CIO/CIAT Meeting

CIAT Palmira October 10-12, 2005

CIRAD

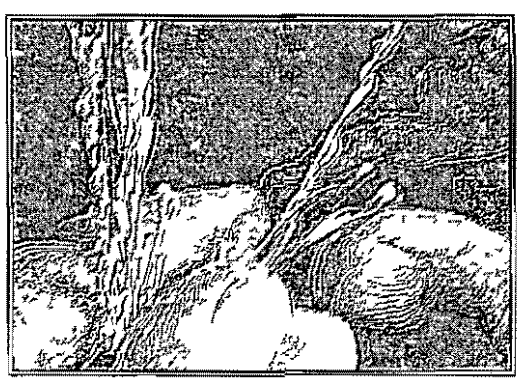
Rice Collaborative Project

CIAT

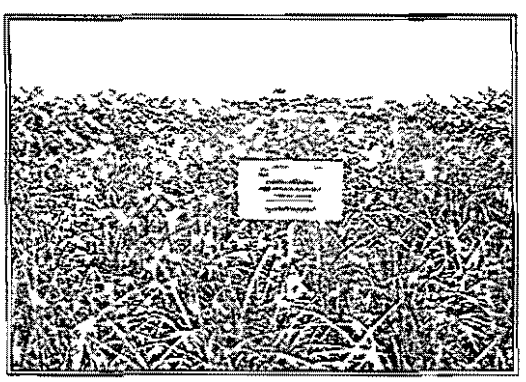
Outputs 2003-2005

Improved Rice Germplasm for Latin America and the Caribbean using composite populations with a recessive male-sterile gene, and conventional crossbreeding

Conventional Crossbreeding



Composite Population Breeding



Marc H Châtel, Lee A Calvert, LAC Cooperators

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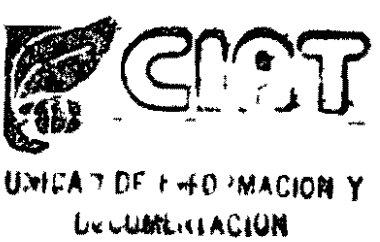

CIO-CIAT Meeting
October 10-12, 2005 CIAT Palmira- Colombia

RICE SHEET Cirad/CIAT

Activity Area	Agro biodiversity and Enhancing Rural Innovation Plant Breeding and Management	Page 1 of 2

Title of Collaboration

Improved Rice Germplasm for Latin America and the Caribbean using composite populations with a recessive male sterile gene, and convencional crossbreeding

The Special Project is part of the CIAT Rice Project IP-4 Improved Rice Germplasm for Latin America and the Caribbean

1 Overall Priority (check one)

Very High	X	High		Medium		Low		No interest	

2 Project Description

2 1 Scientific and Development Objectives

Increasing genetic diversity by the development of composite populations

Enhancing composite populations by recurrent selection breeding

- Developing lines with specific traits useful as potential commercial varieties and/or parents for breeding

Delivering Latin American NARS with enhanced germplasm and knowledge sharing

Networking

2 2 Congruence with Institutional Goals

Increasing genetic diversity

Increasing the efficiency of rice production to make it more competitive at lower prices for consumers

More rational use of natural resources

2 3 Methods

Development of composite populations

Germplasm enhancement by recurrent selection

Combining recurrent selection and conventional breeding for line development

2 4 Expected Outputs

Basic materials (composite populations)

- Site –specific composite populations developed with LAC NARS
- Population breeding for traits of interest yield potential, diseases resistance water efficiency drought and cold tolerance

Sharing segregating and advanced lines with LAC NARS (International Observation Nursery CIAT ION)

Promising lines developed with NARS and variety release

Strengthening LAC NARS Cooperators Networking (GRUMEGA group) International Workshops and Conferences

3 0 Current Status (check one)

Ongoing	X	Well defined		Needs further refinement		Very Preliminary		

Comments

Regional Rice Population Breeding Project started in 1996 with LAC NARS

Promising lines are coming-out in different countries (Brazil Chile Colombia and Cuba)

One line selected in an upland composite population will be released as commercial variety in Bolivia in 2006

During the last 3 years upland varieties coming from conventional breeding were released in Brazil Bolivia and Colombia (CURINGA JACUU and LLANURA 11 respectivelly

A Regional Technical Cooperation Project (TCP) was submitted to FAO The focus is on regional germplasm sharing and capacity building

4 Resources (per year indicate if € US$)

	Total Required	Presently Available	To be Sought
Personnel Nat	US$24 000	US$24 000	
CIAT AMSS	US$11 000	US$11,000	
Operations			
CIAT	US$17 000	US$17,000	
Cirad	US$ 6,000	US$ 6 000	
Total	US$58 000	US$58 000	

Comments

Continued support needed from CIAT and Cirad
Adequate funding and timely release of budget
LAC Cooperators well connected with the local rice sector willing and capable to use new improved germplasm

Estimated Duration Undetermined | Starting Date Regional Project started in 1996/97

5 Collaborating Institutions

South American Argentina, Bolivia, Brazil Chile Colombia Venezuela,
The Caribbean Cuba
Central America through the Cirad/CIAT project (Dr Gilles Trouche)
France through the rice project of Cirad in Camargue and French Guyana (Dr Guy Clement)
International Institutions FLAR, FAO, IRD WARDA

Comments

Research in temperate and sub tropical South America is relevant to the European conditions and vice versa Close collaboration with Cirad rice breeding project in France
Rice population breeding for temperate climate started between France and Chile (Cold tolerant and aromatic rice)
Irrigated tropical germplasm, relevant to tropical French Guyana Close collaboration with Cirad rice breeding project
Participatory rice population breeding through the Cirad/CIAT project in Central America (Dr Gilles Trouche)
Links with the Generation Challenge Program

6 Follow -up Needed

Through

Annual Work Plans
- Annual Reports
- Annual Performance Appraisal, both by CIAT and Cirad

Persons Designated as Responsible

- Cirad

Marc Chatel Rice Breeder Research Unit Rice Breeding and Management (UPR 6)
Nourollah Ahmadi Head of the Research Unit -Rice Breeding and Management (UPR 6)

- CIAT

Lee Calvert Leader Rice Project

Outputs 2003

Highlights

Annual Report

HIGHLIGHTS 2003

I GERMPLASM

1 Variety Launching

1 1 Conventional Breeding

- **Brazil**

CURINGA
Origin Cirad/CIAT Line (CT13226-11-1-M-BR1)
Adaptation Upland **and** Irrigated Rice Ecosystems (Cerrados **and** Varzea)
Official recommendation by EMBRAPA and EPAMIG

- **Bolivia**

JACUU
Origin Cirad Line (IRAT 357)
Adaptation Upland Small-farmer's Rice Ecosystem
Official recommendation by CIAT Santa Cruz

- **Colombia**

"Linea 30" = LLANURA 11
Origin Cirad/CIAT Line (CT 11891-2-2-7-M or CIRAD/CIAT 409)
Adaptation Upland Savannas Rice Ecosystem
Official recommendation by the Instituto Colombiano Agropeduario (ICA)

1 2 Composite population breeding

- **Bolivia**

PCT-4\0\0\1>S2-1584-4-M-5-M-6-M-M
First Upland variety selected from the Composite Population PCT-4
Origin Cirad/CIAT (Upland *japonica* composite population PCT-4)
Adaptation Upland Small-farmer's and Mechanized Rice Ecosystems
Official recommendation by CIAT Santa Cruz

- **Colombia**

PCT-4\SA\1\1>975-M-2-M-3
Upland line selected from the Composite Population PCT-4
Origin Cirad/CIAT (First cycle of recurrent selection of the Upland *japonica* composite population PCT-4)
Adaptation Upland Savannas Rice Ecosystem

2 Distribution of germplasm Upland International Observation Nursery CIAT-ION

- Upland Rice Nurseries (211 lines)

Seed Increase November-March CIAT/Palmira
Shipping April-September
Receptors

Bolivia	CIAT Santa Cruz
Brazil	Embrapa Rice and Beans Center
Colombia	CORPOICA Regional 8
Costa Rica	National Rice Corporation

Cuba	IIA
Nicaragua	INTA through Gilles Trouche Project
Honduras	DICTA through Gilles Trouche Project
Venezuela	INIA-Guarico & Fundacion DANAC

II PUBLICATIONS

1 Referred Journal

- **Châtel, M , Guimarães, E P**

International Partnership for rice improvement in Latin America Cirad, a Case study
Brazilian Society of Plant Breeding
Crop Breeding and Applied Biotechnology (CBAB - 165) v 2, n 4 p 639-648, 2002
Received September 04, 2002
Accepted October 08, 2002

2 Electronic Newsletter

- "TioTaka First Rice Variety in the World Developed from Composite Population Improvement using Recurrent Selection Breeding"

Plant Breeding News (PBN) Edition 134, December 20, 2002
An Electronic Newsletter of Applied Plant Breeding
Sponsored by FAO and Cornell University
Clair H Hershey, Editor

- "Chile developed a site-specific rice composite population for the temperate climate ecosystem" Plant Breeding News (PBN) Submitted August, 2003

An Electronic Newsletter of Applied Plant Breeding
Sponsored by FAO and Cornell University
Clair H Hershey, Editor

3 Book Chapters

Chapter in Composite Population Breeding an alternative for the exploration of rice genetic resources in Latin America Editor Guimarães, E P

- **Chapter 1**

Explorando los recursos geneticos del arroz a traves del mejoramiento poblacional
Guimarães, E P , Châtel, M

- **Chapter 7**

Exploracion de los recursos geneticos del arroz en Argentina a traves del mejoramiento poblacional
Marassi, M A , Marassi, J E , Châtel, M , Ospina, Y

- **Chapter 8**

Mrjoramiento de poblaciones de arroz para clima templado en Chile
Hernaiz, S, Alvarado, J R , Castillo, D, Châtel, M , Ospina,Y

- **Chapter 11**

Las bases para el usoo del mejoramiento poblacional del arroz en Cuba
Polanco, R , Châtel, M , Guimarães, E P

- **Chapter 13**

Mejoramiento poblacional y obtencion de lineas de arroz para el ecosistema de sabana Proyecto Cirad/CIAT
Châtel, M , Ospina,Y , Rodriguez F, Lozano,V H

- **Chapter 16**

Efectos de la seleccion y de las recombinaciones en una poblacion de arroz de secano
Ospina, Y , Guimarães, E P , Châtel, M , Duque, M C

4 Oral presentations

- **Châtel, M , Ospina, Y**

Title The Cirad/CIAT Rice Project Upland Rice Breeding for Latin America and the Caribbean Conventional and Advances Methods
Event Rice National Workshop
Organization CIAT Santa Cruz y DISAPA
Date February 20, 2003
Place Yapacani - Bolivia

- **Marassi, M , Marassi, J E , Châtel, M , Ospina, Y**

Title Advances in Populational Rice Breeding in Argentina
Event 3rd International Temperate Rice Conference
Date March 10-13, 2003
Place Punta del Este- Uruguay

- **Châtel, M**

Title CIRAD, one of the Institutions of the Scientific Park "Agronatura"
Event 4th Board Meeting of the Scientific Park "Agronatura"
Date April 10, 2003
Place CIAT Palmira-Colombia

- **Châtel, M , Guimarães, E P**

Title "Doing Research Together" Contribution and Impact of the Cirad Rice Genetic Resources in Latin America
Event CIAT Intern Seminar
Date May 7, 2003
Place CIAT HQ-Palmira

- **Châtel, M**

Title The Cirad/CIAT Project Rice Improvement using Crossbreeding and Composite Population - Outputs 2001-2003
Event CIO-CIAT Meeting
Date May 26-28, 2003
Place Montpellier-France

- **Ospina, Y , Châtel, M , Rodriguez, F , Lozano, V H**

Title Upland Rice Composite Population Breeding for the Savannas Ecosystem
Event International Upland Rice Seminar-Workshop
Date August 19-22, 2003
Place Villavicencio-Colombia

III CO-ORGANIZATION OF WORKSHOPS, CONFERENCES AND MEETINGS

- CIO-CIAT Strategic Alliance Meeting

Organization CIO & CIAT
Date May 26-28, 2003
Place Montpellier-France

- **3rd International Upland Rice Seminar-Workshop**

Sponsor CIAT Rice Project
Organization Cirad/CIAT Project
Date August 19-23, 2003
Place CIAT Villavicencio-Meta, Colombia

- **3rd Conference on Rice Composite Population Breeding**

Organization Fundacion DANAC, Cirad/CIAT and FAO
Date October 13-14, 2003
Place Maracay-Venezuela

- **1st Venezolan Congress Congreso of Plant Breeding and Biotechnology**

Organization Central University of Venezuela, Fundacion DANAC, Cirad/CIAT and FAO
Date October 15-17, 2003
Place Maracay-Venezuela

IV STUDENTS AND TRAINEES

- **Jose Martinez Teruel**

Ecole Nationale d'Ingenieurs en Techniques Agricoles - ENITA- Clermont-Ferrand, France
Duration and palce -15 days at CIAT HQ-Palmira
-5 Months (May-October, 2002) at Fundacion DANAC, Venezuela
Theme "Efecto de la arquitectura de planta (cerrada o abierta) sobre las caracteristicas agronomicas y los componentes de rendimiento de 5 lineas de arroz y dos testigos'
Effect of plant architecture (Open or Erect) on different agronomic characteristics and yield components in 5 rice lines and 2 checks

- **Stephane Bauguil**

Ecole Europeenne Superieure Tutelle des Universites de Savoie, Jean Moulin Lyon III, et du lycee agricole de Poisy-Annecy
Duration and place -4 Months (April-July, 2003) at CIAT Santa Cruz, Bolivia
Theme "Estudio de los elementos de la cadena productiva del Arroz en el Departamento de Santa Cruz de la Sierra-Bolivia"

- **Juana Viruez**

Institution CIAT Santa Cruz, Bolivia
Practice Upland rice composite population breeding and evaluation of segregating lines
Duration August 11-22, 2003
Place CIAT Villavicencio-Colombia

- **Yorman Jayaro**

Institution Fundacion DANAC, Venezuela
Practice Upland rice composite population breeding and evaluation of segregating lines
Duration August 11-28, 2003
Place CIAT Villavicencio and HQ-Palmira-Colombia

ANNUAL REPORT 2003

OUTPUT 1 Enhancing Gene Pools

1 Upland rice composite population breeding leads to the selection of promising lines for the Colombian savannas ecosystem

Marc Châtel Yolima Ospina Francisco Rodriguez Victor Hugo Lozano - Cirad/CIAT

Abstract
Since 1996, the Cirad/CIAT project has gradually phased out intra-specific tropical japonica conventional crossbreeding activities and concentrate on broadening the genetic base of rice The development and enhancement by recurrent selection of upland rice composite populations are the new breeding strategies to achieve the objective
Using a recessive male-sterile gene (ms), the development of rice population was eased
In Colombia, upland basic composite populations were enhanced using two recurrent selection-breeding methods At each enhancement cycle, fertile plants are selected for the development of segregating lines and progeny selection using the conventional pedigree method The most advanced lines are evaluated in yield trials by the project and in collaboration with the Colombian research organization CORPOICA Regional 8 in Villavicencio Promising lines having good adaptation to acid soils were identified One promising line extracted from the first cycle of recurrent selection of the composite population PCT-4 shows a higher yield potential with same earliness than the best commercial check (Linea 30) developed by conventional crossbreeding

Key words Upland rice, breeding, composite population, promising line

Introduction
Conventional crossbreeding projects of CIAT and Cirad/CIAT have been and still are a source for the release of new varieties in Latin America, like in Bolivia, Brazil and Colombia (INGER, 1991) But the released lines present some narrow genetic base witch needs to be broadened for the development of new varieties (Cuevas-Perez *et al* , 1992, Rangel *et al* , 1996, Montalvan *et al* , 1998) It is the responsibility of international centers like CIAT and Cirad to joint forces to propose and implement new breeding tools for the creation and future release to the rice producers of germplasm with different genetic background
The creation of populations with broad genetic base (Châtel y Guimarães, 1998), and their breeding through recurrent selection is a new breeding method proposed and implemented by the Cirad/CIAT rice project
Since 1996 (Châtel *et al* 2001), the project concentrates in the development and enhancement of upland rice gene pools (*Oryza sativa* L , Tropical Japonica type)
By using a recessive male-sterile gene (ms) from a mutant of IR36 (Singh y Ikehashi 1981), rice population development and enhancement was eased The basic populations were enhanced using two recurrent selection-breeding methods
The main purpose of a breeding project is the creation of variability and the development of breeding material that may lead to the identification of promising lines and new cultivars
To do so, fertile plants are selected form the basic composite populations and at each enhancement step by recurrent selection They are the starting point for the selection of

segregating progenies by conventional pedigree method and the identification of promising fixed lines

The number of progenies developed from population breeding has steadily increased from 1997 on This report presents the outputs of the breeding strategy of the composite population PCT-4 and the identification of promising lines adapted to the Colombian savannas rice ecosystem

Material and Method

Composite population breeding

Population breeding by recurrent selection is very efficient for trait improvement showing low heritability Through short selection-recombination cycles, linkage blocks are break down and favorable genes are accumulated This is a smooth process of continuous improvement

Rice composite populations are highly segregating for numerous traits and are made of fertile (Msms) and male-sterile plants (msms) allowing natural cross-pollination Grains produced by male-sterile plants are Msms and msms (pollen produced by fertile plants is ms or Ms and female organs of male-sterile plants are ms) To allow complete recombination between early and late flowering material, two to three sowing dates are made in the same physical plot To avoid pollen contamination from other rice plots, each population is fenced by Maize rows

Harvesting the male-sterile plants represents a new cycle of recombination as well as seed multiplication of the population

Composite population breeding strategies

Recurrent selection is a cyclic process involving three main steps plant selection (selection unit), evaluation and recombination (recombination units) of the best performing selection units Two recurrent selection strategies where used mass recurrent selection and S_2 progenies evaluation

The first strategy is based on phenotype selection or mass selection on booth sexes before flowering time S_0 plants of each cycle of recurrent selection are at the same time the selection and recombination units Each recurrent cycle is one year long Selection pressure is needed at field condition, this was the case for acid soil and diseases

The second strategy involves progeny evaluation S_0 fertile plants are selected during the normal cropping season (March-September) at LSE The generation S_1 is advanced at the Experimental Station of Palmira (PES) during the period October-February S_2 seeds are harvested at PES and planted at LES during the normal cropping season S_2 lines are evaluated and selected compare to commercial checks in a statistical design (Federer, 1956) The best progenies are selected and then recombined from the remnant seed from S_0 plants A recurrent cycle is completed in 2 years time

Selection of fertile plants for line development

The selection of S_0 fertile plants (Msms) is the starting point for segregating line development

Through out the selection process, selecting and harvesting only fertile plants allows eliminating the male-sterile gene Advanced progenies are 100% fertile (MsMs) Line development follows traditional evaluation and pedigree selection

The major characteristics bred for savanna conditions are early vigor, tolerance of soil acidity, resistance to rice blast (*Pyricularia grisea* Sacc), good grain quality (translucent, long-slender grain) and early maturity (total cycle about 115 days)

A total of 179 advanced S_9 lines was selected using the pedigree method This material comes from different phases of enhancement of the population PCT-4 (Table 1) and passes through the overall process of selection and agronomic evaluations

Yield trials

Promising lines from different breeding populations were selected during the last years Some of them were evaluated in preliminary experimental yield trials in Colombia, at LES and on-farm, in collaboration with CORPOICA Regional 8 The experimental design was of randomized blocks with 3 replications

The yield trials were cultivated on acid soils (Table 2) The fertilization was of 300 kg ha ^{1} of dolomite lime applied 30 days before sowing (nutrient in Calcium and Magnesium but not for acid soil correction), 177 kg ha ^{1} of Nitrogen (59 kg ha ^{1} at 20, 35 and 45 days after sowing), 155 kg ha ^{1} of Phosphorus at sowing and 116 kg ha ^{1} of Potassium (58 kg ha ^{1} at sowing and 29 kg ha ^{1} at 20 and 35 days after sowing) No pesticide or insecticide was applied

24 advanced lines selected from the first recurrent selection cycle of the population PCT-4 and 3 commercial checks (Oryzica Sabana 6, Oryzica Sabana 10, and "Linea 30") were evaluated During the cropping seasons 2000 and 2001 the trial were located at LES and in 2002, in collaboration with CORPOICA, it was conducted in 5 places, 2 at LES, and 3 on-farm under savanna condition (see section 2 of this report)

Results and discussion

The combined analysis of the 3 years 2000 at LES (Table 3) shows that grain yields vary between 1550 and 3300 kg ha ^{1} The checks Oryzica Sabana 10, Oryzica Sabana 6 and Linea 30 yielded 1550, 2614 and 2038 kg ha ^{1}, respectively It is to notice the bad behavior of the Linea 30 that showed erratic yielding throughout the years and its low yield in 2002 This is mainly because of spicklets sterility due to low temperatures (Figure 1) as a consequence of cold fronts coming from Brazil Cold susceptibility of the Linea 30 was formerly detected when it was cultivated in the Coffee region at 1450masl where it presented more than 60% spicklets' sterility The year 2002 was also atypical with heavy rain precipitations and low solar radiation (Figure 2) that in association with cold temperature contributed to high level of physiologic sterility

At contrary , all the lines from the population PCT-4 that are as early as the Linea 30, showed stable yields and in 2002 do not presented high levels of sterility that is an indirect measurement of their tolerance to cold The analysis of the 3 years trials shows that the average yield of the line

PCT-4\SA\1\1>975-M-2-M-3 is 35, 50 and 113% more than Linea 30, Oryzica Sabana 6 and Oryzica Sabana 10, respectively, and is as early as the earliest check Linea 30 This is a confirmation of the last year results where it we stated that it was possible to breakdown the negative correlation generally observed between earliness and grain yield

The best performing line PCT-4\SA\1\1>975-M-2-M-3 at LES was also selected by Hernando Delgado in the trials conducted by CORPOICA Regional 8 (Table 1 Section 2)

Twelve other lines show similar yielding potential as the best check Linea30 From these 12 lines, CORPOICA Regional 8, selected 5 (Table 3 and Table 1 Section 2) These lines represent a diversified option for upland rice in the Colombian savannas and can contribute to diversify the genetic material for the producers Grain quality of 3 lines is presented in the table 4 In 2002 the 24 lines of the Colombian trial were shipped to Bolivia (CIAT Santa Cruz), Nicaragua (Gilles Trouche- Cirad/CIAT) and Venezuela (Fundacion DANAC y INIA Guarico) for local evaluation and selection

Seed multiplication and genetic seed production

During 2003, the 13 best promising lines were cultivated at PES for seed increase and further evaluation of milling and grain quality 50 individual panicles of each line were evaluated for the

production of genetic seed Depending of the results, the top best materials would be grown next year in demonstration plots at LES

Reference

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Table 1 Segregating lines from different composite populations
Experimental Station La Libertad Villavicencio-Colombia, 2002

Population	Generation and number of line						
	S_1	S_2	S_3	S_4	S_5	S_7	S_9
PCT A\PHB\1\0 PHB\1 PHB\1 PHB\1 PCT-4\PHB\1\0, PHB\1 PHB\1, PHB\1 PCT-5\PHB\1\0 PHB\1 PHB\1 PHB\1 PCT-4\SA\1\1\, SA\2\1 PCT-4\SA\5\1 PCT 4 Bolivia PCT 11 Bolivia CNA-7 Bolivia	394						
PCT-4\SA\4\1		15					
PCT-4\SA\1\1 SA\1\1 PCT-11\0\0\3 PCT-4\SA\4\1			23				
PCT-4\0\0\2 PCT-4\SA\2\1				23			
PCT 4\0\0\0					7		
PCT 11\0\0\1						2	
PCT-4\SA\1\1 PCT-4\PHB\1\1, PHB\1 PCT A\0\0\0 PCT-4\0\0\1							178

Table 2 Soil analysis
Experimental Station La Libertad Villavicencio-Colombia, 2002

Rep	cm	M O (%)	P Bray II (ppm)	pH	Al	Ca	Mg	K	C I E	B	Zn	Mn	Cu	Al Saturation
					(meq / 100 g)									(%)
1	0 20	4 1	17 4	3 9	2 39	0 90	0 37	0 25	3 91	0 52	0 48	14 6	0 52	61 1
	20-40	3 5	4 7	3 8	2 96	0 45	0 17	0 11	3 69	0 66	0 40	9 0	0 56	80 2
2	0 20	5 9	22 5	4 1	2 70	0 69	0 34	0 22	3 73	0 23	0 41	11 1	0 49	72 4
	20-40	4 3	2 0	3 8	2 90	0 30	0 12	0 17	3 32	0 12	0 29	6 53	0 42	87 4

Clay = 43 4% Sand = 39 1% Loam = 17 5%

Table 3 Selected lines from the yield trial
Experimental Station La Libertad Villavicencio-Colombia, 2000, 2001 and 2002

Line from the population PCT-4\SA\1\1*	Grain yield (Kg/Ha)						
	Year			Average	% CIRAD 409	% O Sabana 6	% O Sabana 10
	2000	2001	2002				
>975 M 2 M 3	3644	3333	2924	3300	1 35	1 50	2 13
>975 M 2 M 2	3275	3480	2669	3141	1 28	1 42	2 03
>975 M 3-M 2	3215	3439	2580	3078	1 26	1 40	1 98
>975 M-3-M 3	3367	3081	2529	2992	1 22	1 36	1 93
>982 M-3-M 5	3277	3240	2388	2968	1 21	1 35	1 91
>975 M 3-M 4	3321	3179	2375	2958	1 21	1 34	1 91
>1479 M 1 M 3	3028	3477	2271	2925	1 19	1 33	1 89
>1479 M 1-M 5	3016	3444	2306	2922	1 19	1 32	1 88
>1036 M 6 M-2	2868	3647	2206	2907	1 19	1 32	1 87
>1479-M 1 M-6	3265	3300	2142	2902	1 18	1 32	1 87
>1479 M 1 M-1	3240	3074	2356	2890	1 18	1 31	1 86
>975-M 2 M 1	2947	2972	2640	2853	1 16	1 29	1 84
>1044 M-3-M 4	3379	2890	2001	2757	1 13	1 25	1 78
Check							
Linea 30 CIRAD 409	2139	3226	749	2038		1 11	1 58
Sabana 6	2332	3531	1978	2614	0 90		1 42
Sabana 10	1240	2770	641	1550	0 63	0 70	

* PCT-4\SA\1\1 Nomenclature of the population PCT 4 One cycle of recurrent selection cycle for acid soil conditions

Table 4 Grain quality of 3 bets promising lines and checks
Years 2000, 2001 and 2002

	Year			
	2000	2001	2002	
Line	White Belly			% Amylase
PCT-4\SA\1\1>975-M-2 M-3	0 6	0 3	0 7	25 4
PCT-4\SA\1\1>975 M 3 M-3	0 5	0 3	0 6	26 4
PCT-4\SA\1\1>975-M 2-M 1	0 9	0 4	0 7	25 0
Check				
Linea 30 (CIRAD/CIAT 409)	0 4	1 0	0 8	25 5
Oryzica Sabana 6	0 6	0 7	0 4	25 2
Oryzica Sabana 10	0 8	0 5	0 8	24 0

Figure 1 Temperature minima during 3 cropping seasons
Experimental Station La Libertad Villavicencio-Colombia, 2000, 2001 and 2002

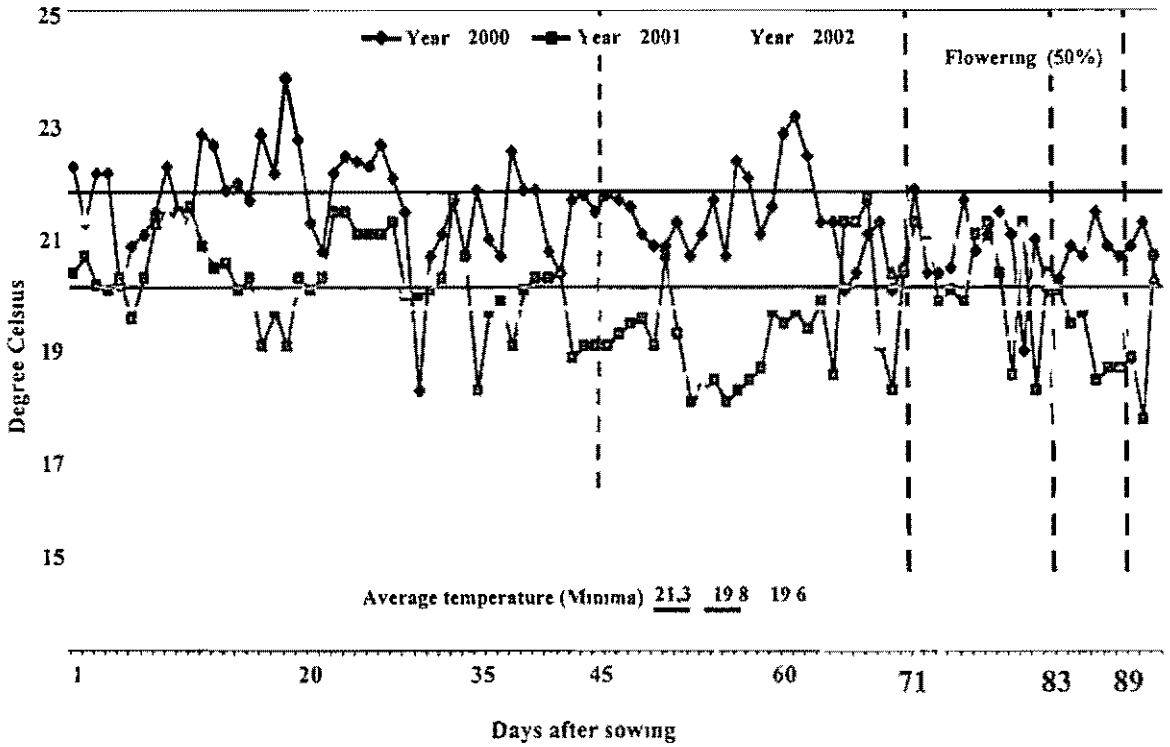
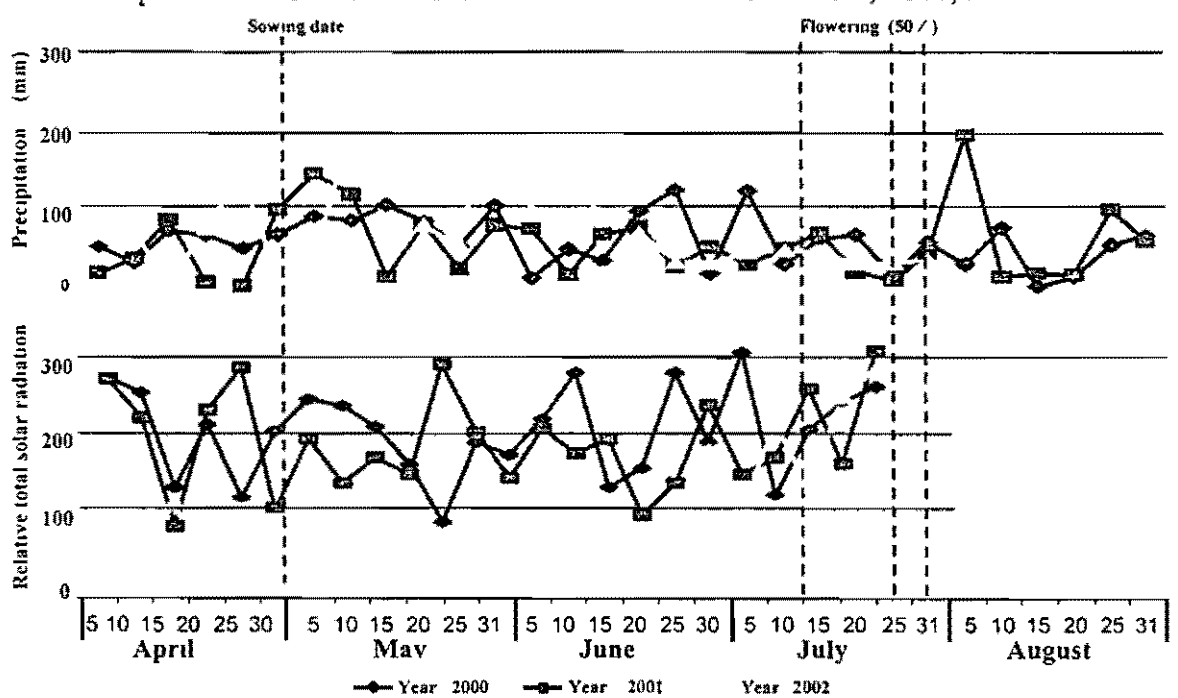


Figure 2 Rain precipitation and total relative solar radiation
Experimental Station La Libertad Villavicencio-Colombia, 2000, 2001 and 2002



2 Upland rice yield trials in the Colombian Altillanura savannas and the Research Center La Libertad CIAT-CORPOICA, 2002

Hernando Delgado - CORPOICA Regional 8
Marc Châtel Yolima Ospina Francisco Rodriguez Victor Hugo Lozano -Cirad/CIAT

Yield trials

Location Farms Santa Cruz, La Palomera and Lagos de Menegua in the Colombian Altillanura savannas and the Research Center La libertad (C I La Libertad)

Farm la Palomera

The majority of the lines presented a high degree of physiological spicklets sterility as a consequence of low night temperature that coincided with the period of influence of the cold fronts coming from Brazil This information was from the person in charge of the faro

Farm Lagos de Menegua

Because the trials were cultivated on already corrected soils for Maize cropping with 2 tons / ha of lime the material presented high vigor Stormy weather and strong winds during the grain filling stage lead to the lodging of the material

Farm Santa Cruz

As well as at Lagos de Menegua some material lodged

C I La Libertad

In this location the liming was normal for savannas rice cultivation (300 kg/ha) Nevertheless, some lines do not presented good plant type with high stature and fragile straws susceptible to lodging

Line selection

Base on the evaluations, observations and yield potential mainly at the farm Santa Cruz and C I La Libertad, 12 materials (Table 1) were selected for next year evaluation in native savannas conditions with the recommended lime application fro savannas rice One option is the new experimental station of CORPOICA (Estacion Experiemntal Sabanas)

Recommendation

It seems a necessity to prioritize the selection criteria for the promising lines like shorter plant height and strong straws for avoiding lodging problems

As the future varieties have to be well adapted to the specific conditions of the Colombian savannas and specifically to blast strains that are different from the ones present at C I La Libertad, it is important to select and evaluate the lines in the savannas area

Table 1 Upland rice lines selected by CORPOICA for next year evaluation

Entry	Pedigree
104	PCT-4\SA\1\1>540-M 3-M 5
105	PCT 4\SA\1\1>975-M-2 M 1
107	PCT-4\SA\1\1>975-M 2 M 3
109	PCT-4\SA\1\1>975-M 3M 3
110	PCT-4\SA\1\1>975 M-3 M-4
111	PCT-4\SA\1\1>982 M-3-M-4
113	PCT 4\SA\1\1>1036 M 6 M-2
114	PCT-4\SA\1\1>1044-M-3 M-2
116	PCT-4\SA\1\1>1260-M 6-M 6
120	PCT 4\SA\1\1>1479 M-1-M 5
123	PCT 4\SA\1\1>1837 M-2-M 2
124	PCT-4\SA\1\1>1837 M 2 M 3

3 Upland rice Internacional Observation Nursery for Latin America and the Caribbean

Marc Châtel Yolima Ospina Francisco Rodriguez Victor H Lozano Daniel Guzman
Cirad/CIAT

Abstract
As IRRI was no more in condition to finance its association with FLAR witch was in charged of the distribution of the INGER-LAC public nurseries to regional NARS, this activity was formally reactivated by the rice project in late 2002
The new nurseries are called CIAT-ION (International Observation Nursery) and for the specific case of upland rice, 3 CIAT-ION for a total of 211 materials, were dispatched to 8 national breeding programs of Latin America and the Caribbean Following the CIAT policy on Intellectual Property Rights, the nurseries were dispatched with a Material Transfer Agreement (MTA)

Key words Nurseries, public material, upland rice, national programs, Latin America and the Caribbean

Introduction
CIAT rice germplasm sharing with regional partners was made through a mechanism known as INGER-LAC nurseries sponsored by IRRI From 1996 to 2001, IRRI was a funding partner of FLAR witch in counterpart was managing and distributing the public INGER-LAC nurseries
At the end of 2001, IRRI took the decision to discontinue its partnership with FLAR and the INGER-LAC mechanism was no more funded
In 2002 and to continue attending the necessity of the rice national programs, the IP-4 rice project of CIAT took the initiative to formally reactivate the sharing of public genetic goods it produces Regional partners were informed of the continuity of public germplasm sharing and the new nurseries were called CIAT-ION (International Observation Nursery)

Upland rice nurseries
The upland rice project CIAT/CIRAD have been in charge of the preparation and dispatch of 3 upland rice CIAT-ION

- CIAT-ION **SC** (Conventional crossbreeding), with 27 advanced Cirad/CIAT lines
- CIAT-ION **SI** (Inter-specific crossbreeding) with lines from CIAT (Progreso / *O barthii* and Caiapo / *O glaberrima*) and 88 NERICA lines (**NE**w **RIC**e for **A**frica) developed by WARDA-Cote d'Ivoire and introduced and selected at CIAT in collaboration with Dr Cesar Martinez
- CIAT-ION **SSR** (Composite population breeding) with 66 advanced lines (S_5-S_9) from Cirad/CIAT

Seed multiplication
All the lines were seed increased at PES during the period October 2002 –February 2003

Seed distribution
For dispatching plant material from Colombia we need two types of documentation One is the import permit from the receptor and the other one is the phytosanitary certificate from the Colombian quarantine service Having these documents the material can be dispatched out of Colombia

Receptors

The nurseries were sent with a MTA to 8 receptors of Latin America and the Caribbean (Table 1) In Colombia, the upland CIAT-ION were cultivated at LES, Villaviecencio with 3 replications During the International Upland Breeding Workshop held at Villavicencio, August 19-22, 2003, the participants had a chance to evaluate and select lines that had been already shipped to their respective country

Follow-up

If breeding material sharing is important for our regional partners as a source of public genetic material, it is also very important for the Cirad/CIAT breeding project to do the follow-up of the use of the material selected by each receptor If lines are selected as promising material and/or parental lines for local breeding, this is a direct measurement of the impact of the breeding work done in Colombia for the region For that reason, we asked each receptor to send back to the project any relevant information about the CIAT-ION

Table 1 Upland rice CIAT-ION 2003

Country	Institution	Responsible
Argentina	Universidad de Tucuman	Alberto Villegas
Bolivia	CIAT Santa Cruz	Roger Taboada
Brazil	Embrapa Arroz e Feijão	Orlando Peixoto
Colombia	CORPOICA Regional 8	Hernando Delgado
	CIAT/CIRAD	Marc Chatel
Cuba	IIA	Ruben Alfonso
Honduras	DICTA y CIAT/CIRAD	Napoleon Reyes
Nicaragua	INTA y CIAT/CIRAD	Lazaro Narvaes
Venezuela	INIA Guarico	Gelis Torrealba

OUTPUT 3 Education and Rice Cultivation as a Vehicle to Alleviate Poverty

Measurable indicator New varieties and germplasm

1 Brazil launches a new variety adapted to upland and lowland rice ecosystems

Orlando Peixoto de Morais – Embrapa Arroz e Feijão
Marc Châtel- Cirad/CIAT

The new variety named CURINGA originates from the conventional upland crossbreeding line CT13226-11-1-M-BR1 Crossing was made at CIAT in 1993 and involved 10 parents from different origin and adapted to upland and lowland rice ecosystems (Table 1)

In 1996, breeding lines (F_4 generation) were shipped to Brazil and the Embrapa Rice and Beans Center followed-up the selection The line passed through the different agronomic evaluation trials and was identified as promising line showing a broad adaptation to upland ("Ecosistema de Terras altas") and lowland ("Ecosistema de Varzeas") rice ecosystems

The official launching of the variety is scheduled in late 2003 or early 2004

Table 1 Genetic constitution CURINGA

Parental line	Contribution (%)	Origin	Rice Ecosystem
IRAT 216	29 0	CIRAD Cote d Ivoire	UPLAND
Tox 1780	17 6	IITA Nigeria	Upland
IAC 47	11 8	IAC-Brazil	Upland
IAC 165	5 9	IAC-Brazil	Upland
IRAT 124	5 9	CIRAD Madagascar	Tropical Lowland
Camponi	5 9	Surinam	Tropical Lowland
Tox 1785	5 9	IITA-Nigeria	Upland
Taipei 309	5 9	Taiwan	Tropical Lowland
Ngovie	5 9	Liberia (Ex WARDA HQ)	Tropical Lowland
Quilla 65101	5 9	INIA Chile	Temperate climate Lowland

2 Colombia launches the "Linea 30" as a new commercial variety for the upland savannas ecosystem

Hernando Delgado - CORPOICA Regional 8-Colombia
Marc Châtel Y Ospina F Rodriguez V Hugo Lozano - Cirad/CIAT
Jaime Gomez Fernando Correa Lee Calvert - CIAT-Colombia

Five years ago, a rice line adapted to the Colombian savannas ecosystem was identified as promising The line comes from the Cirad/CIAT upland conventional crossbreeding project A number of yield trials conducted in experimental station and on-farm have demonstrated the potential of the line with good yield potential and earliness (3 months seed to seed)
This material can be a component of the agronomic systems for the Colombian savannas, in rotation with other annual crops or in association with young perennial species
During 2002, and the first semester of 2003, CIAT and CORPOICA Regional 8 in Villavicencio jointly set-up the efficiency trials that are the Colombian Institution ICA perquisites for the official launching of any plant material as commercial variety

The promising line is known "Linea 30" (CIAT), "Linea 60189" (CORPOICA) or Cirad/CIAT 409 after it registration in the rice breeding catalogue of Cirad

Efficiency trials

The efficiency trials were set-up with the funding support of the CIAT rice project at the La Libertad Experimental Station (LES) and on-farm in the Altillanura plain (Santa Cruz, La Palomera and Lagos de Menegua)

Results

- **Santa Cruz and La Palomera farms**

The line presented sterility on the secondary ramifications of 45 8 and 40 3% in average respectively (Table1) that affected grain production (2611 y 2451 Kg /ha respectively)

Low temperature registered during the cropping season 2002, as it was reported before as well as the development of saprophytes (Table2) was the main factor that reduced the grain yield

Nevertheless, the commercial plot sowed one month later in the season in the Santa Cruz farm, the Linea 30 yielded 3155 Kg /ha (Table 3) This indicates that the difference in yield on the same farm was because of low temperature during the flowering time of the first sowing date

- **Lagos de Menegua farm**

On this farm, the sowing date was on May 9, 2002 and cold temperatures did not affect the grain yield of the line during the flowering period The line yielded 3806 Kg /ha or 300, and 558 Kg /ha the checks Oryzica Sabana 6 and Oryzica Sabana 10

- **La Libertad**

The sowing date was May 17, 2002 The line yielded 3339 Kg /ha similar to Oryzica Sabana 6 with 3402 Kg /ha but lower than Oryzica Sabana 10 with 4350 Kg /ha

Disease incidence

This year, the Linea 30 continues showing very low leaf blast scoring (0-1) but some higher susceptibility than in previous experiments to rhynchosporium (leaf scald) and helmintosporium (brown spot) and grain discoloration

As it was reported above, the line presented some level of grain sterility caused by cold temperature but not by neck blast

After 7 years of experimentation in different locations of the Colombian Altillanura plain the Linea 30 shows a high degree of tolerance on leaves and panicles The plant pathology laboratory of CIAT assessed the pathogens present on the panicle collected at the Santa Cruz farm and it is to notice that the incidence of rice blast is 8% (Table 2)

Official recommendation and launching

The results of the efficiency trials during the cropping season 2002 and the anterior results of regional trials conducted since 1995 were remitted to the Colombian Institute ICA for consideration and recommendation of the Linea 30 as a new commercial variety for the Colombian savannas of the Altillanura plain During the first semester of 2003, CORPOICA Regional 8 cultivated a demonstration plot and finally ICA recommended the line as variety The official notification was in August 2003 It is quite certain that the launching of the new variety would be during October 2003

Seed multiplication and distribution

Seed multiplication was made during the second semester of 2003 at the Experimental Station Santa Rosa, Villavicencio and 3 5 Tons of seed were harvested in March 2004

One ton of seed was remitted to CORPOICA Regional 8 and the rest was stored in the installations of FEDEARROZ of Villavicencio

The private company ARGEAGRO officially registered by the commercial legal office of Villavicencio show interest in buying seed and CIAT responded with the selling of 1 ton of seed with MTA and a specific agreement for royalties

Mister Julio Roberto Camacho, who owns a farm in the Altillanura plain of Colombia and is a pioneer in annual crop production in the region also showed interest in buying seeds CIAT sold 1 Ton under the same terms as for ARGEAGRO

We are confident that the distribution of seed to the private sector is a good start for the new variety

Table 1 Sterility (%) of the line 60189
Efficiency trials in the Altillanura plain, 2002

Replication	"La Palomera" Sowing date May 1	"Santa Cruz" Sowing date April, 29	Commercial plot "Santa Cruz" Sowing date June, 6
I	30	60	20
II	28	45	-
III	35	40	-
IV	68	38	-
Average	40 3	45 8	-

Table 2 Diagnosis of fungus presence line 60189
Efficiency trial Farm Santa Cruz 2002

Pathogen	Incidence (%)
Fusarium	38
Rhynchosporium	35
Curvularia	35
Penicillium	13
Pyricularia	**8**
Helmintosporium	5
Nigrospora	5
Cladosporium	3

Table 3 Agronomic data of the line 60189 Efficiency trials in the Altillanura plain, 2002

Location	Area (ha)	Vigor	Bl	NBl	LSc	Bs	Gd	Flowering (Days)	Average yield (Kg/ha)
La Libertad	1	1 3	3	1 3	5	3	1	63	3632
Lagos de Menegua	0 2	1 3	1	1 3	5	1	1	62	3806
Santa Cruz	3	3	1	3	3	5	3	62	3155

Bl =Leaf blast NBl = Neck blast LSc = Leaf scald Bs = Brown spot Gd = Crain discoloration

Table 4 General behavior of the line 60189 and commercial checks
Efficiency trials Santa Cruz, La Palomera and Lagos de Menegua farms and La Libertad 2002

Material	Vigor	Bl	NBl	LSc	Bs	Flowering (days)
O Sabana 6	3 5	3 5	1-3	5	3	79
O Sabana 10	3	3	1 3	5	1 3	83
Selecta 3 20	5	7	5	5-7	3 5	96
Linea 30	1 3	1	3	5	3 5	60

Bl =Leaf blast NBl = Neck blast LSc = Leaf scald Bs = Brown spot

3 Bolivia launches two new upland rice varieties from conventional crossbreeding and composite population breeding

3 1 Cirad upland variety for the small-farmers rice ecosystem

Roger Taboada Rene Guzman Juana Viruez V Hugo Callau - CIAT Santa Cruz-Bolivia
Marc Châtel - Cirad/CIAT

The new upland rice variety named JACUU (Sacia-9) is the CIRAD variety IRAT 357 that originates from conventional crossbreeding The cross was made in Côte d'Ivoire and the variety was released in that country in 1989 It involves 2 parents, E 425 and IRAT 257
IRAT 357 was introduced in Bolivia through the upland INGER-LAC nursery managed by the former collaborative project between IRRI and CIAT
The line passed through the local different agronomic evaluation trials and was identified as a promising variety well adapted to the small-farmers manual rice ecosystem The main characteristics the farmers' praise are

Grain yield (3600 Kg /ha)
Good initial vigor
Long and wide leaves that rapidly covers the soil (natural weed control)
Strong straws and good resistance to lodging
Tolerant to main diseases
Tolerant to drought
Medium duration cycle (130 days from seed to seed)
Plant height for manual harvesting (110-120 cm)
Medium grain shape (popular grain type) and high seed weight (35 7 grams)

In 2002, the rice program of the Tropical Research Agriculture Center (Centro de Investigacion Agricola Tropical) of Santa Cruz de la Sierra (CIAT-Santa Cruz) produced the genetic seed

The official launching of the variety JACUU was in January 2003

3 2 First upland rice variety from composite population breeding

Roger Taboada Rene Guzman Juana Viruez V Hugo Callau - CIAT Santa Cruz-Bolivia
Marc Châtel Y Ospina F Rodriguez V Hugo Lozano - Cirad/CIAT

In Bolivia, Rice is a very important staple food Consumption is steadily increasing reaching in the recent years 35 Kg per capita
In Bolivia, two main rice production ecosystems are present (1) upland mechanize where the Province of Santa Cruz represents 75% of the total Bolivian rice area and produces 80% of the

total production of the country and (2) the manual ecosystem is represented in all the Bolivian Provinces where the production is by small farmers
The overall production is for the domestic market and auto-consumption One of the main factors limiting the development of the rice sector is the lack of adapted varieties for each ecosystem leading the rice program of CIAT Santa Cruz to invest in breeding with the objective of releasing new varieties better adapted One of the outputs of the project is the release scheduled in early 2004 of a new germplasm that is the result of the close collaboration with the Cirad/CIAT upland rice composite population breeding project

New variety for small farmers and mechanize rice ecosystem
The new upland rice variety with the code name SR 99343 is a Cirad/CIAT line that originates from composite population breeding The line was selected at La Libertad Experimental Station, Villavicencio-Colombia from the first cycle of recombination of the composite population PCT-4 The genetic composition of the composite population PCT-4 developed in Colombia is presented in the table1
Segregating generations were advanced using the conventional pedigree method The advanced line PCT-4\0\0\1>S2-1584-4-M-5-M-6-M-M was shipped to Bolivia for local evaluation
At CIAT Santa Cruz-Bolivia, the line passed through the local different agronomic selection and evaluation trials and was identified as a promising variety well adapted to booth small-farmers' manual and mechanize upland rice ecosystems
The agronomic characteristics and reaction to disease of the line are presented in the tables 2 and 3 Yield potential data from the efficiency trial in 2003, for manual and mechanize rice ecosystem are presented in the table 4 and the characteristics of the new variety is presented in the table5
For the small farmers, the earliness of the variety associated with a good yield potential is an important quality, allowing early harvest and easing crop rotation Furthermore it permits the commercialization at a better price of the production surplus at a time when there is no rice in the market place
For the mechanize system, the variety shows good plant type and long grain shape which is the type preferred by the rice industry and market

Launching the variety
CIAT Santa Cruz informed the rice project of CIAT-Colombia of the good behavior of the new germplasm recognizing the Intellectual Property Rights (IPR) of CIAT and Cirad and invited the rice project leader to the launching ceremony

Table 1 Genetic constitution of the original composite population PCT-4

Parent	Origin	Frequency (%)
CT6196 33-11-1 3-M	Upland line from CIAT	8 33
CT11231-2 2 1-4 M	Upland line from CIAT	4 17
CT11231 2 2 3-1 M	Upland line from CIAT	4 17
CT11231-2 2 2 1 2-M	Upland line from CIAT	8 33
CT11608-8-6-M-2-M	Upland line from CIAT	8 33
IR53167-3-M	Upland line from IRRI	8 33
A 8-394-M	Upland line from Brazil	8 33
CNA-IRAT A	Japonica composite population	50 0
Genetic constitution of the japonica composite population CNA-IRAT A		
IRAT 104	IRAT 13/Moroberekan	6 25
53/2	IRAT 2/IAC 25	12 5
IRAT 257	Mutante of Makuta	6 25
Batatais	Brazil	6 25
Batatais 1	Brazil	6 25
IRAT 199	Cuttack 4/IRAT 104	6 25
Ligero	Brazil	6 25
CNA IRAT 5	Japonica gene pool	50 0

Table 2 Agronomic characteristics
Regional adaptation trial, CIAT Santa Cruz Summer, 2002/03

	Flowering (Days)	Plant height (cm)	Vigor	Grain length (mm)	1000 seed weight (g)	Head rice (%)	White Belly	Temp Gel
Line								
SR 99343	85	96	1	7 05	32 3	49,4	1,7	High
Check								
Jasaye	100	108	1	6 82	36,1	56 4	4,1	Interm
Tutuma	93	104	3	6 73	26 6	47 7	1 8	High

Table 3 Disease incidence
Regional adaptation trial, CIAT Santa Cruz Summer, 2002/03

Location	Saavedra II					CRI-Yapacani					San Pedro					Canandoa					Peta Grande				
	Bl	Lsc	Bs	NBl	Gd	Bl	Lsc	Bs	NBl	Gd	Bl	Lsc	Bs	NBl	Gd	Bl	Lsc	Bs	NBl	Gd	Bl	Lsc	Bs	NBl	Gd
Line																									
SR 99343	3	3	1	1	1	1	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1
Check																									
Jasaye	3	1	1	1	1	1	3	1	1	1	3	1	1	1	1	3	3	1	1	1	1	3	1	1	1
Tutuma	1	1	1	1	1	1	1	1	5	1	3	1	1	1	1	3	1	1	1	1	1	1	3	1	1

Bl =Leaf blast NBl = Neck blast LSc = Leaf scald Bs = Brown spot Gd = Grain discoloration

Table 4 Efficiency trials Manual and mechanized rice ecosystems

Grain yield Upland manual ecosystem (Kg /ha)	
Line	
SR 99343	4706
Check	
Jacuu	4861
Jisunu	4115
Cheruje	3948
Jasaye	3713
Tapeque	3102

Grain yield Mechanized ecosystem (Kg /ha)	
Line	
SR - 99343	4662
Check	
Tari	5380
Epagri 109	4633

Table 5 Characteristics of the new variety

Agronomic characteristics	
Average yield (Kg /ha)	4091
Vigor	Good
Flowering (Days)	90
Growing duration (days)	120
Plant height (cm)	112
Lodging	Resistant
Panicle exertion	Good
Panicle length (cm)	22 8
Grain/panicle	161
Shattering	Intermediate
Diseases	
Leaf blast	Resistant
Neck blast	Resistant
Brown spot	Intermediate
Leaf scald	Intermediate
Grain discoloration	Resistant
Grain characteristics	
Porosity	No
1000 grain weight (g)	32 2
Grain length -White rice (mm)	7 60
Grain width (mm)	2 75
Longitude/width	2 76
Temperature of gelatinization	High
Grain type	Long
White belly	1 8
Visual appearance	Good

4 Chile develops a new rice site-specific population for the temperate climate ecosystem

Santiago Hernaiz L Jose Alvarado A - INIA Quilamapu Chile
Marc Châtel Yolima Ospina - Cirad/CIAT

Conventional crossbreeding has permitted the selection of the commercial varieties actually planted in Chile with greater yield potential and grain quality Data collected showed that they reached a yield plateau The best Chilean rice producers are getting between 8 5 to 10 tons ha^{-1} that seems very difficult to overpass New breeding methods like composite population breeding are new tools that can help break the yield plateau

A new site-specific composite population was developed in collaboration with the Cirad/CIAT rice collaborative project The parental lines used to set-up the population and its genetic constitution is presented in the tables1 and 2 The population named PQUI-2 was set-up by INIA Quilamapu Center –Chile and recombined at CIAT-Colombia

PQUI-2 is composed of japonica parental lines with cold tolerance from different geographic and genetic background This is a guarantee that population breeding by recurrent selection and line selection could result in promising lines showing cold tolerance and high yield potential

Table 1 Parents of the composite population PQUI – 2

Parental line	Origin	Pedigree
CH 410-2	INIA-Chile	B581 A6-545-2/Peta IR 276 1 6 9 / Kuatsu
Quila 121304	INIA-Chile	Diamante / CT 6746
Quila 68405	INIA-Chile	Delta / Quila 29101*
Tuc 25	INIA-Chile	-
CH 530 14	INIA Chile	Dw/T(N)1IR 151-4 19/Ch 101 (RR/B138 1 1/Oro)
Cinia 1014	CIAT/INIA-Chile	CT 10809
IR 13155 4 1	IRRI-Filipinas	BG90 2/KN-1B 214 1-4 3//IR28
PRA 767 5CH	CIRAD Madagascar	PRA 523/CIRAD 403
PRA 775-1CH	CIRAD-Madagascar	PRA 622 / Luluwini 22 M
PRA 741-1CH	CIRAD-Madagascar	Estrela / Long sweet glutinous rice
PRA 737 1CH	CIRAD Madagascar	Cuiabana / Long sweet glutinous rice
PRA 760 1CH	CIRAD Madagascar	Long sweet glutinous rice / Progreso

* Krasnodarskj 3352//Gallardo/Kuatsut

Table 2 Relative participation of the different parents used for the creation of the composite population PQUI-2

Parents	Relative participation (%)
PRA 760 1CH	13,15
PRA 767 5CH	8 20
IRRI 13155-4-1	5 75
PRA 775-1CH	4 78
CH 530-14	3 70
QUILA 68405	3,40
CH 410 2	3,10
TUC 25	2 41
QUILA 121304	2 15
PRA 741 1 CH	1 55
CINIA 1014	1 30
PRA 737 –1CH	0 51
PQUI – 1 \CH\3\1	**50,00**

Measurable indicator **Workshops**

International upland rice breeding Seminar-workshop for Latin America and the Caribbean (LAC) Villavicencio, Meta- Colombia, August 19-22, 2003

Marc Châtel Y Ospina F Rodriguez V Hugo Lozano J Gomez L Calvert

The Cirad/CIAT rice collaborative project has regional responsibility and has created throughout the year's strong links with National Rice Breeding Programs of LAC

In late 1999, Cirad/CIAT , FAO and LAC NARS established a Working Group on Advanced Rice Breeding (GRUMEGA in Spanish) managed by Cirad/CIAT More information about GRUMEGA is found at http //www fao org/ag/AGP/AGPC/doc/riceinfo/America/AmCont htm

Within the networking activities are the offer of workshops in Colombia and helping NARS in doing the same at local level The first International workshop took place in 2000 in Colombia, the second was in 2001 in Bolivia co organized with CIAT Santa Cruz and the Japanese cooperation in this country The third workshop was organized by Cirad/CIAT in August of this year

The main objective is the regional integration of upland rice breeders and to create a forum for sharing ideas and experiences as well as to have the opportunity to do participatory breeding of genetic material at field condition

Workshop funding

Every invited participant was asked for fund raising within its country to support its participation but at the same time the CIAT rice project funded the organizing committee with US$ 4,000 in case of some participant could not raise sufficient funding The estimated total coast of the event was US$ 10,000

Participants

32 researchers from 7 countries (Bolivia, Brazil, Colombia, Cuba, Honduras, Nicaragua and Venezuela) attended the event (Table 1) As the programmed workshop coincided with the coming to CIAT of two people from the European Union for the review of the rice project they were invited to participate

Objectives of the Workshop

- Regional integration of the community of upland rice breeders
- Creation of a forum for discussion and ideas sharing
- Implementation of participatory breeding at field
- Training of the less advanced rice breeders in composite population breeding (Honduras and Nicaragua)
- To have the group concept about the outputs of the Cirad/CIAT rice breeding project
- Selection of germplasm by the different breeders and follow-up of its use

Duration 4 days

- 2 days of technical presentations about the status and advances of upland rice research programs in LAC 20 communications were presented Argentina (1), Bolivia (2), Brazil (2), Colombia (10), Cuba (1), Honduras (1), Nicaragua (2) and Venezuela (1)
- 2 field days at the La Libertad and Santa Rosa Experimental Stations where the participants were able to observe and select the following genetic material
    - Segregating generations
    - Composite populations

- Yield trials of promising lines
- Advanced lines from the upland CIAT-ION nurseries

All the lines selected by the different LAC breeders will be seed increased at Palmira Experimental Station and then shipped to the respective countries

Recompiling information of the germplasm selected by the LAC breeders' panel

The proceedings of the Seminar-workshop are in preparation and will be published electronically and will also be available in the Web page of the rice project of CIAT

http //www ciat cgiar org/riceweb/esp/inicio htm

Proceedings content

- General information
- Abstracts of the communications
- Oral presentations slide show
- Results and analysis of germplasm selection by the LAC breeders panel

In this report we present the last point that we consider as the main output of the workshop

- **Line selection segregating and advanced generations**

General comments

The results of the selection by the panel of 11 LAC breeders are presented in the table 2

In average, 71 8% of the observed lines were selected Selection intensity varies depending of the status of the generation, it was of 63 3% in the early generation S_1 and 97 4% in the advanced generation S_5 This is in part because the more fixed is the line the easiest is the selection based on visual observation

For the Cirad/CIAT breeding project, the high intensity of selection in the advanced generations by the breeders' panel is a very important data showing that the lines present good adaptation and are promising lines and future varieties for the Colombian savannas ecosystem

Specific comments

✓ **Generation S_1**

The average selection intensity was 63 3% and the most selected lines (83 8%) were from the composite population PCT-11\0\0\2,Bo\2 coming from shuttle breeding with Bolivia (one cycle of selection in Colombia and one cycle of recurrent selection in Bolivia) This data justifies the implementation of this collaborative activity

The selection intensity of the lines coming from others composite population is about 50%

✓ **Generation S_2**

The average selection intensity was 80 3% The highest selection intensity (92 8%) was in the composite populations PCT-4\SA\1\1\,SA\2\1 witch is the result of two cycles of recurrent selection in Colombia This suggests that recurrent selection is an efficient breeding tool

✓ **Generation S_3**

The selection intensity of the unique population represented was 90 9% and is suggesting the overall good adaptation of the lines to the savannas rice ecosystem and the efficiency of the selection of the previous segregating generations

The composite population PCT-4\SA\4\1 comes from one cycle of recurrent selection followed by 3 recombination

✓ **Advanced generations**

The average selection intensity of the generations S_4 and S_5 was 83 3 and 97 4% respectively These numbers clearly indicate that the selected advanced lines have a very good potential for the future development of varieties after passing through agronomic trials

Most selected material

30 lines (5 5% of the total number of observed lines) were the most selected ones by the breeders' panel (Table 3) They originate from different generations and composite populations

The following 5 lines were selected by more than 70% of the breeder's panel

PCT-4\SA\6\1>2, PCT-11\0\0\2,Bo\2>49, PCT-4\SA\5\1>1742-5, PCT-4\SA\4\1>330-1-2 and PCT-4\SA\2\1>10-2-3-1-1

We will dedicate special attention in the follow-up of the selection of the most selected lines during next year cropping season as well as their adaptation in the breeding programs of LAC

- **Upland rice nurseries CIAT-ION**

General comments

The results of the selection by the panel of 10 LAC breeders are presented in the table 4

It is to notice that depending of the breeder the intensity of selection varies from 4 3 by INIA-Venezuela up-to 88 1% by DICTA-Honduras The other breeders of the panel selected about 10% of the observed lines, except IIA-Cuba and Fundacion DANAC-Venezuela with 29 4 and 19 4% respectively

Specific comments

The result of the selection are presented in the table5, and are arranged within 3 ranking groups of selection intensity

- ✓ Lines selected by up-to 30% of the breeders panel
- ✓ Lines selected by 30 to 50% of the panel
- ✓ Lines selected by more than 50% of the panel

The most selected nurseries were CIAT-ION SC and CIAT-ION SSR

Most selected material

13 materials (6,2% of the total number observed) were the most selected ones by the breeders' panel (Table 6) This material are considered as highly promising and special attention will be put in future agronomic evaluation in Colombia as well as in the different countries that received and evaluated the CIAT-ION nurseries

The following 4 materials were selected by more than 70% of the breeder's panel

CT13576-1-2-M-1-M	FROM CIAT-ION SC
WAB901-7A1 1-1	FROM CIAT-ION SI WARDA
PCT-4\SA\1\1>721-M-2-M-4-M-6-M-2-M	FROM CIAT-ION SSR
PCT-4\SA\1\1>721-M-4-M-1-M-5-M-1-M	FROM CIAT-ION SSR

Conclusion

Workshops with participatory selection by breeders is a very useful mechanism in different fronts (1) every participant of the workshop is now well aware about the activities of the different upland rice breeding projects in LAC, (2) breeders know better what the offer of the CIRAD/CIAT upland rice project is, (3) in-site line selection by each national breeder make them better appropriate the genetic resource they selected and (4) as the CIRAD/CIAT upland breeding project is regional, the result of the selection is an important input We know better what kind of breeding lines and associated traits they like and need

Table 1 List of participants

Country	Institution	Participant
Bolivia	CIAT Santa Cruz	Roger Taboada Paniagua Juana Viruez
Brazil	EMBRAPA Arroz e Feijão	Beatriz Pinheiro Orlando Peixoto
Colombia	CORPOICA Regional 8	Diego Aristizabal Hernando Delgado
	FEDEARROZ	Harold Bastidas Alberto Davalos
	Semillas El Aceituno	Roberto Simmonds
	CIAT	Joachim Voss Lee Calvert Cesar Martinez Fernando Correa Diego Molina Jaime Gomez Diana Delgado James Carabali Jaime Borrero Monica Triana
	Cirad/CIAT	Francisco Rodriguez Victor Hugo Lozano Marc Chatel Yolima Ospina Joanna Dossmann
Cuba	IIA	Ruben Alfonso
Honduras	DICTA	Napoleon Reyes
Nicaragua	INTA	Lazaro Narvaes Rojas Marlon Ortega
	Cirad/CIAT	Gilles Trouche
	Mision Tecnica China Taiwan	Victor Kuo
Venezuela	INIA	Gelis Torrealba
	Fundacion DANAC	Carlos Gamboa Yorman Jayaro
European Union	GTZ Germany	Andreas Springer-Heinze
	NRI United Kingdom	Tim Chancellor

Table 2 Selection of segregating and advanced lines by the breeders' panel

Material		Nbr of line		Nbr of selected lines (%)
		Evaluated	Selected	
Population Generation S_1				
PCT-4\SA\1\1 SA\3\1		59	31	52 5
PCT-4\SA\6\1		42	21	50 0
PCT-4\SA\1\1 Bo\2		75	38	50 7
PCT-11\0\0\2,Bo\2		117	98	83 8
CNA 7\Bo\2\1		53	31	58 5
	Total	346	219	63 3
Population Generation S_2				
PCT-5\PHB\1\0 PHB\1 PHB\1 PHB\1		4	3	75 0
PCT-4\SA\1\1\, SA\2\1		14	13	92 8
PCT 4\SA\5\1		27	23	85 2
PCT-4\SA\1\1 Bo\1		14	10	71 4
PCT-11\0\0\2 Bo\1		34	27	79 4
CNA 7\Bo\1\1		19	14	73 6
	Total	112	90	80 3
Population Generation S_3				
PCT 4\SA\4\1		33	30	90 9
	Total	33	30	90 9
Population Generation S_4				
PCT-4\SA\1\1 SA\1\1		6	4	66 7
PCT 11\0\0\3		6	6	100
	Total	12	10	83 3
Population Generation S_5				
PCT-4\0\0\2		8	8	100
PCT-4\SA\2\1		24	24	100
PCT-4\SA\4\1		7	6	85 7
	Total	39	38	97,4
Cross Generation F_7				
CT10069		7	7	100
	Total	7	7	100
Grand Total		549	394	71,8

Table 3 Most selected lines

	Most selected lines	
	Nbr of selection	In % of the panel
Generation S_1		
PCT 4\SA\1\1 SA\3\1>40	5	45 4
PCT 4\SA\1\1 SA\3\1>18	5	45 4
PCT 4\SA\6\1>2	9	81 8
PCT 11\0\0\2 Bo\2>39	5	45 4
PCT 11\0\0\2 Bo\2>47	5	45 4
PCT 11\0\0\2 Bo\2>49	8	72 7
PCT 11\0\0\2 Bo\2>51	7	63 6
PCT 11\0\0\2 Bo\2>76	6	54 5
PCT-11\0\0\2 Bo\2>81	5	45 4
CNA 7\Bo\2\1>53	5	45 4
Generation S_2		
PCT 4\SA\1\1\ SA\2\1>164-2	6	54 5
PCT 4\SA\1\1\ SA\2\1>1059 1	7	63 6
PCT 4\SA\5\1>1360 2	6	54 5
PCT 4\SA\5\1>1742-5	9	81 8
PCT 11\0\0\2 Bo\1>19 1	5	45 4
PCT 11\0\0\2 Bo\1>62 2	5	45 4
Generation S_3		
PCT-4\SA\4\1>302-2 5	5	45 4
PCT-4\SA\4\1>330-1-2	10	90 9
PCT-4\SA\4\1>330-2 2	7	63 6
PCT-4\SA\4\1>330-2-4	6	54 5
PCT 4\SA\4\1>330-3 2	5	45 4
Generation S_4		
PCT-11\0\0\3>1497 M-1-2	6	54 5
Generation S_5		
PCT 4\SA\2\1>10 2 1-2-4	5	4 4
PCT 4\SA\2\1>10 2-1-2 5	5	4 4
PCT-4\SA\2\1>10-2 1-3 1	6	54 5
PCT-4\SA\2\1>10-2 1 3 2	5	45 4
PCT 4\SA\2\1>10-2 3-1 1	8	72 7
PCT-4\SA\2\1>10-2 3 2-3	5	45 4
PCT-4\SA\2\1>10-2 5 1-4	6	54 5
PCT 4\SA\2\1>44-3-1 1 1	7	63 6

Table 4 Result of the selection of the CIAT-ION

		Nurseries CIAT-ION					
		SC*	SI**		SSR***		
		Number of line evaluated in each nursery				Total of line	
		27	118		66	211	
			(30 CIAT)	(88 WARDA)			
Country	Institution	Number of line selected in each nursery				Total	%
Brazil	EMBRAPA Arroz e Feijão	2	0	10	0	12	5 7
Colombia	Corpoica	1	0	6	8	15	7 1
	Semillas El Aceituno	4	4	21	11	40	18 9
Cuba	IIA	9	7	21	25	62	29 4
Honduras	DICTA	26	28	67	65	186	88 1
Nicaragua	Cirad/CIAT	7	4	12	4	27	12 8
	INTA	3	0	9	7	19	9 0
	Chinese Mission Taiwan	8	0	4	7	19	9 0
Venezuela	Fundacion DANAC	3	0	22	16	41	1 4
	INIA Guarico	2	0	5	2	9	4 3

* SC= Conventional Crossbreeding ** SI= Inter specific cross *** SSR= Recurrent selection breeding

Table 5 CIAT-ION nurseries Selection intensity

		Selected material Up to 30% of the panel		30 - 50% of the panel		More than 50% of the panel	
		Selected lines					
CIAT-ION nursery	Evaluated lines	Selected	%	Selected	%	Selected	%
SC	27	21	77 8	3	11 1	3	11 1
SI CIAT	30	27	90 9	3	10 0	0	0 0
SI WARDA	88	55	62 5	20	22 7	4	4 5
SSR	66	44	66 7	15	22 7	7	10 6

Table 6 CIAT-ION Most selected lines

Nursery and line	Most selected line	
	Number of In selection	% of the panel
CIAT-ION SC		
CT13576-1 2 M-1-M	9	90
CT13576 1-4 M-1-M	6	60
CT13572 3-3 M-2-6 1 M	6	60
CIAT-ION SI WARDA		
WAB759-54-2 3-HB 2	6	60
WAB894-B 5A2 1-4	6	60
WAB901-7A1 1-1	7	70
WAB901-7A1 1-3	6	60
CIAT-ION SSR		
PCT 4\SA\1\1>721 M-2 M-4 M 2-M-3 M	6	60
PCT 4\SA\1\1>721 M-2 M-4 M 6-M-2 M	7	70
PCT-4\SA\1\1>721 M-4 M-1 M 4-M-1 M	5	50
PCT-4\SA\1\1>721 M-4 M-1 M-4-M-4 M	6	60
PCT-4\SA\1\1>721-M-4 M 1 M-5-M 1 M	7	70
PCT-4\SA\1\1>721-M-4 M-1-M-5-M 2 M	6	60

Outputs 2004

Highlights

Annual Report

HIGHLIGHTS 2004

I NEW VARIETIES AND GERMPLASM

1 Variety Launching

1 1 Conventional Breeding

- **Brazil**

BRSMG CURINGA
"VARIEDADE DE ARROZ PARA PLANTIO EM CONDIÇÕES DE TERRAS ALTAS E VARZEAS"
Launching First semester 2004
Origin Cirad/CIAT Line (CT13226-11-1-M-BR1)
Intellectual property Cirad/CIAT and EMBRAPA
Adaptation Aerobic Rice Ecosystems (Cerrados and Varzea)

- **Colombia**

Llanura 11
Official registration and release by ICA-Colombia First semester 2004
Origin Cirad/CIAT Line (CT 11891-2-2-7-M or CIRAD/CIAT 409)
Intellectual property Cirad/CIAT and CORPOICA
Adaptation Aerobic Rice Ecosystems (Savannas of the "Altillanura" region and the "Piedemonte" ecosystems) FEDEARROZ is very interested by the line because of its adaptation to the mechanized favorable conditions

1 2 Composite population breeding

- **Bolivia**

SR 99343 PCT-4\0\0\1>S2-1584-4-M-5-M-6-M-M
First Upland variety coming from the Composite Population PCT-4
Official release February 2005 (to be confirmed)
Origin Cirad/CIAT (Upland *japonica* composite population PCT-4)
Intellectual property Cirad/CIAT and CIAT Santa Cruz -BOLIVIA
Adaptation Small-farmer's and mechanized aerobic rice ecosystems

2 Germplasm

2 1 Adaptation of aerobic germplasm in Central America

Excellent adaptation of aerobic advanced and segregating lines
Origin of the germplasm Cirad/CIAT (conventional and population breeding in Colombia)
Intellectual property Cirad/CIAT
Adaptation Lines are evaluated and selected with and by framers (Participatory Variety Selection-PVS-) The selected lines show earliness, good yielding potential and resistance to diseases
This germplasm is highly praised because it offers the possible diversification of the actual cropping systems and also because of the reduction in costs production
The results are very relevant for the aerobic Cirad/CIAT rice project and represent a valorization of the work done in Colombia

2 2 New composite population

- **Chile and France**

PACQ-1 Site-specific population for the temperate climate ecosystem

Origin Cirad/CIAT (Aromatic lines from Cirad introgressed into the anaerobic *japonica* composite population PQUI-1)
Intellectual property Cirad, CIAT and INIA Chile
Adaptation Temperate climate ecosystem
Population enhancement will focus on cold tolerance and aroma

II GENERATION CHALLENGE PROGRAM

Two activities were financed and implemented in 2003/2004

- Characterization of *O glaberrima* genetic resources and utilization in marker assisted composite population breeding
- Assemble and document information on selected entries of CIAT, Cirad, IRD and EMBRAPA rice working collections

III PUBLICATIONS

1 Referred Journal

- **Santiago Hernaiz L, Jose Alvarado A, Marc Châtel and Yolima Ospina Rey**

"Creacion de la poblacion PQUI-2 con tolerancia a frio para seleccion recurrente en arroz" Fitotecnia colombiana Organo de la associacion colombiana de fitomejoramiento y produccion de cultivos Vol 3 No 2 Julio-Diciembre 2003 p 38-42

- **Yolima Ospina Rey, Elcio P Guimarães and Marc Châtel**

"Respuesta a la seleccion y a ciclos de recombinacion en la poblacion de arroz (*Oryza sativa* L) de secano PCT-4" Fitotecnia colombiana Organo de la associacion colombiana de fitomejoramiento y produccion de cultivos Vol 3 No 2 Julio-Diciembre 2003 p 59-68

- **Argemiro M Moreno Berrocal, Marc Châtel, Yolima Ospina, Jaime Borrero, Elcio Guimarães** "El arroz de secano, nueva opcion de cultivo para la region cafetera de Colombia Estudio agronomico del sistema arroz (*Oryza sativa* L) intercalado con siembras nuevas de cafe (*Coffea arabica* L) Fitotecnia colombiana Organo de la associacion colombiana de fitomejoramiento y produccion de cultivos Vol 4 No 1 Enero-Junio 2004 p 9-17

2 Proceeding

- "Memorias da Conferência Taller Melhoramiento genetico do arroz na America Latina e Caribe" Goiânia-Brazil March 14-20, 2004 Embrapa Arroz e Feijão, CIAT, Cirad and FAO CD Rom Documentos On-line 160 ISSN 1678-9644 April 2004

3 Report

- In Cirad-ca Annual Report 2003 Rice Project Cirad/CIAT Rice Improvement Using Conventional Breeding and Gene Pools and Populations with Recessive Male-Sterile Genes

4 Oral Presentations

- **Marc Châtel, Elcio P Guimarães, Michel Vales and Gilles Trouche**

"El proyecto de arroz del Cirad en CIAT Actividades e impactos alcançados -1991-2003-" International Year of Rice " Conferência Taller Melhoramiento genetico do arroz na America Latina e Caribe" Goiânia-Brazil March 14-20, 2004

- **Marc Châtel and Yolima Ospina**

"Projet riz du Cirad au CIAT Amelioration varietale pour l'Amerique latine et les Caraïbes, croisements et populations Reunion equipe rizicultures Montpellier-France July 5-7, 2004

- **Marc Châtel, Gilles Trouche, Yolima Ospina, Jaime Borrero, and Zildghean Chow**

"La Seleccion Recurrente con Androesterilidad Genetica para ampliar la base genetica" Seminario Taller Regional sobre Manejo Integrado del Cultivo del Arroz Managua- Nicaragua September 27-October 3, 2004

5 Concept notes (developed in collaboration with Mathias Lorieux and Cesar Martinez Generation Challenge Program

- Characterization of *O glaberrima* genetic resources and utilization in marker assisted composite population breeding
- Assemble and document information on selected entries of CIAT, Cirad, IRD and EMBRAPA rice working collections

IV VISITS TO PARTNERS AND ORGANIZATION OF EVENTS

1 Visit to Partners

- **Brazil**

-International Year of Rice Embrapa Rice and Beans Center March 15-20, 2004

- **Dominican Republic**

- RedBio and LAC breeder's meeting to discuss the setting-up of the breeding network Red-MeGAA Santo Domingo June 21-25, 2004

- **Cuba**

- International Year of Rice Taller de seleccion participativa para condiciones de riego y secano July 12-16, 2004 *(Yolima Ospina attended the workshop on my behalf)*

- **France**

- New reform of CIRAD Montpellier, July 5-7 and August 30-Septenber 2, 2004

- **Nicaragua**

- Field monitoring tour with Gilles Trouche

2 Meeting and Conference organization

- With EMBRAPA (main responsible), CIAT and FAO of the "Conferência Taller Melhoramiento genetico do arroz na America Latina e Caribe" Goiânia-Brazil March 14-20, 2004
- With INIA Quilamapu-Chile (main responsible), and FAO of the next GRUMEGA meeting to be held in Chile in 2006
- With the "Asociacion Colombiana de Fitomejoramiento y Produccion de Cultivos" (main responsible), CORPOICA Regional Palmira, CIAT and Cirad of the " IX Congreso de la Asociacion Colombiana de Fitomejoramiento y Produccion de Cultivos' to be held in CORPOICA Palmira, May 11- 13, 2005

V STUDENTS

- **Bauguil Stephane**

(I played the role of facilitator by identifying host institution and technical working theme)
Memoir End of the 4th year scholarship

"Que posibilidades de desarrollo para la agricultura de subsistencia? En un pais caracterizado por bajos niveles de ingreso, y sometido a procesos de integracion comercial regional Un intento de respuesta, el ejemplo de Bolivia y del sector arrocero nacional" Ecole superieure europeenne Ingenierie de l'espace rural (IER)-France

- **Luis Armando Castilla Lozano**

Jury Member at the presentation of the PhD scientific project
'Respuesta de genotipos interespecificos de arroz (*Oryza spp*) a la inoculacion con las bacterias fijadoras de nitrogeno *Azotobacter chroococcum* y *Asospirillum amazonense* en un suelo (*Typic haplustalf*) de la meseta de Ibague, Colombia" Universidad Nacional de Colombia Sede Palmira

ANNUAL REPORT 2004

OUTPUT 1 Enhancing Gene Pools

1A Broadening the Genetic Base of Aerobic Rice in Latin America

- **Aerobic rice composite population improvement**

Marc Châtel Yolima Ospina Francisco Rodriguez Daniel Guzman Cirad/CIAT
Funding Cirad and CIAT

Abstract
Since 1996, the Cirad/CIAT project have gradually phased out intra-specific tropical japonica conventional crossbreeding activities and concentrated on broadening the genetic base of rice by the development and enhancement by recurrent selection of aerobic rice composite populations These breeding strategies use a recessive male-sterile gene (ms) to, development highly diverse rice populations based on multiple parents
In Colombia, the basic aerobic composite populations were enhanced using two recurrent selection-breeding methods In Bolivia with the Centro de Investigaciones Agricola Tropical shuttle breeding was implemented since the year 2000 and leads to the development of 3 enhanced populations, 2 from the Cirad/CIAT project (PCT-4 Bo and PCT-11 Bo and one from EMBRAPA Rice and Beans Center (CNA 7 Bo) At each enhancement cycle, fertile plants are selected for the development of segregating lines and progeny selection using the conventional pedigree methods The most advanced lines are evaluated in yield trials in collaboration with LAC Cooperators by bilateral lines sharing and from 2003 through the CIAT-ION nurseries Promising lines from the enhanced population PCT-4 were identified in Colombia, Bolivia and Cuba

Key words Aerobic rice, breeding, and composite population

Background
Conventional crossbreeding projects of CIAT and Cirad/CIAT have been and still are a source for the release of new varieties in Latin America In early 2004, the Rice and Beans Center of EMBRAPA in Brazil officially launched the variety CURINGA with recognition of property rights to CIAT and Cirad
Since 1993, CIAT and Cirad have joined forces to propose and implement new breeding tools for the creation and future release to the rice producers of germplasm with wider genetic background The creation of populations with broad genetic base, and their breeding through recurrent selection is a new breeding method proposed and implemented by the Cirad/CIAT Rice Project

From 1996 on the activities concentrate on the development and enhancement of aerobic rice gene pools (*Oryza sativa* L , Tropical Japonica type) using a recessive male-sterile gene (ms) from a mutant of IR36 The basic populations were enhanced using two recurrent selection-breeding methods The main purpose of a breeding project is the creation of breeding populations with broad genetic diversity that leads to the identification of promising lines and the development of new cultivars To do so, fertile plants are selected from the basic composite

populations and at each enhancement step by recurrent selection They are the starting point for the selection of segregating progenies by conventional pedigree method and the identification of promising fixed lines

Materials and Methods

Composite Population Breeding Strategies

Population breeding by recurrent selection is efficient for trait improvement showing low heritability Through short selection-recombination cycles, linkage blocks are broken down and favorable genes are accumulated This is a smooth process of continuous improvement The methodology applied to rice and implemented by the project was described in previous reports

Materials

Populations

During the cropping season 2004, at La Libertad Experimental Station (LES), Villavicencio-Meta, Colombia, the 3 populations coming from the shuttle-breeding project with Bolivia were observed and selected

- PCT-4\SA\1\1, Bo\3

Population from Cirad/CIAT with one cycle of recurrent selection in Colombia followed by one cycle of recurrent selection in Bolivia and 2 recombinations

- PCT-11\0\0\2, Bo\3

Population from Cirad/CIAT with two recombinations in Colombia followed by one cycle of recurrent selection in Bolivia and 2 additional recombinations

- CNA-7\Bo\3\1

Population from Brazil (EMBRAPA Rice and Beans Center) with one cycle of recombination and enhanced in Bolivia by one cycle of recurrent selection followed by 2 recombinations

Line Development

A total of 1485 progenies from the S_2 to S_7 generation coming were observed and selected using the pedigree method These materials come from different phases of selection and enhancement of the populations PCT-4, PCT-11 and CNA 7

Line development follows traditional evaluation and pedigree selection The major characteristics bred for savanna conditions are early vigor, tolerance of soil acidity, resistance to rice blast (*Pyricularia grisea* Sacc), good grain quality (translucent, long-slender grain) and early maturity (total cycle about 115 days)

The selection of S_0 fertile plants (Msms) is the starting point for segregating line development Throughout the selection process, selecting and harvesting only fertile plants allows the elimination of the male-sterile gene, and advanced progenies are 100% fertile (MsMs)

Results and Discussion

The results of the selection made during the cropping season 2004 are presented in the table 1

From the 3 populations mentioned above, a total of 553 S_0 fertile plants was selected

From the segregating lines from different populations and steps of recurrent selection, 1599 plants were selected as well as 74 advanced lines in bulk

This year, the selection intensity applied to the 3 populations resulting from the shuttle- breeding activities with Bolivia was relatively low In fact we selected a range of phenotypes to attend different cooperators with a diverse set of segregating generations from which they can follow-up the selection to attend different targeted local situations (mechanized and manual rice ecosystems)

The selected advanced lines will be seed increased at PES during the second semester of 2004 to set-up the aerobic CIAT-ION nursery to be shipped in 2005 to LAC cooperators in Brazil, Bolivia, Venezuela and Central America through the Cirad/CIAT project managed by Gilles Trouche
The selected segregating lines will be observed and selected during the next cropping season at LES

As we have a great number of segregating lines it was decided to follow-up their evaluation and selection and to hold-on the enhancement of the existing populations that will be kept in the cold chamber The decision was also because of the development of a new aerobic population (see next part of the report) using the PCT-4 background as source of male-sterility and introducing a set of fixed lines, each one of them having a fragment of the genome of an *Oryza galberrima* accession

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Table 1 Segregating Lines from different Composite Populations Experimental Station La Libertad, Villavicencio-Colombia, 2002

Generation	Population	Number of selections		
		Fertile plants	Plants	Bulk
S_1	CNA-7\Bo\3\1	140		
	PCT-11\0\0\2 Bo\3	204		
	PCT 4\SA\1\1 Bo\3	209		
Total		**553**		
S_2	PCT-4\0\0\1>		29	
	PCT-4\SA\7\1>		47	
	PCT-4\SA\1\1 SA\4\1>		46	
	PCT-4\SA\1\1,Bo\2\1>		69	
	PCT-11\0\0\2 Bo\2\1>		167	
	CNA-7\Bo\2\1>		9	
Total			**367**	
S_3	PCT 4\SA\1\1 SA\3\1>		175	
	PCT 4\SA\6\1>		55	2
	PCT-4\SA\1\1,Bo\2\1>		39	
	PCT 11\0\0\2 Bo\2\1>		303	15
	CNA-7\Bo\2\1>		9	
Total			**581**	17
S_4	PCT 5\PHB\1\0 PHB\1,PHB\1,PHB\1		7	
	PCT 4\SA\1\1 SA\2\1>		134	
	PCT 4\SA\5\1>		238	
	PCT 4\SA\1\1 Bo\1\1>		42	
	PCT 11\0\0\2,Bo\1\1>		46	
	CNA-7Bo\1\1>		41	
Total			**508**	
S_5	PCT 4\SA\4\1>		132	
Total			**132**	
S_6 and S_7			6	7
			5	24
				5
				8
				6
				7
Total			**11**	**57**

Characterization of *O glaberrima* genetic resources and utilization in marker assisted composite population breeding

Marc Châtel Yolima Ospina - Cirad/CIAT
Mathias Lorieux Jaime Lozano A Garavito Victor Hugo Lozano Marco Brito - CIAT/IRD
Cesar Martinez Jaime Borrero – CIAT
Funding Cirad IRD CIAT and the Generation Challenge Program

Abstract
Before the launching of the Generation Challenge Program, this activity was presented and discussed during the 2003 CIO/CIAT meeting held in Montpellier
After the launching of the GCP it was submitted and accepted for one year funding The activity falls into the Sub-Project 3 (SP3) "Gene Transfer and Crop Improvement",
Cluster 2a 5 (C2a 5) "Marker-assisted Selection of Rice"
The principal objective of the activity is to increase the genetic diversity of *Oryza sativa* composite populations targeting the aerobic rice ecosystem Rice composite populations already exist and were developed using a recessive male-sterile gene
The new variability comes from fixed inter-specific lines from the cross between the Brazilian aerobic rice variety Caiapo (CIAT breeding lines) and an *Oryza glaberrima* accession
The project is taking advantage of existing advanced breeding methods (composite population breeding, molecular marker techniques and inter-specific lines) to merge them for the development of rice lines for the aerobic rice ecosystems The project outputs would benefit Latin American NARS and WARDA

Key words Genetic diversity, *Oryza glaberrima Oryza sativa* aerobic rice, marker assisted composite population breeding

Background
The project aims at incorporating in existing aerobic composite populations a representative sample of lines introgressed by *O glaberrima* to i) enlarge the genetic diversity of composite populations ii) determine through marker analysis *O glaberrima* loci controlling interesting traits and/or interacting with *O sativa* genome

The African cultivated rice species *O glaberrima* is an important genetic resource for broadening the genetic diversity available for rice breeding (use of bio-diversity) WARDA uses inter-specific crosses between the Asian and African rice and developed the New Rice for Africa or NERICA
The CIAT Rice Project also made crosses between the two cultivated species and came-out with inter-specific progenies evaluated at field condition and mapped for introgression fragments of the genome of the *O glaberrima* accession
Aerobic *O sativa* composite populations from the Cirad/CIAT project already exist and would be introgressed by a selected set of intersepecific lines
The new broaden genetic base composite population(s) would be made available to Latin American NARS and WARDA/ NERICA Consortium in Africa
This activity is through a multi-institutional partnership for the use of composite population breeding and *O glaberrima* germplasm through recurrent selection

Links with others projects of the GCP are with SP2 cluster C1 "Inventory of genetic resources" and SP2 C4 "QTL Analysis"

Materials and Methods

Materials

Dr Cesar Martinez of the CIAT Rice Project has developed inter-specific lines from the cross between *O glaberrima* (accession IRGC103544) and *O sativa* (cv CAIAPO, a CIAT aerobic line launched in Brazil) This genetic resource was developed using an upland tropical *japonica* genetic background and was also checked by markers, proving a good representation of the *O glaberrima* genome Moreover, these lines are doubled haploid fixed lines derived from BC3F1 and were evaluated erlier for agronomic traits

A sub-set of 120 inter-specific lines was selected Each one of then carries a fragment of the *O glaberrima* accession and all together represent the entire genome of the accession used in the inter-specific cross (Figure 1)

Some agronomic characteristics of the interspecific lines are presented in the table 1

The background of male-sterility is the aerobic enhanced composite population PCT-4 and its original genetic constitution is presented in the table2

Synthetization of the population

- Evaluation of the genetic variability of the population PCT-4

At 30 days after sowing, on each one of the plants present into the population a leaf sample is collected Bulks of samples of 8 individual plants were made and geneticaly characterized with markers by Mathias Lorieux

- Sowing of the inter-specific lines at two different dates
- Crosses between each one of the inter-specific lines and a male-sterile plant of the population PCT-4
- Each one of the 120 male-sterile plant is labeled cut and fertilizer applied for rattoning From the ratton, leaves are harvested and geneticaly characterized with markers by Mathias Lorieux
- Hybrid seeds produced by on each one of the 120 fecunded male-sterile plant are individually harvested
- The F1 generation is individually planted for observation and seed increase
- Part of the F2 seeds will be evaluated during the next semester for drought tolerance
- The remnant F2 seeds of each individual cross will be mixed in equal proportion to get the new population identified as **POSG-1/0/0/0** (P= population, O=Oryza, S=sativa and G=glaberrima)

Results and discussion

The task assignments were as follow CIAT and two French Agropolis Research Institutions (CIRAD and IRD) are involved in the project

- C Martinez (CIAT) and M Lorieux (IRD/CIAT) to select/compile and assemble information on inter-specific lines to be introgressed into an existing composite population
- M Châtel (Cirad/CIAT) to select composite population
- M Lorieux, M Châtel and C Martinez to develop MARS

- Two technicians appointed at CIAT Palmira to perform crosses and conduct recurrent selection and to assist / conduct molecular characterization are currently trained

We initiated the identification of SSR markers showing *O glaberrima* specific alleles (Figure 2) We expect to obtain a series of such alleles that cover well the rice genome and that will be helpful to monitor the introgression of *O glaberrima* QTLs in the recurrent population through Marker-Assisted Recurrent Selection

During the second semester of 2004, crosses between each one of the 120 inter-specific lines and male-sterile plants of the aerobic composite population PCT-4 are in progress The F_1 generation of each one of the 120 crosses will be evaluated and characterized next year and the F_2 seeds assembled to obtain the basic population, which will be recombined further

Once we get the basic recombined population the germplasm will be made available to regional partners for evaluation in specific environments and for targeted traits

The enhancement of the basic composite populations with marker assisted recurrent selection will be made at CIAT and with selected partners During the enhancement process, line development will be done and segregating lines evaluated for agronomic traits
The funding of the activity by the GCP was of one year, but as it is a planned activity between CIAT, Cirad and IRD presented and accepted during the last CIO/CIAT meeting we have to follow-up independent of new funding As the global composite population breeding project is starting bearing fruits with the launching of new varieties by partners we can hold-on the enhancement of the existing populations and concentrate time and resources on the development and enhancement by MARS of the new population

Figure 1 Distribution of inserted fragments of *O glaberrima* into the 12 chromosomes of *O sativa* cv Caiapo (from M Lorieux and C Martinez)

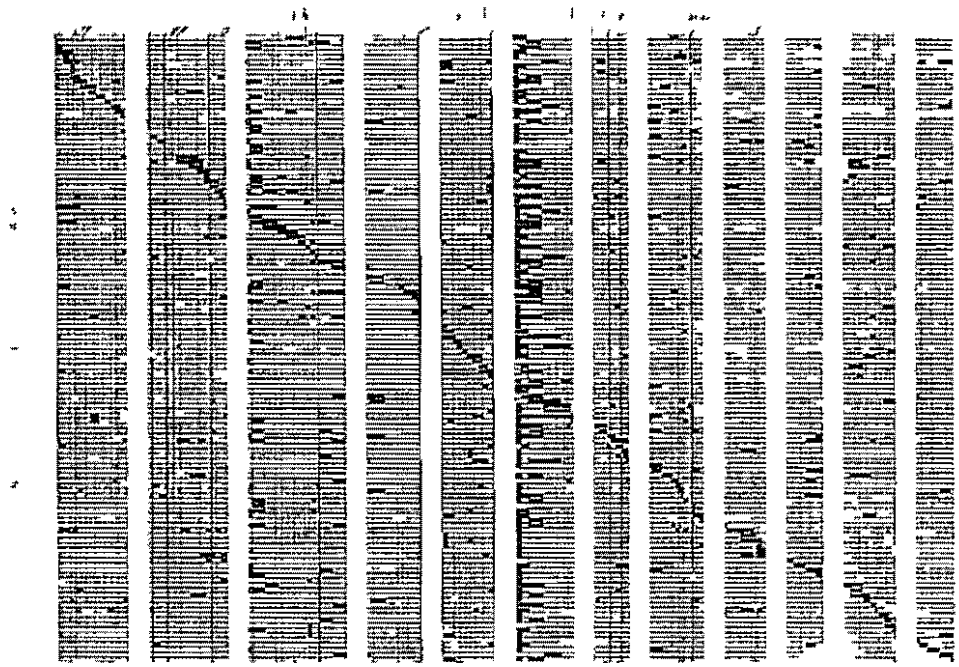
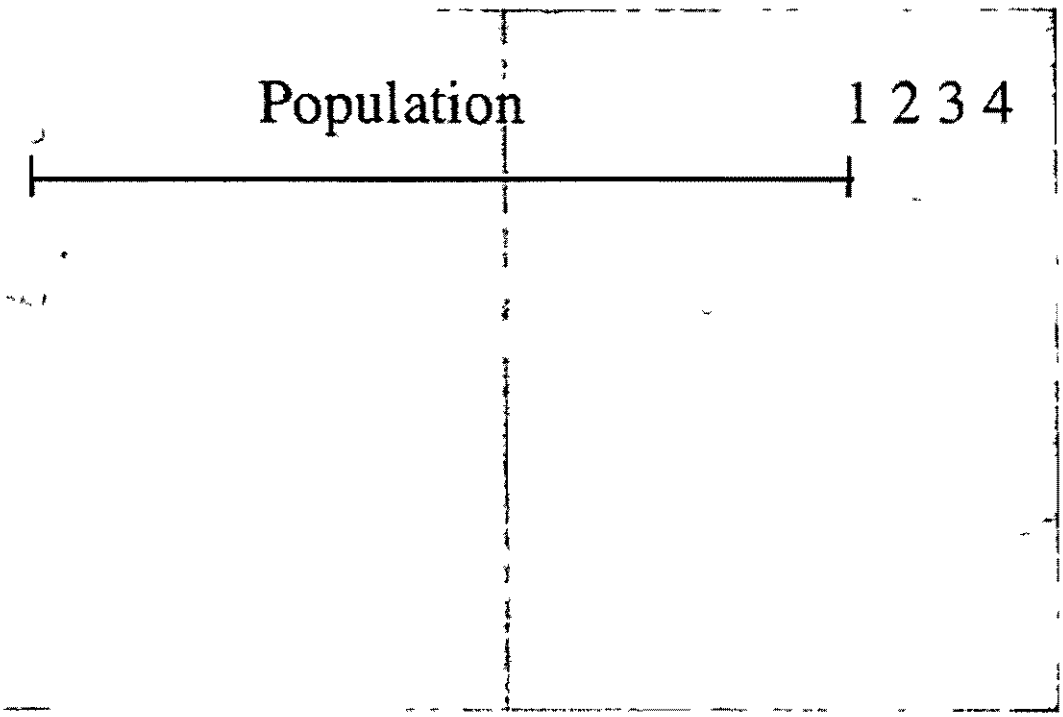


Figure 2 Example of a polyacrylamide gel electrophoretic separation of PCR product for an SSR marker *O sativa* and *O glaberrima* specific alleles can be found for several markers, allowing to use them for Marker-Assisted Recurrent Selection (Mathias Lorieux)



1 IR 64 *(O sativa)*, 2 Tog 5681 *(O glaberrima)*, 3 IRGC103544 *(O glaberrima)*, 4 Caiapo *(O sativa)* The population was derived from multiparental crosses

Table 1 Some characteristics of the 126 interspecific lines selected (from C Martinez)
PT= Plant Type FL= 50% Flowering (days) HT=Height (cm) NTI= Number of tiller PL= Panicle Length

Pedigree	PT	FL	HT	NTI	PL
CT16308 CA 5 M	Compact	80	123	12	24
CT16333(1)-CA 24-M	Open	100	117	14	26
CT16333(1) CA 23 M	Open	85	117	14	26
CT16312(1) CA 1 M	Compact	80	128	17	25
CT16344 CA 20-M	Compact	80	126	10	26
CT16329 CA 7 M	Compact	87	135	12	25
CT16355 CA 1 M	Compact	87	103	12	21
CT16340 CA 13 M	Compact	80	113	10	27
CT16350-CA 19 M	Compact	78	110	11	25
CT16341 CA 9 M	Compact	83	106	11	25
CT16329 CA 10-M	Compact	87	110	8	24
CT16333(2) CA 6 M	Compact	90	111	12	24
CT16342 CA-4 M	Compact	102	129	15	30
CT16334(1) CA 18 M	Compact	78	111	13	26
CT16337 CA 7 M	Compact	97	116	14	26
CT16345 CA 8 M	Compact	102	117	15	33
CT16307 CA 11 M	Compact	89	143	17	31
CT16317 CA-4 M	Open	87	131	11	27
CT16331 CA 8 M	Open	100	125	12	34
CT16356(?) CA 9 M	Compact	80	143	12	27
CT16355-CA 15 M	Compact	87	129	11	26
CT16307 CA 5 M	Compact	90	127	13	31
CT16313-CA 8 M	Compact	101	120	13	22
CT16342-CA 13 M	Compact	102	125	20	28
CT16307(1) CA 8 M	Compact	90	146	12	30
CT16328-CA 12 M	Compact	90	118	9	28
CT16353 CA 14 M	Compact	90	122	17	30
CT16324-CA 8 M	Compact	80	130	8	27
CT16333(2) CA 3 M	Open	99	123	17	27
CT16333(2)-CA 15 M	Compact	89	136	13	25
CT16324 CA 1 M	Compact	80	123	22	29
CT16356(2) CA 8 M	Compact	80	129	11	29
CT16354 CA 10 M	Compact	83	116	14	29
CT16307(1) CA 5 M	Compact	80	126	14	25
CT16350-CA 8 M	Compact	78	106	45	27
CT16313-CA 6 M	Compact	89	137	17	26
CT16350 CA 39 M	Compact	80	120	14	25
CT16328-CA 3 M	Compact	100	127	17	25
CT16333(1) CA 18 M	Open	100	115	18	27
CT16330(1) CA 2 M	Compact	80	118	12	26
CT16342-CA 23 M	Compact	80	119	12	26
CT16338 CA 8 M	Compact	80	114	11	24
CT16333(1) CA 16-M	Open	80	111	13	24
CT16322 CA 9 M	Compact	80	133	13	25
CT16313-CA 11 M	Compact	90	121	12	25
CT16330(1) CA 3 M	Compact	83	114	10	26
CT16334(1) CA 2 M	Compact	80	123	15	27
CT16323 CA 13 M	Compact	87	84	7	28
CT16334(1)-CA 8 M	Compact	80	130	11	30
CT16319 CA 4 M	Open	100	132	14	30
CT16333(1) CA 3 M	Open	83	113	15	26
CT16330(1) CA 12 M	Compact	88	112	11	26
CT16350-CA 35 M	Compact	78	119	12	25
CT16345-CA 3 M	Compact	85	119	18	32
CT16334(2) CA 2 M	Compact	80	111	9	25
CT16338 CA 10 M	Compact	83	113	13	24
CT16330(1) CA 15 M	Compact	80	115	12	26
CT16323-CA 23 M	Compact	87	136	12	27
CT16338-CA 2 M	Compact	80	115	16	
CT16346 CA 3 M	Compact	87	107	11	24
CT16346-CA 10 M	Compact	83	105	12	25
CT16325-CA ? M	Compact	101	101	11	23
CT16355-CA 2 M	Compact	87	110	14	24
CT16334(2)-CA 11 M	Compact	80	119	10	26
CT16310(2) CA 5 M	Compact	89	118	23	24
CT16327 CA 9 M	Compact	87	118	10	27
CT16354 CA 5 M	Compact	80	127	17	23
CT16350 CA 5 M	Compact	78	109	15	25
CT16333(1) CA 22 M	Open	85	120	8	26
CT16355 CA 19 M	Compact	85	119	15	24
CT16350 CA 12 M	Compact	78	115	10	27
CT16315(1) CA 16 M	Compact	82	136	16	25
CT16334(1) CA 9 M	Compact	78	115	18	26
CT16319 CA 11 M	Open	78	142	12	28
CT16311(1) CA 6 M	Compact	90	127	17	28
CT16346 CA 5 M	Compact	93	99	16	23
CT16327-CA 22 M	Compact	92	112	17	25
CT16315(1)-CA 5 M	Compact	88	134	27	26
CT16346-CA 12 M	Compact	80	111	11	26
CT16327 CA 20 M	Compact	87	124	11	28
CT16345 CA 13 M	Compact	85	119	13	30
CT16341 CA 8 M	Compact	83	103	16	26
CT16321 CA 1 M	Open	80	139	15	25
CT16338 CA 19 M	Compact	80	108	13	23
CT16338 CA 11 M	Compact	80	115	14	23
CT16337 CA 10 M	Compact	80	112	15	25
CT16315(1)-CA 1 M	Compact	85	130	15	27
CT16313-CA-4 M	Compact	85	123	11	25
CT16353 CA 11 M	Compact	87	119	11	28
CT16330(1)-CA 6 M	Compact	87	111	12	27
CT16308-CA 2 M	Compact	80	117	14	26
CT16340-CA 9 M	Compact	85	121	10	27
CT16337 CA 12 M	Compact	78	107	15	25
CT16333(2)-CA 18 M	Compact	78	108	16	26
CT16315(1) CA 19 M	Compact	101	139	13	26
CT16342 CA 18 M	Compact	90	127	20	28
CT16329 CA 5 M	Compact	87	124	10	28
CT16319 CA 13 M	Open	94	135	21	32
CT16345-CA 14 M	Compact	90	123	16	31
CT16344-CA 12 M	Compact	80	123	11	27
CT16338 CA 16-M	Compact	83	105	8	24
CT16338 CA 28 M	Compact	80	109	9	26
CT16338 CA 29 M	Compact	80	103	9	23
CT16307 CA 2 M	Open	90	129	16	27
CT16307-CA 19 M	Compact	80	137	15	29
CT16342 CA 17 M	Compact	83	126	16	27
CT16338 CA 3 M	Compact	80	122	8	25
CT16337 CA 3 M	Compact	90	104	9	23
CT16315(1) CA 22 M	Compact	100	134	13	27
CT16307(1) CA-4 M	Compact	80	134	14	28
CT16353-CA 17 M	Compact	83	111	14	26
CT16328 CA 7 M	Compact	87	113	15	26
CT16353 CA 5 M	Compact	90	119	14	26
CT16356(2) CA 3 M	Open	80	132	13	29
CT16323-CA 30-M	Compact	78	94	12	23
CT16338 CA 6 M	Compact	80	116	14	23
CT16307 CA 7 M	Compact	87	126	14	29
CT16334(2)-CA 12 M	Compact	83	121	9	27
CT16334(2) CA 1 M	Compact	80	124	10	27
CT16316 CA 2 M	Compact	92	140	15	30
CT16316 CA 6 M	Compact	80	127	15	27
CT16342 CA 25 M	Compact	80	126	12	25
CT16328 CA 8 M	Compact	90	131	13	28
CT16337 CA 6 M	Compact	97	116	10	26
CT16337 CA 9 M	Compact	87	115	12	27
CT16334(1)-CA-4 M	Compact	78	123	17	30

Table 2 Original genetic constitution of the aerobic composite population PCT-4

Parent	Origin	Frequency (%)
CT6196 33-11-1 3-M	CIAT Upland Line	8 33
CT11231 2-2 1 4 M	CIAT Upland Line	4 17
CT11231 2-2 3-1-M	CIAT Upland Line	4 17
CT11231 2 2-2 1-2 M	CIAT Upland Line	8 33
CT11608 8 6-M 2 M	CIAT Upland Line	8 33
IR53167-3 M	IRRI Upland Line	8 33
A 8 394-M	Brazilian Line	8 33
CNA-IRAT A	Japonica Population	50 0

Genetic constitution of the aerobic population CNA-IRAT A developed in Brazil by CIRAD and EMBRAPA		
IRAT 104	*IRAT 13/Moroberekan*	*6 25*
53/2	*IRAT 2/IAC 25*	*12 50*
IRAT 257	*Makuta mutant*	*6 25*
Batatais	*Brazil*	*6 25*
Batatais 1	*Brazil*	*6 25*
IRAT 199	*Cuttack 4/IRAT 104*	*6 25*
Ligero	*Brazil*	*6 25*
CNA-IRAT 5	*Japonica Gene Pool*	*50 0*

- **Assemble and document information on selected entries of CIAT, Cirad, IRD and EMBRAPA rice working collections**

Marc Chatel Yolima Ospina and Francisco Rodriguez - Cirad/CIAT
Mathias Lorieux – IRD/CIAT
Cesar Martinez Jaime Borrero - CIAT
Pericles de Carvalho Neves Orlando Peixoto de Morais - EMBRAPA
Funding Cirad IRD CIAT and the Generation Challenge Program

Abstract
This proposed activity was submitted and accepted for one year funding to the Generation Challenge Program (GCP) and falls into the Sub-Project 1 (SP1) "Global Genetic Diversity", Cluster 1 (C1) "Composite genotype sets"
Data on drought tolerance at field condition at La Libertad Experimental Station (LES) in Villavicencio, Colombia of the composite genetic set made of accessions from CIAT, Cirad/CIAT , IRD and EMBRAPA curate and documented will be made available for genetic diversity analysis and to the public domain
A subset of the composite collection may be included in the diversity assessment to be done by using markers in SP1 C2 with IRRI/EMBRAPA

Key words Drought evaluation, genetic diversity, composite genotype set,

Background
CIAT holds a rice working collection of varieties grown in Latin America and the Caribbean (LAC), as well as landraces grown in several regions Elite breeding lines developed over time by the CIAT rice project and some national rice programs are also held in this core collection More recently, wide crosses between *Oryza sativa* and some wild species, mainly *O glaberrima O rufipogon* and *O barthii* have resulted in advanced interspecific lines

The EMBRAPA Rice and Beans Center holds a large collection of aerobic traditional rice varieties and elite breeding lines The main objective is to assemble the molecular and agronomic data on an elite set of about 300 accessions from the different research institutions part of this activity

Materials and Methods
The field trial at LES was composed of 274 accessions assembled from different research institutions and 12 checks representing 3 different groups wild species, aerobic japonica and irrigated indica (Table 1)
The trial was conducted at LES in Villavicencio, Colombia during the dry season 2003/2004 (November 03 - February 04) and 3 sowing dates, and during the 2004 wet cropping season (May – September)
For each one of the sowing dates, the statistical design was of Federer's augmented blocks The accessions were distributed into 5 blocks each one of them randomized with 61 materials and 6 checks Each individual plot was of 2 rows of 5 meters long and spaced by 0,26 cm between rows

The fertilization was of 70 kg/ha of P, 70 kg/ha of K in two applications and 80 Kg/ha of N in 3 applications The trial was protected against weeds, pests and diseases The data collected are presented in the table 2

Results and discussion

The task assignments were as follow

- Marc Châtel from Cirad/CIAT and Cesar Martinez from CIAT to select and assemble accessions from the CIAT and Cirad/CIAT rice projects
- Orlando Peixoto de Morais and Pericles de Carvalho Neves to select and assemble accessions from Brazil
- Yolima Ospina and Francisco Rodriguez to conduct the field experiments for drought tolerance evaluation at LES
- Yolima Ospina and the statistics unit of CIAT to analyze the collected data
- Mathias Lorieux to conduct molecular characterization at CIAT Palmira of the inter-specific lines
- One technician appointed at CIAT Palmira to assist / conduct molecular characterization is currently trained

Data collected during the 2003 off-season 3 sowing dates (November) and the 2004-cropping season (May-September) were collected and the statistical analysis is in progress

Visual observations show that some material presented growing recovery after drought stress followed by a first rainfall in 40 days (see photos below)

Futures activities are to finish the statistical analysis and data interpretation This would lead to the identification of drought tolerant accessions followed by molecular genetic characterization by markers

Table 1 Rice accessions Institutions, number and type

Institution	Number	Type
CIAT	97	*O glaberrima /O sativa* japonica aerobic
	7	*O glaberrima*
Cirad/CIAT	55	*O sativa* japonica aerobic
EMBRAPA	95	Traditional *O sativa* japonica aerobic
	20	Elite lines *O sativa* japonica aerobic

Check	Type
O rufipogon	Wild specie
O barthii	Wild specie
O glaberrima	Wild specie
Caiapo	*O sativa* japonica aerobic
O sabana 6	*O sativa* japonica aerobic
O sabana 10	*O sativa* japonica aerobic
CIRAD 409	*O sativa* japonica aerobic
Azucena	*O sativa* japonica aerobic
Oryzica 1	*O sativa* indica
CICA 8	*O sativa* indica
Fedearroz 50	*O sativa* indica
IR 64	*O sativa* indica

Table 2 Data collected at each sowing date during the dry season

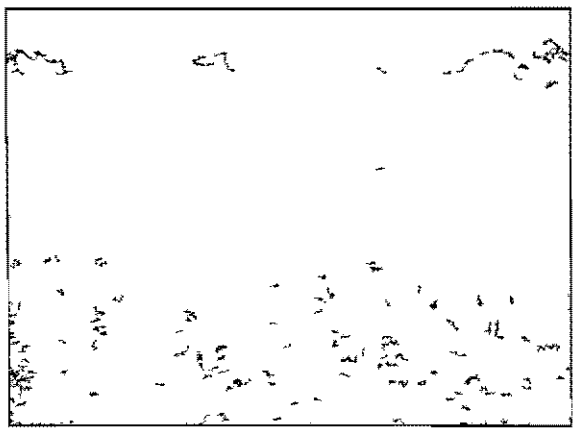
Data collected		
On plants	**On soil**	**On climate**
Percentage of germination at 5 and 10 days after sowing (das)	Soil humidity monitoring at 4 depth (0-10 10-20 20 30 30-40 cm) every 8 days up to 85 das	Rainfall
Plant vigor at 25 and 40 das		Wind speed
Percentage of onion type leaves		Solar radiation
Tiller number at 40 das		
Root type		
Flowering date (if reached)		
Plant height		

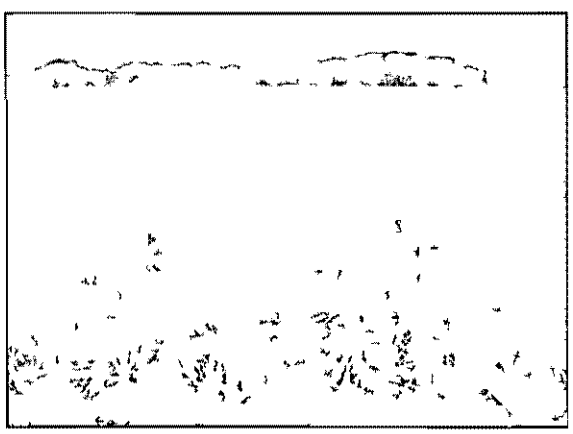
Genetic Resources Evaluation for Drought Tolerance

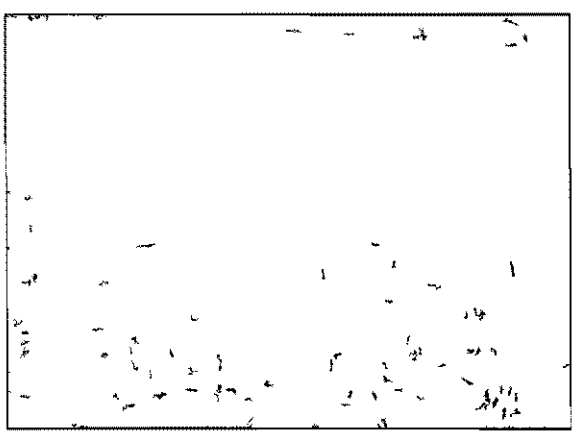
Growth recovery of some accessions
First drought spell during 26 days followed by 45 mm rainfall

□ Second drought spell during 35 days followed
by 23 mm rainfall

Dry season 2003 Third sowing date







OUTPUT 3 Education and Rice Cultivation as a Vehicle to Alleviate Poverty

1 Measurable indicator New varieties and germplasm

- **BRSMG CURINGA in Brazil**

"VARIEDADE DE ARROZ PARA PLANTIO EM CONDIÇÕES DE TERRAS ALTAS E VARZEAS"

Orlando Peixoto de Morais – Embrapa Arroz e Feijão
Marc Châtel- Cirad/CIAT

- ✓ Launching In 2004 in the Minas Gerais State, by EPAMIG, the Universidad Federal de Lavras and Embrapa Arroz e Feijão
- ✓ Origin Cirad/CIAT Line (CT13226-11-1-M-BR1) from conventional crossbreeding at CIAT up to the F_4 generation and terminated in Brazil by Embrapa Arroz e Feijão The line involves 10 parents from different origins and adaptation to both aerobic and anaerobic rice ecosystems
- ✓ Intellectual property CIAT, Cirad and EMBRAPA
- ✓ Adaptation Aerobic Rice Ecosystems (Cerrados and Varzeas)
  - "Cerrados ecosystem" Average grain yield (3,687 Kg ha^{-1}), higher than Caiapo and Canastra (8,63% and 12,82% respectively)
  - "Varzeas ecosystem" Average grain yield (4,465 Kg ha^{-1}), higher than Charisma, Canastra and Caiapo (9 65, 11 76 and 19 71% respectively)

- **Llanura 11 in Colombia**

Hernando Delgado - CORPOICA Regional 8
Marc Châtel Yolima Ospina Francisco Rodriguez - Cirad/CIAT
Jaime Gomez Fernando Correa Lee Calvert - CIAT

- ✓ Official registration and release by ICA-Colombia First semester 2004
- ✓ Origin Cirad/CIAT Line (CT 11891-2-2-7-M or Cirad/CIAT 409) from conventional crossbreeding at CIAT and evaluation in collaboration with CORPOICA Regional 8, Villavicencio-Meta The line is made of aerobic parents from Cirad and CIAT
- ✓ Intellectual property CIAT, Cirad and CORPOICA
- ✓ Adaptation Aerobic Rice Ecosystems (Savannas of the Colombian Oriental plain "Altillanura" and the Piedmont ecosystems) FEDEARROZ is very interested by the line because of its adaptation to the mechanized favorable upland conditions of the Colombian Piedmont
  - "Altillanura" ecosystem Average grain yield 3, 800 Kg ha^{-1}
  - Piedmont ecosystem Average grain yield 5,700 Kg ha^{-1}, in commercial fields The line is praised because of earliness (100 days seed to seed) and resistance to diseases Producers call the line "arroz ecologico" because they use fewer pesticides
- ✓ Discussions took place between Cirad/CIAT, CORPOICA and FEDEARROZ to reach an agreement for seed production by FEDEARROZ and corresponding royalties

- **SR 99343 in BOLIVIA**

"FIRST UPLAND VARIETY COMING FROM THE POPULATION PCT-4"

Roger Taboada Rene Guzman Juana Viruez V Hugo Callau - CIAT Santa Cruz-Bolivia
Marc Châtel Yolima Ospina Francisco Rodriguez - Cirad/CIAT

- ✓ Official release by the Rice Producers Association (ASPAR) in February 2005
- ✓ Origin Line PCT-4\0\0\1>S2-1584-4-M-5-M-6-M-M selected from the aerobic japonica composite population PCT-4
- ✓ Intellectual property Cirad/CIAT and CIAT Santa Cruz -BOLIVIA
- ✓ Adaptation Small-farmer's and mechanized aerobic rice ecosystems
- ✓ Average grain yield
  - Manual ecosystem 4,706 Kg ha ^{1}
  - Mechanized ecosystem 4,662 Kg ha ^{1}
- ✓ The main characteristics the farmers' praise are
  - Small farmers Earliness of the variety associated with good yield potential, allowing early harvest and easing crop rotation
  - Mechanize system Earliness, good and rather short plant type and long slender grain, which are the preferred rice, format both by the rice industry and consumers
- ✓ Discussions took place between Cirad/CIAT , CIAT Santa-Cruz and ASPAR to reach an agreement for the launching of the variety and seed production by ASPAR and corresponding royalties

- **Adaptation of aerobic germplasm in Central America**

Gilles Trouche Zildghean Chow – Cirad/CIAT Nicaragua
Marc Châtel Yolima Ospina Francisco Rodriguez - Cirad/CIAT Colombia

- ✓ Excellent adaptation of aerobic advanced and segregating lines in Nicaragua and Costa Rica
- ✓ Origin of the germplasm Cirad/CIAT (conventional and population breeding in Colombia)
- ✓ Intellectual property Cirad/CIAT
- ✓ Adaptation Lines are evaluated and selected with and by framers (participatory variety selection-PVS-) The selected lines show earliness, good yielding potential and resistance to diseases
- ✓ This germplasm is highly praised because it offers the possibility to diversify the actual cropping systems and also because of the reduction in costs production
- ✓ The results are very relevant for the aerobic Cirad/CIAT rice project and represent a valorization of the work done in Colombia

- **COMPOSITE POPULATION PACQ-1 for CHILE and FRANCE**

"BROADENING THE GENETIC BASE OF IRRIGATED RICE IN LATIN AMERICA NEW SITE-SPECIFIC COMPOSITE POPULATION WITH COLD TOLERANCE AND AROMA"

Marc Châtel Yolima Ospina - Cirad/CIAT
Guy Clement- Cirad
Santiago Hernaiz L Jose Alvarado A - INIA Chile

Abstract
Conventional crossbreeding has permitted the selection of the commercial varieties actually planted in Chile and France with greater yield potential and better grain quality
In countries where rice production and consumption are relatively low, one have to take in consideration the necessity of offering to the producers an added value to their crops In these countries there are market niches for special types of foods and aromatic rice is one of them Aromatic rice is highly praised in France and Cirad jointly with the French Rice Center (CFR) has selected and launched new aromatic varieties that satisfied the rice industry and consumers In Chile the rice producers and millers are interested in diversifying the offer of rice and the wealth urban consumers in Santiago are starting looking after new rice types
The aroma in rice is a complex characteristic and involves many genes This results in not only one but in a diversity of flavors In that scope, population breeding using recurrent selection seems to be an appropriate breeding method because of the possibility to accumulate favorable genes that lead to the expression of the aromatic characteristic(s)

Key words Aromatic rice, composite population, and temperate climate

Introduction
From an economic point of view, aromatic rice has a special place in the international market In Europe, imports of aromatic rice are increasing because consumers are more exigent on rice sensory quality
Like France, Chile is a small rice producing country but rice consumption is higher A way for the rice producers to add value to their crop is to diversify the offer of new rice types
The aroma in rice is a complex characteristic and involves many genes It is also dependant of agronomical factors This results in not only one but in a diversity of flavors A study conducted in Italy (Stefano Bocchi, 2001) show that from the volatile components of the aroma, Pyroline was detected to be the responsible for the so called "popcorn –like" aroma, but many other components can contribute to the global flavor bouquet of aromatic races
Research partnership between the Cirad/CIAT rice project and INIA Chile started in 1996 From that year-on, tight collaboration was maintained in rice population breeding for temperate conditions Two populations for recurrent selection were set-up and enhanced by recurrent selection Segregating and fixed lines were evaluated and selected and next year a new variety coming from this collaborative work would be released to farmers
Through the collaborative project, Chilean rice genetic resources were introduced in France for the rice growing area of the "Camargue" region
During a visit to Chile in 2001 discussions took place between the Cirad France and INIA Chile projects The result was an agreement on collaborative work for the development of an "aromatic" population and its further enhancement both in Chile and France

Materials and Methods
Aromatic and non-aromatic parental lines adapted to temperate conditions were selected from the Cirad Camargue project in France to set-up the population
The male-sterile background is the Chilean population PQUI-1, fruit of the collaboration between the Cirad/CIAT and INIA Chile projects This is a guarantee that the new population and its enhancement by recurrent selection would result in promising lines showing cold tolerance, high yield potential and aroma

Results and discussion

Steps of the setting-up of the population

- **Choosing parental** Cirad France and INIA Chile 2001

A set of 26 parents was selected by Guy Clement from its breeding project in France for crossing with male-sterile plants of the Chilean population PQUI-1 adapted to temperate climate and enhanced in Chile The list and characteristics of the parents and the genetic constitution of the population PQUI-1 are presented in the table 1 and 2 respectively

- **Crosses** CIAT Palmira Experimental Station (PES) 2001

- Introduction to CIAT of the parental lines and the Chilean population
- Individual crosses between each parental line and male-sterile plants of PQUI-1
- Harvesting of the F1 hybrid seed of each of the 26 crosses

- **Basic population** CIAT-PEL 2001/2002

- Sowing of each one of the 26 F1 and individual harvesting of the F2 generation
- Part of the individual F2 generation seed was shipped to CIRAD France for field evaluation and the other part was physically mix in equal proportion for each one of the 26 F2 to obtain the basic population identified as PACQ-1\0\0\0 (P means Population, A means Aromatic, C refers to Cirad and Q to the Chilean experimental station of Quilamapu

- **Recombination of the basic population** CIAT-PEL 2002/2003

- Sowing of the population PACQ-1\0\0\0 presenting segregation for fertile and male-sterile plants
- Harvesting, on each one of the male-sterile plant the grains resulting from cross-pollination with fertile plants The physical mixture of the seeds of each one of the harvested male-sterile plants represents the first cycle of recombination identified as PACQ-1\0\0\1 The recombined population was shipped to INIA Chile
- A second recombination (PACQ-1\0\0\2) of the basic population was made at CIAT PEL and the seeds were shipped to Cirad France

- **Population enhancement by recurrent selection** Cirad France and INIA

Chile (started during the cropping season 2002/2003 in Chile and 2003 in France

- The enhancement of the population started in Chile and France after the first and the second recombination cycle of the basic population respectively
- The main characteristics to be selected are the overall agronomic adaptation to the specific climatic conditions, yield potential and grain type For the aroma(s), a mass-screening methodology was developed by the grain quality laboratory of Cirad Montpellier and will be used to detect the presence or absence of aroma
- The first cycle of recurrent selection took place in 2003 and the progenies of the S_0 selected plants, both by Cirad France and INIA Chile, will be screened at Cirad Montpellier

Line development

Selection of S_0 fertile plants into a population is also the starting point for the development of segregating lines

Temperate climate ecosystem

This activity is in progress in Chile and in France In 2004, Dr Guy Clement identified a very promising progeny (personal communication)

Tropical ecosystem

From the basic and recombined population, S_0 fertile plants were selected at CIAT PES 30 progenies are under evaluation They show good adaptation to the tropics earliness (50% flowering at 70 days), good plant type and grain shape (long-slender)
The future activities will be the monitoring, with cooperators in Chile and France, of the progress in the enhancement of the population and the follow-up of the evaluation and selection of the segregating progenies under tropical conditions at CIAT PES and Santa Rosa Experimental station

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Table 1 Parents used for the setting-up of the population PACQ-1 (from G Clement Cirad)

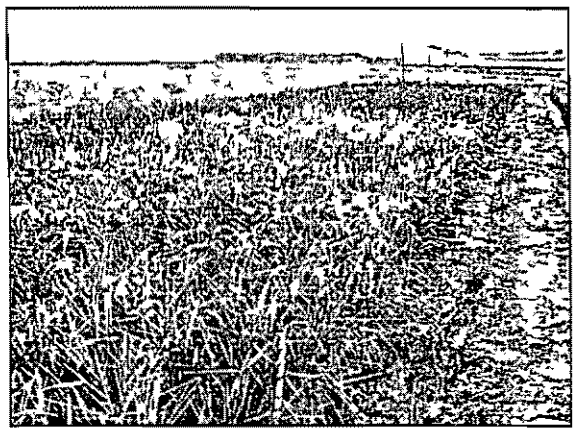
CIAT Cross	Female Parent	Male Parent			
		Variety	**Origin**	*** Aroma (+/-)**	**Grain shape**
CT17452	PQUI-1 Ch\0\0\3	A-301	USA	+++	Long slender
CT17453	PQUI 1 Ch\0\0\3	Basmati C621	Pakistan	+++	Long slender
CT17454	PQUI 1-Ch\0\0\3	Fidji	France	+++	Long slender
CT17455	PQUI-1 Ch\0\0\3	L 24	France	-	Long slender
CT17456	PQUI-1 Ch\0\0\3	HT A 301	France	+++	Long slender
CIAT Cross	**Female Parent**	**Crossbreeding Progeny**	**Origin**	*** Aroma (+/-)**	**Grain shape**
CT17457	PQUI-1 Ch\0\0\3	HT A 301 / Miara-B	France	++	Long slender
CT17458	PQUI-1 Ch\0\0\3	Goolarach / Miara-B	France	+++	Long large
CT17459	PQUI-1-Ch\0\0\3	34/88xA-301-F1	France	+	Long slender
CT17460	PQUI 1-Ch\0\0\3	Mejanes 4 / A-301 D	France	+	Long slender
CT17461	PQUI 1-Ch\0\0\3	Mejanes 4 / Azucena-B	France	-	Long large
CT17462	PQUI-1 Ch\0\0\3	IRAN 79005 / Miara-N2	France		Long slender
CT17463	PQUI-1 Ch\0\0\3	A 301 / Basmati C621 I	France	+	Long slender
CT17464	PQUI-1 Ch\0\0\3	Miara / Basmati C621-T	France	-	Long slender
CT17465	PQUI 1-Ch\0\0\3	L 203 / Basmati C621 G	France	++	Long slender
CT17466	PQUI 1-Ch\0\0\3	L 203 / Basmati C621 J4 7	France	+	Long slender
CT17467	PQUI 1 Ch\0\0\3	L 203 x Basmati C621 J4- 4	France	++	Long slender
CT17468	PQUI-1 Ch\0\0\3	L 203 / Basmati C621-R2 1	France	+++	Extra long slender
CT17469	PQUI-1 Ch\0\0\3	L 203 / Basmati C621 R2-2	France	++	Long slender
CT17470	PQUI-1-Ch\0\0\3	Basmati C621 / Carinam B1-4	France	++	Extra long slender
CT17471	PQUI 1-Ch\0\0\3	Basmati C621x Carinam B1-5	France	++	Extra long slender
CT17472	PQUI-1-Ch\0\0\3	Basmati C621x Carinam H4	France	+++	Extra long slender
CT17473	PQUI-1 Ch\0\0\3	Basmati C621x Carinam-AD-4	France	-	Long slender
CT17474	PQUI-1 Ch\0\0\3	Basmati C621x Carinam AD 5	France	-	Long slender
CT17475	PQUI 1 Ch\0\0\3	285 x Pasa Basmati	Brazil	+++	Long slender
CT17476	PQUI 1-Ch\0\0\3	A-301 x Miara B	France	+++	Long slender

*The aromatic characteristics come from
A 301 (derived from Delle and Azucena)
Basmati C621 (a Basmati well adapted to temperate condition)
Crossbreeding progenies selection (Cirad France)

Table 2 Original genetic constitution of the population PQUI-1, source of male-sterility and genetic background adapted to rice temperate climate ecosystem
(from J Taillebois – Cirad)

Parent	Origin/Cross	Frequency (%)
Diamante	Chilean variety	10 30
Buli	Chilean variety	13 30
Quila 67108	Chilean line	16 22
CINIA 609	INIA Chile CIAT line	5 09
CINIA 606	INIA Chile CIAT line	5 09
GPIRAT-10	Temperate japonica Gene Pool	50 0

Genetic constitution of the temperate japonica gene pool GPIRAT-10 developed by CIRAD in Brazil and French Guyana		
Anseatico	*Italy*	*1 19*
Bonnetbell	*USA*	*2 60*
Europa	*Italy*	*1 19*
Koral	*Italy*	*1 19*
Mutique Vercelli	*Italy*	*2 60*
Rocca	*Italy*	*1 19*
Sesia	*Italy*	*1 19*
Strella	*Italy*	*1 19*
Miara	*Italy*	*14 41*
6FMT	*Lebonnet//CI9881/IR659 10 8-3*	*1 41*
IRAT 112	*Cote d Ivoire (CIRAD Aerobic line)*	*1 41*
L 202	*R456 3-2-1 sel/72 3 2-2-7-8//L 201*	*1 41*
Lebonnet	*USA*	*1 41*
Mercury	*Short Mars/Nato*	*1 41*
Alan	*Labelle/L 201*	*1 92*
Labelle	*Belle Patna/Dawn*	*1 92*
Mejanes 4	*France*	*1 92*
Rexmont	*USA Newrex/Bellemont*	*1 92*
Skybonnet	*USABluebelle//Belle Patna/Dawn*	*1 92*
Ariete	*France*	*2 60*
Delta	*taly*	*1 19*
Italpatna	*Italy*	*1 19*
Lido	*Italy*	*2 60*
Rica	*Nortai//CI9545/Nova*	*2 60*
Senatore Novelli	*Italy*	*1 19*



Segregating lines selected from the population PACQ-1 in the tropics

They present earliness, good panicle and grain type

CIAT Palmira Experimental Station 2004

2 Measurable indicator Workshops

BRAZIL
"CONFERÊNCIA E TALLER MELHORAMIENTO GENETICO DO ARROZ NA AMERICA LATINA E CARIBE"

Marc Châtel – Cirad/CIAT
Lee Calvert – CIAT
Elcio P Guimarães- FAO

- In the framework of the International Year of Rice, the Conference/Workshop was held in Goiânia-Brazil on March 14-20, 2004 Embrapa Arroz e Feijão, CIAT, Cirad and FAO where in charge of the organization

Participants
The list of participant countries and Institutions is presented in the table 1
Funding
The venue of the event was financed mainly by EMBRAPA through the fund for cooperation with CIAT Some support was given by FAO to the Embrapa Arroz e Feijão Center
Funding was used to invite the great majority of the out of Brazil participants
Conference (3 days)
Objectives
The first main objective was the reviewing of the actual status and perspectives of the rice breeding projects in LAC There were 34 oral presentations and 5 by CIAT , Cirad/CIAT and FLAR
An other important objective was to debate the interest of the creation of a regional rice-breeding network The idea was discussed and agreed by the participants Further discussions took place during the RedBio meeting in the Dominican Republic in June 2004 The new network call « Red de Mejoramiento Genetico de Arroz en America" (Red-MeGAA) will focus on breeding and sharing rice genetic resources and training activities The public and private rice sectors of LAC are welcome to be part of the new network, which is not exclusive
Workshop (2 days)
The objectives of the workshop were to create the conditions for a forum of discussion, to act as a group and to select material at field condition
The breeders attending the conference were invited to evaluate and select materiel in the observation nurseries, preliminary and advanced trials of Embrapa Arroz e Feijão in two different locations, one for aerobic and the other for anaerobic rice The material selected by the participants will be shipped to CIAT for further dispatch to the different countries' participants
Proceedings
A CD Rom Of the proceedings of the Conference/Workshop were published by Embrapa Arroz e Feijão, CIAT, Cirad and FAO
"Memorias da Conferência Taller Melhoramiento genetico do arroz na America Latina e Caribe" Documentos On-line 160 ISSN 1678-9644 April 2004

Public recognition

At the end of the Conference/Workshop the participants made a written special public recognition to Embrapa Arroz e Feijão an other one to the 3 International Centers, CIAT, Cirad and FAO, not only in recognition to the efforts in organizing the event but also for the sustained work in direction of the rice sector of the region, stressing germplasm sharing, human resources training and publication and documentation

Signed by Argentina, Nicaragua, Cuba, Venezuela, Peru, Costa Rica, Bolivia, Ecuador, Brazil, Colombia and Dominican Republic

Table 1 Participants Countries and Institution

Country	Institution
South America	
Argentina	University of Corrientes and INTA
Bolivia	CIAT Santa Cruz CONARROZ (Private sector)
Brazil	Embrapa Arroz e Feijão Embrapa Meio Norte Embrapa Agropecuaria Oeste IAC São Paulo State USP University of São Paulo EPAGRI Santa Catarina State IRGA Rio Grande do Sul State)
Colombia	FEDEARROZ (Public Private sector)
Ecuador	PRONACA (Private sector)
Peru	INIA
VENEZUELA	DANAC Fondation and INIA
Central America	
Nicaragua	INTA
Costa Rica	INTA
The Caribbean	
Cuba	IIA
Dominican Republic	IDIAF
International Institutions	
CIRAD CIAT and FAO	

3 Measurable indicator **<u>Organization of Conferences to be held in 2006</u>**

CHILE
« IV CONFERENCE OF THE GRUMEGA GROUP ON RICECOMPOSITE POPULATION BREEDING »

Santiago Hernaiz and Roberto Alvarado- INIA
Marc Châtel and Yolima Ospina – Cirad/CIAT
Elcio P Guimarães- FAO

The fourth GRUMEGA Conference is to take place in early 2006 in Chile
INIA Quilamapu-Chile is the main responsible of the organization along with CIAT, Cirad and FAO The objective is to present and compile the progress in rice population breeding and main outputs since the last GRUMEGA Conference held in 2003 in Venezuela

COLOMBIA
" IX CONGRESO DE LA ASOCIACIÓN COLOMBIANA DE FITOMEJORAMIENTO Y PRODUCCIÓN DE CULTIVOS"

Jaime Borrero-CIAT
Marc Châtel-Cirad/CIAT

The IX Congress of the Colombian Association of Crop Breeding and Production is to be held on May 11-13, 2005 Jaime Borrero and myself are active members of the organizing committee that coordinates the activities for the venue of the biennale congress
The congress counts with the back support of CORPOICA, CENICAÑA, CIAT and Cirad
The focuses of the Congress are on

1 Globalization TLC, ALCA and implications in plant breeding
2 Breeding of Perennial Crops
3 Added-value chain Biofortification and other strategies
4 Genetic resources

Year 2005
Individual Work Plan
Highlights (January-July)

CIAT Individual Work Plan

1 **CIAT Project Rice IP-4** **Title Improved Rice Germplasm for Latin America and the Caribbean**
Collaborative Project CIAT/CIRAD

2 **Year 2005** **Your Name Marc CHATEL** **Project Manager Lee CALVERT**

1 CIAT Development Challenge Agrobiodiversity Per cent of my time to be assigned to this Output 70%		**Important Assumptions at the Activity Level for this Output**	
ENHANCING RICE GENE POOLS		1 Continued support from CIAT and CIRAD 2 Adequate funding and timely release of budget 3 NARS willing, capable to use improved populations, segregating material and to release cultivars	
To be completed for planning at year-beginning			**To be completed at year-end**
Activities	**Measurable Indicators**	**Milestones for this year**	**Achievements**
1 1 UPLAND RICE BREEDING			
1 1 1 Enhancement of composite populations by recurrent selection			
• Composite Populations Breeding	• Enhanced populations	• Starting a new cycle of recurrent selection • Selection of S_0 fertile plants	
1 1 2 Development of segregating lines by conventional breeding			
• Development of segregating lines	• Number of segregating lines	• Line evaluation and selection	
1 1 3 Advanced fixed lines			
• Nursery observation	• Number of promising lines	• Line evaluation and selection	
• Advanced lines trials	• Number of lines	• Yield trials	
• Demonstration plot	• Number of best promising lines	• Agronomic trials	
1 1 4 Development of a new population for the upland rice ecosystem (with Mathias Lorieux and Cesar Martinez)			
• Germplasm development New composite population by introgression of CIAT inter specific lines *(O sativa japonica / O glaberrima)*	• F1 generation	• Evaluation of the F1 generation	

1 2 LOWLAND RICE BREFDING (with LAC cooperators)			
1 2 1 Site-specific composite populations			
• Population for tropical sub-tropical and temperate climate ecosystems	• Enhanced populations	• Evaluation of segregating and advanced lines from former enhancement cycles	

2 CIAT Development challenge Enhancing Rural Innovation Per cent of my time to be assigned to this Output **30%**	**Important Assumptions at the Activity Level for this Output**
INTENSIFICATION OF RICE SYSTEMS	1 Continued support from CIAT CIRAD and LAC NARS 2 Adequate funding and timely release of budget

2 1 LAC BREEDERS' INTEGRATION PARTICIPATORY RESEARCH and COMMUNICATION with COOPERATORS			
2 1 1 Information sharing			
• Cooperative work with NARS	• Information shared • Breeding progress monitored	Strait collaboration with • South America Argentina Bolivia Brazil Chile Colombia Venezuela • The Caribbean Cuba • Central America (Collaboration with Gilles Trouche)	
2 1 2 Networking			
• Germplasm sharing (CIAT-ION Nurseries)	• Number of receptors	• Seed increase of the lines • Line shipped to receptors	
• GRUMEGA Group	• Networking	• Visits and field work • Conference planning (Chile February 2006)	
• Regional Technical Cooperation Project	• Full project submitted to FAO	• Writing the full project	
2 2 INNOVATION for the BENEFIT of the RICE SECTOR			
• Monitoring promising lines	• Number of promising lines	• Follow up with LAC NARS	
• New cultivar release	• Varieties into released process	• One cultivar (Bolivia)	
• Intellectual property and specific agreements with NARS	• Agreements with LAC NARS	• Follow up with LAC NARS	

HIGHLIGHTS 2005 (January - July)

I PUBLICATIONS

1 Referred Journal

- Delgado, H , Châtel, M , Ospina, Y Llanura 11, nueva variedad de arroz para el ecosistema de sabana de la Altillanura colombiana Fitotecnia colombiana Organo de la associacion colombiana de fitomejoramiento y produccion de cultivos Vol 4 No 2 Julio-Diciembre 2004 ISSN 0123-1286 p 8-11

2 Book Chapters

The book chapters are on-line at http //www fao org/docrep/008/y5843e/y5843e00 htm

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- **Guimarães E P , Châtel M** 2005 Exploiting rice genetic resources through population improvement In Guimarães E P , (ed) *Population improvement A Way of exploiting the rice genetic ressources of Latin America* Rome, Italy FAO, 3-17
- **Hernaiz S , Alvarado J R , Châtel M , Castillo D , Ospina Y** 2005 Improving irrigated rice populations of the temperate climate in Chile In Guimarães E P , (ed) *Population improvement A Way of exploiting the rice genetic ressources of Latin America* Rome, Italy FAO, 129-143
- **Marassi M A , Marassi J E , Châtel M , Ospina Y** 2005 Exploiting the genetic resources of rice in Argentina through population improvement In Guimarães E P , (ed) *Population improvement A Way of exploiting the rice genetic ressources of Latin America* Rome, Italy FAO, 113-127
- **Ospina Y , Guimaraes E P , Châtel M , Duque M C** 2005 Effects of selection and of recombinations on an upland-rice population In Guimarães E P , (ed) *Population improvement A Way of exploiting the rice genetic ressources of Latin America* Rome, Italy FAO, 331-350
- **Perez Polanco R , Châtel M , Guimarães E P** 2005 Acquiring a basic understanding of rice population improvement for use in Cuba In Guimarães E P , (ed) *Population improvement A Way of exploiting the rice genetic ressources of Latin America* Rome, Italy FAO, 205-220

3 Oral presentation

- Taboada, R , Châtel, M Bolivia lanza la primera variedad de arroz de secano originada del mejoramiento poblacional III Congreso Internacional del Arroz y III Congreso Nacional del Arroz de La Habana-Cuba, June 6-10, 2005

4 Proceedings

- Taboada, R , Guzman, R , Viruez, J , Callau, V-H (Bolivia) Châtel, M , Ospina, Y , Rodriguez, F , Lozano, V-H (Colombia) Bolivia lanza la primera variedad de arroz de

secano originada del mejoramiento poblacional Simposio 1 Mejoramiento Genetico Proceedings of the III Congreso Internacional del Arroz y III Congreso Nacional del Arroz de La Habana-Cuba, June 6-10, 2005 p1

II ORGANIZATION OF EVENT

- " IX Congreso de la Asociacion Colombiana de Fitomejoramiento y Produccion de Cultivos" Congress of the "Asociacion Colombiana de Fitomejoramiento y Produccion de Cultivos" Palmira, May 11- 13, 2005
- IV Conferencia Internacional de Mejoramiento Poblacional en Arroz Grupo de Mejoramiento Genetico Avanzado en Arroz GRUMEGA Chillan-Chile February 27 – March 3, 2006