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(Activity 1). Conventional crossbreeding

Upland savannas ecosystem

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Abstract

Conventional crossbreeding has permitted the development and release of modern upland lines in Latin America (Bolivia, Brazil and Colombia). CIAT and CIAT/CIRAD projects now concentrate on broadening the genetic base of upland rice. Inter-specific crosses between *Oryza sativa* and the African cultivated *Oryza. Glaberrima*, and wild relative species is one of the new breeding strategies used to achieve this objective.

Since 1996, no new conventional “*Japonica*” *Oryza sativa* by “*Japonica*” *Oryza sativa*” crosses were made. Though, as we have advanced segregating lines in the pipeline, we continue their evaluation and multiplication in Colombia for release to Latin American and Caribbean (LAC) NARS partners.

Key words: Conventional crossbreeding, *Japonica Oryza sativa*, Latin America, line release, genetic base.

Highlights

- 4 Upland lines released in Brazil (1994-1999)
- 1 line to be released in Colombia (pending)
- 5 promising Upland lines in Vietnam
- Application for registration of 1 Upland line in CIRAD’s catalogue

List of cooperators

➤ **Latin America and the Caribbean**

Argentina

- Marta Nicosia, University of Tucumán
- Alberto Villegas, University of Tucumán

Bolivia

- Roger Taboada, CIAT Santa Cruz de la Sierra
- Jorge Rene Guzmán, CIAT Santa Cruz de la Sierra

Brazil

- Elcio Perpetuo Guimarães, Embrapa, Rice and Beans Center

Colombia

- Hernando Delgado, Corpoica Regional 8

Cuba

- René Perez Polanco, Instituto de Investigaciones del Arroz (IIA)
- Rubén Alfonso, Instituto de Investigaciones del Arroz (IIA)

Venezuela

- Gelis Torrealba, Instituto Nacional de Investigacion Agricola (INIA former Fonaiap)

➤ **Africa**

- Through CIRAD – France –
- Monty Jones, WARDA – Cote d’Ivoire –

➤ **Asia**

- **IRRI** – The Philippines –

South East Asia

- Peter Kerridge, CIAT Asian Office

China

- Tao Dayun, Food Crop Research Institute of the Yunnan Academy of Agricultural Sciences (FCRI / YAAS – Yunnan Province)

- Lee Kai Mian, Chinese Academy of Tropical Agricultural Sciences (CATAS-Hainan Province)

1. Introduction

CIAT and CIAT/CIRAD projects are phasing out “*Japonica*” *Oryza sativa* by “*Japonica*” *Oryza sativa* conventional crossbreeding activities and concentrate on broadening the genetic base of upland rice.

Inter-specific crosses of *Oryza sativa* by *O. glaberrima*, and *Oryza sativa* by wild relative species is a new breeding strategy to achieve this objective.

Since 1996, no new conventional “*Japonica*” *Oryza sativa* by “*Japonica*” *Oryza sativa*” crosses were made for the development of segregating and fixed lines. Though, as we have advanced segregating lines in the pipeline, we continue their evaluation and multiplication in Colombia for release to Latin American and Caribbean (LAC) NARS partners.

We also evaluate and select NERICA lines (NEW RICEs for Africa) introduced from WARDA and inter-specific progenies from crosses between *Oryza sativa* and wild rice species developed at CIAT by Dr. César Martínez.

In previous years, advanced upland lines selected in Colombia or introduced from CIRAD were shipped to regional NARS, for evaluation and possible release.

2. Materials and Method

2.1. Material

During the cropping season 2001, a total of 1613 lines was evaluated at, “La Libertad Experiment Station” (LES), Villavicencio – Meta.

- Traditional intra-specific (*Oryza sativa*) cross breeding

694 lines were evaluated and seed-increased for further shipping to NARS

- NERICA lines introduced from WARDA

9 lines were evaluated

- Inter-specific progenies developed at CIAT

910 CIAT inter-specific progenies between *Oryza sativa* by *O. Glaberrima* (488 lines) and *Oryza sativa* by *O. barthii* (422 lines) were evaluated.

2.2. Method

Each line was sown as a 2 row plot of 5m long and 0,26 m spacing. Each 23 evaluated lines where 3 checks plots (Orizica Sabana 6, Orizica Sabana 10 and Línea 30 (CIRAD 409)

Recorded data are initial vigor, tolerance to soil acidity and diseases, plant height, days to flowering and grain shape.

3. Results and discussion

- Traditional intra-specific (*Oryza sativa*) crossbreeding

Each evaluated line was selected and bulk harvested separately. Samples of fresh seed are to be stored in the cold chamber at CIAT and also shipped to NARS for local evaluation.

- NERICA lines introduced from WARDA

From the 9 lines evaluated, 2 were selected and harvested for new evaluation to be done next year

- Inter-specific progenies developed at CIAT

From the 910 lines evaluated, 69 were selected and harvested for new evaluation to be done next year. The results of evaluation and selection were sent to Dr. César Martínez who developed this germplasm.

4. Line release (previous years)

In previous years, were shipped for evaluation and selection by regional Latin American (Bolivia, Brazil, Colombia) and Asian (China and Vietnam) NARS, advanced upland lines selected in Colombia or introduced from the rice genetic resource core collection of CIRAD.

4.1. Latin America

4.1.1. Bolivia

In 1999 the line CIRAD 170 was released as JASAYE for upland small holders. The Bolivian Center for Research (CIAT Santa-Cruz) and the Japanese Cooperation (JICA) are very promoting the use of the line through demonstration plots, seed multiplication and diffusion.

4.1.2. Brazil

Participation of CIAT/CIRAD material in different trials continues to be very important. Main characteristics praised by Brazilian from CIRAD/CIAT material are earliness, plant and grain type.

During the period 1994-1999, from a total of 6 varieties released in different Brazilian States (Goias, Maranhão, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Para, Piaui, Rondonia, Roraima and Tocantins), 4 are from the CIAT/CIRAD project.

CANASTRA	CT7415-6-5-1-2-B
MARAVILHA	CT6516-23-10-1-2-2-B
BONANÇA	CT11614-1-4-1-M
CARISMA	CT11251-7-2-M-M

4.1.3. Colombia

“Línea 30” or CIRAD 409 has already been tested in different cropping systems in rotation with others crops and in inter-cropping with perennial species.

The line shows adaptation to acid soils, earliness, good yielding potential and grain quality. Because of problems faced by CORPOICA Regional 8 of Villavicencio, the line was not already officially released.

4.2. Asia

4.2.1. China

CIRAD- CA has close links with the Food Crops Research Institute (FCRI) of the Yunnan Academy of Agricultural Sciences (YAAS), and had shipped CIAT/CIRAD and CIRAD (IRAT) upland lines in the recent years.

After screening, they were used for direct release or as parents.

In 1996 and 1998, IRAT104 and IRAT359 were released in the Yunnan Province.

In 1999, FCRI/YAAS released the variety YUNLU29, coming from a cross between a Chinese line and IRAT216.

4.2.2. Vietnam

Two CIRAD lines (IRAT 177 and IRAT 216) were registered as direct cultivars.

From the 10 best promising upland/hillsides lines, 5 are from the CIAT/CIRAD project and have CIRAD (IRAT) parents.

CT6516-24-3-2. Two out of three parents are IRAT121 and IRAT216.

CT10575-5-5-3-M-2-1-M. One out of seven parents is IRAT 216

CT10576-21-4-M-1-3-M. Two out of seven parents are IRAT124 and IRAT216.

CT11620-29-2-M-4-M-M. Three out of nine parents are IRAT122, IRAT124 and IRAT216.

CT11626-2-5-M-M. Three out of nine parents are IRAT124, IRAT194 are IRAT 216.

It is interesting to note that line CT6516-24-3-2 comes from the same original cross as MARAVILHA (CT6516-23-10-1-2-2-B) released in Brazil.

5. Upland Line Registration

CIAT does not register lines. If a specific line does well in a given country, the national research institution may decide, following the local legislation, to name it and recommend its commercial cultivation, acknowledging in the application form the genetic and institutional intellectual property.

CIRAD has a mechanism by which breeders can register specific material not necessarily release as variety. It receives a consecutive CIRAD catalogue number and the country name where it was bred. If the line was release with a local name for commercial cultivation it is also mentioned.

In 2001 we applied for the registration of 1 upland savanna line CT 10069-27-3-1-4 that performed very well in the Colombian Andes, at mid-altitude (1400 m.a.s.l), when grown in association with young coffee plantations (grain yield of more than 5 T/ha without affecting further coffee production).

5. Conclusion

Conventional upland rice cross breeding have permitted the release of enhanced lines in different Latin American countries, as well as in Asia.

But, the released lines are of narrow genetic base and there is a need for broadening it using new breeding strategies.

Since 1996, following CIAT's recommendations, the CIAT rice project IP-4 and the CIAT/CIRAD collaborative project are phasing out "*Japonica*" *Oryza sativa* by "*Japonica*" *Oryza sativa* conventional cross breeding activities and concentrates on broadening the genetic base of upland rice.

Inter-specific crosses between *Oryza sativa* and wild relative species (CIAT project IP-4) as well as population breeding (CIAT/CIRAD project) are new breeding strategies to achieve this objective.

The number of progenies developed from population breeding has steadily increased from 1997 on. In 2001, more than 90% of the lines under evaluation and selection come from recurrent populations.

7. Future activities

- Phasing-out conventional intra-specific crossbreeding ("*Japonica*" *Oryza sativa* by "*Japonica*" *Oryza sativa*)
- Seed multiplication of selected upland lines and dispatch to NARS for evaluation and selection.
- Long term conservation at CIAT germplasm bank

Annex 1.

Publications

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Annex 2.

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