

Cassava flour processing plant
Valencia, Córdoba

CLAYUCA

Annual Report 2003

Executive Summary

Cassava flour processing plant
Beráztegui, Córdoba

Cassava flour processing plant
Sabana de Torres, Santander

Field day, CIAT/CLAYUCA

Commercial cassava field
Jamundi, Valle

CLAYUCA
Latin American and Caribbean Consortium to
Support Cassava Research and Development

CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture



SUMMARY ANNUAL REPORT 2003



**PROJECT:
LATINOAMERICAN AND CARIBBEAN CONSORTIUM TO SUPPORT
CASSAVA RESEARCH AND DEVELOPMENT - CLAYUCA**

Inputs:

Investigators:

Name	Discipline	Time Dedication %
Bernardo Ospina	Cassava Postharvest Management Rural Development	100
Luis Fernando Cadavid	Soil Fertility Crop Management	100
Lisímaco Alonso	Post harvest Management Rural Development	100
Jorge Luis Gil	Animal Nutrition	100
Amalia F. Jaramillo	Administrative Management	100
Nidia Betancourth	Communication Specialist	100
Johanna Aristizabal	Postharvest Management	100
Alvaro Alban	Crop Management	100
Andrea García	Secretary	100
Three field workers	Technical	100

Collaborators:

Within CIAT: Genetic Resources, Cassava Improvement, IPM and Agroindustrial Enterprises,, Biotechnology.

Outside CIAT: Public and private sector institutions and agencies, Universities, NGOs and farmer groups from Colombia, Venezuela, Ecuador, Cuba, Haiti, Paraguay, Bolivia, Mexico, Peru and Nicaragua.

Budget (Income during 2003)			
Item	Description/Source	Value (US\$)	
CIAT contribution	Executive Director Position (Seconded to CLAYUCA)	75,400	
<i>Subtotal CIAT contribution</i>		<i>75,400</i>	
Annual quota from country members	Perú	15,000	
	Venezuela	15,000	
	Nicaragua	15,000	
	Colombia (13% of funds given to CIAT cassava improvement project)	22,668	
	Annual membership payment of stakeholders (public and private)	16,270	
<i>Subtotal Annual quota from country members</i>		<i>83,938</i>	
Special projects (Approved in 2003) (Colombia)	1.Processing Laboratory for fresh cassava (MADR)	10,714	
	2.Use of cassava in bread-making (MARD)	10,714	
Special projects (Carryover from 2002)	3.Training Master Plan-Colombia-(MARD, Chemonics)	39,067	
	4. Minimum Tillage - (MARD)	21,150	
	5.Dextrines (2) -(MARD, Chemonics)	24,940	
	6. Cassava Production System with Mechanized Planting, Fertilization and Harvesting-(MARD)	6,694	
	7.Croquetes dry process -(MARD)	10,939	
	8. Adhesives from refined cassava flour	4,170	
	9. Refined cassava flour	3,007	
	<i>Subtotal Special projects income (2003)</i>		<i>109,967</i>
	Consultancies and services	1.In Colombia	4,111
2.In Africa		14,350	
<i>Subtotal Consultancies and services (2003)</i>		<i>18,461</i>	
Selling products	1. Selling books	4,980	
	2. Selling products and services	15,701	
<i>Subtotal Income for selling products</i>		<i>20,681</i>	
International projects	CFC Project	100,000	
<i>Subtotal international projects income (2003)</i>		<i>100,000</i>	
Total		428, 874	

RESEARCH HIGHLIGHTS 2002

Output 1: Technology development, adaptation and dissemination activities aimed at developing sustainable, efficient and competitive production and processing systems

Activities:

1.1 Development, adaptation and dissemination of a technology package for processing of cassava flour for use in animal feeding

Results:

- In nine regions of Colombia (Cordoba, Cesar, Putumayo, Meta, Bolivar, Casanare, Norte de Santander, Santander and Antioquia), through processes led by CLAYUCA stakeholders, agroindustrial cassava-based projects are under implementation. These projects include the installation of cassava flour processing plants. Several Colombian firms are now selling cassava flour processing equipment. Private sector companies have got interested in the process and have made investments to complement and improve the original technological process developed jointly between CLAYUCA and one stakeholder firm. This renewed interest in the industrialization of cassava is contributing to the industrial and technological development of the cassava sector. At least four different technologies are now available for investment in cassava flour processing plants.
- A thesis work was concluded with students of Chemical Engineering from Universidad del Valle through which a mathematical model was developed. The model represents the behaviour and characteristics of the cassava drying process in the pilot plant built at CLAYUCA. The importance of this work is that it allows the determination of the best operating conditions for the plant and a better estimation of real processing costs.
- Technology information and technical advice continues to be the main demand to CLAYUCA from stakeholders, especially in relation to cassava-based production and processing projects. Performing this function, the Consortium is consolidating its role as a technology-clearing house for the cassava sector in Colombia and other countries in the region

1.2 Adaptation and dissemination of a technology package for mechanized planting and harvesting of cassava

Results:

- Technological package adapted by CLAYUCA is now used in four cassava growing regions in Colombia, under commercial scale operations (Atlantico, Meta, Bolivar and Casanare)
- CLAYUCA imported the latest version of the cassava-mechanized planter available in Brazil. Evaluation trials of this equipment are underway
- Trials to evaluate the feasibility of mechanized fertilization in cassava were concluded with good results. This practice, complemented with mechanized planting and harvesting could allow farmers to make significant savings in production costs of cassava.
- CLAYUCA's technical personnel is giving direct technical assistance to 5 agroindustrial projects that will be planting annually a total of 4,000 has of cassava. Biggest challenge is to work on the adjustment and modification of production packages adapted to each region's specific edapho-climatic conditions. The main objective is to help farmers groups to get yields of 20 or more tons per hectare, at competitive production costs.

1.3 Adaptation and dissemination of technology for production and utilization of cassava leaves

Results:

- CLAYUCA has continued the promotion of cassava leaves cultivation and processing as a practice that can help farmers to increase incomes, generate employment and expand marketing options
- Advances were made in the development of silage and nutritional blocks for dairy feeding, using cassava leaves, cassava roots and molasses. These technologies have been demonstrated during the training courses, field days and technical assistance activities conducted by CLAYUCA and collaborators in different regions of Colombia.
- Private companies in Colombia are now selling machines imported from Brazil that are very useful for cutting and chopping cassava leaves. CLAYUCA has used them in several demonstration and field days

1.4 Development, adaptation and dissemination of a technology package for producing a refined cassava flour through a dry process that can be used as the starting point for the production of glue for industrial uses and starch for human consumption and industrial uses

Results:

- Development of the technology package to produce high quality cassava flour is now finished, at pilot stage. Prototypes were designed, built and tested. Product obtained is of a very high quality and in some specific uses (cardboard and plywood factories), it could easily be used to replace products such as cassava starch obtained through wet processes and/or wheat flour
- Two-thesis works were concluded, a) the use of cassava flour for the production of glue for industrial uses and b) obtaining cassava starch from dry cassava chips through a dry process with minimum use of water.
- Two thesis works have been initiated aimed at scaling up the prototypes designed and developed during the pilot stage.
- Trials with high quality refined cassava flour were conducted with two potential users and markets (plywood and cardboard industries) with excellent results.
- A new project has been initiated recently aimed at producing bread with the use of the high quality cassava flour as a partial replacement of wheat flour

1.5 Development, adaptation and dissemination of technological packages to produce new cassava-based products that can help cassava farmers to increase their incomes and employment opportunities through the development of new market alternatives

Results:

- A project is near completion aimed at developing a technology package to produce cassava croquettes through a dry process. This project is a collaborative activity with professors and thesis students of the Faculty of Agricultural Engineering of the Universidad del Valle.
- A project is near completion aimed at developing a technological package to produce high quality dextrines from cassava starch. This project will finish by August 2004.
- A project has been initiated to evaluate the use of waxes to treat fresh cassava roots. This treatment allows storage of the roots for periods of up to 3 weeks. Technology used currently is based on the use of paraffin, a petrol-derived, highly pollutant substance
- CLAYUCA has financed some experimental work conducted by Universidad del Valle and SENA (Servicio Nacional de Aprendizaje) aimed at using cassava starch and high quality flour to produce bio-packaging materials. Initial results look very promising.

1.6 Evaluation of sweet potato cultivars with the objective of using this crop as complement to cassava. Cassava and sweet potato production systems can become very important in Colombia as raw materials for animal feeding,

Results:

- CLAYUCA completed the third evaluation cycle of the set of improved sweet potato cultivars received from CIP-Peru. Agronomic data is now available
- A group of eight clones were selected for its adaptation and good yielding potential under Colombian conditions
- Planting material of these selected varieties has been sent to stakeholders in five departments of Colombia (Atlantico, Cundinamarca, Valle, Cordoba and Putumayo). Observation trials have been installed in these regions
- A new set of improved clones was received and it's currently being multiplied, comprising elite lines of the orange-flesh type sweet potato. The potential of this particular type of varieties in human nutrition projects is undeniable. Recently, CIP was awarded the King Baldwin Prize in recognition for the work with this orange flesh sweet potato in Africa. CLAYUCA intends to conduct some projects with this crop in 2004, aimed at promoting its use as a complement to cassava in human nutrition.

1.8 Development, adaptation and dissemination of a technology package for cultivation of vanilla crop.

Results:

- Vanilla cuttings and plantlets were obtained from CLAYUCA from different sources (Colombia, San Salvador, Costa Rica)
- Around 140 plants are being kept growing at CIAT under field and greenhouse conditions

Output 2: Increased membership and consolidation of CLAYUCA as a regional planning and coordination mechanism to support cassava research and development activities in Latin America and the Caribbean region

Activities:

2.1 Follow up visits and coordination of activities with member countries and private and public sector stakeholders in each member country

Results:

- Nicaragua became a new member of CLAYUCA. Leading institution is the Instituto Nicaraguense de Tecnología Agropecuária-INTA.
- Membership of CLAYUCA in Colombia has been maintained fairly constant. Some members went away but new ones kept coming. As of December 2003, 14 institutions from public and private sector are active stakeholders.
- Despite the difficult political situation that has prevailed in Venezuela during the last year, that has affected the relationship between public and private sectors, the Ministry of Science and Technology (M C y T), has managed to maintain its role as the coordinating institution for CLAYUCA in this country. Plans are under way to establish FUNVEYUCA, a foundation type scheme that will become the coordinator of all the activities of CLAYUCA in Venezuela
- Fourth Annual meeting of the group of stakeholders in Colombia was held at CIAT with very good attendance
- Technical assistance missions of CIAT and CLAYUCA personnel were realized in Colombia, Mexico and Nicaragua
- Training activities were conducted in Colombia, Mexico and Nicaragua
- Bolivia, Paraguay, Ecuador, Cuba and Haiti continue to be country members that have not consolidated its participation in the Consortium. So far, their participation in activities promoted by CLAYUCA has been minimal.

2.2 Contacts with public and private groups in countries interested in becoming members of CLAYUCA

Results

- A promotion visit was realized to Honduras to discuss possible mechanisms that could facilitate adhesion of the cassava sector in this country to the Consortium.

Output 3: Donor support seeking aimed at financing cassava research and development activities conducted by the Consortium

Activities:

3.1 Project proposals writing and follow up negotiations with Colombian Ministry of Agriculture

Results:

- Four proposals were approved during the period January-December 2003. Two of them were elaborated by CLAYUCA. The other two include CLAYUCA as a co-executor. Total value of these proposals was US\$ 44, 196

3.2 Project proposals writing and follow up negotiations with international donors aimed at seeking financial support for cassava research and development activities conducted by the Consortium

Results:

- Negotiations and logistical procedures with CFC and FAO/IGG were conducted by CLAYUCA and CIAT throughout the year to get the project approved by Common Fund for Commodities (CFC) finally on the ground.
- In November 2003, the start-up meeting of the project was held at CIAT with participation of representatives from CFC, FAO/IGG and project stakeholders from Colombia and Venezuela
- In November 2003, the first disbursement from CFC/FAO/IGG was finally received at CIAT (US\$ 100,000). Project activities will initiate formally in January 2003
- CLAYUCA participated in the elaboration of two proposals presented to the European Commission Research Directorate General, as part of the 6th Framework programme for international scientific cooperation projects. The two proposals are:
 - *Network for sustainable/organic cassava development: a regional initiative to improve natural resources management –SACAN*
 - *Increasing sustainable vegetable crop production as a mean to improve nutrition and promote economic growth of people living in peri-urban and rural areas of Latin America and the Caribbean –VINPEG*

In both proposals, CLAYUCA has been included as member of a consortium of research and technology transfer institutions, universities and private sector enterprises from various countries in Europe, Latin America and the Caribbean region.

- Two concept notes for regional projects, presented recently by CIAT to CIDA-Canada, have included postharvest components with CLAYUCA as the coordinating partner for this component.

Output 4: Consolidation of CLAYUCA as a technology-clearing house and as an important partner in human resources development for the cassava sector in Latin America and the Caribbean region

Activities:

4.1 Training activities for cassava researchers, technology transfer agents, farmer groups and private sector enterprises, conducted at CIAT and in member countries

Results:

- Five courses conducted in Colombia with a total of 108 participants
- 18 technicians from four countries (Venezuela (1), Nicaragua (1), Dominican Republic (1), Bolivia (1) and Colombia (14)) participated in specialized, in-service training activities at CIAT/CLAYUCA
- Four field days were organized in cassava growing regions of Colombia with a total attendance of 180 persons
- CLAYUCA received a total of 137 visitors from Colombia
- CLAYUCA received a total of 25 visitors from other ten countries
- CLAYUCA/CIAT technical personnel conducted 32 consultancy visits with Colombian stakeholders for a total of 88 man-days
- CLAYUCA technical personnel conducted 7 consultancy visit at international level with a total of 50 man-days

4.2 Publication and dissemination of scientific information related to cassava research and development

Results:

- The Book and booklet on cassava production, processing and utilization, published in 2002 by CIAT/CLAYUCA, with financial support from MADR, continues to have high demand. Probably, by mid 2004, it will be sold out.
- FAO-Rome was officially approached by CLAYUCA with a proposal to finance its translation to English language
- A document on the use of cassava in cattle feeding, published original by the Thai Tapioca Development Institute in Thai language (1998), was translated into English, printed and made available as PDF document in Clayuca web page. CIAT-Bangkok and CLAYUCA co-financed this work
- First draft of translation to English of the book “La Yuca en la Alimentación Animal” (by Julian Buitrago), was finished. FOODNET, an IITA-supported network has agreed to do a scientific editing of the draft. Initially will be circulated as Web-page document, and financial support will be sought in 2004 to publish it.

- Two issues of CLAYUCA's electronic bulletin were distributed in 2003.

4.3 Thesis Work projects conducted in agreement with 3 Universities (Valle, Nacional and Javeriana) and their faculties of Agronomy, Agricultural, Industrial, Mechanical and Agroindustrial Engineering

Results:

- 3 thesis work projects were finished in 2003
- Two thesis work were initiated in 2003

4.4 Establishing partnerships and linkages with institutions and organizations around the world that are currently working in areas related to CLAYUCA's mission and objectives

Results:

- CLAYUCA attended the International Conference "A Global Post-harvest Systems Initiative for the 21st Century: Linking Farmers to Markets", organized jointly by FAO, GFAR and PhAction, held in Rome, October 7-9, 2003.
- CLAYUCA attended the Business meeting of PhAction held at Rome in October 10th, 2003.

Output 5: Contribution to the formulation and implementation of a collaborative agreement with IITA, seeking a more integrated, system-wide framework for cassava research and development activities

Activities:

5.1 Consultancy mission to IITA/SARRNET to Malawi and Tanzania (March 9-18, 2003)

Results:

- Activities conducted as agreed upon in work plan
- Final report prepared and presented

5.2 Facilitator/Coordinator role for facts-finding trip to Brazil and Colombia of a group of Nigerians from private and public sector institutions

Results:

- A group of 10 Nigerians, on behalf of the Nigerian Presidential Initiative On Cassava Market Development and Export, visited Brazil and Colombia with the objective of knowing experiences and advances on cassava production, processing and utilization systems in both countries
- Two members of CLAYUCA undertook a consultancy mission to Nigeria to give technical advice on cassava production and processing to Nigerian Starch Mills (NSM), the largest cassava starch processing plant in Nigeria.
- Two members of NSM visited Colombia and Brazil with the objective of knowing experiences and advances on cassava production, processing and utilization systems in both countries
- South-south collaboration on cassava development activities is starting to materialize as a result of these exchange of experiences. Cassava starch processing equipment produced in Brazil and cassava flour processing equipment produced in Colombia has attracted interest from the Nigerian group. Negotiations are underway to purchase equipment that could be worth around two million dollars.

PERFORMANCE INDICATORS, CLAYUCA 2003

1. TECHNOLOGY, METHODS, TOOLS

➤ DEVELOPMENT, ADAPTATION AND DISSEMINATION OF A TECHNOLOGY PACKAGE FOR PRODUCING A REFINED CASSAVA FLOUR THROUGH A DRY PROCESS THAT CAN BE USED AS THE STARTING POINT FOR THE PRODUCTION OF GLUE FOR INDUSTRIAL USES AND STARCH FOR HUMAN CONSUMPTION AND INDUSTRIAL USES

Development phase of this technology has been concluded. The product that is obtained currently is of excellent quality and has potential to be used in different market niches. Basic design of prototypes equipment has been finished. Scaling up of the process is an ongoing activity. Two trials conducted at commercial scale in the fabrication of plywood and cardboard were conducted successfully. The largest user of cardboard in Colombia (Banana exporting company) has initiated activities to build its own factory to produce the cassava-refined flour. Their goal is to produce the glue and the cardboard boxes they use in their banana exporting business. Processing equipment companies are expressing interest in incorporating the refining unit into their current designs of cassava flour processing plants. Next steps will be to test the viability of the refined flour in the bread-making industry as a partial replacement of wheat flour and in the beer industry as partial component of the raw materials used (substituting wheat and barley flour).

➤ DEVELOPMENT, ADAPTATION AND DISSEMINATION OF A TECHNOLOGY PACKAGE FOR PROCESSING CASSAVA FLOUR FOR USE IN ANIMAL FEEDING

Efforts realized during the last four years by CIAT and CLAYUCA, with financial support from the Ministry of Agriculture and Rural Development (MARD) and many collaborators, have started to give off the results expected. By the end of 2004, 11 agro industrial, cassava-based projects are in the process of building their cassava flour processing plants. In each of these projects, commercial planting of cassava is included. Some of them are already operating. These projects have brought a new dynamism to the cassava sector in the country. Near 6,000 has are being established by these groups to attend the demands of raw material in 2004 by their processing units. Cassava industrial varieties, mechanization, integrated crop management, and in general, all the components of a commercial scale, profit-oriented operation are in high demand. This situation represents an excellent opportunity for CIAT and CLAYUCA to enhance transfer and adoption of improved technologies. Additionally, it is helping to reaffirm the potential of the cassava crop as a commodity that can be used as an important, strategic component that is helping the Government to promote rural development.

➤ ADVANCES MADE IN THE DEVELOPMENT OF METHODOLOGIES FOR THE PRODUCTION OF DEXTRINES FROM CASSAVA STARCH AND REFINED FLOUR (FOR INDUSTRIAL USES)

This technology development process is near its completion. Experimental work has finished and prototype development is almost finished. Several private companies that are using imported dextrines have been contacted and have expressed interest in conducting trials at commercial scale. Next phase will concentrate in developing the lay out required to set up a factory. One of the donors of this work (Chemonics, Inc) is currently establishing two cassava-processing plants in one region of Colombia and could be interested in setting a plant to produce dextrines from cassava

➤ ADVANCES MADE IN THE DEVELOPMENT OF METHODOLOGIES FOR THE PRODUCTION OF CROQUETTES FROM REFINED CASSAVA FLOUR (HUMAN CONSUMPTION USES)

Important advances have been made in the development of this novel technological process,. Despite the fact that CLAYUCA does not own an extruder and has to rely on equipment owned by collaborators, several trials have been conducted and promising results have been obtained. It is expected that by the end of 2004, this technology could be fully developed.

One aspect that confirms the potential that this technology could have is the fact that the majority of the cassava-based agroindustrial processes that are being established in Colombia, are including not only the processing of cassava flour for animal feeding but have also a component for the production of croquettes for human consumption. This is a sound strategy to diversify marketing options.

➤ ADVANCES MADE IN THE EVALUATION OF SWEET POTATO CULTIVARS WITH THE OBJECTIVE OF USING THIS CROP AS COMPLEMENT TO CASSAVA.

Sweet potato can become a very important crop in Colombia and other countries in the region that are promoting cassava production and processing systems, especially in relation to animal feeding systems. CLAYUCA has completed its second year of work with this crop, testing elite lines that were obtained from CIAT. Initial results are very promising and some lines have already been selected. Planting material of these lines has been distributed among some CLAYUCA stakeholders. The idea that CLAYUCA is promoting is the establishment of sweet potato field, side by side with cassava fields so that farmers can have an earlier harvest of the sweet potato, make some income and at the same time, have some raw material to process in the plants before the cassava is ready for harvest.

A second line of work with this crop has been initiated with the introduction of a selected collection of orange flesh varieties of sweet potato from CIP. These varieties are characterized by its very high content of betacarotenes that act as precursor of vitamin A in the human body. CIAT has been recently awarded the CGIAR Partnership Award for its work with orange flesh sweet potato in Africa. The in-vitro multiplication phase with the

elite lines sent by CIP is about to be finished. Next step will be to harden them off and establish the first observation trials. The idea of CLAYUCA is to promote these varieties through some projects aimed at developing products for human consumption

2. PUBLICATIONS

➤ **Book chapters**

- Published one
JIRCAS International Symposium Series No. 11, ISSN 1340-6108). March, 2003.
Japan

- Submitted
Four papers to be published in the proceedings of the VII Regional Cassava Workshop for Asian Countries, held in Bangkok, Thailand, November , 2002

➤ **Documents published**

- **Cassava in cattle feeding.**

This working document published originally by the Thai Tapioca Development Institute in Thai language was translated into English and published as a printed document and also as a PDF document. CLAYUCA and CIAT-Bangkok financed the publishing of this document

➤ **Scientific Meetings Presentations**

- One presentation (International)
- 17 presentations (National)
- Two evaluation meetings with MARD personnel

3. STRENGTHENING NARS AND STAKEHOLDERS

➤ **Training courses**

- Four courses in Colombia (Production, processing and utilization technologies)
- Four field days in Colombia (Production, processing and utilization technologies)

➤ **Individualized training**

- 1 technician from Nicaragua on tissue culture methods
- 1 technician from Dominican Republic on tissue culture methods
- 1 technician from Bolivia on postharvest technologies
- One technician from Venezuela on cassava production, processing and utilization technologies

➤ **PhD, M.Sc. and pre graduate students**

- B.Sc. 7 students are currently conducting their thesis work at CLAYUCA

➤ **Workshops and Meetings**

- IV Annual Meeting Clayuca-Colombia , CIAT, Cali, Colombia
- International Conference “Global Post-harvest Systems Initiative for the 21st Century: Linking farmers to markets”. FAO, Rome, October 7-9, 2003
- Ph Action Group, Business Meeting, Rome, October 10th, 2003
- Seminario Internacional: Competitividad y Productividad Agrícola y Agroindustrial”. Universidad Nacional, Palmira , Valle, October 3-5, 2003

➤ **Technical assistance to stakeholders**

- Consultancy visit to Mexico
- Consultancy visit to Nicaragua
- 32 Consultancy visits to stakeholders in Colombia for a total of 88 man-days
- 137 visitors from Colombia
- 25 visitors from other countries

4. PARTNERSHIPS, COLLABORATIVE AGREEMENTS

- Consultancy visit to Tanzania and Malawi as part of collaborative agreement IITA/CIAT/SARRNET/CLAYUCA
- Consultancy visit to Nigerian Starch Mills in Nigeria
- Coordination of facts-finding trips for two groups of Nigerian representatives of private and public sector

5. RESOURCE MOBILIZATION

➤ **Fund contribution form stakeholders**

- Four countries contributed its annual quota
- Five countries have not yet contributed its annual quota

➤ **Proposals funded - Colombia**

- 4 proposals were funded by the Colombian Minister of Agriculture

➤ **Proposals funded – International Donors**

- Proposal funded by CFC – First payment was received (November, 2003)