International Rice Testing Program for Latin America

Upland Rice in Mato Grosso Monitoring Tour Report May 1981

Manuel Rosero

COOPERATION
Centro Internacional
de Agricultura Tropical, CIAT

The International Rice
Research Institute, IRRI

CIAT Series 02ER-4(81)
November 1981

Upland Rice in Mato Grosso Monitoring Tour Report May 1981

Manuel Rosero

Centro Internacional de Agricultura Tropical, Apartado 6713
Cali, Colombia

Centro Internacional de Agricultura Tropical, CIAT
Apartado 6713
Cali, Colombia
November 1981

Bibliographic citation:

Rosero, Manuel. 1981. Upland Rice in Mato Grosso, report on a monitoring tour, May 1981. Cali, Colombia. Centro Internacional de Agricultura Tropical. 24 p.

Press run: 100 copies.

Contents

Rice is a very important part of agricultural development in Brazil, and is a staple in the people's diet, with *per capita* consumption reaching 50 kg of white rice annually.

Some 5.4 million hectares are planted with rice, 77.4% of which under upland conditions, 12.0% under controlled irrigation, and 1.1% in a lowland system called "varzeas"; the rest of the area is planted to a combination of all three systems. In a percentage breakdown by system, 7.6 million tons are paddy rice produced under the upland system amounting to 58.6% of total production; the irrigated system produces 27.6%, varzeas produce 4.0%, and the combined systems, 9.8%.

In Brazil, upland rice is mainly grown in the States of Goiás, Maranhão, Mato Grosso, Minas Gerais, Mato Grosso Sul, Saõ Paulo and Paraná. Except for the rice acreage in Saõ Paulo, rice growing takes place in "Cerrados" where red-yellow and red latosols predominate, covering 52% of the aréa. These soils are characterized by their depth, considerable weathering, low fertility and high aluminium content.

The region's pluviometrical system is possibly even more important than soil fertility since it conditions production stability and keeps farmers from employing high grade technology.

Rice is planted during the rainy season from September to April; however, rain distribution is irregular, particularly in the central region of Brazil where there are dry seasons regionally known as "veránicos" that occur in February or March and last anywhere from one to three weeks. These veránicos or dry spells occur less often in the upland rice area of Paraná and in the pre-Amazonic areas of Maranhão and Mato Grosso.

This report presents the observations made by a group of technical experts who visited upland rice crops in several zones of Mato Grosso.

Monitoring Tour Group

The members of the Monitoring Tour Group that visited upland rice growing areas in Mato Grosso included the heads of:

National Rice Programs:

Leonardo Hernández A., Mexico

José I. Murillo, Costa Rica

Ezequiel Espinosa, Panama

José Hernández L., Peru

Francisco Paz A., Bolivia

Jorge E. Rodas, Paraguay

Other participants:

Fleet Lee, phytopathologist from the Research and Extension Center of the University of Arkansas, Stuttgart (U.S.)

Seung Chan Lee, head of the Department of Plant Pathology of the Institute of Agricultural Science, Suweon, Korea

Satish Chandra Mathur, head of the Pathology Division of the Central Institute of Rice Research, Cuttack, India

Ricardo José Guazzelli, technical head of CNPAF, EMBRAPA, in Goiânia, Brazil

Manuel J. Rosero, IRRI representative for Latin America, monitoring tour leader.

Juarez Simeao Albuquerque Penso, head of the Agricultural Research Institute at Cuiabá in the State of Mato Grosso (EMPA-MT) made all of the necessary contacts for this monitoring tour. He assigned several of the Institute's technical experts to accompany the group on the tour:

Iosiel Rangel de Souza, technical director
Mirtes Ferreira Leao, plant pathologist
Eugenio Nilmar Dos Santos, rice production
Luis Gonzaga de Barros, Rice and Bean Research
Vilson de Oliveira, Pasture Research
Luciano de Oliveira, Office of Public Relations, Department of Agriculture,Cuiabá, Mato Grosso.

General Agricultural Situation in the State of Mato Grosso

The State of Mato Grosso extends for some 881,000 km^2 that cover three main zones: 49% cover a pre-Amazon zone; 37% covers the "Cerrado" zone; and 14% covers a swampy low zone, "Pantanado".

The three major crops grown in the area are upland rice (950,000 ha); soybeans (140,000 ha), and corn (120,000 ha). The area also has good potential for perennial crops: by 1985, there should be some 100,000 hectares planted with rubber; plans are also under way to set up guaraná (supplejack), coffee and pepper plantations.

Cassava is an important industrial crop used for extracting alcohol. There is a cassava flour processing plant in Mato Grosso where alcohol extraction is done. It is located in the Fazenda CIDADE "SINOP" Cuiabá-Santarem, km 500, and has a production capacity of one million liters of alcohol per day.

Livestock raising is another important farming activity in this State; there is a total of four million head of cattle spread over an area of 90,000 km^2.

Empresa Matogrossense de Pesquisa Agropecuaria (EMPA)

A visit was made to the Empresa Matogrossense de Pesquisa Agropecuaria, EMPA, (Mato Grosso Research Institute) in Cuiabá in the Cerrado zone. This Institute was founded one year ago and is attached to the Mato Grosso Department of Agriculture. Working at the Center are 15 agronomists, three administrators, four laboratory technicians and eight field workers.

The Institute also has five laboratories, four of them are very well equipped and one is in the process of being installed. These five labs include:

- Soil Laboratory: provides farmers with physical and fertility analyses.

- Plant Pathology Laboratory: designed to isolate and classify rice and soybean pathogens.

- Soil Fertility and Crop Quality Laboratory: provides research programs with information on these topics.

- Soil Research Laboratory: designed to analyze major and minor elements of the soil for different programs.

- Livestock Nutrition Laboratory: currently being set up; will conduct tests on protein, fiber and fat digestibility.

EMPA has five experimental field sites located on individual farms in Jaciara, Rondonópolis, Canarana, Progreso and Diamantino.

EMPA research focuses on upland rice, soybeans, pastures and livestock; research is currently oriented towards adapting technology originated in other states; subsequently, it will concentrate on generating technology.

EMPA will establish two more research units similar to the Cuiabá one in order to cover the three main zones in the State — Cerrado, Pantanado, and pre-Amazon. The research priorities in these zones will include:

	Priority 1	Priority 2
Cerrado	soybeans, rice, pastures, livestock, cassava	corn, sorghum
Pantanado	livestock, pastures, buffalo	rice
pre-Amazon	rubber, livestock, oils, cassava, coffee, cocoa	beans, rice, corn

EMPA works closely with other agencies of the Mato Grosso Department of Agriculture. Among them are: the Empresa de Asistencia Técnica y Extensión Rural, EMATER (Technical Assistance and Rural Extension Enterprise), the Corporación de Desarrollo Agrícola, CODEAGRI (Agricultural Development Corporation), the Empresa Nacional de Enfermedades , Pestes, ENDEP (National Disease and Pest Institute), the Corporación Agrícola de Secamiento y Almacenamiento, CASEMAT (Agricultural Drying and Storage Corporation), and the Comisión Estatal de Planeación Agrícola, CEPA (State Agricultural Planning Commission).

Empresa de Asistencia Técnica y Extensión Rural (EMATER)

Dr. Pinheiro Da Silva, director of EMATER, gave the monitoring tour group a full report on the work being done by this agency in Mato Grosso. The state is divided into 55 municipalities; by 1980, EMATER had established 50 offices in the state and had plans to open 10 more in 1981 so that there would be at least one office for each municipality.

EMATER has 180 technical experts working in six regional offices in the state; these experts provide farmers with technical assistance. EMATER has six technical experts working at the central offices and 25 technical directors; there are 98 administrative officials and 16 technical experts who work with other agencies in the Department of Agriculture. In 1980, EMATER provided technical assistance to 14,448 farms; the goal for 1981 is to provide assistance to 16,000 farms. This agency covers with technical assistance 50% of the rice-growing area which comprises a total of 900,000 hectares.

Technical assistance is provided directly and basically involves working out production and credit plans and programs for small, medium and large farmers. In the Cerrado area, small farmers own up to 400 ha; they are allowed to plant 200 of them and the rest must be left for forest; in fertile zones, they own from 24 to 100 ha that can be planted. Medium-size farmers own between 600 and 3000 ha, and large farmers own more than 3000 ha each.

Upland Rice in Mato Grosso

Upland rice is the main crop in Mato Grosso. 900,000 hectares were planted with rice in the 1979/1980 seasqn with an average yield of 1.3 t/ha. 1980/1981 season estimates indicate that 950,000 ha will be planted with rice. The most widely grown varieties are IAC 47, medium cycle, IAC 25 and Pratao Precoce, short cycle.

The rice-growing zones in Mato Grosso have humid tropical and subtropical climates and definite seasons: the rainy season goes from October to April with an average of 1500-2000 mm of rain; the dry season goes from May to September. Periods of drought ("veránicos") sometimes occur during the rainy season.

The average temperature during the rice growing season is 25°C. For the most part, no problems arise as a result of low temperatures.

There are two main upland production systems in use:

Manual upland: this system is used by colonists who grow rice on cleared land. All phases of land preparation and cropping are performed manually; no chemical fertilizers are used, and areas from 1 to 40 ha are sown. Three types of producers use this system: owners, renters and share-croppers. They grow IAC 47, IAC 25 and Pratao Precoce rice varieties. Rice is planted in rows spaced 50-60 cm apart; 10 to 15 seeds are placed in each hole at a depth of 3-5 cm, and the holes are spaced 20-30 cm apart. Using this system, yields reach 2.1 t/ha.

Mechanized upland: this system is used by farmers in Cerrado and forest zones. Modern inputs and mechanized methods are employed; good infrastructure is available along with access to rural credit; the area planted is larger than 100 hectares. The farmers either buy or rent the machinery they use and employ medium-level technology. They plant IAC 47 and IAC 25 certified seed. Rice is planted in rows spaced 40, 45 or 50 cm apart, and 35-40 kg of seed is used per hectare. Fertilization is done by applying 10 kg/ha of N, 50-60 kg/ha of P205, 30 kg/ha K20 and 4-6 kg/ha

of Zn to the crop. Weeds are controlled mechanically for the first two years and chemically during the third year.

Diseases and pests are controlled by chemical compounds recommended by EMATER technical experts. Farmers using recommended techniques obtain yields that fluctuate between 1.6 t/ha for the first harvest and 2.1 t/ha for second year harvests in areas where fertility has been corrected. Planting seasons for both systems run from October through December.

To give the monitoring group an overall idea of upland rice growing in Mato Grosso, the technical director of EMPA planned an itinerary that enabled the group to become familiar with the production systems and problems of crops at different stages of development in experimental and commercial farms in Cuiabá, Jaciara, Rondonópolis, Chapada dos Guimaraes and Poconé (Pantanado area).

EMPA Experimental Fields

The EMPA experimental rice fields at Rondonópolis and Jaciara were visited.

The experimental field at Rondonópolis is situated on a private farm called "Guarita". Its owner provided EMPA with 10 hectares for experimental work on rice, soybeans, corn and grasses.

The group observed a uniform rice yield trial involving 18 varieties in three repetitions. The material being tested was made up of four varieties from the Instituto Agronómico de Campinas, IAC (Campinas Agronomical Institute), ten lines from the Centro Nacional de Investigaciones de Arroz y Fríjol, CNPAF (National Rice and Bean Research Center) and four commercial control varieties (IAC 47, IAC 25, Dourado Precoce, and Pratao Precoce).

The rice trial was planted on 5 December 1980, and the group observed it when it was 102 days old. Before planting, the field was fertilized with 3.5 t/ha of lime, 200 kg/ha of P, 100 kg/ha of K and 200 kg/ha of a complete 5-30-15. Fifty days after seeding, 100 kg/ha of N were applied to the field.. Insect and disease control was not practiced. Most of the material observed was at the flowering-maturity phase. There

was a high incidence (80%) of sheath rot (*Acrocylindrium oryzae*) in the Dourado Precoce and Pratao Precoce control varieties; IAC 47 and IAC 25 were severely affected by rice blast (*Pyricularia oryzae*), leaf scald (*Rhynchosporium oryzae*), sheath rot and stemborers (*Diatraea* sp.). Several plants among these varieties showed the typical symptoms of Zn deficiency.

Of the new IAC varieties, IAC 165 showed the best agronomical performance and the greatest tolerance to diseases; IAC 164 was highly affected (60%) by sheath rot; IAC 5544 is a late variety and showed susceptibility to leaf scald and Zn deficiency.

Line CNAX 790825 of the CNPAF material proved to be superior to check varieties; CNAX 793835 was susceptible to leaf scald and Zn deficiency; all other lines performed better except for CNAX 790827, which was susceptible to narrow brown leaf spot (*Cercospora oryzae*) and CNAX 791059, which was highly susceptible to stackburn disease (*Alternaria padwickii*) (Figure 4, Appendix).

The group found this experimental field to be excellent for selecting disease-resistant materials — especially materials resistant to sheath rot or "mulata" as it is called in Brazil.

Several experiments were observed at the experimental site in Jaciara: a uniform yield trial and a test involving chemical control of blast disease. The yield trial was much like the one conducted at Rondonópolis (18 varieties with three repetitions). The materials being tested were at the flowering-maturity phase and had been affected by leaf scald, leaf and panicle blast and sheath rot. As for insects, the group observed spittlebug (*Aeneolamia* sp.), a large black mite (unidentified) that affected the grain, stinkbugs and stemborers.

Zn deficiencies were also observed, and the materials showed variability in tolerance. IAC 47 was very susceptible,

while CNAX 790941 was tolerant and IAC 5544 and CNAX 700821 were highly tolerant. CNAX 790941 was the best line in terms of resistance to disease and insects and tolerance to Zn deficiencies.

The chemical blast control trial was conducted with IAC 47, which was 87 days old. A 5-6 grade blast disease was observed on the leaf, but its intensity was low. Fungicides had not been used since treatment was aimed at protecting the panicle.

Commercial Crops

Several commercial crops were observed in Cuiabá, Jaciara, Rondonópolis, Chapada dos Guimaraes and Poconé on the "Umurama", "Prata", "Guarita", "Santa Fe","Estrella do Norte" and "Ipiranga" farms.

Hacienda Umurama. On this farm, 2000 ha have been planted with rice which has been grown for two years. IAC 47 was planted in 1980 with the average yield reaching 2.4 t/ha.

A field of IAC 47 ready to be harvested was observed; it had been planted in rows spaced 60 cm apart at a seed density of 50 kg/ha. The crop was fertilized with 150 kg/ha of the complete 5-30-15. It had been affected by a 20-30% neck blast infection; sheath rot, helminthosporiosis and narrow brown leaf spot were also observed but to a lesser extent. Several patches of plants were observed that showed Zn deficiency.

Production costs in second harvest areas fluctuate between 12,000-13,000 cruzeiros/ha (US$160-180/ha) and 17,000 cruzeiros (US$230/ha) for first harvest lands.

Hacienda Prata. This farm has a total area of 16,000 ha,

1200 of which are planted with soybeans and 800 with rice; the rest is used for cattle raising. The farm is well-equipped for drying, cleaning and classifying and has bulk storage silos with automatic temperature and humidity controls for soybeans and rice. The farm also has a small plane for applying herbicides, fungicides and fertilizers, two combines and several tractors.

Rice has been grown on this farm for five years; the IAC 47, IAC 25 and IAC 164 varieties are used. The soil is loam-sandy and acid (pH 4.5). Before planting, the soil is fertilized with 3.0 t/ha of lime, 300 kg/ha of triple superphosphate and 250 kg/ha of complete 5-25-15. Sixty days after planting, 20 kg/ha of urea are applied to the crop. To prevent the high incidence of blast disease and especially of panicle blast, the fungicide Bim is applied just before or during flowering.

The group observed one lot of IAC 47 rice which was 90 days old and another lot of IAC 164 rice which was 110 days old. In the IAC 47 lot, which was at the booting stage, there was a high incidence of leaf scald and some incidence of blast disease and helminthosporiosis. Zn deficiency was common. There was also a significant difference in phosphorus response. In rows that had not been fertilized due to error, plant growth was much lower than that of fertilized plants (Figure 5, Appendix).

The lot of IAC 164 rice, which was ready to be harvested, showed a very high incidence of sheath rot that significantly affected yield; panicle neck blast and leaf scald were also observed.

These two lots of rice were planted in rows spaced 47 cm apart at a seed density of 50 kg/ha. No weeds were observed. IAC 47 harvests had yielded 1.5-2.4 t/ha.

Production costs on this farm came to 13,000 cruzeiros/ha (US$180/ha). Paddy rice sells for 11.6-13.3 cruzeiros/kg

(US$0.16-0.18/kg). White rice sells for 30-40 cruzeiros/kg (US$0.41-0.55/kg).

Hacienda Guarita. This farm has a total area of 18,000 hectares, 700 of which are planted with rice and 2200 with soybeans; the rest is used for grassland. The IAC 47 variety is planted in rows spaced 47 cm apart at a seed density of 45 kg/ha. The land is fertilized with 250 kg/ha of complete 4-14-8, which has 3% S and 0.02% Zn. The soil on this farm is sandy, acid (pH 4.0) and low in organic matter (1.0-1.5%). Neither herbicides nor pesticides are used. Rice is mainly grown on this farm to cover the costs of establishing grasslands. Once the rice is 25 days old, grasses like yaraguá and brachiaria are manually planted.

A 120 day old lot of IAC 47 close to harvest was observed. The crop was full of weeds, and the leaves and panicle were severely affected by narrow brown leaf spot. Production yield was estimated to be 0.9-1.0 t/ha.

Hacienda Santa Fe. There are 350 hectares of rice and 150 of soybeans on this farm. Rice if grown mainly for seed, with 80% of the rice acreage sown with IAC 47 and 20% with IAC 25. Two production systems are used: soybeans and then rice, and rice and rice. Experience has shown that the amount of weeds increases with the rice + rice system, and herbicides have to be used to control them; yields reach 1.5 t/ha. On the other hand, the soybean/rice system presents no weed problems, and yields have reached 3.0 t/ha.

Before planting, the soil is fertilized with 3.0 t/ha of lime, 500 kg/ha of triple superphosphate and 230 kg/ha of the complete 4-20-20. The plants are treated twice for blast disease — the first time when the panicle appears and the second 15 days afterwards. Commercial doses of Bim and Hinosan are used.

Production costs run from 25,000-30,000 cruzeiros/ha (US$340-410/ha); 18,000 cruzeiros are spent on the crop itself and the rest goes for seed drying and processing. The seed is sold for 30 cruzeiros/kg (US$0.41/kg).

Two lots of IAC 47 were observed on this farm. One of the lots was 120 days old and showed irregular dark brown/red spots on the grain. Tests done by EMBRAPA plant pathologists have shown that this infection is caused by the fungus *Phyllosticta* sp. The other lot was 72 days old; in it there were patches of dead seedlings where the leaves had entirely dried up and the roots were rotting. The EMPA plant pathologist isolated a fungus belonging to the *Fusarium* sp. from these rice plants.

Estrella do Norte. This farm is in the Chapada dos Guimaraes region which lies 50 km to the North of Cuiabá, 680 masl. The average temperature here is 20°C. Rice is grown on 30,00 hectares in this area: 70% planted with IAC 47 and 30% with IAC 25. The average yield is 1.2 t/ha. In "Estrella do Norte" IAC 47 and IAC 25 varieties are grown on 900 hectares.

The group observed two lots: one lot of IAC 25 planted on 11 November 1980, which was being harvested; and another lot of IAC 47 which was at the flowering stage. These crops had been fertilized with 400 kg/ha of the complete 3-30-16. Kitazin was applied at the flowering stage to prevent severe blast infection.

There was high incidence of sheath rot in both varieties, along with a lesser incidence of narrow brown leaf spot, leaf scald, neck blast and sheath blight (*Thanatephorus cucumeris*).

In parts of the IAC 47 lot, sown at the end of November, 1980, seedlings had died 15 days after planting; the cause of this problem could not be determined by the group.

The farm owner informed the group that he had obtained yields of 1.8-2.4 t/ha from the lots which had been harvested before the monitoring visit; his production costs came to 17,000 cruzeiros/ha (US$230/ha).

Poconé. This region lies 100 km southeast of Cuiabá. It is a swampy (Pantanado) region where 10,000 ha have been planted with IAC 47, IAC 25 and Pratao Precoce rice varieties. Yields range from 2.1-2.4 t/ha. The soil in this region is slightly acid with a pH of 5.1-6.9; it is also low in phosphorus, potassium and organic matter (1.1-1.3%). Rice crops are fertilized with 150 kg/ha of the complete 5-30-15.

EMATER technical experts in Poconé told the monitoring group that the Pantanado area covers 17,000 km^2; one fourth of this area is forestland and the rest is used for raising crops and cattle. The government runs wildlife protection programs in this area, and consequently, does not encourage technical agricultural development since it would bring with it the use of environment-contaminating pesticides.

The monitoring group visited the "Ipiranga" farm which extends over 6000 hectares; the main agricultural activity on the farm is cattle raising. Rice is grown to colonize the land for the establishment of pastures.

Varzeas Project. A farm located 60 km from Cuiabá where EMATER is running a "varzeas" project headed by Pedro Kaiser, agricultural engineer, was visited to observe a four hectare contour lot of IAC 899 rice which was at the booting stage. The crop showed no signs of weeds or diseases. It had a 10-15 cm layer of irrigation water which came from a lake which collects rainwater; the lake is located on high ground on the farm so that irrigation is done by gravity.

The aim of the project is to adapt and prepare about 200 hectares for the "varzeas" system.

Mr Kaiser indicated that in the state of Matto Grosso there were approximately two million hectares that could be adapted for rice crops using the "varzeas" system. Results from other farms show that two harvests a year can be obtained with this system, producing yields of 5.0-6.0 t/ha per harvest.

Discussion and Recommendations

During a meeting held with the directors of EMPA, EMATER and CEPA in Cuiabá, at which each entity explained its work and future projects, the members of the monitoring group discussed problems affecting rice and made several suggestions:

- Mato Grosso upland rice differs from rice grown in Goiás and São Paulo in terms of drought problems. "Veránicos" (dry spells) are shorter and less frequent in Mato Grosso, and for this reason average yields are higher (1.5-2.5 t/ha) with the same varieties IAC 47, IAC 25, IAC 164 and Pratao Precoce.

  The group thought productivity could be expanded through the use of high producing varieties having intermediate height and good initial vigor, greater disease resistance and tolerance to acid soils; such varieties are being distributed to national programs in IRTP favored upland and acid soils nurseries.

- EMPA experimental sites at Jaciara and Rondonópolis are good places to select materials resistant to sheath rot, leaf scald, blast and Zn deficiency. The material EMPA is currently evaluating is very limited in terms of amount and genetic diversity; therefore, the suggestion was made to diversify and increase the germplasm for evaluation trials.

- The system of spacing rice plant rows some 40-50 cm apart has been adopted and is being used in other states in Brazil where there are serious drought problems. Since Mato Grosso has fairly good rainfall distribution, the group thought it advisable to reduce row spacing to 20-30 cm. Nevertheless, future EMPA research should focus on this point.

- The Hacienda Santa Fe obtains yields of 1.5 t/ha using rice/rice crop rotation. However, yields doubled when rice is planted after soybeans. Rice producers in the region should be informed of this production rotation system either through demonstration crops, field days, etc.

- Lowland areas in Mato Grosso are being adapted for rice production in the Provarzeas Project. Project experience to date has shown that two harvests a year can be grown that produce yields of 5.0-6.0 t/ha per harvest. This project should receive priority, and incentives for growing upland rice in high risk areas should be minimized.

Figure 1. **Satish Chandra Mathur from India and Manuel Rosero from IRRI observing disease symptoms in a commercial rice farm. Leonardo Hernández from Mexico in the background.**

Figure 2. **Two monitoring team members and EMPA technicians evaluating an upland rice crop.**

Figure 3. **Pantanado is a lowland area subject to flooding where rice research is second in priority after cattle raising, buffaloes and pastures.**

Figure 4. **Symptoms of** *Alternaria padwickii* **in line CNAX 791059 in Rondonópolis.**

Figure 5. Poorly developed row of plants in the middle, left without fertilization by mistake in a commercial plantation. It shows by contrast the very good response to fertilization from the rest of the crop.