	2.4	8.4
Performance of the 294 clones evaluated in Block -2							
Maximum	5.0	50.1	59.4	0.81	56.7	20.0	49.4
Minimum	1.0	1.3	2.0	0.18	22.8	0.4	-56.9
Average	3.0	24.5	23.0	0.51	35.0	8.8	0.0
St. Deviation	0.8	10.6	10.2	0.10	4.3	4.3	18.5
60 selected clones from Block-3							
Maximum	4.0	65.9	69.0	0.76	47.2	22.6	39.5
Minimum	1.0	21.6	10.8	0.42	34.3	8.9	15.5
Average	2.9	37.9	28.4	0.59	38.7	14.6	22.7
St. Deviation	0.8	8.4	12.9	0.07	2.1	2.8	6.0
Performance of the 294 clones evaluated in Block -3							
Maximum	5.0	65.9	69.0	0.81	47.2	22.6	39.5
Minimum	1.0	3.0	5.5	0.14	26.9	0.9	-58.9
Average	3.2	26.2	24.1	0.52	36.3	9.5	0.0
St. Deviation	0.8	9.8	10.6	0.10	3.1	3.8	17.3

Clonal Evaluation Trials are very large experiments around one hectare in size. A major constraint in their evaluation is the experimental error associated with the unavoidable variation in environmental conditions in such a large experimental plot. Because this is the first evaluation and selection stage (See Output 3) only 7 stakes are available from each genotype. Replication of each clone, therefore, is difficult to implement. On the other hand clones are grouped in either full- or half-sib families. Since many clones are generally available from each family they are randomly allocated in one of three blocks in which the field is divided. In other words instead of planting all the clones from a given family together one after the other, they are split in three groups, which are planted in the three blocks the

entire evaluation is divided into (Figure 4.1).

A summary of the results from the *CET* for the mid-altitude valleys environment harvested this year is presented in Table 6.2. The 882 clones included in the *CET* (as well as few checks) were planted in three blocks with 294 clones each. Table 6.2 provides information on the averages for each of the three blocks. The variation among these three blocks is an error that eventually affects the selection process. By selecting within each block, however, this environmental effect could be effectively avoided. Since selection indexes were calculated within each block there is no major variation for this variable across blocks. On the other hand the average fresh root yields were 25.7, 24.5, and 26.2 t/ha respectively for Blocks 1, 2 and 3. This highlights the large environmental variation that is overcome by stratifying the selection within each block. This difference of almost 2 t/ha in fresh root yield (blocks 2 and 3), it should be pointed out, was found in CIAT Experimental Station which has very uniform conditions compared with those in the sub-humid and acid-soils environments.

Table 6.3. Results from the **Clonal Evaluation Trial** grown in Palmira (Valle del Cauca Department). The results from all the clones from a given family have been grouped. Therefore family data is combined across the three blocks in which the trial was divided into.

Family	Size	# selected clones	Selection Index	Family	Size	# selected clones	Selection Index
GM 509	22	12	11.97	CM 9919	6	1	-2.58
GM 254	10	5	10.18	GM 555	19	2	-2.87
CM 9953	21	11	8.24	GM 308	35	8	-3.29
GM 284	20	7	7.91	SM 2985	21	3	-3.39
GM473	13	3	6.09	GM 374	34	5	-3.75
CM 9903	24	9	4.52	SM 3087	28	6	-4.07
CM 9901	27	10	4.39	GM 228	18	2	-6.28
SM 3096	23	7	3.92	GM 314	16	2	-6.31
GM 230	15	4	3.31	SM 3090	11	2	-6.33
SM 3091	29	9	3.18	CM 9920	3		-6.36
GM 370	4	1	2.59	GM 372	17	3	-6.64
GM 309	17	7	2.59	GM 373	26	2	-7.20
GM 260	4	1	2.15	SM 2860	12	1	-7.66
GM 291	18	5	1.43	SM 3085	34	6	-8.77
GM 295	20	3	1.30	GM 306	26	0	-9.79
GM 292	16	3	1.13	SM 3094	14	0	-9.82
SM 3097	16	4	0.51	GM 501	11	2	-10.02
GM 266	11	3	0.18	GM 375	21	1	-10.18
GM 268	15	4	-0.57	SM 3099	22	0	-10.37
GM 269	9	2	-0.62	SM 3092	26	6	-11.08
SM 2859	3	0	-0.96	GM 503	23	1	-11.23
SM 2802	20	3	-1.10	GM 502	14	1	-13.72
GM 297	36	7	-1.21	SM 3098	29	3	-20.17
SM 2983	7	1	-2.25				
SM 2982	13	2	-2.38	TOTAL	879	180	-.-

On average the 180 clones selected across the three blocks yielded 14.4 t/ha of dry matter. The highest dry matter yield, among the selected clones, reached 22.6 t/ha and the minimum was 8.9 t/ha. Both extremes were found in block 3 from the *CET* (Table 6.2).

In Table 6.3 the size (number of clones) and the number of selected clones from each family has been consolidated. This data has been obtained by combining information of the three blocks in which the *CET* was divided into. The average selection index has also been included. The use of selection index has been already described in Output 3.

Table 6.4. Results from all the progenies of a given clone evaluated in the **Clonal Evaluation Trial**. These results give an approximation of the breeding value of each parent involved in this trial.

Progenitor	# Fam.	# clones	Selec. clones	Plant type (1-5)	FRY (t/ha)	FFY (t/ha)	HI (0-1)	DMC (%)	DMY (t/ha)	Sel. Ind.
SM 1219-9	11	193	66	2.9	25.7	22.8	0.53	37.1	9.7	2.6
SM 1636-24	2	35	11	3.1	28.6	24.4	0.54	37.3	10.7	5.6
SM 1741-1	9	172	49	2.8	25.8	22.7	0.54	36.8	9.6	2.1
SM 1665-2	1	18	5	3.1	25.1	22.3	0.52	37.8	9.6	1.4
CM 6740-7	8	157	40	3.0	26.5	27.0	0.50	36.5	9.8	-0.6
SM 1278-2	4	52	13	3.4	22.3	17.2	0.56	37.8	8.5	0.7
CM 8370-11	1	13	3	2.9	25.1	18.1	0.59	38.5	9.7	6.1
CM 8151-1	1	13	3	2.9	25.1	18.1	0.59	38.5	9.7	6.1
SM 1673-10	3	35	8	3.1	21.2	16.7	0.56	37.0	8.0	0.9
SM 1557-17	3	71	15	3.0	27.3	28.9	0.49	35.7	9.8	-2.2
MECU 72	5	110	21	3.0	26.1	28.8	0.48	35.0	9.3	-3.3
SM 1460-1	3	57	10	3.3	23.2	23.0	0.50	33.0	7.9	-10.5
SM 1565-17	1	6	1	3.0	23.2	25.5	0.50	34.4	8.3	-2.6
MTAI 8	3	51	8	3.3	23.4	23.7	0.50	36.9	8.8	-2.9
SM 2219-11	1	20	3	2.9	27.1	22.8	0.54	35.1	9.5	1.3
CM 2772-3	7	149	20	2.9	26.6	25.9	0.51	33.1	8.9	-5.2
HMC 1	1	16	2	3.5	25.6	30.0	0.46	35.5	9.1	-6.3
MPER 183	3	91	10	3.0	23.8	27.7	0.46	33.0	8.1	-10.4
SM 1210-4	6	82	9	3.5	23.5	24.6	0.49	35.1	8.3	-6.9
SM 1660-4	3	67	7	3.3	24.3	24.0	0.50	35.0	8.6	-5.5
CM 7951-5	3	21	2	2.9	21.5	20.2	0.53	35.2	7.7	-5.5
SM 1689-18	1	21	1	2.6	22.4	19.4	0.53	30.5	6.9	-10.2

FRY=Fresh root yield; **FFY**= Fresh Foliage yield; **HI**= Harvest Index; **DMC**= Dry matter content; **DMY**=Dry matter yield; **Sel.Ind.**= Selection Index.

Family GM 509 had 22 clones scattered in the three blocks of the *CET*. Twelve of these clones (55%) were selected (Table 6.3). The average selection index for this family was 11.97. A family with an average performance would have a selection index around zero. Positive selection indexes mean an average performance better than the mean of the population. A negative selection index, on the other hand, suggests a performance below the mean of the population. In the case of family GM 509, it is obvious that the general performance of that family was outstanding because its selection index (averages across the 22 clones that conformed this family) was 11.97. Moreover, the average selection pressure in the whole *CET* was 20% and this family had a much higher percentage of selected clones (55%).

At the bottom of the right side of Table 6.3 concentrate the worst performing families. For instance Family SM 3098 had 29 clones scattered in the three blocks of the *CET*. Only three of them were selected (10%). As expected the average selection index for this family was negative (-20.17).

The information from Table 6.3 can be further consolidated around the average performance of each progenitor used to generate the *CET*. This is so because each progenitor can be used to produce more than one family. For instance Clone SM 1219-9 (Table 6.4) was used as one of the progenitors in eleven full- or half-sib families. Table 6.4 provides information for the most important characteristics of the progenies from each parent. This information is very closely related to the GCA estimates and reflects the breeding value of each progenitor. This information is very useful for defining the parents to be included in the crossing nurseries in the future.

The parental clones listed in Table 6.4 have been ordered based on the proportion of clones selected. Clone SM 1219-9 was used, as stated above, in eleven families, which combined included a total of 193 clones, 66 of them were selected (34%). On the other hand, at the bottom of Table 6.4 it is clone SM 1689-18. This clone participated in just one family with 21 clones with an average selection index of -10.2. As expected, a low proportion of clones making up this family were selected (one clone out of the 21 evaluated).

As explained in Output 3 (Figure 3.1) the following step in the selection process is the **Preliminary Yield Trial** or **PYT**. Clones evaluated in these trials are those selected during the *CET* conducted the previous year. The seven plants from the *CET* produce more than 30 stakes. Therefore, they are planted with three replications of 10-plant plots. Each experimental plot consists of two rows with five plants each. Since selections at the *CET* stage are conducted in there different blocks selections within each block generate a respective *PYT*. The clones allocated to each block at the *CET* (and selected) are therefore, competing among themselves also at the *PYT* stage. The reasons for this are: **a)** This approach maximized the genetic variability within each by maximizing the number of families present in it; **b)** The performance of the cassava plant depends heavily on the quality of the stake from which it grew, and the quality of the stakes, in turn, depends on the environmental conditions in which the mother plant grew. By keeping together in the same trial the clones that grew together at the *CET* a better uniformity of the quality of the stakes is achieved and, therefore, the experimental error at the *PYT* is somewhat reduced.

Table 6.5. Relevant results from the **Preliminary Yield Trial-1** planted in Palmira (Valle del Cauca Department). Performances of the best ten clones are presented.

Clon	Plant type	Fresh root yield	Fresh foliage yield	Harvest Index	Dry matter content	Dry matter yield	Selection index
	(1-5)	(t/ha)	(t/ha)	(0-1)	(%)	(t/ha)	
CM 9903-107	2.33	38.24	34.38	0.53	44.61	16.83	31.84
GM 234-132	2.67	47.61	40.58	0.54	41.22	19.63	29.39
SM 2913-4	2.67	40.06	34.77	0.54	42.87	17.23	26.75
SM 2983-13	2.67	46.53	29.73	0.67	37.80	17.57	25.06
SM 2865-9	1.67	41.67	27.78	0.59	39.56	16.45	24.79
SM 2865-10	2.00	50.22	36.98	0.58	37.60	18.86	24.39
GM 297-54	2.00	42.49	30.99	0.58	39.38	16.75	22.52
SM 2860-10	2.00	36.24	25.35	0.59	40.93	14.87	21.80
SM 2858-2	2.33	42.45	32.38	0.56	39.81	16.94	21.66
GM 297-47	1.67	41.23	35.89	0.54	39.98	16.50	21.50
Parameters of the 25 clones selected							
Maximum	4.00	50.22	43.49	0.68	44.61	19.63	31.84
Minimum	1.33	31.68	16.67	0.45	34.68	12.94	5.53
Average	2.44	41.69	32.06	0.57	39.16	16.27	18.13
St. Deviation	0.74	4.93	6.57	0.05	2.24	1.71	6.80
Parameters of the 100 clones evaluated							
Maximum	4.67	50.22	46.57	0.68	44.61	19.63	31.84
Minimum	1.00	9.16	16.67	0.31	31.03	3.50	-55.53
Average	2.72	33.62	30.77	0.52	37.92	12.80	0.00
St. Deviation	0.76	9.10	4.39	0.07	2.20	3.55	16.79

Table 6.6. Relevant results from the **Preliminary Yield Trial-2** planted in Palmira (Valle del Cauca Department). Performances of the best ten clones are presented.

Clon	Plant type	Fresh root yield	Fresh foliage yield	Harvest Index	Dry matter content	Dry matter yield	Selection index
	(1-5)	(t/ha)	(t/ha)	(0-1)	(%)	(t/ha)	
SM 2858-31	2.33	48.74	34.90	0.59	38.16	18.64	41.66
SM 2870-51	1.67	37.46	31.90	0.54	38.47	14.42	29.02
GM 295-18	3.00	39.54	28.91	0.57	38.99	15.42	27.18
SM 2858-36	2.33	39.32	36.55	0.52	38.20	15.06	24.00
SM 2988-23	3.67	41.75	50.87	0.45	40.81	16.73	23.93
SM 2861-20	1.00	35.07	33.33	0.51	36.84	12.95	21.99
GM 297-68	3.00	41.49	42.41	0.50	37.98	15.75	19.98
SM 2862-33	2.00	38.02	38.46	0.50	37.04	14.13	18.82
SM 2860-38	2.67	40.54	33.16	0.55	36.34	14.70	18.56
SM 2865-37	2.33	36.81	26.35	0.58	36.40	13.50	18.21
Parameters of the 25 clones selected							
Maximum	3.67	48.74	50.87	0.61	40.81	18.64	41.66
Minimum	1.00	31.08	26.35	0.44	34.21	11.74	8.37
Average	2.43	37.49	35.00	0.52	37.29	13.98	17.86
St. Deviation	0.70	3.95	6.23	0.04	1.66	1.58	7.28
Parameters of the 100 clones evaluated							
Maximum	4.00	60.24	50.87	0.61	40.81	21.30	41.66
Minimum	1.00	13.11	19.71	0.18	29.16	5.69	-47.20
Average	2.74	30.66	33.05	0.48	36.50	11.27	0.00
St. Deviation	0.72	7.43	6.30	0.07	1.99	2.72	16.43

During the July 2002-May 2003 seasons two different *CETs* were planted in Palmira. One of them was to be continued in the Cauca and Valle del Cauca Departments (geographic valley of the Cauca River). The other *CET* was to be followed by trials planted in the Huila and Tolima Departments (geographic valley of the Magdalena River). In each *CET* the selection was performed as usual and *PYT*s were prepared from each block. However, the trials for the Huila and Tolima Departments could not be planted in that region because of lack of an adequate location. Therefore, during the July 2003-May 2004 season six *PYT*s were planted in Palmira (Table 6.1). The first three were those originally targeting the Cauca River Valley, and the last three were those originally targeting the Upper Magdalena River Valley.

Tables 6.5 to 6.7 include clones that were selected during the *CET* for the Cauca River Valley harvested in May 2003 and Tables 6.5 to 6.7 provide the most relevant information for *PYT*s 1, 2 and 3, respectively. Comparison of the mean performance of each trial across Tables 6.5 through 6.7 reveals the kinds of environmental variation that can be found, which is effectively controlled by growing three different trials. Average fresh root yields were 33.62 30.66, and 31.10t/ha respectively for *PYT*s 1, 2 and 3.

Table 6.7. Relevant results from the **Preliminary Yield Trial-3** planted in Palmira (Valle del Cauca Department). Performances of the best ten clones are presented.

Clon	Plant type (1-5)	Fresh root yield (t/ha)	Fresh foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry matter yield (t/ha)	Selection index
SM 2864-21	3.33	39.37	20.01	0.66	41.52	16.34	37.06
SM 2862-42	2.33	43.58	35.59	0.55	40.35	17.57	33.25
GM 254-79	3.00	40.32	35.20	0.53	42.54	17.12	32.56
GM 297-79	2.33	43.19	40.76	0.50	40.28	17.63	27.74
GM 264-149	2.67	42.23	40.97	0.51	40.23	16.96	26.02
CM 9953-121	1.33	31.94	23.79	0.57	41.61	13.28	24.98
SM 2863-28	4.33	44.01	30.99	0.58	39.06	17.23	24.05
SM 2858-46	2.00	41.06	31.86	0.57	37.95	15.61	22.98
SM 2858-47	3.00	42.06	28.21	0.60	37.13	15.60	19.95
GM 234-143	2.33	33.59	39.93	0.46	43.17	14.47	19.93
Parameters of the 25 clones selected							
Maximum	4.33	44.14	40.97	0.66	43.17	17.63	37.06
Minimum	1.33	29.12	20.01	0.46	35.58	12.05	10.15
Average	2.69	37.48	31.54	0.54	39.69	14.87	19.06
St. Deviation	0.69	4.70	5.96	0.04	1.80	1.71	7.75
Parameters of the 100 clones evaluated							
Maximum	5.00	44.58	50.17	0.66	43.17	17.63	37.06
Minimum	1.33	17.84	17.84	0.38	33.28	6.75	-40.68
Average	2.85	31.10	31.51	0.50	38.64	12.05	0.00
St. Deviation	0.80	6.18	6.28	0.06	2.09	2.47	16.06

Table 6.8. Relevant results from the **Preliminary Yield Trial-4** planted in Palmira (Valle del Cauca Department). Performances of selected clones are presented.

Clon	Plant type (1-5)	Fresh root yield (t/ha)	Fresh foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry matter yield (t/ha)	Selection index
Performance of the 12 clones selected							
CM 9733-108	2.67	48.0	44.2	0.52	37.5	18.0	36.31
GM 265-173	1.00	43.0	39.7	0.52	34.5	14.8	27.90
CM 9962-1	2.33	34.1	42.6	0.44	39.3	13.4	23.09
SM 1521-27	4.00	38.2	51.6	0.42	40.1	15.3	19.01
CM 9791-64	3.00	29.9	34.0	0.47	40.1	12.1	18.61
CM 9914-8	4.00	27.0	18.6	0.59	40.0	10.8	16.90
GM 265-177	2.00	36.2	30.6	0.54	34.6	12.5	15.04
CM 9914-2	3.00	25.7	16.0	0.62	37.2	9.6	11.73
SM 2834-43	2.67	29.3	26.5	0.53	36.2	10.6	7.78
SM 2865-64	3.00	32.2	35.2	0.48	36.4	11.7	6.75
SM 2829-44	1.67	24.4	29.8	0.45	36.8	9.0	5.18
SM 2839-47	2.67	27.1	22.8	0.54	35.7	9.7	3.93
Parameters of the 36 clones evaluated							
Maximum	4.67	48.0	51.6	0.62	40.1	18.0	36.31
Minimum	1.00	13.7	8.5	0.30	32.6	4.7	-38.16
Average	3.07	26.6	27.7	0.50	36.3	9.7	0.00
St. Deviation	0.77	8.0	9.87	0.07	1.9	3.0	17.37

Clones representing a total of 31 different families were selected from *PYT*s grown this year in the mid-altitude valley environment (Cauca River Valley). One advantage of blocking *CET*s is that no particular family is benefited or affected by particular environmental conditions. This fact is reflected by the number of families that will still be represented at the *AYT* planted for the June 2004-May 2005 season. About 50 families made the *CET* planted two years ago and more than 50% of these families are still represented in the third phase of selection. Two families (GM297 and SM 2858) out of the 31 that will be represented in the *AYT* stand out because eight of its clones were selected, respectively. Family SM 2862 had five clones selected during the *PYT*s where they were grown. Families CM 9953, GM 234, SM 2865 and SM 2913 had each four clones selected for the following *AYT* planted this year. Four families had three clones selected, six families had two clones selected, and only one clone was selected from the remaining 14 families. This information is provided to highlight two features of the selection scheme employed: large variability (large number of families) is still available for the third stage of selection (the *AYT*) yet the system is capable of detecting superior families (in this case GM297 and SM 2858) favoring a larger number of their clones to pass to the next phase of selection.

Tables 6.8 to 6.10 provide the results of the *PYT*s derived from *CET* for the Magdalena River Valley (Huila and Tolima Departments). These were smaller trials with 36 genotypes, compared with the 100 included in the *PYT*s for the Cauca River Valley. A large number of families (17) had at least one of its clones selected for the following phase of the selection process (*AYT*). Family GM265 was outstanding with six clones selected, followed by families SM 2802, SM 2834 and SM 2865 with four clones selected.

Table 6.9. Relevant results from the **Preliminary Yield Trial-5** planted in Palmira (Valle del Cauca Department). Performances of selected clones are presented.

Clon	Plant type (1-5)	Fresh root yield (t/ha)	Fresh foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry matter yield (t/ha)	Selection index
Performance of the 12 clones selected							
GM 265-190	1.67	42.18	37.50	0.53	33.84	14.32	27.94
SM 2804-61	1.67	32.20	34.76	0.48	36.99	12.00	24.12
SM 2805-21	2.67	31.47	27.91	0.53	37.88	12.00	21.65
SM 2802-78	3.00	32.42	28.17	0.53	38.31	12.39	21.61
SM 2802-76	2.33	38.41	24.91	0.60	32.90	12.63	19.15
GM 265-179	3.00	41.75	39.45	0.51	34.30	14.32	15.56
SM 2865-83	2.67	32.98	25.04	0.57	34.37	11.36	12.15
SM 2834-55	2.33	21.53	16.88	0.56	37.02	7.96	11.04
GM 265-182	2.33	29.64	26.95	0.52	35.06	10.43	9.92
SM 2826-36	2.33	35.63	49.95	0.41	35.29	12.60	9.89
SM 2834-60	3.00	29.5	27.78	0.51	36.3	10.7	7.57
SM 2834-58	2.33	22.5	24.26	0.48	37.2	8.5	5.94
Parameters of the 36 clones evaluated							
Maximum	4.00	42.18	49.95	0.60	40.27	14.32	33.56
Minimum	1.67	10.63	11.37	0.35	32.87	3.64	-35.33
Average	2.83	24.59	24.80	0.50	35.79	8.83	0.00
St. Deviation	0.53	7.89	8.55	0.06	1.98	2.81	17.17

Table 6.10. Relevant results from the **Preliminary Yield Trial-6** planted in Palmira (Valle del Cauca Department). Performances of selected clones are presented.

Clon	Plant type (1-5)	Fresh root yield (t/ha)	Fresh foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry matter yield (t/ha)	Selection index
Performance of the 13 clones selected							
SM 2804-65	2.00	42.14	23.48	0.64	14.92	14.92	30.73
SM 2802-85	3.00	36.72	24.82	0.59	14.21	14.21	23.67
SM 2865-99	2.00	35.02	32.12	0.53	13.26	13.26	20.66
SM 2826-40	2.00	23.26	20.53	0.53	9.55	9.55	17.51
SM 2839-65	2.50	32.90	35.50	0.48	12.84	12.84	15.46
CM 9912-92	3.50	32.72	32.42	0.50	12.83	12.83	10.99
GM 265-191	2.50	37.02	35.89	0.51	12.89	12.89	6.83
SM 2804-63	3.00	36.54	30.73	0.52	13.28	13.28	5.82
SM 2865-97	4.00	32.38	22.18	0.59	12.13	12.13	4.57
SM 2802-84	3.00	22.65	12.80	0.64	8.56	8.56	4.10
SM 2836-59	2.00	25.0	27.3	0.48	38.0	9.5	2.85
GM 234-171	1.50	25.8	23.2	0.53	35.8	9.3	2.41
CM 9914-22	4.00	25.6	17.4	0.60	38.5	9.8	1.39
Parameters of the 50 clones evaluated							
Minimum	4.00	42.14	43.79	0.64	14.92	14.92	30.73
Maximum	1.50	14.84	12.80	0.41	5.13	5.13	-35.03
Average	2.79	26.58	24.55	0.52	9.94	9.94	0.00
St. Deviation	0.76	6.75	7.88	0.07	2.62	2.62	16.56

There were a total of 112 genotypes selected from the *PYT*s for the Cauca and Magdalena River Valleys (75 and 37 clones, respectively). Phenotypic data from these trials were combined and correlations among different variables estimated. Table 6.11 provides information from these correlations. Some of these correlations had been reported before and, therefore, provide no new information.

Fresh root yield was positively associated with fresh foliage yield ($r = 0.51$); harvest index ($r = 0.21$); dry matter content ($r = 0.32$); and negatively associated with leaf retention ($r = -0.50$). It is worth mentioning the positive relationship observed in the combination of trials between fresh root yield and dry matter content. This correlation suggests that it is possible to obtain clones with high fresh root yield and simultaneously high dry matter content. But the most interesting result of the correlations shown in Table 6.11 is the excellent relationship between fresh root yield and leaf retention score. The latter is a 1-9 scale where 1 indicates good leaf retention and 9 represents a poor one. The way the scale for leaf retention operates explains why the correlation has a negative sign. These results come to support the conclusions presented in an article to be published soon (Lenis, J.I., F. Calle, G. Jaramillo, J.C. Perez, H. Ceballos, and J.H. Cock. 2004. The effect of leaf retention in cassava productivity. **Field Crops Research**, accepted for publication after minor revision).

Table 6.11. Phenotypic correlations between variables measured in the selected clones from *PYY1* to 6. Data based on 112 genotypes.

Variable	Plant type score	Fresh root yield	Fresh foliage yield	Harvest Index	Dry matter content	Dry matter yield	Select. Index	Leaf retention
Plant type score	1.00	0.04	-0.06	0.14	-0.02	0.11	-0.15	0.12
Fresh root yield	0.04	1.00	0.51	0.21	0.32	0.94	0.58	-0.50
Fresh foliage yield	-0.06	0.51	1.00	-0.70	0.30	0.51	0.26	-0.33
Harvest Index	0.14	0.21	-0.70	1.00	-0.10	0.16	0.19	0.00
Dry matter content	-0.02	0.32	0.30	-0.10	1.00	0.41	0.35	-0.63
Dry matter yield	0.11	0.94	0.51	0.16	0.41	1.00	0.66	-0.58
Selection Index	-0.15	0.58	0.26	0.19	0.35	0.66	1.00	-0.32
Leaf retention	0.12	-0.50	-0.33	0.00	-0.63	-0.58	-0.32	1.00

According to the scheme presented in Figure 3.1 after the *PYT*, selected clones are grouped in the **Advanced Yield Trials** or *AYT*. Because of problems encountered in previous seasons, no *AYT* was planted for the mid-altitude valleys in the July 2003-May 2004 season.

Table 6.12 provides information of one **Regional Trial (RT)** planted in La Dolores. This trial included 64 genotypes evaluated in three replications with 20-plant plots. Four checks were among the 64 genotypes evaluated. The mean performance of this trial was excellent with an

average root dry matter productivity of about 11 t/ha. The best performing clone, however, yielded as much as 21.4 t/ha. This is a yield potential considerably higher than that of the best performing check (MBRA 383, with dry matter yield of 16.8 t/ha). Clone 7951-5 has had an outstanding performance in the past few years and it is producing a consistent superiority, which may result in an official release soon.

Table 6.12. Averages from the **Regional Trail** planted in La Dolores. The trial included 28 genotypes, evaluated in three replications with 20-plant plots. Individual performances of all the clones (ordering based on dry matter yield) are presented.

Clon	Height 1 st branching (cm)	Fresh root yield (t/ha)	Fresh foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry matter yield (t/ha)
CM 7951-5	225	54.74	37.52	0.59	39.05	21.38
BRA 383	210	43.48	39.04	0.53	38.60	16.78
SM 2198-4	305	38.93	54.00	0.41	35.55	13.84
SM 1219-9	90	38.56	55.41	0.41	35.75	13.78
SM 1779-7	110	35.52	68.19	0.34	37.75	13.41
SM 1520-18	175	32.63	34.37	0.48	39.95	13.04
SM 1965-1	325	32.85	39.89	0.46	39.40	12.94
CM 8370-11	335	33.85	65.00	0.34	36.50	12.36
SM 1855-15	95	33.96	46.44	0.42	35.15	11.94
SM 2058-2	155	35.63	51.63	0.39	33.40	11.90
SM 2085-7	40	33.15	70.00	0.32	35.45	11.75
SM 2211-3	305	32.44	41.44	0.44	36.10	11.71
CM 7463-2	120	30.26	55.22	0.36	38.05	11.51
SM 1660-4	120	30.96	57.70	0.35	37.00	11.46
CM 6660-21	175	28.04	46.37	0.37	37.10	10.40
CM 523-7	135	26.81	57.67	0.31	38.55	10.34
SM 2160-2	145	26.85	44.41	0.38	37.63	10.11
CM 8370-10	110	27.22	56.26	0.29	37.10	10.10
SM 2073-1	195	28.44	47.22	0.37	35.15	10.00
SM 1871-33	110	27.00	73.63	0.27	35.90	9.69
SM 1642-22	300	25.78	58.33	0.30	34.25	8.83
SM 1520-16	80	26.22	22.74	0.54	33.45	8.77
SM 2052-4	130	23.85	48.33	0.33	35.30	8.42
TAI 8	90	21.15	25.37	0.46	35.73	7.56
HMC 1	25	20.70	63.07	0.25	35.10	7.27
COL 2760	165	19.63	22.11	0.46	35.90	7.05
PER 183	25	19.33	53.56	0.27	31.35	6.06
COL 2737	135	14.70	37.89	0.28	32.35	4.76
Parameters of the 64 clones evaluated (including the four checks)						
Minimum	25.00	14.70	22.11	0.25	31.35	4.76
Maximum	335.00	54.74	73.63	0.59	39.95	21.38
Average	158.21	30.10	49.03	0.38	36.16	10.97
St. Deviation	88.65	8.17	13.62	0.09	2.08	3.34

Table 6.13 provides information of a second *RT* planted in Montelindo. This trial included 64 genotypes evaluated in three replications with 20-plant plots. Four checks were among the

64 genotypes evaluated. The mean performance of this trial was excellent with an average root dry matter productivity of about 9 t/ha. The best performing clone, however, yielded as much as 15.3 t/ha of dry matter. This is a yield potential considerably higher than that of the best performing check (MBRA 383, with dry matter yield of 14.8 t/ha). Clone SM 1219-9 has had an outstanding performance in the past few years and it is producing a consistent superiority (see Table 6.4), which may result in an official release soon.

Table 6.13. Relevant results from the **Regional Trial** planted in Montelindo (Caldas Department). Individual performances of the 20 clones evaluated is presented (based on selection index) are presented.

Clon	Plant type (1-5)	Fresh root yield (t/ha)	Fresh foliage yield (t/ha)	Harvest Index (0-1)	Dry matter content (%)	Dry matter yield (t/ha)	Cooking quality (1-5)
Performance of the 13 clones selected							
SM 1219-9	2.7	67.5	43.3	0.61	34.3	15.3	5.00
MBRA 383	2.7	60.5	60.2	0.50	37.1	14.8	1.60
CM 4843-1	3.0	60.8	60.5	0.50	36.8	14.8	5.00
SM 653-14	3.0	47.8	56.4	0.46	39.8	12.6	5.00
SM 1741-1	3.0	47.4	47.3	0.50	38.5	12.1	2.30
CM 7951-5	3.3	48.3	22.2	0.68	36.7	11.7	5.00
MTAI 8	3.3	44.6	36.9	0.56	35.0	10.3	5.00
SM 1557-17	2.7	41.8	59.5	0.40	37.1	10.2	5.00
Regional	4.0	43.6	36.8	0.56	35.3	10.2	1.60
MPER 183	3.3	36.1	54.7	0.40	42.6	10.2	2.30
HCM 1	3.7	33.7	43.1	0.44	34.9	7.8	3.60
MVEN 25	3.7	32.0	50.9	0.39	36.3	7.7	5.00
SM 1433-4	3.0	29.2	62.1	0.32	36.5	7.0	2.30
CM 3306-4	3.7	26.3	40.9	0.40	39.9	6.9	1.60
CM 6119-5	3.7	31.9	40.1	0.44	31.7	6.7	3.60
CM 7514-7	3.3	23.9	37.6	0.39	39.2	6.2	5.00
CM 523-7	2.3	22.2	25.0	0.47	36.6	5.4	3.00
CM 849-1	3.7	23.5	42.0	0.36	33.8	5.3	5.00
CG 1141-1	4.0	21.9	46.3	0.32	34.4	5.0	3.60
Manzanita	3.0	17.0	38.6	0.29	29.1	3.3	3.00
Parameters of the 20 clones evaluated							
Maximum	4.0	67.5	62.1	0.68	42.6	15.3	5.00
Minimum	2.3	17.0	22.2	0.29	29.1	3.3	1.60
Average	3.3	38.0	45.2	0.45	36.3	9.2	3.68
St. Deviation	0.5	14.4	11.3	0.10	3.0	3.6	1.36