

## ANNUAL REPORT 1990

### SEED UNIT

#### EXECUTIVE SUMMARY

Concurrent with the philosophy that simpler and less expensive middle ground seed supply systems are required to further extend the benefits of seed-embodied technologies, the Unit's major achievement has been demonstrating in the field that artisanal seed production/supply schemes are feasible. This is evidenced by the San Gil case in Colombia and the Jutiapa case in Guatemala. Despite all the organizational flexibility needed, features of this scheme are: farmer as the central participant, reduced operational infrastructure to start out, utilization of locally-abundant resources, simplicity in post-harvest seed management, and differentiation of improved seeds. The success achieved with the first pilots has led to the initiation of other pilot projects in various countries.

Research in post-harvest seed-management technologies was very active. The results are presented in a small-scale seed conditioning prototype, which is utilized for research as well as training purposes. Inexpensive, but highly-efficient methods, were developed for seed selection, combining modern principles with traditional methods. The methods include harvesting, drying, cleaning, and selection of seeds. New, scientifically-valid methods are incorporated into the flow of operations and are currently presented in the small-scale seed management prototype.

To cope with the overwhelming interest in this new concept, the Unit focused on training trainers and strengthening regional/in-country training capacity, in order that CIAT-trained professionals can train others. Highly-tailored workshops were carried out. These are currently being replicated in a cascade fashion in several countries.

In brief, the middle ground concept in seed supply is being field-tested and is showing positive results. CIAT's efforts in terms of strengthening national seed systems, development of seed technologies, and human resource development have focused on this evolving system.

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The development of seed supply systems (SSS) in Latin America has not kept pace with advances in the development of improved varieties, especially in those production systems where medium and small farmers predominate. There is also increasing evidence that generating new varieties is not enough to achieve adoption and impact through seed-related technologies. Thus there is a need to strengthen existing organized seed supply systems and to propose technological innovations to accelerate the development of organized seed supply schemes. The lack of organized seed supply systems is a serious constraint in beans, cassava, pastures, and open-pollinated maize. This is also the case for traditional production systems in rice.

The year ending has been one of further sharpening the focus and achievements in the Unit. After overcoming weaknesses of the past, the Unit is now gaining greater capacity in post-harvest management of seeds in a very simple but effective way. Even with methodologies that were mainly tested with beans, and due to their complexities in post-harvest, the findings indicate that the approach will be effective with other grain crops. With this achievement, the Unit is now acquiring the capacity to present seed production methodologies that go beyond the scope of industrial systems. The new artisanal methodologies (presented in a stepwise flow in the small-scale seed conditioning unit) are unique in the developing world.

The goal of the Unit is to contribute to agricultural growth, equity, and sustainability by developing technologies that will accelerate the evolution of seed supply systems and increase availability and utilization of improved seeds for CIAT mandate commodities and maize. This objective cannot be achieved simply by developing highly efficient production methodologies, but by complementing through strengthening institutions that take part in national seed supply systems.

Thus, in the year ending, predevelopment activities oriented toward the initiation of alternative seed supply schemes in several countries were successfully undertaken.

The geographic area of concentration is tropical America, with emphasis on the following four subregions: Central America, the Andean region, the Caribbean, and northeast Brazil. Due to reduced human resources at the senior level, areas of concentration this year were narrowed to beans in Central America and the Andean region and cassava in Colombia.

## ACHIEVEMENTS

The thrust of the Unit is to develop effective national seed supply systems. This is sought in cooperation with CIAT commodity programs and national research, seed, and extension organizations. This thrust is supported by two main activities: the development of component technologies and human resource development. Achievements in these three areas are briefly reported.

### 1. Development of Seed Supply Systems

An organized seed supply system requires several specialized functions such as research, seed production/distribution, and utilization linked in a functional manner. At the national level, these functions and other supporting functions are carried out by different public and private organizations. Even though isolated segments normally exist, integrated and chain-like functional systems are lacking. This is especially the case with beans, cassava, pastures, and open-pollinated maize. Rice under commercial farming already has organized seed supply systems. To overcome this constraint, an alternative middle ground named artisanal seed supply schemes or nonconventional schemes in recent literature has been proposed to national partners with overwhelming receptivity. Currently, the scheme is being field-tested in selected regions of Guatemala, Panama, Honduras, Colombia, Ecuador, and Peru in cooperation with national research, seed, and extension organizations.

The artisanal scheme in essence attempts to develop inexpensive middle-ground seed supply systems between the conventional (industrial) and traditional (farmer-saved seed) systems by capitalizing on simple but highly efficient production methods that are carried out by local farmer-producer organizations (FPOs). The new producing/marketing units for improved seeds receive local official support from research (through supply of new varieties), seed, and extension services (through technical assistance). CIAT assists the institutional evolution by providing production and organizational technologies and human resource development.

The development of these proposed alternatives, is still in its testing phase at this stage. Therefore great flexibility in concepts, methods, and tools is being exercised by CIAT and its counterpart organizations. Despite having many possible variations, the major features assured from the outset in this evolving system are: the farmer as the central participant; smallness of operation in the beginning; utilization of local resources; and simplicity in post-harvest management and differentiation of seeds.

The mechanism for CIAT assistance in this thrust is technical consultations that required our presence on-site to assess situations and design plans/projects to overcome constraints (Table 1). This implied consultation trips to Guatemala, Honduras, Ecuador, the Dominican Republic, and, naturally, several regions in Colombia. In Guatemala, a seed-producers' cooperative has been set up; in Honduras, the artisanal scheme is being introduced; in Ecuador, maize and bean seed production is being initiated; and in the Dominican Republic, a small-scale seed plant has been proposed at CEDIA-CRIB to become a prototype of its kind for the Caribbean. In Colombia, the San Gil Project, which started as an artisanal operation in 1983, is now a "success" case and the major bean seed supplier in the country. Having learned important lessons, other pilot projects are being initiated in the coffee-growing area of Pereira, Risaralda, and in Pescador, Cauca. The latter is based on IPRA's participatory project.

Regardless of variations in organization, size of operations, and other local conditions, one key objective in this new system is that production/marketing should be competitive in production, quality, and cost. The middle-ground seed system needs to satisfy rigorously the features of long-term financial sustainability. This imposes the need for inexpensive but highly efficient seed production methodologies so as to assure greater availability of quality seeds at low cost. This brings us to the second major activity of the Seed Unit.

## 2. Research and Development of Component Technologies

Despite growing interest, the development of organized seed supply systems is limited by the lack of methodologies. Therefore the Unit has been focusing on two areas of research: seed management and socio-organizational technologies (Table 2).

Seed management concentrates on the area of greatest potential impact, which in Tropical America is post-harvest management. Efficient technologies allow creating an added value and differentiating improved seed, which in turn are needed for effectively incorporating into the market. With this objective in mind, the Unit this year continued developing simplified methods to incorporate scientific principles in a manner that would be easily replicated by small-scale seed producing/marketing units. Among other methods, simple pneumatic seed-cleaning and visual/manual seed-sorting devices were developed and tested. These methods were very effective and have currently been incorporated as the routine component in the small-scale seed-conditioning prototype.

Other specific components were developed in the previous year. These and the new components are currently presented in a stepwise flow or process in the small-scale seed-conditioning prototype. The prototype includes alternative methods for each of the following activities: threshing/shelling; drying; screening/selecting and storing; and quality assessment. The alternatives vary from

hand-operated to larger machine-operated methods that can be scaled up or down within a range of 1000 kg capacity/day. As anticipated in their conception, these methods are readily being replicated at several pilot sites in Central America and the Andean region. Each method and the whole post-harvest process have been tested using beans as experimental materials. Given the achievements in this area, impact with simplified seed management methodologies is anticipated for research on production methodologies for maize, which normally coexists with beans and rice.

The new middle-ground seed supply system capitalizes on local farmer participation in production and distribution of improved seeds. To gain more knowledge, anthropological studies were carried out with selected indigenous communities in northern Ecuador to test the viability of this scheme of seed supply. The findings indicate that indigenous communities have advantageous features for testing and disseminating improved seeds and other technologies, provided that existing research and development organizations develop mechanisms to link themselves with the "base community" and vice versa. Once the linkage is established, participatory testing of new varieties and production and distribution of new seeds would be accelerated through existing internal networks of the indigenous communities.

### 3. Human Resource Development

This activity directly supports strengthening those institutions that take part in organized seed supply systems in our counterpart countries. The first course offered in 1989 on development of seed supply systems under medium-farmer and small-farmer conditions generated an overwhelming interest on the part of national agricultural research and development institutions. To cope with it, a new strategy based on training trainers and developing regional/in-country capacity to train others has been systematically initiated in this year. Guatemala and Panama (in Central America),



the Dominican Republic (in the Caribbean), and Colombia, Ecuador, and Peru (in the Andes) are interested in developing their own capacity to train others in artisanal seed supply schemes. To assist this evolution, the Seed Unit offered highly tailored courses/workshops (Tables 3 and 4) to train selected professionals who in turn train others within their own country/region. ICA (in Colombia) has offered a cassava seed production course; ICTA-DIGESA has offered artisanal bean seed production courses and will host a regional workshop in 1991; Panama has offered an artisanal bean seed production course; in Ecuador, professionals of several organizations have offered artisanal bean seed production courses in Loja; and in Peru a similar approach has been used in Chincha. Given the fact that the new seed management techniques are simplified, most methods and tools can be easily replicated in a cascade fashion. This is considered as one of the Seed Unit's important accomplishments in 1990. The new capacity contrasts with the past, where trained national professionals were inhibited in training others because they lacked imported machines and tools for drying, cleaning, storing, and testing seeds.

Several formal and informal publications were produced (Table 5) to support these three activities. Seeds of newly released varieties and prerelease lines of beans, tropical pastures, and cassava were also produced as direct assistance to commodity programs (Table 6), and seed-conditioning services for a fee were provided (Table 7).

TABLE 1. TECHNICAL COOPERATION IN DEVELOPMENT OF NATIONAL SEED SUPPLY SYSTEMS.-

CLIENT INSTITUTION <sup>1</sup>	BRIEF DESCRIPTION
/COUNTRY	
INIAP-CIMMYT, Ecuador	To study and recommend a small-scale seed conditioning plant, for corn and bean seed production to be operated by INIAP. Assistance was also provided in the construction of CIMMYT sponsored equipment.
DIGESA, Guatemala	Assistance in the assembly of an artisanal seed conditioning prototype in Jutiapa. Implementation project was written in cooperation with the National Coordinator of Artisanal Seeds.
CEDIA-CRIN, Dominican Republic	Design of a small seed plant for conditioning basic rice seed produced in the JUMA-BONAO experimental station by CEDIA. The facility would be used as a training center in CRIN network.
INIPA, Peru	Design and assist in the construction of a <u>Brachiaria</u> seed harvester in Pucallpa. Equipment was finished.
FEDECAFE, Colombia	Assistance on postharvest bean seed conditioning for the federation's bean seed project.
DIGESA-USAID, Guatemala	Development of proposal for the micro-irrigation bean seed project. Assistance was provided through a short-term consultant in cooperation with PROFRIJOL.
SRN, Honduras	Field evaluation of bean seed supply. Training on artisanal scheme was recommended to set up pilot projects

<sup>1</sup>/ INIAP = Instituto Nacional de Investigaciones Agropecuarias  
DIGESA = Dirección General de Servicios Agropecuarios  
CEDIA = Centro de Investigaciones Arroceras  
INIPA = Instituto Nacional de Investigaciones y Promoción Agraria  
CIMMYT = Centro Internacional de Mejoramiento de Maíz y Trigo  
FEDECAFE = Federación Nacional de Cafeteros  
SRN = Secretaría de Recursos Naturales



TABLE 2. RESEARCH AND DEVELOPMENT OF COMPONENT TECHNOLOGIES.

ACTIVITY	OBJECTIVE	STATUS
<u>PRODUCTION METHODS</u>		
Evaluation of different sundrying methods in bean seeds	Test and compare the effect on seed quality and on water removal efficiency of six different seed drying methods and three different seed height layers.	Experimental phase
Simplified seed moisture estimation in beans and rice	Develop simple methods, applicable under small farmer conditions, to determine bean and rice seed moisture content. Identify visible physical reactions related with its percent moisture content.	Experimental phase
Development and evaluation of small-scale equipment for seed threshing, drying, selection, and storage of seeds	Develop simple but efficient equipment for equipment for post-harvest conditioning of seeds in artisanal seed supply schemes.	Some equipment are concluded and others are in experimental phase
Development of mass in-vitro cassava-propagation method	Develop a simplified in-vitro propagation of basic seeds of cassava. In cooperation with Biotechnology and Cassava Program.	Experimental phase
Effect of soil salinity on production of cassava stakes	Determine the effect of alkaline soils on production and quality of stakes.	Experimental phase

(continues)

TABLE 2. (CONTINUED)

ACTIVITY	OBJECTIVE	STATUS
Effect of early, optimum and delayed harvest on bean seed production and quality	To determine its effect on seed yield and quality	Concluded
Design, development and evaluation of a portable, continuous-flow blower for seed and grain cleaning	Develop a small, effective, inexpensive, portable blower for cleaning bean seed and grains in general.	Concluded
<u>SOCIAL-ORGANIZATIONAL METHODS</u>		
Second phase of artisanal cassava seed production and distribution schemes in four pilot projects in the Atlantic Coast of Colombia	Study organizational alternatives for cassava seed production and distribution with cassava drying cooperatives.	Experimental phase
Assessment of cassava seed utilization in the Atlantic Coast of Colombia	Diagnose cassava seed availability in order to establish the basis for developing a regional seed production plan.	Final phase
Anthropological studies of seed supply systems in indigenous communities	Study the strengths of indigenous communities for organized testing; production and utilization of improved seeds.	Final phase

TABLE 3. HUMAN RESOURCE DEVELOPMENT THROUGH COURSES AND WORKSHOPS.

EVENT	OBJECTIVE	SITE	SPONSORS	NO. OF PARTICIPANTS	DATE
<u>COURSES AT CIAT HEADQUARTERS</u>					
Course on rice seed production	Present methodologies for rice seed production.	CIAT	CIAT	8	29 May - 7 July
Artisanal technology for post-harvest conditioning of bean seed (Workshop)	To present new advances to selected NARD personnel and receive their feedback for further improvement.	CIAT	CIAT/Emphasis in Central America	13	30 July - 17 Aug
Cassava seed production	Learn the principles and methodologies for cassava seed (stake) production and post-harvest management.	CIAT	ICA <sup>1</sup> /CIAT	25	27-31 Aug
Artisanal technology for post-harvest conditioning of bean seed (Workshop) <sup>2</sup>	Provide participants with the opportunity to become acquainted with artisanal post-harvest seed management methods.	CIAT	CIAT/Emphasis in Andean region	10	22 Oct - 2 Nov

1/ ICA = Instituto Colombiano Agropecuario

2/ Course designed in support of in-service training in Bean Agronomy

(continues)

TABLE 3. (CONTINUED)

EVENT	OBJECTIVE	SITE	SPONSORS	NO. OF PARTICIPANTS	DATE
<u>IN-COUNTRY/REGIONAL</u> <sup>3</sup>					
Intensive course on cassava, beans, and tropical pastures, designed for SENA instructors.	Develop skills for adequate management of cassava, beans, and tropical pastures to enable participants to direct technology transfer events in their specific areas of work.	Cali (CIAT), Colombia	CIAT SENA	11	14 May - 1 June
Artisanal seed production. Phase I.	To initiate an artisanal bean seed supply in support of disseminating bean varieties being released by the national program.	Chincha, Peru	INIA PROFRIZA CIAT	15	2-7 July
Artisanal seed production. Phase II.	Review theoretical and practical aspects of artisanal seed conditioning of bean seeds promoted by INIAP in the Province of Loja.	Loja, Ecuador	INIAP PROFRIZA CIAT	13	9-13 July
Artisanal seed production. Phase II.	Provide the basis for a bean seed production and marketing system.	Chincha, Perú	INIA PROFRIZA CIAT	15	26 Nov - 1 Dec

<sup>3/</sup> Courses organized by other CIAT programs in collaboration with the Seed Unit.

TABLE 4. IN-SERVICE RESEARCHERS<sup>1</sup>

NAME	INSTITUTION <sup>2</sup>	COUNTRY	DATE
Briones Vásquez, Alipio	INIAA	Peru	10-14 Sep
Carvajulca, César Abel	Extension Agency	Peru	22 Oct - 9 Nov
Garzón Vasconez, Nelson Aníbal	Ministerio de Agricultura	Ecuador	10-14 Sep
Gamarra G., Víctor Augusto	Fomento a la Vida	Peru	22 Oct - 9 Nov
Herrera Toledo, Jorge Néstor	FODERUMA - Banco Central	Ecuador	29 May - 16 Jun
Idrobo León, Wilson Eugenio	Ministerio de Agricultura y Ganadería	Ecuador	29 May - 16 Jun
Ramos Cuba, Francisco	CEDEP	Peru	22 Oct - 9 Nov
Rocha de Ventura, Alicia	Empresa Comercializadora de Alimentos	Peru	23 Apr - 31 Dec
Samaniego Rente, Víctor Hugo	PREDESUR	Ecuador	29 May - 16 Jun

1/ This activity is implemented at different times in the year to accommodate NARD personnel needing urgent and individualized internship.

2/ INIAA = Instituto Nacional de Investigaciones Agrarias y Agroindustrias  
 FODERUMA = Fondo de Desarrollo Rural Marginal del Banco Central del Ecuador  
 CEDEP = Centro de Estudios para el Desarrollo y la Participación  
 PREDESUR = Subcomisión Ecuatoriana para el Desarrollo del Sur del Ecuador

TABLE 5. SEED UNIT PUBLICATIONS AND CONFERENCES PREPARED DURING 1990.

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Seed Production

- Almacenamiento de semilla de yuca. H. Collazos. (mimeo)  
(Storage of cassava stakes)
  
- Aspectos relacionados con la calidad de la semilla vegetativa de yuca. J. López. (mimeo)  
(Aspects related vegetative seed quality of cassava)
  
- Aspectos teóricos y aplicados en la descripción varietal de arroz. G. Muñoz, G. Giraldo, J. E. Douglas, J. Banguero.  
(Theoretical and applied aspects of varietal description in rice)
  
- Control total y control interno de calidad. E. Burbano (mimeo)  
(Total control and internal quality control)
  
- Descriptores varietales: Arroz, frijol, maíz, sorgo. G. Muñoz, G. Giraldo, J. Fernández de Soto.  
(Varietal descriptors: Rice, beans, maize, sorghum)
  
- Determinación de la época oportuna de cosecha de semilla de frijol (Phaseolus vulgaris L.) en condiciones de trópico húmedo. G. Giraldo. (mimeo)  
(Determining timely harvest period of bean seeds in humid tropics (Phaseolus vulgaris L.))
  
- Diseño y evaluación de una venteadora portátil de flujo continuo para la limpieza de granos y semillas de frijol (Phaseolus vulgaris L.).  
R. Aguirre. (mimeo)  
(Design and evaluation of a portable, continuous-flow blower for cleaning bean, (Phaseolus vulgaris L.), seeds and grains).
  
- Efecto del método de secamiento sobre la calidad de la semilla de arroz (Oryza sativa).  
C. Rivera, A. Garay, R. Aguirre. (mimeo)  
(Effect of drying methods on rice, (Oryza sativa), seed quality.

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TABLE 5. (CONTINUED)

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- Métodos simplificados para estimar el contenido de humedad de la semilla. E. Burbano. (mimeo)  
(Alternative methods for determining seed moisture content)
  - Métodos simplificados para determinar la germinación de semillas. E. Burbano. (mimeo)  
(Alternative methods for the evaluation of germination.)
  - Producción comercial de semilla de yuca. J. López. (mimeo)  
(Commercial seed production)
  - Required bean seed moisture for short-term sealed storage. R. Aguirre, S. T. Peske. (mimeo)  
(Accepted for publication in: Seed Science & Technology)
  - Tecnología artesanal para el manejo poscosecha de semillas: Demostración del proceso integral con semillas de frijol. A. Garay, R. Aguirre, G. Giraldo. (mimeo)  
(Artisanal technology for postharvest seed management of seeds: Demonstration of process with bean seeds). (Draft).

Publications/Conferences in the Area of Social-Organizational Methods

- Artisanal seed supply schemes: A strategy to extend the development of organized seed supply systems to medium and small farmers. A. Garay
  - Costos de producción de frijol: Comparación entre granos y semillas. U. Gutiérrez. (mimeo)  
(Bean production costs: Comparison between grains and seeds)
  - Diferenciación de la semilla mejorada en el mercado. U. Gutiérrez, A. Garay. (mimeo)  
(Differentiating improved seeds in the market)
  - Fortalecimiento de sistemas para mejorar la calidad de semillas  
(Strengthening systems for seed quality improvement) Proceedings of the workshop held in Montevideo, Uruguay, 9-13 November, 1987. A. Mendoza (ed.). (Spanish)
  - Desarrollo de la industria de semillas: Enfoque participativo de Bolivia. A. Garay, P. Pattie, J. Landivar, J. Rosales. (Spanish)  
(Development of a seed industry: Successful approach in Bolivia)
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TABLE 6. SEED UNIT BASIC SEED PRODUCTION DURING 1990.

VARIETY/LINE	AMOUNT PRODUCED
<u>BEANS SEEDS PRODUCED</u>	
	(kg)
ICA Citará (PVA 476)	2998
PVA 773	3.426
PVA 916	300
Miscellaneous Lines	<u>6.972</u>
Total	13.696
	=====
<u>TROPICAL PASTURE SEEDS PRODUCED</u> <sup>1</sup>	
	(kg)
<u>C. macrocarpum</u>	1827
<u>C. acutifolium</u> (Vichada)	1050
<u>Stylosanthes capitata</u> (Capica)	800
<u>S. guianensis</u>	30
<u>Brachiaria dictyoneura</u> (Llanero)	<u>1312</u>
Total	5019
	=====
<u>CASSAVA SEEDS (STAKES) PRODUCED</u>	
	(stakes)
MCOL 1505 (P-12)	130,000
MCOL 2215 (Venezolana)	82,000
CG 1141-1	60,000
CM 3306-4	30,000
CM 3306-9	25,000
CM 3555-6	17,000
Miscellaneous Lines	<u>32.000</u>
Total	376.000
	=====

1, Includes production under contract; production, processing, and distribution is carried out jointly with Tropical Pastures Program.

TABLE 7. AMOUNT (kg) OF SEED CONDITIONED BY THE SEED UNIT FOR OTHER INSTITUTIONS UNDER A SERVICE-FOR-FEE ARRANGEMENT.

CROP	CLIENTS	1988	1989	1990
Corn	FENALCE, PROCAMPO	52,247	337,878	660,940
Rice	ICA, HOECHST	63,018	285,258	78,040
Sorghum	CRESEMILLAS, FEDEARROZ, PIONEER, INTSORMIL	7,335	-	20,270
Soybeans	ICA, PIONEER	23,285	14,265	22,215
<b>Total</b>		<b>145,885</b>	<b>637,401</b>	<b>781,465</b>

TABLE 8. SEED UNIT STAFF DURING 1990

Permanent

ADRIEL E. GARAY, Ph.D., Seed Systems and Production Technology,  
(Acting Head)

ROBERTO AGUIRRE, Post-harvest Technology (Research Assistant)

EDGAR A. BURBANO, Quality Control (Research Assistant)

URIEL GUTIERREZ, Training (Associate)

JOSE FERNANDEZ DE SOTO, Seed Plant Management (Research Assistant)

GUILLERMO GIRALDO, Bean Seed Production (Research Assistant)

JAVIER LOPEZ, Cassava Seed Production (Research Assistant)

HAROLD COLLAZOS, Cassava Seed Production (Research Assistant)

JUAN CARLOS LONDOÑO, Laboratory Assistant (Transferred to TCSP)

ALEXANDRA WALTER, Publications (Editorial Assistant) (Transferred to TCSP)

GLORIA S. DE GARCIA, Secretary

REBECA BOLAÑOS, Secretary

LUZ ELENA TOBON, Secretary (Transferred to Rice Program)

RODRIGO NUÑEZ, Laboratory Analyst

GERMAN ADOLFO OYUELA, Laboratory Analyst

JORGE VILLEGAS, Seed Conditioning Technician

CARLOS ORLANDO VIVAS, Seed Conditioning Technician

MARIO ROMERO, Field Production Technician

BENJAMIN REINOSO, Small-Scale Seed Plant Technician

OMAR GUTIERREZ, Laborer

GILBERTO GONZALEZ, Laborer

GONZALO MONZON, Laborer

ALBERTO OROZCO, Laborer

RUDECINDO PALMA, Laborer

RICAURTE ROJAS, Laborer

Non permanent

LES FIELD, Anthropologist, Postdoctorate Rockefeller Fellow

ALEJANDRO MENDOZA, Seed Technologist, Consultant for two weeks