OUTPUT 8
Collaboration with other institutions, scientific meetings, and publications.

Activity 8.1 Support national programs that have traditionally collaborated with CIAT in the development and improvement of cassava.

Rationale:
CIAT has the responsibility to contribute with cassava research worldwide. In the past, this was achieved through the collaboration of National Agriculture Research Programs (NARs), and in the case of Africa, with the valuable collaboration with IITA. This scenario has changed drastically through the last decade, when the NARs in most of the tropical countries weakened consistently. However, new institutions and partners are assuming a leading role and CIAT is actively searching for these new partners. In this activity, at least for Latin America, we are closely collaborating with CLAYUCA. In the implementation of industrial uses of cassava, because of the convenience of our location, most of the validation and adaptive research is carried out in Colombia. Once the technology (for instance, for the artificial drying of cassava roots) is evaluated and offers acceptable results, it can be moved out to other countries. This strategy implies that a considerable portion of our research is carried out in Colombia. However, this does not imply that cassava projects at CIAT are restricting their activities only to Colombia.

Specific Objectives:
a) To promote the use of cassava and the adoption of new technologies and germplasm by cassava growing countries of the world.
b) To contribute to the training of personnel involved with cassava research.
c) To identify new partners in each country.

Results
A major thrust in CIAT's strategy to achieve the stated objectives has been through training and visits to NARs, in addition to the provision of germplasm described in Output 3 to Output 7. A summary of the most important events in which personnel from the project participated is provided. Although some of these events were scientific meetings, it should be pointed out that the list involves only those events leading to the development of research proposal or else were part of ongoing collaborative efforts.

There are many more specific activities and contributions that cannot be mentioned because of their informal nature. An important activity in this regard is the continuous consulting from producers, students, researchers and processors from Colombia and other countries. An important amount of energy is dedicated to satisfy the demand for information and products through these requests.

Table 8.1. Events where personnel from cassava breeding project participated for the development or execution of research proposals. Additional events were attended by personnel working in the areas of entomology, plant pathology, and biotechnology and are not listed here to avoid duplications.

Date	Event	Location
26-01/29-01	Implementation of HarvestPlus project with World Vision.	Haiti *
29-01/02-02	Implementation of Doubled Haploids project with INIVIT.	Cuba *
28-02/06-03	Workshop for implementation of project on mutagenesis at IAEA.	Vienna, Austria
19-02	Workshop on cassava for animal feeding and industrial uses.	Popayán, Colombia
16-04	Workshop on cassava for animal feeding in dairy production.	Barranquilla, Colombia
02-05/07-05	HarvestPlus meeting on reaching end user at IBPGR.	Rome, Italy
10-05/11-05	Cassava starch quality symposium.	Thailand
12-05/13-05	Implementation of Doubled Haploids project with MOA.	Thailand *
13-05/16-05	Implementation of Doubled Haploids and HarvestPlus projects.	Vietnam *
16-05/18-05	Prospective visit to Laos.	Laos *
31-05/01-06	PAC Meeting for the HarvestPlus project.	Cali, Colombia
24-08-28-08	Implementation of Doubled Haploids and HarvestPlus projects.	Cruz das Almas, Brazil
4-10/8-10	Workshop on artificial drying of cassava.	Cali, Colombia
01-11/05-11	Participation at the ISTRC-African Branch Workshop.	Mombasa, Kenya
08-11/10-11	Participation at the ECHO conference	Fort Myers, FL, USA
14-11/18-11	Participation at the IVACG conference	Lima, Peru

* Different locations in the country

Table 8.2. Visitors that have spent more than two weeks involved in diverse areas of interest related to cassava.

Name of Vistor	Country	Main Interest
Claire Hershey	USA	Write a book on cassava breeding
Claudia Ferreira	EMBRAPA - Brazil	Molecular markers.
Leonardo Pastor Tovar	Univ. Exp. Guayana - Venezuela	Cassava breeding
Manuel Valdivie	ICA- Cuba	Animal Feeding
Zou Jixin	CATAS- (Hainan, China)	Molecular markers.

In addition the project has received the visit of different scientists in activities that can be described as training. However, the nature of these visits was very diverse and varied from graduate students to visiting scientist. Table 8.2 lists the personnel that visited the IP3 project for more than two weeks during 2004. Table 8.3 provides a list of the students enrolled in different degree programs from different universities that continued to be associated with the project or begun his/her association during the current year. It should be emphasized that these are the students enrolled in cassava breeding or genetics. Plant pathology and plant entomology students are not reported herein to avoid duplications.

Table 8.3. Training of students (undergraduate and graduate) doing their research work at within the cassava breeding project.

Name	**University**	**Genre**	**Degree**
Amparo Rosero	Universidad Nacional de Colombia	Female	Undergraduate
Ana María Correa	Universidad del Valle	Female	Undergraduate
Angie Ayala	Universidad del Valle	Female	Undergraduate
Carlos H. Victoria	Universidad San Buenaventura	Male	Undergraduate
María E. Buitrago	Universidad del Valle	Female	Undergraduate
Milena Sepúlveda	Universidad Nacional de Colombia	Female	Undergraduate
Paola Alfonso	Universidad Javeriana	Female	Undergraduate
Andrés Bolaños	Universidad Nacional de Colombia	Male	M.Sc.
Martha I. Moreno	Universidad del Valle	Female	M.Sc.
Adriana Tofiño	Universidad Nacional de Colombia	Female	Ph.D.
Akinbo Olalekan	Univ of Orange Free State – S. Africa	Male	Ph.D.
Ana Cruz Morillo	Universidad Nacional de Colombia	Female	Ph.D.
Henry Ojulong	Univ of Orange Free State – S. Africa	Male	Ph.D.
Yacenia Morillo	Universidad Nacional de Colombia	Female	Ph.D.

Activity 8.2 Development of collaborative projects with partners in Africa, Asia and Latin America and the Caribbean.

Rationale:
There is a clear trend in the last few years for a reduction of core contributions to CIAT and a simultaneous increase of special projects. Also the trend involves a stronger participation of NARs as key partners in the execution of different projects. Several proposals have been developed and submitted during the course of the year and few of them have already been approved. Below is a brief description of each of these successful research proposals.

High carotene cassava roots.
This is the cassava component of the Biofortification Initiative (now *Harvest Plus*). After more than ten years developing the basic data that allowed the initiative to move forward, full activities begun in 2004.

In Africa the activities will be coordinated by IITA and several countries will eventually join the field activities for the development, multiplication, and promotion of elite germplasm with yellow, high-carotene roots. EMBRAPA-CNPMF (Brazil) and CIAT will produce vitroplants of elite clones with high carotene, drought resistance and other desirable characteristics and then ship them to IITA for their introduction and incorporation in the breeding programs in Africa. Eventually some clones could be released if they prove to have outstanding performance. EMBRAPA-CNPMF will also produce sexual seed and share it with other collaborators. EMBRAPA has been a very important and traditional partner for CIAT in the area of cassava research. This project will benefit and continue with this history of collaboration between the two institutions.

In Latin America and the Caribbean two key countries will participate in the initiative: Brazil and Haiti. The target region in Brazil is the North East region where cassava is important and poverty and vitamin A deficiency are common. EMBRAPA – CNPMF as well as other EMBRAPA institutes such as CENARGEN in Brazilia and CTAA in Rio de Janeiro.

Haiti is the second target country for the deployment of cassava clones with yellow roots. In that case CIAT will work together with World Vision in the Central Plateau. A variety (Yema de Huevo) has already been identified and the initial reaction has been very positive because of its excellent cooking quality. As part of the collaborative activities in this areas visits to Haiti and Brazil took place during the year (Table 8.1)

In Asia, also two countries have been targeted based on the prevalence of human consumption of cassava and vitamin A deficiency on one hand and an assessment of the possibilities of attaining success. The countries are India and Vietnam. India has an excellent root and tuber program lead by the Central Tuber Crops Research Institute (CTCRI) in Kerala State, Southern India. CTCRI will participate within Harvest Plus not only in the area of cassava research but also on sweet potato. In Vietnam the higher human consumption of cassava takes place in the central region (for example Hue Province). CIAT will introduce cassava germplasm with yellow roots into Vietnam since not much such germplasm exists currently. The main collaborator in Vietnam for this particular initiative is Thai Nguyen University of Agriculture and Forestry. As part of the collaborative activities a visit to Vietnam took place during the year as well as a prospective trip to Laos (Table 8.1).

Doubled-Haploids for cassava genetic improvement.
The introduction of inbreeding in cassava has been an evolving idea for a few years now. The year 2004 the project for the introduction of inbreeding in cassava started with the support of Rockefeller Foundation. A technical description of the project was provided in Output 2 (Activity 2.1).

There will be several countries participating in the project mainly in the process of producing segregating populations with varying levels of inbreeding. The main objective is to improve tolerance to inbreeding in elite cassava germplasm and to eventually identify useful recessive

traits that could offer commercial advantages. For the implementation of this project visits to Cuba, Thailand, Vietnam and Brazil took place during the year (Table 8.1). In addition CIAT has initiated contacts with Uganda (National Agricultural and Animal Research Institute) in Eastern Africa and Ghana (Council for Scientific and Industrial Research and Crops Research Institute) in Western Africa.

CLAYUCA

As stated in the Annual Reports from previous years the creation of CLAYUCA has been a very positive development of the cassava project at CIAT. CLAYUCA is effectively helping in the technology transfer and in south-to-south collaboration among the participating countries. Through CLAYUCA, CIAT maintains a close association with many countries in the Region. During the workshop on modern technologies for the artificial drying of cassava roots, CIAT participated actively.

Mutagenesis project with IAEA

As mentioned in Output 2 (Activity 2.2) CIAT and the National University of Colombia started a collaborative project on mutagenesis in cassava. The project is financed by the International Atomic Energy Agency and will last for five years. The resources of this project are mostly invested in training students from that University.

Development of research proposal within Challenge Programs.

Two new global challenge programs have been approved within the CG system one is the Water Challenge Program and the second is the Genetic Resources Global Challenge Program (GRGCP). Because of their very nature these research proposals involve close collaboration with different NARs and NGOs. In the GRGCP, however, two pre-proposals have been successfully submitted. Many of them involve join activities with EMBRAPA and CORPOICA, representing respectively Brazil and Colombia, two key countries from the cassava genetic biodiversity point of view.

Activity 8.3. The collaboration with Colombia.

Project IP3 has a special relationship with Colombia. As host country for CIAT it is in Colombia where a large proportion of the research on cassava is conducted. But the relationship with Colombia goes well beyond this point. Colombia has been a key financial supporter of the projects turning around industrial uses of cassava both from the Government (Ministry of Agriculture) and the private sector (Poultry Growers Association).

There are too many events developed in Colombia to be listed. Instead, what is happening with the idea of *Trapiches Yuqueros* will be used as an illustration of the intensity and success of the activities developed in the country. A *Trapiche Yuquero* is basically a centralized facility for artificial (or mixed) drying of cassava roots and foliage, surrounded by 300-1000 hectares of cassava grown by many farmers. Frequently the farmers growing the cassava are also part owners of the drying facility.

Table 8.4 Different activities that took place during the January-October 2004 period promoting cassava in Colombia.

Type of event	Location	# people	Objective
January			
Meeting	CIAT-CLAYUCA	4	Define cooperation between Secretaría de Agricultura del Valle and CIAT.
Meeting	CIAT	3	Define cooperation between La Fundación para el Desarrollo Rural Comunitario and CIAT
Visit	Atlántico Department	3	Evaluation of planting area for 140 ha in collaboration with INYUCAL
Field trip	Eje Pereira-Manizales	3	Field trip to the coffee growing area to strengthen collaboration with Mr. José Isaac Hernandez
February			
Meeting	Malambo (Atlántico)	3	Define cooperation between INYUCAL and CIAT.
Meeting	CIAT	3	Define cooperation between de Incubadora Santander S.A. and CIAT
Meeting	Cali – FENALCO	30	Meeting for the presentation of proposals for ALIANZAS DE PAZ
Training	Jamundí-Agrícola LTDA	2	Desarrollo de un proyecto comercial de yuca industrial. Training of two Cuban visitors.
Training	Polonuevo (Atlántico)	15	Presentations of cassava genetic improvements, varieties and cultural management.
Field trip	Valle del Cauca Department	10	Define cooperation between Secretaría de Agricultura del Valle del Cauca and CIAT
Field day	Vereda Rejoya Popayán	10	Field day with UMATA, Secretaría de Agricultura del Cauca and Corfocial
Field trip	Sucre y Córdoba	5	Training of FUPAD personnel on handling of stakes and planting techniques
Visit	Chimichagua (Cesar)	3	Prospective visit to evaluate feasibility of a Trapiche Yuquero in the region.
Meeting	Cali	20	Participation in the Poultry Growers Association production chain and SAG.
Meeting	Sincelejo	10	Diffusion of information to farmers on the growing of industrial cassava varieties.
Field day	Jamundí and Quilichao	1	Prospective evaluation of a project on biodegradable plastics with Dr. S. Villada Universidad del Valle.
Meeting	CORPICA-Cereté	30	Planning of planting in the region and definition of production costs for 2004.
Workshop	Pereira	19	Training en cassava management on hillsides, IPM, diseases and cassava germplasm.
March			
Meeting	Sincere	8	Planning meeting to define strategies for the control of frog skin disease.
Meeting	Polonuevo (Atlántico)	40	Promote the planting of industrial cassava, and the signing of forward contracts.
Workshop	Sincelejo	8	Training on cultural practices for industrial cassava in the region.
Field day	Santander de Quilichao	6	Techniques for the determination of dry matter content and cyanogenic potential.

Table 8.2 cont.

Type of event	Location	# people	Objective
Meeting	Baranoa (Atlántico)	30	Meeting with farmers of the Baranoa region (Atlántico) on the topic of industrial cassava.
Training	La Libertad	2	Training on planting of cassava and cultural practices.
Meeting	CORPOICA	12	Planning of planting in the region and definition of production costs for 2004.
Meeting	CIAT	1	Collaboration with the starch company RAISO for implementing industrial plantings of cassava
April			
Training	La Libertad	2	Training on planting of cassava and cultural practices.
Training	La libertad	5	Training on planting of cassava and cultural practices.
Meeting	Barranquilla (Atlántico)	30	Prospective meeting on agriculture and fisheries in the Atlántico Department for year 2003.
Training	La Libertad	5	Training on planting of cassava and cultural practices.
Training	La libertad	10	Training on planting of cassava and cultural practices.
Training	La Libertad	6	Training on planting of cassava and cultural practices.
Meeting	CORPOICA	40	Information about Law N° 84. Presentation of a project on artificial drying of maize.
Workshop	CORPOICA	42	Technical support for the official release of five new varieties.
Field day	La Libertad	30	Selection of healthy planting material and good root aspect.
May			
Field day	Turipaná (Córdoba)	400	Field day for the official release of five new varieties.
Field day	CIAT	23	Techniques for the determination of dry matter content and cyanogenic potential.
Meeting	Puerto López	20	Potential of industrial cassava for the Altillanura region in the Eastern Savannas.
Workshop	Quilichao-Univ. Del Cauca	16	Obtention of dextrines from root flour of cassava obtained through artificial drying.
Visit	Aguazul y Tauramena	6	Feedback on the evolution of several agro-industrial projects involving cassava.
Conference	La Robleda-Cauca	30	Potential of cassava as source of energy in poultry feed.
Meeting.	Barranquilla (Atlántico)	10	Prospective meeting on the potential of cassava for the production of carburant alcohol.
June			
Exposition in Fair	Cali – Ind. Licores del Valle	50	Diffusion of the project of industrial cassava and technologies available from CIAT and CLAYUCA.
Training Course	Jamundí - Valle Pescador - Cauca	34	International Training Course on modern cassava growing and processing technologies.
Meeting	Puerto Gaitán	11	Potential of industrial cassava for the Altillanura region in the Eastern Savannas.

Table 8.2 cont.

Type of event	Location	# people	Objective
Visit	Pto López-Pto G. Hda La Fazenda	3	Evaluation of fields for planting of industrial cassava
Meeting	La libertad	9	Evaluation of cassava field as source of planting materials for the Eastern Savannas.
July			
Workshop	Cimitarra	18	Cultural practices, artificial drying alternatives and options to reduce production costs.
Meeting	Alcaldía Tauramena	4	Definition of planting schedule, and technical assistance to the Municipio
Meeting	Barrancabermeja	4	Meeting to propose FUNDAESMAG as operator for credit of small cassava production.
Meeting	San Vicente	10	Planning of planting cassava and technical support to the Trapiche Yuquero.
Meeting	Aguazul	3	Definition of planting schedule, sources of healthy planting materials and technical assistance.
Meeting	Cúcuta	4	Support for the proposal of a planting of 200 ha of cassava to FINAGRO.
Meeting	Cimitarra	4	Prospective trip to learn about the different cassava growing projects in the region.
Meeting	Bucaramanga	14	Presentation of results from the project with Ministry of Agriculture of Colombia
Meeting	Vivero Agua de Dios- Cundinam.	4	Delivery of planting material and training of ways for their proper handling.
Meeting	CIAT	1	Planning meeting to evaluate collaborative projects with SENA regional
Meeting	Santander de Quilichao	3	Collaboration with Asociación Municipal de Usuarios Campesinos -CIAT
Meeting	Finca Las Palomas-Yopal	3	Planning meeting for the establishment of project for the production of healthy cassava planting material.
Meeting	Cúcuta	6	Support for the proposal of a planting of 200 ha of cassava to FINAGRO and Banco Agrario.
Meeting	UMATA de Villanueva	5	Planning meeting for the establishment of project for the production of healthy cassava planting material
August			
Meeting	Bucaramanga	5	Review of projects approved by FOMIPIME for marketing cassava.
Meeting	CIAT	1	Characterization of cassava cultivars from indigenous communities in Ecuador.
Meeting	Edificio Acuario – Yopal	3	Validation and modification of an industrial cassava project.
Training	Girardot	25	Training of personnel from UAMATAS on cassava cultural practices.
Meeting	Carmen de Apicalá	3	Planning of experiment for the feeding of fish with cassava flour.
Meeting	Oficina – Yopal	4	Evaluation of impact from activities in 2003 and follow up on activities during 2004.

Table 8.2 cont.

Type of event	Location	# people	Objective
Meeting	Popayán – Cauca	70	3d working meeting between the Department Government and Indigenous communities.
Meeting	Barrancabermeja	18	Presentation of FUNDESMAG as credit operator for FINAGRO.
Workshop	Santander de Quilichao -	60	Training on the production of clean planting material for cassava
Field day	Finca Palomas	8	Technical support for planting three new cassava varieties.
Meeting	Barrancabermeja	5	Review of project draft for industrial cassava planting in the region.
Field day	Finca El Paradero	7	Technical support for planting three new cassava varieties.
September			
Meeting	Santander de Quilichao	7	Planning meeting for joint collaborative projects for IICCA/MADR call for proposals.
Field day	Finca El Mangal	5	Technical support for planting cassava varieties developed by CIAT.
Meeting	CIAT	5	Further planning meeting for joint collaborative projects for IICCA/MADR call for proposals.
Meeting	Espinal	4	Collaborative project with CORPOICA for planting multiplication nursery and trials.
Meeting	Agua de Dios-Cundinamarca	6	Evaluation of cassava processing facilities (mainly drying) in the region.
Meeting	San Luís (Tolima)	7	Delivery of clean planting material and training on its handling
Field day	Finca El Paradero	3	Planting of a multiplication nursery of clone CM 523-7 provided by Unitropico.
Field day	Potrerillo CEUNP	5	Selection of samples for the production of biodegradable plastics.
Meeting	Alcaldía de Tauramena	4	Multiplication nursery for the production of clean planting material of new varieties
Training	CEUNP – Potrerillo	1	Evaluation of projects for industrial cassava with Dr. M. Valdivi Instituto de Ciencia Animal (Cuba).
Meeting	Espinal	4	Launching of collaborative project with CORPOICA for planting multiplication nursery and trials.
Field day	Alcaldía de Tauramena	5	Technical support for planting cassava varieties developed by CIAT in a multiplication nursery.
October			
Field day	Potrerillo CEUNP	5	Further selection of samples for the production of biodegradable plastics.
Meeting	Tamalameque	20	Technical assistance to the Trapiche Yuquero de Tamalameque.
Meeting	SAG –Cali	20	Participation in the Poultry Growers Association production chain and SAG.
Training	CIAT	25	Development and evaluation of experimental clones in a cassava genetic improvement project.

CIAT and CLAYUCA have been promoting the creation of *Trapiches Yuqueros* for three years now. To materialize the idea two main issues had to be dealt with. The year 2003 was a turning point for cassava in Colombia because not only the first *Trapiche Yuquero* was created that year, but also because ten additional *Trapiches* followed. This idea has been adopted by many different communities, which further developed or modified the original idea to adapt it to local conditions.

CLAYUCA and CIAT are very proud of these developments. Although this is taking place only in Colombia at this point, the idea has generated enough interest in other countries in the Region (Nicaragua, Venezuela, Ecuador) as well as outside the Region (Nigeria). During the year 2004 the fieldwork begun in many of these *Trapiches Yuqueros* and both CLAYUCA and CIAT are contributing to their activities, providing planting material and technical supervision on their operations.

In addition to the specific involvement with the operations of *Trapiches Yuqueros* IP3 project successfully presented a proposal to COLCIENCIAS for a collaborative project (private sector, National University of Colombia, CENICAFE, CIAT and CLAYUCA) for the creation of a high-capacity starch quality laboratory, which was described in Output 2 (Activity 2.4).

A major factor contributing to the success in the area of collaboration with NARs from Latin American Countries has been the complementation and collaboration between CIAT and CLAYUCA, which is dully acknowledged here. Table 8.4 lists the most important activities conducted in Colombia for the promotion and/or technical development of cassava in which personnel from IP3 actively participated.

Activity 8.4. Scientific meetings and publications.

Scientific publications:

1. Reddy, BVS, AF Rangel, B. Ramaiah and R. Ortiz. A research amd network strategy for sustainable sorghum production systems for Latin America. 2004. In MCS Bantilan, UK Deb, CLL Gowda, BVS Reddy, AB Obilana and RE Evenson (Eds.) Sorghum Genetic Enhancement: research process, dissemination and impacts. ICRISAT, Patancheru 502 324, Andhra Pradesh, India pp. 139-148.

2. Ceballos, H., C.A. Iglesias, J. C. Pérez, & A.G.O. Dixon, 2004. Cassava breeding: opportunities and challenges. **Plant Molecular Biology** (in press).

3. Jaramillo, G., N. Morante, J.C. Perez, F. Calle, H. Ceballos*, B. Arias and A.C. Bellotti. 2004. Diallel analysis in cassava (*Manihot esculenta* Crantz) adapted to the mid-altitude valleys environment. **Crop Science** (in press)

4. 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. (Submitted to **Field Crops Research** and accepted for publication after minor changes).

5. Chávez, A.L., T. Sánchez, G. Jaramillo, J. M.l Bedoya, J. Echeverry, E. A. Bolaños , H. Ceballos, & C.A. Iglesias. 2004. Variation of quality traits in cassava roots evaluated in

landraces and improved clones. (Submitted to **Euphytica** and accepted for publication after minor changes).

6. Ceballos, H, T. Sánchez, A.L. Chávez, C. Iglesias, D.Debouck, G. Mafla, and J. Tohme. 2004. Variation in crude protein content in cassava (*Manihot esculenta* Crantz) roots. (Submitted to **Journal of Food Composition and Analysis**).

7. Sánchez, T., A.L. Chávez, H. Ceballos, D.B. Rodriguez-Amaya, P. Nestel and M. Ishitami. 2004. Reduction or delay of post-harvest physiological deterioration in high-carotene cassava roots. (Submitted to **Journal of the Science of Food and Agriculture**).

8. Morante, N., X. Moreno, J.C. Perez, F. Calle, J.I. Lenis, E. Ortega, G.Jaramillo and H. Ceballos. 2004. Precision of selection in early stages of cassava genetic improvement. (Submitted to **Crop Science**).

9. Cach, N.T., J.I. Lenis, J.C. Perez, N. Morante, F. Calle and H. Ceballos. 2004. Inheritance of relevant traits in cassava (*Manihot esculenta* Crantz) for sub-humid conditions. (Submitted to **Plant Breeding**).

10. Calle, F., J.C. Perez, W. Gaitán, N. Morante, H. Ceballos, G.Llano & E.Alvarez. Genetics of relevant traits in cassava (*Manihot esculenta* Crantz) adapted to acid-soil savannas. (Submitted to **Euphytica**).

11. Nguyen Thi Cach, JC Perez, JI Lenis, F Calle, N Morante and H. Ceballos. 2004. Epistasis in the expression of relevant traits in cassava (*Manihot esculenta* Crantz) for sub-humid conditions (Submitted to **Journal of Heredity**).

12. Perez, J.C., H. Ceballos, F.Calle, W. Gaitán, N. Morante, G.Llano & E.Alvarez. Additive, dominance and epistatic effects of relevant traits in cassava (*Manihot esculenta* Crantz) adapted to acid-soil savannas. (Submitted to **Theoretical and Applied Genetics**).

13. Perez, J.C., H. Ceballos, Jaramillo, G., N. Morante, F. Calle, B. Arias and A.C. Bellotti. 2004. Analysis of the relative importance of epistasis in cassava (*Manihot esculenta* Crantz) adapted to the mid-altitude valleys environment. (Submitted to **Crop Science**).

14. Perez Velázquez, J.C. C.L. Souza Jr. L.A. Narro, S. Pandey, and C. De León. Genetic effects for maize traits under acid and non-acid soils. (Submitted to **Euphytica**)

Scientific Presentations:

1. Rao, I., Ayarza, M., Trouche, G., Ceballos, H., Alves, A., Miles, J., Argel, P., Schmidt, A., Peters, M., Holman, F., Lundy, M., Quirós, C., Rondon, M., Monneveux, P., and Córdoba, H. Improving crop and forage adaptation to dry conditions of Central America. Climate Change Workshop. Catie, Costa Rica. March 16-18, 2004.

2. Perez J.C.; Ceballos H; Lenis J.I.; Ortega E.; Calle F. and Morante N. Stability and genotype by environment analysis in cassava. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

3. Perez J.C.; Ceballos H; Lenis J.I.; Ortega E.; and Morante N. Heritability of agronomically relevant traits in cassava. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

4. Ceballos H; Perez J.C.; Calle F.; Morante N.; Lenis J.I. and Jaramillo G. Alternative for estimating general combining ability in cassava beeding. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

5. Ceballos H.; Lentini Z.; Perez J.C. and Fregene M. Introduction of inbreeding in cassava through the production of doubled haploids. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

6. Ceballos H; Perez J.C.; Jaramillo G.; Morante N.; Calle F. and Lenis J.I. Inheritance of agronomically relevant traits in cassava. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

7. Perez J.C.; Ceballos H; Ortega E.; Lenis J.I.; Calle F. and Morante N. Phenotypic and genetic correlations among agronomically relevant traits in cassava. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

8. Perez J.C.; Ceballos H; Ortega E. and Lenis J.I. Analysis of genotype by environment interactions in cassava using the AMMI model. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

9. Egesi C.; Castelblanco, W.; Morante N.; Mba C.; Ceballos H. and Fregene M. Identification of naturally occurring and irradiation-induced mutant GBSSI alleles of cassava in a heterozygous genetic background. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

10. Morante N.; Sánchez T.; Marin J.; Ospina C.; Gutiérrez J.; Barrera E.; Ceballos H.; Alzate A.; Moreno S. and Fregene M. Mining the primary gene pool of cassava: introgression of resistance to the cassava green mite andhigh root protein from accessions of *Manihot esculenta* sub spp flabellifolia and Manihot tristis into cassava. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

11. Loke J.B.; Alvarez E.; Corredor J. A.; Folgueras M.; Jaramillo G. and Ceballos H. Preliminary evidence of correlation between foliar and root resistance to root rot caused by Phytophtthora tropicalis in cassava. Sixth International Scientific Meeting of the Cassava Biotechnology Network. Cali, Colombia March 8-14, 2004.

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1. Perez, J.C., M. Espitia, H. Ceballos,.J.I. Lenis, and E. Ortega.. Genetic, phenotypic and environmental relationships between different traits in cassava (*Manihot esculenta* Crantz). (to be submitted to **Crop Science**).

2. Chávez, A.L., T. Sánchez, A.L., H. Ceballos, P. Nestel, D.B. Rodriguez-Amaya, and M. Ishitami. Effect of processing on carotenes present in cassava (*Manihot esculenta* Crantz) roots (to be submitted to **Journal of the Science of Food and Agriculture**).

3. Sánchez, T., A.L. Chávez,, H. Ceballos, P. Nestel, D.B. Rodriguez-Amaya, and M. Ishitami. Effect of different storage conditions on carotenes present in cassava (*Manihot esculenta* Crantz) roots (to be submitted to **Euphytica**).