

**CLAYUCA: LATIN AMERICAN AND CARIBBEAN CONSORTIUM TO
SUPPORT CASSAVA RESEARCH AND DEVELOPMENT**

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ABSTRACT

During the last 25 years, cassava research in Latin America and the Caribbean (LAC) has been the responsibility of the Centro Internacional de Agricultura Tropical (CIAT) in collaboration with national programs, and has been financed mainly with public-sector funds. At the end of the 1980s, this model was not longer viable due to changes in the world's socio-economic situation, forcing institutions and countries to organize and establish strategic alliances to continue cassava-based research and development activities. The cassava sector in Latin America and the Caribbean also felt this need.

To solve this situation, it was necessary to identify and establish new models for financing and supporting cassava research and development to attend to the interests and needs of different groups of end-users of the technology from both the public and the private sector. It was proposed to form a Consortium to finance and support research and development of cassava, to strengthen the transfer of improved technologies, and to enhance the exchange of experiences, information and technologies among LAC countries. Thus, CLAYUCA was established.

The mission of CLAYUCA is to contribute to improving living standards and sustainable natural resource management in regions of LAC where cassava plays an important role in agricultural production systems, through the generation, transfer and exchange of technologies, information and scientific knowledge among public and private sector institutions and farmers in the region.

The main objectives are:

1. The organized participation of public and private sector institutions, including universities, non-governmental organizations and farmer groups, in the discussion and identification of priority issues and the definition of a regional research and development agenda for the cassava crop.
2. Execution of collaborative cassava-based research and development activities, with participation of diverse institutions in each member country.
3. Seeking additional financial support to implement research and development activities that could benefit all member countries.
4. Strengthening national capacity in each member country to execute research and development activities at the national level and to participate in activities at the international level.

Founding members of the Consortium are Colombia, Cuba, Bolivia, Ecuador and Venezuela, the International Center for Cooperation in Agricultural Research for Development (CIRAD) and CIAT. In each country, the group of participants in activities promoted by the Consortium are composed of institutions from the public and private sector, universities, non-governmental organizations, farmer groups and other sectors involved in cassava production, processing, commercialization and utilization, training, research and technology transfer. Potential members are all cassava producing countries in LAC, which have the capacity to help finance and execute activities of the Consortium.

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CLAYUCA will be self-financed. Each participating institution will pay an annual membership fee. Resources contributed by each member country will be administered and spent only on activities defined collectively by members of the Consortium. The Consortium's operational budget will be defined in agreement with the workplan established for each year. Moreover, the Consortium will seek additional funding to execute specific projects.

BACKGROUND

Cassava originated in Latin America and the Caribbean (LAC), where it has been cultivated since prehistoric times. Its adaptation to diverse ecosystems, its high production potential and the versatility of its markets and end uses have transformed the crop into a basic food for rural populations and a commercialization alternative for urban markets.

Today, the crop has extended to nearly 90 tropical and subtropical countries, with estimations that its starch-rich roots and protein-rich leaves are feeding about 500 million people. LAC is responsible for about one fifth (34 million) of the 170 million tonnes of fresh cassava roots that are harvested in the world every year.

During the last 25 years, cassava research in the region has been the responsibility of the International Center for Tropical Agriculture (CIAT), with the collaboration of diverse entities and national programs, and has been financed mainly with public-sector funds. At the end of the 1980s and all throughout the 1990s, this model was not longer viable, mainly because many public sector institutions have been undergoing change and reform as part of the region's structural adjustments, including decentralization and privatization. Countries and institutions interested in cassava in the region felt the need to organize and establish strategic alliances that could lead to the establishment of new models for financing and supporting cassava research and development activities. These new alliances were meant to involve different groups of end users of the technology, from both the public and the private sector.

It was proposed to form a Consortium to finance and support research and development of cassava, strengthen the transfer of improved technologies, and enhance the exchange of experiences, information and technologies among LAC countries. That this type of regional mechanisms could function is shown by the Consortium in LAC for irrigated rice: the Latin-American and Caribbean Fund for Irrigated Rice (FLAR), which was formed in 1995 and of which CIAT and CIRAD are also founding and active members. After five years of work, FLAR has a membership of 12 countries and expect to invest annually nearly half a million dollars in rice-based research and development activities.

Based on these considerations, it was proposed to create the Latin American and Caribbean Consortium to Support Cassava Research and Development, CLAYUCA.

RATIONALE

The establishment of a mechanism through which the public and the private sector could jointly support research and development activities is justified on the grounds that it will allow countries to have more control over the research agenda and the benefits obtained. The investors control and assume responsibilities for parts of the agenda, which becomes a regional agenda. Each sector contributes with its own capacities and strengths, and the work is planned and conducted based on common interests and prioritized

problems. For the International Centers the benefits accrue from the help that Consortium activities can give in filling the vacuum left by the Centers in regional research. This vacuum has increased considerably in the last decade due to the Center's financial constraints.

The work of the Consortium goes beyond the traditional research domain and becomes a regional forum. This is an additional benefit for the International Centers that allows them an active presence, at a relatively low cost, in a regional research and development agenda. Finally, private and public sector institutions obtain improved access to technologies generated by International and Advanced Research Centers.

JUSTIFICATION FOR CLAYUCA IN LATIN AMERICA AND THE CARIBBEAN

The newly born Consortium appears a viable mechanism for the LAC region considering the following opportunities and challenges that have arisen during recent years:

- 1) The dynamic growth of the cassava starch market, both for foodstuff and for industrial use.
- 2) Increased growth in cereal imports as raw material for balanced animal feed rations, in tandem with recent technological developments in the use of dried cassava chips as a partial substitute for cereals in animal feed.
- 3) Important advances in the development of improved technologies for manipulating the genetic potential of cassava germplasm (e.g. biotechnology and molecular biology).
- 4) Important advances in the development of improved technologies for sustainable, integrated management of the cassava crop.
- 5) A need to increase the crop's competitiveness through higher productivity, reduced processing costs and improved efficiency in the use of cassava, its products, and byproducts.
- 6) Predominance of cassava as an associated crop in small-farmer production systems found in marginal zones, thus representing an alternative agricultural policy to stimulate the socio-economic development of this sector.
- 7) Interest of the public and private sector in supporting cassava research and development activities aimed at generating improved technologies for production, processing, utilization and commercialization.

CLAYUCA'S MEMBERSHIP

Founding members of the Consortium are Colombia, Cuba, Ecuador and Venezuela, the International Center for Cooperation in Agricultural Research for Development (CIRAD) and CIAT.

In each country, the group of participants in activities promoted by the Consortium are composed of institutions from the public and private sector, universities, non-governmental organizations, farmer groups and other sectors involved in cassava production, processing, commercialization and utilization, training, research and technology transfer. Potential members are all cassava producing countries in LAC, which have the capacity to contribute financially and execute the activities of the Consortium.

CLAYUCA's MISSION

To contribute to the improvement of living standards and sustainable natural resource management in regions of LAC where cassava plays an important role in agricultural production systems, through the generation, transfer and exchange of technologies, information and scientific knowledge among public and private sector institutions and farmers in the region.

CLAYUCA's OBJECTIVES

To establish a self-financing, sustainable regional mechanism to facilitate:

1. Organized participation of public and private sector institutions, including universities, non-governmental organizations, and farmer groups, in the discussion and identification of priority issues, and the definition of a regional research and development agenda for cassava.
2. Execution of collaborative cassava-based research and development activities, with participation of diverse institutions in each member country.
3. Seeking additional financial support to implement research and development activities that could benefit all member countries.
4. Strengthening the national capacity in each member country to execute research and development activities at the national level and to participate in activities at the international level.

CLAYUCA's FINANCING

CLAYUCA will be self-financed. Each participating institution will pay an annual membership fee. This annual fee is calculated based on each country's annual production (see Annex 1). Resources contributed by each member country will be administered and can only be spent on activities defined collectively by members of the Consortium.

The Consortium's operational budget will be defined in agreement with the workplan established for each year. Additionally, the Consortium could seek additional funding to execute specific projects.

The four founding member countries of CLAYUCA have already committed an annual budget of nearly US \$ 100,000. Currently, CIAT's contribution is about US \$ 100,000 and CIRAD is offering scientific expertise upon request. The goal, when the Consortium is fully operating, is to reach US \$ 340,000 per year.

CLAYUCA's ORGANIZATIONAL STRUCTURE

The organizational and operational structure of the Consortium is to be maintained as flexible and light as possible. The main decision-making structure is the Executive Committee composed of one representative from each country and one representative from each International Center. Each one of these members will have voting power. This Committee is responsible for defining the procedures, norms and orientation that the Consortium will follow to conduct its activities.

The second decision-making structure is the Technical Committee composed of up to three members from each country. These representatives are to be selected with

participation of all the members of the Consortium in each country. Each International Center will have one representative in this Committee. The main responsibility of the Technical Committee is to define the working agenda, making sure that the interests and needs of each country are included and accounted for.

The organizational structure of CLAYUCA also includes the Executive Director, appointed by the Executive Committee. His/her principal responsibility is to act as the representative and coordinator of all technical and administrative activities implemented by the Consortium.

CLAYUCA's WORK PLAN

An initial workplan has been defined and approved for the year 2000. It includes topics and issues that were prioritized by the members. Activities will include:

- ◆ **Transfer of cassava germplasm with high yield potential to member countries**

This activity will be conducted with all interested countries and institutions. Shipment of cassava germplasm will include different forms: *in-vitro*, stakes (Colombia) and poly-crossed sexual seed. Initial shipments of sexual seed have been sent to Ecuador and Venezuela.

- ◆ **Post-harvest handling of cassava**

Processing technology for cassava flour for animal feeding is a request that has appeared as top priority in all countries. Options that are being evaluated and adapted to each country's specific characteristics include natural, artificial and mixed (natural + artificial) drying systems.

Cuba and Venezuela are interested in small-scale cassava starch processing technologies. CIRAD and the Rural Agroenterprises Project at CIAT have a wealth of knowledge and accumulated experience in this type of technology, and CLAYUCA will try to negotiate their support and collaboration to implement technology transfer activities.

- ◆ **Technical Assistance and Promotion**

These activities will be conducted in the five member countries, coordinated by the CLAYUCA group of each country. Based upon each specific request, CLAYUCA will try to coordinate support from researchers at CIAT, CIRAD, and the member institutions in each country.

- ◆ **Research and Development**

CLAYUCA's initial agenda for cassava-based research and development activities is aimed at supporting member institutions in each country in the process of transforming cassava into a competitive, efficient and profitable agricultural commodity. The areas defined are (in priority order):

1. Mechanization

There are available, in various countries of Asia, Europe and Latin America, some prototypes for mechanized planting and harvesting of cassava, with potential to reduce

production costs considerably. CLAYUCA has initiated activities aimed to a) identify more viable options (technical and economic), b) purchase and validate the prototypes, and c) make recommendations on the more suitable options according to each country's specific characteristics. This work area will also include mechanized fertilization of cassava.

2. Cassava Drying (Artificial or Mixed)

The potential of cassava flour to be used in the animal feed industry has grown considerably in Latin America during the last decade. These opportunities are based on the dependency that most of the countries in the region have established on the importation of cereals (maize, soybean) for their balanced animal feed rations. To consolidate this potential, besides the basic condition of producing cassava roots at competitive prices (high productivity, low costs), it is necessary also to develop drying systems (artificial or mixed), that allow the final cost of the raw material (cassava flour) to be competitive with that of imported cereals. CLAYUCA will be implementing activities to achieve this goal.

3. Fertilization

Fertilization practices, and especially the issue of soil fertility management, is closely related to the Consortium's general objective of supporting member countries in their search for more efficient, profitable and sustainable cassava production, processing and utilization systems. Based on information and accumulated experiences at CIAT and at some of the institutions affiliated to CLAYUCA (INIVIT-Cuba and Almidones Nacionales de Colombia), the Consortium will develop practices and recommendations based on the use of conventional and non-conventional fertilizers, such as poultry and pig manures, mycorrhizas, azotobacter, phosphorin and others.

4. Integrated Pest and Disease Management

An analysis of strengths existing at CIAT, and in some of the member countries, has shown the importance of implementing research and development activities that could facilitate the validation of technologies based on the use of bio-pesticides, for controlling most of the pest and diseases that affect the cassava crop. In Cuba, for example, during the last five years, the use of chemical pesticides in cassava production has been avoided and the use of biological products such as *Verticillium*, *Metarrizium*, *Bauveria bassiana*, *Bacillus thuringiensis* and *Thrichrograma* has been intensified. CLAYUCA will be implementing activities based on these technological alternatives that could be important in reducing costs and diminishing the use of chemical products.

5. Genetic Modification of Cassava

Although this activity will not be executed directly by CLAYUCA, there have been some discussions about the strategic importance of maintaining the Consortium linked with research projects that are being formulated at CIAT to produce transgenic cassava plants. Some of the possibilities being analyzed include working with genes that will confer Round-up and pests resistance, or that will modify the amylose/amylopectin ratio. The possibility of developing elite, genetically-modified clones of cassava with some of these characteristics could be an important breakthrough in large-scale cassava

plantations and could also be important in small-scale systems in which farmers could grow premium varieties and obtain better prices.

6. Production and Utilization of Cassava Foliage

This activity is also related with the potential of cassava leaves to be used in animal feeding. The cassava top part (leaves and stem), represents an important protein source, that, with very few exceptions, is unused in Latin America and the Caribbean. CLAYUCA will implement activities to validate and adapt existing technologies for the production and utilization of cassava foliage. The aim is to generate reliable technical information on the nutritional value and potential of cassava leaves to be used in animal feeding.

CONCLUSIONS

The promotion of joint ventures between public and private sector institutions and enterprises, with the aim of supporting research and development activities for a specific crop is not a process that develops overnight. A good solid initial thrust has to be developed based on clearly specified objectives, methods, and operational procedures. Thus, private sector investors recognize the importance of sharing risks and responsibilities in supporting and financing research activities, but at the same time, are able to clearly recognize the benefits they will get.

The presence and participation of the public sector is essential in this type of arrangements. Although they usually lack the necessary funds, their importance is based on the wealth of knowledge and information they have about the appropriateness of specific technologies at the local level. They also have a strong capability to facilitate the implementation of activities.

International and Advanced Research Centers are key players in these Consortiums. Over the years they have accumulated knowledge, information and experiences related to technology generation and dissemination. In most cases, problems prioritized by member countries already have technological alternatives tested or in the process of generation. The close participation and joint efforts of the private and public sector helps to speed up the final process of fine tuning these promising technologies.

Experiences developed throughout the last five years by the irrigated rice sector in Latin America, represented by FLAR, and promising results that the cassava sector is starting to obtain, represented by CLAYUCA, indicate the potential of promoting joint ventures of private and public sector institutions, with scientific backstopping from the International and Advanced Research Centers, with the common objective of increasing competitiveness, efficiency and profitability of specific agricultural sectors.

TWO EXAMPLES OF COLLABORATION

Two examples help to illustrate the potential of this Consortium and the type of activities that could be implemented:

1. Institutions conducting research on cassava in Cuba have made important progress in the use of biological control methods for some of the principal pests and diseases that affect the crop. These technologies are relatively unknown in other LAC countries.

One important activity of the Consortium could be the realization of training events through which Cuban researchers could transfer this knowledge to other cassava researchers in LAC. Training activities, as an instrument to strengthen collaboration among research and technology transfer institutions in LAC countries, could be one of the most important work areas for CLAYUCA.

2. In South Brazil (States of Sao Paulo, Paraná, Santa Catarina), there are many cassava starch processing factories, both small- and large-scale. These factories face strong competition from corn-based waxy starches, mostly imported, that were developed with scientific support from universities in the USA. These regional factories have complained about the lack of research on improved cassava varieties that could yield starch of competitive quantity and quality. According to researchers at the Biotechnology Unit of CIAT, there are currently some advances in the manipulation of the genetic characteristics of cassava varieties that could enable the obtention of genetically-modified varieties with higher amylopectin content, which could make them very attractive for industrial purposes. The immediate benefits of this technological advance could be very important: cassava farmers could harvest cassava varieties with improved industrial quality, thus receiving better prices; conversely, cassava processors could elaborate more competitive products and establish more profitable market opportunities.

The Consortium could help turn these technological possibilities into reality.

REFERENCES

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ANNEX 1. MECHANISM FOR FINANCING CLAYUCA

To finance CLAYUCA's activities, a mechanism has been established based on quotas paid by each member country. The criterion used to determine this quota is the annual cassava production for each country. The mechanism is as follows:

a. Annual affiliation quota

- ◆ Countries with an annual production of fresh cassava roots of less than 350,000 tonnes will pay US \$ 15,000 per year
- ◆ Countries with an annual production between 350,000 and 700,000 tonnes will pay US \$ 20,000 per year.
- ◆ Countries with an annual production between 700,000 and 1 million tonnes will pay US \$ 25,000 per year

b. Annual additional quota

An additional quota has also been established as follows:

- Countries with an annual production of more than 1 million and less than 3 million tonnes will pay an additional quota of US \$ 5,000 per year , and
- Countries with an annual production of more than 3 million tonnes will pay an additional quota of US \$ 10,000 per year.

Based on these considerations and using production data from FAO, the quotas currently established for affiliation to CLAYUCA are as shown in **Table 1**.

Table 1. Cassava production in Latin America and the Caribbean and the annual financial contribution to CLAYUCA.

| Country | Annual production ¹ (tonnes) | Annual quota (US \$) |
|--------------------|--------------------------------------------|-------------------------|
| Brazil | 24,551,534 | 35,000 |
| Paraguay | 2,925,477 | 30,000 |
| Colombia | 1,800,066 | 30,000 |
| Peru | 661,996 | 20,000 |
| Haiti | 350,000 | 15,000 |
| Venezuela | 344,238 | 15,000 |
| Bolivia | 316,664 | 15,000 |
| Cuba | 252,500 | 15,000 |
| Argentina | 157,500 | 15,000 |
| Costa Rica | 131,000 | 15,000 |
| Dominican Republic | 123,823 | 15,000 |
| Ecuador | 76,688 | 15,000 |
| Nicaragua | 51,375 | 15,000 |
| Guyana | 35,100 | 15,000 |
| El Salvador | 34,920 | 15,000 |
| Panama | 31,600 | 15,000 |
| Guatemala | 15,683 | 15,000 |
| Honduras | 8,900 | 15,000 |
| Suriname | 6,000 | 15,000 |
| TOTAL | | 340,000 |

¹⁾Average of four years, 1993-1997

Source: FAO, 1999 .