Collaborative Project between CIRAD-CA, CIAT, and FLAR Rice Improvement

Recurrent Selection Breeding: Using Gene Pools and Populations with Recessive Male-Sterile Gene and Conventional Breeding

1997 Report

M. Châtel , Y. Ospina, and J. Borrero

Upland Savanna Rice
Recurrent Selection Breeding
Conventional Breeding

Hillside Rice
Recurrent Selection Breeding
Conventional Breeding

Lowland Rice
Recurrent Selection Breeding
Tropical
Sub-Tropical
Temperate Climate

CIRAD
Centre
de coopération
internationale
en recherche
agronomique
pour le
développement
Département
des cultures

FONDO LATINOAMERICANO Y DEL CARIBE PARA ARROZ DE RIEGO
FLAR

CIAT
o Internacional de Agricultura Tropical
ational Center for Tropical Agriculture

CIRAD

The Centre de cooperation internationale en recherche agronomique pour le developpement (CIRAD) is a French research organization that specializes in agriculture in the tropics and subtropics It is a state-owned body and was established in 1984 following the consolidation of French agricultural veterinary forestry and food technology research organizations for the tropics and subtropics

CIRAD's mission is to contribute to the economic development of these regions through research experiments training, and dissemination of scientific and technical information.

The Center employs 1800 persons including 900 senior staff who work in about 50 countries Its budget amounts to approximately 1 billion French francs more than half of which comes from public funds

CIRAD is made up of seven departments CIRAD CA (annual crops) CIRAD CP (tree crops) CIRAD-FLHOR (fruits and horticultural crops) CIRAD-EMVT (livestock production and veterinary medicine) CIRAD-Foret (forestry) CIRAD-SAR (food technology and rural systems) and CIRAD GERDAT (management, common services and laboratories documentation) CIRAD operates through its own research centers national agricultural research systems or development projects

CIAT

The International Center for Tropical Agriculture (CIAT its Spanish acronym) is dedicated to the alleviation of hunger and poverty in developing countries CIAT applies science to agriculture to increase food production while sustaining the natural resource base

CIAT is one of 16 international agricultural research centers sponsored by the Consultative Group on International Agricultural Research (CGIAR)

The Center s core budget is financed by 25 donor countries international and regional development organizations and private foundations In 1997 the donor countries include Australia, Belgium, Brazil Canada Colombia, Denmark, France Germany Japan, the Netherlands Norway Spain, Sweden Switzerland, the United Kingdom, and the United States of America Donor organizations include the European Union (EU) the Ford Foundation, the Inter-American Development Bank, the International Development Research Center (IDRC) the International Fund for Agricultural Development (IFAD) the Nippon Foundation the Rockefeller Foundation, the United Nations Development Program (UNDP) and the World Bank

Information and conclusions reported in this document do not necessarily reflect the position of any donor agency

FLAR

The Fund for Latin American and Caribbean Irrigated Rice (FLAR) is a means by which the public and private sectors of Latin American and Caribbean (LAC) countries can control and take responsibility for irrigated rice activities

FLAR began in January 1995 after an Act of Acceptance was signed by delegates from Brazil Colombia Venezuela, the International Center for Tropical Agriculture (CIAT) and the International Rice Research Institute (IRRI) In 1996 Costa Rica Panama, and the Centre de cooperation internationale en recherche agronomique pour le developpement (CIRAD) became members

FLAR s mission is to promote sustainable development of irrigated rice production in LAC that is to make it competitive profitable and efficient while lowering relative prices of rice for the consumer FLAR s objectives are

- To provide up-to-date information on market needs and opportunities of member countries through a permanent forum
- To pursue a broad approach in regional rice activities that are of interest to all members
- Increase sustainable rice production, that is ensure the efficiency of production equitable distribution of benefits and resource conservation
- To focus mainly on irrigated rice

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COLLABORATIVE PROJECT BETWEEN CIRAD, CIAT, AND FLAR

Rice Improvement, Using Gene Pools and Populations with Recessive Male-Sterile Gene And Conventional Breeding

Marc Châtel, Yolima Ospina, and Jaime Borrero

1997 Report Summary

1 BACKGROUND

Genetic uniformity or lack of genetic diversity, is of major concern to breeders geneticists, and the agricultural community in general In many crops genetic improvement is usually accomplished by reducing genetic diversity in the gene pools used to develop new varieties But genetic uniformity is now considered as increasing a crop s potential vulnerability to disasters caused by biotic or abiotic constraints

One way of broadening the genetic base of Latin American rice and assessing the genotype-by-environment interaction is to identify specific potential parents and pool them to develop new genetically broad-based breeding material

CIAT and CIRAD s new breeding strategies focus on developing and improving populations to provide sources of potential parents with specific traits required by national breeding programs One suitable breeding method to achieve this goal is recurrent selection

2 RECURRENT SELECTION FOR UPLAND RICE IN THE SAVANNAS AND HIGHLANDS

2 1 Introduction

The upland rice recurrent selection project aims to adapt develop and select upland rice gene pools and populations

The main characteristics of germplasm for savanna conditions are

- Tolerance of soil acidity
- Resistance to diseases mainly rice blast (*Pyncularia grizea* Sacc)
- Resistance to pests mainly rice plant hopper (*Tagosodes orizicolus* Muir)
- Good grain quality (translucent long slender grain)
- Early maturity (total cycle about 115 days)

For highland areas we are looking for

- Tolerance of cold temperatures
- Grain yield potential
- Grain quality

2 2 Upland Savanna Rice

The activities reported here were conducted at Palmira Experiment Station (PES) and at La Libertad' Experiment Station (LES)

2 2 1 Line development from recurrent populations Generation S2 Populations PCT-5\PHB\1\0, PCT-A\PHB\1\0, and PCT-4\PHB\1\1

From the 211 S2 lines evaluated at LES 25 were selected (12%) From each selected line we chose 6 individual plants The 150 S3 lines (25 families of 6 lines) will be grown at PES during 1997 B

2 2 2 Line development from recurrent populations Generation S4

2 2 2 1 Populations PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0\0\1

From the 178 S4 lines evaluated 47 were selected (26%) From each selected line we chose 6 individual plants The 282 S5 lines (47 families of 6 lines) will be grown at PES during 1997 B

2 2 2 2 Population PCT-4\0\0\1>S2

From the 74 S4 lines evaluated 16 were selected (22%) In each selected line we harvested 6 individual plants The 108 S5 lines (16 families of 6 lines) will be grown at PES during 1997 B

2 2 2 3 Populations PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0\0\1 Plant selection in S3 lines at PES, 1996 B

From the 12 S4 lines evaluated 3 lines (25%) were selected from one population

From each selected line we chose 6 individual plants

The 18 S5 lines (3 families of 6 lines) will be grown at PES during 1997 B

2 2 3 Line development from recurrent populations Advanced generations

2 2 3 1 From populations with a male-sterile gene

A yield trial was conducted and analyzed Three lines present a high yield potential and good milling characteristics

2 2 3 2 From populations with no male-sterile gene

The 89 progenies were evaluated under savanna acid soil conditions at LES A total of 36 lines were selected

2 3 Population Enhancement - Recurrent Selection

The CIAT rice project emphasizes the enhancement of populations and is phasing out the production of fixed lines for direct release by the region s national programs (NARS) The strategy is to develop and enhance gene pools and populations for well-targeted trait(s) to be used as sources of potential parents by national breeding programs

In the first 2 years of the recurrent selection project we concentrated on introducing germplasm from Brazil (EMBRAPA Arroz e Feijão [formerly CNPAF] and CIRAD) and French Guiana characterizing and mass selecting it From 1995 onward we concentrated our activities on enhancing and developing new populations

2 3 1 Recurrent selection based on S2 line evaluation Population PCT-4\0\0\1

The population PCT-4\SA\1\1 was grown at LES to go through a second selection cycle

2 3 1 1 Selecting fertile plants

A total of 155 S0 plants were selected A sample of each S0 seed was kept in the cold chamber The S1 generation will be grown during 1997 B at PES and S2 seeds harvested The S2 lines will be evaluated during 1998 A at LES

2 3 1 2 Harvesting male-sterile plants

Male-sterile plants were harvested individually and their seeds mixed in equal proportions to complete the second cycle of recombination of the population selected once The second cycle of recombination is identified as PCT-4\SA\2\1

2 3 2 Mass recurrent selection for both sexes for major agronomic traits, blast, and "hoja blanca" Populations PCT-4\0\0\1, PCT-A\0\0\0, and PCT-5\0\0

During 1997 A the seed mixture of each population with two mass recurrent selection cycles was grown at LES To make the third recurrent selection cycle 218 253 and 165 healthy male-sterile plants fertilized by the pollen of fertile healthy plants were selected from each population

2 4 Development of New Populations

The development of new populations is a basic activity of the project It forms the main source of new recombined variability for population enhancement and line development

In 1996 B we decided to build at PES two new Japonica populations targeting upland savannas and hillside ecosystems The source of male-sterility background is the best Japonica population previously developed by the project

2 4 1 Upland savanna population

The idea in developing that population is to pool the best lines of the CIAT conventional rice breeding project and the commercial varieties released in Brazil Colombia and Bolivia

In 1996 B 18 lines were selected based on their performance for early maturity blast and acid-soil tolerance and grain quality Male-sterile plants from the best adapted upland Japonica population (PCT-4) were used as female parents
During 1997 A at PES each resulting F1 was grown individually and evaluated and individual plants selected The basic population PCT-11\0\0\0 is the result of the mixture of the F2 seed

2 4 2 Upland hillside population

The idea is to develop a population for the Andean highlands of Colombia with early maturity and cold tolerance for high altitude, 1300-1600 m above sea level (masl)

In 1996 B 11 lines from Madagascar CIAT and IRAT were selected based on their previous evaluation at high altitudes The best-adapted upland Japonica population (PCT-4) was used as the source for male-sterility

During 1997 A at PES each resulting F1 was grown individually and evaluated and individual plants chosen The basic population PCT-13\0\0\0 is the result of the mixture of F2 seed

During 1997 B at PES the basic population will be recombined once The identification of the first cycle of recombination of the basic population will be PCT-13\0\0\1

3 CONVENTIONAL BREEDING FOR UPLAND RICE FOR SAVANNAS AND HIGHLANDS

3 1 Savannas Upland Rice

3 1 1 Upland lines from Brazil We received from CNPAF a set of Brazilian lines for evaluation under acid soil conditions

3 1 2 Use of CIAT/CIRAD savanna lines in Brazil

On average 57% and 58% of the lines present in the trials and the segregating generations respectively come from CIAT/CIRAD Furthermore 51 1% of the parents used by EMBRAPA Arroz e Feijão are CIAT/CIRAD lines The main characteristics they like from our lines are grain quality and plant type

3 1 3 New partners interested in savanna upland lines

The new partners are Colombia (Atlantic Coast) Brazil (South IRGA) Argentina (Tucuman Region) and China (Yunnan and Jiangxi Provinces)

In 1995 we sent the first set of savanna lines from Brazil and CIAT/CIRAD to China as part of a collaborative project between the Foods Crops Research Institute (of the Yunnan Academy of Agricultural Science Kunming) and CIRAD The first results were very promising showing good adaptation and acceptability Line CT 9278-11-14-2-1-M is a strong candidate for immediate release in this country

3 1 4 Seed multiplication

In Colombia during 1996 and 1997 the demand for savanna upland seed in the Eastern Plains was very high Not enough seed was available on the market CORPOICA decided to increase the seed of two released lines Oryzica Sabana 6 and Oryzica Sabana 10 We started production of the G0 generation at LES

3 1 5 Line release

Linea 30 has proven a very promising line since 1995 and CORPOICA wants to release it in 1998 In 1997 we started production of genetic seed

3 2 Upland Rice for the Highlands

In 1993 upland lines developed by CIRAD/FOFIFA for the highlands of Madagascar were introduced to Colombia and seed increased The new germplasm was distributed to CENICAFE and CIAT s hillsides project In 1994 line evaluation started in the Department of Cauca

In 1995 the Centro Internacional de Agricultura Organica (CIAO) started evaluations at 1600 masl The first results were presented at the Conference on Rice for the Highlands in Madagascar in April 1996

3 2 1 The Coffee Region – CENICAFE and CIAO

Line CT 10069-27 3-1-4 well adapted to the mid-altitudes was used in a trial with young coffee trees The potential of this line over time is very promising (average grain yield is 4 t/ha) Forty-one new lines were introduced from Madagascar and seed increased at CIAT Palmira Eleven single crosses were made at PES between line CT 10069-27-3-1-4 and 10 lines from Madagascar and CIRAD The F1 generation was grown during 1997 A at PES

3 2 2 Department of Cauca and Central America

In the Department of Cauca the five best lines of the previous year's selection and one savanna upland check (CIRAD 409) were tested on farm by five smallholders The best line (Latsidahy/FOFIFA 62-3) yielded 1400 kg/ha at La Laguna (1600 masl) The savanna upland check showed complete sterility

The 41 introduced lines were dispatched to the CIAT hillsides project for testing in Colombia and Central America

4 RECURRENT SELECTION FOR LOWLAND RICE

4 1 Introduction

The recurrent selection breeding project was started by introducing different gene pools and populations developed in Brazil by EMBRAPA Arroz e Feijão and CIRAD in French Guiana

The germplasm was characterized at CIAT Palmira and the best-adapted populations were used to develop new populations by incorporating new variability This resulted in three populations that were registered in the recurrent selection catalog as PCT-6 PCT-7 and PCT-8 A gene pool was also built up by using a different gene for male sterility The gene pool was registered as GPCT-9 Finally a second gene pool from CIRAD was registered as GPIRAT-10

4 2 Recurrent Selection Recurrent Selection for Both Sexes for "Hoja Blanca"

The objective was to use the recurrent selection breeding method for existing germplasm for hoja blanca virus and blast resistance Three populations PCT 6\0\0\2 PCT-7\0\0\0 and PCT-8\0\0\0 and the gene pool GPCT-9\0\0\0F were evaluated for hoja blanca virus according to the methodology developed at CIAT Healthy plants of each germplasm were transplanted separately for recombination with male-sterile plants The recombined populations after the first cycle of selection were identified as PCT-6\HB\1\2 PCT-7\HB\1\0 PCT-8\HB\1\0 and GPCT-9\HB\1\0F

4 3 Recurrent Selection in Colombia

In 1996, Dr Hernando Delgado from CORPOICA attended the International Course on Rice Recurrent Selection Breeding held at CIAT and selected four germplasm materials (populations PCT-6\0\0\2 PCT-7\0\0\0, and PCT-8\0\0\0 and the gene pool GPCT-9\0\0\0F) Each material was grown separately at LES for recombination characterization and selection of fertile plants for line development The four materials performed well The populations PCT-6 and PCT-7 presented the highest potential for the future

4 4 Recurrent Selection in Costa Rica

In 1996 we sent Costa Rica the Indica gene pool GPCT-9 and population PCT-7 That same year, Dr Randolph C Morera of the National Rice Program attended the International Course on Rice Recurrent Selection Breeding held at CIAT The germplasm was characterized under Costa Rican conditions and was maintained by harvesting male-sterile and fertile plants independently In 1997 the germplasm was used for line development by selecting S0 fertile plants

4 5 Recurrent Selection in El Salvador

In 1995 we sent three populations (PCT-6 PCT-7 and PCT-8) and the gene pool GPCT-9 to the Centro Nacional de Tecnologia Agropecuaria y Florestal (CENTA) where the following activities were carried out

- Line development in 1996 141 and 97 S0 fertile plants were selected from the populations PCT-7 and PCT-8 respectively
- Population enhancement based on S2 progeny evaluation and recombination from the remnant S0 seeds
- New population development the population CNA IRAT ES 1/0/2 was developed by introduction four lines (X-10 CENTA A 1 CENTA A-2 and CENTA A-5) into the Brazilian population CNA IRAT 4/0/6

4 6 Recurrent Selection in Panama

In 1996 we sent Panama the Indica gene pool GPCT-9 and population PCT-7 That same year Dr Ariel E Jaen Sanchez of the Faculty of Agricultural Sciences Universidad de Panama attended the International Course on Rice Recurrent Selection Breeding held at CIAT The introduced germplasm was grown and characterized For each material the earliest S0 fertile plants were harvested for line development

4 7 Recurrent Selection in Venezuela

After he attended the International Course on Rice Recurrent Selection Breeding three populations (PCT-6 PCT-7 and PCT-8) and three gene pools (IRAT 1/420P IRAT MANA and GPCT-9) were sent to Dr E Graterol for characterization under the local conditions of Calabozo Guarico State The objective was to select the best-adapted germplasm to start a recurrent selection program Two populations PCT-6 and PCT-7 were selected as male-sterile background to develop two new local populations identified as PFD-1 and PFD-2

4 8 Recurrent Selection in Argentina

In December 1996 we supplied the Universidad de Corrientes with the populations PCT-6\0\0\0 PCT-7\0\0\0 and PCT-8\0\0\0 The germplasm was observed and characterized The development of a specific population (or populations) is planned for the second semester of 1997 by crossing six varieties (IRGA 417 CYPRESS R P 2 TAIM Don Juan INTA and CH4-7) with male-sterile plants of each population

4 9 Recurrent Selection in Chile

In 1996 we sent Chile the Japonica gene pool GPIRAT-10 developed by CIRAD specifically for temperate climates That same year Dr Santiago Hernaiz from INIA-Quilamapu attended the International Course on Rice Recurrent Selection Breeding held at CIAT

In 1997 the gene pool was grown to characterize and select fertile plants for line development It was also used as a source of male sterility to build up a local population by crossing five Chilean lines (Qui 67108 Diamante Buli CINIA 609 and CINIA 606) with male-sterile plants of the gene pool Part of the hybrid seed was sent to CIAT Palmira for growing the F1 generation F2 seed was shipped back to Chile The basic Chilean population was identified as PQUI-1\0\0\0

4 10 Recurrent Selection in Uruguay

In 1996 we sent Chile the Japonica gene pool GPIRAT-10 That same year Dr Fernando Perez de Vida attended the International Course on Rice Recurrent Selection Breeding held at CIAT

In 1997 the gene pool was grown to characterize and select fertile plants for line development It was also used as a source of male sterility to build up a local population by crossing selected Uruguayan lines with male-sterile plants of GPIRAT-10

4 11 Line Development through Anther Culture

In 1994 we introduced from French Guyana the population IRAT-CT This population comes from the enhancement of the Indica gene pool GPCNA-18 for anther culture response
From 1995 the CIAT anther culture laboratory processed the population IRAT-CT and R2 lines were developed The lines were evaluated by FLAR at the Santa Rosa Experiment Station and five lines were selected

PROYECTO COLABORATIVO ENTRE EL CIRAD, CIAT Y FLAR

Mejoramiento de Arroz Utilizando Acervos Geneticos y Poblaciones Segregando por un Gene de Androesterilidad y el Mejoramiento Convencional

Marc Châtel, Yolima Ospina y Jaime Borrero

Resumen del Informe Anual de 1997

ANTECEDENTES

La uniformidad genetica o la ausencia de diversidad genetica es la mayor inquietud de los mejoradores geneticos y de la comunidad agricola en general En muchos cultivos el mejoramiento genetico se hace teniendo como consecuencia la reduccion de la diversidad genetica en los acervos geneticos basicos El aumento de la uniformidad genetica es considerado como factor importante que puede causar desastres bioticos y abioticos

Una manera de aumentar la base genetica del arroz en America latina es la identificacion de progenitores potenciales especificos para desarrollar acervos geneticos de amplia base genetica

Las nuevas estrategias de mejoramiento estan enfocando el desarrollo y el mejoramiento poblacional como fuente de nuevos progenitores y lineas fijas para caracteristicas especificas para los programas nacionales de arroz Para alcanzar esta meta se esta desarrollando un proyecto utilizando el metodo de seleccion recurrente

I SELECCION RECURRENTE PARA EL ARROZ DE SECANO EN LAS SABANAS Y EN LAS LADERAS DE AMERICA LATINA

1 INTRODUCCION

El proyecto de seleccion recurrente enfoca la adaptacion el desarrollo y la seleccion de acervos geneticos y poblaciones de arroz de secano

Las principales caracteristicas del germoplasma para las sabanas son

- Tolerancia a la acidez del suelo
- Resistencia a enfermedades principalmente Piricularia y Hoja Blanca
- Resistencia a plagas principalmente *Tagosodes orizicolus* Muir
- Buena calidad de grano
- Precocidad

Para las condiciones de laderas

- Tolerancia al frio
- Potencial de rendimiento
- Buena calidad de grano

2 ARROZ DE SABANAS

Las actividades reportadas en este informe, fueron conducidas en la Estacion Experimental de Palmira (EEP) y la Estacion experimental La Libertad (EELL)

2 1 **Desarrollo de lineas a partir de poblaciones recurrentes Generacion S2**
Poblaciones PCT-5\PHB\1\0, PCT-A\PHB\1\0 y PCT-4|PHB\1\1
De las 211 lineas S2 evaluadas se seleccionaron 25 (12%) y en cada linea se seleccionaron 6 plantas individuales Las 150 lineas S3 (25 familias de 6 lineas) seran sembradas en la EEP en el semestre B de 1997

2 2 **Desarrollo de lineas a partir de poblaciones recurrentes Generacion S4**

2 2 1 **Poblaciones PCT-5\0\0\0, PCT-A\0\0\0 y PCT-4\0\0\1**
De las 178 lineas S4 evaluadas fueron seleccionadas 47 (26%) y en cada linea se seleccionaron 6 plantas individuales Las 282 lineas S5 (47 familias de 6 lineas) se sembraran en la EEP en el semestre B de 1997

2 2 2 **Poblacion PCT-4\0\0\1>S2**
De las 74 lineas S4 evaluadas 16 lineas fueron seleccionadas (22%) en cada linea seleccionada fueron cosechadas 6 plantas individuales Las 108 lineas S5 (16 familias de 6 lineas) seran sembradas en la EEP en 1997B

2 2 3 **Poblaciones PCT-5\0\0\0, PCT-a\0\0\0 y PCT-4\0\0\1 seleccion de plantas en lineas S3 en la EEP en 1996B**
De las 12 lineas S4 evaluadas, 3 lineas (25%) fueron seleccionadas en una poblacion y en cada linea seleccionada fueron cosechadas 6 plantas individuales Las 18 lineas S5 se sembraran en la EEP en 1997B

2 3 **Desarrollo de lineas de poblaciones recurrentes Generaciones Avanzadas**

2 3 1 **Poblaciones con el gene de androesterilidad**
Se condujo un ensayo de rendimiento con 33 materiales Tres (3) lineas avanzadas se destacaron presentando un elevado potencial de rendimiento y con buena calidad molinera

2 3 2 **Poblaciones sin el gene de androesterilidad (cruzamientos manuales)**
Fueron evaluadas 89 progenies avanzadas de las cuales se seleccionaron 36 lineas (40%) que conformaran un ensayo de observacion el proximo año

3 MEJORAMIENTO POBLACIONAL A TRAVES DE SELECCION RECURRENTE
El proyecto de Arroz del CIAT esta enfocando el mejoramiento poblacional cuya estrategia es la de desarrollar acervos geneticos y poblaciones para caracteristicas de interes de la region En los dos primeros anos del proyecto se introdujeron germoplasmas de Brasil (CNPAF-CIRAD-CA) y de Guyana francesa (CIRAD-CA) Estas poblaciones se caracterizaron y se les realizo una seleccion masal

A partir de 1995 se concentraron las actividades en el mejoramiento y desarrollo de nuevas poblaciones

3 1 **Seleccion Recurrente basada en evaluacion de lineas S2 Poblacion PCT-4\0\0\1**
La poblacion PCT-4\SA\1\1 fue sembrada en la EELL para desarrollar el segundo ciclo de seleccion recurrente

3 1 1 Seleccion de plantas fertiles

Se seleccionaron 155 plantas S0 La generacion S1 se sembro en la EEP en 1997B y las lineas S2 seran sembradas en la EELL en 1998A

3 1 2 Cosecha de plantas esteriles

Las plantas androesteriles fueron cosechadas individualmente y mezcladas en igual proporcion para completar el segundo ciclo de recurrencia identificado como PCT-4\SA\2\1\.

3 2 Seleccion recurrente masal en ambos sexos para caracteristicas agronomicas y enfermedades Poblaciones PCT-4\PHB\1\1, PHB\1, PCT-5\PHB\1\0, PHB\1 y PCT-A\PHB\1\0, PHB\1

Se seleccionaron 165 218 y 253 plantas androesteriles sanas en cada una de las poblaciones para completar el tercer ciclo de seleccion masal

4 DESARROLLO DE NUEVAS POBLACIONES

El desarrollo de nuevas poblaciones es una de las actividades principales del proyecto Es la fuente principal de recombinacion de nueva variabilidad para el mejoramiento poblacional y el desarrollo de lineas En 1996B se desarrollaron dos poblaciones Japonicas para las condiciones de sabanas y de Laderas

4 1 Poblacion para sabana

El objetivo es de agrupar las mejores lineas del proyecto convencional de mejoramiento y de las variedades comerciales liberadas en Colombia Brasil y Bolivia En 1996B se seleccionaron 18 lineas que fueron cruzadas con plantas esteriles de la Poblacion PCT-4 En 1997A las F1 se evaluaron y se seleccionaron y la semilla F2 se mezclo en proporciones iguales para constituir la poblacion basica PCT-11\0\0\0

4 2 Poblacion para laderas

El objetivo fue el desarrollo de una poblacion enfocando la resistencia al frio de alta altitud (1300-1600 msnm) En 1996B se seleccionaron 11 lineas introducidas de Madagascar, adaptadas al frio las cuales fueron cruzadas con plantas androesteriles de la poblacion PCT-4

En 1997A las F1 se evaluaron y se seleccionaron y la semilla F2 se mezclo en proporciones iguales para constituir la poblacion basica PCT-13\0\0\0

II MEJORAMIENTO TRADICIONAL DE ARROZ DE SECANO PARA LAS SABANAS Y LAS LADERAS

1 ARROZ DE SECANO PARA LADERAS

1 1 Introduccion de lineas de Brasil

Se introdujo germoplasma desarrollado por el Centro de Arroz y Frijol de EMBRAPA con el objetivo de evaluarlo bajo condiciones de suelos mas acidos que los de Brasil

1 2 Utilizacion en Brasil del germoplasma de secano del CIAT/CIRAD

En promedio 57% y 58% de las lineas que conforman los ensayos y las generaciones segregantes respectivamente en el programa de Arroz de secano de EMBRAPA proviene del material desarrollado en Colombia por el CIAT/CIRAD Ademas el 51% de los progenitores del programa de cruzamientos de Arroz de secano de EMBRAPA son tambien originarios del programa de Arroz del CIAT/CIRAD en Colombia

1 3 Nuevos socios interesados en germoplasma de sabanas

Se identificaron, como nuevos socios en Colombia (la Costa Atlantica y el Ministerio de Agricultura) en Brasil (IRGA en el sur de Brasil) en Paraguay y en Argentina (Universidad de Tucuman) Fuera de America Latina la China (Provincias de Yunnan y Jiangxi) esta muy interesada en las lineas de America Latina De las primeras evaluaciones se destaco como candidato para el cultivo comercial la linea CT9278-11-14 2-1-M

1 4 Multiplicacion de semilla

En Colombia en los años 96 y 97 hubo una gran demanda de semillas de variedades para sabana Por tanto CORPOICA multiplico las dos variedades (Oryzica Sabana 6 y 10) y el CIAT/CIRAD produjo la semilla genetica

1 5 Recomendacion de cultivar

La 'Linea 30 (CT11891-2-2-7-M) se viene destacando desde el año 1995 por su rendimiento (5 Tn/ha) y alta precocidad (ciclo total de 95 dias) Actualmente CORPOICA regional 8 esta queriendo lanzar este material y esta multiplicando la semilla

2 ARROZ DE SECANO PARA LADERAS

En 1993 el germoplasma desarrollado por el CIRAD en Madagascar para resistencia al frio de altitud fue introducido en Colombia y multiplicado Parte de la semilla se remitio a CENICAFE al Centro Internacional de Agricultura Organica (CIAO) y el Programa de Laderas del CIAT para la region del Cauca

Los primeros resultados para la evaluacion de este material fueron presentados durante la Conferencia de arroz de Altitud en Madagascar en Abril de 1996

2 1 Colaboracion con CENICAFE y CIAO

La linea CT10069-27-3-1-4 se destaco en la zona de mediana altitud (1300 msnm) en cultivo asociado con el cafe Su potencial en esta zona es de 4 Ton/ha

Fueron introducidas 41 nuevas lineas de Madagascar con el objetivo de evaluarlas en condiciones de mayor altitud (1600 msnm)

Se realizaron 11 cruzamientos en la EEP entre lineas de Madagascar y la linea CT10069-27-3-1-4 La generacion F2 sera evaluada con las instituciones involucradas en el proyecto

2 2 Colaboracion en Colombia (Region del Cauca) y en America Central

En el departamento del Cauca 6 de las mejores lineas de Madagascar se reevaluaron en fincas de pequeños agricultores Del grupo evaluado la mejor linea fue Latsidahy/FOFIFA 62-3 con una produccion de 1400 kg/ha a una altitud de 1600 msnm y el testigo CT10069-27-3-1-4 presento una total esterilidad a esta altitud

Tambien fueron introducidas las 41 lineas de Madagascar con el objetivo de evaluarlas bajo estas condiciones

Con base en estos resultados se esta planeando difundir y adaptar la experiencia adquirida en Colombia a los paises de America Central

II SELECCION RECURRENTE PARA ARROZ DE RIEGO

1 INTRODUCCION

El germoplasma de seleccion recurrente para condiciones de riego introducido de Brasil (EMBRAPA/CIRAD) y de Guyana Francesa (CIRAD) se caracterizo en EEP en 1993 El germoplasma mas destacado fue utilizado como fuente de androesterilidad para desarrollar nuevas poblaciones locales denominadas PCT-6 PCT-7 y PCT-8 y el acervo genetico GPCT-9

2 SELECCION RECURRENTE EN AMBOS SEXOS PARA HOJA BLANCA

El objetivo es el de utilizar el metodo de seleccion recurrente para mejorar el germoplasma existente en relacion a Hoja Blanca que es una de las principales enfermedades en arroz de riego en las condiciones tropicales

Las tres (3) poblaciones PCT-6 PCT-7 y PCT-8 y el acervo genetico GPCT-9 fueron evaluadas para Hoja Blanca segun la metodologia desarrollada por el CIAT Las plantas sanas seleccionadas en los viveros se trasplantaron para ser recombinadas entre ellas El primer ciclo de seleccion recurrente se completo en 1997A en la EEP produciendo las poblaciones PCT-6\HB\1\2 PCT-7\HB\1\0 PCT-8\HB\1\0 y GPCT-9\HB\1\0F

3 SELECCION RECURRENTE EN COLOMBIA

En el año 1996 el Ing Hernando Delgado de CORPOICA atendio el primer curso Internacional en Seleccion Recurrente organizado por el CIAT/CIRAD Despues de su entrenamiento se le remitio el germoplasma PCT-6 PCT-7 PCT-8 y GPCT-9 para incorporarlos a su programa de mejoramiento

Cada germoplasma fue sembrado en la EELL para recombinacion caracterizacion y seleccion de plantas fertiles para la produccion de lineas fijas Las dos poblaciones PCT-6 y la PCT-7 presentaron el mayor potencial para estas condiciones El germoplasma sera evaluado para resistencia a piricularia en la Estacion Experimental Santa Rosa (EESR) en 1998A

4 SELECCION RECURRENTE EN COSTA RICA

En el año 1996, el Ing Randolph C Morera atendio el primer curso Internacional en Seleccion Recurrente organizado por el CIAT/CIRAD Despues de su entrenamiento se le remitio el germoplasma PCT-7 y GPCT-9 para incorporarlos a su programa de mejoramiento Cada germoplasma fue caracterizado y multiplicado cosechando las plantas androesteriles y fertiles separadamente

5 SELECCION RECURRENTE EN EL SALVADOR

En el año 1995, se remitio al Ing Ramon Eduardo Servillon el germoplasma PCT 6 PCT-7 PCT-8 y GPCT-9 para incorporarlos a su programa de mejoramiento En 1996 se seleccionaron 141 y 97 plantas fertiles en las poblaciones PCT-7 y PCT 8 Se esta mejorando la poblacion PCT-7 utilizando el metodo de evaluacion de lineas S2 Se desarrollo una poblacion local denominada CAN IRAT ES 1/0/2 por introduccion de nueva variabilidad (X-10 CENTA A-1 CENTA A-2 y CENTA A 5) en la poblacion CAN IRAT 4/0/6

6 SELECCION RECURRENTE EN PANAMA

En el año 1996 el Ing Ariel E Jaen Sanchez atendio el primer curso Internacional en Seleccion Recurrente organizado por el CIAT/CIRAD Despues de su entrenamiento se le remitio el germoplasma PCT-7 y GPCT-9 para incorporarlos a su programa de mejoramiento Se inicio la caracterizaron del material pero no se completo por causa de falta de agua de irrigacion

7 SELECCION RECURRENTE EN VENEZUELA

En el año 1996 el Ing Eduardo Graterol atendio el primer curso Internacional en Seleccion Recurrente organizado por el CIAT/CIRAD Despues de su entrenamiento se le remitio el germoplasma PCT-6 PCT-7 PCT-8 GPCT 9 IRAT MANA e IRAT 1/420P para incorporarlos a su programa de mejoramiento Se caracterizo la poblacion para determinar el mejor germoplasma para empezar el programa de seleccion recurrente Las poblaciones PCT-6 y PCT-7 sobresalieron y seran utilizadas como fuente de androesterilidad para desarrollar dos poblaciones locales denominadas PDF-1 y PDF-2

8 SELECCION RECURRENTE EN ARGENTINA

En diciembre del año 1996 se remitio a la Ing Maria Antonia Marassi las poblaciones PCT-6, PCT-7 y PCT-8 Se caracterizo y se multiplico el germoplasma Se seleccionaron plantas fertiles para desarrollo de lineas en las tres poblaciones En el segundo semestre de 1997 se esta desarrollando nuevas poblaciones cruzando plantas androesteriles con nuevas fuentes de variabilidad (IRGA 417 CIPRESS R P 2 TAIN DON JUAN INTA y CH4-7)

9 SELECCION RECURRENTE EN CHILE

En el año de 1996 se remitio el gene pool Japonico GPIRAT-10 especificamente desarrollado para las condiciones de clima templado El mismo año el Ing Santiago Hernaiz atendio el Curso Internacional de Seleccion Recurrente organizado en el CIAT En 1997 se caracterizo y se selecciono plantas fertiles para el desarrollo de lineas Tambien se desarrollo una poblacion utilizando las plantas esteriles del gene pool introducido en cruzamiento con nuevas fuentes de variabilidad (Qui 67108 DIAMANTE BULI CINIA 609 y CINIA 606) Parte de la semilla hibrida se envio al CIAT con el objetivo de adelantar el proceso de desarrollo La poblacion basica denominada PQUI-1 se remitio a Chile

10 SELECCION RECURRENTE EN URUGUAY

En el año de 1996 se remitio el gene pool Japonico GPIRAT-10 especificamente desarrollado para las condiciones de clima templado El mismo año el Ing Fernando Perez de Vida atendio el Curso Internacional de Seleccion Recurrente organizado en el CIAT En 1997 se caracterizo y se selecciono plantas fertiles para el desarrollo de lineas Tambien se desarrollo una poblacion utilizando las plantas esteriles del gene pool introducido en cruzamiento con nuevas fuentes de variabilidad

11 DESARROLLO DE LINEAS POR EL METODO DE CULTIVO DE ANTERAS

En 1994 la poblacion Indica IRAT CT fue introducida en Colombia de Guyana Francesa Esta poblacion fue mejorada por su respuesta al cultivo de anteras En 1995 se proceso por cultivos de anteras en el CIAT Las lineas R2 resultantes fueron evaluadas en la EESR en 1997A Cinco lineas R2 se destacaron como promisorias

CHAPTER I
PRESENTATION

1 HIGHLIGHTS

THE CIRAD/CIAT/FLAR COLLABORATIVE PROJECT

The third Collaborative Meeting between CIAT, CIRAD, INRA, and ORSTOM was held at CIAT headquarters in May 1997 At this meeting, the ongoing activities of the CIRAD/CIAT Rice Collaborative Project were confirmed, and the project was reinforced (Appendix 1) by

- The appointment of a new CIRAD scientist (Dr Michel Vales) at CIAT headquarters in August
- Starting the adaptation of the ADVENTROP software to Latin America in March (Dr Thomas Le Bourgeois)

THE CIAT RICE PROJECT

CIAT is developing its research activities according to a project management system The Rice Project's code is IP-4, and its structure is presented in Appendix 2

UPLAND SAVANNA RICE BREEDING

During 1996 A and B, the activities developed by the conventional breeding project for upland savanna rice were at first reduced, but then reactivated to a certain extent during 1997 A

Breeding lines were sent, for observation and seed increase, to EMBRAPA Arroz e Feijão, who incorporated them into its breeding program We maintain close collaborative ties with the scientists of this program, making regular visits and exchanging information on the performance of CIAT breeding lines Seeds were shipped back to CIAT headquarters and increased at the Palmira Experiment Station during 1997 B
The demand for upland rice breeding lines is increasing New partners were identified southern Brazil-IRGA, Colombia-Ministry of Agriculture and small farmers of the Atlantic Coast, Argentina-University of Tucuman, and Venezuela-FONAIAP and the Universidad Nacional Experimental de los Llanos Orientales "EZEQUIEL ZAMORA"

UPLAND RICE FOR THE HIGHLANDS OF COLOMBIA

From 1993, we started, as an informal collaborative effort with the Centro Nacional de Investigaciones de Cafe (CENICAFE) and the CIAT hillsides project, to adapt rice as a new crop for the Colombian highland ecosystem Results so far are very promising (see "Upland Rice Improvement for the Highlands of Colombia, 1996 Report")

Two upland rice lines were proposed for registration in CIRAD's rice catalog One is a savanna upland rice for the mid-altitudes (about 1300 masl, Colombian Coffee Region), and the other is an introduction from Madagascar (CIRAD/FOFIFA Highlands Breeding Project) for the higher altitudes (1600 masl, Cauca Region)

RECURRENT SELECTION BREEDING

CIAT and CIRAD's breeding strategies focus on developing and improving populations, and phasing out the development of finished lines Such population development and enhancement aim to provide national programs (NARS) with sources of potential parents having specific traits

The expertise of the collaborative project on recurrent selection is shared with the NARS through activity reports, didactic documents, field visits, and training courses The first International Course on Rice Recurrent Selection Breeding was held at CIAT in 1996 Fifteen scientists from 13 countries attended the course Back in their home countries, many began using recurrent selection in their breeding programs

Recurrent selection germplasm crosses continents We have shipped populations to Europe (Spain, Hungary, and Romania) and China

The manual on recurrent selection was translated into English and distributed to non-Spanish-speaking countries in Latin America and abroad
The proceedings of the first International Meeting on Rice Recurrent Selection, held in 1995, in Goiânia, Brazil, was published by EMBRAPA, Fundacion Polar, CIRAD, and CIAT

A gene pool developed by the CIRAD/IRRI Collaborative Rice Project was registered in the germplasm catalog for recurrent selection as GPIR-22

FONDO LATINOAMERICANO Y DEL CARIBE PARA ARROZ DE RIEGO (FLAR) ***(FUND FOR LATIN AMERICAN AND CARIBBEAN IRRIGATED RICE)***

In September 1996, CIRAD signed an agreement with the Fund and became a member Beginning in 1997, the CIRAD/CIAT collaborative project developed research activities with FLAR on

- Recurrent selection breeding
- Durable resistance to blast
- Adaptation to Latin America of the CIRAD's ADVENTROP software

In 1997, Paraguay and the Brazilian State of Santa Catarina became members of FLAR

2 ACKNOWLEDGMENTS

This document reports the research activities developed during 1996 B and 1997 B at CIAT headquarters (Palmira, Department of Valle, Colombia), and "La Libertad" Experiment Station (Villavicencio, Department of Meta, Colombia)

In Colombia, we maintain close collaborative ties with CORPOICA and CENICAFE At the regional level (Latin America), we conduct research activities in close collaboration with scientists of different institutions and universities

We would therefore like to acknowledge the excellent work and collaboration of the following persons

Dr Maria Antonia Marassi	Argentina, Universidad de Corrientes
Dr Juan Antonio Marassi	Argentina, Universidad de la Plata
Dr Roger Taboada Paniagua	Bolivia, CIAT
Dr Orlando Peixoto de Morais	Brazil, EMBRAPA Arroz e Feijão
Dr Emilio da Maia de Castro	Brazil, EMBRAPA Arroz e Feijão
Dr Elcio Perpetuo Guimarães	Brazil, EMBRAPA Arroz e Feijão
Dr Roberto Alvarado	Chile, INIA-Quilamapu
Dr Santiago Ignacio Hernaiz Lagos	Chile, INIA-Quilamapu

Dr Hernando Delgado Huertas	Colombia, CORPOICA-Regional 8
Dr Randolph Campos Morera	Costa Rica, Ministry of Agriculture
Ramon Eduardo Servillon	El Salvador, CENTA
Dr Ariel E Jaen Sanchez	Panama, Universidad de Panama
Dr Alberto Herrera G	Venezuela, Universidad (UNILLEZ)
Dr Eduardo Graterol	Venezuela, DANAC – Fundacion Polar
Dr Fernando Blaz Perez de Vida	Uruguay, INIA-Treinta y Tres

3 BACKGROUND INFORMATION

Genetic uniformity, or lack of genetic diversity, is of major concern to breeders, geneticists, and the agricultural community in general In many crops, genetic improvement is usually accomplished by reducing genetic diversity in the gene pools used to develop new varieties But genetic uniformity is now considered as increasing a crop's potential vulnerability to disasters caused by biotic or abiotic constraints

In Latin America, the genetic diversity of rice varieties depends on a small genetic core of landraces (1 in Appendix 6) One way of broadening the genetic base of Latin American rice and assessing the genotype-by-environment interaction is to identify specific potential parents and pool them to develop new, genetically broad-based, breeding material

CIAT and CIRAD's new breeding strategies focus on developing and improving populations to provide sources of potential parents with specific traits required by national breeding programs One suitable breeding method to achieve this goal is recurrent selection

Started in 1992, the CIRAD/CIAT rice improvement collaborative project introduced, from Brazil and French Guiana, gene pools and populations segregating for a male-sterile recessive gene (2 in Appendix 6) The main objectives of the project are

- To understand the performance of the introduced germplasm in the upland acid soils of the Colombian savannas
- To maintain the germplasm by harvesting fecundated male-sterile plants
- To identify adapted fertile genotypes for use in breeding programs for fixed lines
- To start recurrent selection by recombining the best selected genotypes in the introduced germplasm
- To create new populations by incorporating the best locally adapted lines of the CIAT upland-rice breeding program into the best adapted, introduced germplasm that also provides a good source of male-sterile background

CHAPTER II

RECURRENT SELECTION FOR UPLAND RICE FOR SAVANNAS AND HIGHLANDS

1 INTRODUCTION

2 UPLAND SAVANNA RICE

2 1 Line Development from Recurrent Populations

2 1 1 Generation S2

2 1 1 1 Populations PCT-5\PHB\1\0, PCT-A\PHB\1\0, and PCT-4\PHB\1\1

- Cycles
- Cropping Season 1997 A
- Off Season 1997 B

2 1 2 Generation S4

2 1 2 1 Populations PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0\0\1

- Cycles
- Cropping Season 1997 A
- Off Season 1997 B

2 1 2 2 Population PCT-4\0\0\1>S2

- Cycles
- Cropping Season 1997 A
- Off Season 1997 B

2 1 2 3 Populations PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0\0\1 Plant Selection in S3 Lines at PES, 1996 B

- Cycles
- Cropping Season 1997 A
- Off Season 1997 B

2 1 3 Advanced Generations

2 1 3 1 AGs from Populations with a Male-Sterile Gene

- Cycles
- Cropping Season 1997

2 1 3 2 AGs from Populations with No Male-Sterile Gene

- Cycles
- Cropping Season 1997

CHAPTER II

RECURRENT SELECTION FOR UPLAND RICE FOR SAVANNAS AND HIGHLANDS

Marc CHÂTEL, Yolima OSPINA, and *Jaime BORRERO*

1 INTRODUCTION

The upland rice recurrent selection project aims to adapt, develop, and select upland rice gene pools and populations The major characteristics that we look for in germplasm for savanna conditions are

- Tolerance of soil acidity
- Resistance to diseases, mainly rice blast (*Pyricularia grisea* Sacc)
- Resistance to pests, mainly rice plant hopper (*Tagosodes orzicolus*)
- Good grain quality (translucent, long, slender grain)
- Early maturity (total cycle about 115 days)

For highland conditions, we are looking for

- Tolerance of cold temperatures
- Grain yield potential
- Grain quality

2 UPLAND SAVANNA RICE

The activities we report here were conducted at two experiment stations

- Off season (1996 B) October 1996 to March 1997 at the Palmira Experiment Station (PES)
- Cropping season (1997 A) April to September 1997 at "La Libertad" Experiment Station (LES)

The soil and climatic characteristics, and agronomic management of the "La Libertad" Experiment Station are presented in Tables 1, 2, and 3

Reactions to blast, observed on international differential and commercial lines, are presented in Table 4 Blast samples were sent to CIAT, Palmira, for lineage identification

2 1 Line Development from Recurrent Populations

During the enhancement of gene pools and populations through recurrent selection, we selected fertile plants to develop promising fixed lines or potential parents for regional NARS

2 1 1 Generation S2

The generation S2 came from S0 fertile plants selected during 1996 A at LES, and its seed increased during 1996 B at PES

2 1 1 1 Populations PCT-5\PHB\1\0, PCT-A\PHB\1\0, and PCT-4\PHB\1\1

Cycles

During 1996 A, *from the first recurrent selection cycle for leaf blast and "hoja blanca" virus (see 1996 report 4-2), we selected 211 S0 fertile plants, distributed as follows*

- *49 in PCT-5\PHB\1\0 (11 5% of the total number of fertile plants)*
- *48 in PCT-A\PHB\1\0 (12 4% of the total number of fertile plants)*
- *114 in PCT-4\PHB\1\1 (17 3% of the total number of fertile plants)*

During 1996 B *the S1 generation (211 S1 lines) were grown at PES and the S2 seeds sent to LES to grow the S2 generation during 1997 A*

Cropping Season 1997 A

From the 211 S2 lines evaluated at LES, 25 were selected (Table 5)

- PCT-5\PHB\1\0 -- 1 line selected (2%)
- PCT-A\PHB\1\0 -- 2 lines selected (4%)
- PCT-4\PHB\1\1 -- 22 lines selected (19%)

In each selected line, we selected 6 individual plants

Off Season 1997 B

The 150 S3 lines (25 families of 6 lines) will be grown at PES during 1997 B

2 1 2 Generation S4

The generation S4 came from fertile S0 plants selected during 1995 A at LES The generations S1 and S3 were grown during 1995 B and 1996 B, respectively, at PES The S2 generation was selected during 1996 A at LES

2 1 2 1 Populations PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0\0\1

Cycles

During the 1995 A cropping season *at LES, we selected 55, 85, and 18 S0 fertile plants in PCT-5\0\0\0, PCT-A\0\0\0 and PCT-4\0\0\1, respectively, and during the off-season (1995 B), we grew the S1 generation at PES*

During the 1996 A cropping season, *we observed 158 S2 and 3 checks (Oryzica Sabana 6, IAC 165, and CIRAD 409) at LES, and selected mainly for plant type and yield potential discarding 102 S2 lines (64 5%) A total of 56 S2 lines (35 4%) were selected*

- *PCT-5\0\0\0 -- 21 lines (38 1%)*
- *PCT-A\0\0\0 --26 lines (30 6%)*
- *PCT-4\0\0\1 -- 9 lines (50 0%)*

From the 56 selected lines we harvested 178 fertile plants 62 from PCT-5\0\0\0, 91 from PCT-A\0\0\0, and 25 from PCT-4\0\0\1

We applied different selection intensity to each selected S2 line according to the phenotypic value of the lines (grain yield potential, and plant and grain type) For example, the highest average selection intensity in three PCT-5\0\0\0 S2 lines was 14% and the lowest average was 1 6% in 14 S2 lines

The S3 generation was grown during 1996 B at PES and the S4 seeds will be sent to LES to grow the S4 generation during 1997 A

Cropping Season 1997 A

From the 178 S4 lines evaluated, 47 were selected (Table 6)

- PCT-5\0\0\0 -- 3 lines selected (5%)
- PCT-A\0\0\0 -- 35 lines selected (38%)
- PCT-4\0\0\1 -- 9 lines selected (36%)

From each selected line, we selected 6 individual plants

Off Season 1997 B

The 282 S5 lines (47 families of 6 lines) will be grown at PES during 1997 B

2 1 2 2 Population PCT-4\0\0\1>S2

Cycles

During 1996 A, *we started enhancing this population by first evaluating the S2 line We took advantage of the 1996 S2 line trial to select S2 lines and individual fertile plants for line development From 152 S2 lines evaluated we selected 19 (12 5%) and 74 individual plants, based on plant and grain type and grain yield potential*

During 1996 B, *the S3 generation was grown at PES and the S4 seeds were sent to LES to grow the S4 generation during 1997 A*

Cropping Season 1997 A

From the 74 S4 lines evaluated, 16 were selected (22%) (Table 7) In each selected line, we harvested 6 individual plants

Off Season 1997 B

The 96 S5 lines (16 families of 6 lines) will be grown at PES during 1997 B

2 1 2 3 Populations PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0\0\1
Plant Selection in S3 Lines at PES, 1996 B

Cycles

***During 1996 B**, at PES, we selected 12 individual fertile plants, with suitable characteristics, from S3 lines The S4 seed was sown during 1997 A at LES*

Cropping Season 1997 A

From the 12 S4 lines evaluated, only 3 were selected in one population (Table 8)

- PCT-5\0\0\0 -- no selection
- PCT-A\0\0\0 -- no selection
- PCT-4\0\0\1 -- 3 lines selected (75%)

In each selected line, we selected 6 individual plants

Off Season 1997 B

The 18 S5 lines (3 families of 6 lines) will be grown at PES during 1997 B

2 1 3 Advanced Generations

The advanced generations (AGs) came from the S0 fertile plants selected from the germplasm we introduced in 1992 from Brazil (with male-sterile gene) and from the gene pool and populations previously developed at CIAT (no male-sterile gene)

2 1 3 1 AGs from Populations with a Male-Sterile Gene

Cycles

***During 1995 B,** at PLS, we increased seed of 2 and 4 advanced lines selected from CNA-IRAT 5 and CNA-IRAT A, respectively*

***During 1996 A,** we observed these 6 lines at LES From each of the 6 lines, we selected 5 individual plants*

***During 1996 B,** we increased seed of the 30 plants at PES to set up a yield trial during 1997 A*

Cropping Season 1997

The yield trial was conducted and analyzed Three lines presented a high yield potential and good milling characteristics (Tables 9 and 10)

2 1 3 2 AGs from Populations with No Male-Sterile Gene

Cycles

The first lowland populations used in recurrent selection breeding had been developed by manual crossing by the CIAT Rice Program in the early 1990s (Drs E P Guimarães and F Correa) The populations were developed from Indica and Japonica parents and used to target blast resistance One gene pool and three populations were registered in the recurrent selection catalog as GPCT-1, PCT-2, and PCT-3 (Appendix 7)

Fixed lines were selected from GPCT-1 and PCT-3 at the Santa Rosa Experiment Station (a "hot spot" for blast evaluation)

***In 1996 A**, we selected 89 individual plants showing good characteristics for savanna conditions*

Cropping Season 1997

The 89 progenies were evaluated under savanna, acid-soil conditions at LES A total of 36 lines were selected (Table 11) Because these lines come from an Indica-Japonica recombination, Dr J Gibbons from FLAR shows interest in this material as having potential for lowland conditions

2 1 4 Upland Line Registration

CIAT does not register lines when a specific line does well in a given country, the national institution of that country may decide to name and release it for commercial cultivation

CIRAD has a mechanism by which breeders may register a specific material in a catalog The line is named CIRAD (and is also given its local synonym, if it is the result of collaborative work), and is registered as "working material"

History

During 1996, *two advanced lines--CNA-IRAT 5 \SA\0\3>127-2-M-2-M and CNA-IRAT A\SA\0\3>1-M-2-M-4-M selected from the populations CNA-IRAT 5 and CNA-IRAT A--were proposed for registration in the CIRAD rice catalog They are registered as CIRAD 410 and CIARD 411 respectively*

Cropping Season 1997

The results of the trial showed that 3 lines are very promising We will apply for their registration in the CIRAD rice catalog

3 POPULATION MAINTENANCE THROUGH RECOMBINATION

3 1 Cycles

Until now, the upland populations were maintained under irrigated conditions at Palmira But, results obtained in Madagascar under similar conditions show that a possible genetic drift toward an increased frequency of the Indica plant type may occur in the population Such a drift can be explained by a more effective cross-pollination among genotypes with an Indica background We must remember that the male-sterile line used to build up populations is an irrigated Indica line (IR 36 male-sterile mutant)

During the 1996 A cropping season *we decided to maintain and increase seed of upland populations under savanna conditions We maintained the following 6 populations CNA-IRAT 5/0/4 CNA-IRAT A/0/2, CNA-IRAT P/1/1 PCT-A\0\0\0, PCT-5\0\0\0, and PCT-4\0\0\1*

All male-sterile plants were identified, harvested individually, and their seeds mixed in equal proportions Fertile plants were also harvested individually and their seeds mixed in equal proportions

The resulting populations were identified as

Harvest of male-sterile plants	*Harvest of fertile plants*
CNA-IRAT 5/0/5	*CNA-IRAT 5/0/4F*
CNA-IRAT A/0/3	*CNA-IRAT A/0/2F*
CNA-IRAT P/1/2	*CNA-IRAT P/1/1F*

(Table 24) The best line (Latsidahy/FOFIFA 62-3) from last year's experiment was also the best in this year's on-farm trial, with an average grain production of 1400 kg/ha at 1600 masl The savanna upland check showed complete sterility at each farm If these results are confirmed in this semester's trials, we will register line Latsidahy/FOFIFA 62-3 in the CIRAD Rice Catalog

A survey was conducted with the five farmers to know what are the most desirable characteristics of a rice line Ranking at first and second places, respectively, are a high number of panicles and a short cycle (Tables 25 and 26) At the vegetative stage, the line that scored as having the highest acceptability was also the one that had the highest yield

The same set of 41 lines introduced from Madagascar was dispatched to the CIAT hillsides project for testing in Colombia and Central America

CHAPTER IV

RECURRENT SELECTION FOR LOWLAND RICE

CHAPTER IV

RECURRENT SELECTION FOR LOWLAND RICE

1 INTRODUCTION

The recurrent selection breeding project started by introducing different gene pools and populations developed in Brazil to Colombia by EMBRAPA Arroz e Feijão and CIRAD and to French Guiana by CIRAD

The germplasm was characterized at CIAT, Palmira, and the best-adapted populations were used to develop new populations by introducing new variability This resulted in three populations that were registered in the recurrent selection catalog as PCT-6, PCT-7, and PCT-8 This work was conducted at CIAT in close collaboration with Drs C Martinez and E P Guimarães

A gene pool was also built up, using a different source for the gene of male sterility The gene pool was registered as GPCT-9

Finally, a second gene pool, developed by CIRAD for temperate climates, was registered as GPIRAT-10

Descriptions of these populations and gene pools are presented in Appendix 7

2 FLAR/CIRAD RECURRENT SELECTION Recurrent Selection for Both Sexes for "Hoja Blanca"

Marc CHÂTEL, James GIBBONS, Jaime BORRERO, and *Monica TRIANA*

2 1 Introduction

One of FLAR's objectives is to focus on breeding Recurrent selection is an alternative method to conventional breeding and can be incorporated into FLAR's breeding activities

We applied the recurrent selection breeding method to existing germplasm for resistance to the "hoja blanca" virus vector (rice plant hopper, *Tagosodes orizicolus*) and the blast fungus, both considered as the most important biotic problems in the tropics

2 2 Cropping Season 1997

Three populations, PCT-6\0\0\2, PCT-7\0\0\0, and PCT-8\0\0\0 and the gene pool GPCT-9\0\0\0F were evaluated for resistance to the "hoja blanca" virus according to the methodology developed by CIAT

Each germplasm material and check were sown in the "hoja blanca" nursery At 45 days after sowing, the populations and checks were evaluated and the number of healthy and diseased plants counted (Table 27) In the nursery, the four original germplasm materials showed intermediate susceptibility to "hoja blanca" (the same level as that of the check Oryzica 1) After transplanting, PCT-7 and GPCT-9 presented a high number of plants with "hoja blanca" symptoms The two least susceptible germplasm materials were PCT-7 and PCT-8, with 18% and 19% of immune plants, respectively These plants will be recombined to complete the first cycle of recombination

Healthy plants of each germplasm material were transplanted separately for recombination with male-sterile plants The selected populations were PCT-6\HB\0\2, PCT-7\HB\0\0, PCT-8\HB\0\0, and GPCT-9\HB\0\0F The recombined populations, after the first cycle of selection, were identified as PCT-6\HB\1\2, PCT-7\HB\1\0, PCT-8\HB\1\0, and GPCT-9\HB\1\0F

Each germplasm with one cycle of selection-recombination will be evaluated for blast resistance at the Santa Rosa Experiment Station during 1998

3 RECURRENT SELECTION IN COLOMBIA

Hernando DELGADO, Marc CHÂTEL, and *Yolima OSPINA*
(Dr Hernando Delgado attended the International Course on Rice Recurrent Selection Breeding held at CIAT in 1996)

Last year we sent four germplasm materials (PCT-6\0\0\2, PCT-7\0\0\0, and PCT-8\0\0\0 populations and the gene pool GPCT-9\0\0\0F) to CORPOICA Regional 8 Each material was grown separately at LES for recombination, characterization, and selection of S0 fertile plants for line development The four materials performed well, with the PCT-6 and PCT-7 populations presenting the best potential Next year, these populations will be evaluated for blast resistance at the Santa Rosa Experiment Station

4 RECURRENT SELECTION IN COSTA RICA

Randolph C MORERA, Marc CHÂTEL, and *Jaime BORRERO*
(Dr Randolph C. Morera attended the International Course on Rice Recurrent Selection Breeding held at CIAT in 1996)

In 1996, we sent Costa Rica the Indica gene pool GPCT-9 and the population PCT-7 That same year, Dr Randolph C Morera of the National Rice Program attended the International Course on Rice Recurrent Selection Breeding held at CIAT The germplasm was characterized under Costa Rican conditions and maintained by harvesting male-sterile and fertile plants independently In 1997, the germplasm was used for line development by selecting S0 fertile plants

5 RECURRENT SELECTION IN EL SALVADOR

Ramon Eduardo SERVILLON, Marc CHÂTEL, and *Jaime BORRERO*

In 1995, we sent three populations (PCT-6, PCT-7, and PCT-8) and the gene pool GPCT-9 to the Centro Nacional de Tecnologia Agropecuaria y Florestal (CENTA), El Salvador

Line development In 1996, 141 and 97 S0 fertile plants were selected from the PCT-7 and PCT-8 populations, respectively

Population enhancement for grain yield, plant type, blast resistance, and grain quality The recurrent selection method used is based on S2 progeny evaluation and recombination from the remaining S0 seeds One hundred S2 lines from the PCT-7 population were evaluated at two different sites

New population development The population CNA IRAT ES 1/0/2 was developed by introducing 4 lines (X-10 CENTA A-1 CENTA A-2 and CENTA A-5) into the Brazilian population CAN IRAT 4/0/6 The new population has already passed through 2 cycles of recombination and S0 fertile plants were selected during 1997 B

PCT-5\0\0\1 *PCT-5\0\0\0F*
PCT-A\0\0\1 *PCT-A\0\0\0F*
PCT-4\0\0\2 *PCT-4\0\0\1F*

The populations were sent to CIAT, Palmira, and stored in a cold chamber until further use by the project or requested by regional NARS breeding programs

3 2 Cropping Season 1997

As we have enough seed, no new maintenance of this germplasm was made, except for the PCT-5 population

4 POPULATION ENHANCEMENT BY RECURRENT SELECTION

The CIAT rice project emphasizes the enhancement of populations and is phasing out the production of fixed lines for direct release by the NARS of the region The strategy is to develop and enhance gene pools and populations for well-targeted traits for use as sources of potential parents by national breeding programs

In the first 2 years of the recurrent selection project, we concentrated on introducing germplasm from Brazil (EMBRAPA Arroz e Feijão and CIRAD) and French Guiana, and characterizing and mass selecting it From 1995 onward, we concentrated our activities on enhancing and developing new populations

4 1 Recurrent Selection Based on S2 Line Evaluation Population PCT-4\0\0\1

4 1 1 Cycles

***During 1995 A**, at LES 159 S0 fertile plants were selected*

***During 1995 B**, the S1 generation was grown at PES*

***During 1996 A**, we started the first recurrent selection cycle*

- ***Evaluation** 152 lines of S2 and 2 checks (Oryzica Sabana 6 and CIRAD 409) were evaluated and selected at LES under the "Augmented Blocks" statistical design (7 Appendix 6)*
- ***Selection** Results of the S2 trial were analyzed and 53 S2 lines were selected*

- ***Recombination*** *In 1996 B, at PES, remaining seeds from the S0 plants from which originated the selected S2 lines were mixed and grown to develop the recombined enhanced population*
- ***Identification*** *The enhanced recombined population was identified as PCT-4\SA\1\1*

4 1 2 Cropping Season 1997

The population PCT-4\SA\1\1 was grown at LES to go through a second selection cycle

4 1 2 1 Selection of Fertile Plants

A total of 155 S0 plants were selected, and a sample of each S0 seed was stored in the cold chamber The S1 generation will be grown during 1997 B at PES, and S2 seeds harvested The S2 lines will be evaluated during 1998 A at LES

4 1 2 2 Harvest of Male-Sterile Plants

Male-sterile plants were harvested individually and their seeds mixed in equal proportions to complete the second cycle of recombination of the population selected once The second cycle of recombination is identified as PCT-4\SA\2\1 Seed will be stored in the cold chamber for future use

4 2 Mass Recurrent Selection for Both Sexes for "Hoja Blanca", Blast, and Major Agronomic Traits Populations PCT-4\0\0\1, PCT-A\0\0\0, and PCT-5\0\0\0

4 2 1 Cycles

During 1995 A, *at LES, we eliminated at the vegetative stage all plants showing symptoms of leaf blast and HBV At harvest we selected male-fertile plants Seeds produced by these plants were the result of fertilization with pollen produced by healthy fertile plants We selected 102, 99 and 96 male-sterile plants from PCT-5\0\0\0, PCT-A\0\0\0, and PCT-4\0 0\1 respectively, and their seeds were mixed in equal proportions*

The first mass recurrent selection cycles (selection and recombination) were identified as PCT-5\PHB\1\0 - PCT-A\PHB\1\0 and PCT-4\PHB\1\1, respectively

During 1996 A, the seed mixture of each population with one mass recurrent selection cycle was grown at LES

To develop the second recurrent selection cycle the same selection method as that used during 1995 A was applied We selected 304, 341, and 442 healthy male-sterile plants, fertilized with pollen of fertile healthy plants, from PCT-5\PHB\1\0, PCT-A\PHB\1\0, and PCT-4\PHB\1\1, respectively, and mixed their seeds in equal proportions

The second mass recurrent selection cycles (selection and recombination) were identified as PCT-5 PHB\1\0,PHB\1 - PCT-A\PHB\1\0,PHB\1, and PCT-4\PHB\1\1,PHB\1, respectively

4 2 2 Cropping Season 1997

During 1997 A, the seed mixture of each population with two mass recurrent selection cycles was grown at LES (Table 12)

To make the third recurrent selection cycle, the same selection method as that used during 1995 A and 1996 A was applied (all plants with symptoms of leaf blast and "hoja blanca" were eliminated during their vegetative stage) We selected 218, 253, and 165 healthy male-sterile plants, fertilized with pollen from fertile healthy plants, from PCT-5\PHB\1\0,PHB\1, PCT-A\PHB\1\0,PHB\1, and PCT-4\PHB\1\1,PHB\1, respectively, and their seeds mixed in equal proportions The third mass recurrent selection cycles (selection and recombination) are identified as PCT-5\PHB\1\0,PHB\1,PHB\1, PCT-A\PHB\1\0,PHB\1,PHB\1, and PCT-4\PHB\1\1,PHB\1,PHB\1 Fertile plants were selected for line development In each population, 41, 13, and 12 S0 fertile plants, respectively, were harvested The S1 generation will be gown during 1997 B at PES

Tables 13 and 14 present the characteristics of the basic and enhanced populations through one and two cycles of recurrent selection for blast resistance and early maturity In relation to leaf blast, one cycle of recurrent selection reduces the level of susceptibility from an average of 40% to less than 5% For early maturity, the distribution of the proportion of early plants in the different populations is maintained during the selection process

Tables 15, 16, and 17, and the associate figures show the distribution for leaf blast in the S2 and S4 lines from the basic and enhanced populations with one cycle of recurrent selection The trend is the same for each basic population The S2 lines from the enhanced populations presented a higher number of resistant lines

Tables 18 and 19, and the associate figures show the distribution for early maturity in the S2 and S4 lines of the basic populations, and Table 20 and its associate figure for early maturity of S2 lines of the first recurrent selection cycle The earliest maturing lines came from the population PCT-4

5 DEVELOPMENT OF NEW POPULATIONS

The development of new populations is a major activity of the project, and provides the main source of new recombined variability for population enhancement and line development We need to be well focused in our choice of variability and recombine in new germplasm, as well as in the source of male sterility available (usually a well-adapted existing population or gene pool)

In 1996 B, we decided to build up at PES two new Japonica populations, targeting upland savannas and hillsides The source of male-sterility background is the best Japonica population previously developed by the project

5 1 Upland Savanna Population

The idea behind developing that population is to pool the best lines from the CIAT conventional rice breeding project and the commercial varieties released in Brazil, Colombia, and Bolivia

5 1 1 Cycles

***In 1996 B**, 18 lines were selected according to their performance for early maturity, blast and acid-soil tolerance and grain quality Male-sterile plants from the best-adapted upland Japonica population (PCT-4) were used as female parents Each line was crossed with at least four male sterile-plants of the population PCT-4*

5 1 2 Cropping Season 1997

During 1997 A, at PES, each resulting F1 was grown individually, evaluated, and individual plants selected The F2 seed of the selected F1 plants were bulked in equal proportions Each F2 bulk was mixed in balanced proportions to build up a new basic population, identified as PCT-11\0\0\0

During 1997 B, at PES, the basic population will be recombined once The first cycle of recombination of the basic population will be identified as PCT-11\0\0\1

5 2 Upland Hillside Population

The idea is to develop a population for the Andean highlands of Colombia, with early maturity, cold tolerance, and adaptability to high altitudes (1300-1600 masl)

5 2 1 Cycles

***In 1996 B**, 11 lines--6 from the CIRAD/FOFIFA hillsides program of Madagascar, 4 from the CIAT upland savannas program, and 1 IRAT line--were selected according to their previous evaluations at high altitudes for early maturity and spikelet fertility*

We used the best-adapted upland Japonica population (PCT-4) as a source for male sterility Each line was crossed with at least 4 male-sterile plants of PCT-4

5 2 2 Cropping Season 1997

During 1997 A, at PES, each resulting F1 generation was grown individually, evaluated, and individual plants selected The F2 seeds of the selected F1 plants were bulked in equal proportions Each F2 bulk was mixed in balanced proportions to build up the new basic population, identified as PCT-13\0\0\0

During 1997 B, at PES, the basic population will be recombined once The first cycle of recombination of the basic population will be identified as PCT-13\0\0\1

6 REGISTERING NEW POPULATIONS

In 1997, one gene pool, developed by manual crossing (without using male sterility) for durable resistance to blast, was proposed for registration in the Recurrent Selection Catalog (managed by CIAT and CIRAD, and specifically for germplasm developed through recurrent selection) The gene pool was built up in the Philippines by Dr Brigitte Courtois as part of the collaborative project between CIARD and IRRI It was registered as GPIR-22, a description is given in Appendix

7 DISTRIBUTING GERMPLASM TO BRAZIL

A total of 537 breeding lines and 2 recurrent populations (PCT-11\0\0\0 and PCT-11\0\0\1) were sent to EMBRAPA Arroz e Feijão

8 DISTRIBUTING UPLAND-RICE GERMPLASM BRED BY RECURRENT SELECTION

Since 1995 we started to release recurrent populations and gene pools to NARS in Latin America, West Africa, and Asia (Table 28)

9 IDENTIFYING UPLAND-RICE GERMPLASM

The description and genetic constitution of the populations and gene pools in this report are given in Appendix 7

According to the "Nomenclature System for Rice Gene Pools, Populations and Recurrent Selection Breeding General Use and Catalogue Registration" (5, Appendix 6), the meanings of the germplasm identifications used in the text are as follows

Introduced Gene Pool from Brazil (CNPAF/IRAT) CNA-IRAT 5

CNA-IRAT5/0/4	4 recombinations of the basic gene pool
CNA-IRAT5/0/4F	Harvest of fertile plants from the 4th recombination of the basic gene pool
CNA-IRAT5/0/5	5 recombinations of the basic gene pool

Introduced Population from Brazil (CNPAF/IRAT) CNA-IRAT A

CNA-IRAT A/0/2	2 recombinations of the basic population
CNA-IRAT A/0/2F	Harvest of fertile plants from the 2nd recombination of the basic population
CNA-IRAT A/0/3	3 recombinations of the basic population

Introduced Population from Brazil (CNPAF/IRAT) CNA-IRAT P

CNA-IRAT P/1/1	1 selection followed by 1 recombination
CNA-IRAT P/1/1F	Harvest of fertile plants of the population selected and recombined once
CNA-IRAT P/1/2	1 selection followed by 2 recombinations

Enhancement of Population CNA-IRAT A for acid soils 3 Selection-Recombination Cycles
The New Enhanced Population is PCT-A

PCT-A\0\0\0	Basic population
PCT-A\0\0\0F	Harvest of the fertile plants from the basic population
PCT-A\0\0\1	1 recombination of the basic population
PCT-A\PHB\1\0	One selection for blast (P) and "hoja blanca" virus (HB) in the basic population, followed by one recombination
PCT-A\PHB\1\0,PHB\1	Second round of selection for blast (P) and "hoja blanca" virus (HB), followed by 1 recombination
PCT-A\PHB\1\0,PHB\1,PHB\1	Third round of selection for blast (P) and "hoja blanca" virus (HB), followed by 1 recombination

Population Developed by CIAT and CIRAD PCT-4

PCT-4\0\0\1	1 recombination of the basic population
PCT-4\0\0\1F	Harvest of fertile plants of the 1 recombination of the basic population
PCT-4\0\0\2	2 recombinations of the basic population
PCT-4\PHB\1\1	One selection for blast (P) and "hoja blanca" virus (HB) in the first recombination of the basic population, followed by one recombination
PCT-4\PHB\1\1,PHB\1	Second round of selection for blast (P) and "hoja blanca" virus (HB), followed by 1 recombination
PCT-4\PHB\1\0,PHB\1,PHB\1	Third round of selection for blast (P) and "hoja blanca" virus (HB), followed by one recombination
PCT-4\SA\1\1	One selection for acid soils (SA) in the first recombination of the basic population, followed by one recombination
PCT-4\SA\2\1	One selection for acid soils (SA) in the first recombination of the basic population, followed by two recombinations

Enhancement of the Gene Pool CNA-IRAT 5 for Acid Soils after 3 Selection-Recombination Cycles
The New Enhanced Population is PCT-5

PCT-5\0\0\0	Basic population
PCT-5\0\0\1	1 recombination of the basic population
PCT-5\PHB\1\0	One selection for blast (P) and "hoja blanca" virus (HB) in the basic population, followed by one recombination
PCT-5\PHB\1\,PHB\1	Second round of selection for blast (P) and "hoja blanca" virus (HB), followed by 1 recombination
PCT-5\PHB\1\0,PHB\1,PHB\1	Third round of selection for blast (P) and "hoja blanca" virus (HB), followed by 1 recombination

Population Developed by CIAT and CIRAD PCT-11

PCT-11\0\0\0	Basic population
PCT-11\0\0\1	Basic population recombined once

Population Developed by CIAT and CIRAD PCT-13

PCT-13\0\0\0	Basic population
PCT-13\0\0\1	Basic population recombined once

Gene Pool and Population Developed by CIAT (manual crossing)

GPCT-1	Basic gene pool
PCT-2	Enhanced population for blast resistance
PCT-3	Enhanced population for blast resistance

Gene Pool and Population Developed by IRRI and CIRAD (manual crossing)

GPIR-22	Basic gene pool

CHAPTER III

CONVENTIONAL BREEDING FOR UPLAND RICE FOR SAVANNAS AND HIGHLANDS

CHAPTER III

CONVENTIONAL BREEDING FOR UPLAND RICE FOR SAVANNAS AND HIGHLANDS

1 SAVANNA UPLAND RICE

Marc CHÂTEL, Yolima OSPINA, and *Jaime BORRERO*

As was stated earlier, we are gradually phasing out most of the activities involved in the development of fixed lines for direct release by NARS

In 1996 B, we sent savanna upland lines (F4 and F5 generation) to EMBRAPA Arroz e Feijão for observation and seed increase These lines were sent back to CIAT, Palmira, in 1997

1 1 Upland Lines from Brazil

We received from EMBRAPA Arroz e Feijão a set of 18 Brazilian lines (Table 21) to evaluate under more acid-soil conditions than are found in Brazil

1 2 Use of CIAT/CIRAD Savanna Lines in Brazil

During our visit to EMBRAPA Arroz e Feijão, we had the opportunity to track back the use of CIAT lines in the breeding program of this Center The results of the survey, for the 1996/1997 cropping season, showed that the CIAT/CIRAD savanna materials are very useful for the Brazilians at each step of their breeding program (Table 22) On average, 57% and 58% of the lines used in trials and for segregating generations, respectively, come from the CIAT/CIRAD breeding project

About 51% of CIAT/CIRAD lines are used as parents by EMBRAPA Arroz e Feijão The main characteristics they like from our lines are grain quality and plant type

1 3 New Partners Interested in Savanna Upland Lines

During 1997 B, we increased seed of the Latin American breeding or fixed lines that we received back from Brazil and were in demand by identified new partners and the CIRAD rice program The new partners are Colombia (North Coast), southern Brazil (IRGA), Argentina (Tucuman Region), and China (Yunnan and Jiangxi Provinces)

In 1995, we sent China the first set of savanna lines from Brazil and CIAT/CIRAD as part of a collaborative project between the Foods Crops Research Institute (of the Yunnan Academy of Agricultural Science, Kunming) and CIRAD Preliminary results are highly promising, showing good immediate adaptation and acceptability

This year, Dr Tao Dayun sent us a letter in which he stated that the savanna upland line CT 9278-11-14-2-1-M is a strong candidate for immediate release he genetic constitution of this line is presented in Table 23

1 4 Seed Multiplication

In Colombia, in 1996 and 1997, the demand for seed of savanna upland rice for the Eastern Plains was very high, but supplies were insufficient CORPOICA decided to increase seed of two released lines, Oryzica Sabana 6 and Oryzica Sabana 10 We began G0 generation at LES

1 5 Line Release

Since 1995, 'Linea 30' has shown promise but has so far not been released because of the adjustment plan for CORPOICA Regional 8 Last year, the line was registered as CIRAD 409, and this year, CORPOICA wants to release it We have therefore started producing basic genetic seed

2 HIGHLAND UPLAND RICE

Marc CHÂTEL, Argemiro MORENO-B, Jaime BORRERO, and *Carlos QUIROS*

The Andean Mountains range across Colombia from south to north, rising to almost as high as 6000 masl The most important agricultural activity in the mid-altitudes (1000-2000 masl) of this area is coffee, planted by small farmers This crop takes at least 3 years to reach commercial productivity, but, in the meantime, farmers must use considerable resources to control weeds and prevent erosion With this cropping system in mind, CENICAFE has been working on different alternatives for crop diversification to help farmers earn income while waiting for the coffee to reach commercial productivity

Another area of significant agricultural activity by small farmers is in the Department of Cauca, southwestern Colombia, where new crops are being incorporated into existing cropping systems or new ones developed by CIAT to ensure local food security

2 1 History

To identify upland germplasm adapted to the hillside areas of Colombia, the CIAT/CIRAD rice project, together with CENICAFE, started, in 1993, to evaluate 31 selected savanna lines in the heart of the coffee-growing area, at 1300 masl Climatic data collected at the main site show annual average temperatures ranging from 23 1 to 20 6 °C The monthly average maximum (28 5 °C) occurs in February and the minimum (16 9 °C) in September The germplasm for this region must therefore tolerate cold (i e , have high spikelet fertility)

The lines used for the first trial were selected from the savanna upland germplasm collection at CIAT Selection was based on knowledge previously gained from the CIRAD/FOFIFA Highland Rice Project in Madagascar Upland lines must be early maturing and tolerate cold (as measured by panicle fertility)

Results obtained in La Catalina, Department of Risaralda showed that the percentages for empty grains ranged from almost 100% to 12%, indicating that the germplasm presented variability for cold tolerance Growing period extended to about 150 days after sowing (DAS), compared with 120 DAS under savanna conditions

Selection concentrated on lines with at least 60% fertility The average grain yield of the six best-adapted lines was higher than expected, ranging from 3775 to 5592 kg/ha

***In 1993**, upland lines developed by CIRAD/FOFIFA for the highlands of Madagascar were introduced to Colombia and seed increased The new germplasm was distributed to CENICAFE and the hillside project at CIAT*

***In 1994**, line evaluation started in the Department of Cauca*

***In 1995**, the Centro Internacional de Agricultura Organica (CIAO) began evaluations at 1600 masl*
The first results were presented at the Conference on Rice for the Highlands in Madagascar in April 1996

2 2 Cropping Seasons 1996-1997

2 2 1 Coffee Region – CENICAFE and CIAO

Line CT 10069-27-3-1-4, well adapted to the mid-altitudes, was used in a trial with young coffee trees Considering the potential of this line over time (average yield grain production of 4 t/ha), we decided to register it in the CIRAD Rice Catalog

2 2 1 1 Germplasm Introductions

Forty-one new lines were introduced from Madagascar to Colombia and seed increased at CIAT, Palmira, and then dispatched to CENICAFE, CIAO, and CIAT's hillsides project

2 2 1 2 Crosses

Eleven single crosses were made at PES between line CT 10069-27-3-1-4 and 10 lines from Madagascar and CIRAD, previously selected for their good performance under highland conditions The F1 generation was grown during 1997 A at PES, and the F2 seed sent to our partners

2 2 2 Department of Cauca and Central America

In the Department of Cauca, the five best lines were selected last year and, with one savanna upland check (CIRAD 409), tested this year on farm by five smallholders

6 RECURRENT SELECTION IN PANAMA

Ariel E JAEN SANCHEZ, Marc CHÂTEL, and *Jaime BORRERO*
(Dr Ariel E JAEN SANCHEZ attended the International Course on Rice Recurrent Selection Breeding held at CIAT in 1996)

In 1996, we sent Panama the Indica gene pool GPCT-9 and the population PCT-7 That same year, Dr Ariel E Jaen Sanchez of the Faculty of Agricultural Sciences, Universidad de Panama, attended the International Course on Rice Recurrent Selection Breeding held at CIAT The introduced germplasm was grown and its characterization started But, because of water shortages, irrigation was a problem The materials suffered and the work could not be completed Nevertheless, from each material, the earliest S0 fertile plants were harvested New samples from the recurrent populations were sent to Panama

7 RECURRENT SELECTION IN VENEZUELA

Eduardo GRATEROL, Marc CHÂTEL, and *Yolima OSPINA*
(Dr Eduardo Graterol attended the International Course on Rice Recurrent Selection Breeding held at CIAT in 1996)

After attending the International Course on Rice Recurrent Selection Breeding, three populations (PCT-6, PCT-7, and PCT-8) and three gene pools (IRAT 1/420P, IRAT MANA, and GPCT-9) were sent to Dr E Graterol, for characterization under local conditions in Calabozo, Guarico State The objective of the characterization was to select the best-adapted germplasm to start a recurrent selection program The traits evaluated in each germplasm material were time to flowering, tillering ability, plant height, and disease tolerance (of leaf-and-neck blast, brown spot, sheath blight, and sheath rot)

Two populations, PCT-6 and PCT-7, were selected as the best introduced material to be used as sources of male-sterile background to develop two new local populations, identified as PFD-1 and PFD-2

PFD-1

Male-sterile plants of PCT-6 were crossed with 5 lines

FONAIAP 1
IR 62140-48-3-1-2-3
CT 10310-15-3-2P-4-3
CT 9868-3-2-3-1-4P-M-1-1P
CT 9509-17-3-1-1-M-1-3P-M-1

PFD-2

Male-sterile plants of PCT-6 were crossed with 4 lines

CT 9868-3-2-3-1-4P-M-1-1P	IR 62140-48-3-1-2-3
CT 10310-15-3-2P-4-3	CT 9509-17-3-1-1-M-1-3P-M-1

8 RECURRENT SELECTION IN THE SOUTHERN CONE

8 1 Recurrent Selection in Argentina

Maria Antonia MARASSI, Juan Eduardo MARASSI, Marc CHÂTEL, and *Jaime BORRERO*

In December 1996, we supplied the Universidad de Corrientes with the populations PCT-6\0\0\0, PCT-7\0\0\0, and PCT-8\0\0\0 They were sown at the experimental field of the Company "La Arrocera Argentina", Villaguay, State of Entre Rios They were observed and characterized The populations were multiplied by harvesting male-sterile plants The resulting populations were identified as PCT-6\0\0\1, PCT-7\0\0\1, and PCT-8\0\0\1

Fertile plants showing potential were selected and harvested individually for line development From the respective populations, 17, 14, and 34 S0 fertile plants were selected and given the following identification PCT-6>Arg-1 to 17, PCT-7>Arg-1 to 14, and PCT-8>Arg-1 to 34

For 1997 B, we plan to develop a specific population by crossing 6 varieties (IRGA 417, CYPRESS, R P 2, TAIM, Don Juan INTA, and CH 4-7) with male-sterile plants of each population

Argentina has a project for developing the Pampas Region, where climatic conditions are similar to those present in Chile, along the latitude with Chillan City, 400 km south of Santiago The Universidad de la Plata has, consequently, expressed keen interest in our collaborative effort with Chile The gene pool GPIRAT-10 and the population PQUI-1, together with Chilean and European lines, may be useful for the Pampas

8 2 Recurrent Selection in Chile

Roberto ALVARADO, Santiago HERNAIZ, Marc CHÂTEL, and *Jaime BORRERO*
(Dr Santiago Hernaiz attended the International Course on Rice Recurrent Selection Breeding held at CIAT in 1996)

In 1996, we sent Chile the Japonica gene pool GPIRAT-10, which was especially developed by CIRAD for temperate climates That same year, Dr Santiago Hernaiz from INIA-Quilamapu attended the International Course on Rice Recurrent Selection Breeding held at CIAT

In 1997, the gene pool was grown for characterization and selection of the best fertile plants for line development It was also used as a source of male sterility to build up a local population by crossing five Chilean lines (Qui 67108, Diamante, Buli, CINIA 609, and CINIA 606) with male-sterile plants of the gene pool Some of the hybrid seeds were sent to CIAT, Palmira, for growing the F1 generation (Chile has only one cropping season per year) The F2 seed was shipped back to Chile in September 1997 The basic Chilean population was named PQUI-1\0\0\0

At CIAT, Palmira, during 1997 B, we will conduct the first cycle of recombination to ensure seed increase for future use The first cycle of recombination will be identified as PQUI-1\0\0\1

8 3 Recurrent Selection in Uruguay

Fernando PEREZ DE VIDA, Marc CHÂTEL, and *Jaime BORRERO*
(Dr Fernando Perez de Vida attended the International Course on Rice Recurrent Selection Breeding held at CIAT in 1996)

In 1996, we sent Chile the Japonica gene pool GPIRAT-10 That same year, Dr Fernando Perez de Vida from INIA-Treinta y Tres attended the International Course on Rice Recurrent Selection Breeding held at CIAT

In 1997, the gene pool was grown for characterization and selection of the best fertile plants for line development It was also used as a source of male sterility to build up a local population by crossing selected Uruguayan lines with male-sterile plants of GPIRAT-10

9 MAINTAINING GERMPLASM BRED BY RECURRENT SELECTION

Because we manage the Register for rice germplasm bred by recurrent selection we also have the responsibility to ensure the presence of sufficient seed in the germplasm bank The seed of the following germplasm was increased during 1997 A at PES IRAT MANA, IRAT LULU GPIRAT-10, GPCT-9, PCT-8, PCT-7, and PCT-6

10 DISTRIBUTING LOWLAND-RICE GERMPLASM BRED BY RECURRENT SELECTION

Since 1995 we started to release recurrent selection populations and gene pools to NARS in Latin America and in countries of West Africa Asia and Europe (Table 28)

11 LINE DEVELOPMENT THROUGH ANTHER CULTURE

Zaida LENTINI Marc CHÂTEL James GIBBONS and *Yolima OSPINA*

In 1994, we introduced the population IRAT-CT from French Guiana This population comes from the enhancement of the Indica gene pool GPCNA-18 for anther culture response

11 1 Cycles

One cycle of selection-recombination for anther culture response was previously made in Brazil at EMBRAPA Arroz e Feijão This gave rise to the population identified as IRAT-CT From 1995 the anther culture laboratory at CIAT processed the population IRAT-CT and R2 lines were developed

11 2 Cropping Season 1997

The R2 lines were evaluated by FLAR at the Santa Rosa Experiment Station and five were selected (Table 29)

12 IDENTIFYING LOWLAND-RICE GERMPLASM

The description and genetic constitution of the populations and gene pools presented in this report are given in Appendix 7

According to the "Nomenclature System for Rice Gene Pools, Populations and Recurrent Selection Breeding General Use and Catalogue Registration" (5, Appendix 6), the meanings of the germplasm identifications used in the text are as follows

Introduced Population from French Guiana IRAT LULU

IRAT LULU/0/2	Basic population recombined two times

Populations Developed by CIAT and CIRAD PCT-6

PCT-6\0\0\0	Basic population
PCT-6\0\0\1	Basic population recombined once
PCT-6\0\0\2	Two recombinations of the basic population
PCT-6\HB\0\2	One selection for hoja blanca' (HB) from the second recombination cycle of the basic population
PCT-6\HB\1\2	One selection for hoja blanca' (HB) from the second recombination cycle of the basic population followed by one recombination

Populations Developed by CIAT and CIRAD PCT-7

PCT-7\0\0\0	Basic population
PCT-70\0\1	Basic population recombined once
PCT-7\HB\0\0	One selection for 'hoja blanca" (HB) from the basic population
PCT-7\HB\1\0	One selection for 'hoja blanca" (HB) in the basic population, followed by one recombination

Populations Developed by CIAT and CIRAD PCT-8

PCT-8\0\0\0	Basic population
PCT-8\0\0\1	Basic population recombined once
PCT-8\HB\0\0	One selection for "hoja blanca" (HB) from the basic population

PCT-8\HB\1\0	One selection for "hoja blanca" (HB) from the basic population, followed by one recombination

Populations Developed by INIA-Chile PQUI-1

PQUI-1\0\0\0	Basic population
PQUI-1\0\0\1	Basic population recombined once

Gene Pool Developed by CIAT and CIRAD GPCT-9

GPCT-9\0\0\0F	Harvest of the fertile plants of the basic population
GPCT-9\\0\0\1	Basic population recombined once
GPCT-9\HB\0\0F	One selection for "hoja blanca" (HB) from the basic population maintained through fertile plants
GPCT-9\HB\1\0F	One selection for "hoja blanca" (HB) from the basic population maintained through fertile plants, followed by one recombination

Gene Pool Developed by CIRAD GPIRAT-10

GPIRAT-10\0\0\0	Basic gene pool

Gene Pool Developed by EMBRAPA and CIRAD CNA IRAT 4

CNA IRAT 4/0/6	Six recombinations of the basic gene pool

Population Developed by El Salvador (CENTA) CNA IRAT ES 1

CNA IRAT ES 1/0/2	Two recombinations of the population

TABLES

Table 1 Soil analysis of the experimental site (Lote Loma 5) at 'La Libertad Experiment Station Colombia 1997 cropping season

No	Depth (cm)	O M (%)	P Bray II (ppm)	pH	Al	Ca	Mg	K	C I E	B	Zn	Mn	Cu	Al sat (%)
					(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% and loam = 17 5%

Table 2 Climatic characteristics of the 1997 cropping season at 'La Libertad" Experiment Station, Colombia

Characteristic	April	May	June	July	Aug	Sept	Total
Rainfall (mm)	252	454 5	242 5	268 5	257 2	381	1855 7
Days of rain (no)	11	15	11	15	10	9	71
Temperature (maximum °C)	30 9	30 3	30 3	28 6	30 9	31 7	-
Temperature (minimum °C)	21 2	20 2	20 3	20 1	20 3	20 3	-
Relative humidity (%)	68 6	101 7	75 2	78 5	69 9	74 6	-

Table 3 Agronomic management of the experimental site (Lote Loma 5) at La Libertad Experiment Station, Colombia cropping season 1997

Activity	Dosage	Date
1 SOIL PREPARATION		February
- Chisel		March
- Lime application		April
- Light offset		
2 SOWING		
- Blast spreaders		1 April
- Rice crop		21 April
- Maize fences		8 May
3 FERTILIZATION (kg/ha)		
- <u>Before sowing</u>		
Dolomite lime	300	15 March
Triple superphosphate	60	20 April
($46\%\ P_2O_5$)	30	20 April
KCl ($60\%\ K_2O$)		
- <u>After sowing</u>		
KCl ($60\%\ K_2O$)	15	12 May
	15	22 May
Urea (46% N)	20	12 May
	20	22 May
	10	2 June
	10	23 June
4 CHEMICAL CONTROL (L/ha)		
- Propanil 500	4	April-May
- Machete	1	
- Basagran	3	
- Round Up	3	

Table 4 Incidence of leaf and neck blasts on international differentials and commercial lines, La Libertad Experiment Station, Colombia 1997 A

Line	Lesion type*	Leaf blast evaluation **		Neck blast evaluation**
		1a	2a	
Kusabue	3 4	3	3	3
Sha-Tiao-Tsao	5	5	6	9
K-59	1	1	2	1
Fujisaka-5	5	4	5	7
Shin 2	1	1	4	1
Fukunishiki	1(3)	2	3	1
K-1	3	2	4	5
K-8	1	1	2	1
PI No 4	5	7	9	7
Caloro	5	7	9	-
Bl-1	5	6	7	7
Usen	5	8	5	5
Kanto 51	5	4	3(4)	1
IR 42	3	3	8	-
Zenith	5	6	8	-
Aichi-Asahi	5	7	8	7
NP 125	5	3	4	1
Peta	5	8	8	-
Chokoto	1(3)	2	2	1
Raminad STR3	5	8	9	-
Kataktara DA2	5	6	6	5
Fanny	7	9	9	-
Dulor	5	6	6	5
Tetep	5	4	7	5
O Sabana 6	5	3	4	1
BB I T 50	5	4	5	5
Colombia 1	5	4	5	7
O Llanos 5	5	4	4	3
IAC 165	5	3	3	1
Ceysvoni	5	3(4)	4	3
CICA 4	5	8	9	-
CICA 6	5	5	6	7
CICA 7	5	7	8	7
CICA 8	5	5	8	-
CICA 9	5	7	8	7
Oryzica 1	5	8	9	7
Oryzica 2	5	4	4	3

Oryzica 3	5	4	6	7
O Caribe 8	5	9	9	-
Linea 6	3	3	3	3
Metica 1	5	8	9	-
IR 8	5	8	9	-
Tsuyuake	5	3	4	5
Moroberekan	3	3	3 4	1
Taichung	5	8	9	-
O Yacu 9	5	6	8	5
IRAT 13	1	1	1	1
Linea 2	5	5	7	5
O Llanos 4	5	5	6	7
Selecta 3-20	5	7	7	5
IR 22	5	6	8	7
Tailandia 5	5	6	7	5
O Sabana 10	3	3	3	1
Carreon	1	1	2(3)	3
Isol 8	5	8	8	7
Isol 10	5	9	9	-

* Data from the rice pathology project

** Standard evaluation scale (1 to 9)

Table 5 Characteristics of the S2 lines selected in the population PCT5\PHB\1\0, PCT-A\PHB\1\0, and PCT-4\PHB\1\1 (on cycle of mass selection of both sexes for blast and 'hoj blanca'), 'La Libertad' Experiment Station Colombia 1997 A

No	Field no 1997 A	Pedigree	Vg	Bl 1	Bl 2	AC	Fl (50%)	LSc	BS	NBl	Gd
1	720029	PCT-5\PHB\1\0>1165-M	1	2	1	1	74	3	1	3	3
2	720051	PCT-A\PHB\1\0>161-M	3	3	3	1	71	3	1	3	1
3	720093	PCT-A\PHB\1\0>1443 M	1	3	3	1	63	3	1	1	1
4	720107	PCT-4\PHB\1\1>145-M	3	1	1	1	62	1	1	3	1
5	720109	PCT-4\PHB\1\1>196-M	1	1	1	1	63	3	3	5	1
6	720110	PCT-4\PHB\1\1>209-M	1	2	2	1	63	1	1	3	1
7	720111	PCT-4\PHB\1\1>231-M	1	2	3	1	62	3	1	1	3
8	720112	PCT-4\PHB\1\1>277 M	1	1	2	1	63	3	1	1	1
9	720116	PCT-4\PHB\1\1>268-M	1	2	3	1	59	3	1	1	1
10	720121	PCT-4\PHB\1\1>453 M	1	3	4	1	61	3	1	1	3
11	720123	PCT-4\PHB\1\1>485-M	1	2	2	1	71	[illegible]	1	1	1
12	720128	PCT-4\PHB\1\1>538-M	1	3	3	1	81	1	1	1	3
13	720131	PCT-4\PHB\1\1>582-M	1	1	3	1	74	5	1	1	3
14	720133	PCT-4\PHB\1\1>603-M	3	1	1	1	73	5	1	1	3
15	720137	PCT-4\PHB\1\1>749-M	1	3	2	1	77	1	1	1	1
16	720138	PCT-4\PHB\1\1>751-M	1	3	2	1	60	3	1	1	1
17	720139	PCT-4\PHB\1\1>752-M	1	3	3	1	71	1	1	1	3
18	720140	PCT-4\PHB\1\1>783-M	1	1	2	1	62	1	1	1	1
19	720142	PCT-4\PHB\1\1>822-M	1	1	1	1	63	1	1	1	1
20	720146	PCT-4\PHB\1\1>846-M	3	3	3	1	63	1	1	1	1
21	720147	PCT-4\PHB\1\1>856-M	1	1	2	1	81	3	1	1	3
22	720154	PCT-4\PHB\1\1>994-M	3	1	1	1	63	1	1	1	1
23	720180	PCT-4\PHB\1\1>1332-M	3	2	4	1	77	1	1	1	3
24	720206	PCT-4\PHB\1\1>1678-M	3	1	1	1	65	1	1	1	1
25	720209	PCT-4\PHB\1\1>1723-M	3	1	2	1	63	3	1	1	1

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = soil acidity reaction Fl = flowering LSc = leaf scald BS = brown spot NBl = neck blast Gd = grain discoloration

Table 6 Characteristics of the S4 lines selected in the basic populations PCT 5\0\0\0 PCT-A\0\0\0 and PCT-4\0\0\1 'La Libertad Experiment Station, Colombia, 1997A

No	Field no 1997 A	Pedigree	Vg	Bl 1	Bl 2	AC	Fl (50%)	LSc	BS	NBl	Gd	Sel no	Ht
1	740011	PCT 5\0\0\0>1496-M 1 M	3	3	3	1	62	3	1	1	1	6	88
2	740033	PCT 5\0\0\0>2130-M 2 M	1	3	3	1	62	3	1	1	1	6	104
3	740042	PCT-5\0\0\0>2314-M 1 M	1	1	3	1	76	3	1	1	1	6	103
4	740070	PCT A\0\0\0>175-M 1 M	3	1	1	1	80	3	1	1	1	6	118
5	740072	PCT A\0\0\0>175-M 3-M	1	3	2	1	77	3	1	1	1	6	119
6	740073	PCT A\0\0\0>175-M 4-M	3	3	2	1	73	3	1	1	1	6	120
7	740075	PCT A\0\0\0>175-M 6-M	1	1	1	1	66	5	1	1	1	6	105
8	740077	PCT A\0\0\0>189-M 1 M	1	2	1	1	62	3	1	1	1	6	87
9	740078	PCT A\0\0\0>189-M 2 M	3	1	1	1	60	3	1	1	1	6	94
10	740079	PCT A\0\0\0>189-M-3-M	3	1	1	1	61	3		1	1	6	94
11	740080	PCT A\0\0\0>189-M-4-M	1	1	1	1	61	1	1	1	1	6	93
12	740081	PCT A\0\0\0>278 M 1 M	1	1	1	1	66	3	1	1	1	6	91
13	740085	PCT A\0\0\0>394-M 1 M	1	1	1	1	73	3	1	1	1	6	106
14	740086	PCT A\0\0\0>394-M 2 M	1	1	1	1	73	3	1	1	1	6	103
15	740088	PCT A\0\0\0>503-M 1 M	1	3	2	1	66	3	1	1	1	6	96
16	740090	PCT A\0\0\0>1169-M 1 M	1	1	1	1	61	3	1	1	1	6	90
17	740091	PCT A\0\0\0>1169-M 2 M	1	1	1	1	66	3	1	1	1	6	92
18	740096	PCT A\0\0\0>1321 M 2 M	3	1	1	1	63	3	1	1	3	6	95
19	740109	PCT A\0\0\0>1452 M 1 M	1	3	3	1	73	3	1	1	1	6	114
20	740110	PCT A\0\0\0>1485-M 1 M	1	1	3	1	68	3	1	1	1	6	107
21	740116	PCT A\0\0\0>1488 M 4-M	1	1	1	1	68	3	1	1	1	6	110
22	740117	PCT A\0\0\0>1488 M 5-M	1	1	1	1	70	3	1	1	1	6	121
23	740125	PCT A\0\0\0>1674-M 1 M	1	1	1	1	63	3	1	1	1	6	93
24	740126	PCT A\0\0\0>1674-M 2 M	1	1	1	1	63	1	1	1	1	6	105
25	740130	PCT A\0\0\0>1674-M 6-M	1	1	1	1	64	3	1	1	1	6	106
26	740133	PCT A\0\0\0>1788 M 2 M	3	1	1	1	69	3	1	1	1	6	93
27	740134	PCT A\0\0\0>1788 M 3-M	1	1	1	1	67	3	1	1	1	6	107
28	740136	PCT A\0\0\0>1788 M 5-M	1	1	1	1	65	3	1	1	1	6	107
29	740137	PCT A\0\0\0>1832 M 1 M	1	1	3	1	62	1	1	1	1	6	107
30	740143	PCT A\0\0\0>1955-M 2 M	3	1	1	1	69	3	1	1	3	6	92
31	740144	PCT A\0\0\0>1955-M 3-M	3	1	2	1	71	3	1	1	3	6	94
32	740145	PCT A\0\0\0>1955-M 4-M	3	1	1	1	70	1	1	1	3	6	90
33	740146	PCT A\0\0\0>1955-M 5-M	3	1	3	1	71	3	1	1	1	6	106
34	740147	PCT A\0\0\0>2083-M 1 M	3	3	4	1	85	3	1	1	1	6	108
35	740148	PCT A\0\0\0>2083-M 2 M	1	1	3	1	82	3	1	1	1	6	96
36	740150	PCT A\0\0\0>2137 M 2 M	3	1	1	1	76	3	1	1	3	6	98
37	740151	PCT A\0\0\0>2149-M 1 M	3	1	2	1	85	3	1	1	1	6	104
38	740155	PCT A\0\0\0>2149-M 3-M	3	2	1	1	82	3	1	1	1	6	109
39	740156	PCT 4\0\0\0>1311 M 1 M	1	1	1	1	81	3	1	1	1	6	116
40	740157	PCT-4\0\\0\0>1311 M 2 M	1	3	2	1	85	3	1	1	1	6	116
41	740165	PCT-4\0\0\0>90-M 2 M	3	1	1	1	69	3	1	1	3	6	101
42	740169	PCT 4\0\0\0>106-M 3-M	1	4	3	1	63	3	1	1	1	6	104
43	740171	PCT-4\0\0\0\1>2435-M 2 M	1	1	3	1	85	1	1	1	1	6	115
44	740176	PCT-4\0\0\0\1>2485-M 1 M	3	1	3	1	77	3	1	1	1	6	108
45	740177	PCT-4\0\0\0\1>2485-M 2 M	3	4	3	1	63	1	1	1	1	6	96
46	740178	PCT-4\0\0\0\1>2485-M 3-M	3	3	3	1	62	3	1	1	1	6	93
47	740179	PCT-4\0\0\0\1>2486-M 1 M	3	3	3	1	59	3	1	1	1	6	93

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald
BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected Ht = height (cm)

Table 7 Characteristics of the S4 lines selected from the PCT-4\0\0\1>S2 population, La Libertad ' Experiment Station, Colombia 1997A

No	Field no 1997 A	Pedigree	Vg	Bl 1	Bl 2	AC	Fl (50%)	LSc	BS	NBl	Gd	Sel	Ht
1	740181	PCT 4\0\0\1>S2-41 1 M	3	1	2	1	63	3	1	1	1	6	90
2	740182	PCT-4\0\0\1>S2-41 2 M	3	1	2	1	63	3	1	1	1	6	92
3	740183	PCT-4\0\0\1>S2-1532 1-M	1	2	2	1	63	3	1	1	1	6	95
4	740193	PCT 4\0\0\1>S2-1803 3 M	3	1	1	1	62	1	1	1	1	6	89
5	740195	PCT 4\0\0\1>S2-2324-2 M	3	1	1	1	65	3	1	1	1	6	94
6	740196	PCT-4\0\0\1>S2-2324 3-M	3	2	1	1	68	3	1	1	1	6	96
7	740197	PCT 4\0\0\1>S2-2324-4-M	3	2	1	1	63	3	1	1	3	6	94
8	740198	PCT-4\0\0\1>S2 2324-5-M	3	3	2	1	62	3	1	1	1	6	93
9	740214	PCT-4\0\0\1>S2 2358 2 M	3	1	1	1	61	3	1	1	1	6	89
10	740226	PCT 4\0\0\1>S2 227 3 M	3	1	1	1	63	3	1	1	1	6	101
11	740227	PCT-4\0\0\1>S2 227 4 M	3	1	1	1	63	3	1	1	1	6	95
12	740233	PCT-4\0\0\1>S2 1584 1 M	1	3	3	1	62	3	1	1	1	6	80
13	740236	PCT 4\0\0\1>S2 1584-4 M	1	1	1	1	63	1	1	1	1	6	98
14	740240	PCT 4\0\0\1>S2 2197 3 M	3	3	3	1	65	3	1	1	1	6	90
15	740248	PCT 4\0\0\1>S2 2145 5 M	3	4	4	1	64	3	1	1	1	6	87
16	740253	PCT-4\0\0\1>S2 1038 1 M	3	2	1	1	58	1	1	1	1	6	101

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald. BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected Ht = height (cm)

Table 8 Characteristics of the S4 lines selected from S3 individual plants, themselves selected in Palmira during 1996 B, 'La Libertad ' Experiment Station, Colombia, 1997 A

No	Field no 1997 A	Pedigree	Vg	Bl 1	Bl 2	AC	Fl (50%)	LSc	BS	NBl	Gd	Sel
1	720222	PCT-4\0\0\1>S2-41-1 1	3	3	2	1	60	1	1	1	1	6
2	720223	PCT-4\0\0\1>S2-41-2 1	1	1	1	1	65	3	1	1	1	6
3	720224	PCT-4\0\0\1>S2-41 2-2	3	3	1	1	66	3	1	1	1	6

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald. BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected. Ht = height (cm)

Table 9 Characteristics of the advanced lines from the populations CNA IRAT 5 and CNA IRAT A yield trial La Libertad Experiment Station Colombia 1997 A

No	Field no 1997 A	Pedigree	Rep	Vg	Bl 1	Bl 2	AC	NBl	Fl (50%)	LSc	BS	Gd	Ht	Yield (t/ha)
01	780001	CNA IRAT 5\SA\0\3>127 2 M-1 M-1	1	3	1	1	1	1	81	3	1	3	84	1 7
01	780053	CNA IRAT 5\SA\0 3>127 2-M-1 M-1	2	1	1	2	1	1	76	3	1	1	88	1 9
01	780090	CNA IRAT 5\SA\0\3>127 2 M-1 M-1	3	1	1	2	1	1	77	3	1	1	91	1 8
02	780002	CNA IRAT 5\SA\0\3>127 2-M-1 M-2	1	1	1	3	1	1	62	1	1	1	106	2 2
02	780039	CNA IRAT 5\SA\0\3>127 2-M-1 M-2	2	3	1	3	1	1	63	1	1	1	106	2 2
02	780078	CNA IRAT 5\SA\0\3>127 2-M-1 M 2	3	3	1	2	1	1	63	1	1	1	104	1 9
03	780003	CNA IRAT 5\SA\0\3>127 2-M-1 M 3	1	1	1	1	1	1	67	3	1	3	96	2 1
03	780057	CNA IRAT 5\SA\0\3>127 2-M-1 M-3	2	1	1	1	1	1	70	3	1	1	83	1 6
03	780095	CNA IRAT 5\SA\0\3>127 2-M-1 M-3	3	1	1	3	1	1	67	3	1	3	89	1 9
04	780004	CNA IRAT 5\SA\0\3>127 2-M- M-4	1	3	1	1	1	1	69	3	1	5	92	2 0
04	780066	CNA IRAT 5\SA\0\3>127 2 M-1 M-4	2	1	1	2	1	1	68	5	1	3	84	2 0
04	780092	CNA IRAT 5\SA\0 3>127 2-M-1 M-4	3	3	1	1	1	1	71	3	1	3	86	1 3
05	780005	CNA IRAT 5\SA\0\3>127 2-M-1 M-5	1	3	1	1	1	1	70	3	1	3	87	1 6
05	780056	CNA IRAT 5\SA\0\3>127 2 M-1 M-5	2	1	1	1	1	1	71	3	1	3	88	1 5
05	780068	CNA IRAT 5\SA\0\3>127 2 M-1 M-5	3	1	1	1	1	1	69	3		3	90	2 3
06	780006	CNA IRAT 5\SA\0\3>127 2-M-2 M-1	1	3	1	1	1	1	67	3	1	3	92	2 1
06	780054	CNA IRAT 5\SA\0\3>127 2 M-2 M 1	2	3	2	2	1	1	66	5	1	3	73	1 6
06	780081	CNA IRAT 5\SA\0\3>127 2 M-2 M 1	3	3	1	2	1	1	68	3	1	3	86	1 8
07	780007	CNA IRAT 5\SA\0\3>127 2-M-2 M-2	1	3	1	1	1	1	67	5	1	3	82	1 7
07	780058	CNA IRAT 5\SA\0\3>127 2 M-2 M-2	2	2	3	2	1	1	68	3	1	3	76	1 4
07	780091	CNA RAT 5\SA\0\3>127 2 M-2 M 2	3	3	1	2	1	1	66	3	1	1	83	1 6
08	780008	CNA IRAT 5\SA\0\3>127 2-M-2 M-3	1	1	2	2	1	1	68	5	1	3	89	2 6
08	780064	CNA IRAT 5\SA\0\3>127 2 M-2 M-3	2	1	3	2	1	1	70	5	1	3	80	1 8
08	780070	CNA IRAT 5\SA\0\3>127 2-M-2 M-3	3	1	2	2	1	1	69	5	1	3	84	2 2
09	780009	CNA IRAT 5\SA\0\3>127 2 M-2 M 4	1	1	2	2	1	1	66	5	1	3	89	2 2
09	780047	CNA IRAT 5\SA\0\3>127 2-M-2 M-4	2	3	3	3	1	1	65	5	1	3	87	1 8
09	780067	CNA IRAT 5\SA\0\3>127 2-M-2 M-4	3	3	1	1	1	1	66	5	1	3	89	2 2
10	780010	CNA RAT 5\SA\0\3>127 2 M-2 M 5	1	1	1		1	1	67	3	1	3	88	1 8
10	780042	CNA IRAT 5\SA\0\3>127 2 M-2 M-5	2	3	1	2	1	1	68	5	1	3	90	1 9
10	780097	CNA IRAT 5\SA\0\3>127 2-M-2 M 5	3	1	1	2	1	1	67	3	1	1	89	1 8
11	780011	CNA IRAT A\SA\0 3>1 M-2 M-1 M 1	1	3	1	1	1	1	66	3	1	1	106	3 0
11	780051	CNA IRAT A\SA\0\3>1 M-2 M-1 M-1	2	5	1	1	1	1	66	1	1	1	106	2 7
11	780080	CNA IRAT A\SA\0\3>1 M-2 M-1 M-1	3	5	1	1	1	1	66	1	1	1	102	2 4
12	780012	CNA IRAT A\SA\0\3>1 M-2 M-1 M-2	1	5	1	1	1	1	66	3	1	1	113	3 1
12	780043	CNA IRAT A\SA\0\3>1 M-2 M-1 M 2	2	5	1	1	1	1	67	1	1	3	101	2 0
12	780089	CNA IRAT A\SA\0\3>1 M-2 M-1 M-2	3	3	1	1	1	1	66	1	1	1	99	2 6
13	780013	CNA IRAT A\SA 0\3>1 M-2 M-1 M 3	1	5	1	1	1	1	65	3	1	1	09	2 7
13	780052	CNA IRAT A\SA\0\3>1 M 2 M 1 M 3	2	5	1		1	1	65	3	1	1	103	2 1
13	780074	CNA IRAT A\SA\0\3>1 M 2 M-1 M-3	3	3	1	1	1	1	68	1	1	1	97	1 5
14	780014	CNA IRAT A SA\0\3>1 M-2 M-1 M-4	1	3	1	1	1	1	67	3	1	3	110	2 7
14	780059	CNA IRAT A\SA\0 3>1 M-2 M-1 M-4	2	4	1	1	1	1	67	1	1	1	91	1 1
14	780072	CNA IRAT A\SA\0\3>1 M-2 M-1 M-4	3	5	1	1	1	1	69	1	1	1	105	1 8
15	780015	CNA IRAT A SA\0\3>1 M-2 M-1 M-5	1	3	1	1	1	1	65	3	1	1	114	? 9
15	780048	CNA IRAT A\SA\0\3>1 M-2 M-1 M-5	2	5	1	1	1	1	66	1	1	1	108	2 4
15	780086	CNA IRAT A\SA 0\3>1 M-2 M-1 M-5	3	3	1	1	1	1	65	1	1	1	108	2 5
16	780016	CNA IRAT A\SA\0\3>1 M-2 M-2 M-1	1	5	1	1	1	1	65	3	1	1	116	2 6
16	780045	CNA IRAT A\SA\0\3>1 M 2 M-2 M-1	2	5	1	1	1	1	67	1	1	1	103	1 8
16	780083	CNA IRAT A\SA\0\3>1 M-2 M-2 M-1	3	3	1	1	1	1	63	1	1	1	112	2 3
17	780017	CNA IRAT A\SA 0\3>1 M-2 M-2 M-2	1	5	1	1	1	1	65	3	1	1	118	2 5
17	780050	CNA IRAT A\SA\0\3>1 M-2 M-2 M-2	2	3	1	1	1	1	66	1	1	1	107	2 3
17	780076	CNA IRAT A SA\0\3>1 M-2 M-2 M-2	3	3	1	1	1	1	66	1	1	1	99	2 2
18	780018	CNA IRAT A\SA 0\3>1 M-2 M-2 M-3	1	5	1	1	1	1	65	3	1	1	117	2 2
18	780063	CNA IRAT A\SA\0\3>1 M-2 M-2 M-3	2	2	1	1	1	1	67	1	1	1	100	2 0
18	780082	CNA IRAT A\SA 0\3>1 M-2 M-2-M-3	3	5	1	1	1	1	65	1	1	1	102	2 0
19	780019	CNA IRAT A\SA\0\3>1 M-2 M-2 M-4	1	5	1	1	1	1	65	3	1	1	110	2 8
19	780061	CNA IRAT A\SA\0\3>1 M-2 M-2 M-4	2	4	1	1	1	1	66	1	1	1	102	1 7
19	780084	CNA IRAT A\SA 0\3>1 M-2 M-2 M-4	3	3	1	1	1	1	65	1	1	1	105	2 2
20	780020	CNA IRAT A\SA 0\3>1 M-2 M-2 M-5	1	5	1	1	1	1	67	1	1	1	105	2 0
20	780038	CNA IRAT A\SA\0\3>1 M-2 M-2 M-5	2	3	1	1	1	1	65	1	1	3	116	2 0

Table 9 continued

#	Field # 1997A	Pedigree	Rep	Vg	Bl 1	Bl 2	AC	NBl	Fl (50%)	LSc	BS	Gd	Ht cm	Yield T/Ha
21	780021	CNA IRAT A\SA\0\3>1 M-2 M-3-M-1	1	5	1	1	1	1	67	1	1	1	100	2 1
21	780035	CNA IRAT A\SA\0\3>1 M-2 M-3-M-1	2	5	1	1	1	1	65	3	1	1	110	2 1
21	780099	CNA IRAT A\SA\0\3>1 M-2 M-3-M-1	3	3	1	1	1	1	65	1	1	1	119	2 1
22	780022	CNA IRAT A\SA\0\3>1 M-2 M-3-M-2	1	5	1	1	1	1	66	3	1	3	113	2 2
22	780062	CNA IRAT A\SA\0\3>1 M-2 M-3-M-2	2	4	1	1	1	1	66	1	1	1	106	2 0
22	780085	CNA IRAT A\SA\0\3>1 M-2 M-3-M-2	3	3	1	1	1	1	65	1	1	1	112	2 5
23	780023	CNA IRAT A\SA\0\3>1 M-2 M-3-M-3	1	5	2	1	1	1	66	3	1	1	114	1 8
23	780040	CNA IRAT A\SA\0\3>1 M-2 M-3 M-3	2	5	1	1	1	1	68	1	1	1	102	2 0
23	780087	CNA IRAT A\SA\0\3>1 M-2 M-3-M-3	3	3	1	1	1	1	64	1	1	1	13	2 6
24	780024	CNA IRAT A\SA\0\3>1 M-2 M-3-M-4	1	5	1	1	1	1	65	3	1	3	108	2 4
24	780037	CNA IRAT A\SA\0\3>1 M-2 M-3 M-1	2	3	1	1	1	1	65	3	1	3	113	2 0
24	780079	CNA IRAT A\SA\0\3>1 M-2 M-3 M-1	3	5	1	1	1	1	65	1	1	1	113	1 9
25	780025	CNA IRAT A\SA 0\3>1 M 2 M-3-M-5	1	3	1	1	1	1	65	3	1	1	114	2 4
25	780044	CNA IRAT A\SA\0\3>1 M-2 M-3 M 5	2	5	1	1	1	1	65	3	1	1	108	1 9
25	780071	CNA IRAT A\SA\0\3>1 M-2 M-3 M-5	3	5	1	1	1	1	65	1	1	1	112	2 6
26	780026	CNA IRAT A\SA\0\3>1 M-2 M-4 M-1	1	3	1	1	1	1	69	5	1	3	85	2 2
26	780065	CNA IRAT A\SA\0\3>1 M-2 M-4-M-1	2	3	1	1	1	1	69	2	1	3	81	2 1
28	780096	CNA IRAT A\SA\0\3>1 M-2 M-4-M-1	3	5	1	1	1	1	68	3	1	3	84	1 4
27	780027	CNA IRAT A\SA\0\3>1 M 2 M-4-M-2	1	1	1	1	1	1	68	5	1	1	78	2 0
27	780049	CNA IRAT A\SA\0\3>1 M-2 M-4 M 2	2	3	1	1	1	1	67	1	1	1	101	2 6
27	780098	CNA IRAT A\SA\0\3>1 M 2 M-4 M-2	3	3	1	1	1	1	66	3	1	1	97	2 2
28	780028	CNA IRAT A\SA\0\3>1 M-2 M-4-M-3	1	1	1	1	1	1	68	3	1	1	95	2 8
28	780060	CNA IRAT A\SA\0\3>1 M-2 M-4-M-3	2	4	1	1	1	1	69	3	1	1	82	1 8
28	780075	CNA RAT A\SA\0\3>1 M-2 M-4 M-3	3	3	1	1	1	1	70	1	1	1	83	2 1
29	780029	CNA IRAT A\SA\0\3>1 M 2 M-4 M-4	1	1	1	1	1	1	67	5	1	1	90	2 8
29	780034	CNA IRAT A\SA\0\3>1 M-2 M-4 M-4	2	5	1	1	1	1	68	5	1	3	94	1 8
29	780088	CNA IRAT A\SA\0\3>1 M-2 M-4-M-4	3	3	1	1	1	1	69	1	1	1	95	2 1
30	780030	CNA IRAT A\SA\0\3>1 M-2 M-4-M-5	1	3	1	1	1	1	68	5	1	1	83	1 9
30	780041	CNA IRAT A\SA\0\3>1 M-2 M-4-M-5	2	5	1	1	1	1	70	3	1	3	88	1 8
30	780073	CNA IRAT A\SA\0\3>1 M-2 M-4 M-5	3	3	1	1	1	1	69	3	1	3	85	1 8
31	780031	ORYZICA SABANA 6	1	1	4	4	1	1	82	3	1	1	105	2 6
31	780036	ORYZICA SABANA 6	2	3	3	4	1	1	82	5	1	1	106	2 1
31	780077	ORYZICA SABANA 6	3	3	4	4	1	1	83	3	1	1	110	2 3
32	780032	LINEA 30	1	1	1	1	1	1	62	3	1	1	91	3 6
32	780055	LINEA 30	2	1	1	1	1	1	63	3	1	1	88	3 2
32	780093	LINEA 30	3	1	1	1	1	1	63	3	1	1	92	3 1
33	780033	ORYZICA SABANA 10	1	3	2	3	1	1	85	3	1	1	108	2 4
33	780046	ORYZICA SABANA 10	2	3	1	2	1	1	85	3	1	1	110	3 0
33	780069	ORYZICA SABANA 10	3	3	2	1	1	1	86	3	1	1	106	2 5

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald. BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected. Ht = height (cm)

Table 10 Grain quality and milling characteristics of advanced lines from two enhanced recurrent populations CNA-IRAT-5\SA\0\3 and CNA-IRAT-A\SA\0\3, 'La Libertad Experiment Station,Colombia, 1997A

No	Pedigree[a]	Grain quality[b]				Milling	
		G T	W B	S T	Amyl (%)	White rice (%)	Head rice (%)
1	CNA IRAT-5\SA\0\3>127 2 M 1 M 1	IH	2 8	L	25	66 97	55 57
2	**CNA-IRAT-5\SA\0\3>127-2-M-1-M-2**	**I**	**0 6**	**L**	**29**	**80 14**	**65 76**
3	CNA-IRAT 5\SA\0\3>127 2 M-1 M-3	I	3 0	M	23	67 78	56 97
4	CNA-IRAT 5\SA\0\3>127 2 M-1 M-4	I	3 0	M	29	66 55	57 09
5	CNA-IRAT-5\SA\0\3>127 2 M-1 M 5	I	2 8	M	25	73 20	62 83
6	CNA IRAT-5\SA\0\3>127 2 M 2 M-1	I	3 0	M	27	68 62	59 52
7	CNA IRAT 5\SA\0\3>127 2 M 2 M 2	'H	3 0	M	25	68 17	59 95
8	CNA-IRAT-5\SA\0\3>127 2 M 2 M 3	I	3 2	M	26	71 29	61 19
9	CNA-IRAT 5\SA\0\3>127 2 M-2 M-4	I	2 8	L	23	70 44	60 07
10	CNA-IRAT 5\SA\0\3>127 2-M 2 M 5	I	2 6	L	26	70 47	62 60
11	**CNA-IRAT-A\SA\0\3>1 M-2-M-1-M-1**	**H**	**0 8**	**L**	**22**	**69 40**	**62 95**
12	CNA-IRAT-A\SA\0\3>1 M 2-M-1 M-2	H	1 2	L	22	73 88	67 10
13	CNA IRAT-A\SA\0\3>1 M 2 M-1 M 3	H	1 4	L	22	69 90	59 30
14	CNA IRAT A\SA\0\3>1 M 2 M-1-M-4	H	0 8	L	20	69 08	61 54
15	CNA-IRAT A\SA\0\3>1 M 2 M-1-M 5	H	2 2	L	20	66 72	59 61
16	CNA-IRAT-A\SA\0\3>1 M-2 M 2 M-1	H	2 0	L	22	71 29	63 15
17	CNA-IRAT A\SA\0\3>1 M-2-M 2 M 2	H	1 8	L	22	71 93	66 23
18	CNA IRAT-A\SA\0\3>1 M-2 M 2 M-3	H	1 0	L	22	66 97	59 87
19	CNA IRAT-A\SA\0\3>1-M-2-M-2 M-4	H	1 2	L	24	65 67	58 30
20	CNA IRAT-A\SA\0\3>1-M 2-M-2 M-5	H	1 2	L	22	67 18	57 85
21	CNA IRAT A\SA\0\3>1-M 2 M-3 M-1	H	2 2	L	19	65 95	58 76
22	CNA-IRAT-A\SA\0\3>1-M 2-M-3 M-2	H	1 6	L	20	67 58	58 56
23	CNA-IRAT A\SA\0\3>1 M 2 M-3-M-3	H	1 6	L	21	66 64	59 30
24	**CNA IRAT-A\SA\0\3>1-M-2-M-3-M-4**	**H**	**1 0**	**L**	**23**	**70 20**	**63 50**
25	CNA-IRAT-A\SA\0\3>1 M 2 M 3 M-5	H	1 8	L	22	71 64	65 38
26	CNA IRAT-A\SA\0\3>1 M-2-M-4 M 1	H	1 4	L	21	72 12	65 77
27	CNA IRAT-A\SA\0\3>1-M 2-M-4 M-2	H	1 6	L	23	72 99	65 89
28	CNA IRAT-A\SA\0\3>1-M 2 M-4 M-3	H	1 2	L	21	72 15	67 10
29	CNA-IRAT-A\SA\0\3>1 M 2 M-4 M-4	H	1 2	L	22	74 24	67 95
30	CNA-IRAT A\SA\0\3>1 M-2-M-4 M-5	IL	0 6	L	24	72 55	67 06
31	ORYZICA SABANA 6	I	2 2	L	26	73 04	55 67
32	LINEA 30	I	1 2	L	24	71 06	66 60
33	ORYZICA SABANA 10	H	1 2	L	23	71 53	61 73

a Advanced lines in bold were selected
b G T = Gelatinization temperature W B = white belly S T = seed type Amyl = amylose content

Table 11 Characteristics of the advanced lines selected from the gene pool GPCT-1 and the population PCT-3 ' La Libertad" Experiment Station, Colombia, 1997 A

No	Field no 1997 A	Pedigree	Vg	Bl 1	Bl 2	AC	Fl (50%)	LSc	BS	NBl	Gd	Ht
1	700002	CT 13447-M 5 2 M-M	3	2	1	1	88	1	1	1	3	88
2	700003	CT 13448 M 2 1 M M	3	3	2	1	85	3	1	1	3	73
3	700004	CT 13448 M-2-2-M-M	3	1	1	1	84	3	1	1	5	77
4	700006	CT 13448 M-8-2-M-M	3	2	1	1	83	1	1	1	1	85
5	700007	CT 13448 M 9 1 M M	3	1	1	1	81	3	1	1	1	93
6	700008	CT 13448 M-13-1-M M	3	1	1	1	88	3	3	1	3	76
7	700011	CT 13448 M 6-1-M-M	3	1	1	1	86	1	3	3	3	83
8	700013	CT 13449 M 3 1-M M	3	1	1	1	88	3	3	1	3	75
9	700014	CT 13449 M 8-1 M M	5	1	1	1	86	1	1	1	3	66
10	700019	CT 13450 M-18-1-M M	3	3	2	1	81	3	1	1	3	84
11	700022	CT 13457-M-5-1 M-M	3	1	2	1	84	3	3	3	3	82
12	700024	CT 13458 M 3 1-M M	3	1	1	1	80	3	1	3	1	74
13	700025	CT 13458 M-3-2 M M	5	1	1	1	80	7	1	1	3	69
14	700026	CT 13458-M-3-3 M-M	5	1	1	1	81	7	1	1	5	67
15	700027	CT 13458 M 3-4 M-M	5	1	1	1	78	7	1	1	1	67
16	700028	CT 13458-M-13-1 M M	3	1	1	1	77	5	1	1	3	90
17	700029	CT 13462-M-3-1-M-M	3	1	1	1	88	3	1	1	3	77
18	700031	CT 13462 M 7-2 M-M	3	1	1	1	81	3	1	1	3	71
19	700032	CT 13462 M-7 3 M M	3	1	1	1	83	3	1	1	3	75
20	700033	CT 13462-M-7-4 M M	3	1	1	1	82	3	1	1	3	77
21	700035	CT 13462 M 12 1 M-M	3	1	1	1	83	3	3	1	3	92
22	700036	CT 13462 M 12 2 M M	3	1	1	1	84	3	3	1	3	103
23	700044	CT 13462-M-17-6 M M	1	1	1	1	81	3	5	1	3	73
24	700049	CT 13462 M 18 5 M M	3	3	2	1	83	5	3	1	5	75
25	700050	CT 13463 M-4 1 M M	1	3	2	1	81	3	3	1	3	72
26	700055	CT 13465-M-15 2-M M	1	1	1	1	75	5	1	1	3	92
27	700056	CT 13465-M 15-3 M M	1	1	1	1	76	5	1	1	3	71
28	700057	CT 13465 M 15-4 M M	1	1	1	1	78	3	1	1	3	88
29	700066	CT 13480-M-16-1-M M	3	1	1	1	86	3	1	1	3	63
30	700068	CT 13480 M 10 1 M M	1	1	2	1	94	5	1	1	3	68
31	700071	CT 13488 M 9 2-M M	1	1	1	1	85	3	1	1	3	69
32	700082	CT 13503 M 3 1 M M	1	1	3	1	85	3	3	1	3	88
33	700086	CT 13503 M 13-1 M M	3	2	2	1	86	5	3	3	5	76
34	700087	CT 13503 M-18-1 M M	3	1	1	1	85	5	1	1	5	78
35	700088	CT 13503 M-18-2-M M	1	1	1	1	86	5	3	1	5	76
36	700089	CT 13503 M-18-3 M M	1	1	1	1	86	5	3	1	5	74

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected Ht = height (cm

Table 12 Main characteristics of the recurrent selection rice populations PCT-4\SA 1\1 PCT-4\PHB\1\1 PHB\1 PCT-5\PHB\1\0 PHB\1 and PCT A\PHB\1\0,PHB\1

Characteristic	Population			
	PCT4\SA\1\1	PCT 4\PHB\1 1,PHB\1	PCT5\PHB\1\0 PHB\1	PCTA\PHB\1\0 PHB\1
Sown seed	2015	2012	2016	2012
Developed plants	1733 (86 0%)	1479 (72 8%)	1559 (76 2%)	1555 (77 3%)
Plants with hoja blanca	464 (28 7%)	398 (28 7%)	456 (35 5%)	602 (38 7%)
Plants with leaf blast	101 (5 5%)	67 (4 5%)	54 (3 7%)	52 (3 4%)
Plants at harvest	917	815	689	679
Fertile plants	*752 (82%)*	*461 (56 6%)*	*386 (56 0%)*	*337 (49 8%)*
Male sterile Plants	*165 (18%)*	*354 (4[illegible] 4%)*	*303 (44 0%)*	*342 (50 4%)*
Fertile plants selected	153 (20 3%)	41 (9 0%)	12 (2 1%)	12 (3 6%)
Male sterile plants selected	165 (100%)	223 (62 99%)	218 (71 9%)	253 (74%)

Table 13 Evaluation of blast and hoja blanca ' in three basic populations, after one and two cycles of mass recurrent selection respectively for both sexes

POPULATION PCT-4

Germplasm	Year of Evaluation	Blast* (%)	Hoja blanca * (%)
Basic population PCT 4\0\0\1	1995	42 7	4 9
First cycle of RS PCT 4\PHB\1\1	1996	0 5	19 0
Second cycle of RS PCT 4\PHB\1\1 PHB\1	1997	4 5	29 7

Percentage of plants with symptoms of blast or hoja blanca

POPULATION PCT-5

Germplasm	Year of evaluation	Blast* (%)	Hoja blanca (%)
Basic population PCT 5\0\0\0	1995	47 8	6 2
First cycle of RS PCT-5\PHB\1\0	1996	1 5	31 4
Second cycle of RS PCT-5\PHB\1\0 PHB\1	1997	3 7	35 4

Percentage of plants with symptoms of blast or hoja blanca

POPULATION PCT-A

Germplasm	Year of evaluation	Blast* (%)	Hoja blanca * (%)
Basic population PCT A\0\0\0	1995	35 3	8 1
First cycle of RS PCT A\PHB\1\0	1996	1 0	38 5
Second cycle of RS PCT A\PHB\1\0 PHB\1	1997	3 3	38 7

Percentage of plants with symptoms of blast or hoja blanca

Table 14 Evaluation of early maturity of three basic rice populations, after the first and the second cycles of mass recurrent selection for both sexes

POPULATION PCT-4

Days	Basic population PCT 4\0\0\1	First cycle of RS PCT-4\PHB\1\1	Second cycle of RS PCT-4\PHB\1\1 PHB\1
<70	30 5%*	25 2%	20 9%
70 80	52 8%	49 0%	30 6%
81-90	21 0%	23 6%	18 0%

Percentage of plants

POPULATION PCT-5

Days	Basic population PCT-5\0\0\1	First cycle of RS PCT-5\PHB\1\1	Second cycle of RS PCT 5\PHB\1\1 PHB\1
<70	6 0%*	9 6%	7 5%
70 80	64 3%	55 8%	40 0%
81 90	36 5%	28 4%	25 3%

Percentage of plants

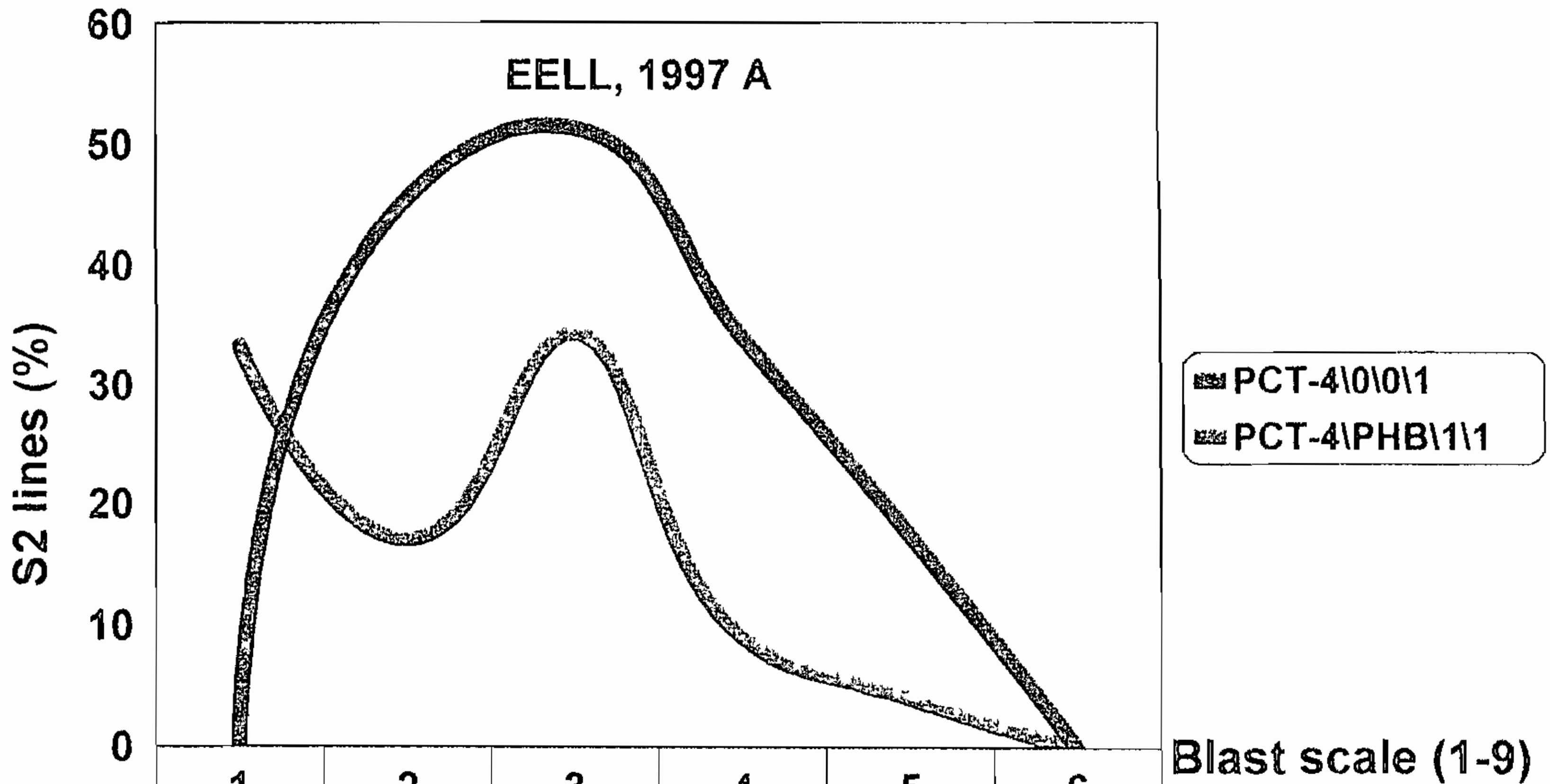
POPULATION PCT-A

Days	Basic population PCT-A\0\0\1	First cycle of RS PCT A\PHB\1\1	Second cycle of RS PCT A\PHB\1\1 PHB\1
<70	6 8%*	12 9%	7 4%
70-80	60 9%	59 1%	36 4%
81 90	41 0%	29 0%	30 4%

Percentage of plants

Blast incidence in S2 lines from the basic and enhanced populations, PCT-4\0\0\1 and PCT-4\PHB\1\1, respectively

(one cycle of recurrent selection for both sexes for disease resistance)

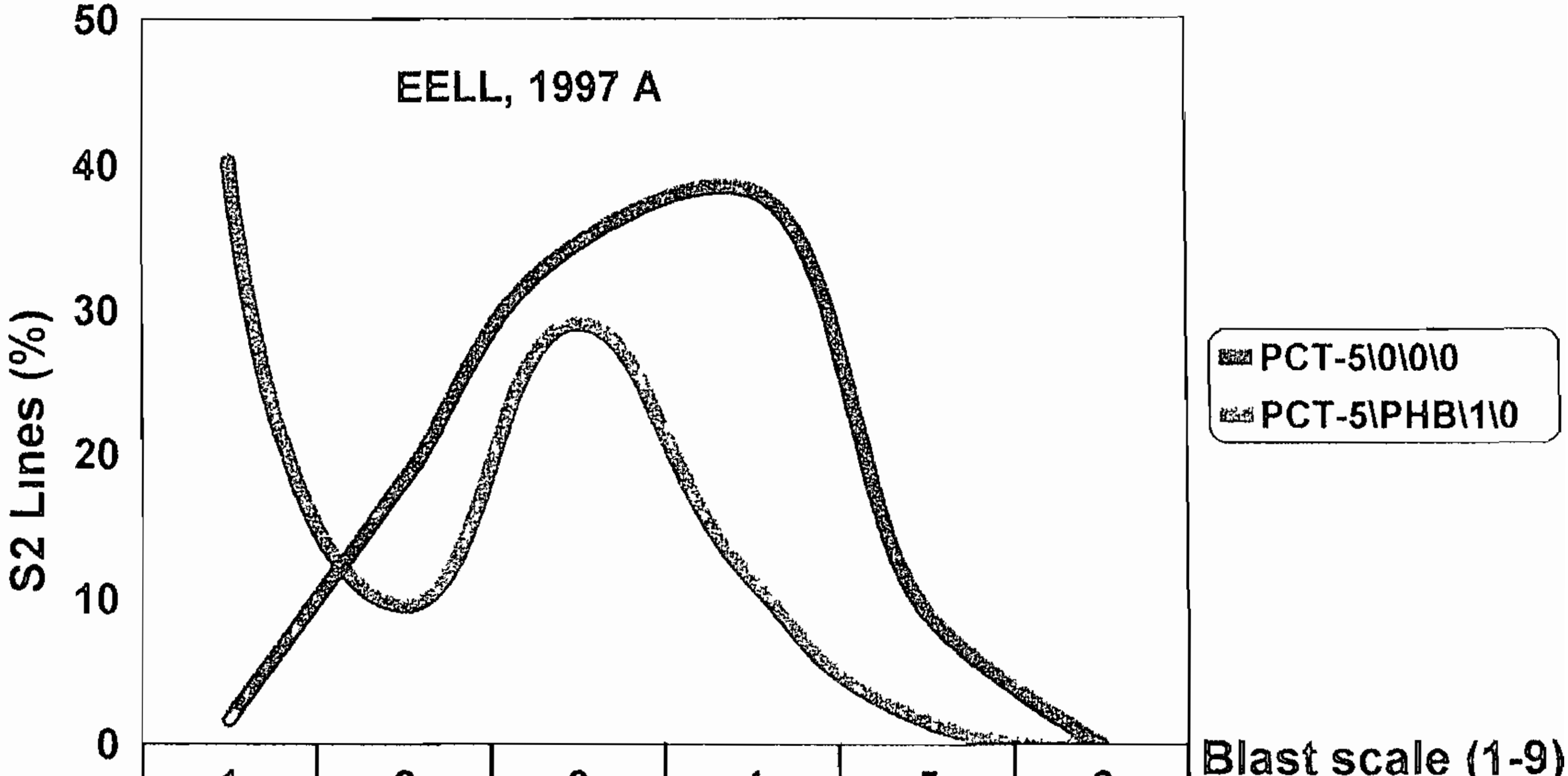


	1	2	3	4	5	6
PCT-4\0\0\1	0	45 4	51 3	34	17 5	0
PCT-4\PHB\1\1	33 3	17 1	34 3	9 1	4	0

Table 15

Blast incidence in S2 lines from the basic and enhanced populations, PCT-5\0\0\0 and PCT-5\PHB\1\0, respectively

(one cycle of recurrent selection for both sexes for disease resistance)

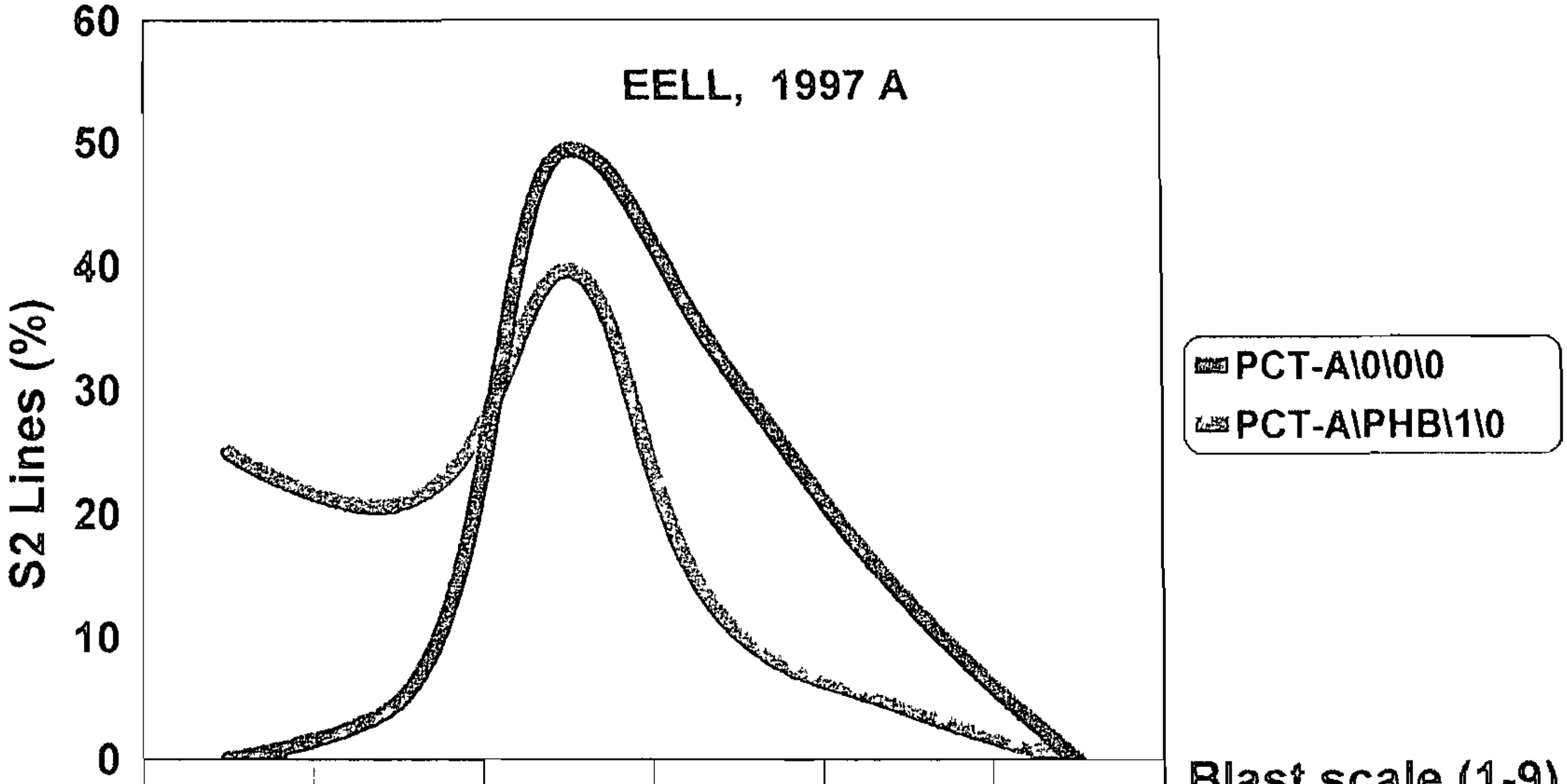


	1	2	3	4	5	6
PCT-5\0\0\0	1 7	18 2	34 5	38 2	9 1	0
PCT-5\PHB\1\0	40 3	9 6	29	11 3	1 6	0

Table 16

Blast incidence in S2 lines from the basic and enhanced populations, PCT-A\0\0\0 and PCT-A\PHB\1\0, respectively

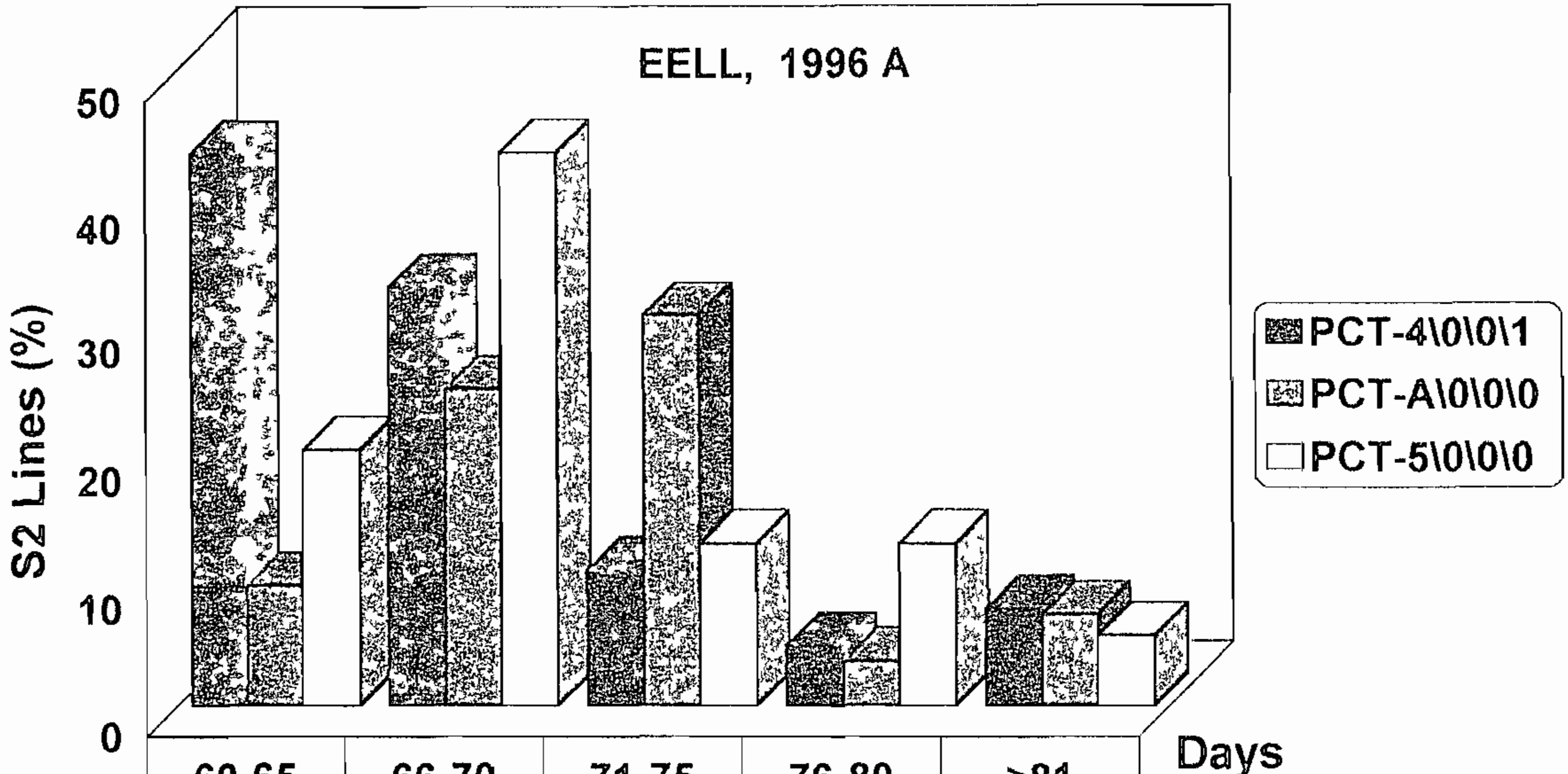
(one cycle of recurrent selection for both sexes for disease resistance)



	1	2	3	4	5	6
PCT-A\0\0\0	0	4 7	49 4	30 6	12 9	0
PCT-A\PHB\1\0	25	20 8	39 6	10 4	4 1	0

Table 17

Evaluation of early maturity in S2 lines from three basic populations



	60-65	66-70	71-75	76-80	>81
PCT-4\0\0\1	43 5	32 9	10 6	4 7	7 6
PCT-A\0\0\0	9 4	24 7	30.6	3 5	7 1
PCT-5\0\0\0	20	43 6	12 7	12 7	5 5

Table 18

PCT-13

Institution	CIRAD-CA/CIAT
Year of registration	1996
Scientists	M Châtel, J Borrero, and Y Ospina
Ecosystem	Upland high altitudes
Objectives	Yield potential Cold tolerance Grain quality
Germplasm type	Japonica population
Germplasm development	Synthesis of a new derived population
Male-sterility source	Male-sterile plants of PCT-4 population
Line source	11 lines from CIAT, Madagascar and CIRAD-CA
Crossing method	Manual crossing development Recombination on male-sterile plants
Cytoplasm source	Monocytoplasm from PCT-4 population
Evaluation	F1 generation of each individual cross
Plant selection	In each selected F1F1
Seed mixture	F_2 seeds from each individual cross
Proportion mixture	Variable for the different crosses
Genetic constitution	See table

Germplasm status and identification

PCT-13\0\0\0, PCT-13\0\0\1, and PCT-13\0\0\0F

Requests for seed to

Dr M Châtel
Centro Internacional de Agricultura Tropical (CIAT)
Rice Program
Apdo Aereo 6713 Cali Colombia
Phone (57-2) 445-0000 - Fax (57-2) 445-0073
E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-13

Parent	Origin/Cross	Frequency (%)
Latsidahy/ Fofifa 62-1	Madagascar	4 55
Latsidahy/ Fofifa 62-2	Madagascar	4 55
Latsidahy/ Fofifa 62-3	Madagascar	4 55
Fofifa 62/Shin Ei – 3	Madagascar	4 55
Latsibavy/Daniela – 4	Madagascar	4 55
Latsibavy/Daniela – 5	Madagascar	4 55
WAB 96-7-1	WARDA	4 55
HD (IRAT 112/Apura//IAC 25) 152	CIRAD	4 55
CT 11891-13-12-M-4-M	CIAT	4 55
CT 10069-27-3-1-M	CIAT	4 55
IRAT 104	CIRAD	4 55
PCT-4	**Japonica Population**	**50 00**

GENETIC CONSTITUTION OF PCT-13

Parent	Origin/Cross	Frequency (%)
Latsidahy/ Fofifa 62-1	Madagascar	4 55
Latsidahy/ Fofifa 62-2	Madagascar	4 55
Latsidahy/ Fofifa 62-3	Madagascar	4 55
Fofifa 62/Shin Ei – 3	Madagascar	4 55
Latsibavy/Daniela – 4	Madagascar	4 55
Latsibavy/Daniela – 5	Madagascar	4 55
WAB 96-7-1	WARDA	4 55
HD (IRAT 112/Apura//IAC 25) 152	CIRAD	4 55
CT 11891-13-12-M-4-M	CIAT	4 55
CT 10069-27-3-1-M	CIAT	4 55
IRAT 104	CIRAD	4 55
PCT-4	**Japonica Population**	**50 00**

GPCNA-18

Synonyms	CNA-IRAT 4
Institutions	CIRAD-CA / EMBRAPA-CNPAF
Year of registration	1996
Scientists	J Taillebois and P Rangel
Ecosystem	Lowlands
Objectives	General adaptation to tropical lowland
Germplasm type	Indica Gene Pool
Germplasm development	Synthesis of an original Gene Pool
Male-sterility source	IR 36 male-sterile gene
Crossing method	Individual crosses between lines and IR 36 male sterile plants
Cytoplasm source	Polycytoplasm (lines and IR 36)
Line source	9 tropical lowland lines
Evaluation	Recombined Gene Pool
Genetic constitution	See table
Germplasm identification	PCNA-18\0\0\0 (CNA-IRAT 4/0/4)
Requests for seed to	Dr Paulo H Rangel EMBRAPA-CNPAF Caixa Postal 179, CEP 74001-970 Goiânia-GO, Brazil Phone (55-62) 833 21 10 Fax (55-62)833 21 00 E-mail phrangel@cnpaf embrapa br

GENETIC CONSTITUTION OF GPCNA-18

Parent	Origin/Cross	Frequency (%)
BG 90-2	IR 262/Remadja	8 33
CNA 7	T 141/IR 665-1-1-75-3	8 33
CNA 3815	CICA 4/BG90-2//SML 5617	8 33
CNA 3848	IR 36/CICA 7//5461	8 33
CNA 3887	BG 90-2/Tetep//4440	8 33
Colombia 1	Napal/Takao Iku 18	8 33
Eloni	IR 454/SML Kapuri//SML 66410	8 33
Nanicâo	Brazilian germplasm	8 33
UPR 103 30 1 2	IR 24/Cauvery	8 33
IR 36 (msms)	Mutant of IR36	25 00

GPIR-22

Institutions CIRAD/IRRI

Year of registration 1997

Scientists B Courtois

Ecosystem Uplands

Objectives Tolerance to Rice Blast

Germplasm type Japonica Population

Germplasm development

Male-sterility source	No
Crossing method	Manual crossing
Cytoplasm source	Polycytoplasm
Line source	24 Upland lines
Evaluation	Double crosses with a specific blast isolate

Genetic constitution See table

Germplasm identification GPIR-22\0\0\0

Requests for seed to

Dr Brigitte Courtois
IRRI/CIRAD
P O Box 933, Manilla 1099 - Philippines
Phone (63-2) 818 1926 -Fax (63-2) 891 1292
E-mail b courtois@cgnet com

GENETIC CONSTITUTION OF GPIR-22

Reaction of parental lines to blast isolate V85-0256

Compatible	Incompatible
1 AZUCENA	A 62667
2 ARIAS	B Araguia
3 B2997C-TB-60-3-3	C Diwani
4 CT 6510-24-1-2	D IR 58662-04
5 IR 53236-280	E IR 60080-46A
6 IR 55419-04	F IR 63380-08
7 IR 55435-05	G IRAT 104
8 IRAT 169 F 10/6	H IRAT 212
9 LUBANG RED	I IRAT 216
10 PALAWAN	J KETAN MENAH
11 SPEAKER	K P 5589-1-1-3P
12 VANDANA	L MED NOI

BUILDING GPIR-22

PARENTS OF THE GENE POOL

S= 1,2,3,4,5 6, 12 R= A,B,C,D,E, ,L

FIRST ROUND OF CROSSES

A/1 1/B B/2 2/C 12/A

All F1 are resistant

SECOND ROUND OF CROSSES

A1/B2 1B/2C B2/C3 2C/3D L12/A1

The plants compatible with blast isolate V85-0256 are selected

THIRD ROUND OF CROSSES

A1/B2//C3/D4 1B/2C//3D/4E B2/C3//D4/E5 J10/K11//L12/A1

An equal quantity of seeds of each cross is mixed

Parent	Origin/Cross	Frequency (%)
IAPAR 9	Batatais/IAC F3-7	1 57
IRAT 112	Dourado Precoce/IRAT 13	1 47
CNA 4135	IAC47/IRAT 2	1 36
IREM 238	PJ110/IAC 25	1 35
Arroz de Campo	Brazilian germplasm	1 25
CA 435	African germplasm	0 84
Palawan	Asian germplasm	12 50
IR36	Male sterile mutant	12 50

PCT-6

Institution	CIAT/CIRAD-CA
Year of registration	1995
Scientists	C Martinez and M Châtel
Ecosystem	Tropical Lowlands
Objectives	Yield potential
Germplasm type	Indica Population
Germplasm development	Introduction of new variability into IRAT-Mana
Male-sterility source	Plants of IRAT-Mana (population developed with IR 36 male-sterile gene)
Line source	9 Lines of different origin
Crossing method	Hand crossing between lines and male-sterile plants
Cytoplasm source	Monocytoplasm from IRAT-Mana
Evaluation	F1 generation of each single cross
Plant selection	In each F1
Seed mixture	S2 seeds of selected F_1 plants
Proportion mixture	Equal from each cross
Recombination	On male-sterile plants
Genetic constitution	See table
Germplasm identification	PCT-6\0\0\0
Requests for seed to	Dr M Châtel Centro Internacional de Agricultura Tropical (CIAT) Rice Program Apdo Aereo 6713 Cali Colombia Phone (57-2) 445-0000 - Fax (57-2) 445-0073 E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-6

Parent	Origin/Cross	Frequency (%)
B4353C-Kn-7-0-0-2	-	5 0
BG989	BG563/BG379-2	5 0
PNA 1004F4-33	Inti/BG90-2	5 0
OR83-23	CO18/Hema	5 0
RP2087-115-10-5-1	RP1017-76-1-4-3/Manasarovar	5 0
Oryzica 3	CICA 7//CICA 8/ Pelita I-1	5 0
Perla	-	5 0
Oryzica Llanos 4	CR1113/IRAT 122//Colombia 1/P 1274-6-8M	5
Morelos A88	C318Za76-7/C99Za76-1	5 0
IRAT Mana	**Indica Population**	**50 0**
*CNA1613 **	*CNPAF- Brazil*	*3 3*
*CNA 3814 **	*CNPAF-Brazil*	*3 3*
*CNA 4191 **	*CNPAF-Brazil*	*3 3*
*CNA 4987 **	*CNPAF-Brazil*	*3 3*
*CNA 4995 **	*CNPAF-Brazil*	*3 3*
*CNA 5179 **	*CNPAF-Brazil*	*3 3*
*CNA 5551 **	*CNPAF-Brazil*	*3 3*
*CNA 6158 **	*CNPAF-Brazil*	*3 3*
*CT 6163-8-9-1-2A **	*CIAT- Colombia*	*3 3*
*IR 841-63-5-18-2 **	*IRRI-Philippines*	*3 3*
*IRAT 335 **	*IRAT-Brazil*	*3 3*
*IRAT 347 **	*IRAT-French Guiana*	*3 3*
*IRAT 348 **	*IRAT-French Guiana*	*3 3*
*P 5747-12-9-3-7 **	*Colombia*	*3 3*
*#26 W **	-	*3 3*
*CNA-IRAT M ***	*Indica Population*	*50 0*

** GENETIC CONSTITUTIUON OF CNA-IRAT MANA*

*** GENETIC CONSTITUTION OF CNA-IRAT M Selection for grain shape in CNA-IRAT 4 (GPCNA-18)*

PCT-7

Institution	CIAT/CIRAD-CA
Year of registration	1995
Scientists	C Martinez and M Chatel
Ecosystem	Tropical Lowlands
Objectives	Yield potential
Germplasm type	Indica Population
Germplasm development	Introduction of new variability into IRAT1/420P population
Male-sterility source	Male-sterile plants of IRAT1/420P population developed with IR 36 male-sterile gene
Line source	6 Lines of different origins
Crossing method	Hand crossing development Recombination on male-sterile plants
Cytoplasm source	Same as IRAT1/420P
Evaluation	F1 generation
Plant selection	In each F1
Seed mixture	Selected F_1 plants
Proportion mixture	Equal amount from each selected F_1 plant
Genetic constitution	See table
Actual users	Colombia (CIRAD-CA/CIAT) and FLAR members

Germplasm status and identification

PCT-7\0\0\0

Requests for seed to

Dr M Châtel
Centro Internacional de Agricultura Tropical (CIAT)
Rice Program
Apdo Aereo 6713 Cali, Colombia
Phone (57-2) 445-0000 - Fax (57-2) 445-0073
E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-7

Parent	Origin/Cross	Frequency (%)
B4353C-Kn-7-0-0-2	-	8 33
BG989	BG563/BG379-2	8 33
PNA 1004F4-33-1	Inti/BG90-2	8 33
OR83-23	CO18/Hema	8 33
Oryzica 3	CICA 7//CICA 8/ Pelita I-1	8 33
RP2087-115-10-5-1	RP1017-76-1-4-3/Manarovar	8 33
IRAT 1/420P*	Indica Population	50 00

**IRAT 1/420P Selection for earliness in CNA-IRAT 4 (GPCNA-18)*

PCT-8

Institution	CIAT/CIRAD-CA
Year of registration	1995
Scientists	C Martinez and M Chatel
Ecosystem	Tropical Lowlands
Objectives	Yield potential
Germplasm type	Indica Population
Germplasm development	Introduction of new variability into CNA-IRAT4/2/1 population
Male-sterility source	Male-sterile plants of CNA-IRAT4/2/1 (population developed with IR 36 male-sterile gene)
Line source	6 Lines of different origins
Crossing method	Manual crossing development Recombination on male-sterile plants
Cytoplasm source	Same as for CNA-IRAT4/2/1 population
Evaluation	Basic population
Plant selection	Selected fertile and male-sterile plants
Proportion mixture	Equal amount from each selected plant
Genetic constitution	See table
Actual users	Colombia (CIRAD-CA/CIAT) and FLAR members

Germplasm status and identification

PCT-8\0\0\0

Requests for seed to

Dr M Châtel
Centro Internacional de Agricultura Tropical (CIAT)
Rice Program
Apdo Aereo 6713 Cali, Colombia
Phone (57-2) 445-0000 - Fax (57-2) 445-0073
E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-8

Parent	Origin/Cross	Frequency (%)
B4353C-Kn-7-0-0-2	-	8 33
BG989	BG563/BG379-2	8 33
Perla	-	8 33
El Paso 144	IR930-2/IR665-31-2-4	8 33
Oryzica 3	CICA 7//CICA 8/ Pelita I-1	8 33
Oryzica Llanos 4	CR1113/IRAT 122//Colombia 1/P 1274-6-8M-1-3M	8 33
CNA-IRAT 4/2/1*	Indica Population	50 00

** CNA-IRAT 4/2/1 Selection in CNA-IRAT 4 (GPCNA-18)*

GPCT-9

Institution	CIAT
Year of registration	1995
Scientists	C Martinez
Ecosystem	Tropical Lowlands
Objectives	Yield potential Grain quality Blast resistance Leaf Scald resistance
Germplasm type	Indica Gene Pool
Germplasm development	Synthesis of an original gene pool
Male-sterility source	Male-sterile plants of WC 232*5-Early (male-sterile gene of TOX 1011-4-1)
Line source	14 lines of different origins
Crossing method	Manual crossing development (7 double crosses) Recombination on male-sterile plants
Cytoplasm source	Monocytoplasm from WC 232*5-Early
Evaluation	F_1 generation
Plant selection	In each F_1
Seed mixture	F_2 seeds of the selected F_1 plants
Proportion mixture	Equal amount from each selected F_1 plant
Genetic constitution	See table
Actual users	Colombia (CIRAD-CA/CIAT) and FLAR members
Germplasm status and identification	GPCT-9\0\0\0, and GPCT-9\0\0\1
Requests for seed to	Dr M Chatel Centro Internacional de Agricultura Tropical (CIAT) Rice Program Apdo Aereo 6713 Cali Colombia Phone (57-2) 445-0000 - Fax (57-2) 445-0073 E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF GPCT-9

Parent	Origin/Cross	Frequency (%)
B4353C-Kn-7-0-0-2	-	3 57
CT6241-17-1-5-1	Ngovie/Taipei 309//Col 1xM 312A	3 57
BG989	BG563/BG379-2	3 57
Oryzica Turipana 7	Carolino/TOx 1785-19-18//TOx 1011-4-1	3 57
PNA 1004F4-33	Inti/BG90-2	3 57
5685	P 901/P 914//P 914/P 882	3 57
OR83-23	CO18/Hema	3 57
Perla	-	3 57
RP2087-115-10-5-1	RP1017-76-1-4-3/Manasarovar	3 57
BR-IRGA 409	IR930-53/IR665-31-2-4	3 57
BG90-2	IR262/Remadja	3 57
El Paso 144	IR930-2/IR665-31-2-4	3 57
Oryzica 3	CICA 7//CICA 8/ Pelita I-1	3 57
Morelos A88	C318Za76-7/C99Za76-1	3 57
WC232*5	IR46/IRAT 120//P 2062F4-17-33-1	50 00

GPIRAT-10

Institution	CIRAD-CA
Year of registration	1995
Scientists	J Taillebois
Ecosystem	Irrigated Temperate Lowlands
Objectives	Yield potential Cold temperature tolerance Grain quality
Germplasm type	Japonica Gene Pool
Germplasm development	Synthesis of a new derived gene pool
Male-sterility source	Male-sterile plants of CNA-IRAT 5 gene pool developed with IR 36 male-sterile gene
Line source	40 lines from France, Italy, Chile and USA
Crossing method	Manual crossing development Recombination on male-sterile plants
Cytoplasm source	Monocytoplasm from CNA-IRAT 5 gene pool
Seed mixture	F_2 seeds from each individual cross
Proportion mixture	Variable for different crosses
Genetic constitution	See table
Actual users	Uruguay, Chile Spain Hungary and Romania

Germplasm status and identification

GPIRAT-10\0\0\1

Requests for seed to

Dr M Châtel
Centro Internacional de Agricultura Tropical (CIAT)
Rice Program
Apdo Aereo 6713, Cali, Colombia
Phone (57-2) 445-0000 - Fax (57-2) 445-0073
E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF GPIRAT-10

Parent	Origin/Cross	Frequency(%)
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	-Upland	1 41
L 202	IR456-3-2-1-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	-Italy	1 19
Italpatna	-Italy	1 19
Lido	-Italy	2 60

Parent	Ongin/Cross	Frequency(%)
Rıca	Nortaı//CI9545/Nova	2 60
Senatore Novellı	-Italy	1 19
Sıua	-	1 19
Vıtro	-Italy	1 19
Crıstalava	-France	1 41
Indıo	-Italy	1 41
Katy	Bonnet73/CI9722//Starbonnet/Tetep/// Lebonnet	1 41
LA110	-	1 41
Mars	CI9580/Saturn	1 41
Nortaı	Northrose/Taınan Iku 487	1 41
Arlesıenne	-France	1 92
ISCR 6	-	1 92
M 202	IR8/CS-M3*2//10-7*2//M 101	1 92
Quılamapu	-Chıle	1 92
SKBT	-	1 92
Tebonnet	Bluebelle//Belle Patna/Dawn	
CNA-IRAT 5 *	**Japonıca Upland Gene Pool**	**19 00**

** GENETIC CONSTITUTION OF CNA-IRAT 5 (see genetıc constıtutıon of PCT-5)*

PCT-11

Institution	CIRAD-CA/CIAT
Year of registration	1996
Scientists	M Châtel J Borrero, and Y Ospina
Ecosystem	Tropical Uplands
Objectives	Yield Potential Adaptation to acid soils Grain quality
Germplasm type	Japonica population
Germplasm development	Synthesis of a new derived population
Male-sterility source	Male-sterile plants of PCT-4 population
Line source	17 lines from Brazil Colombia , CIAT and CIRAD
Crossing method	Manual crossing development Recombination on male-sterile plants
Cytoplasm source	Monocytoplasm from PCT-4 population
Evaluation	F1 generation of each individual cross
Plant selection	In each selected F1F1
Seed mixture	F_2 seeds from each individual cross
Proportion mixture	Variable for the different crosses
Genetic constitution	See table

Germplasm status and identification

PCT-11\0\0\0, PCT-11\0\0\1, and PCT-11\0\0\0F

Requests for seed to

Dr M Châtel
Centro Internacional de Agricultura Tropical (CIAT)
Rice Program
Apdo Aereo 6713 Cali, Colombia
Phone (57-2) 445-0000 - Fax (57-2) 445-0073
E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-11

Parent	Origin/Cross	Frequency (%)
CAIAPO	Brazil	2 94
PROGRESSO	Brazil	2 94
ORYZICA SABANA 6	Colombia	2 94
ORYZICA SABANA 10	Colombia	2 94
ORYZICA TURIPANA 7	Colombia	2 94
CIRAD 409	France/Colombia	2 94
MARAVILLA	Brazil	2 94
CT 11251-9-M-2-3-5	CIAT	2 94
CT 11635-17-M-1-M	CIAT	2 94
CT11891-2-2-3-6-M	CIAT	2 94
CT 11891-3-10-3-5	CIAT	2 94
DH5A-3	France	2 94
CT 12243-22-9	CIAT	2 94
IDSA 6/IAC 164-3	Ivory Coast	2 94
CUAIBANA/IDSA 6-3	Ivory Coast	2 94
IRAT 147	Ivory Coast	2 94
CT 11859-9-10-3-M	CIAT	2 94
PCT-4	**Japonica Upland Population**	**50 00**

(continued)

Parent	Cross	Frequency (%)
CT6393 M 9 2 5 M	TOx 503 1 52 1/Suakoko//P 3085F4 59 1/Colombia 1	2 16
P 3621F2 1 2 8 1B	Metica 1//Suakoko/Ceysvoni	3 18
Araguaia	IAC 47/TOs 2578 7 4 2 3 B2	4 08
IRAT 144	IRAT 110/IRAT 13	3 54
IRAT 146	IRAT 13/Dourado Precoce	2 58
IR35353 94 2 1 3	IR17494/IR18272//IR19661	2 64
IR35410 16 3 2 2 2 2	IR2307/IR15689//IR4744	3 24
TOx 340 1 7 1	Tchenchouai//TN1/1031 1716 2 3 10	2 58
CICA 9	IR665 23 3 1//IR841 63 5 104 1B/C 46 15	0 90
Oryzica 2	BG90 2//CICA 8/CICA 7	3 90
CT6113 8 9 7 M	TOx 95/Oryzica 2//CICA 8	3 12
CT6458 9 3 6 M	P 3919F4 45 5/IRAT 120//IR4568 225 3 2/IR5657 33 2 2 3	4 80
CT5756 3 5 1 M	P 1274 6 8M 1 3M 1/P 5227//Campeche A 80	3 54
P 5446 9 4 4 M	TOx 1011 4 1/Oryzica 2//Ceysvoni/IRAT 122	3 00
CT6240 12 2 2 1 1P	Ngovie/IRAT 124//Col 1 X M312A 74 2 8 8	3 60

PCT-2

Institution	CIAT
Year of registration	1995
Scientists	E P Guimarães and F Correa
Ecosystem	Irrigated and Favored Upland
Objectives	Blast resistance (Scores $\leq$ 3)
Germplasm type	Indica-Japonica Population
Germplasm development	Recurrent selection breeding on GPCT-1
Male-sterility source	No
Method	S_2 progeny evaluation from GPCT-1
Cycles	Two
Cytoplasm source	From all parents
Evaluation	S_1 plant and S_2 line
Plant selection	Yes
Recombination	Manual crossing of selected plants
Seed mixture	S_0 seeds
Proportion mixture	Equal proportions of all crosses
Genetic constitution	See table
Germplasm identification	PCT-2\0\0\0 PCT-2\1\1\1 PCT-2\2\2\1
Requests for seed to	Dr M Châtel Centro Internacional de Agricultura Tropical (CIAT) Apdo Aereo 6713, Cali, Colombia Phone (57-2) 445-0000 - Fax (57-2) 445-0073 E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-2

Parent	Cross	Frequency (%)
P 5589 1-1-3P 4-MP	Carolıno/TOx1785-19 18//Colombıa 1/TOx 1011-4-1	0 29
CT6196-33-11-1 3-M	Col 1 X M312A 74-2 8 8/IRAT 124//RHS 107-2-1-2TB-1JM	0 73
CT6261 5-7-2P-5-1P	Camponı/Col 1 X M3121-74-2-8-8//TOx 1785-19-18	0 44
CT7242 16 9-2-M	TOx 1780 2-1-1P-3/Col 1 X M312A-74-2-8-8//TOx 718 AL-27-1CM-1JN	1 32
Ceysvonı	SML 997/Aıwını	0 29
Ecıa 122 J8 1-2 1	Rustıc//7399/IRAT 13	0 14
Ecıa 24	IR1529-430/VNI IR3223	0 88
C 48CU76-3-2-1 4-5M	IR2003/IR1615	0 15
P 4076F3 2 2-4	P 1386 6-8M 1 3M-1//P 1482-8-9M 1-2M-1B/Camponı	0 15
P 2851F4-145-9 58-1B-10	S 7-6//IR11-452-1 1/Camponı	0 44
P 3055F4-3-4P-1P-1B	S 5-11//Camponı/K 8	0 59
P 4725F2-9 6-1X	P 2026F4-49-5-5//IR5533-13-1-1/Oryzıca 1	0 29
TOx 1859-102 6M-3	TOx 95/Multıple Parent 109	2 35
P 4743F2 80-2 1X	P 1274-6-8M 1-3M-1//P 1386-6-8M-1-3M-1/Metıca 1	1 61
CT6278-3-7-4P-1	P 2062F4-17-33-1/IRAT 120//Col 1 X M312A-74-2-8-8	2 20

(continued)

Parent	Cross	Frequency (%)
CT6393 M 9 2-5 M	TOx 503-1-52-1/Suakoko//P 3085F4-59-1/Colombia 1	0 29
P 3621F2-1-2-8-1B	Metica 1//Suakoko/Ceysvoni	1 76
Araguaia	IAC 47/TOs 2578-7-4-2-3-B2	0 44
IRAT 144	IRAT 110/IRAT 13	1 17
IRAT 146	IRAT 13/Dourado Precoce	1 61
IR35353 94 2 1 3	IR17494/IR18272//IR19661	0 00
IR35410 16-3 2 2-2-2	IR2307/IR15689//IR4744	4 41
TOx 340 1 7-1	Tchenchouai//TN1/1031 1716-2 3-10	0 15
CICA 9	IR665-23-3-1//IR841 63-5-104 1B/C 46-15	3 23
Oryzica 2	BG90-2//CICA 8/CICA 7	1 76
CT6113-8-9-7 M	TOx 95/Oryzica 2//CICA 8	5 77
CT6458-9-3-6 M	P 3919F4-45-5/IRAT 120//IR4568 225-3-2/IR5657-33-2-2-3	7 05
CT5756-3-5 1-M	P 1274-6-8M-1-3M-1/P 5227//Campeche A-80	27 75
P 5446-9-4 4-M	TOx 1011-4 1/Oryzica 2//Ceysvoni/IRAT 122	15 71
CT6240-12 2-2-1-1P	Ngovie/IRAT 124//Col 1 X M312A-74-2-8 8	17 0

PCT-3

Institution CIAT

Year of registration 1995

Scientists E P Guimarães and F Correa

Ecosystem Irrigated and Favored Upland

Objectives Blast resistance (scores $\leq$ 5)

Germplasm type Indica-Japonica Population

Germplasm development Recurrent selection breeding of GPCT-1

- Male-sterility source: No
- Method: S_2 progeny evaluation from GPCT-1
- Cycles: Two
- Cytoplasm source: From all parents
- Evaluation: S_1 plants and S_2 lines
- Plant selection: Yes
- Recombination: Manual crossing of selected plants
- Seed mixture: S_0 seeds
- Proportion mixture: Equal proportions of all crosses

Genetic constitution See table

Germplasm identification
PCT-3\0\0\0
PCT-3\1\1\1
PCT-3\2\1\1

Requests for seed to
Dr M Chatel
Centro Internacional de Agricultura Tropical (CIAT)
Apdo Aereo 6713, Cali, Colombia
Phone (57-2) 445-0000 - Fax (57-2) 445-0073
E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-3

Parent	Cross	Frequency (%)
P 5589-1-1 3P-4 MP	Carolino/TOx1785-19-18//Colombia 1/TOx 1011-4 1	0 38
CT6196-33-11-1-3 M	Col 1 X M312A 74 2-8-8/IRAT 124//RHS 107 2-1-2TB-1JM	0 89
CT6261-5-7 2P-5-1P	Camponi/Col 1 X M3121-74-2-8-8//TOx 1785-19 18	0 64
CT7242 16 9 2-M	TOx 1780-2 1-1P-3/Col 1 X M312A-74-2 8-8//TOx 718 AL 27 1CM 1JN	1 15
Ceysvoni	SML 997/Aiwini	0 51
Ecia 122 J8-1 2-1	Rustic//7399/IRAT 13	0 38
Ecia 24	IR1529 430/VNI IR3223	0 76
C 48CU76 3 2 1-4 5M	IR2003/IR1615	0 13
P 4076F3-2-2 4	P 1386-6-8M 1-3M 1//P 1482-8 9M-1-2M-1B/Camponi	0 25
P 2851F4-145-9 58-1B-10	S 7-6//IR11 452-1-1/Camponi	0 38
P 3055F4-3 4P-1P 1B	S 5 11//Camponi/K 8	0 51
P 4725F2-9 6-1X	P 2026F4-49 5 5//IR5533-13 1-1/Oryzica 1	0 38
TOx 1859-102 6M 3	TOx 95/Multiple Parent 109	2 67
P 4743F2-80 2-1X	P 1274-6-8M 1 3M 1//P 1386-6-8M 1-3M-1/Metica 1	1 40
CT6278-3-7 4P-1	P 2062F4-17-33 1/IRAT 120//Col 1 X M312A-74 2-8 8	2 16

(continued)

Parent	Cross	Frequency (%)
CT6393 M-9 2 5 M	TOx 503-1-52 1/Suakoko//P 3085F4-59 1/Colombia 1	0 25
P 3621F2-1-2 8-1B	Metica 1//Suakoko/Ceysvoni	1 66
Araguaia	IAC 47/TOs 2578 7-4-2-3-B2	0 51
IRAT 144	IRAT 110/IRAT 13	1 27
IRAT 146	IRAT 13/Dourado Precoce	1 53
IR35353 94-2 1 3	IR17494/IR18272//IR19661	00 0
IR35410 16 3 2 2-2-2	IR2307/IR15689//IR4744	3 82
TOx 340 1 7 1	Tchenchouai//TN1/1031 1716 2-3 10	0 25
CICA 9	IR665-23 3 1//IR841-63-5-104-1B/C 46-15	3 69
Oryzica 2	BG90-2//CICA 8/CICA 7	1 78
CT6113 8-9-7-M	TOx 95/Oryzica 2//CICA 8	6 11
CT6458 9-3-6 M	P 3919F4-45-5/IRAT 120//IR4568 225 3 2/IR5657 33-2 2 3	7 64
CT5756 3-5 1 M	P 1274-6 8M 1-3M 1/P 5227//Campeche A-80	26 37
P 5446 9 4-4-M	TOx 1011-4 1/Oryzica 2//Ceysvoni/IRAT 122	15 92
CT6240 12 2-2-1 1P	Ngovie/IRAT 124//Col 1 X M312A-74-2-8 8	16 56

PCT-4

Institution	CIAT/CIRAD-CA
Year of registration	1995
Scientists	M Chatel and E P Guimarães
Ecosystem	Upland
Objectives	Tolerance to soil acidity Early maturity Blast resistance
Germplasm type	Japonica Population
Germplasm development	Introduction of new variability into CNA-IRAT A
Male-sterility source	Plants of CNA-IRAT A (population developed with IR36 male-sterile gene)
Line source	5 CIAT 1 IRRI, and 1 IAPAR (Brazil) upland lines
Crossing method	Manual crossing between lines and male-sterile plants Recombination on male-sterile plants
Cytoplasm source	Monocytoplasm from CNA-IRAT A
Evaluation	F_1 generation of each single cross
Plant selection	From selected F1
Seed mixture	F_2 seeds of selected F1 plants
Proportion mixture	Varied according to crosses
Recombination	On male-sterile plants
Genetic constitution	See table
Germplasm identification	PCT-4\0\0\0 PCT-4\0\0\1
Requests of seed to	Dr M Chatel Centro Internacional de Agricultura Tropical (CIAT) Apdo Aereo 6713 Cali, Colombia Phone (57-2) 445-0000 - Fax (57-2) 445-0073 E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF PCT-4

Parent	Origin/Cross	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
*IRAT 104 **	*IRAT 13/Moroberekan*	*6 25*
*53/2 **	*IRAT 2/IAC 25*	*12 50*
*IRAT 257 **	*Makuta mutante*	*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*

** GENETIC CONSTITUTION OF CNA-IRAT A*

** GENETIC CONSTITUTION OF CNA-IRAT 5 (see PCT-5 Population)

PCT-5

Institution	CIAT/CIRAD-CA
Year of registration	1995
Scientists	M Châtel and E P Guimarães
Ecosystem	Upland
Objectives	Tolerance to soil acidity Early maturity Blast resistance
Germplasm type	Japonica Population
Population development	Recurrent selection breeding on CNA-IRAT 5
Male-sterility source	Plants of CNA-IRAT 5 (gene pool developed with IR 36 male-sterile gene and 27 Lines from Brazil, Africa, and Asia
Cytoplasm source	Polycytoplasm (IR36 and different lines of CNA-IRAT 5 constitution)
Evaluation	Population
Recurrent Selection	
Method	Mass selection
Plant selection	Male-sterile plants
Seed mixture	Selected male-sterile plants
Proportion mixture	Equal for each selected male-sterile plant
Cycles	Three
Genetic constitution	See table
Germplasm identification	PCT-5\0\0\0 PCT-5\0\0\0F PCT-5\0\0\1
Requests for seed to	Dr Marc Châtel Centro Internacional de Agricultura Tropical (CIAT) Apdo Aereo 6713, Cali Colombia Phone (57-2) 445-0000 - Fax (57-2) 445-0073 E-mail mchatel@cgnet com

PCT-5 POPULATION DEVELOPED BY RECURRENT SELECTION IN CNA-IRAT 5

GENETIC CONSTITUTION OF THE ORIGINAL GENE POOL CNA-IRAT 5

Parent	Origin/Cross	Frequency (%)
Beira Campo	Brazilian germplasm	5 39
CNA 4097	IRAT 2/IAC 25	5 39
CNA 4145	IAC 47/Kinandong Patong	5 39
IRAT 177	Mutant of IRAT 79	5 39
IREM 41-1-1-4	Mutant of Makouta	5 39
Palha Murcha	Brazilian germplasm	5 39
TOx 1011-4-2	IRAT 13/DP689//TOx 490-1	5 39
CNA 5171	IAC47/IRAT 13	2 69
Casca Branca	Brazilian germplasm	0 84
CNA 5179	IAC 47/IRAT 13	0 84
CNA 770187	Brazilian germplasm	0 84
Comum Criolo	Brazilian germplasm	0 84
Jaguary	Brazilian germplasm	0 84
L 13	Brazilian germplasm	0 84
L 81-24	IAC 2091/Jaguary//IRAT 10	0 84
Santa America	Brazilian germplasm	0 84
Cuiabana	IAC 47/SR2041-50-1	8 10
IRAT 237	IAC 25/RS 25	6 73
IAC 165	Dourado Precoce/IAC 1246	2 69
IREM 247	Mutant of IAC 25	2 50
IAPAR 9	Batatais/IAC F3-7	1 57

Rice Sheet No 4 IP-4

Activity Area	Improving Productivity	Page 1 of 2

Title of Proposed Collaboration   Improved Rice Gene Pools for LAC Multimedia CD ROM for rice weeds (Adventrop)

1 Overall Priority (check one)

Very High		High	X	Medium		Low		No interest	

2 Project Description

2 1 Development and Scientific Objectives

- Tool for weed identification and management

  More efficient weed control

2 2 Congruence with Institutional Goals

- Better more rationale use of herbicides
- Lower costs of production

  Reduce environmental hazards

2 3 Methods

  Multimedia CD ROM database on identification and knowledge base of rice weeds

- Extensive survey of rice weeds throughout LAC
- Digitalization of drawings and pictures
- Database organization

2 4 Expected Outputs

- CD-ROM in Spanish (possibly Portuguese) for rice weeds in LAC
- Powerful tool for training specialists nonspecialists and farmers

3 Current Status (check one)

On going		Well defined	X	Needs further refinement		Very Preliminary		

Comments

- Base product already developed for cotton in Africa by CIRAD-CA

4 Resources (per year indicate if FF US$)

	Total Required	Presently Available	To be Sought
Personnel	0 25	0 25	
Operations	US50 000	US$50 000	
Total			

Comments

Project coordinated by Thomas le Bourgeois

Estimated Duration 4 years

Estimated Starting Date 1997

5 Collaborating Institutions

CIRAD CIAT and FLAR
Brazil (IRGA EPAGRI) Colombia (Fedearroz U Nal/Facultad de Agronomia) Costa Rica
(CIPROC ONS) Cuba (IIA) Panama (IDIAP) Venezuela (Fundarroz Aproscello UNV/FA)

Comments Project started in March 1997 and will end in 2001

6 Followup Needed

Persons Designated as Responsible

- Thomas le Bourgeois

Luis Roberto Sanint

APPENDIX 2

CIAT RICE PROJECT

Project IP-4 Improved Rice Germplasm for Latin America and the Caribbean

Project objective

To increase genetic diversity and enhance gene pools for higher, more stable yields with lower unit production costs and reduced environment hazards

Outputs	**Gene pools enhanced**	**Knowledge of the physiological basis for rice traits gained**	**Rice pests and genetics of resistance characterized**	**Project priorities and research capacity enhanced**
Activities	• Introduce germplasm from different sources • Identify progenitors for crossing • Generate and evaluate gene pools • *Seed multiplication* distribution to FLAR and other partners • Identify useful traits in wild germplasm and make it interspecific crosses (linked to SB 2) • Use AC and embryo rescue to speed up development of breeding lines • Select for useful traits with aid of molecular markers (linked with SB 2)	• Characterize and promote new plant type for direct seeding • Improve demand-driven N supply and N uptake for full expression of yield potential • Understanding the physiological mechanism for tolerance of low P and acid soils • Make crosses of competitive cultivars with submergence tolerance and early vigorous progenitors • Conduct close response tests and field evaluation for diagnosis of herbicide resistance and cross resistance and to monitor management practice	• Monitoring genetic and virulence diversity of blast pathogen • Improve breeding methods for developing durable blast resistance • Evaluation of rice germplasm including transgenic rice for resistance to *Tagosodes orisiculus* and RHBV • Collaboration with FEDEARROZ to transfer *Tagosodes* and RHBV evaluation techniques • Conduct field surveys • Isolation and characterization of the causal agent and vector of entorchamiento • Development of germplasm screening technique for resistance and implementation of entorchamiento control measures	• Coordinate breeding activities with FLAR and other institutions (linked to SN 2) • Organize and support training and information activities (linked to SN 2) • Characterize rice technologies and costs (irrigated and upland) • Apply questionnaires to farmers with national programs • Refine priorities • Train national scientists of Latin America in new research technologies

APPENDIX 3
PUBLICATIONS, CONFERENCES, AND POSTERS

CATALOGUE REGISTRATION FOR RICE GENE POOLS AND POPULATIONS 1997 issue Chatel, M and E P Guimarães CIRAD/CIAT

UPLAND RICE IMPROVEMENT Using Gene Pools and Populations with Recessive Male-Sterile Gene, 1996 CIRAD/CIAT Rice Project Report February 1996 CIRAD/CIAT document 31 p

UPLAND RICE IMPROVEMENT IN THE HIGHLANDS OF COLOMBIA A New Crop for the Coffee Region 1997 Châtel, M , A Moreno, E P Guimarães, and J Borrero In Proceedings of the Rice for the Highlands Conference, Antananarivo, Madagascar, June 1997

CIRAD/CIAT COLLABORATIVE PROJECT on Improved Rice Gene Pools for Latin America and the Caribbean 1997 Châtel, M L Sanint Paper presented at the Third Collaborative Meeting between CIAT, CIRAD, INRA, and ORSTOM, May 7-9, 1997, at CIAT, Palmira Colombia

CIRAD-CA/CIAT RICE BREEDING PROJECT 1997 Châtel, M , E P Guimarães, C P Martinez Paper presented at the X Conferencia Internacional del Arroz para America Latina y el Caribe, Venezuela-Acarigua and Caracas March 2-8, 1997

CIRAD-CA RICE GERMPLASM Its Use in Latin America 1997 Châtel, M E P Guimarães, F Cuevas Paper presented at the X Conferencia Internacional del Arroz para America Latina y el Caribe, Venezuela-Acarigua and Caracas, March 2-8, 1997

POPULATION IMPROVEMENT FOR RICE BLAST AND ACID SOILS 1997 Châtel, M , E P Guimarães F Correa, J Borrero, Y Ospina, C Huertas, E Tulande Paper presented at the X Conferencia Internacional del Arroz para America Latina y el Caribe, Venezuela-Acarigua and Caracas, March 2-8, 1997

RECURRENT SELECTION IN RICE, USING A MALE-STERILE GENE 1997 Châtel, M , E P Guimarães CIRAD-CA/CIAT publication 70 p (English translation of *Seleccion Recurrente con Androesterilidad en Arroz*)

SELECCION RECURRENTE EN ARROZ March 1997 Editor E P Guimarães Published by EMBRAPA, Fundacion POLAR CIRAD-CA, and CIAT 240 p

THE RICE COLLABORATIVE PROJECT BETWEEN CIRAD, CIAT, and FLAR 1997 Paper presented at a meeting on "Cooperação Internacional na Pesquisa do Arroz", Jaguarão, RS Brazil, May, 1997

APPENDIX 4
TRIPS

<u>National Trips</u>

Marc CHÂTEL

- VILLAVICENCIO	Field works
- MANIZALES	Interaction with CENICAFE
- SANTA MARTA	IV Congreso Nacional de la Sociedad Colombiana de Fitomejoramiento y Produccion de Cultivos, May 28-30, 1997

Michel VALES

Dr M Vales arrived in mid-August 1997 but has had the opportunity to interact with the CIAT rice project and with FLAR CENICAFE and CIAO in the field

- VILLAVICENCIO	Field works
- MANIZALES	Interaction with CENICAFE and CIAO

Yolima OSPINA

-CIAT headquarters	Field works
-SANTA MARTA	IV Congreso Nacional de la Sociedad Colombiana de Fitomejoramiento y Produccion de Cultivos, May, 28-30, 1997

Jaime BORRERO

- VILLAVICENCIO	Field works
- MANIZALES	Interaction with CENICAFE and CIAO

<u>International Trips</u>

Marc CHÂTEL

FRANCE

1 Scientific contacts with the CIRAD Rice Program 7-10 July 1997
2 CIRAD September days and field visit to the French rice-growing region of Camargue, September 1-10 1997

BRAZIL

1 Visit to IRGA and EMBRAPA Arroz e Feijão, March 17-27, 1997

2 Meeting on Cooperação Internacional na Pesquisa do Arroz", Jaguarão-RS, May 14-17, 1997

CHILE

Contacts and field work with INIA-Quilamapu, February 17-21, 1997

ARGENTINA

1 Contacts and field work with INTA-Corrientes and the University of Corrientes, February 22-25 1997

2 Universidad de Tucuman November 1997

URUGUAY

Contacts and field work with INIA-Treinta y Tres, February 26-28, 1997

VENEZUELA

1 X Conferencia Internacional del Arroz para America Latina y el Caribe Acarigua, March 2-6, 1997

2 Rice World Day Caracas, March 7, 1997

ROMANIA

Contacts with ICCPT Fundulea, Bucharest, September 13-17 1997

PANAMA

FLAR Board meeting, Ciudad de Panama, November 6-7, 1997

UNITED KINGDOM

International Symposium on Rice Quality, Nottingham November 24-27, 1997

Michel VALES

Dr M Vales arrived in mid-August 1997 and could participate in the most relevant international meetings during 1997 B)

BRAZIL

1 XXII Remião da Cultura do Arroz Irrigado, Camburiu-SC, September 23-26, 1997

2 Contacts with Dr J Taillebois - CIRAD /G4I collaborative project

Yolima OSPINA

BRAZIL
Field work at EMBRAPA Arroz e Feijão, Goiânia-GO, March 8-April 6, 1997

VENEZUELA
Lecture and presentation of the CIAT/CIRAD Recurrent Selection Project Course on Rice Breeding organized by DANAC, Fundacion Nacional del Arroz, and the Universidad Central de Venezuela, Calabozo September 8-12 1997

Jaime BORRERO

BRAZIL
XXII Reunião da Cultura do Arroz Irrigado, Camburiu-SC, September 23-26, 1997

APPENDIX 5
RECIPROCAL VISITS FROM SCIENTISTS

From CIRAD-CA to Latin America

Christian POISSON, Leader Rice Program, CIRAD-CA, France
Guy CLEMENT, Rice Breeder, France
Jean CHAROY, Agronomist, French Guiana

They attended (1) X Conferencia Internacional del Arroz para America Latina y el Caribe, Acarigua, Venezuela, March 2-6 1997 and (2) Rice World Day Caracas, Venezuela, March 7, 1997

Thomas LE BOURGEOIS Weed Scientist

Adaptation of ADVENTROP for Venezuela, Colombia Costa Rica and Cuba, March 1997

Patricio MENDEZ DEL VILLAR, Economist

Chile, November 1997

From Latin America to CIRAD-CA

Zaida LENTINI, Biotechnologist CIAT Rice Project

Contacts with the Rice Biotechnology Unit of CIRAD-CA and the University of Montpellier II, to develop a joint project for rice transformation, targeting iron toxicity, May 1997

Luis Roberto SANINT, Leader, CIAT Rice Project, and Director, FLAR

Contacts with different scientists of the CIRAD-CA Rice Program and participation in rice field days at Camargue, September 1997

Roberto ALVARADO, Leader, INIA Rice Program, Chile

Contacts with different scientists of the CIRAD-CA Rice Program and participation in rice field days at Camargue September 1997

APPENDIX 6
REFERENCES

1 Cuevas-Perez F , E P Guimarães, L E Berrio, D I Gonzalez 1992 Genetic base of rice in Latin America and the Caribbean, 1971 to 1989 Crop Sci 32(4) 1054-1059

2 Châtel M E P Guimarães 1995 Recurrent selection in rice gene pools and populations review of present status and progress CIRAD/CIAT Cali, Colombia 30 p

3 Chatel M E P Guimarães 1995 Upland rice improvement using gene pools and populations with recessive male-sterile gene CIRAD/CIAT, Cali, Colombia 29 p

4 Chatel, M E P Guimarães 1996 Upland rice improvement using gene pools and populations with recessive male-sterile gene CIRAD/CIAT, Cali, Colombia 31 p

5 Châtel M E P Guimarães 1995 Nomenclature system for rice gene pools, populations and recurrent selection breeding General use and catalogue registration CIRAD/CIAT Cali Colombia 10 p

6 Châtel M E P Guimarães 1995 Catalogue registration to manage rice gene pools and populations improvement CIRAD/CIAT, Cali, Colombia

7 Federer W T 1956 Augmented (or hoonuiaku) designs Hawaiian Planter's Record 55 191-208

APPENDIX 7

DESCRIPTION AND GENETIC CONSTITUTION OF GERMPLASM FOR RECURRENT SELECTION BREEDING

GPCT-1

Institution	CIAT
Year of registration	1995
Scientists	E P Guimarães and F Correa
Ecosystem	Irrigated and Favored Upland
Objectives	Blast resistance
Germplasm type	Indica-Japonica Gene Pool
Germplasm development	Development of an original gene pool
Male-sterility source	No
Line source	30 breeding lines and commercial varieties
Crossing method	Manual crossing development Manual crossing recombination
Cytoplasm source	From all parents
Evaluation	Basic germplasm
Plant selection	No
Seed mixture	S_0 seeds
Proportion mixture	Equal proportions of all 417 double crosses made with the 30 parents
Recurrent Selection	
Method	No
Cycles	No
Genetic constitution	See table
Germplasm identification	GPCT-1\0\0\0
Requests for seed to	Dr M Châtel Centro Internacional de Agricultura Tropical (CIAT) Apdo Aereo 6713, Cali, Colombia Phone (57-2) 445-0000 - Fax (57-2) 445-0073 E-mail mchatel@cgnet com

GENETIC CONSTITUTION OF GPCT-1

Parent	Cross	Frequency (%)
P 5589 1 1 3P 4 MP	Carolino/TOx1785 19 18//Colombia 1/TOx 1011 4 1	2 76
CT6196 33 11 1 3 M	Col 1 X M312A 74 2 8 8/IRAT 124//RHS 107 2 1 2TB 1JM	3 96
CT6261 5 7 2P 5 1P	Camponi/Col 1 X M3121 74 2 8 8//TOx 1785 19 18	3 24
CT7242 16 9 2 M	TOx 1780 2 1 1P 3/Col 1 X M312A 74 2 8 8//TOx 718 AL 27 1CM 1JN	4 80
Ceysvoni	SML 997/Aiwini	4 02
Ecia 122 J8 1 2 1	Rustic//7399/IRAT 13	3 12
Ecia 24	IR1529 430/VNI IR3223	3 84
C 48CU76 3 2 1 4 5M	IR2003/IR1615	3 24
P 4076F3 2 2 4	P 1386 6 8M 1 3M 1//P 1482 8 9M 1 2M 1B/Camponi	4 98
P 2851F4 145 9 58 1B 10	S 7 6//IR11 452 1 1/Camponi	3 30
P 3055F4 3 4P 1P 1B	S 5 11//Camponi/K 8	3 06
P 4725F2 9 6 1X	P 2026F4 49 5 5//IR5533 13 1 1/Oryzica 1	3 00
TOx 1859 102 6M 3	TOx 95/Multiple Parent 109	3 24
P 4743F2 80 2 1X	P 1274 6 8M 1 3M 1//P 1386 6 8M 1 3M 1/Metica 1	2 64
CT6278 3 7 4P 1	P 2062F4 17 33 1/IRAT 120//Col 1 X M312A 74 2 8 8	4 02

Activity Area	Improving Productivity	Page 1 of 2

Title of Proposed Collaboration: Improved Rice Gene Pools for LAC Integrated rice blast management

1 Overall Priority (check one)

Very High		High	X	Medium		Low		No interest	

2 Project Description

2 1 Development and Scientific Objectives

- Higher stability of yields through space and time
- Lower applications of fungicides
- Long-lasting resistance to blast

2 2 Congruence with Institutional Goals

- More rational use of pesticides
- Lower costs of production
- Environmental protection

2 3 Methods

- Identification of potential parents for partial resistance to blast lineages
- Gene pool and population development
- Develop recurrent selection method for resistance to blast lineages

2 4 Expected Outputs

- Improved knowledge of genes controlling partial resistance to blast
- New methodologies to breed resistant lines
- Enhanced gene pools available to NARS

3 Current Status (check one)

Ongoing		Well defined	X	Needs further refinement		Very Preliminary		

Comments

This project reinforces two ongoing projects the CIRAD/CIAT/FLAR recurrent selection of rice and the characterization of blast lineages and sources of resistance

4 Resources (per year indicate if FF US$) SS Senior Staff

	Total Required	Presently Available	To be Sought
Personnel	0 55		0 55
Operations	US$30 000	US$30 000	
Total			

Comments

This project was well defined since 1996

- The person identified to execute it is Michael Vales with 50% of time in this project

Estimated Duration 4 years

Estimated Starting Date 1998

5 Collaborating Institutions

- CIRAD CIAT and FLAR

Comments Final arrangements to locate M Vales at CIAT in September 1997 still pending

6 Follow up Needed

- CIRAD to communicate CIAT its decision on M Vales If reaction is positive to send a letter with terms of agreement to CIAT

Persons Designated as Responsible

- C Poisson

  Luis Roberto Sanint

Rice Sheet No 3 IP-4

Activity Area	Improving Productivity	Page 1 of 2

Title of Proposed Collaboration: Improved Rice Gene Pools for LAC Rice adaptation and breeding for the Andean Highlands

1 Overall Priority (check one)

Very High	X	High		Medium		Low		No interest	

2 Project Description

2 1 Development and Scientific Objectives

- Obtain rice lines well adapted to Hillside conditions
- Introduce rice as a crop and food alternative for small self- sufficient farmers
- Combine rice with other crops in soil management schemes for Hillsides

2 2 Congruence with Institutional Goals

- New alternatives for poor rural farmers
- Better management of Hillside soils

2 3 Methods

- Line breeding
- Population breeding
- Use of CIRAD Madagascar material

2 4 Expected Outputs

- Varieties well adapted to mid altitude conditions
- Cropping techniques suitable to Hillsides

3 Current Status (check one)

Ongoing	X	Well defined		Needs further refinement		Very Preliminary		

Comments

- This project is to be reinforced by additional collaboration between CIRAD and CIAT

4 Resources (per \ear ındıcate ıf FF US$ ¥ etc) SS Senıor Staff

	Total Requıred	Presenth Av aılable	To be Sought
Personnel	0 75	0 25	0 50
Operatıons	US$30 000	US$30 000	
Total			

Comments

0 50 of the tıme of Mıchael Vales

- 0 25 of the tıme of Marc Ch ıtel

Estımated Duratıon 7 \ears | Estımated Startıng Date 1995

5 Collaboratıng Instıtutıons

- CIAT
- CIRAD
- Cenıcafe (Colombıa)
- CIAO (Colombıa)

Comments Mıchael Vales should come to CIAT bv September 1997

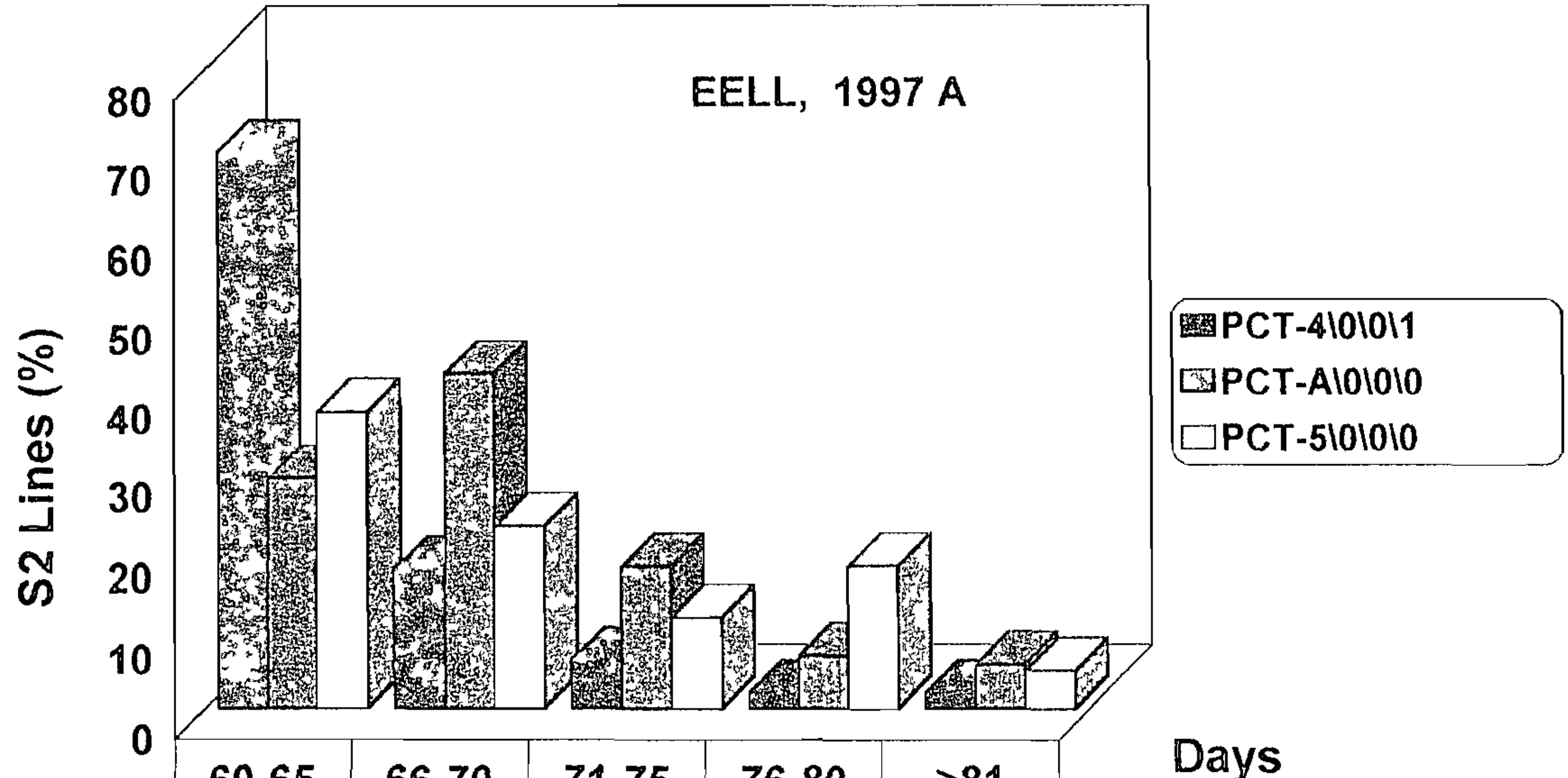
6 Follow up Needed

CIRAD to decıde on outpostıng M Vales to CIAT If posıtıve to send a letter wıth terms of agreement to CIAT to reınforce thıs project through Mıchel Vales

Persons Desıgnated as Responsıble

- C Poısson
- Luıs Roberto Sanınt

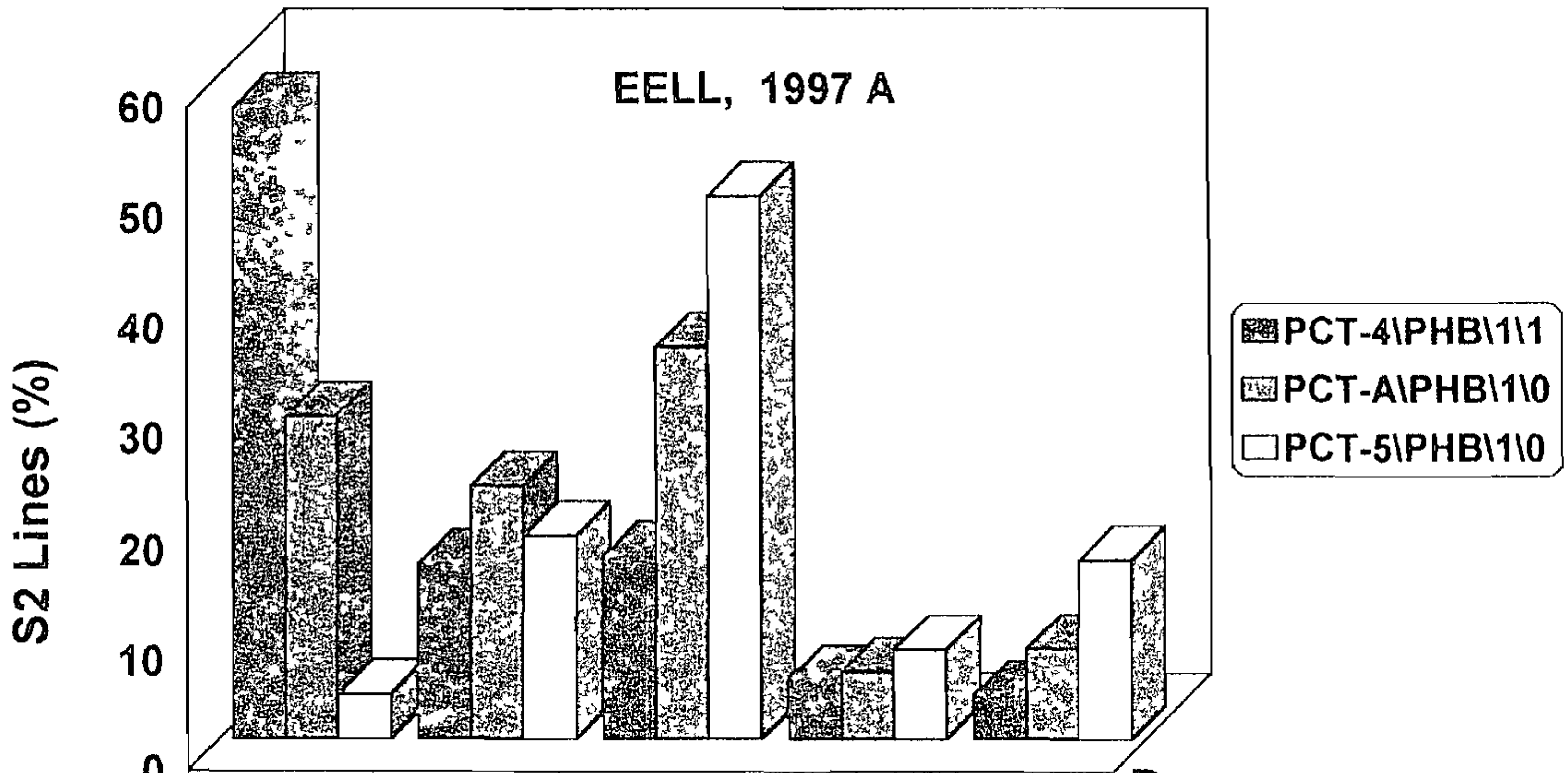
Evaluation of early maturity in S4 lines from three basic populations



	60-65	66-70	71-75	76-80	>81
PCT-4\0\0\1	69 7	17 2	6	2	2
PCT-A\0\0\0	28 6	41 8	17 6	6 6	5 5
PCT-5\0\0\0	37	22 6	11 3	17 7	4 8

Table 19

Evaluation of eary maturity in S2 lines from three populations
(one cycle of recurrent selection for both sexes for disease resistance)



	60-65	66-70	71-75	76-80	>81
PCT-4\PHB\1\1	57 1	15 9	16 6	5 5	4
PCT-A\PHB\1\0	29 2	22 9	35 4	6.2	8 3
PCT-5\PHB\1\0	4 1	18 4	49	8 2	16 3

Table 20

Table 21 Characteristics[a] of upland lines introduced from Brazil (EMBRAPA Arroz e Feijão) to La Libertad ' Experiment Station Colombia, 1997 A

No	Field no 1997 A	Pedigree[b]	Vg	Bl 1	Bl 2	AC	Fl 50%	LSc	BS	NBl	Gd	Ht
1	700090	CNAx2888 B 12-1-1	1	3	3	1	84	3	1	1	1	116
2	700091	CNAx1947 8-1 1-1-1	3	1	1	1	81	3	1	1	1	116
3	**700092**	**CNAx3608-6 1 2 2 1 M-M**	**3**	**1**	**2**	**1**	**68**	**1**	**1**	**1**	**1**	**112**
4	700093	CNAx3611-19-5-B-1-M	3	1	1	1	85	3	1	1	1	107
5	700094	CNAx4855 410 220	5	1	1	1	86	3	1	1	3	121
6	700095	CNAx4849 146 12	1	1	1	1	64	3	1	1	1	103
7	700096	CNAx4448 6 1 B 1	5	1	1	1	69	1	1	1	1	98
8	700097	CNAx3624 6-7 B 1	5	1	1	1	81	1	1	1	1	98
9	**700098**	**CNAx3619-3-1-B 2 M M***	**3**	**3**	**4**	**1**	**86**	**3**	**1**	**1**	**1**	**102**
10	**700099**	**CNAx4754-80-B M-7 M-M***	**3**	**1**	**2**	**1**	**66**	**1**	**1**	**1**	**1**	**97**
11	700100	CNAx4858 BM500 B M 7	1	1	1	1	76	3	1	1	1	117
12	700101	CNAx4754-6 B M 25	1	1	1	1	74	1	1	1	1	106
13	700102	CNAx4858 BM500-B-M-22	3	1	1	1	77	1	1	1	1	123
14	700103	CNAx4858 BM500-B M 31	3	1	1	1	84	1	1	1	1	117
15	**700104**	**CNAx4754 128 B M-4 M***	**3**	**1**	**1**	**1**	**74**	**1**	**1**	**1**	**1**	**95**
16	700105	CNAx4754-6 B M 29	3	1	1	1	74	1	1	1	3	100
17	700106	CNAx4858 BM500-B-M 30	3	1	1	1	79	3	1	1	1	115
18	**700107**	**CNAx4754-61 B M-20-M***	**3**	**1**	**1**	**1**	**91**	**3**	**1**	**1**	**1**	**104**

a Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected Ht = height (cm)
b Upland lines in bold are selected lines

Table 22 Use of CIAT/CIRAD savannas upland lines for yield trials (A) and segregating generations (B) in Brazil

A

Trial	Total no of lines	Checks (no)	CIAT/CIRAD lines (no)	CIAT/CIRAD participation (%)
Observation	159	4 (1 CIAT)	27	18 0
Preliminary II	36	3	25	75 7*
Preliminary III	49	2 (1 CIAT)	39	85 1*
Advanced II	25	5 (2 CIAT)	12	60 0*
Advanced III	20	5	7	46 6*

B

Generation	No of lines	CIAT/CIRAD lines	CIAT/CIRAD parents	CIAT/CIRAD participation (%)
F6	891	21	-	2 3
F4	1179	672	-	57 8*
F3	555	-	-	-
F2	104	-	40	38 5
F1	141	-	72	51 1*

* Participation at 35% or more

Table 23 Genetic constitution of the CIAT/CIRAD savanna upland line, CT 9278-11-14-2-1-M to be immediately released in China (Bold and underlining refer to CIRAD lines)

Parent	Participation (%)
<u>IRAT 216</u>	**<u>37 50</u>**
Tox 1785-19-18	25 00
<u>IRAT 124</u>	**<u>12 50</u>**
KAOHSIUNG 180	12 50
BG 90-2	12 50

Table 24 Grain yield[a] of highland upland rice in an on-farm trial La Laguna 1600 m above sea level, Department of Cauca, Colombia, 1996 B (Line in bold and underlined was selected)

Line	Grain yield (kg/ha)					Average grain yield (kg/ha)
	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	
LATSIDAHY/ FOFIFA 62-2	900	1600	650	775	*****	981 25
FOFIFA 116/ SHIN EI	1050	1425	500	*****		991 67
LATSIDAHY/ FOFIFA 62-1	262	1785	500	550	*****	775 00
<u>LATSIDAHY/ FOFIFA 62-3</u>	**<u>1250</u>**	**<u>3200</u>**	**<u>550</u>**	**<u>1300</u>**	**<u>720</u>**	**<u>1404 00</u>**
FOFIFA 116/ SHIN EI 3	1025	-	*****	800	*****	912 50
CIRAD 409	*****	*****	*****	*****	-	*****

a ***** = complete sterility - = not tested

Table 25 Acceptability of upland rice lines according to a survey conducted with farmers La Laguna,Department of Cauca Colombia,1996 B

Favorable comments			Unfavorable comments		
Characteristic	Frequency (%)	Ranking	Characteristic	Frequency (%)	Ranking
High number of panicles	**46 2**	**1**	**Few panicles**	**38 1**	**1**
Short cycle	23 1	2	Long cycle	28 6	2
Plant type	15 4	3	Heterogeneity	14 3	3
Homogeneity	7 7	4	Small plants	4 8	4
Heavy panicles	3 8	5	Small panicles	4 8	4

Table 26 Acceptability to farmers of six upland rice lines in their vegetative stage, La Laguna, Department of Cauca Colombia, 1996 B

Line	Score	Ranking
LATSIDAHY/FOFIFA 62-2	17	3
FOFIFA 116/SHIN EI	15	5
LATSIDAHY/FOFIFA 62-1	21	2
LATSIDAHY/FOFIFA 62-3	**23**	**1**
FOFIFA 116/SHIN EI 3	7	6
CIRAD 409	17	3

Table 27 Recurrent selection for both sexes for hoja blanca ' germplasm evaluation and selection of plants for recombination (A = recurrent selection germplasm B = checks)

A

Germplasm identification	No and % of plants showing 'hoja blanca' symptoms		No and % of immune and transplanted plants for recombination
	In the nursery	After transplanting	
PCT-6\0\0\2	2800 (75%)	517 (14%)	416 (11%)
PCT-7\0\0\0	2670 (62%)	850 (20%)	**762 (18%)**
PCT-8\0\0\0	2423 (72%)	298 (9%)	**629 (19%)**
GPCT-9\0\0\0F	2727 (66%)	1096 (26%)	331 (8%)

B

Line identification	Plants showing "hoja blanca symptoms (%)	Immune plants (%) and reaction type	
CICA 8	99 70	0 30	S
COLOMBIA 1	7 48	92 51	R
BLUE BONNET 50	99 58	0 42	S
ORYZICA 1	68 49	31 50	MS
METICA 1	88 21	11 79	S
CARIBE 8	95 77	4 23	S
ORYZICA LLANOS 5	16 71	83 29	R

a S = susceptible R = resistant MS = moderately susceptible

Table 28 Release of recurrent selection germplasm around the world

Country	Institution	Germplasm
Savanna upland rice		
Latin America and the Caribbean		
Brazil	EMBRAPA	PCT-4
Colombia	FEDEARROZ and CORPOICA	PCT-4 and CNA-IRAT
Costa Rica	MAG	PCT-4
Cuba	IIAC	PCT-4
Venezuela	DANAC and FONAIAP	PCT-4 and CNA-IRAT
Asia		
The Philippines	CURAD IRRI	CNA-IRAT-P, PCT-4, PCT-A, and PCT [illegible]
Lowland rice		
Latin America and the Caribbean		
Argentina	Universidad de Corrientes	PCT-6, PCT-7, and PCT-8
Brazil	EMBRAPA	GPIRAT 10
Chile	INIA	GPIRAT 10
Colombia	FEDEARROZ and CORPOICA	GPCT-9, GPIRAT 10, PCT-6, PCT-7, PCT-8, and IRAT-CT
Costa Rica	MAG	GPCT 9 and PCT 7
Cuba	IIAC	GPIRAT 10 and PCT 7
El Salvador	CENTA	GPCT 9, PCT-6, PCT 7, and PCT 8
Panama	Universidad de Panama	GPCT 9, PCT-6, PCT 7, and PCT 8
Venezuela	DANAC, FONAIAP, and Fundacion Polar	GPCT-9, GPIRAT 10, PCT-6, PCT-7, PCT-8, and IRAT-CT 0[illegible]
Uruguay	INIA	GPIRAT 10
Europe		
Spain	Centro de Recursos Geneticos	GPIRAT 10
Hungary		GPIRAT 10
Romania	ICCPT Fundulea	GPIRAT 10

Table 29 Characteristics of the R2 lines from the IRAT CT population selected by FLAR Santa Rosa Experiment Station, Colombia, 1997 A

No	Field no 1997 A	Pedigree	Vg	Bl 1	Bl 2	Bl 3	BS	LSc	Fl (50%)	NBl	Gd
1	972946	IRAT CT/0/1F>4-CA 1	1	4	2	2	1	1	93	3	2
2	972947	IRAT CT/0/1F>4-CA-2	1	4	1	1	1	1	88	1	3
3	972988	IRAT CT/0/2>7 CA-5	1	4	2	2	1	1	102	1	3
4	973003	IRAT CT/0/2>8-CA-3	1	4	4	4	3	3	106	1	5
5	973006	IRAT CT/0/2>7-CA-1	1	3	3	3	5	5	102	1	3

Vg = vigor Bl 1 = leaf blast Bl 2 = leaf blast AC = acid soil reaction Fl = flowering LSc = leaf scald. BS = brown spot NBl = neck blast Gd = grain discoloration Sel = number selected Ht = height (cm)

APPENDIX 1

CIRAD/CIAT/FLAR

RICE SHEETS

Rice Sheet No 1 IP-4

Activity Area	Improving Productivity	Page 1 of 2

Title of Proposed Collaboration Improve Rice Gene Pools for LAC Recurrent Selection of Rice

1 Overall Priority *(check one)*

Very High	X	High		Medium		Low		No interest	

2 Project Description

2 1 Development and Scientific Objectives

- To increase genetic diversity and enhance gene pools for higher and more stable yields
- To increase the efficiency of rice production to make it more competitive at lower prices for consumers

2 2 Congruence with Institutional Goals

- Higher productivity
- Lower prices to poor consumers
- More rational use of pesticides water and soil

2 3 Methods

- Gene pool and population development
- Gene pool and population enhancement
- Combining recurrent selection and traditional breeding.

2 4 Expected Outputs

- Basic materials (gene pools and populations)
- Population breeding for traits of interest blast yield, cold hoja blanca virus and *Tagosodes*

3 0 Current Status (check one)

Ongoing	X	Well defined		Needs further refinement		Very Preliminary		

Comments

- Started in late 1991
- Network of thirteen countries and three institutions CIAT CIRAD FLAR
- Research in temperate South America relevant to European conditions

4 Resources (per year indicate if FF US$)

	Total Required	Presently Available	To be Sought
Personnel	0 80	0 80	
Operations	US$55 000	US$55 000	-
Total			

Comments

- Continued support from CIAT CIRAD and FLAR
- SS is Marc Chatel

Estimated Duration 10 years

Estimated Starting Date Late 1991

5 Collaborating Institutions

- 13 countries Brazil Colombia Bolivia Venezuela Chile Argentina Uruguay Cuba Panama Costa Rica Paraguay Guatemala French Guiana

  CIAT CIRAD and FLAR

Comments Relationships with CIRAD CFR breeding program

6 Follow up Needed

- None

Persons Designated as Responsible

- Marc Chatel

  Luis Roberto Sanint