International Rice Testing Program for Latin America

Report of the sixth International Rice conference for Latin American and the Caribbean

August 4- 9, 1985

Cooperation:

Centro Internacional de Agricultura Tropical, CIAT

International Rice Research Institute, IRRI

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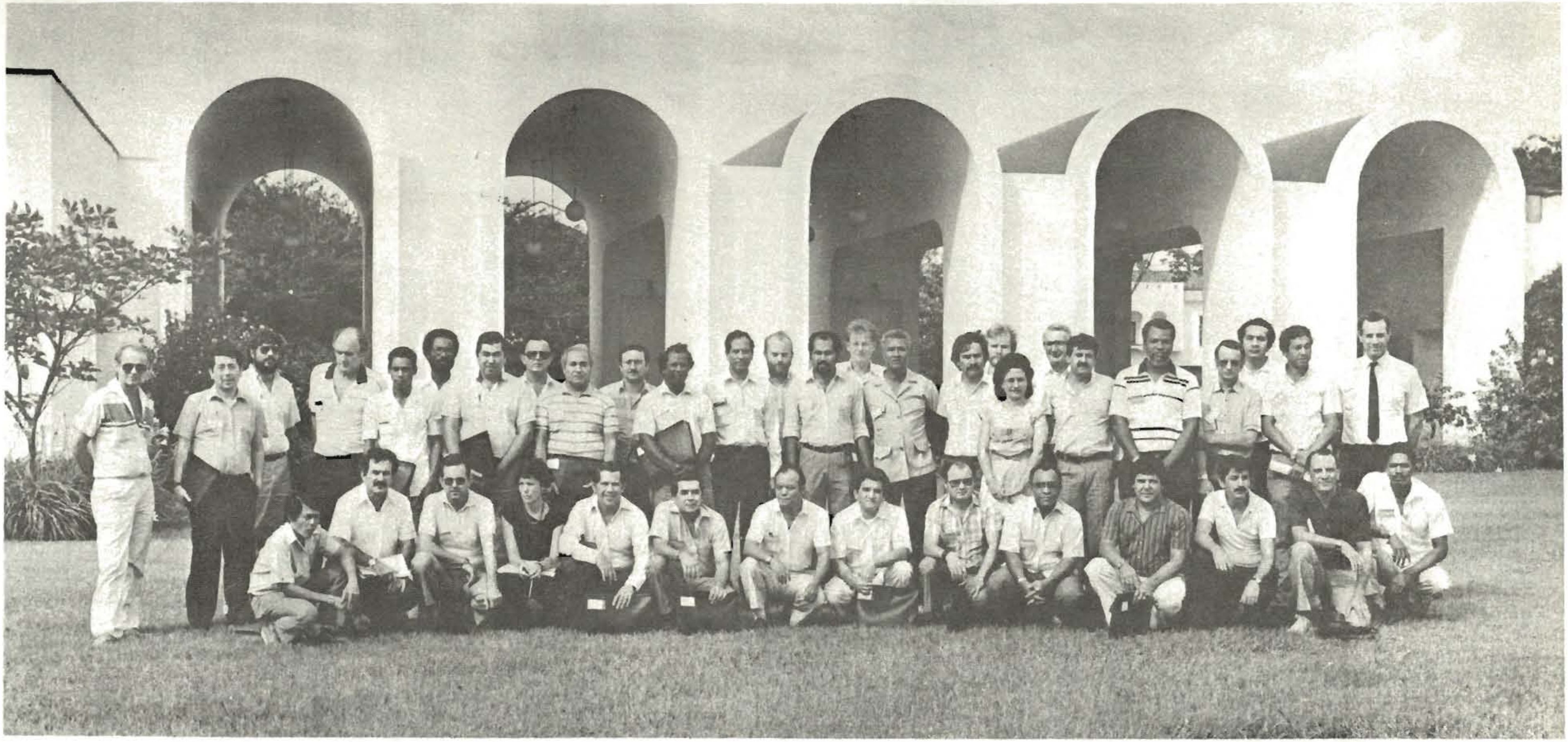
CONTENIDO



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1. INTRODUCTION

The International Rice Testing Program (IRTP) for Latin America and the Caribbean is sponsored by the International Rice Research Institute (IRRI) with funds from the United Nations Development Programme (UNDP) and by the Centro Internacional de Agricultura Tropical (CIAT). This network for international cooperation provides a research link among the national programs in the region and the rice program of CIAT and those of the Genetic Evaluation and Utilization of IRRI.

IRTP's activities in Latin America and the Caribbean are oriented to: (a) the evaluation, selection and distribution of improved germplasm to the national programs through nurseries specifically oriented to the crop limitations of rice in the different production ecosystems; (b) to obtain information through visits and observation trips on the production problems of the different ecosystems, behavior and identification of germplasm through the cooperative network, research needs and training of personnel; (c) organization of conferences with the cooperating scientists to discuss the problems and advances of research and to conduct regional workshops with the breeders, pathologists and other specialists for the evaluation, selection, and harvesting of appropriate materials specifically for certain production ecosystems.

The VI conference was held on August 4-9, 1985 in CIAT-Palmira and complemented by a visit to CIAT-Santa Rosa, ICA-La Libertad and the seed production plant "Semillano" in Villavicencio. Some 47 scientists participated- 29 leaders of national programs from 19 countries, 2 scientists from IRRI and 18 scientists, associates and research assistants from the CIAT Rice Program.

This report summarizes the inaugural sessions of the conference, the reports presented in the session on "Selection Methodology", behavior of promising germplasm distributed in 1982-84, the discussion on production costs, summaries of production problems and the collaboration requested from the international centers CIAT/IRRI by the national programs, the decisions or recommendations on the reorganization of the IRTP in Latin America and the Caribbean, data on the present situation of rice production in the region based on surveys formulated by the heads of the national programs.

2. INAUGURAL SESSION

This conference was inaugurated by Dr. Gustavo Nores, Adjutant Director for Crop Research in Rice and Tropical Pastures at CIAT, who welcomed the participants and emphasized the importance of this event as a highly efficient means for discussing research problems and needs of the national programs, to report on the research progress for the international centers and to establish priorities for cooperative research in the region for the benefit of the national programs.

Dr. Nores also informed the participants of the broadening of the IRTP cooperative network to the Caribbean with more direct support from IRRI and CIAT to further strengthen the rice research programs of the countries in this region.

Dr. D.V. Seshu made the introduction to the VI conference with an explanation of the global network for the evaluation of rice germplasm with special reference to Latin America and at the same time informed the participants of the principle objectives of the conference which are to discuss the following items with the leaders of the national programs:

a. The new reorganization of the IRTP for Latin America and the Caribbean oriented to better serve the cooperators in the region.

b. The present structure of the CIAT Rice Program and the selection methodologies.

c. The behavior of the IRTP germplasm distributed in 1982-84 throughout Latin America.

d. The problems of the national programs in the region and the collaboration requested from the international centers, CIAT and IRRI to solve these problems, and

e. To observe the research activities of the CIAT Rice Program in Santa Rosa, ICA- La Libertad, irrigated and rainfed, and the seed production plant "Semillano" in Villavicencio to observe the different stages in the processing of certified rice seed.

Dr. Peter R. Jennings, CIAT Rice Program leader, spoke about the new organization of the CIAT program and the proposals for the reorganization of IRTP activities in Latin America.

With respect to the new organization of the CIAT Rice Program, Dr. Jennings noted the present decentralization of research being carried out in three work sites, as:

a. Colombia-
CIAT-Santa Rosa: an upland favored ecosystem with fertile soils, abundant and well-distributed rainfall, and high fungal disease pressure. In this system, segregating populations and advanced materials are evaluated to be distributed through the IRTP to cooperators in the region.
ICA-La Libertad: irrigated acid soils which facilitate the selection of materials resistant to iron toxicity which are of interest to the various programs in the region.

ICA-La Libertad: rainfed, acid infertile soils, abundant and well- distributed rainfall. This ecosystem facilitates the selection of materials tolerant to aluminum toxicity and fungal diseases. Materials of interest for the potential rice production zones of existing savannas in Colombia, Venezuela, and Brazil- Amazonia.

CIAT-Palmira: laboratories for the evaluation of the grain quality and the resistance to sogata and the hoja blanca virus. Anther cultivation. In the field, advanced materials are multiplied and selected for distribution through the IRTP to the national programs.

b. Panama-
In cooperation with the Instituto de Investigaciones Agropecuaris (IDIAP) in David, Chiriqui, a promising ecosystem, representative of Central America and the Yucatan peninsula in Mexico, and Rio Hato, a promising moderately dry ecosystem with moderately fertile soils and erratic rainfall (with short dry periods). In these ecosystems, the segregating and advanced populations are evaluated which are of interest to the Central American and Mexican programs.

c. Peru-
In cooperation with the Instituto Nacional de Investigaciones Pecuarias y Agricolas (INIPA) in la Selva-Tarapoto, Huallaga Central and Alto Mayo. Irrigated ecosystem with good disease pressure, principally helminthosporiosis, rice blast, cercosporiosis and hoja blanca (Alto Mayo).

With respect to the reorganization of the IRTP activities in Latin America, Dr. Jennings stated that this cooperative network was created to better serve the national programs and the reorganization is oriented to correct some deficiencies in the supply of germplasm to meet the needs of the programs and to achieve, through conferences and workshops, greater participation and discussion of common problems in the crop production ecosystems of each region.

Dr. Jennings presented a summary on the proposed changes (Table 2.1) for the consideration of the participants subject to their analysis, suggesting the modifications which are thought necessary, to be discussed and approved during the conference.

TABLE 2.1. Summary of the changes proposed for the reorganization of the IRTP in Latin America

ACTIVITY	PRESENT	PROPOSED
GERMPLASM EVALUATION	a) IRTP-IRRI nurseries in CIAT-Palmira.	a) Evaluate in the three ecosystems in Meta: irrigated acid soils, promising upland, upland acid soils-savanna
	b) Nominations by national programs in CIAT and selection of the best lines	b) Multiplication in CIAT-Palmira and inclusion of all candidates in VIOAL.
IRTP NURSERIES FOR LATIN AMERICA	- Seven nurseries General nurseries VIRAL-T VIOAL (for irrigated and promising upland) VIOAL-SNF (Non-promising upland) VIOAL-HB (Hoja blanca)	- One observation nursery, VIOAL, with specific sets by ecosystem.
	Specific nurseries VIOSAL (Salinity) VITBAL (Low Temp.) VIRAL-F (Deep water)	- Discontinue dispatch from CIAT. The national programs request them from IRRI through IRTP-CIAT
IRRI NURSERIES/ OTHER MATERIALS	Some national programs request them directly from IRRI or through IRTP-CIAT.	- National programs can request any nursery from IRRI through IRTP-CIAT.

Continues...

Table 2.1. (Cont.)

ACTIVITY	PRESENT	PROPOSED
SEED DISPATCH	- 60 g distributed in 6 packets (10 g/packet) numbered for planting in 6 rows 5m long/selection. with list of materials.	- 40g distributed in 4 packets (10g/pakcet) numbered. Plant as for observation plots.
DATA TAKEN	- Cycle, plant height, lodging, yield, diseases in all materials	- Cycle, reaction to ecological stresses and yield only in selected materials.
DATA REPORTED	- 4 to 6 months after harvest.	- One month after harvest.
NURSERY REPORT	- Final report one year after harvest.	- Two final reports: a) For the northern hemisphere and Ecuador which would be sent three months after harvest. b) Southern hemisphere: three months after harvest.

Continues....

Table 2.1. (Cont.)

ACTIVITY	PRESENT	PROPOSED
CONFERENCES	- One biennial conference in CIAT. Some researchers from each national program participate.	- One central conference in CIAT every three years. The heads of the national programs participate. - Regional conferences every other year. a) Central America to strengthen the meeting of the PCCMCA every two years, with the participation of researchers from Mexico and other countries in the area. b) Brazil to collaborate with the Irrigated Rice Conference every two years. Researchers from Argentina, Paraguay and Uruguay participate.
OBSERVATION TRIPS	- One observation trip in alternate years to the biennial conference.	- Selection Meetings a) In Panama every two years for Central America countries and Mexico. b) In Colombia (Villavicencio) every two years for countries excluded from the regional meeting: Venezuela, Ecuador, Peru, Bolivia and Colombia.

Continues....

Table 2.1. (Cont.)

ACTIVITY	PRESENT	PROPOSED
ADVISORY COMMITTEE	- Non-existent	- Form an advisory committee with representatives from Mexico, Central America, the Caribbean, South America, IRRI, CIAT to analyze, approve and recommed the policies and research needs of the network.

3. SELECTION METHODOLOGY

3.1 METHODOLOGIES FOR THE EVALUATION OF RICE QUALITY

Cesar P. Martinez*

3.1.2. Introduction

There are many and diverse factors which affect the quality of rice. Some refer to the characteristics intrinsic to the variety and others to the harvest and its handling; collection; transport, drying storage, processing, etc. Several recommendations have been made to reduce the percentage of broken rice but these recommendations are not applied in certain areas due to factors related to the management of the crop or to socio-economic factors.

As a consequence, there are discrepancies between farmers and breeders, generally because the farmers cannot obtain the mill yields under their own conditions which were reported for a specific variety under experimental conditions.

The breeders use several criteria for the evaluation of the milling and cooking quality of promising lines: the presence of a white belly, the length of the grain, the mill yield, the percentage of whole grain rice, gelatinization temperature, and amylose content. However, each of these parameters measures a specific character and does not indicate the quality of the rice which the farmer will obtain under his own conditions. As a result, the efficiency of some of the methods used in the evaluation of quality must be improved in order to give breeders more precise information.

Results and recommendations are presented to carry out quality trials.

3.1.3. Methodologies and Recommendations

3.1.3.1. The White Belly

Under experimental conditions discrepancies have been observed among data on the white belly corresponding to a line planted in the same site but in different semesters (Table 3.1). The white belly is under genetic control and the environment contributes strongly to its expression but the size of the sample should also be considered. To study the relationship between the white belly and the size of the sample, 100 advanced lines were

* Breeder, Rice Program, CIAT.

TABLE 3.1. Variations in the white belly

Entry	Semester A	Semester B
IR 25924-51-2-3	0.8	2.0
P 2017 F4-18-1B-1B	1.0	2.4
20117 (F_4)	0.2	1.6
20250 (F_4)	0.2	2.4

selected and subsamples were taken from each of 3, 20 and 100g. Each subsample was coded for white belly in the quality laboratory and the data is presented in Figure 3.

The experience indicates that rice which has excellent grain appearance has a white belly of less than 0.7 while those grains with values of 1.2 had an acceptable appearance. In Figure 3.1, it was observed that if the objective is a rice with an acceptable appearance (white belly of 1.2) then based on samples of 100g, 21 lines could be identified which have this characteristic. But when the sample size was reduced to 3g, then 41 lines were classified as excellent (white belly of 0.7), when really only 21 were excellent and the rest were simply acceptable, i.e. the efficiency is only 51% when a 3g sample is used.

However, if the objective is to identify lines with an acceptable appearance (white belly of 1.2) then the situation changes, i.e. 54 lines are classified as acceptable when 100g samples are used. But this number increased to 67 when based on a sample of 3g. Of the 67 lines only 52 had an acceptable appearance and the 15 others corresponded to erroneous readings. In addition, two lines with acceptable grain quality were not included. The efficiency is 78%(52/67) when a 3g sample is used for the identification of lines with acceptable quality.

Following this same line of reasoning, 21 lines were classified as excellent based on 100g samples but this number increased to 31 when the sample was 20g. Of the 31, only 20 were excellent and 11 acceptable, i.e. the efficiency is 65% when sample sizes of 20g are used to identify excellent quality and 87% to identify acceptable quality.

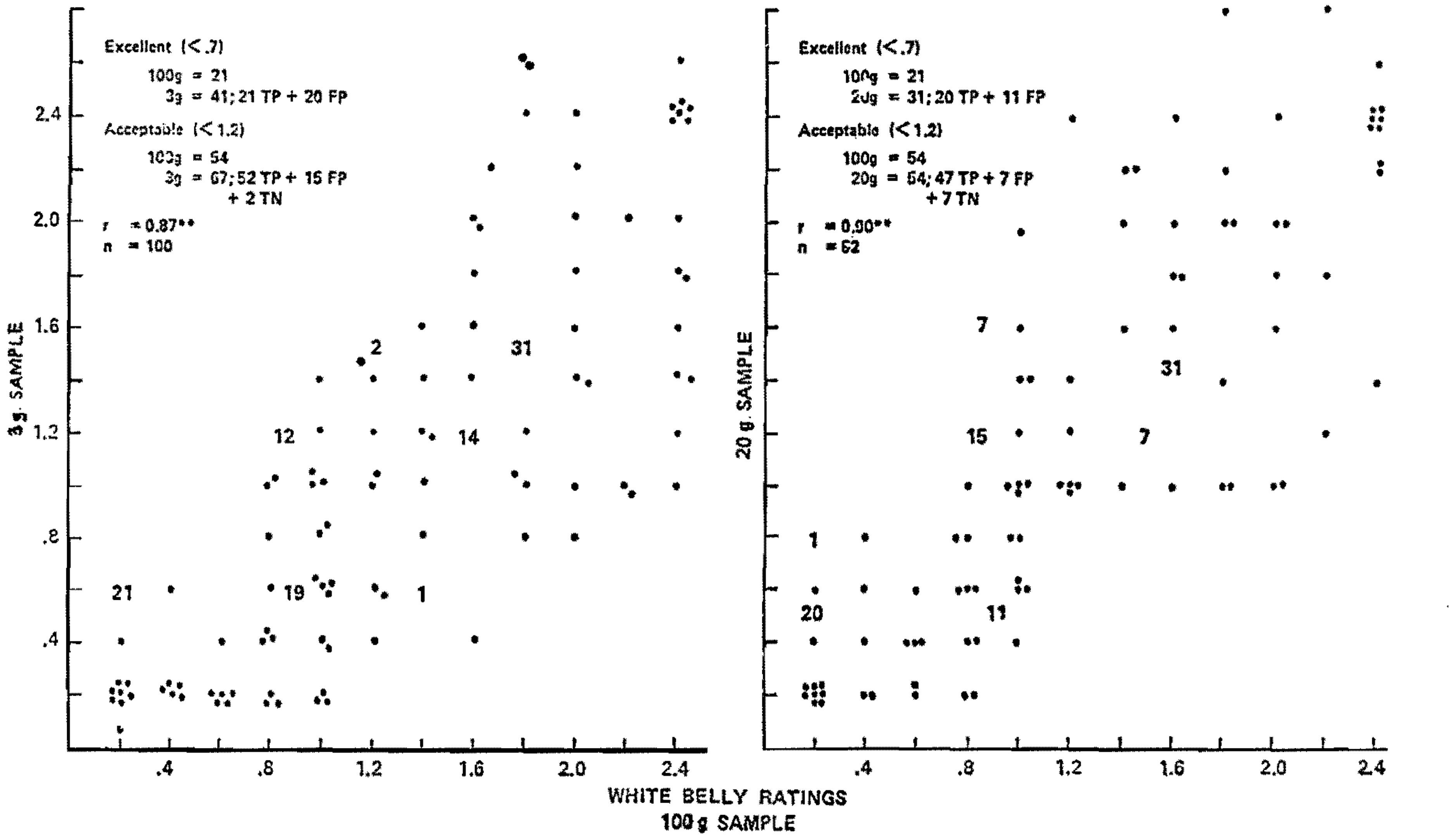

FIGURE 3.1. Size of sample required to determine white belly.

These data suggest that the level of precision desired depends upon the size of the sample and of the proposed objectives. If the objective is excellent quality, samples of 3 and 20g will give a level of precision of 51 and 65%, respectively. If the objective is an acceptable appearance, the 3 and 20g samples will give a level of precision of 78 and 87%, respectively.

In a breeding program such as that of CIAT in which the early generations are evaluated under upland conditions and in direct seeding, it is very difficult to take samples bigger than 3g for white belly analysis. In this case, we suggest using 3g samples to identify lines with acceptable quality but use 100g samples as soon as they reach advanced generation levels (F5 and F6) to eliminate those with inferior quality.

3.1.3.2. Alkaline Dispersion

The alkaline dispersion trial is used as an evaluation of the gelatinization and cooking temperature of a rice sample. The method described in the Standard Evaluation System for rice is the one most frequently used. Nevertheless, in certain peak work periods it would be advantageous to process more rapidly the incoming field material. To determine the influence of the size of the sample and the quantity of the KOH solution, several tests were done varying the size of these parameters.

The data are presented in Table 3.2. Neither of the two variables, number of grains, or quantity of the KOH solution affected the alkaline dispersion. The experiment was repeated

TABLE 3.2. Influence of size of the sample and quantity of KOH solution on the alkaline dispersion

Variety	KOH solution ml.	No. grains	Dispersion	Description
IR 8	10	6*	7.0	Low
Bluebonnet 50	10	6*	5.0	Intermediate
Colombia 1	10	6*	2.0	High
IR 8	10	12	7.0	Low
Bluebonnet 50	10	12	5.0	Intermediate
Colombia 1	10	12	2.0	High
IR 8	20	12	7.0	Low
Bluebonnet 50	20	12	5.0	Intermediate
Colombia 1	20	12	2.0	High

* Two replications

several times with identical results. Nonetheless, with 20ml of KOH greater turbidity was observed in the solution at the end of the test, which made the reading a little more difficult. As a consequence, the best treatment consisted of using a 1/g sample/plastic box and 10ml of the KOH solution. The other parameters remain the same as described in the Standard Evaluation System using only one replication, however, as this reduces by one half the number of plastic boxes necessary, with which the number of samples analyzed can be doubled over a period of time.

3.1.3.3. Mill Yield

There are factors in the field which affect the milling quality of rice among others, the harvest season and threshing. The effect of several harvest and threshing times was examined in three different sites on the percentage of whole grain of the variety CICA 8. Greater percentages of whole grain were obtained when CICA 8 was harvested and threshed at an opportune moment, i.e. when the grain had a 20-24% moisture content (Figure 3.2).

The effect of the time to threshing was also studied (Table 3.3) on the percentage of whole grains of CICA 8 and three lines (18521, 18476 and 18522). It was observed that late threshing reduced the percentage of whole grains.

The milling quality of four promising lines and CICA 8 was analyzed (Table 3.4), managed under two different conditions-by researchers in experimental plots and by farmers on four farms. The mill yield (total white rice) of the lines and of CICA 8 were the same under both conditions but the percentage of broken grains was greater on the farms where the materials were managed, harvested and threshed by the farmers.

In CIAT, the percentage of whole rice was compared among 34 varieties harvested in two different seasons: at physiological maturity and 10 days later (Table 3.5). It was found that in the varieties IR 28 and Anayansi there was no reduction or loss with respect to the percentage of whole grains, while in other varieties such as IR 8, IR 30, and CR 201, there were great losses. In other varieties such as CR 1113, Eloni, and CICA 4, the losses were small (Figure 3.3). These results prove the existance of varietal differences reported by several investigators when rice is left to overmature in the field.

In an experiment carried out in Peru (Table 3.6), the quality of rice obtained when left to overmature in the experimental plots is equal to that obtained by the farmer on his land. In other words, through late harvesting of genetic materials under experimental conditions, data can be obtained which approximates that of the quality of rice which the farmer obtains on his farm.

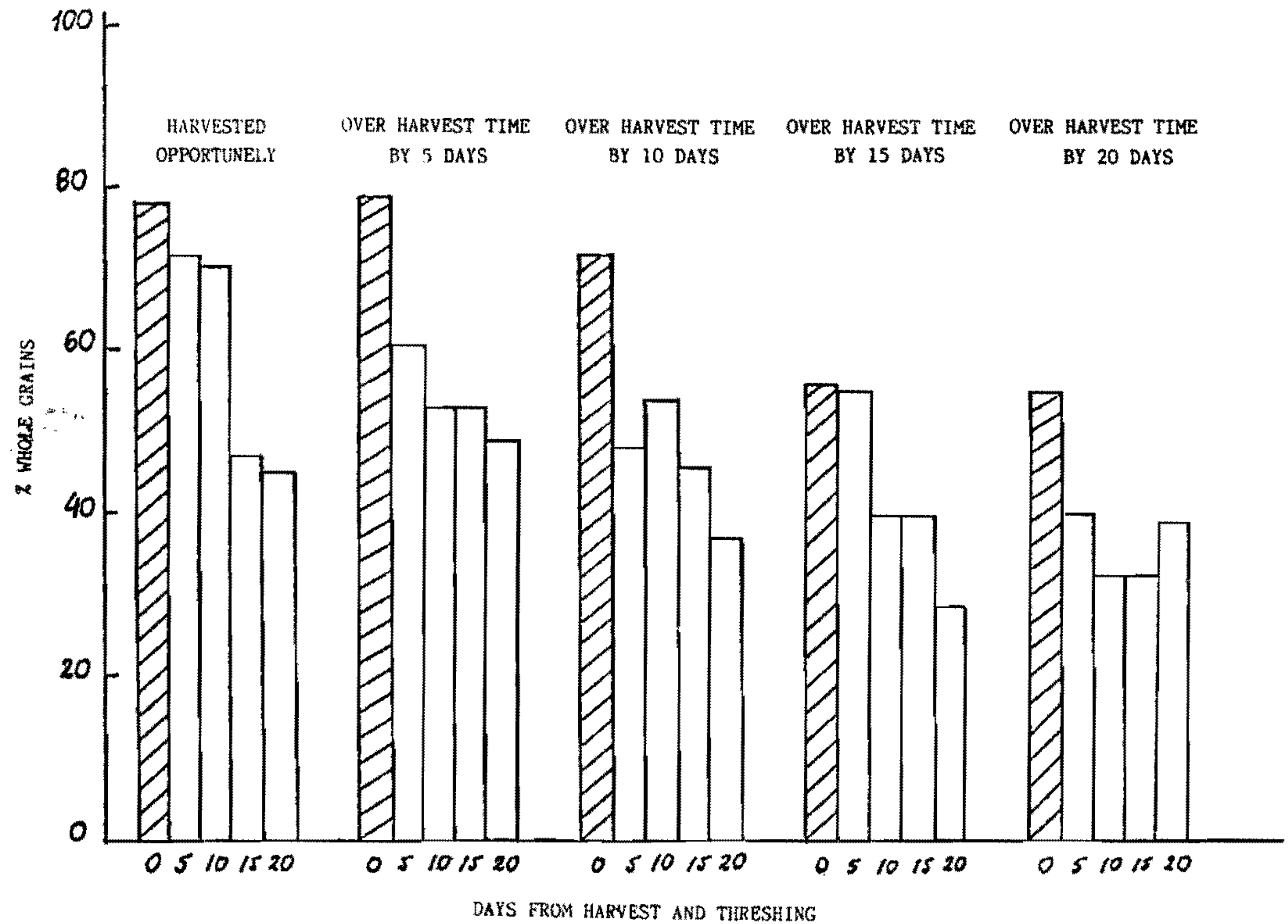

FIGURE 3.2. Effect of overharvesting and threshing on the milling quality of CICA 8. Average of three sites.

This evaluation will prevent the release of varieties which produce high percentages of broken rice and at the same time will give a more precise evaluation of tolerance to lodging of the materials. It is suggested that this evaluation be adopted in the trials carried out by the IRTP with materials which form part of the VIOAL and that the data be included in the information which is sent to the national programs.

TABLE 3.3. Effect of time to threshing on yield of whole grain rice

Variety	Threshing: Immediate (% G.E.)	Late
CICA 8	88	60
18476	88	69
18521	95	70
18522	96	81

TABLE 3.4. Comparison of the milling quality of promising lines under experimental conditions and on farms.

	Experimental Conditions			Farmers' Fields		
Entry	Mill yield %	Whole grains %	Broken grains %	Mill yield %	Whole grains %	Broken grains %
11643	72	64	36	71	58	42
18476	73	88	12	70	68	32
18521	74	96	4	69	82	18
21862	74	79	21	72	57	43
CICA 8	74	88	12	72	70	30

TABLE 3.5. Comparison of mill yield (% excelso) in two harvest periods for 34 varieties of rice in CIAT-Palmira.

Variety	Physiological Maturity		Maturity + 10 days		
	% Moisture Content	% Excelso	% Moisture Content	% Excelso	% Loss
IR 5	18	64	14	45	30
IR 8	23	54	15	15	72
IR 20	31	48	18	45	6
IR 22	21	58	15	31	47
IR 28	-	62	18	62	0
IR 30	21	32	13	10	69
IR 32	20	64	19	51	20
IR 36	23	42	22	20	52
IR 38	22	54	14	40	26
IR 40	22	63	14	49	22
IR 42	20	52	14	40	23
IR 43	18	64	14	42	34
IR 52	16	46	12	31	33
IR 54	21	54	14	42	22
IR 56	18	34	12	15	56
IR 58	-	58	16	49	16
CICA 4	22	63	15	55	13
CICA 6	20	65	14	49	25
CICA 7	19	46	12	30	35
CICA 9	26	66	15	54	18
ORYZICA 1	25	65	16	51	22
ORYZICA 2	26	58	16	39	33
DIWANI	21	44	13	32	27
CEYSVONI	18	42	13	34	19
ELONI	-	46	21	43	7
ANAYANSI	24	60	21	60	0
DAMARIS	18	60	17	55	8
CR 201	23	54	13	23	57
CR 1113	22	64	13	58	9
BAMOA A 75	25	60	19	46	23
CULIACAN A 82	22	54	15	45	17
JUMA 58	20	65	10	50	23
BR IRGA 409	16	58	13	52	10
TIKAL 2	24	61	15	54	11

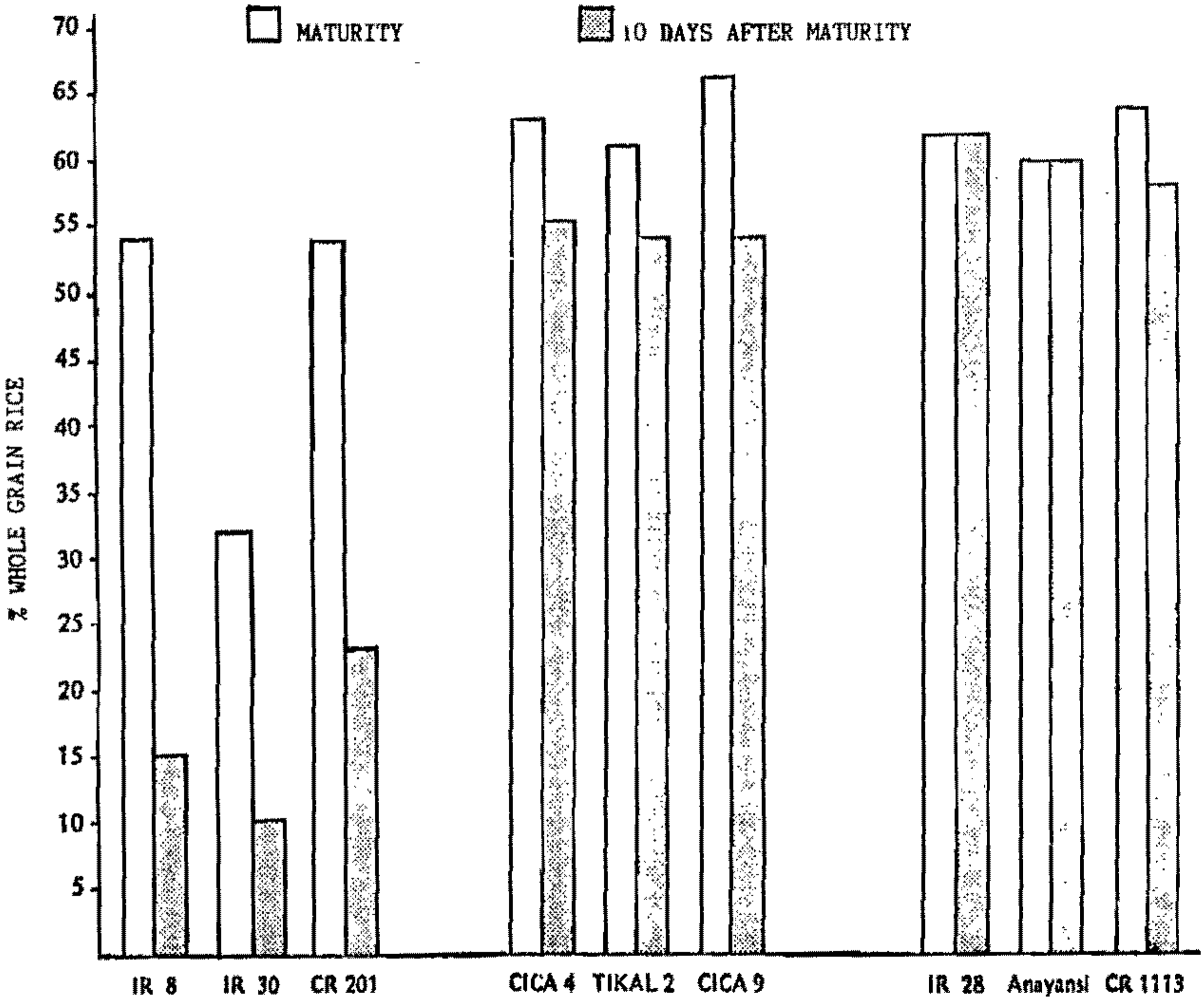

FIGURE 3.3. The effect of a harvest (10 days after maturity) on the percentage of broken grains

TABLE 3.6. Effect of a late harvest on the quality of rice obtained. *

Entry	Experimental Station	Farms	Late Harvest
CICA 8	3	5	5
18476	3	5	5
18521	1	4	4
21862	4	6	6

* According to U.S. standards.

3.2. SELECTION METHODOLOGY FOR RESISTANCE TO DISEASES

Robert S. Ziegler*

The rice phytopathology program has the following objectives:

1. Development of evaluation methods appropriate for CIAT and the national programs.

2. Insure that the Rice Program's materials including introductions from IRTP are evaluated for resistance to the principal diseases before being selected and dispatched to the national programs.

3. Development of new strategies for disease control.

4. Follow up on the phytosanitary conditions of rice in Latin America.

This talk presents the way in which the program is developing methods for evaluation of <u>Pyricularia oryzae</u>, <u>Helminthosporium oryzae</u> and the hoja blanca virus. These diseases are or could be important in many areas of Latin America. By evaluating the material before sending it to cooperators in the national programs we can prevent the dispatch of susceptible material. Nevertheless, we know that we cannot guarantee that the material which is sent will be resistant to these problems in every site. But with an intensive and uniform evaluation during the selection process, we can expect that within the materials sent to the national programs there are no lines which are highly susceptible and there is also high probability that there is good material for local conditions.

For whatever evaluation method there are some minimal requisites which guarantee a reliable selection- high and uniform disease pressure. To arrive at this ideal situation, a site is needed (with an environment favorable to the development of the disease and minimal infrastructure to facilitate the evaluations), and appropriate methods which insure the uniformity of the disease.

The importance of an appropriate environment resulted in the transfer of the Rice Program to the Eastern Plains of Colombia where there is a rice-growing environment highly favorable to the development of diseases. However, since the relationship between diseases, environment and the rice is complicated, the location of the program in Santa Rosa does not insure a high and

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uniform incidence of the diseases. It is clear that complementary measures must be applied to increase the incidence of the diseases. Because of the uneveness of the disease in the area and the changes which occur from one year to the next, it would be useful to describe what we are doing to give uniformity to the infection of these three diseases.

3.2.1. Pyricularia oryzae

This method consists of three semi-independant parts:

1. Spreader rows around the plot planted 2-3 weeks before the material to be evaluated and the periodic spraying with inoculum throughout the growing season. The rows consist of a mixture of old commercial varieties that have lost their resistance, varieties which are currently under production and highly susceptible varieties used to initiate the epidemic.

2. Physically mixing the seed of the genetic material from the F2 with seed from highly susceptible material (Fanny) and very susceptible material (B-40) in a 50% ratio. The purpose is for each individual to have as a neighbor a susceptible plant which can produce inoculum continuously. Eventually, Fanny dies while B-40 survives but is morphologically different and discernible from the material under selection.

3. Inoculate the plots with inoculum produced by infected leaves of commercial varieties. The inoculum is spray-applied every week.

In short, the spreader rows initiate an epidemic with virulent pathogens on the commercial varieties in the area. The inoculum produced in these varieties can be multiplied on susceptible material and spread on the lines to be selected. Inoculation by aspersion serves as a security measure.

These methods always give a good distribution of the pathogen on the material. There is very little probability of escapes. The method produces a uniform infection and as a consequence, it is expected that the selected material will be resistant to the population of the pathogen that was present.

3.2.2. Helminthosporium oryzae

The dry inoculum produced on grains of rice that have been sterilized in the autoclave is distributed in the field when the rice is at maximum tillering. Since it is still not known whether the method works or not, experimental applications are made of 20 and 80kg of inoculum/ha in the favored upland and savanna ecosystems (acid soils). If the method is successful, large-scale areas could be inoculated using broadcast spreaders.

3.2.3. Hoja Blanca

With good sources of resistance already identified, resistant lines are available for the different ecosystems with potential for hoja blanca. This requires evaluation of 5,000-10,000 segregating and advanced lines for a year which would eliminate the need to do greenhouse trials. In order to develop a method of artificial field inoculation large populations of vectors (1,000,000) with a high transmission potential would be liberated at the same time and distributed uniformly.

We are arriving at that objective by making controlled crosses among proven vectors of the virus and their progeny. The final multiplication of the vector population will be done in the field in cages especially made for the liberation of insects.

Other evaluation sites

It should be clear that with the exception of hoja blanca there is no guarantee that the material selected in these trials done with local pathogens will be resistant in other ecosystems.

Over the past three years cooperative projects have been established with the national rice programs of Peru and Panama. In Peru (Selva), there are sites with a high incidence of Pyricularia, *Helminthosporium*, *Dreschlera gigantea* (eye spot) and *Cercospora*. In Panama, there are sites with a high incidence of blast, *Helminthosporium* and *Entyloma*. The fundamental objective of the projects is to facilitate local selection of resistant material. But these sites with their diverse ecologies also facilitate the observation of the behavior of the material and at the same time, the selection of promising materials to be sent for evaluation to other countries.

3.3 METHODOLOGY OF THE SELECTION OF IRRIGATED RICE GENOTYPES FOR RESISTANCE TO IRON TOXICITY

Richard Elias Bacha*
Takazi Ishiy**

3.3.1. Introduction

With the rise in modern crop production in Brazil, fields of yellowing plants can be observed in the different rice-growing states, caused by iron concentrations in the soil and which is aggravated by puddling that accentuates the phytotoxic effects.

In the states of Santa Catarina and Rio Grande do Sul, the phenomenum appears to be most intense, in some cases reaching alarming proportions. In Santa Catarina, due to the system of soil preparation and the planting method in puddled fields, this yellowing shows up in different varieties, particularly in newly cultivated areas and during the first years of the crop.

In Rio Grande do Sul, the problem first manifested itself with the recommendation of the variety BR-IRGA 409, whose expansion in the area under cultivation caused further accentuation of the symptoms. This variety appears to promote greater oxidation capacity of the rhyzosphere and as a result, oxidizes the ferrous iron precipitatiing it as ferric iron on the root surface. Under conditions of high iron concentration in the soils, this precipation can be sufficiently intense so as to form a layer of iron on the root surface and in this way reduce or block the absorption of nutrients by the plants as confirmed by CHEN et al (1980) and HOWELER (1981). Iron toxicity manifests itself with the appearance of a yellowing of the foliar area (HOWELER, cited by CHEN et al . 1980), and followed by drying and death of the leaves.

According to PONAMERUM (1977), puddling, principally in acid soils rich in organic material and with a high iron content can be prejudicial to the development of rice. The concentration of iron in these soils can reach 600ppm, approximately three weeks after puddling.

The nutritional state of the plant according to YOSHIDA (1981) affects its tolerance to iron toxicity, and he observed that deficiencies in potassium, calcium, magnesium, phosphorus and

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manganese reduce the plant's ability to prevent the deposition of iron on the rice roots. He recommends that special attention should be given to plants deficient in potassium. Plants deficient in potassium frequently have a high iron content and show severe toxicity symptoms.

HOWELER (1981) in an attempt to correct the yellowing in irrigated rice in the Colombian Plains, suggested among other practices, the application of organic matter, calcium, and fertilizers in order to accelerate soil reduction so that the pH would rise rapidly and the maximum iron concentration would occur when the plants were very young. In general, the problem is less severe in young plants than in adult ones. Susceptibility to iron toxicity is a varietal characteristic that merits attention on the part of the breeders for the selection of tolerant genotypes because the use of resistant varieties constitutes an efficient , economic and simple method up to a certain concentration of iron in the soil.

To select resistant lines and varieties for iron toxicity, EMPASC has carried out experiments for varietal competition specifically to this end.

3.3.2. Selection Methodology

In Santa Catarina, on the Itajai Experiment Station, the selection of tolerant genotypes to iron toxicity is carried out under field conditions in an area with a high concentration of iron, an intermediate concentration of phosphorus and potassium, and a low organic matter content (Table 3.7).

The area in question was prepared by removing the upper soil layer, levelling and then replacing the arable layer which had been removed.

In the first crop, grown with adequate fertilization of phosphorus, potassium, and nitrogen, the majority of the plants did not develop but died before flowering. Analyses and observations done proved the presence of iron toxicity.

In this way, the area was shown to be highly propicious for the selection of genotypes for their tolerance to iron. Therefore, the area was prepared initially by removing all the harvest residues, and levelling the soils superficially with a plow coupled to a tractor. This operation is carried out annually.

Soil preparation is done with a disk plow and several passes with a rotovator to break up the soil. The small slopes produced by the machines can be levelled manually.

The planting is done in dry soil at a depth of less than 3cm in rows made with a hand plow, the rows spaced 30cm apart.

TABLE 3.7. The results of chemical and physical analyses from five soils samples taken from the experimental area. Itajai Experiment Station-EMPASC, 1985.

Sample	pH H_2O	pH SMP	P ppm	K ppm	M.O. %	Al me%	Ca+ me%	Mg me%	Fe ppm	Mn ppm	Zn ppm	% Clay	% Lime	Fine Sand %	Course Sand %	Texture
1	4.8	5.6	4.0	54	1.1	3.0	1.8	0.5	287	22	3.4	43.5	38.0	16.9	1.8	1
2	4.7	5.2	5.0	47	1.1	3.3	1.1	0.3	253	12	3.3	43.5	36.0	17.7	2.7	1
3	4.7	5.3	3.5	42	1.0	3.3	1.8	0.4	291	12	3.0	43.5	36.0	18.1	2.3	1
4	4.9	5.6	5.0	51	1.1	2.4	1.9	0.5	313	22	3.2	43.5	36.5	17.3	2.7	1
5	4.9	5.7	3.0	40	1.1	2.8	1.5	0.4	309	17	3.2	42.5	37.5	18.2	1.8	1
Average	4.8	5.5	4.1	47	1.1	3.0	1.6	0.4	280	17	3.2	43.3	36.8	17.6	2.3	-

Each genotype under study is planted in three parallel rows of 1m apart without replications. Perpendicular to the rows are planted two rows of a variety resistant to iron toxicity and two rows of a susceptible variety, as controls for comparison (Figure 3.4).

Basic fertilization is done at planting with phosphorus and potassium, and at canopy coverage, approximately 30 days after emergence, with nitrogen, in minimal quantities only for plant maintenance.

Irrigation begins with germination and after the emergence of the plantlets a sheet of water is maintained. As the plants develop, the water layer is gradually increased up to @ 10cm through to the maturation phase.

Phytosanitary treatments are carried out whenever necessary so that the incidence of insects, diseases and weeds do not interfere with the normal development of the experiment.

Evaluations are made visually, carried out according to the reactions shown by the plants, on a scale of 1-9 where:

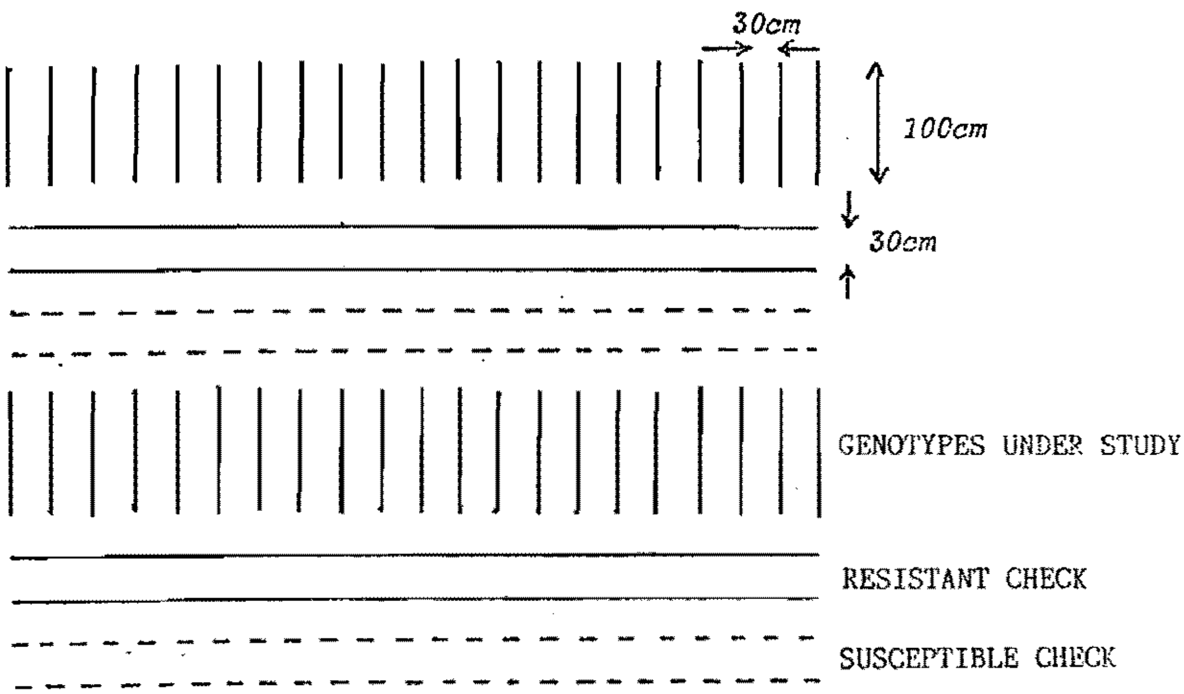

FIGURE 3.4. Field plan for irrigated rice genotypes tolerant to iron toxicity, EMPASC, 1983.

VALUE	% OF AFFECTED OR DEAD LEAVES
1	Less than 1 (resistant control)
3	1-5
5	5-25
7	25-50
9	50-100 (susceptible control)

Where: 1-3 = resistant
5 = tolerant
7-9 = susceptible.

The evaluations are carried out in stages 2-8 (tillering- grain at milk stage), at intervals of approximately 10 days in order to detect the most critical phases.

The source of the materials is principally IRGA (Rio Grande do Sul), the Centro Nacional de Pesquisa de Arroz e Feijao, and CIAT.

The genotypes cultivated in the area with an elevated concentration of iron show different reactions during the plant cycle. Some are resistant throughout the whole cycle, while others show an elevated level of toxicity in the initial phase and later die. There are also genotypes which initially look resistant but gradually become susceptible, and those which have the opposite reaction, i.e. they look susceptible in the initial phase and are resistant in the final phase. Less frequently genotypes are observed that demonstrate susceptibility in the initial phase and become resistant when the reproductive phase is initiated and once again show a susceptible reaction three weeks later.

3.3.3. Bibliography

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3.4. UPLAND RICE BREEDING FOR ACID SOILS

Surapon Sarkarung*

3.4.1. Introduction

Rice in Latin America is cultivated in different ecosystems. The basic division between ecosystems is based principally on rainfall (quantity and distribution), cultural practices, soil types and pathogens. The principal production systems in Latin America have been classified tentatively into: irrigated, low-lying- puddled; favored upland; moderately favored upland; non-favored upland; and hand cultivated upland or traditional. A further characterization would undoubtedly identify additional ecosystems.

Vast areas of the acid infertile soils of the Latin American Tropics are under-utilized. In these soils, some irrigated rice is cultivated in different ecosystems But no upland rice is grown. The highly acid soils which are found in the savanna and jungle ecologies represent approximately 1,400 million hectares. These are principally oxisoles and ultisoles. And a small area is represented by the acid inceptisoles, entisoles and alfisoles.

Chemically, these soils are high in aluminum (saturation is greater than 60%) and deficient in N,P,K,Ca,S and Zn. Physically, they are easy to work, have low water retention capacity and are easily eroded.

The principle interest of the CIAT researchers in these acid infertile soils is the development of a system of production of upland mechanized rice with low inputs for the savanna ecologies where rain is abundant (greater than 1,800mm) and well distributed during the crop season. Upland rice can be considered a monocrop, or rather, a frontier crop to open up the land to pastures after one or two rice harvests. The potential area for upland rice is approximately 300 million hectares, principally in the Colombian Plains and Venezuela, northern Brazil, and southeastern Mexico, Guyana, Bolivia, and Peru.

3.4.2. Production Constraints

The principle production constraints for upland rice on the acid plains are:

a. Lack of adapted varieties

b. Biological and physical factors

c. Agronomic practices

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3.4.3. Breeding Objectives for Upland Rice for the Savanna

Adaptation to the ecology of the savanna requires resistance to diseases and insects, and tolerance to mineral deficiencies and toxicities. The yield potential which is looked for in varieties for the dry season on the savanna is 3 to 3.5t/ha. The specific characteristics are as follows:

a. Tolerance to aluminum toxicity and to minor element deficiencies.

b. Resistance to rice blast.

c. Resistance to other foliar and panicle diseases such as leaf scald, helminthosporiosis and hoja blanca.

d. Resistance to grain discoloration

e. Tolerance to the insects- Sogatodes and Diatraea .

f. Short stature- dwarf and intermediates, and moderate tillering

g. Early and intermediate maturity (95-130 days)

h. Resistance to lodging.

i. Thick and deep roots

j. Good quality grain (without the white belly and an intermediate amylose content).

k. Moderate resistance to drought

The rice research at CIAT for acid soils is focused directly on obtaining varieties which develop well with a minimum of inputs. Varietal improvement requires germplasm adapted to the adverse conditions of a hostile environment and the efficient utilization of soil nutrients which are scarce.

The varieties are evaluated in the La Libertad Experiment Station of ICA, located in the Colombian Plains on an oxisol typical of the Latin American savanna. The fertility of the soil is:

M.O.	pH	P (Bray II) (ppm)	meq./100g soil				Al saturation %
			Al	Ca	Mg	K	
3.7	4.1	4.6	3.1	0.37	0.07	0.17	83.6

A field evaluation design was developed to compare varieties under two different conditions of high and low acidity. Some highly acid rows were designed (Figure 3.5) 5.0m wide, alternating with the low acid rows. The high acid rows received 3.0t/ha of dolomitic lime, 15 days before planting.

The fertilization regime was 50-26-33 kg/ha of NPK, respectively. Each variety was planted directly into two rows in the high and low acid rows. Three reference varieties were planted (Metica 1 which is susceptible, IAC 165 and IRAT 122 which are tolerant) every 24 rows of experimental material. The plots were protected with fungicides and insecticides to prevent insect and disease damage.

The toxicity symptoms were registered for both rows 40 days after planting or as soon as the symptoms appeared on the susceptible variety. A second reading was taken before flowering. A scale of 1 to 5 was used (1 = good tolerance, 5 = highly susceptible) (Table 3.8). A few plants from each treatment were carefully pulled up to evaluate their root systems on a 1-5 scale (Table 3.9).

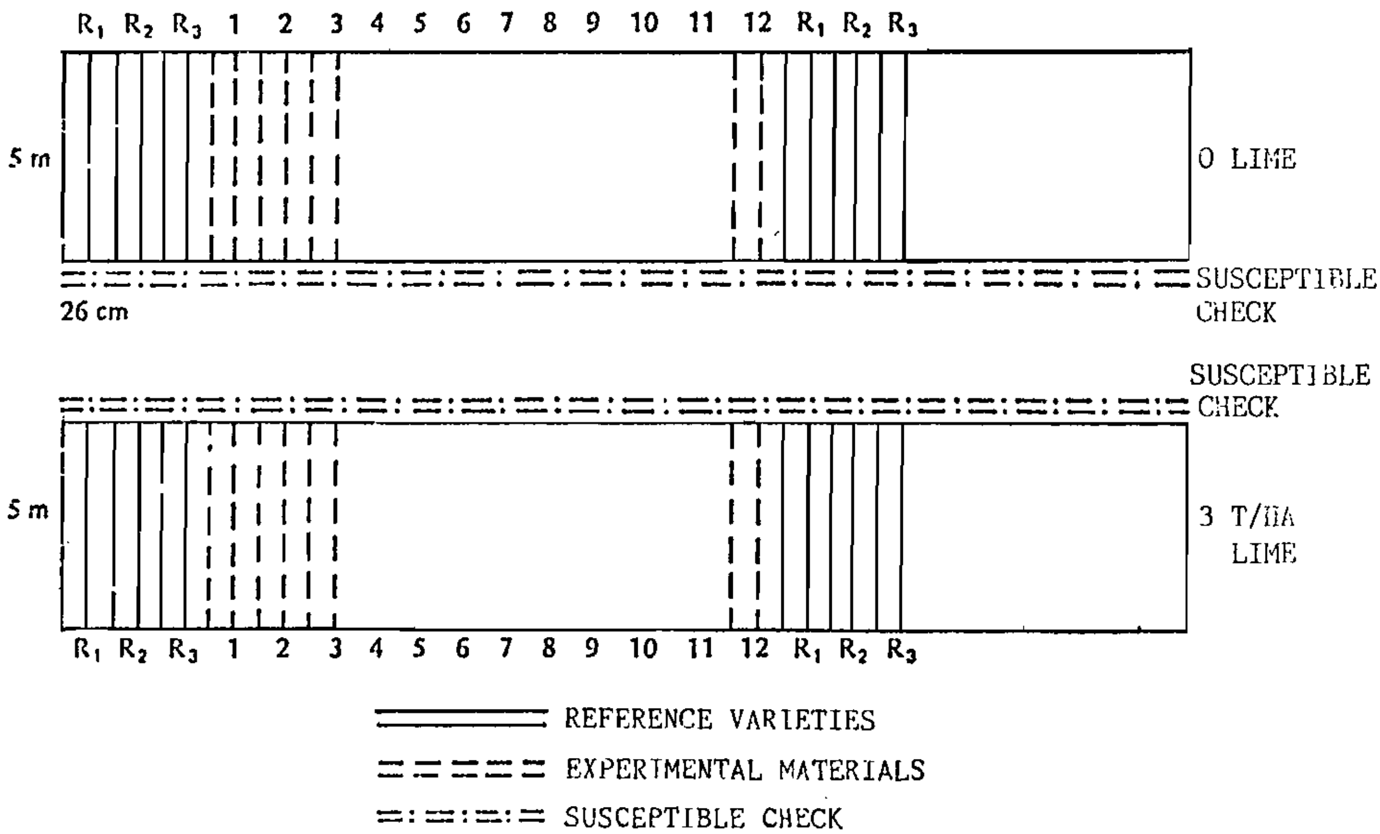

FIGURE 3.5. Field design for the evaluation of tolerance to aluminum toxicity

TABLE 3.8. Evaluation scale for aluminum toxicity.

Scale	Description
1	No difference in growth in the highly acid and slightly acid rows.
2	Little yellowing on some plants in the highly acid rows. Little difference in growth.
3	Some yellowing of the plants. Slight reduction in plant height in the highly acid rows.
4	Uniform yellowing, marked reduction in height, no leaf death.
5	Severe yellowing, great height reduction, death of the lower leaves.

TABLE 3.9. Morphology scale for root systems on acid soils, 75 days after planting.

Scale	Description	Example of Varieties
1	Few, thick and large	Monolaya, IAC 165
2	Many, thick and large	Improved lines from IITA and IRAT
3	Many, intermediate and large	IRAT 122, varieties from Surinam
4	Few and large, the majority fiberous	Traditional upland varieties of the lowland zones
5	All fiberous, superficial ciales	IR 8, CICA 8

The aluminum toxicity symptoms were expressed directly as a typical chlorosis (severe yellowing of all the plants or indirectly as a deficiency interactive with other elements. The resistant varieties (scale 1 and 2) had little or no yellowing, and the plant height and root development were normal.

Some 17% of the 1,360 cultivars evaluated were tolerant to soils with high aluminum. The semi-dwarf varieties developed under irrigated conditions did not grow under both conditions- with lime and without. Obviously, these varieties are not adapted to these soils.

There is excellent tolerance to aluminum toxicity available in rice. Very good cultivars are found in different genetic bases originating in the forests of western Africa, the Asiatic highlands, and the Campo Cerrado of Brazil. These cultivars are also adapted to infertile soils.

The tolerant varieties are grouped according to the morphological improvement in selected improved lines and in native or traditional varieties. Many materials recently bred by IITA and IRAT appear to have better tolerance than their parents suggesting that the genes for tolerance are accumulated in new lines or cultivars.

3.4.4. Evaluation and Selection of Segregating Materials (F2-F5)

The segregating materials are planted alternately in highly acid soils in La Libertad (first semester) and in Santa Rosa (second semester). The F2 lines are evaluated first in the rainy season in La Libertad (85% aluminum saturation) where the acid infertile soils favor a constant disease pressure. The selected F3 lines are then re-evaluated in Santa Rosa during the second semester under supplementary irrigation. The aluminum saturation in Santa Rosa is @ 75%.

A summary of the limiting factors to which the segregating materials are subjected in La Libertad and Santa Rosa is presented in Table 3.10.

Figure 3.6 indicated the experimental design in the field used for the selected materials and the pedigree F3 families. The sources of inoculum, which consist of a mixture of susceptible and tolerant varieties are planted perpendicularly in the experimental plots and in the direction of the prevalent wind, 15 days before the experimental materials. This is an evaluation of early generations. Although the non-variables (soil, inoculum sources, upland conditions) facilitate the selection, they are not to be overestimated. Continuous selection in one site can lead to a resistance specific to that site. This can be especially pertinent in the selection for resistance to blast due to the heterogeneity of the upland soils. For the savanna ecology, it is suggested that the F4-F6 lines be evaluated in other sites on the savanna (Figure 3.7).

TABLE 3.10. The principle limiting factors of rice in La Libertad, Santa Rosa, Villavicencio, Colombia.

Limitations	Site/Generation	
	La Libertad	Santa Rosa
	F_2-F_4	F_3-F_5
Acid soil toxicity	x	x
Blast - leaf	x	x
Blast - neck	x	x
Scald	x	x
Helmintosporiosis	x	-
Grain discoloration	x	-
Borer (Diatraea)	x	x

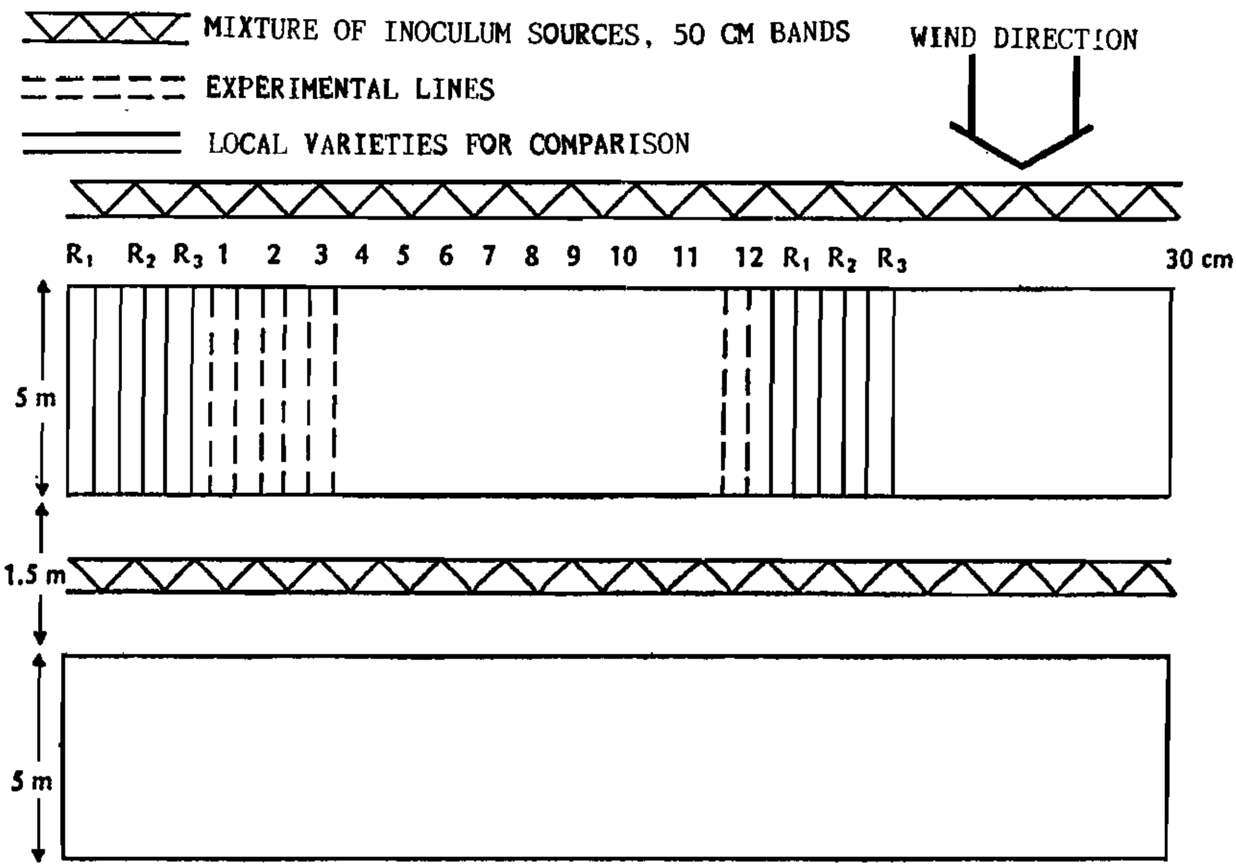

FIGURE 3.6. Experimental design to evaluate pedigree families and elite cultivars

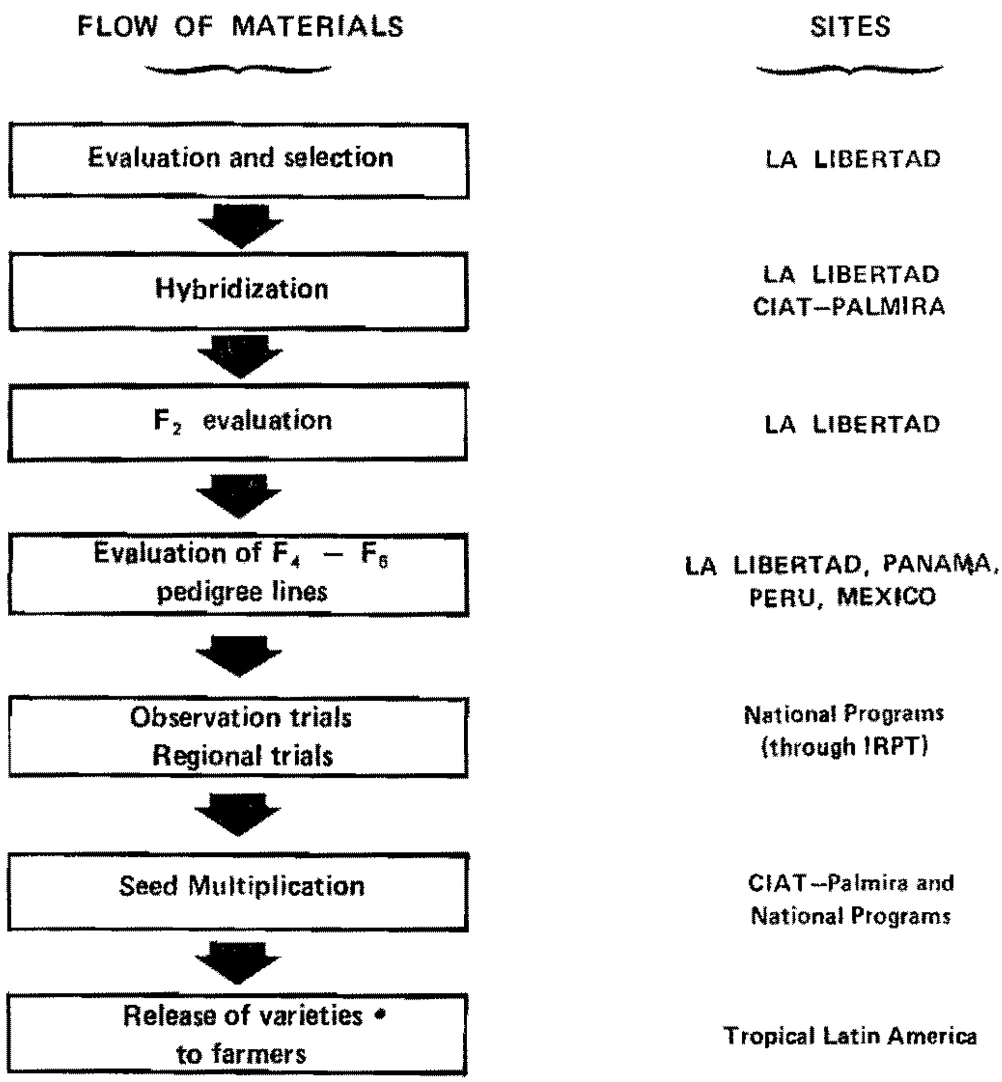

FIGURE 3.7. Flow of materials and experimental locations for upland rice improvement on acid soils.

3.5 APPLICATION OF ANTHER CULTIVATION TO RICE BREEDING

Victor Manuel Nuñez*

3.5.1. Introduction

Anther.cultivation is an in vitro technique by which plants are obtained from miscrospores. About 50% of the plants obtained are diploids.

Although this process has been known for more than 15 years, it has never been used in a breeding program for several reasons:

1. Low percentage of induction or production of callouses, especially in the indica types, and

2. The low percentage of plant regeneration.

With these low percentages of induction and regeneration, arther cultivation was not attractive to breeders. However, over the past 10 years progress has been made in the manipulation of better nutrient media for induction as well as regeneration. The low temperature treatment of anthers after planting also increased significantly the induction or production of callouses.

It has been shown that the miscrospore in a unicellular state responds favorably to the production of callouses. Generally, this stage is easy to detect in the field, since it correlates with the distance between the auricles of the final leaves.

Bearing in mind this information, a callous induction can be achieved of about 50% and a 25% regeneration , both of which are highly attractive to a breeding program.

3.5.2. Objectives

The objective of anther cultivation in CIAT is to harvest panicles from F1 or F2 plants from crosses which incorporate good characteristics. The isolation and planting of anthers in a simple nutrient medium induces the formation of callouses which are then placed in another nutrient solution where homozygotic plants are produced or plants with a stable genotype. The whole process takes approximately nine months distributed in the following stages:

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F1	Anthers	2.5 mos
Anthers	Callous	1.5 mos
Callous	R1 plants	1.0 mos
R.	R2 seed	4.0 mos

Homozygotic line........9.0 mos

The great advantage of anther cultivation is the considerable reduction in the time required to obtain homozygous lines. We should bear in mind that the rice zones such as southern Brazil, northern Argentina, central Chile, Uruguay and northern Mexico, can only obtain one generation per year due to their location in the temperate zone. The same thing also occurs on the Eastern Plains of Colombia, from which due to the rainfall distribution only one crop can be obtained. As a consequence, the goal of CIAT is to develop a technology for the cultivation of anthers to be used by the national programs. This can be done in two ways: R2 lines from crosses made in CIAT can be sent for their evaluation in the respective country or by training personnel to produce their own R2 lines.

If we are going to use this technique in a breeding program, the question is how many plants should be produced. Breeders believe that a population of 5,000 F2 plants is adequate to select a good genotype. According to the results obtained in China, a population of 5,000 F2 plants is equivalent to 150 R1 plants. Obtaining this number of plants is relatively easy since the panicle generally produces 20 flowers from which 50 anthers emerge. Some 25% of the anthers produce callouses (12 callouses) and 50% of the callouses regenerate plants (six plants). 25% of these will be selected (1.5 R1).

Taking 100 panicles per cross we have 5,000 anthers, 1,250 callouses and 150 R1. If 100 crosses can be managed per year, you have 500,000 anthers, 125,000 callouses and 15,000 R1 plants.

3.5.3. Flow of materials to Brazil

Considering that the varietal requirements for southern Brazil are: tolerance to blast, tolerance to iron toxicity, tolerance to low temperatures and good grain quality; in CIAT some 100 three-way crosses have been made for this region from which approximately 15,000 R2 lines can be obtained (20g seed/line). These lines will be evaluated for their resistance to blast at the plantlet stage and it is hoped that about 50% of the material will be resistant.

This material will be evaluated for iron toxicity in the plantlet stage. It is hoped that among the material resistant to blast, 50% will be tolerant to iron toxicity, i.e. of the 15,000 R2 lines, 3,000 lines will have resistance to blast and tolerance to iron toxicity.

These will be evaluated for white belly.

The lines which combine resistance to blast, tolerance to iron toxicity and good grain quality will be sent to southern Brazil where these lines will be evaluated for their phenotypical characteristics and tolerance to low temperatures under field conditions.

The lines selected in Brazil will eventually be shared with other countries with similar production problems.

3.5.4. Flow of Materials to Argentina

A similar pattern is being used for Chile and Argentina. In the case of Argentina, where varietal improvement requires some tolerance to blast, minimum tolerance to iron toxicity, resistance to erect head, low temperatures, and an exportable grain quality; three-way crosses have also been done to process them through anther cultivation. In this case, a sample of three grams of R2 seed will be used to evaluate resistance to erect head, utilizing a methodology using arsenic to induce this disease (which has been under development at CIAT). The selected lines will be tested for their resistance to blast and grain quality. The lines which combine these characteristics will be sent to Argentina to be planted in observation plots.

3.5.5. Conclusions

1. Anther cultivation has the potential to considerably reduce the time required to produce homozygous lines.

2. Success depends upon:
   a. The capability for induction and regeneration of the genotypes.

   b. Selection methods of the R2 lines.

   c. The lines obtained through anther cultivation should have the desired characteristics which have been sought using conventional methods.

4. EVALUATION OF GERMPLASM

4.1. A GLOBAL NETWORK FOR EVALUATION OF RICE GERMPLASM WITH SPECIAL REFERENCE TO LATIN AMERICA

D.V. Seshu*

The International Rice Testing Program (IRTP) was established in 1975 to provide a mechanism for the exchange of elite rice among rice scientists in different countries for evaluation and utilization in their respective environments. Thus, the program represents an inter-country cooperative effort toward genetic improvement of rice targeted to the many environments in which the crop grows around the world. With access to a wide range of genetic materials, the gain in time is an important dividend for the network scientists in their efforts to develop improved varieties.

The main objectives of the IRTP are as follows:

a. To make the world's elite germplasm available to rice scientists around the world either for direct use or for use in crosses within their breeding programs.

b. Provide rice scientists with an opportunity to assess the performance of their own advanced breeding lines over a wide range of climatic, cultural, soil and disease, and insect conditions.

c. Identify varieties with broad spectrum resistance to major disease, insects, and other stresses.

d. Monitor and evaluate the genetic variation of pathogens and insects.

e. Serve as a center for information on interaction of varietal characteristics for the diverse rice-growing environments of the world.

f. To promote interaction among the rice scientists in the world.

IRTP is organized and coordinated by IRRI with funding from the United Nations Development Programme (UNDP). More than 800 rice

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scientists from 75 countries in Asia, Africa, Latin America, North America, Europe, and Oceania participate in the IRTP network. Representative scientists from some of the participating countries serve on an advisory committee to assist in program planning and implementation of the IRTP. About 75% of the nurseries are tested in different regions of Asia and 10% each in Latin America in collaboration with the Centro Internacional de Agricultura Tropical (CIAT), and in Africa in collaboration with the International Institute of Tropical Agriculture (IITA), and the West African Rice Development Association (WARDA).

More than 30 types of nurseries are composed and distributed each year to different countries. These fall into two broad categories:

a. Nurseries to identify superior varieties for different rice cultural types.

b. Nurseries for the identification of genetic donors for individual biological, physical, and chemical stresses.

Approximately, 65% of the entries are contributed by the national programs and the remaining originate from IRRI and other international centers.

As of December 1984, 72 IRTP entries originating from 14 national programs and from the international centers have been released to farmers in 35 countries in Asia, Africa, and Latin America. National breeding programs and the international centers also utilized several hundred entries in hybridization programs to improve the present varieties with respect to certain agronomic traits or resistance to specific stresses.

Scientists from the national programs and from IRRI participate periodically in IRTP-sponsored international monitoring programs to review the performance of entries in the international nurseries and in the national breeding trials in selected countries. The monitoring program provides a forum for interaction among rice scientists and for planning breeding strategies.

The results of the multilocation nursery and the monitoring tour observations and recommendations are published each year and distributed to rice scientists and research administrators in various countries.

Many significant results and research leads have been obtained from the IRTP tests. The following are some examples:

a. IRTP yield trials indicate varietal

differences in the degree of stability of yield performance. Varieties with broad adaptability, as well as region-specific adaptability are identified under irrigated and favored upland conditions.

b. The brown planthopper (BPH) is a major insect pest of rice and one of the IRTP nuseries is designed to screen and identify varieties resistant to this insect. Results from this nursery led to the information that the biotypes of the insect in southern Asia are distinctly different from those in Southeast Asia and are relatively more virulent. Recently, varieties with genes for resistance to biotypes in all regions were identified in IRTP nurseries, thus laying the foundation for an in-depth collaborative project among Asia's scientists.

c. Gall midge is another important insect pest, particularly, in parts of China, India, Indonesia, Thailand and Sri Lanka. The International Rice Gall Midge Nursery facilitated the identification of differences in biotypes of this insect both between countries as well as within large countries such as India. Several improved varieties have been identified with a high level of resistance.

d. Blast is a most destructive rice disease. Evaluation of rice germplasm in the IRTP blast nursery indicated wide genetic variability of the pathogen and at the same time several varieties resistant to a broad spectrum of race of the pathogen were identified. The results stimulated intensified research on the genetic interaction of the host and pathogen and the dynamics of pathogen populations.

e. Strain variations in another major disease, bacterial leaf blight, became evident from the IRTP screening tests designed for that disease. Sources of resistance were identified for different strains. In general, the strains from Southern Asia proved to be more virulent.

f. The tungro virus disease has caused considerable losses in rice yields in several South and Southeast Asian countries. The IRTP tungro screening tests indicated variation in the virus as well as in the vector, the green leafhopper. Traditional and improved sources of resistance have been identified for use in breeding programs in different regions.

g. IRTP genetic materials are tested at sites over a wide range of environments- from arid regions where temperatures go above 45 C to mountainous areas at elevations up to 2,300m where growing season temperatures range between 15 and 25 C. Also, the test entries are located in latitudes ranging from 35 S to 41 N. Germplasm with tolerance to temperature extremes and daylength variation has been identified and is being used in many breeding programs.

h. Some of the IRTP entries are grown in adverse soils and several varieties with different degrees of tolerance to such soils have been identified. The mechanism of such tolerance is being studied by scientists in different countries. Genetic tolerance for adverse soils will greatly reduce costs due to soil amendments, and will also bring additional land into rice production.

i. The association of grain yield with major weather factors such as solar radiation and temperature at the reproductive and ripening stages was studied in IRTP yield trials and statistical models formulated to explain the relationship.

4.1.1. (2) IRTP IN LATIN AMERICA AND THE CARIBBEAN

The national programs in Latin America and the Caribbean have been participating in the IRTP since 1975. The IRRI liaison scientist located at CIAT coordinates the program which is jointly implemented by IRRI and CIAT in collaboration with the national programs in the region. Global IRTP nurseries are evaluated at specific sites in different countries representing various ecologies. A regional testing program is organized with material from the global nuseries with the promising breeding material from CIAT and the national programs in the region.

The global nurseries tested in the region include the yield and observational nurseries for irrigated and upland conditions, rainfed lowland observational nursery and the screening of nurseries for tolerance to low temperature and blast. The entries rated "good" in the nurseries in different countries in the region during the period 1975 - 1983 are listed in Tables 4.1 - 4.10.

TABLE 4.1. Entries in the irrigated IRYN-VERY EARLY in top three ranks for yield in Latin America, 1980-1983

Country/Location	Year	Entries in top three ranks
COLOMBIA		
Palmira	1980	BG 276-5, IR 9729-67-3, IR 19746-28-2-2, IR 19728-9-3-2
	1981	RNR 7306, IR 19791-12-1-2-2-2, IR 19743-25-2-2
	1982	IR 19735-5-2-3-2-1, IR 19743-25-2-2-3-1, Kaohsiung Sen Yu 252
	1983	IR 28128-45-2, UPR 231-28-1-2, IR 50
BRAZIL		
Cachoeirinha	1980	IR 9729-67-3, IR 19743-25-2-2, IR 19728-9-3-2
	1981	BG 276-5, bg 367-7, BG 367-4
Goiania	1982	IR 9729-67-3, BG 367-7, RP 1674-4038-78-3, UPR 103-80-1-2
	1983	DR 92, IR 25588-7-3-1, IR 25924-51-2-3, UPR 254-35-3-2
CUBA		
Bauta	1982	Kaohsiung Sen Yu 252, IR 15429-268-1-2-1
MEXICO		
Culiacan & Ebano	1983	IR 25890-82-5-3, UPR 231-28-1-2, TKM 9

NOTE: Where no more than one location is involved in a given country, the entries listed are based on the best average performance over those locations.

TABLE 4.2. Entries in the irrigated IRYN-EARLY in top three ranks for yield in Latin America, 1975-1983

Country/Location	Year	Entries in top three ranks
BRAZIL		
Goiania	1976	RP 633-9-5-8-1, IR 2061-628-1-6-4-3, IR 2307-84-2-1-2
	1978	BR 51-54-2, IR 9129-192-2, CR 156-5021-207
COLOMBIA		
Palmira	1976	IR 1561-228-3-3, RP 633-9-5-8-1, MTU 6368, IR 2307-84-2-1-2, B 541b-Pn-58-5-3-1
	1978	IR 52, Mala/J 15, Kaohsiung 139, IR 36
	1979	B 2360-6-7-1-4, IR 8608-298-3-1-1-2, IR 9224-117-2-3-3-2
	1980	BR 169-1-1, MTU 3419, PAU 41-B-31-1-PR 407
	1981	BAU 2-3-43, BR 109-74-2-2-2, ir 13427-60-1-3-2-2
	1982	UPR 307-7-1-1, UPR 254-24-1, Chianung Sen Yu 13
	1983	IR 13540-56-3-2-1, IR 18348-36-3-3, Taichung Sen Yu 285
CUBA		
Niña Bonita	1978	MRC 603-303, B 1991b-Pn-43-4-1, IR 9209-181-2
EL SALVADOR		
La Libertad	1978	IR 9093-216-3, IR 52, IR 9129-136-2, IR 9129-196-2
GUYANA		
Mon Repos	1976	RP 319-34-8-1-3, RP 6-1899-25-4
MEXICO		
Culiacan & Los Mochis	1976	B 541b-Pn-58-5-3-1, BR 51-46-1-C 1, PAU 125-102

Continues...

Table 4.2 (Cont.)

Country/Location	Year	Entries in top three ranks
Culiacan, Los Mochis & Zacatepec	1977	B 1991-Pn-43-4-1, RP 319-34-8-1-3, RP6-1899-25-4, RP6-156-31-4, Faro 15
Salguero, Culiacan & Los Mochis	1978	IR 52, B 459b-Pn-32-3-5, B 1991b-Pn-43-4-1
Juchitan	1982	PK 95-29-2-1-1-2, UPR 238-42-2-3-TCAL
Culiacan	1983	IR 13540-56-3-2-1, Kaohsiung Sen Yu 252, IR 21015-80-3-3-1-2
SURINAM		
Nieuw, Nickerie	1978	IR 9093-216-3, Mala/J 15, RP 79-9, IR 9209-181-2, MR 603-303
	1981	Taichung Sen Yu 285, BAU 2-3-43

NOTE: Where more than one location is involved in a given country, the entries listed are based on the best average performance over those locations.

TABLE 4.3. Entries in the irrigated IRYN-MEDIUM in top three ranks for yield in Latin America, 1975-1983.

Country/Location	Year	Entries in top three ranks
BRAZIL		
Goiania	1976	BG 374-1, IR 46, IR 2823-399-5-6, Taichung Sen Yu 195
COLOMBIA		
Palmira	1976	IR 2863-38-1-2, BG 375-1, BG 374-1
	1977	CICA 8, B 541b-Kn-22-7-2, IR 4422-98-3-6-1
	1978	IR 4422-98-3-6-1, IR 54, IR 8
	1979	CICA 8, CR 261-7039-236, PAU 41-262-1-5-PR 288, MR 1
	1980	BIET 360 (RAU 14-28-1-1), BR 51-282-8, BR 109-74-2-2-1
	1981	BR 400-1, Taichung Sen 10, BR 319-1, MR 1
	1982	BR 51-282-8, B 2489b-Pn-1-76-8, MR 24
	1983	RNR 74229, Taichung Sen 10, BG 400-1
CUBA		
Niña Bonita	1978	BR 51-46-5, IR 2863-38-1-2, IR 4422-98-3-6-1
ECUADOR		
Guayaquil	1977	IR 4422-98-3-6-1, BR 4, BR 52-87-1
MEXICO		
Culiacan & Los Mochis	1976	BR 52-87-1, IR 46, BR 51-46-5
	1977	CR 156-5021-207, B 541b-Kn-22-8-2, RP 516-34-1-8, BG 375-1
Culiacan, Los Mochis Tampico & Salguero	1978	BR 51-46-5, IR 46, IR 48

Continues...

Table 4.3 (Cont).

Country/Location	Year	Entries in top three ranks
Juchitan	1982	RP 1125-1526-2-2-3, RP 1125-1548-1-4-3
Culiacan	1983	BG 400-1, RNR 74229, BR-IRGA 409

NOTE: Where more than one location is involved in a given country, the entries listed are based on the best average performance over those locations.

TABLE 4.4. Entries in the irrigated IRYN-LATE in top three ranks for yield in Latin America, 1977-1980

Country/Location	Year	Entries in top three ranks
COLOMBIA		
Palmira	1978	IR 4625-132-1-2, CR 1009, IR 3464-75-1-1
	1979	CR 1006, IR 3454-80-2-1
	1980	CR 1006, CR 1024, CR 1005
CUBA		
Niña Bonita	1978	CR 1009, CR 1012, RP 975-109-2
ECUADOR		
Guayaquil	1977	CR 1009, CR 1016, IT 4625-132-1-2
MEXICO		
Culiacan	1977	IR 4625-132-1-2, RD 5, RPW 6-17

TABLE 4.5. Entries in the irrigated observational nursery IRON given good phenotypic ratings in Latin America, 1975-1983.

Country/Location	Year	Entries rated good phenotypically
ARGENTINA		
La Plata, Colonia Mascias	1977	J 3-756, Ratnagiri 9-5-3-2
BRAZIL		
Goiania & Cachoeirinha	1976	IR 2071-588-5-4-5-5, R 27-2511, IR 2823-103-5-1, IR 2832-141-2-1, IR 3449-172-2-1, IR 3464-126-1-3, IR 4219-64-1-3, IR 4227-28-3-2, IR 42, IR 2823-399-5-6, Kalongi Bao, K 41-146-1
Goiania	1977	BR 167-2B-9, BR 169-1-1, Sein Ta Lay, RP 6-516-33-1-1, RP 825-71-4-11, RP 967-65-4-3-13, MTU 6024, B 539b-KPJ-3-5-3-2, B 542b-Pn-68-9-2-2, B 702d-Kn-21-1-1-2, B 707c-Mr-13-1, B 805d-Mr-16-8-3, B 1367c-Mr-26-1, B 1665b-Mr-7-SI-5, B 2096c-Mr-31-1, B 2160c-Mr-64-1, B 2186b-Mr-71-1, B 2928-29-1-3-3-2, B 2931-19-2-2-1-1, S 32c-46-1, IR 4870-15-1-1
Goiania & Campos	1978	IR 5254-3-5, SI-2
Goiania	1982	PAU 14-2-13-9-2-1-1, Palghar 68-1, PNA 235-F4-66-1, PNA 237-F4-130-1, PNA 246-F4-81-1, PNA 277-F4-247-1
COLOMBIA		
Palmira	1978	IR 4568-86-1-3-2
	1979	None
	1980	40 entries were given score of 4.0
	1981	IR 9698-16-3-3-2, IR 17492-18-6-1-1-3-3, 343 D.T., BR 171-2B-8, KAU 1734-2, V.1 SL, X.2-D.T., Chianung Sen Yu 13, IR 9828-91-2-3

Continues...

Table 4.5. (Cont.)

Country/Location	Year	Entries rated good phenotypically
COLOMBIA		
Palmira	1982	Tainung Sen 12
	1983	IR 62, IR 24632-34-2, KJT 6-31-16-17, PK 350-17-1-1-1, IR 25620-68-3-2-1-3, IR 25909-11-2-2-3-2, IR 27315-19-3-3, RNR 52147, IR 18348-36-3-3
COSTA RICA		
Cañas	1978	IR 8, B 2360-2-3-1-9-1, B 2360-2-3-1-9-5, B 2360-2-3-1-9-1-Mr-1, B 2360-2-3-1-9-5-Mr-2, CNBP 217, RP 9-10-3-2-1-2, CR 138-1040, PAU 608A, IR 4219-22-1-1-2, RU 305-32-2-3-4, BKN 6819-36-3-1, IR 3259-PP 5-160-1, IR 9559-PP 889-1, IR 4432-28-5
MEXICO		
Culiacan, Los Mochis & Uxpanapa	1977	RP 633-86-3-1-4, Mala/J 11, CNM 31, CNBP 217, RP 84-39-1 RP 633-9-5-8-1, MTU 3626, B 57c-Md-10-2, IR 2823-103-5-1, IR 4422-6-2-3-1, IR 5629-64-3, 75-5111, BG 374-1, IR 48-29-89-2-1
Salguero	1978	RP 9-10-3-2-1-2, CNBP 217, RP 84-39-1, CR 138-1040, CR 140-62, RP 611-106-1-10-7, RP 633-86-3-1-4, IR 9218-276-3, IR 9439-20, IR 42, CR 138-994-A29
Culiacan	1982	BKNLR 75001-B3-CNT-B4-RST-47-2, BKNLR 75001-B3-CNT-B4-RST-47-3, BR 14-83-127-3, BR 4-34-13-5, BR 4-9-16-3-1, BRC 23-107-5, ECIA 31-18-11, ECIA 31-36-3-1, HPU 71, IR 25588-32-2, IR 25861-35-3-3, RNR 36626, RP 1899-1689-98, SKL 17-67-11, UPR 103-44-2, UPR 231-28-1-2-TCA 2, UPR 245-17-1
Culiacan	1983	IR 13538-48-2-3-2, IR 24924-51-2-3

TABLE 4.6. Entries in the rainfed upland yield nursery IURYN in top three ranks for yield in Latin America, 1975-1983

Country/Location	Year	Entries in top three ranks
BRAZIL		
Goiania	1975	IET 1444, C 22, BPI 76*9/Dawn
	1976	IR 43, IRAT 13, BPI 76*9, C 22, IR 3380-17
	1977	IRAT 13, IET 1444
COLOMBIA		
Villavicencio	1983	C 894-21, IR 6023-10-1-1, UPL Ri-5
COSTA RICA		
Cañas	1977	IR 43, IR 1750-F5B-5
MEXICO		
Edzna & H. Cardenas	1976	MRC 172-9, IR 2042-178-1, BPI 76*9/Dawn, C 22
Edzna, Chetumal, Villaflores, Huixtla	1978	IR 45, MRC 172-9, IR 43, Gama 318, IR 3839-1
CAE Santiago	1983	UPL Ri-5, UPL Ri-3, IR 3179-25-3-4
PANAMA		
Tocumen & Bayano	1977	IR 2035-242-1, IR 43, C 22, C 46-15/IR 24*2

NOTE: Where more than one location is involved in a given country, the entries listed are based on the best average performance over those locations.

TABLE 4.7. Entries in the rainfed upland observational nursery IURON given good phenotypic ratings in Latin America, 1975-1983.

Country/Location	Year	Entries rated good phenotypically
BRAZIL		
Goiania	1976	IR 1545-339, B 9c-Md-3-3, Kencana (Acc 36756), IAC 25, ICA 47, MRC 172-9
	1977	ASD 7, IR 2307-217-2-3, DJ 29, IRAT 13
	1978	Azucena, IR 4503-12-1-3-1, IR 4515-409-2-6, IR 4535-8-2-1, IR 4535-14-4-3, IR 52, Kinandang Patong, MI-48, IRAT 13, IR 9575 sel., B 981k-TB-14, IRAT 104, IRAT 106, IRAT 111, Sein Ta Lay, Seratus Malam, IAC 25, IAC 47, IAC 1246
COLOMBIA		
Villavicencio	1983	C 894-21, C 894-7, B 3619c-Tb-8-1-4, C 171-20, IR 9560-2-6-3-1, BW 170, IR 3179-25-3-4, C 924-9, Intan, IR 18189-42-2-3, IR 2987-13-1, INIAP 415, IR 13146-13-3-3-3, KN 96, IR 8192-166-2-2-3, IR 9101-124-1
COSTA RICA		
Cañas	1977	IR 8*7/Dawn, IR 2071-588-6, IR 3259-P5-160-1, IR 3260-PP 91-100, IR 3273-PP 339-1, BG 96-3
	1978	IR 8, IR 3259-P 5-160-1, IR 3271-760-1482, IR 1909-1-3-3, IR 3260-PP 91-100, IR 3262-3-338-5, IR 3271-745-1479, IR 4520-90-4-1-1, IR 4528-2-1-2, IR 4531-5-2-3-, IR 4531-9-1-1, IR 4532-1-3-1, IR 4532-2-3-3, IR 4540-1-3-2, IR 5533-15-1-1, IR 9560-9-1-1
MEXICO		
Edzna, H. Cardenas Ros. Izapa	1976	26 entries were given score of 1.0

Continues...

Table 4.7. (Cont.)

Country/Location	Year	Entries rated good phenotypically
MEXICO		
Edzna,H.Cardenas Juchitan, Chetumal, Villaflores & Huixtla	1978	IR 3271-760-1482, IR 4505-4-1-2, IR 4520-90-4-1-1, IR 4722-167-1-1, IR 5620-1, IR 5533-15-1-1, IR 9690-1-1-7, Kinandang Patong, IR 9669 sel., IRAT 104, IRAT 105, IRAT 106, IRAT 108, IRAT 109, IRAT 110, IRAT 111
SURINAM		
Paramaribo	1977	RPW 6-17, IR 1746-F5B-24, ARC 10372, Acc 8, FH 109, MTU 6368, RP 319-34-8-1-3, UPR 1900-8-1, UPR 1900-17-1, 14-M-69, 61-K-70, 55-K-70, MI-48

TABLE 4.8. Entries in the rainfed lowland observational nursery IRRSWON given good phenotypic ratings in Latin America, 1978-1983

Country/Location	Year	Entries rated good phenotypically
BRASIL		
Goiania	1978	None
	1982	ITA 123, ITA 134, IR 11418-15-2, IR 13146-41-3, IR 19083-22-2-2
COSTA RICA		
Cañas	1978	IR 8, IR 3259-P 5-160-1, OB 677
MEXICO		
Culiacan	1982	IR 21178-17-P 2, IR 13358-67-3-2, IR 13369-86-2-2, IR 21141-24-2
Huimanguillo		IR 21178-39-P 1, IR 21178-44-P3

NOTE: Where more than one location is involved i a given country, the entries listed are based on the best average performance over those locations.

TABLE 4.9. Entries in the cold tolerance observational nursery IRCTN given good phenotypic ratings in Latin America, 1976-1983.

Country/Location	Year	Entries rated good phenotypically
ARGENTINA		
La Plata	1980	Anna, Stejaree 45, Fuzi 102, Kwansansad, Taichung 176, Hua 110 (Acc 47562), M 7
BRASIL		
Itajai	1978	Suweon 235, IR 3941-45, P 33-C-19 (HPU 67), RP 1311-109-1, RP 1311-122-7, CR 126-42-1, IR 2403-PLPB-7-2-1-3B, IR 3941-54-1-2-2
Pelotas		IR 3941-77, K 35-67-2-1-3-1, Towada (Acc 8318), TY 12
Pelotas	1982	Ching-shi 15 (Acc 36852), Europa, Fuji 269, Fuzi 102, H 115-20-1-1, HPU 5010-Plp21-2-1B, HPU 5070-Nag-3-5-3, IR 9758-191-2, HR 100 (Acc 653), HPU 5101-Nag-1-2, IR 15685-2-2-2-3, IR 19746-28-2-2, IR 19746-28-2-2-3, IR 19764-15-1-1, IR 22623-R-R-4-2, IR 8455-K 2, P 33-C-30 (HPU 71), RP 1931-115-2-1-2, SR 3054-55-1-2-3, SR 3055-129-3-2-2, YR 1641-GH 12-5-1 GH 4-1
CHILE		
Chillan	1982	YR 2379-79-2, Antonio, Balilla, Deog Jeog Jodo, Stejaree 45
CUBA		
Bauta	1980	Tomoyutaka, Deog Jeog Jodo, Fuzi 102, Hwanghaedo, Olbyeo
PERU		
Chiclayo	1979	Kn-11-361-BLK-27-1, Kn-1B-361-1-8-6-9, RP Kn-2, IR 2061-522-6-9-1, IR 3249-19-1-2, IR 8460-120-2-2

Continues...

Table 4.9. (Cont.)

Country/Location	Year	Entries rated good phenotypically
URUGUAY		
Treinta y Tres	1978	TY 12, IR 3941-14-2-2-3, B 2266b-Cw-16-2-1, IR 1846-284-1-1, IR 1846-296-3, IR 1846-300-1-1, IR 2637-44-2, IR 3249-19-1, K 84, K 279, KH 1001, KT 31-1, KT 32-2, Shensi variety, Shimokita, Some-wake, Tatsumi-mochi, Towada (Acc 8318), Yamabiko, Yoneshiro, Kalimpong I
	1980	Jodo
	1981	IR 9708-51-1-2, Fuzi 102, Jodo, Tatsumi-mochi, Baekgogna, IR 9202-36-3-2, Sailboro 56-2, Pawn Buh, K 312-8-56.

NOTE: Where more than one location is involved in a given country, the entries listed are based on the best average performance over those locations.

TABLE 4.10. Entries in the blast screening nursery IRBN rated resistant at least twice in each country in Latin America, 1975-1983.

Country/Location	Entreis rated resistant
BRAZIL	
Goiania, Campinas Cachoeirinha, & Pelotas	BG 367-4, CI 5309, Milyang 48, Raminad Str. 3, TH 005, IR 2071-105-9-4-6, IR 2793-10-2, IR 36, IR 38, IR 4432-28-5, IR 4432-52-6-4, IR 4722-36-1, IR 4723-217-3, IR 52, IR 5257-49-2, IR 5533-14-1-1, CIAT-ICA 5*, IR 1529-680-3-2, IR 1544-238-2-3, IR 1544-414-3-1, IR 1905-81-3-11*, IR 1909-PP 234, Peta, RU 257-3-7*, RU 370-54-1-5, RU 371-40-2-5, Cheolweon 32, IR 13540-56-3-2-1, Milyang 55*, Milyang 56, MRC 603-303, Tres Marias *, Carreon*, IR 13423-10-2-3, IR 13429-299-2-1-3, IR 1416-1-42-2-3-3, IR 19672-140-2-3-2, IR 5533-PP 856-1, IR 5533-13-1-1, IR 5533-15-1-1, IR 5851-165-1-1-2, IR 9129-209-2-2-2-1*, IR 9224-22-2-2-2-3, IR 9660-00948-1, IR 9752-71-3-2, IR 9805-97-1, IR 9852-18-1, 5719, RU 369-7-2-1-4
COLOMBIA	
Villavicencio & Palmira	Chulweon 1, CIAT-ICA 1, CIAT-ICA 5, Colombia I, Colombia II, Colombia III, Guatakka (73044), Hahng Yi 71, Huan-sen-goo, IR 3259-PP8-172-6, IR 3259-5-160-3, IR 3464-29-3-1, IR 4227-140-2-1, IR 4547-6-3-2, IR 4712-228-1, IR 4744-295-2, IR 5533-PP 854-1*, IR 5533-PP 856-1*m NP-125*, Raminad Str.3*, Ta-poo-cho-z*, Tetep, T 23, 158154, 229/54, 273-15, 428-25-1-4, Zenith, Tres Marias, C 46-15
CUBA	
Niña Bonita	Carreon, CI 5309, Colombia II, Hahng Yi 71, IR 5533-13-1-1, IR 9559-4-1-1, Kanto 51, K 1, OS 6, Ta-poo-cho-z, Tetep, Toride, Tres Marias, Tsuyuake

Continues...

Table 4.10 (Cont.)

Country/Location	Entries rated resistant
MEXICO	
Zacatepec, Edzna, H.Cardenas Villaflores Huimanguillo Lorna Bonita, Tocumen & Campeche	CIAT-ICA 5, Colombia 1 (73120), IR 2035-290-2-1-1, IR 4547-10180-20-7, IR 4547-6-2-4, IR 5533-PP-854-1*, IR 5533-PP 856-1*, IR 9669-PP 836-1, Raminad Str. 3, RU 369-7-2-1-4, Ta-poo-cho-z, Huan-sen-goo, IR 2793-80-1, IR 4547-14-3-1, IR 4744-295-2, Ram Tulasi
SURINAM	
Paramaribo & Coebiti	B 50, Dawn, IR 1544-312-3-3, IR 26, RU 257-3-7, RU 370-54-1-5, RU 371-28-2-5, RU 371-40-2-5, Tetep

* Rated resistant more than twice.

4.2. BEHAVIOR OF IRIP GERMPLASM DISTRIBUTED IN 1982-84 IN LATIN AMERICA

Manuel J. Rosero*

4.2.1. Introduction

The distribution of improved germplasm through the IRIP nurseries has been done with the objective of broadening the genetic base of the national programs so that their researchers may evaluate and select the most appropriate materials for their rice production ecosystems.

Bearing in mind that human and financial resources are limited, not only in the international programs but also in the national rice improvement programs, it is essential that researchers identify and prioritize the problems which limit rice production in their ecosystems and concentrate all their efforts on solutions for them.

Success in the selection of a variety for a particular ecosystem depends principally on the genetic variability of the germplasm and the evaluation techniques used to identify materials tolerant to the principle problems which limit productivity in said ecosystem. At this stage, the integrated action of the team of breeders, pathologists, entomologists and soil specialists, and physiologists of the national programs plays a very important role.

In the germplasm distributed to the national programs in the IRIP nurseries, promising materials have been included which have been generated at CIAT, IRRI and in some national programs. In this conference the performance of these materials is discussed, and evaluated by the cooperators in the irrigated favored upland and non-favored, upland ecosystems in the region.

4.2.2. Germplasm Distributed in 1982-84

From 1982-84, 1,383 promising lines were included in seven nurseries. Two of them, VIRAL-T and VIOAL for the irrigated and favored upland ecosystems, are of interest to the majority of the national programs. The other nurseries were for specific ecosystems of interest only to some of the programs (Table 4.11).

* Scientific Representative for IRRI for Latin America. CIAT.

TABLE 4.11. IRTP nurseries for Latin America distributed in 1982-1984.

NURSERY a/	1982 LINES (no.)	1982 SETS (no.)	1983 LINES (no.)	1983 SETS (no.)	1984 LINES (no.)	1984 SETS (no.)
<u>Yield</u>						
VIRAL-T	30	68	28	59	24	45
VIRAL-F	20	7	21	6	21	6
<u>Observation</u>						
VIOAL	153	58	223	52	184	57
VIOAL-SNF	91	27	56	28	49	31
VIOAL-HB	74	5	90	13	83	11
VIOSAL	30	13	36	9	61	8
VITBAL	20	13	52	12	37	10
T O T A L	418	191	506	179	459	168

VIRAL-T = International nursery for rice yield-early maturing varieties
VIRAL-F = International nursery for rice yield-floating varieties
VIOAL = International rice observation nursery
VIOAL-SNF = International rice observation nursery-for non-favored upland rice
VIOAL-HB = International rice observation nursery-for hoja blanca
VIOSAL = International rice observation nursery-for salinity and alkalinity
VITBAL = International rice nursery for low temperatures

4.2.3. Nurseries Distributed in 1982

VIRAL-T was formed with 30 lines and was planted in 13 sites under irrigation and 16 under favored upland conditions. According to the data sent in by the cooperators, several lines performed well (had tolerance to diseases and high yield) in each of the sites for both irrigated-tropical and favored upland conditions in every country (Final Reports of the Nurseries Distributed in 1982). In Table 4.12, the yield and disease reaction is shown of the best lines in the nursery for the two ecosystems, irrigated and favored upland.

TABLE 4.12. Yield and disease reaction of the best lines of VIRAL-T, 1982, under irrigated and favored upland conditions for Latin America.

	DISEASE REACTION a/					YIELD (T/HA) b/	
DESIGNATION	B1 (6)	NB1 (4)	LSc (12)	BS (9)	ShB (5)	IRRIGATED	FAVORED UPLAND
P 2034 F4-25-6-1B	5	5	7	6	4	6.3	4.3
IR 5853-118-5	5	3	7	7	6	6.2	4.1
P 2015 F4-66-5-1B	5	4	6	6	6	6.0	4.2
P 2015 F4-148-5-1B	5	4	5	4	4	5.7	3.8
P 2015 F4-150-4-1B	4	5	5	4	4	5.7	4.0
P 2020 F4-140-3-1B	5	3	6	5	4	5.7	4.5
P 2025 F4-159-3-1B	4	2	5	4	3	5.7	4.8
IR 4422-98-3-6-1	3	4	6	4	3	5.5	4.3
P 2015 F4-108-1B-1B	4	2	5	6	4	5.5	4.3
P 2030 F4-217-4-1B	3	3	7	5	3	5.2	4.3
P 2023 F4-74-2-1B	5	3	5	6	4	5.2	4.2
CICA 4	9	6	7	6	6	5.9	3.2
CICA 8	5	3	6	5	4	6.0	4.9

a. Evaluations in upland favored conditions in Central America and Mexico, on a 0-9 scale: 0 = Resistant; 9 = Susceptible
B1 and NB1 = Blast on leaves and panicles, respectively.
LSc = Leaf scald; BS = Helminthosporiosis; ShB = Sheath blight.
Maximum level observed in a site.
In parentheses number of sites.

b. Average of 13 sites for irrigated and 16 for favored upland conditions.

VIOAL was planted in 29 locations in 16 countries, 13 under irrigated and 16 under favored upland conditions. On the basis of the disease evaluation in the favored upland conditions of Mexico and Central America, among the 153 lines included in the nursery, 26 were resistant to blast (leaf and panicle) and to sheath blight; 15 were resistant to blast and leaf scald; 12 were resistant to blast and grain discoloration. Among these materials, 21 lines combined tolerance to these four diseases and had good yield potential in the two ecosystems (Table 4.13).

VIOAL-SNF, with 91 lines was planted in eight sites, four in favored upland conditions and four in non-favored upland

TABLE 4.13. Performance of the best VIOAL lines in 1982 in the irrigated and favored upland ecosystems of Latin America.

DESIGNATION	DISEASE REACTION a/					YIELD (T/HA) b/	
	Bl (4)	NBl (3)	LSc (4)	ShB (2)	MG (2)	IRRIGATED	FAVORED UPLAND
IR 5853-118-5	5	3	5	3	5	6.0	4.5
CR 1002	5	1	5	1	4	5.5	3.8
IR 9698-16-3-3-2	3	1	5	5	3	5.3	3.9
IR 9845-145-3-3	5	1	3	5	3	5.1	3.6
P 2193 F4-140-1B-1B	1	3	3	1	5	5.1	4.4
P 2057 F4-48-5-1B	4	1	5	5	3	5.0	5.0
P 2060 F4-2-5-1B	3	1	5	1	5	4.9	4.6
IR 11248-148-3-2-3-3	5	3	5	3	5	4.9	4.2
Chianung Sen Yu 13	5	3	3	5	4	4.7	3.7
P 1358-5-19M-2-1B	3	3	3	1	5	4.7	4.1
P 2220 F4-28-1B	5	3	3	3	3	4.6	4.9
P 2057 F4-88-3-1B	1	1	5	3	4	4.5	4.0
P 2182 F4-39-1B-1B	3	3	5	3	5	4.5	4.1
IR 9852-53-2	3	5	5	1	4	4.5	4.0
P 1383-8-11M-3-1B	2	3	5	1	4	4.3	4.6
P 2182 F4-49-1B-1B	3	1	3	1	5	4.2	3.6
IR 11248-13-2-3	3	5	4	1	4	4.2	4.9
IR 14632-22-3	3	3	3	1	6	4.1	4.9
IR 11288-8-8-445-1	1	1	5	5	4	4.0	5.0
CICA 4	7	7	3	6	6	5.2	3.2
CICA 8	3	4	6	3	4	5.9	5.1

a. Evaluations in favored upland conditions of Central America on a 0-9 scale, where 0 = Resistant; 9 = Susceptible.
Bl and NBl = Blast in the leaves and panicles, respectively.
LSc = Leaf scald; ShB = Sheath blight; MG = Grain discoloration.
Maximum level observed in a site.
In parentheses, number of sites.

b. Average of nine sites under irrigation and eight in favored upland conditions where they were evaluated for their disease reaction.

conditions. Among the 91 lines, 13 showed tolerance to diseases in the four non-favored upland sites but their yields were low (Table 4.14).

The observation nursery for low temperatures (VITBAL) was distributed to Brazil, Chile, Mexico, Peru and Uruguay.

Data have been received from Mexico and Uruguay. In Mexico, the nursery was planted in Ebano but the temperature was not low enough.

TABLE 4.14. Entries from VIOAL-SNF, 1982, with disease tolerance in four locations under non-favored upland conditions.

	DISEASE REACTION a/						YIELD (T/HA) b/
DESIGNATION	Bl	NBl	ShB	BS	LSc	GD	NON-FAVORED UPLAND (SNF)
IAC 1246	0	5	4	3	3	3	2.8
BR 51-282-8	0	5	4	3	3	3	2.7
BR 10 (BR 51-46-5)	0	3	3	2	2	3	2.7
IR 8098-41-3	0	0	2	2	5	3	2.6
CR 1024	0	0	3	2	3	3	2.6
Chianung SI-PI 661020	0	0	2	3	5	4	2.4
IR 9217-58-2-2	0	0	2	1	2	3	2.4
IR 14632-2-3	1	1	2	3	4	4	2.2
PR 106	0	0	1	4	4	5	2.1
IR 2058-435-3-2-2-2	0	0	3	2	3	3	1.8
IR 13149-71-3-2	0	0	1	3	4	4	1.8
IET 4082 (CR 138-1040)	0	0	3	2	4	5	1.7
IRAT 122	0	3	2	3	4	3	1.7
Checks							
Salumpikit	0	5	5	3	4	5	1.7
IAC 47	5	9	3	4	6	5	1.6
Monolaya	4	5	3	3	4	5	1.4
Sein Ta Lay	0	9	2	3	3	2	1.9

a. Maximum level observed, according to a 0-9 scale: 0 = Resistant; 9 = Susceptible.
Bl in Cañas (Costa Rica); NBl in ICA-La Libertad and Cañas; ShB in Tocumen (Panama); BS and LSc in ICA-La Libertad, Cañas, Tocumen and Cuyuta (Guatemala); GD in ICA-La Libertad, Tocumen and Cuyuta.

b. Average in SNF of ICA-La Libertad, Santa Cruz Porrillo (El Salvador), Cuyuta and Tocumen.

In Uruguay, the nursery was planted on the Estacion Experimental del Este in Treinta y Tres. The low temperatures occured during the plantlet stage, extending the growing cycle of the germplasm. The low temperatures which occurred at the reproductive stage did not affect the yield of the majority of the materials. In Table 4.15, the lines are presented which were superior to the local control, Bluebelle.

With respect to specific nurseries for salinity (VIOSAL) and for flooding (VIRAL-F) distributed to several programs, no information has been received.

4.2.4. Results of Nurseries Distributed in 1983.

In 1983, VIRAL-T was made up of 28 promising lines and was planted under irrigation (15 sites) and in favored upland conditions (11 sites). The performance of the germplasm varied between ecosystems and between sites. In each site, there were several lines with equal to or better performance than the local checks (Final Report of the Nurseries distributed in 1983). Nevertheless, of the 28 lines, nine were tolerant to diseases (in several locations in Central America) and to iron toxicity in ICA-La Libertad. In addition, they had good yield in both ecosystems, under irrigation or under favored upland conditions (Table 4.16).

VIOAL, which was made up of 223 lines, was planted in 25 sites, nine under irrigation, 13 in favored upland conditions and two in non-favored upland conditions. The cooperators evaluated the reaction of the germplasm to the principle diseases present in these ecosystems, primarily, blast, leaf scald, helminthosporiosis and sheath blight. The disease pressure was severe in several locations of favored upland conditions in Central America. The reaction of the germplasm to each of these diseases varied in each location and between locations. The lines resistant to blast were susceptible to leaf scald or helminthosporiosis. The majority of the lines resistant to blast in all locations were susceptible to leaf scald. Nevertheless, several lines showed combined resistance to blast, helminthosporiosis and sheath blight and in addition had good yield under irrigated and favored upland conditions (Table 4.17).

TABLE 4.15. Crop cycle and yield of the best entries of VITBAL, 1982, in Treinta y Tres, Uruguay.

DESIGNATION	ORIGIN	FLOWERING (DAYS)	YIELD (T/HA)
IR 579-ES 38-PLP 28	India	96	11.1
M 101	USA	87	9.5
IR 9129-169-3-2-3-3	IRRI	99	9.2
IR 9201-91-2-2-1-3	IRRI	100	9.2
IR 8608-239-2-2-3	IRRI	99	9.1
Bluebelle (Local check)		92	8.5

TABLE 4.16. Entries of VIRAL-T, 1983, tolerant to diseases and with good yield under irrigated and favored upland conditions in Latin America.

	DISEASE REACTION [a]								YIELD (T/HA) [b]		
DESIGNATION	Bl (7)	NBl (8)	LSc (9)	BS (5)	ShB (6)	MG (1)	Fe TOX [c]	LODG-ING [d]	TROPICAL IRRIGAT.	TEMPERATE IRRIGAT.	FAVORED IRRIGATED
P 2231 F4-138-2-1B	4	3	5	4	7	3	2	3	5.5	5.8	5.0
P 2231 F4-138-1-1B	4	3	4	4	5	3	3	4	5.7	6.4	5.2
P 2023 F4-74-2-1B	2	2	6	6	4	3	4	2	6.0	5.2	4.8
P 2217 F4-30-4-1B	3	4	6	4	6	3	5	2	5.2	5.1	4.1
P 2189 F4-27-1B-1B-1-1B	3	4	4	5	4	5	4	8	5.6	6.7	4.4
P 2180 F4-7-5-1B	2	4	6	5	3	4	5	5	5.5	6.8	4.3
P 2189 F4-64-1-1B	2	3	6	5	3	5	4	8	5.6	4.6	4.1
IR 4422-98-3-6-1	3	3	6	3	4	5	5	5	5.6	5.2	4.9
P 2180 F4-55-1B-1B-7-1B	3	4	7	6	3	4	5	1	5.0	4.3	3.4
CICA 8	3	5	6	5	6	3	4	9	5.8	6.9	4.5
CICA 4	4	7	6	3	4	5	4	3	5.3	5.5	3.9

a. Maximum level observed in a site under favored upland conditions in Central America on a 0-9 scale, where 0 = Resistant; 9 = Susceptible.
Bl and NBl = Blast in the leaves and panicles, respectively; LSc = Leaf scald; BS = Helminthosporiosis; ShB = Sheath blight; MG = Grain discoloration.
Number of sites is in parentheses.

b. Average of 12 sites under tropical irrigation, two under temperate irrigation, and 11 under favored upland conditions in Central America.

c. In ICA-La Libertad.

d. Evaluated in nine sites, maximum level observed in a site.

TABLE 4.17. Entries of VIOAL, 1983 tolerant to diseases and with good yield under favored upland conditions in Central America and in tropical-irrigated.

DESIGNATION	REACTION TO DISEASES [a] Bl (4)	NBl (8)	LSc (6)	BS (4)	ShB (2)	FLOWERING (DAYS)	YIELD (T/HA) [b] FAVORED UPLAND	TROPICAL IRRIGATED
P 1274-6-8M-1-3M-1	4	4	5	3	2	96	5.4	6.0
P 3085 F4-31	2	3	7	4	4	106	5.3	6.1
P 2068 F4-116-2-1B	2	4	7	4	4	89	5.2	5.5
P 1358-5-19M-2-1B	2	3	7	4	3	100	5.1	5.8
P 3082 F4-4	2	3	5	5	1	102	5.0	6.5
P 2053 F4-88-2-1B	3	4	6	5	3	97	4.9	5.7
P 3083 F4-58	3	3	5	4	3	95	4.9	6.3
P 3299 F4-33	1	3	3	7	1	98	4.7	6.9
P 1377-1-15M-1-2M-3	2	3	7	3	2	100	4.7	6.0
P 2737 F4-7-1B	4	4	7	5	5	95	4.6	4.5
P 3082 F4-18	3	4	7	5	3	99	4.6	5.0
P 3084 F4-59	2	4	5	3	1	98	4.5	6.3
P 2189 F4-27-1B-1B-3-2	1	3	7	4	3	104	4.5	6.3
P 3083 F4-61	3	3	5	5	7	97	4.4	7.0
P 2058 F4-47-3-1B	3	3	5	6	3	95	4.4	6.4
P 2189 F4-27-1B-1B-1-1	1	3	5	4	3	102	4.3	6.4
P 3085 F4-35	2	4	7	4	1	101	4.2	5.8
P 3084 F4-34	2	3	5	4	1	104	4.1	5.9
P 3081 F4-22	3	3	9	5	3	100	4.0	4.8
IR 25586-45-1-2	4	3	7	3	1	99	3.6	5.2
PNA 46-25-1-31	2	4	7	6	3	106	3.5	7.0
CICA 4	6	9	7	3	3	91	3.7	5.3
CICA 8	3	5	9	3	3	98	5.2	5.8

a. Scale of 0-9: 0 = Resistant; 9 = Susceptible.
Bl and NBl = Blast on the leaves and panicles, respectively; LSc = Leaf scald; BS = Helminthosporiosis; ShB = Sheath blight.
Maximum level of severity observed in a site.

b. Favored upland, average of eight sites where the NBl was evaluated. Tropical irrigated, average of seven sites.

In 10 sites of favored upland rice conditions in Central America and Mexico (Yucatan), 16 lines from VIOAL had high yields and resistance to helminthosporiosis and sheath blight (Table 4.18).

In Corrientes, Argentina, where straight head limits production, 63 lines of VIOAL were resistant. Among these lines, several had good yield potential (Table 4.19). In addition, these showed resistance to sheath blight and tolerance to blast in several ecosystems of favored upland conditions in Central America.

TABLE 4.18. Promising lines of VIOAL, 1983, which combine resostance to BS and ShB with good yield, under favored upland conditions in Central America Central and Mexico (Yucatan).

DESIGNATION	REACTION a/ BS	REACTION a/ ShB	FLOWERING b/ (DAYS)	YIELD b/ (T/HA)
P 3081 F4-58	3	1	94	5.6
P 3293 F4-54	3	3	91	5.1
P 1377-1-15M-2M-3	3	2	94	5.1
P 2053 F4-99-4-1B	3	3	97	5.0
P 3081 F4-2	3	1	93	4.9
P 3294 F4-48	3	3	96	4.8
IR 9852-22-3	3	4	92	4.8
P 3293 F4-96	3	1	98	4.7
P 3293 F4-15	3	1	92	4.6
PNA 237 F4-33-1	3	3	101	4.4
IR 21734-16-3-2-2-2	3	2	92	4.4
P 3081 F4-29	3	1	95	4.4
P 3081 F4-31	3	3	91	4.3
P 1496-7-7M	3	1	96	4.3
IR 255-45-1-2	3	1	93	4.0
CICA 8	3	3	98	5.2
CICA 4	3	3	91	3.7

a. Maximum level, on a scale of 0-9: 0 = Resistant; 9 = Susceptible. BS = Helminthosporiosis in Alanje, Panama and Cuyuta, Guatemala; ShB = Sheath blight in Tocumen and Chepo (Panama)

b. Average of ten sites, two in Mexico (Yucatan) and eight in Cental America.

TABLE 4.19. Crop cycle length and yield of some entries from VIOAL, 1983, resistant to straighthead in Corrientes (Argentina) and their reaction to Sheath blight and blast.

DESIGNATION	FLOWERING (DAYS)	YIELD (T/HA)	DISEASES [a/] E.E	ShB	Bl	NBl
P 3299 F4-61	104	7.9	0	2	1	5
P 3293 F4-19	98	7.6	0	1	3	5
P 3299 F4-33	114	7.3	0	1	1	3
P 3081 F4-2	102	6.3	0	1	3	5
P 3065 F4-41-1B	104	5.5	0	3	4	5
P 3299 F4-74	118	5.3	0	1	1	5
P 3295 F4-54	108	5.0	1	3	5	4
IR 841 (Local check)	113	-	9	-	-	-
Bluebonnet 50 (Local check)	103	-	7	-	-	-

a. Scale of 0-9: 0 = Resistant, 9 = Susceptible
EE = Straighthead; ShB = Sheath blight; Bl and NBl = Blast on leaves and panicles respectively.
Maximum level observed: ShB in Tocumen and Chepo (Panama); Bl in Cristina (Guatemala), David, Alanje and Chepo (Panama); NBl in Cuyuta and Cristina (Guatemala); Tocumen, Alanje. Chepo and David (Panama).

The observation nursery for non-favored upland conditions (VIOAL-SNF) was formed with 56 lines selected from IURON and IRLRON nurseries in 1982. This nursery was sent to Mexico, Colombia, Guatemala, El Salvador, Honduras, Costa Rica, Panama, Venezuela and Brazil. The cooperators evaluated the nursery under favored and non-favored conditions. Under favored upland conditions some lines had good performance but under non-favored upland conditions, the majority of the materials were susceptible to blast, leaf scald and/or helminthosporiosis.

The observation nursery for low temperatures (VITBAL) for 1983 was made up of 52 lines and was sent to Rio Grande do Sul, Brazil; Treinta y tres, Uruguay; Chillan, Chile; and Ebano, Mexico. In Ebano, Mexico, there were no problems with low temperatures. In Brazil, the nursery was evaluated in Campo de Leon (RS) for low temperatures, with a minimum of 17 C, maximum of 26 C and an average temperature of 22 C. Under these conditions, five lines yielded 1t/ha more than the local check (5.7 t/ha). In Treinta y Tres, Uruguay, eight lines tolerated the low temperatures and yielded 1 or 2 t/ha more than Bluebelle (the local check). By the same token, in Chillan, Chile, with a minimum temperature of 9 C, maximum of 25 C and an average temperature of 17 C, some lines tolerated the low temperatures but the yields were low- on a par with the local check (Table 4.20).

The observation nursery for hoja blanca (VIOAL-HB) distributed in 1982 was evaluated in sites with a high incidence of the virus in Colombia, Ecuador, Peru, and Venezuela. The majority of these lines were susceptible to the virus. There were, however, some differences in the reaction of several lines. Certain lines resistant in Colombia were susceptible in other countries and viceversa. These variations in resistance were considered to be escapes due to the low percentage of insect vectors. Nevertheless, the lines that were resistant in some sites and susceptible in others were included once again in the nursery distributed in 1983. The results of this second evaluation carried out in Colombia, Venezuela, and Peru indicated susceptibility of all the materials, with the exception of a few lines which were tolerant in the three countries (Table 4.21).

To demonstrate the resistance of these lines to the virus, they were evaluated under laboratory conditions in CIAT with a vector colony having a 72% infection capacity. The results showed the susceptibility of the lines with the exception of IR 1148-19-2-3 which showed tolerance at a 25% infection level.

4.2.5. Results of the Nurseries Distributed in 1984

Of the germplasm distributed in 1984, we shall discuss the performance of the materials included in the VIRAL-T, VIOAL and VIOAL-SNF nurseries on the basis of the data received (as of June 30, 1985) from the cooperators in the northern hemisphere. With respect to the southern hemisphere data has not been received except from the VIOAL sent to Santa Catarina, Brazil.

VIRAL-T was planted in 10 locations under favored upland conditions in Central America and seven under irrigated tropical conditions. The yield and disease reactions of the best lines in each country are shown in Table 4.22.

Despite the fact that the performance of the germplasm varied from one location to another, several lines showed good performance in the sites under favored upland conditions. The yield of these materials is shown in Table 4.23. These lines were tolerant to blast, leaf scald, helminthosporiosis and sheath blight in several locations in the region under high disease pressure. These lines also had good yield in several locations under irrigation (Table 4.24), indicating their good adaptation in both ecosystems.

TABLE 4.20. Crop cycle length and yield of the best lines of the 1983 VITBAL in Uruguay, Brazil (RS) and Chile.

DESIGNATION	ORIGIN	FLOWERING (DAYS)	YIELD (T/HA)	LODGING [a]
Uruguay (Treinta y Tres)				
Suweon 288	Korea	91	9.4	2
HPU 5101-NAG-1-2	India	95	9.1	3
IR 9201-91-2-2-1-3	IRRI	92	9.1	3
RP 1845-83-45-1	India	89	8.9	2
YR 1641-GH 59-7	Korea	95	8.8	1
YR 1641-GH 12-5-1-GH 4-1	Korea	103	8.4	1
YR 1805-17-3-21	Korea	94	8.0	2
L 201	USA	87	7.3	1
Bluebelle (Local check)		88	6.3	3
Brazil (RS)				
IR 19746-28-2-2	IRRI	90	7.1	1
IR 19754-15-1-1	IRRI	88	6.9	1
IR 19746-23-2-2-3	IRRI	90	6.9	1
IR 9201-91-2-2-1-3	IRRI	92	6.8	1
P 33-C-30 (HPU 71)	India	94	6.5	1
Local check		88	5.7	1
Chile (Chillán)				
K 31-163-3	India	57	3.1	3
IR 9202-5-2-2-2	IRRI	75	3.0	1
Europa	Italy	75	2.9	1
IR 19746-28-2-2-3	IRRI	69	2.7	1
IR 197-22-2-2	IRRI	70	2.6	1
Quella (Local check)	Chile	51	2.0	3

a. Scale of 0-9: 0 = Resistant, 9 = Susceptible

TABLE 4.21. Reaction to Hoja blanca under field conditions and in the laboratory, of five entries from VIOAL-HB in 1983.

	REACTION TO HOJA BLANCA [a/]						
	COLOMBIA	VENEZUELA		PERU			% INFECTION AT CIAT [b/]
DESIGNATION	1	1	2	1	2	3	
IR 11418-19-2-3	0	1	3	1	0	3	28
B 2791B-MR-257-3-2	3	3	2	2	5	3	79
IR 8192-31-2-1-2	4	5	2	0	2	2	88
IR 17492-18-6-1-1-3-3	0	5	3	0	1	0	81
IR 14753-120-3	0	3	2	2	0	3	91
Checks							
Bluebonnet 50	6	7	7	6	6	7	97
CICA 8	5	9	5	7	7	7	-
Colombia 1	3	1	1	0	0	0	9
ICA-10	3	2	3	0	0	0	-

a. Scale 0-9: 0 = Resistant, 9 = Susceptible
Under field conditions in Nataima, Colombia; Araure, Venezuela (two plantings) and Peru- 1 and 2 plantings in Huarangopampa and 3 in Alenya.

b. In the laboratory, with a colony having a vector potential of 72%.

TABLE 4.22. Behavior of the best entries of VIRAL-T, 1984, under favored upland conditions in Mexico and five countries in Central America.

ENTRY (no.)	DESIGNATION	DISEASES [a/] B1	NB1	LSc	BS	ShB	FLR. [b/] (DAYS)	YIELD [b/] (T/HA)
Mexico (Papaloupan, Campeche)								
3	P 1358-5-19M-2-1B	2	2	2	1	-	106	4.6
2	P 2231 F4-138-6-2-1	2	2	3	1	-	102	4.6
5	P 2231 F4-138-2-1B	2	2	3	1	-	102	4.4
8	P 2231 F4-138-6-1	3	2	3	1	-	101	4.2
7	P 3062 F4-170-1-1	4	1	3	1	-	99	4.2
	Cárdenas A 80 (T.Local)	3	1	3	1	-	103	2.8
Guatemala (Cuyuta and Panzos)								
14	P 2231 F4-45-8-1B	1	3	3	5	-	113	8.8
15	P 2189 F4-27-1B-1B-1-1B	1	3	2	4	-	108	8.2
23	P 2192 F4-39-5-1	1	3	2	4	-	112	7.9
16	P 2053 F4-99-4-1B	1	3	3	3	-	108	7.7
22	IR 25909-11-2-2-3-2	1	5	5	6	-	104	7.7
7	P 3062 F4-170-1-1	1	4	3	4	-	102	7.5
5	P 2231 F4-138-2-1B	1	3	3	4	-	107	7.4
	ICTA Virginia (L.check)	1	3	3	3	-	105	8.7
El Salvador (San Andres)								
22	IR 25909-11-2-2-3-2	-	5	2	3	-	102	6.5
3	P 1385-5-19M-2-1B	-	7	2	4	-	97	5.9
11	P 3295 F4-26	-	6	2	4	-	99	5.8
16	P 2053 F4-99-4-1B	-	6	2	4	-	98	5.8
17	P 2025 F4-159-3-1B	-	5	2	5	-	103	5.7
	Local check	-	6	2	6	-	98	5.5
Honduras (Guaymas, Comayagua and San Fco. del Valle)								
2	P 2231 F4-138-6-2-1	1	-	4	4	-	105	6.3
11	P 3295 F4-26	2	-	5	4	-	105	6.3
5	P 2231 F4-138-2-1B	2	-	4	4	-	105	6.2
17	P 2025 F4-159-3-1B	3	-	4	4	-	106	6.0
22	IR 25909-11-2-2-3-2	3	-	6	3	-	108	6.0
19	IR 4422-98-3-6-1	3	-	7	3	-	108	5.9
	CICA 8 (T.Local)	5	-	5	3	-	109	4.9
Costa Rica (Cañas)								
17	P 2025 F4-159-3-1B	-	0	5	-	3	103	5.9
4	P 2057 F4-88-3-1B	-	1	6	-	0	97	5.4
2	P 2231 F4-138-6-2-1	-	1	6	-	0	98	5.4
5	P 2231 F4-138-2-1B	-	1	6	-	2	97	5.2
8	P 2231 F4-138-6-1	-	1	6	-	0	97	5.1
	CR 5272 (L. check)	-	7	7	-	0	91	3.0

Continues...

Table 4.22 (Cont.)

ENTRY (no.)	DESIGNATION	DISEASES a/					FLR. b/ (DAYS)	YIELD b/ (T/HA)
		Bl	NBl	LSc	BS	ShB		
Panama (Alanje, Chepo and David)								
16	P 2053 F4-99-4-1B	4	5	4	3	6	86	5.7
15	P 2189 F4-27-1B-1B-1-1B	4	2	4	4	4	88	5.5
22	IR 25909-11-2-2-3-2	3	1	6	4	3	87	5.4
5	P 2231 F4-138-2-1B	3	4	4	3	6	86	5.4
17	P 2025 F4-159-3-1B	4	5	3	3	3	90	5.4
	Local check	3	4	5	5	4	87	4.5

a. Scale 0-9: 0 = Resistant; 9 = Susceptible
Bl and NBl = Blast on the leaves and panicles, respectively; LSc = Leaf scald; BS = Helminthosporiosis; ShB = Sheath blight.
Maximum level observed in one of the two or three evaluation sites.
(-) indicates that no evaluation was done.

b. Yield and flowering, average of the sites evaluated in each country.

TABLE 4.23. Average yield (t/ha) of the best entries of VIRAL-T, 1984, planted under favored upland conditions in Mexico and Central America.

	COUNTRIES						
DESIGNATION	MEXICO [a/]	GUATEMALA [a/]	EL SALVADOR	HONDURAS [b/]	COSTA RICA	PANAMA [b/]	PROM.
P 2053 F4-99-4-1B	3.4	7.7	5.8	5.7	5.1	5.7	5.6
P 2025 F4-159-3-1B	3.9	7.1	5.7	6.0	5.9	5.4	5.7
IR 25909-11-2-2-3-2	3.9	7.7	6.5	6.0	3.6	5.5	5.5
P 2231 F4-138-2-1B	4.4	7.4	5.0	6.2	5.2	5.4	5.6
P 2189 F4-27-1B-1B-1-1B	3.0	8.2	4.8	5.6	3.4	5.5	5.1
P 2231 F4-45-8-1B	3.9	8.8	4.3	5.4	4.5	4.5	5.2
IR 4422-98-3-6-1	2.9	7.3	4.6	5.9	2.2	5.0	4.7
Checks							
CICA 4	2.9	6.0	4.6	4.2	0.9	2.7	3.6
CICA 8	3.6	8.2	5.2	5.3	3.1	4.5	5.0
Local [c/]	2.8	8.7	5.5	4.9	3.0	4.5	4.9

a. Average of two sites.
b. Average of three sites
c. Different in each country. Cardenas A 80 in Mexico, ICTA Virginia in Guatemala, CICA 8 in Honduras, CR 5272 in Costa Rica, Toc. 5430 in Alanje and David, Anayansi in Chepo (Panama).

TABLE 4.24. Average yield (t/ha) of the best entries of the 1984 VIRAL-T planted under irrigation in nine sites in Latin America.

DESIGNATION	COUNTRIES							PROM.
	COLOMBIA [a]	MEXICO [a]	NICARAGUA	CUBA	ECUADOR	VENEZUELA	SURINAM	
P 2053 F4-99-4-1B	5.3	7.1	6.6	5.1	7.1	6.1	6.4	6.2
P 2025 F4-159-3-1B	5.2	6.2	7.4	4.8	7.3	5.8	8.2	6.4
IR 25909-11-2-2-3-2	5.3	6.2	7.5	4.5	6.6	5.7	6.4	6.0
P 2231 F4-138-2-1B	5.0	5.3	6.0	4.6	5.6	5.6	6.7	5.5
P 2189 F4-27-1B-1B-1-1B	5.8	4.1	7.4	5.0	7.0	5.4	8.0	6.1
P 2231 F4-45-8-1B	5.5	6.2	7.7	4.7	7.2	5.3	7.9	6.4
IR 4422-98-3-6-1	5.5	4.8	7.4	4.4	8.5	5.7	7.4	6.2
Checks								
CICA 4	4.6	4.8	6.3	5.6	5.0	4.3	6.3	5.2
CICA 8	5.4	6.1	6.8	3.9	5.9	5.3	8.1	5.9
Local check [c]	5.4	5.4	5.4	6.4	5.4	4.9	5.8	5.5

a. Average of two sites.

b. Difrerent in each country: Oryzica 1 in Colombia, J-104 in Cuba, INIAP 6 in Ecuador, Araure 1 in Venezuela, Eloni in Surinam.

VIOAL was made up of 184 lines and was planted under favored upland conditions in Guatemala, Costa Rica, Panama, Honduras and El Salvador. The cooperators evaluated the reaction of the germplasm to the principle diseases: blast, leaf scald, helminthosporiosis and sheath blight. The resistance of the germplasm to these diseases varied among the sites within each country and among countries. The lines which had good performance in each country are shown in Table 4.25.

Data from the VIOAL on iron toxicity were received from Santa Catarina, Brazil. Of the 184 lines in the nursery, 112 were resistant to iron toxicity. Of these resistant lines, 54 combined resistance to blast, as evaluated in CIAT-Santa Rosa, Colombia in 1984. Of the 54 lines, 18 also had resistance to grain blight evaluated in Santa Rosa. The reaction of the materials to these stresses and the length of the crop cycle and yield observed in several sites under irrigated and favored upland conditions, are shown in Table 4.26. These materials are of interest for countries in which iron toxicity, blast and grain discoloration limit productivity.

The observation nursery for non-favored upland conditions (VIOAL-SNF) was made up of 49 lines and distributed to Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama and Venezuela. In Panama, the nursery was evaluated in the non-favored upland ecosystem of Rio Hato. In the other countries, the evaluation corresponded to favored upland rice conditions. In Table 4.27 lines are presented which had the best performance in each country.

4.2.6. Utilization of Germplasm

The network of IRTP nurseries was created to help the national programs with improved germplasm to be evaluated by the respective programs and for their selection of the most appropriate materials for their production ecosystems. The majority of the programs are evaluating germplasm but are not selecting materials despite the fact that the evaluation data which they send us on germplasm received demonstrate the existence of promising materials for their production ecosystems.

Some programs have selected several lines from the germplasm distributed in 1983 and 1984, some to be tested in yield trials and others as parents for crossing projects. (Table 4.28).

The national programs of six countries released eight varieties in 1984 and 1985 (Table 4.29). The variety released in Brazil is recommended for irrigation conditions in the state of Santa Catarina. This variety is tolerant of blast and iron toxicity.

TABLE 4.25. Performance of the best entries of VIOAL, 1984, under favored upland conditions in five countries in Central America. [a/]

ENTRY (no.)	DESIGNATION	DISEASES [b/] Bl	NBl	LSc	BS	ShB	FLR. (DAYS)	YIELD (T/HA)
Guatemala (Cuyuta, Cristina)								
213	P 2231 F4-45-8-1	1	4	3	4	-	115	8.2
173	P 3304 F4-54-5	1	1	5	5	-	90	8.2
172	P 2945 F4-41-1	1	4	3	4	-	91	8.1
159	P 3083 F4-61	2	3	5	3	-	98	7.9
278	P 3094 F4-1-3	1	3	5	3	-	115	7.8
266	P 3081 F4-78	1	4	3	2	-	98	7.7
228	P 3081 F4-76	2	5	3	3	-	95	7.7
131	P 3304 F4-5	2	3	3	3	-	91	7.7
170	P 3284 F4-5	3	2	3	4	-	96	7.6
179	P 2867 F4-52-2	3	3	3	3	-	96	7.5
256	PNA 46-25-1-31	1	3	3	5	-	114	7.5
	ICTA-Virginia (T. Local)	2	4	3	3	-	105	7.3
El Salvador (San Andres and Santa Cruz Porrillo)								
270	P 3304 F4-12-1	-	5	1	3	-	106	5.0
239	P 3299 F4-86	-	3	3	3	-	104	4.8
268	P 2863 F4-79-6	-	5	1	-	-	108	4.8
233	P 2887 F4-9-4	-	-	3	3	-	100	4.7
241	P 3299 F4-7	-	3	5	3	-	102	4.6
202	P 2231 F4-138-6-1B	-	5	1	5	-	97	4.6
193	SI-PI 692033	-	5	1	1	-	95	4.4
182	P2862 F4-53-4	-	5	1	5	-	94	4.4
194	IR 25587-109-3-3-3-3	-	-	1	3	-	102	4.4
232	P 3282 F4-33-2	-	3	3	5	-	105	4.3
	Local check	-	7	1	3	-	106	3.6
Honduras (Guaymas, Comayagua, San Fco. del Valle, La Ceiba and Olancho)								
203	P 2231 F4-13-2-1B	3	-	5	3	1	102	7.2
188	P 3293 F4-48	1	-	5	3	1	103	6.8
172	P 2945 F4-41-1	3	-	5	3	1	97	6.8
202	P 2231 F4-138-6-1B	3	-	3	1	1	102	6.7
247	P 2859 F4-97-6	3	-	3	3	1	103	6.2
248	P 2859 F4-99-1	3	-	3	5	1	104	6.2
151	P 2053 F4-26-4-1B	5	-	5	5	1	103	6.2

Continues...

Table 4.25. (Cont.)

ENTRY (no.)	DESIGNATION	DISEASES b/					FLR. (DAYS)	YIELD (T/HA)
		Bl	NBl	LSc	BS	ShB		
201	P 3081 F4-2	3	-	3	1	1	105	6.1
136	P 2231 F4-13-2-1	3	-	3	1	1	102	6.1
173	P 3304 F4-54-5	3	-	5	5	1	102	6.1
215	P 3299 F4-5	5	-	5	5	1	106	6.1
	CICA 8 (Local check)	5	-	5	5	5	112	4.3
Costa Rica (Cañas)								
152	P 2060 F4-49-4-1B	0	0	5	0	1	99	7.0
136	P 2231 F4-13-2-1	0	0	3	0	0	99	7.0
203	P 2231 F4-13-2-1B	0	0	1	0	0	99	6.9
182	P 2862 F4-53-4	0	0	3	0	0	104	6.6
265	P 3082 F4-18	0	0	5	0	0	99	6.4
212	P 2231 F4-45-5-4	0	0	5	0	0	107	6.3
259	P 3081 F4-58-3	0	0	5	0	0	99	6.2
211	IR 2153-276-1-10-PR 509	0	0	5	3	0	99	6.1
252	P 2192 F4-39-5-1B-1	0	0	7	0	0	109	5.7
232	P 3282 F4-33-2	0	0	5	0	0	104	5.5
	Costa Rica 1113 (L.check)	4	0	5	0	0	90	-
Panama (Tocumen, Alanje, Chepo and David)								
233	P 2887 F4-9-4	3	2	4	6	4	91	5.2
159	P 3083 F4-61	4	2	4	5	4	93	5.2
158	P 3081 F4-58	4	2	3	5	3	94	5.1
228	P 3081 F4-76	4	5	5	1	5	94	5.1
241	P 3299 F4-7	3	2	4	7	5	93	5.0
239	P 3299 F4-86	4	2	4	8	4	92	4.7
229	P 2055 F4-92-2-2-1B	5	5	5	2	4	96	4.7
288	P 2030 F4-217-4-1B	4	4	5	6	4	100	4.6
236	PAU 50-B-25-1	5	5	4	6	4	95	4.6
	Toc.5430 (Local check)	3	4	4	8	5	94	3.8

a. Flowering and yield, average of the sites evaluated in each country.

b. Scale 0-9: 0 = Resistant, 9 = Susceptible. Bl and NBl = Blast on leaves and panicles, respectively; LSc = Leaf scald; BS = Helminthosporiosis; ShB = Sheath blight.
Maximum level observed on one of the evaluation sites.
(-) indicates no evaluation.

TABLE 4.26. Plant cycle length and yield of entries from the 1984 VIOAL, resistant to iron toxicity, blast and grain discoloration.

DESIGNATION	REACTION a/ Fe Toxc.	Bl	NBl	MG	IRRIGATED b/ FLR. (DAYS)	YIELD (T/HA)	FAV.UPLAND c/ FLR. (DAYS)	YIELD (T/HA)
P 3299 F4-86	0	1	2	3	103	7.0	100	5.8
P 3304 F4-12-1	1	1	3	2	104	6.7	99	4.9
P 3295 F4-43	2	2	1	3	103	6.5	101	4.9
P 3284 F4-5	2	4	3	3	99	6.1	98	4.7
P 3094 F4-1-3	0	2	3	2	112	6.1	108	4.7
P 2859 F4-99-1	0	3	3	3	101	6.0	101	5.7
P 3059 F4-79-1	0	1	3	1	99	5.9	94	4.8
P 2231 F4-138-2-3	1	2	1	2	103	5.9	98	5.5
IR 3262-3-9-4-5	0	4	2	2	106	5.9	99	4.6
P 3304 F4-58-1	0	4	3	4	102	5.9	106	3.8
P 3059 F4-25-3	0	3	3	2	97	5.8	102	5.4
P 2867 F4-52-2	2	2	3	2	94	5.8	96	5.1
P 2231 F4-13-2-1	0	3	3	3	102	5.7	100	5.1
IR 19670-263-3-2-2-1	2	3	2	2	108	5.7	105	4.3
P 2887 F4-9-4	1	2	2	3	103	5.4	99	5.7
P 2862 F4-53-4	1	2	3	3	104	5.1	97	4.6
P 3081 F4-78	2	4	3	2	107	5.0	102	5.0
P 3304 F4-5	0	3	3	2	94	4.5	96	5.1
CICA 4	2	7	9	7	91	4.8	95	3.4
CICA 8	1	4	4	4	105	6.3	104	4.8

a. Scale 0-9: 0 = Resistant; 9 = Susceptible. Iron toxicity in Santa Catarina (Brazil); Bl, NBl and MG en CIAT-Santa Rosa (Colombia).

b. Average of four sites (CIAT-Palmira, Venezuela, Ecuador and the Dominican Republic).

c. Average of 13 sites (five in Honduras, four in Panama, two in El Salvador and two in Guatemala)

TABLE 4.27. Flowering, yield, and reaction to diseases of the best VIOAL-SNF entries from 1984 in seven countries in Latin America. [a/]

ENTRY (no.)	DESIGNATION	DISEASE REACTIONS [b/] Bl	NBl	ShB	BS	LSc	FLR. (DAYS)	YIELD (T/HA)
Mexico (Campeche)								
333	UPL RI-5	-	3	5	1	1	95	4.8
334	IR 6023-10-1-1	-	3	5	1	1	99	4.4
336	C 894-7	-	1	5	1	1	99	3.9
331	16871 (IAC Irrad.Dwarf)	-	2	3	2	1	99	3.7
338	MR 24	-	3	5	3	1	100	3.5
	CICA 8 (L.check)	-	1	3	1	1	101	2.6
Panama (Rio Hato)								
312	P 1035-5-6-1-1-1M	0	-	-	-	2	110	3.3
345	P 1332-3-8M-1-1B	2	-	-	-	3	125	3.2
301	IRAT 112	0	-	-	-	-	73	3.1
344	P 2030 F4-235-1B-1B	2	-	-	-	3	117	3.0
346	IR 14632-212-2	2	-	-	-	3	130	2.8
317	IRAT 104	1	-	-	-	2	97	2.7
	Toc. 5430 (L. check)	2	-	-	-	5	117	1.8
Guatemala (La Maquina)								
341	PAU 50-B-25-1	-	-	-	2	-	-	6.3
346	IR 14632-212-2	-	-	-	2	-	-	6.3
312	P 1035-5-6-1-1-1M	1	-	-	2	1	-	6.2
345	P 1332-3-8M-1-1B	-	-	-	2	-	-	6.1
332	IET 4082 (CR 138-1040)	1	-	-	2	1	-	6.0
303	C 1008-1	1	-	-	2	2	-	5.9
	ICTA-Cristina (L.check)	-	-	-	2	-	-	4.7
El Salvador (Sta. Cruz Porrillo)								
318	UPL RI-7	-	-	-	-	3	81	5.2
323	C 894-21	-	-	-	3	1	98	4.0
316	BR 319-1	-	-	-	-	3	88	3.9
325	IR 8997-4-4-2	-	-	-	3	3	98	3.9
324	IR 4744-295-2-3	-	-	-	3	3	87	3.8
	Local check	-	-	-	5	-	101	1.8
Nicaragua (Malacatoya)								
333	UPL RI-5	-	-	-	-	-	94	5.3
328	IR 5105-156-2-3	-	-	-	-	-	88	5.2
319	IR 3179-25-3-4	-	-	-	-	-	87	4.9
312	P 1035-5-6-1-1-1M	-	-	-	-	-	94	4.8
322	IR 841-67-1	-	-	-	-	-	91	4.8
	CICA 8 (L. check)	-	-	-	-	-	108	3.5

Continues...

Table 4.27. (Cont.)

ENTRY (no.)	DESIGNATION	DISEASE REACTION b/ Bl	NBl	ShB	BS	LSc	FLR. (DAYS)	YIELD (T/HA)
Honduras (Guaymas, Comayagua. San Fco. del Valle) d/								
318	UPL RI-7	3	-	-	1	5	93	6.3
324	IR 4744-295-2-3	3	-	-	1	5	102	6.0
328	IR 5105-156-2-3	3	-	-	1	7	104	6.0
341	PAU 50-B-25-1	3	-	-	3	5	113	6.0
309	IR 2053-436-1-2	1	-	-	1	3	98	5.9
339	IR 8098-41-3	1	-	-	1	5	113	5.9
	CICA 8 (L.check)	4	-	-	1	3	113	3.8
Venezuela (Araure)								
347	IR 10781-75-3-2-2	1	-	-	-	1	110	6.7
305	P 2054 F4-26-4	1	-	-	-	5	95	5.7
326	IR 5931-110-1	1	-	-	1	3	100	5.7
314	Chianung SI-PI 661020	1	-	-	1	3	97	5.4
323	C 894-21	1	-	-	-	3	105	5.4
324	IR 4744-295-2-3	1	-	-	-	3	100	5.4
	Araure 1 (L.check)	4	-	-	1	3	105	4.6

a. Non-favored upland conditions in Panama and favored upland conditions in other countries.

b. Scale 0-9: 0 = Resistant, 9 = Susceptible. Bl and NBl = Blast on leaves and panicle, respectively; ShB = Sheath blight; BS = Helminthosporiosis; LSc = Leaf scald.
Maximum level observed on one of the sites evaluated.

c. (-) Indicates no evaluation done.

d. Flowering and yield, average of the three sites.

TABLE 4.28. Number of lines selected by the cooperators from the germplasm distributed in 1983 and 1984. [a/]

	PARENTS		YIELD TRIALS	
COUNTRY/PROGRAM	1983	1984	1983	1984
ARGENTINA				
CORRIENTES			66	
ENTRE RIOS			13	
BRAZIL				
CNPAF			59	
IRGA	39	5	2	4
EMPASC				24
CHILE			13	
COSTA RICA			17	19
CUBA				6
ECUADOR			86	
HONDURAS				20
MEXICO			4	
DOMINICAN REP.				4
PERU			18	
URUGUAY			4	
VENEZUELA			165	
T O T A L	39	5	447	77

a. Information supplied by the cooperators.
Preliminary data for 1984.

TABLE 4.29. New varieties released by the National Programs in Latin America in 1984 and 1985.

COUNTRY	INSTITUTION [a/]	COMMERCIAL NAME	DESIGNATION	YEAR
BRAZIL	EMPASC	EMPASC 104	IR 841-67-1-2	1985
COLOMBIA	ICA	ORYZICA 2	P 2023 F4-74-2-1B	1984
COSTA RICA	MAG	CR 1821	P 881-19-22-4-1-1B-CR 1	1985
HONDURAS	SRN	YOJOA 44	P 918-25-15-2-3-2-1B	1984
PERU	INIPA	PA-2	P 2030 F4-88-1-2	1984
PERU	INIPA	PA-3	IR 4570-83-3-3-2	1984
VENEZUELA	FONAIAP	ARAURE 3	PR 106	1984
VENEZUELA	FONAIAP	ARAURE 4	P 2217 F4-30-4-1B	1984

a. EMPASC = Empresa de Pesquisa Agrícola de Santa Catarina
ICA = Instituto Colombiano Agropecuario
MAG = Ministerio de Agricultura y Ganadería
SRN = Secretaría de Recursos Naturales
INIPA = Instituto Nacional de Investigación Agropecuaria
FONAIAP = Fondo Nacional de Investigación Agropecuaria

Oryzica 2 in Colombia is recommended for irrigated and favored upland conditions. it is a high- yielding variety, tolerant of fungal diseases and hoja blanca.

PA-2 and PA-3 are recommended for the areas under irrigation in Tarapoto and Bagua, Peru, respectively. PA-3 has shown tolerance to hoja blanca, the principle problem in Bagua.

The varieties released in Honduras and Costa Rica are recommended for favored upland conditions.

In Venezuela, Araure 3 and Araure 4 are recommended for favored upland and irrigated conditions, respectively.

With the new reorganization of the IRTP which is under consideration by the heads of the national programs and to be discussed in this meeting, we expect to better serve the cooperators by supplying them with germplasm which is more appropriate for the different ecosystems of each country. At the same time, it is hoped that the cooperators will concentrate more of their resources on the evaluation, selection, multiplication of seed and the rapid release to farmers of these promising materials. The only way to increase productivity is to stabilize yields (diversifying varieties, with fewer problems of diseases and pests), reduce importations (for countries with a balance of payment deficit) or to increase the export volume (for export to other countries).

5. DISCUSSION OF PRODUCTION COSTS

5.1. COSTS OF PRODUCTION IN LATIN AMERICA AND THE CARIBBEAN: A GUIDE FOR THE IDENTIFICATION OF PRODUCTION PROBLEMS

Edward Pulver*

5.1.1. Introduction

IRTP is a liaison between CIAT-IRRI and the national programs to foment the dissemination and utilization of rice germplasm. Undoubtably, improved varieties continue to play an important role in the search for higher and more stable yields. Nevertheless, over the past several years, some rice production zones have increased their productivity notably due to the adoption of modern rice varieties, to such an extent that it is difficult to achieve another great increase in yield with new varieties. In these cases, crop management has become the principle limiting factor in terms of crop productivity or production efficiency.

As part of the new focus on rice cultivation, the IRTP sent out a questionaire to national programs in the region requesting data on the production per hectare in the different ecosystems of Latin America and the Caribbean. The data received have been summarized and information added on costs in other countries or zones.

This type of analysis is useful to us as an indication of the production problems found in our countries. In the first place, it facilitates the identification of the most important limiting factors in crop management and the establishment of research priorities oriented to lower costs. For example, heavy investment in pesticide application, indicates the need to look for other methods of control of pests and diseases. On the other hand, a small investment in nitrogenous fertilizers indicates that the research on nitrogen fixation with Azolla or other organisms merits low priority. In the economic analysis of costs, emphasis should be laid on the interactions of different agronomic practices. In all the ecologies of the region, weeds constitute an important limiting factor. More adequate and economic control of weeds will result in savings in other practices such as seed density, fertilization, control of pests and diseases, and a better harvest due to less lodging.

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The other great value of cost analysis is an estimate of the profitability of the crop in relation to government policies. In some cases, the price received by the rice producer is too low to stimulate production. In other cases, the prices received are over the price/t of the big exporting countries. This can result in unnecessary and high subsidies or on the other hand in excessively high costs/ha due to factors which are controlled by the national governments such as inputs, credit and machinery.

In this study, the production costs and the price of rough rice were analyzed in 14 countries in Latin America and the Caribbean. The idea was to identify the factors which limit production or can make the costs of rice production excessive. In some cases, alternatives were suggested which might reduce the production costs or increase yields; either one of which might increase the profitability of the crop, thus stimulating production.

5.2.1. Irrigated Rice

5.2.1.1. Importance of irrigated Rice

Irrigated rice is the predominant production system in Latin America and the Caribbean, totalling approximately 55% of the annual production. In some countries such as Argentina, Chile, Cuba, Jamaica, Surinam and Uruguay, the production is exclusively irrigated. At the same time, irrigated rice is responsible for 98% of the production in the Dominican Republic, 92% in Colombia, 87% in Peru, 76% in Paraguay, and 70% in Ecuador. In Mexico, more than 60% of the present production is irrigated and there is an enormous potential to increase production in this ecosystem. Even in Brazil which has the highest production of upland rice in Latin America, irrigated rice is increasing in importance and is presently 40% of the total production. These figures clearly demonstrate the importance of irrigated rice in this region and consequently, this study concentrated on this production system.

5.2.1.2. Panorama of the Production Costs and Prices.

An economic analysis of rice is relatively simple; requiring information only on the costs incurred in the production of a hectare, the yield obtained and the price of rough rice. The validity of any analysis depends upon the exactitude of the cost estimates. Frequently, the costs of production are expressed as cost/mt. However, this is a unit of production efficiency. The only way to compare the production among countries and to detect excessive costs is to express the costs based on a hectare (cost/ha). Generally, the production efficiency (cost/mt) is more variable than the cost/ha since there are great differences in yield among countries and even within a country. The profitability can be measured in tons or by hectare but the most common expression is by tons due to the fact that the price of rough rice is expressed in tons. Nevertheless, a farmer is more interested in the profitability per hectare because the loans which he receives are calculated based on hectage.

The average cost of producing a hectare of irrigated rice in Latin America was @ US$760, for the 1983/84 harvest, which is less than 50% that required to produce a hectare in California (Table 5.1). In Venezuela, Paraguay and Guyana, the capital necessary to produce a hectare of irrigated rice was less than US$ 500. By contrast, the production costs per hectare in Colombia were 2-3 times higher. In Brazil, the costs of production/hectare varied considerably, being only US$ 550 in the state of Santa Catarina and US$ 1,000/ha in Rio Grande do Sul despite the fact that these two production zones are contiguous. In Peru, the third largest rice producer in Latin America, costs range from US$ 700-800/ha.

These great variations in the capital used to produce a hectare of rice show that the systems of production are different not only among countries but also within a country. As a consequence, it is not practical to generalize on production problems, nor is it valid to generalize on the costs of production among ecosystems due to the variations found not only within an ecosystem but among them.

On the average, the production efficiency of irrigated rice in Latin America is adequate since it costs US$ 158/mt. In comparison, the efficiency in California is inferior with a cost of US$ 238/tm. However, there are countries in which the production efficiency is low resulting in a cost/mt which is higher than the price/mt. Countries where irrigated rice production is not profitable are: Argentina, Ecuador (in 1983) and Panama in 1984. In these three countries, rice was not profitable due to the fact that the yields were relatively low (3.5 mt/ha), and in Argentina and Ecuador (during 1983/84) rough rice prices were below the international market price. In none of these three countries, were the production costs excessive and the only alternatives are to improve yield and/or to increase the price of rough rice. In Brazil (Rio Grande do Sul), and presently in Colombia, the production costs/mt are almost equal to the price of rough rice. The farmers in these regions are in trouble. In addition, the price of rough rice is equivalent to the international price. Colombia has the highest production costs/ha in Latin America and the yields are also relatively high being an average of 5.5 mt/ha. The only solution to improve the profitability of irrigated rice is to significantly reduce production costs/ha. In Rio Grande do Sul, Brazil, the costs/ha are not as high (US$ 938/ha) and there is the possibility to improve yield by at least 1 mt/ha.

TABLE 5.1. Analysis of the profitability of rice in several countries in Latin America and in the Caribbean for 1983/84 or 1984/85. (Information provided by the leaders of National Programs). Data on irrigated rice in California is presented for comparison.

Country	Year	Total Cost US$/Ha	Yield mt/ha	Production Cost US$/mt	Price rough rice US$/mt
Argentina	84/85	691	3.5	198	112
Brazil					
Rio Grande	84/85	925	4.8	215	198
Santa Catarina	83/84	567	4.5	126	150
Chile	84/85	586	6.5	90	135
Colombia					
Meta	83	1126	5.2	217	315
Meta	84	1137	5.9	192	255
Tolima	84	1456	6.7	217	255
Ecuador					
Transplant	83/84	747	3.5	214	133
Direct seeding	84/85	715	4.0	179	264
Guyana	83/84	259	3.3	79	200
Honduras	83/84	657	6.0	110	200
Mexico	84	676	4.5	150	208
Panama	83	932	5.5	169	242
	84	829	3.7	223	209

Continues...

Table 5.1. (Cont.)

Country	Year	Total Cost US$/Ha	Yield mt/ha	Production Cost US$/mt	Price rough rice US$/mt
Paraguay	83/84	469	5.0	94	156
Peru	83/84	702	7.1	99	202
Dominican Rep.	83/84	800	5.7	140	173
Uruguay	83/84	759	4.5	169	180
Venezuela	83/84	438	4.0	110	329
AVERAGE		760	4.9	158	202
USA (California)	83	1669	7.0	238	198

In all the other countries in this study irrigated rice is profitable. In Peru and Venezuela, profits are at a maximum but for different reasons. The price of unhulled rice is equal to the international market price and the costs of production/ha are middling (US$ 700-800/ha) The high profitability is due to high yields on the order of 7 mt/ha. In Venezuela, the production/ha is middling but the costs are low (US$ 438/ha and there is a heavy subsidy of the price of rough rice (US $309/mt).

5.2.1.3. Use of Inputs

Generally speaking, the average costs for seeds and urea are not excessive (Table 5.2). The only country with high seed costs is Colómbia (US$ 150/ha). This is due to two factors: (a) the high cost of certified seed (US$ 680/mt) and a high quantity of seed for planting (250 kg/ha). In truth, the cost of the certified seed is not high in relation to its quality. In Colombia, red rice was a big problem, but at present there are few areas with a high incidence of the weed. The fundamental reason for the nearly complete elimination of this weed was the quality of the certified seed. As a consequence, we do not recommend reducing the price of certified seed since this could possibly reduce its quality. Nevertheless, seed costs can be reduced by reducing the quanitity planted. Studies have been done on optimum seed quantity which indicates that the quantity of seed planted can be reduced by at least 150kg without affecting yield.

Studies carried out in other parts of the world have shown an increase in the yield when there are more than 150 plants/m2. However, with a seed quantity of 250 kg/ha, the farmers obtain a density of approximately 500 plants/m2.

The price of certified seed in southern Brazil is too low (US$ 150/mt) and this possibly explains its low quality. Red rice is a severe problem in southern Brazil and the quality of rice seed must be improved to reduce the incidence of this weed.

Expenditures for urea are not excessive in any country in this study. As a consequence, the research on the use of Azolla in the biological fixation of nitrogen is not practical or economical.

The big surprise in this study was the use of pesticides, especially insecticides (Table 5.3). It is not understood why so many farmers are applying insecticides nor what insects they are trying to eliminate. However, it is known that overuse of insecticides can break the biological balance resulting in greater use of insectides. It is essential to focus on this problem and to elicit the farmers' cooperation in the identification of these insects which are producing economic damage.

TABLE 5.2. Costs for seeds and urea and their relationship to the total cost of production in some countries in Latin America. Information supplied by the leaders of National Programs).

	Seed Costs				Urea costs			
Country	Price $/mt	Planting rate kg/ha	Total Cost $/ha	% Total Cost	Price $/mt	Effect rate kg/ha	Total cost $/ha	% Cost
Brazil								
Rio Grande	159	190	30.21	3.3	200	33	6.60	0.7
Santa Catarina	133	150	19.95	3.5	300	50	15.00	2.6
Chile	373	160	59.68	10.2	277	260	72.0	12.3
Colombia 83	612	180	110.16	9.8	364	200	72.80	6.5
84	688	250	172.00	15.1	259	200	51.80	4.6
84	667	250	166.75	11.6	271	400	108.40	7.5
Ecuador 84/85	778	90	70.00	9.8	70	300	81.00	11.3
Honduras	690	80	55.20	8.4	330	90	29.7	4.5
Mexico	389	150	58.35	8.6	98	370	36.26	5.4
Panama 83	605	125	75.63	8.1	383	137	52.47	5.6
Paraguay	303	97	29.39	4.2	301	200	60.20	8.6
Dominican Rep.	400	100	40.00	5.0	286	73	20.88	2.6
Uruguay	269	200	53.80	7.1	314	80	25.12	3.3
Venezuela	316	120	37.92	8.7	82	100	8.20	1.9
AVERAGE	446	151	67.98	8.1	269	173	44.73	5.6

TABLE 5.3. Expenditures incurred in the protection of irrigated rice in several countries in Latin America and the Caribbean, 1983/84 or 1984/85 harvest. (Information supplied by the leaders of National Programs). Data on irrigated rice in California is presented for comparison.

		COST OF CROP PROTECTION												
		Weed Control			Insect Control			Disease Control			Total Cost			
Country	Year	Applic. No.	US$ $/ha	US$ $/tm	Applic. No.	US$ $/ha	US$ $/tm	Applic. No.	US$ $/ha	US$ $/tm	US$ $/ha	US$ $/tm	% Total Cost	
Argentina	84/85	1	37.50	10.71	1	10.00	2.86	0	0	0	47.50	13.57	6.9	
Brazil	84/85	1	29.68	6.97	1	2.00	0.50	2	20.38	4.74	52.06	12.10	5.6	
Rio Grande	84/85	1	29.68	6.97	1	21.66	4.74	0	0	0	76.66	17.00	19.7	
Santa Catarina	83/84	1	55.00	12.22	1	21.66	4.74	0	0	0	76.66	17.00	13.5	
Chile	84/85	1	115.16	17.72	0	0	0	0	0	0	115.16	17.72	19.7	
Colombia														
Meta	83	2	95.00	18.27	2	67.22	12.93	2	56.68	10.90	218.90	42.10	19.4	
Meta	84	2	76.19	12.90	2	62.27	10.55	2	67.86	11.50	206.32	35.00	18.1	
Tolima	84	2	112.90	17.92	6	113.00	17.94	3	64.50	10.20	290.40	46.02	20.1	
Ecuador														
Transplant	83/83	2	79.25	22.64	1	56.00	0	0	0	135.35	38.67	38.67	18.1	
Direct Seed	84/85	1	33.00	8.25	2	56.50	14.13	0	0	0	89.50	22.38	12.5	
Guyana	83/84	1	18.64	5.65	1	11.48	3.48	0	0	0	30.12	9.13	11.6	
Honduras	83/84	2	53.60	8.94	1	23.50	3.92	0	0	0	77.10	12.85	11.7	

Continues...

Table 5.3 (Cont.)

		COST OF CROP PROTECTION											
		Weed Control			Insect Control			Disease Control			Total Cost		
Country	Year	Applic. No.	US$ $/ha	US$ $/tm	Applic. No.	US$ $/ha	US$ $/tm	Applic. No.	US$ $/ha	US$ $/tm	US$ $/ha	US$ $/tm	% Total Cost
Mexico	84	1	60.48	13.44	1	21.00	4.68	0	0	0	81.48	18.11	12.1
Panama	83	2	72.50	13.18	2	51.00	9.27	2	51.67	9.39	175.17	31.85	18.1
	84	2	57.82	15.62	1	25.50	6.90	1	25.50	6.90	108.82	29.41	13.1
Paraguay	83/84	1	13.13	2.63	1	12.42	2.48	0	0	0	25.55	5.11	5.4
Peru	83/84	1	19.43	2.73	1	16.20	2.28	0	0	0	35.63	5.00	4.9
Dominican Rep.	83/84	2	62.24	10.92	3	55.88	9.80	1	20.85	3.66	138.97	24.38	17.4
Uruguay	83/84	2	42.78	9.51	0	0	0	0	0	0	42.78	9.51	5.6
Venezuela	83/84	2	44.00	11.00	2	71.14	17.79	2	36.33	9.08	151.50	37.86	34.6
AVERAGE		1.6	56.75	11.12	1.5	35.62	7.09	0.8	18.09	3.20	110.47	23.68	14.1
USA (California)	83/84	2	88.88	12.70	2	29.75	4.25	0	0	0	118.63	16.95	7.1

The use of insecticides in Colombia is on the order of US$ 250/ha representing almost 20% of the production cost. Presently, the CIAT Rice Program in close collaboration with the Federacion Nacional de Arroceros and ICA are focusing on this problem.

5.2.1.4. Financing and Interest

In Latin America, there are two production systems: small farms which predominate in Peru, the Dominican Republic and Santa Catarina, Brazil and others; and big farms which are most common in Colombia and Rio Grande do Sul, Brazil. On small farms, the capital involved in machinery is minimal and their yields are generally high. Consequently, the production in this system is highly profitable. On the other hand, on the large farms the cost of interest represents a high percentage of the total production cost due to the great quantity of capital costs for machinery. It is estimated that in this type of production the interest on equipment is 1 mt/ha. With this type of problem the only solution is to try to minimize the other expenditures and maximize yields.

6. COLLABORATION REQUESTED BY THE NATIONAL PROGRAMS FROM THE INTERNATIONAL CENTERS CIAT/IRRI

6.1 Roundtable Discussions

6.1.1. Southern Cone

President: M.A. de Oliveira
Moderator: N. Chebataroff
Participating
Programs: Argentina
Brazil (southern)
Chile
Paraguay
Uruguay

The participants in the roundtable discussion identified the general and specific problems which limit production in the countries in the southern cone.

Weeds (gramineas and broad-leafed weeds) and red rice, blast and low temperatures are the principle problems throughout the zone. Among the specific problems mentioned were: iron toxicity in Rio Grande do Sul and Santa Catarina, Brazil; straight head and iron toxicity in Corrientes, Argentina; sheath blight, stem rot in Uruguay and Rio Grande do Sul; and cercosporiosis, helminthosporiosis and grain discoloration in Paraguay.

6.1.1.1. Collaboration Requested

- Improved germplasm with large grains and good milling quality (translucent rice with a high percentage of whole grains) and with good cooking qualities (intermediate amylose content), tolerant to low temperatures, iron toxicity, straight head and blast.

- Segregating materials, principally in the F2, and materials from anther cultivation.

- Assistance in crop management , especially in the control of weeds and red rice.

- Assessment by CIAT scientists through annual visits to identify problems and receive assistance in the evaluation and selection of germplasm during the flowering and harvest periods.

- Training of personnel in short courses at CIAT in the different program disciplines, production and seeds; in in-country short courses in the southern cone and training at the post-graduate level (MS).

- Provision of laboratory equipment

6.1.2. Tropical South America

President: F. Zimmerman
Moderator: D.Leal
Participating
Programs: Bolivia
Brazil
Colombia
Ecuador
Peru
Venezuela

In this roundtable discussion the delegates from Bolivia and Peru did not participate. The participants from the other countries (Brazil, Colombia, Ecuador and Venezuela) identified the following problems:

- Existence of few varieties with high yields, which have a similar genetic base.

- Weeds and red rice

- Diseases: principally blast, leaf scald, hoja blanca, grain discoloration, and eye spot.

- Insects: principally stemborers, beetles, and water beetles

- Crop management, fertilization and weed control

- Lack of certified seeds

- Soils, iron toxicity on irrigated acid soils; zinc deficiency in irrigated alkaline soils; salinity (Ecuador and the coast of Peru)

6.1.2.1. Collaboration Requested

- Improved germplasm, large grains and good milling and cooking qualities, resistant to leaf scald, blast, hoja blanca (Colombia, Ecuador, Peru and Venezuela), iron toxicity, salinity (Ecuador and the coast of Peru), flooding and susceptibility to shelling, and a long crop cycle (Brazil-Amazonia).

- Assistance in crop management, principally on fertilization efficiency, herbicides and control of red rice.

- Parents resistant to leaf scald and a methodology for the evaluation of materials for this disease.

- Determine the levels of economic damage of insects, principally beetles, stemborers and sogata

- Distribution of publications, principally on studies of red rice and grain quality

- Training of personnel in short courses in entomological problems and hoja blanca in CIAT, short courses on seeds and, training at the postgraduate level (MS).

- Economic support so that the leaders of national programs can visit CIAT to update their skills.

6.1.3. Central America and Mexico

President: E. Espinosa
Moderator: J.L. Armenta
Participating Programs: Costa Rica
El Salvador
Guatemala
Honduras
Mexico
Nicaruagua
Panama

In this roundtable discussion Honduras did not participate. The participants from the other countries identified the following limitations on rice production in Central America and Mexico.

- Drought due to erratic rainfall

- Weeds due to lack of research on their control in the upland ecosystem

- Diseases, principally blast, leaf scald, helminthosporiosis and grain discoloration

- Insects, principally beetles, borers and stemborers

- Soils: phosphorus deficiency in acid soils (Atlantic coast of Guatemala; Tabasco, Mexico; David, Panama; Guanacaste, Costa Rica

- Flooded soils in Tabasco, Mexico

- Lack of machinery adequate for small farmers

6.1.3.1. Collaboration Requested

- Improved germplasm with long grains and good milling and cooking quality, with combined tolerance to fungal diseases and drought

- Segregating germplasm with intermediate- long crop cycle principally for Guatemala and El Salvador

- That the IRTP nurseries from IRRI be evaluated in Panama where the favored upland ecosystem is most representative of the region

- Training of personnel in short courses in CIAT and IRRI on seed technology, tissue culture, land preparation for irrigated rice, evaluation and utilization (GEU) and transference of technology for extensionists.

- For training at the postgraduate level (MS) we request that IRRI do this in Latin America through agreements between IRRI and certain universities in the region

- Assistance in crop management, principally in the control of weeds and efficient upland fertilization

- Carry out production studies of upland conditions to reduce costs

- Maintain support of the IDIAP-CIAT cooperative research project

- Scientists in the CIAT Rice Program should carry out visits to the national programs in the region

- Distribute to Mexico the hybrid rice and rice for flooded conditions from IRRI

- Assist in the implementation of appropriate machinery for small farmers in what relates to land preparation, planting, application of inputs, harvesting and threshing

6.1.4. The Caribbean
President: F. Cuevas
Moderator: V. Castillo
Participating
Programs: Beliz

Cuba
Guyana
Haiti
Jamaica
Dominican Republic
Surinam
Trinidad and Tobago

In this roundtable discussion, Cuba, Jamaica and Haiti did not participate. The delegates from the other countries felt that rice production in the Caribbean has the following problems:

- High costs of production and marketing

- Lack of small machinery for the different crop chores

- Weeds and red rice

- Lack of water and infrastructure, principally for soil levelling

- Lack of certified seed, what exists is a mixture of varieties

- Problems with rats and birds

6.1.4.1. Collaboration Requested

- Improved germplasm with a short- intermediate or long crop cycle, long grains with good milling and cooking qualities, tolerant to salinity and adverse soils, and which responds to low inputs

- Visits by CIAT scientists to national programs to evaluate research projects

- Establishment of the IRTP network in the Caribbean with its headquarters in the Dominican Republic

- Support for the implementation of small equipment in land preparation, planting and the application of inputs.

- Training of personnel in short production courses for seeds and entomology

- Adequate technology for the production of upland rice

- In agronomy, fertilization studies, principally on the utilization efficiency of nitrogen and Azolla, weed control and post-harvest studies

7. REORGANIZAATION OF THE IRTP IN LATIN AMERICA AND THE CARIBBEAN

The reorganization of the IRTP in Latin America and the Caribbean was discussed on the basis of a document elaborated by the Scientific Representative of IRRI for Latin America and the leader of the CIAT Rice Program. In this document changes were suggested with respect to germplasm evaluation, the formation of an observation nursery with specific materials for the different ecosystems, specific nurseries which the national programs require, to be distributed directly from IRRI, and changes in the present system of conferences and workshops.

This document was distributed to the heads of the national programs for their study and suggestions or modifications to be discussed during the individual group meetings. Four work groups were formed as follows:

1. Southern cone, represented by the heads of programs in Brazil (Rio Grande do Sul and Santa Catarina), Uruguay, Argentina Corrientes), Paraguay and Chile.

2. Tropical South America, represented by the heads of the programs of Brazil (tropical), Colombia, Ecuador and Venezuela. Peru and Bolivia did not participate.

3. Central America and Mexico, represented by the heads of the programs of Mexico (irrigated and upland), Guatemala, El Salvador, Nicaragua, Costa Rica and Panama. Honduras did not participate.

4. The Caribbean represented by the heads of the programs from Beliz, Guyana, Surinam, the Dominican Republic, and Trinidad and Tobago. Haiti, Jamaica and Cuba did not participate.

7.1. DISCUSSION AND CONCLUSIONS

The workgroups which met individually, discussed the proposed changes and presented their modifications and suggestions in the plenary session for discussion and final approval.

The principle modifications proposed by the four work groups and accepted in the plenary session were as follows:

7.1.1. Germplasm Evaluation

The four groups considered that the evaluation of germplasm in the IRTP nurseries coming from IRRI in Meta where there is strong disease pressure would lead to the elimination of interesting materials for other ecosystems with less disease pressure. As a result, it was suggested that evaluation sites be included in Panama, Peru, the Dominican Republic and some site in the Southern Cone. This suggestion was widely discussed and it was agreed that Panama would be another site for germplasm evaluation. With respect to the Dominican Republic, the participants were informed that the IRTP network for the Caribbean considers this country as an evaluation and selection site of materials for cooperators in the Caribbean region.

With respect to Peru and another site in the Southern Cone, the budget limitations do not allow for more evaluation sites. However, an attempt will be made to procure funds so that in the future the germplasm evaluation can be broadened to include these sites.

7.1.2. Nurseries

- Form one observation nursery (VIOAL) with specific sets for different ecosystems. The cooperators would only receive the set or sets for their specific ecosystems.

- Discontinue dispatch from CIAT of the following nurseies for salinity (VIOSAL), low temperature (VITBAL) and flooding (VIRAL-F). The programs that require these nurseries will solicit them from IRRI through the IRTP-CIAT.

- The national programs can request any nursery or other materials from IRRI through IRTP-CIAT.

7.1.3. Conferences

- A central conference in CIAT every three years with the participation of the heads of the national programs.

- Regional conferences in alternate years:

  a. PCCMCA every two years for Central American and Mexican programs.

  b. Irrigated rice meeting in Brazil every two years for the programs in the Southern Cone.

  c. Caribbean, every two years in one of the Caribbean countries for the programs in the region.

7.1.4 Selection Meetings

These selection meetings substitute the observation trips and would be carried out:

a. In Panama every two years for researchers from countries in the area and Mexico.

b. In Colombia (Villavicencio) every two years for researchers in countries not included in the regional meetings: Bolivia, Colombia, Ecuador, Peru and Venezuela.

c. Dominican Republic, every two years for researchers in the Caribbean countries.

7.1.5. Advisory Committee

The creation of aan advisory committee of the IRTP for Latin America and the Caribbean was approved, to analyze, approve, and recommend the research policies and needs of the network.

In Table 7.1. the changes approved for the IRTP network for Latin America and the Caribbean are summarized.

The Advisory Committee for IRTP for Latin America and the Caribbean which was approved unanimuously was composed of 10 members (Table 7.2).

TABLE 7.1. Summary of the changes approved for the reorganization of the IRTP in Latin America and the Caribbean, during the VI International Rice Conference, carried out in CIAT, Augost 4-9, 1985.

Activity	Changes approved
Germplasm Evaluation	
a. IRTP-IRRI nurseries	a. Evaluate in three sites: - Meta: Irrigated, acid soils; favored upland; upland- acid soils savanna - Panama: In the IDIAP-CIAT project ecosystems - Dominican Republic: In the IRTP network site for the Caribbean
b. Nominations by National Programs	b. Multiply seed in CIAT-Palmira and include all the nominations in the VIOAL
Seed Multiplication	
a. Germoplasm selected in evaluation sites	a. Multiply seed in CIAT-Palmira. Final selection of germplasm for distribution in Latin America.
Nurseries	
a. Observaction	a. Only one observation nursery VIOAL, with specific sets for each ecosystem.
b. Specific VIOSAL VITBAL VIRAL-F	b. Discontinue dispatch from CIAT and the National Programs solicit them from IRRI through IRTP-CIAT

Continues...

Table 7.1 (Cont.)

Activity	Changes approved
c. Nurseries from IRRI and other materials	c. National Programs may solicit any nursery and other materias from IRRI through the IRTP-CIAT.
<u>Seed Dispatch</u>	
Observation Nursery Specific sets	60g distributed in six packets (10g/packet), numbered. To be planted i the same conditions as observation plots.
<u>Data Recording</u>	
According to the scales in Standard Evaluation System Rice.	Cycle, reaction to stresses in their ecosystem and yield of materials which the cooperators selecteo.
<u>Data Dispatch</u>	
Nursery field book	Two months after harvest.

Continues...

Table 7.1 (Cont.)

Activity	Changes approved
Nursery Reports	
Results of the evaluations	Two final reports: a. For the northern hemisphere and Ecuador, two months after receipt of data. b. Southern hemisphere, two months after receipt of data.
Conferences	
a. Central	a. A central conference at CIAT every three years with the participation of the heads of the National Programs.
b. Regional	b. Every two years: - Central America to strengthen the meeting of the PCCMCA with participation of researchers from Mexico and countries in the area. - Brazil (Southern) to collaborate with the Irrigated Rice Conference with participation of researchers from Argentina, Chile, Paraguay and Uruguay. - Caribbean, with the participation of the Caribbean countries.

Continues...

Table 7.1 (Cont.)

Activity	Changes approved
Selection Meetings	
Replace the monitoring tours	a. In Panama, every two years for researchers from Central America and Mexico b. In Colombia (Villavicencio), every two year for countries not included in regional meetings: Bolivia, Colombia, Ecuador, Peru and Venezuela. c. In the Dominican Republic, every two years for researchers in the Caribbean countries.
Advisory Committee	
IRTP-Latin America and the Caribbean	Integrated by representatives of Mexico, Central America, Andean region (Colombia and Peru), the Caribbean, southern cone (Brazil), South America (central) (Brazil-EMBRAPA), IRRI and CIAT.

TABLE 7.2. Advisory Committee for the IRTP in Latin America and the Caribbean

Region or Institution	Country	Name	Position
Andean	Colombia	Dario Leal	Coordinator National Rice Program-ICA
	Peru	Jose Hernandez	Coordinator Programa Nacional-INIPA
Caribbean	Surinam	Mahomed J. Idoe	Breeder SML
Central America	Panama	Ezequiel Espinosa	Director General IDIAP
Northern Cone	Mexico	Jorge Luis Armenta	Coordinator National Program-Irrigated CIAPAN-INIA
Southern Cone	Brazil	Marco A.de Oliveira	Research Director-IRGA
South America (Center)	Brazil	Francisco Zimmerman	National Rice Program Coordinator EMBRAPA
CIAT	Rice Program Leader		
IRRI	Global Coordinator for IRTP		
Secretary			
	IRRI/CIAT - IRTP Coordinator		
President			
	M.J. Rosero - IRRI Liaision Scientist for Latin America		

8. PARTICIPANTS' TRIP TO VILLAVICENCIO

After the closing session of the Sixth International Rice Conference for Latin America and the Caribbean, the participants travelled to Villavicencio, Meta.

This trip was programmed to demonstrate to the participants the activities of the CIAT Rice Program in the Santa Rosa Experimental Station in the favored upland ecosystem, in the ICA-La Libertad station in the irrigated-acid soils, and upland-acid soils (savanna) ecosystems, and to visit the processing plant for certified seed- "Semillano".

8.1 THE SANTA ROSA EXPERIMENTAL STATION

The technicians from the CIAT Rice Program demonstrated in the field the materials under evaluation, composed of segregating populations F2-F4, advanced materials F5-F7, observation plots and the germplasm from the IRTP nurseries introduced from IRRI. The participants observed the severe incidence of blast, leaf scald and grain discoloration in the materials which facilitated the selection of tolerant materials.

8.2. ICA-LA LIBERTAD-IRRIGATED

Field methodology was observed for the evaluation of resistance to iron toxicity of the materials in F4 and the advanced materials from the program and introduced germplasm.

Among the materials under evaluation in the plantlet stage (50 days after planting), the participants observed contrasting varietal differences in resistance, tolerance and susceptibility on a 0-9 scale. Resistant materials were classified 1-3 on the scale and were equal to the resistant checks- Damaris, CICA 8 and Oryzica 1; susceptible materials were classified on a scale of 6-9, equal to the susceptible check IR 4673; and the tolerant materials were classified at the intermediate level of 4-5.

8.3 ICA-LA LIBERTAD- UPLAND ACID SOILS (SAVANNA)

In this ecosystem observations were made on the research which is being carried out by the Instituto Colombiano Agropecuario in rice, sorghum, and maize. Promising materials with tolerance to acid soils of the savanna and with good potential were observed.

The participants observed the materials (F2 and introduced materials) that the CIAT Rice Program is evaluating in this ecosystem with the objective of selecting varieties tolerant to aluminum toxicity, fungal diseases and having good grain characteristics. Among the F2 and introduced populations several materials were detected with better development than the checks, indicating the possibility of future varieties for this ecosystem with good potential for the Eastern Plains of Colombia, Venezuela and northern Brazil.

In this ecosystem research was observed which is being developed by the Instituto Colombiano Agropecuario in rice, sorghum, and maize. Promising materials with tolerence to the acid soils of the savanna and with good potential were observed in these crops.

8.4 "SEMILLANO" SEED PLANT

In "Semillano" the participants in the VI International Rice Conference were hosted by:

8.4.1. Dr. Aristobulo Cortes Gomez, General Administrator, who gave the general presentation on the company's activities.

8.4.2. Dr. Nestor Ramos Gonzalez, Vice Director for Production, gave a lecture on rice production emphasizing the production stages,how to reduce costs and the present problems of the crop.

8.4.3. Dr. Francisco Bonilla Pretell, Plant Superintendant, demonstrated to the participants the different stages of seed processing in the new plant.

Semillano offered a reception and dinner in the installations. the Empresa Semillas del Llano Ltda. "Semillano" was created in Dicember 1974 in Villavicencio, Meta, Colombia, with the objective of producing certified seed for rice, grasses and legumes.

In its first operational year (1975) Semillano produced 100 tons of certified rice seed of the CICA 6 variety and 120 kg of seed of the grass *Brachiaria*

At present Semillano is the most important producer of certified rice seed on the Eastern Plains and of pastures and forages in the country. Semillano produces certified rice seed of the following varieties Oryzica 1, Oryzica 2, Metica 1 and CICA 8 and seeds selected from the following grasses- *Brachiaria decumbens* , *Andropogon gayanus* (Carimagua 1), Guinea or India (*Panicum maximum* , Jacq), Angleton (*Dichanthium aristatum*) Gordura (*Melinis minutiflora* , Beauv.), Puntero (*Hypharrhenia rufa*) and the tropical legumes Kudzu and Estilosantes capica (*Stylosanthes capitata*). The seeds which the company produces are distinguished by the seal "CON ALTO VR" indicating that the seeds are of high quality so that farmers and ranchers can recognize their seed quality, purity and good germination. In addition to seed production, Semillano's specialists also provide services in research, technical assistance, publicity and promotion, and efficient marketing and rice production for consumption.

The modern processing plant in Villavicencio was inaugurated in 1983 and has drying facilities, equipment for seed classification and treatment.

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TABLE 9.2 Distribution by ecosystems of the area, production and yield of rice in Latin America and the Caribbean, 1983/1984 harvest.

Ecosystem	Area (000 ha)	%	Production (000 ha)	%	Yield (t/ha)
Irrigated	2387.2	31.9	10063.9	60.7	4.2
Favored Upland	409.1	5.5	987.2	6.0	2.4
Moderately Favored Upland	329.4	4.4	819.7	4.9	2.5
Non-favored Upland	4146.0	55.3	4345.9	26.2	1.0
Manual or Traditional	156.3	2.1	195.5	1.2	1.3
Low-lying flooded zones	63.0	0.8	157.4	1.0	2.5
Total	7491.0	100.0	16569.6	100.0	2.2

TABLE 9.3. Rice varieties cultivated in Latin America and the Caribbean, 1983/84 harvest.

			Ecosystem/Area and Percentage											
			I		UF		UMF		UNF		M/T		L-LZ	
Country	Variety	Type of Variety a/	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%
Argentina	Bluebonnet 50	TI	100.0	30.0										
	Bluebelle	TI		30.0										
	Fortuna	T		20.0										
	IR841-63-5-18	D		10.0										
	BR-IRGA 409	D		5.0										
	Others	TI, T		5.0										
Belize	CICA8	D	1.1	60.0			2.2	60.0						
	Bluebonnet 50	TI						20.0						
	CR1113	D						20.0						
	CICA4	D		10.0										
	Bluebelle	TI		20.0										
	Texas	TI		10.0										
Bolivia	Bluebelle	TI	0.5				34.7	10.0			23.5			
	Dourado	T										50.0		
	Pico Negro	T										50.0		
	CICA 8	D		40.0				10.0						
	Bluebonnet	TI						10.0						
	IR 1529	D		20.0				60.0						

Continues...

Table 9.3 (Cont.)

Country	Variety	Type of Variety a/	I (000 ha)	I %	UF (000 ha)	UF %	UMF (000 ha)	UMF %	UNF (000 ha)	UNF %	M/T (000 ha)	M/T %	L-LZ (000 ha)	L-LZ %
Bolivia	IR Dominicana	D		20.0										
	CICA 9	D		20.0				10.0						
Brazil	BR-IRGA 409	D	960.0		230.0				«100.0		10.0		30.0	
	BR-IRGA 410	D												
	IR 841	D												
	IRGA 408	D												
	Bluebelle	TI												
	EMPASC 101	D												
	EMPASC 102	D												
	EMPASC 103	D												
	IAC 47, 165, 25, 164	TI												
	Others	D, TI and T												
Chile	Oro	TI	39.9	45.0										
	Diamante	TI		30.0										
	Quella	TI		25.0										
Colombia	Oryzica 1	D	319.2	55.0	50.7	60.0					60.0			
	IR 22	D		15.0		5.0								
	CICA 8	D		11.0		15.0								
	CICA 9	D		8.0										

Continues..

Table 9.3 (Cont.)

Country	Variety	Type of Variety [a/]	Ecosystem/Area and Percentage											
			I		UF		UMF		UNF		M/T		L-LZ	
			(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%
Colombia	CICA 4	D		7.0		10.0								
	METICA 1	D		4.0		10.0								
	Traditional varieties (Monolaya, Miramono, Ligerito, Pablo Montes)	T										100.0		
Costa Rica	CR1113	D	3.5	90.0	37.4	60.0	15.3	80.0	16.0	100.0	1.0	20.0		
	CR5272	D		8.0		25.0		10.0						
	CR201	D				15.0		10.0						
	CR1821	D		1.0										
	CR1707	D		1.0										
	Americans	TI										80.0		
Cuba	J-104	D	180.0											
	IR 880	D												
	Caribe 1	D												
	Naylamp	D												
	IR 1529	D												

Continues...

Table 9.3 (Cont.)

			Ecosystem/Area and Percentage											
			I		UF		UMF		UNF		M/T		L-LZ	
Country	Variety	Type of Variety a/	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%
Dominican Rep.	Juma 57	D	118.8		1.9									
	Juma 58	D												
	ISA-40 (CICA 8)	D												
	ISA-21 (CICA 9)	D												
	Tanioka	D												
	Mingolo	T		15.0		100.0								
	IR 6	D												
	Juma 51	D												
Ecuador	INIAP 415	D	63.0	70.0	6.5	60.0	41.5	40.0			1.0	60.0	24.0	10.0
	INIAP 7	D				15.0		10.0						
	INIAP 6	D		25.0				10.0						5.0
	Other improved			5.0		20.0								10.0
	Traditonal varieties	T				5.0		40.0				40.0		75.0
El Salvador	CENTA A-1	D	1.3	-			11.3	-						
	CENTA A-2	D		-				-						
	X-10	D		-				-						

Continues...

Table 9.3 (Cont.)

Country	Variety	Type of Variety a/	Ecosystem/Area and Percentage: I (000 ha)	I %	UF (000 ha)	UF %	UMF (000 ha)	UMF %	UNF (000 ha)	UNF %	M/T (000 ha)	M/T %	L-LZ (000 ha)	L-LZ %
Guatemala	ICTA-Virginia	D			16.0	30.0								
	Tikal 2	D				30.0								
	Starbonnet	TI				10.0								
	Lebonnet	TI				10.0								
	New Rex	TI				10.0								
	Others	T				10.0								
Guyana	Rustic	D	73.5	10.0			19.5	20.0						
	Diwani	D		10.0										
	Variedad N	D		10.0				10.0						
	IR 22	D		5.0										
	Starbonnet	TI		30.0				20.0						
	BG 79	T		10.0				10.0						
	Variedad T and S	D		20.0		40.0								
	Bluebelle	TI		5.0										
Haiti	Dawn	TI	47.9	40.0										
	MCI 3	D		10.0										
	Quisqueya	D		10.0										
	Starbonnet	TI		10.0										

Continues...

Table 9.3 (Cont.)

Country	Variety	Type of Variety [a/]	Ecosystem/Area and Percentage: I (000 ha)	I %	UF (000 ha)	UF %	UMF (000 ha)	UMF %	UNF (000 ha)	UNF %	M/T (000 ha)	M/T %	L-LZ (000 ha)	L-LZ %
Haiti	MCI 65	D		10.0										
	Ti Fidele	TI		20.0										
Honduras	CICA 8	D	6.0		15.0		5.0		2.0		3.1		3.0	
	CICA 6	D												
	CICA 4	D												
	CICA 9	D												
	Yojoa 44	D												
	Others	TI										100.0		
Jamaica	CICA 8	D	1.2	100.0									0.01	
	Red Rice	T												100.0
Mexico	Navolato A 71	D	67.8	69.5			83.3	23.8						
	CICA 4	D		8.7				10.8						
	Morelos A 70	TI		7.0										
	Bamoa A 75	D		6.0										
	Juchitan A 74	D		4.5										
	Culiacan A 82	D		1.5										
	Huastecas	D		0.8										
	Sinaloa A 68	D		2.0				4.0						

Continues...

Table 9.3 (Cont.)

Country	Variety	Type of Variety a/	Ecosystem/Area and Percentage											
			I		UF		UMF		UNF		M/T		L-LZ	
			(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%
Mexico	Campeche A 80	D						40.0						
	Cardenas A 80	D						20.0						
	CICA 8	D						0.3						
	Criollas	T						1.1						
Nicaragua	CICA 8	D	33.2	50.0	3.0	40.0	2.1	80.0	2.3	80.0	7.7	70.0		
	J-104	D		30.0		50.0		20.0		20.0		30.0		
	IR 100	D		20.0										
	Caribe 7	D				10.0								
Panama	CICA 8	D	6.2	15.0	24.8	27.0			13.0	62.0	50.0		4.0	80.0
	Toc. 5430	D		30.0		9.0				5.0				
	CR 5272	D		25.0		8.0				20.0				
	CR 1113	D		14.0		48.0				11.0				
	Oryzica 1	D		13.0		5.0								14.0
	Metica 1	D		2.0		2.0								
	Surinam 70 (Dloni)	D								1.0				
	Chino Petaca	T										100.0		
	Anayansi	D		1.0		1.0				1.0				6.0

Continues..

Table 9.3 (Cont.)

Country	Variety	Type of Variety [a/]	Ecosystem/Area and Percentage: I (000 ha)	I %	UF (000 ha)	UF %	UMF (000 ha)	UMF %	UNF (000 ha)	UNF %	M/T (000 ha)	M/T %	L-LZ (000 ha)	L-LZ %
Paraguay	CICA 8	D	15.8	36.0			12.0							
	CICA 6	D		15.0										
	CICA 9	D		6.0										
	Wilcke 2	D		14.0										
	Bluebelle	TI		5.0										
	Vista	T		10.0										
	Others	D, TI, T		14.0										
	Brasileras (IAC47, 25)	TI						100.0						
Peru	INTI	D	201.2		23.8		2.5		12.7					
	VI-Flor	D												
	MB2-24	TI						100.0						
	BG 90-2	D												
	CICA 8	D												
	Carolino	T								100.0				
Surinam	Eloni	D	31.0	60.0										
	Diwani	D		35.0										
	Camponi	D		5.0										

Continues...

Table 9.3 (Cont.)

Country	Variety	Type of Variety a/	Ecosystem/Area and Percentage											
			I		UF		UMF		UNF		M/T		L-LZ	
			(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%	(000 ha)	%
Trinidad & Tobago	Starbonnet	TI	0.1	100.0									2.0	2.0
	Sughandi	T												10.0
	D 110	TI												5.0
	DIMA	TI												5.0
	D 52-37	TI												10.0
	IR 5	D												20.0
	IR 22	D												28.0
	CICA 4	D												20.0
Uruguay	Bluebelle	TI	76.0	90.0										
	976	D		2.0										
	DDA 404	T		8.0										
Venezuela	Araure 1	D	40.0	87.5			100.0	80.0						
	CICA 4	D		12.5				20.0						

TABLE 9.4. Distribution by ecosystems of the rice varieties cultivated in Latin America and the Caribbean, 1983/84 harvest.

Ecosystem	Area (000 ha)	Percentage Distribution of varieties		
		Dwarfs	Tall improved	Traditionals
Irrigated	2387.2	71.6	21.9	6.5
Favored Upland	409.1	41.7	57.4	0.9
Moderately Favored Upland	329.4	86.3	7.8	5.9
Upland Non-Favored	4146.0	0.8	74.2	25.0
Manual or Traditional	156.3	5.4	2.0	92.6
Low-lying flooded areas	63.0	32.4	19.7	47.9

TABLE 9.5 Consumption, production state, and rice processing in Latin America and the Caribbean, 1983/84.

Country	Per cãpita Consumption	Production State	Processing [c]			
			Drying	Storage	Billing	Transport
Argentina	5.0	S	R	R	G	G
Belize [d]	23.0	D	B	B	B	B
Bolivia [d]	13.5		B	R	R	B
Brazil	50.0	SS	R	R	G	G
Chile	9.4	D	R	R	G	G
Colombia	45.0	SS	G	R	G	R
Costa Rica	52.0	SS	G	G	G	G
Cuba [d]	49.0	D	G	G	G	G
Dominican Rep.	53.0	SS	G	R	G	G
Ecuador	25.3	SS	G	G	G	G
El Salvador	5.6	SS	B	B	R	G
Guatemala	5.5	SS	R	G	G	G
Guyana	75.0	S	B	G	B	R
Haiti [d]	14.2	D	R	R	R	R
Honduras [d]	16.0	SS	R	R	R	R
Jamaica	25.0	D	R	R	G	G
Mexico	8.0	D	R	R	R	G
Nicaragua	32.3	SS	G	R	R	R
Panama	51.0	S	G	G	G	G
Paraguay	18.0	SS	B	R	G	G

Continues...

Table 9.5 (Cont.)

Country	Per cápita Consumption	Production State	Processing c/			
			Drying	Storage	Billing	Transport
Peru	28.0	S	R	R	R	R
Surinam	83.0	S	G	R	G	G
Trinidad and Tobago	36.0	D	B	B	B	G
Uruguay	10.0	S	G	G	G	G
Venezuela	24.0	SS	G	G	G	G

a. White rice, kg/person/year

b. SS = Self-sufficiente; D = Deficient; S = Super production

c. G = Good; R = Rormal; B = Bad

d. Data from harvest of 1981/1982.

TABLE 9.6 Future tendencies in the production of rice in Latin America and the Caribeean.

	Ecosystems/Tendencies [a]					
Country	Irrigated	Favored Upland	Moderately Favored Upland	Non-Favored Upland	Low Lying Zones	Manual/ Traditional
Argentina	A					
Belize	A					
Bolivia						
Brazil	A	A		R	A	R
Chile	A					
Colombia	M	M		A		M
Costa Rica	A	A	M	R		R
Cuba						
Dominican Rep.	A	R				
Ecuador	A	M	R		R	A
El Salvador	A		A			
Guatemala						
Guyana	A		R			
Haiti	A					
Honduras						
Jamaica	A					
Mexico	A		A		A	
Nicaragua	A	M	M	R		M
Panama	A	M		R	R	M
Paraguay	A		M			
Peru (Jungle)	A		A			
Peru (Coast)	R					
Surinam						
Trinidad & Tobago	A	A			M	
Uruguay	A					
Venezuela	M		R			

[a] A = Augment; M = Maintain; R = Reducing

TABLE 9.7. Predominant disease and pests in rice for the irrigated ecosystem in Latin America and the Caribbean during the 1983/1984 harvest.

	Diseases a/										Insects b/								Others c/		
Country	Bl	BS	LSc	GD	ShB	ShR	SR	HB	EE	NBLS	Sog	ChT	ChP	SB	RWM	Gor	Spo.	Othres	Ne	Bir	Ro.
Argentina	*2	3		2	3	3	1		1			2	1	3		1		1	2	2	3
Belize	2	1									2			3			1			1	2
Bolivia	2	2	1									3	3	1			2			1	
Brazil	2	1	1	1	1						3	1	2	2		1	2	2			2
Chile				2			3									3				3	
Colombia	2	2	1	2	2	2		2			2	2	2	2	2	3				3	2
Costa Rica	3	3	3	3	3	3	3	3			3	3	2	2	3	3				1	2
Cuba	2							2			2										
Dominican Rep.	3	3	3	3	3	3	3	3			3		2		2	2		3		3	2
Ecuador				3		2	2	1			2		2	1	3		2			3	2
El Salvador	2		1	1							2		1	2				2			2
Guyana	2	3				3					3		3		3						3
Haiti		1								2		1	1		2			2		1	2
Honduras	1		2									2	2				3			1	2
Jamaica		2											2	2				2			
Mexico	3	3	3										1	3						1	1
Nicaragua	3	3	2	2	3			3			3	2	2	2	3	2				3	1
Panama	2		3		2	2	2	3			2		2	3	1					2	2
Paraguay	3	2	2	2	2	2	3		3			2	3	2		3				3	
Peru	1	2		3				2		2	2				2						
Surinam	3	3	3		3	3	3	3			3		2		2						2
Trinidad & Tobago	3	3										3	3	3						3	
Uruguay	3				2	3	2													2	
Venezuela	1		2	2				3			3		1	2		1	1			2	1

a. Bl = Blast; BS = Helmintosporiosis; LSc = Leaf scald; GD = Grain discoloration; ShB = Sheath blight; ShR = Sheath rot; SR = Stem rot; HB = Hoja blanca; EE = Straighthead; NBLS = Cercosporiosis
b. Sog = Sogata; ChT = Stem chinch bug; ChP = Panicle chinch bug; SB = Stemborers; RWM = Hydrellia; Gor = Waterbug; Spo. = Spodoptera Sp.
c. Ne = Nematodes; Bir = Birds; Ro. = Rodents
* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.8. Predominant diseases and pests in rice for the favored upland ecosystem in Latin America and the Caribbean for the 1983/1984 harvest.

	Diseases a/										Insects b/								Othres c/		
Country	Bl	BS	LSc	GD	ShB	ShR	SR	HB	EE	NBLS	Sog	ChT	ChP	SB	RWM	Gor	Spo.	Othres	Ne	Bir	Ro.
Brazil	*2	2	2	1	3						3	1	2	2			1				
Colombia	2	2	1	2	2	2		2			2	2	2	2	3					3	2
Costa Rica	3	3	2	3	3	3	3	3			3	3	2	2	3	3				1	2
Ecuador	1	1	2	3		2		3			3		2	2			1			2	2
Guatemala	1	1	1	2	3	3	3					2	2	3			2				
Honduras	1		2							2		2	2				3			1	2
Nicaragua	2	2	2	2	3			3			3	2	2	2	3	3				3	1
Panama	2		3	3	2	2	2	3			2		2	3	1					2	1
Peru																					

a. Bl = Blast; BS = Helminthosporiosis; LSc = Leaf scald; GD = Grain discoloration; ShB = Sheath blight; ShR = Sheath rot; SR = Stem rot; HB = Hoja blanca; EE = Straighthead; NBLS = Cercosporiosis

b. Sog = Sogata; ChT = Stem chinch bug; ChP = Panicle chinch bug; SB = Stemborers; RWM = Hydrellia; Gor = Waterbug; Spo. = Spodoptera Sp.

c. Ne = Nematodes; Bir = Birds; Ro. = Roedents

* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.9. Predominant diseases and pests in rice for the moderately favored upland ecosystem in Latin America and the Caribbean during the 1983/1984 harvest.

	Diseases a/										Insects b/								Othres c/		
Country	Bl	BS	LSc	GD	ShB	ShR	SR	HB	EE	NBLS	Sog	ChT	ChP	SB	RWM	Gor	Spo.	Othres	Ne	Bir	Ro.
Belize	*2	1									2			3			1			1	2
Bolivia	2	2	1									3	3	1			2			1	
Brazil																					
Costa Rica	2	3	2	3	3	3	3	3			3	3	2	2	3	3				1	1
Ecuador	2	2		3		3		3			2		2	2			1			2	2
El Salvador	1	3	1	1							2		1	2				2			2
Guatemala	1	1	1	2	3	3	3					2	2	3			2				
Guyana	2	3				3					3		3		3						3
Honduras	1	2								2		2	2							1	2
Mexico	1	1	2	3	3								2	3						1	2
Nicaragua	2	2	2	2	3	3	3	3			3	2		2	3	3				3	1
Panama	2		3	3	2	2	2	3			2		2	3	1					2	1
Paraguay																					
Peru	1	2		3						1			2								
Venezuela	1	2	2	2				3			3		1				1				

a. Bl = Blast; BS = Helminthosporiosis; LSc = Leaf scald; GD = Grain discoloration; ShB = Sheath blight; ShR = Sheath rot; SR = Stem rot; HB = Hoja blanca; EE = Straighthead; NBLS = Cercosporiosis

b. Sog = Sogata; ChT = Stem chinch bug; ChP = Panicle chinch bug; SB = Stemborers; RWM = Hydrellia; Gor = Waterbug; Spo. = Spodoptera Sp.

c. Ne = Nematodes; Bir = Birds; Ro. = Roedents

* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.10. Predominant diseases and pests in rice for the non-favored upland ecosystem for Latin America and the Caribbean, during the 1983/1984 harvest.

	Diseases a/									Insects b/								Othres c/		
Country	Bl	BS	LSc	GD	ShB	ShR	SR	HB	NLBS	Sog	ChT	ChP	SB	RWM	Gor	Spo.	Othres	Ne	Bir	Ro.
Brazil	*1	3	3	2	3					3		2				1				
Costa Rica	1	2	2	2	3	3	3	3		3	3	2	2	3	3				1	1
Guatemala	1	1	1	2	3	3	3				2	2	3			2				
Honduras	1	2							2		2	2							1	2
Nicaragua	3	3	2	2	3			3		3	2	2	2	3	3				3	1
Panama	1	2	3	2				3		2		2	3						2	1
Peru	1	1		3					1						2					

a. Bl = Blast; BS = Helmintosporiosis; LSc = Leaf scald; GD = Grain discoloration; ShB = Sheath blight; ShR = Sheat rot; SR = Stem rot; HB = Hoja blanca; NBLS = Cercosporiosis

b. Sog = Sogata; ChT = Stem chinch bug; ChP = Panicle chinch bug; SB = Stemboreres; RWM = Hydrellia; Gor = Waterbug; Spo. = Spodóptera

c. Ne = Nematodes; Bir = Birds; Ro = Rodents

* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.11. Predominant diseases and insects in rice for the manual or traditional ecosystem in Latin America and the Caribbean during the 1983/84 harvest.

	Diseases a/									Insects b/						Othres c/		
Country	BL	BS	LSc	GD	ShB	ShR	SR	HB	NBLS	Sog	ChT	Chp	SB	RWM	Gor	Ne.	Bir	Ro.
Bolivia	*2	2	1								3	3	1				1	
Brazil	3	2	2	3	3					3		2						
Colombia	2	2	2	3	2	1		1		2	2	2	1	3			2	2
Costa Rica	1	2	2	1	3	3	3	3		2	3	2	2	3	3		1	1
Ecuador	1	1	2	1									2				1	2
Guatemala	1	2	3	3							2	2	3					
Honduras	1	2							2		2	2					1	2
Nicaragua	3		3	3	3			3		3	2	2	2	3	3		3	1
Panama	1	2	3	2				3		2		2	3				2	1

a. Bl = Blast; BS = Helmintosporiosis; LSc = Leaf scald; GD = Grain discoloration; ShB = Sheath blight; ShR = Sheath rot; SR = Stem rot; HB = Hoja blanca; NBLS = Cercosporiosis

b. Sog = Sogata; ChT = Stem chinch bug; ChP = Panicle chinch bug; SB = Stemborers; RWM = Hydrellia; Gor = Waterbug

c. Ne = Nematodes; Bir = Birds; Ro = Rodents

* 1 = Severe; 2 Moderate; 3 = Light

TABLE 9.12. Predominant diseases and pests in rice for the low-lying flooded zones in Latin America and the Caribbean, during the 1983/1984 harvest.

	Diseases [a]								Insects [b]							Othres [c]		
Country	Bl	BS	LSc	GD	ShB	ShR	SR	HB	Sog	ChT	ChP	SB	RWM	Gor	Spo	Ne.	Bir	Ro.
Brazil	*2	1	1	1	2				3	1	2				1			2
Ecuador											2	2			3		3	2
Jamaica																		
Panama	2		3					3	2		2	3					2	2
Trinidad and Tobago	3	3								3	3	3						

a. Bl = Blast; BS = Helmintosporiosis; LSc = Leaf scald; GD = Grain discoloration; ShB = Sheath blight; ShR = Sheath rot; SR = Stem rot; HB = Hoja blanca

b. Sog = Sogata; ChT = Stem chinch bug; ChP = Panicle chinch bug; SB = Stemborers; RWM = Hydrellia; Gor = Waterbug; Spo. = Spodoptera

c. Ne. = Nematodes; Bir = Birds; Ro. = Roedents

* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.13 Problems with weeds, climate, soils, water management and machinery which are predominant in rice in the irrigated ecosystems of Latin America and the Caribbean during the 1983/84 harvest.

	Weeds a/				Climate b/			Soils c/									Water management d/		Machinery e/	
Country	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	FeDef	PDef	MnDef	Org	IrP	Dre	Av	Ned
Argentina	*1	1	2	1	2	2	3	2	3	3	2	3	3	2	2	2	2	1	2	2
Belize	1		2	1							1									
Bolivia	1							3												
Brazil	1	1	2	1	1			3	1	1	1			2			3	1		
Chile	1	2	1		1												3		2	2
Colombia	1	2	3	2	3			2		3	2	3		3			2		2	
Costa Rica	1	3	3	3										3						
Cuba									1											
Dominican Rep.	2	2	2	2	3	2	3	2	2	3	3	3		3		3	3	2	2	2
Ecuador	1	2	2	1					3								2	2	2	1
El Salvador	2	2	2	1										3			1		2	
Guyana	2	2	3	2				3									3	3		
Haiti	2	2	2	1					1									1		
Honduras	1			2		1		3		3										
Jamaica	2	2	2	2												1	2	2		2
Mexico	1	2	2	1	3				2	2		3					3	3	3	
Nicaragua	1	1	1	1	3	3	3	3	3	3	3		3	3	3	2	2	2	2	2
Panama	1	1	2	2									2				2		1	1
Paraguay	1	1	2	2	3	2		2			3	3		1			2	2	2	2

Continúa...

Table 9.13 (Cont.)

Country	Weeds a/				Climate b/			Soils c/									Water management d/		Machinery e/	
	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	FeDef	PDef	MnDef	Org	IrP	Dre	Av	Ned
Peru	2	2			3	2			1									2		1
Surinam	1	2	2	1				2	2					2			2			
Trinidad y Tobago	3	3	3						3						3					
Uruguay	1	2	3		1									2					3	
Venezuela	1	2	1	2																

a. Gra = Gramineas; Cyp = Cyperaceas; HA = Broad-leafed; RR = Red rice.

b. ColT = Low temperatures; Drt = Drought; DeepW = Deep waters.

c. AC = Acidity; Sal = Salinity; Alk = Alkalinity; FeTox = Fe toxicity; AlTox = Al toxicity; FeDef = Fe deficiency PDef = P deficiency; MnDef = Mn deficiency; Org = Organic.

d. IrP = Irrigation problesm; Dre = Drainage problems

e. Av = Avilability; Ned = Needs

* 1 = Severe; 2 = Moderate; 3 = Light.

TABLE 9.14. Predominant problems with weeds, climate, soils, water management and machinery in rice cultivation for the upland favored ecosystem of rice in Latin America during the harvest of 1983/1984.

	Weeds a/				Climate b/			Soils c/										Water management d/		Machinery	
Country	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	CuTox	FeDef	PDef	MnDef	Org	IrP	Dra	Av.	Ned
Brazil	*2		1					1				1			1				2		
Colombia	1	2	3	2	3	2		3			3	2			2				2	2	
Costa Rica	1	3	3	3		3					2		1	1	3						
Dominican Rep.	1			2																	
Ecuador	1	3	1	2															3		3
Guatemala	1	1	2	3		1		2				2	2		1						
Honduras	1			2		1	2	3		3											
Nicaragua	2	1	1	1	3	3	3	3	3	3	3			3	3	3	2	2	2	2	2
Panama	1	2	2	2		2	3	3						2					2	1	1
Peru																					

a. Gra = Gramineas; Cyp = Cyperaceas; HA = Broad-leafed; RR = Red rice

b. ColT = Low temperatures; Drt = Drought; DeppW = Deep waters

c. AC = Acidity; Sal = Salinity; Alk = Alkalinity; FeTox = Fe toxicity; AlTox = Al toxicity; CuTox = Cu toxicity
FeDef = Fe deficiency; PDef = P deficiency; MnDef = Mn deficiency; Org = Organic

d. IrP = Irrigation problems; Dra = Drainage problems

e. Av = Availability; Ned = Needs

* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.15. Predominant problems with weeds, climate, soils, water management and machinery in rice in the moderately favored upland ecosystem in Latin America and the Caribbean during the 1983/1984 harvest.

	Weeds a/				Climate b/			Soils c/										Water management d/		Machinery e/	
Country	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	CuTox	FeDef	PDef	MnDef	Org	IrP	Dra	Av.	Ned
Belize	*1		2								1										
Bolivia	1							3													
Costa Rica	1	2	3	3		2					2				3						
Ecuador	1	1	1	1		2													1	2	2
El Salvador	2	3	2			1									3					2	
Guatemala	1	1	2	3		1		2				2	2		1						
Guyana	1	3	2	2		2		3	3									1			
Honduras	1			2		1	2	3	3												
Mexico	1	1	1	3		2		2		2	2	1									1
Nicaragua	2	1	1	1	3	2	3	3	3	3	2	2		2	2	2	2			2	2
Panama	1	2	2	2		2	3	3						2					2	1	1
Paraguay																					
Peru	2		2					2			2										1
Venezuela	1	2	1	2		1															

a. Gra = Gramineas; Cyp = Cyperaceas; HA = Broad-leafed; RR = Red rice

b. ColT = Low temperatures; Drt = Drought; DeepW = Deep waters

c. AC = Acidity; Sal = Salinity; Alk = Alkalinity; FeTox = Fe toxicity; AlTox = Al toxicity; CuTox = Cu toxicity FeDef = Fe deficiency; PDef = P deficiency; MnDef = Mn deficiency; Org = Organic

d. IrP = Irrigation problems; Dra = Drainage problems

e. Av. = Availability; Ned = Needs

* 1 = Severe; 2 = Moderate; 3 = Light

TABLE 9.16. Predominant problems of weeds, climate, soils, water management and machinery in rice in the non-favored upland ecosystem in Latin America and the Caribbean, during the 1983/1984 harvest.

	Weeds a/				Climate b/			Soils c/										Water management d/		Machinery e/	
Country	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	CuTox	FeDef	PDef	MnDef	Org	IrP	Dra	Av.	Ned
Brazil	*2		1			1		1				1			1						
Costa Rica	1	1	2	3		1									3	2					
Guatemala	1	1	2	3		1		2				2	2		1						
Honduras	1			2		1	2	3		3											
Nicaragua	2	1	1	1	3	1	3	3	3	2	2	2		2	2	2	2				
Panama	1	2	2	2		1		1				1		1						1	1
Peru	1		1			2		1				1									

a. Gra = Gramineas; Cyp = Cyperaceas; HA = Broad-leafed; RR = Red rice

b. ColT = Low temperatures; Drt = Drought; DeepW = Deep waters

c. AC = Acidity; Sal = Salinity; Alk = Alkalinity; FeTox = Fe toxicity; AlTox = Al toxicity; CuTox = Cu toxicity FeDef = Fe deficiency; PDef = P deficiency; MnDef = Mn deficiency; Org = Organic

d. IrP = Irrigation problems; Dra = Drainage problems

e. Av. = Availability; Ned = Needs

* 1 = Severe; 2 = Moderate; 3 = Light

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TABLE 9.17. Predominant problems of weeds, climate, soils, water management and machinery in rice in the traditional or manual ecosystems in Latin America and the Caribbean, during the 1983/1984 harvest.

	Weeds a/				Climate b/			Soils c/									Water management d/		Machinery e/	
Country	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	FeDef	PDef	MnDef	Org	IrP	Dra	Av.	Ned
Bolivia	*1							3												
Brazil	2		1			1		2						2						
Colombia	1	2	2	-3	3	1		2			3	2		2						1
Costa Rica	2	1	1	3		1								3						
Ecuador	2	3	1					1												
Guatemala	1	1	2	3		1		2				2		1						
Honduras	1			2		1	2	3	3											
Nicaragua	2	3	1	2	3	3	3	2	2	2	2	2	2	2	2	3		1		
Panama	1		2			1		1				1	1							

a. Gra = Gramineas; Cyp = Cyperaceas; HA = Broad-leafed; RR = Red rice.

b. ColT = Low temperatures; Drt = Drought; DeepW = Deep waters.

c. AC = Acidity; Sal = Salinity; Alk = Alkalinity; FeTox = Fe toxicity; AlTox = Al toxicity; FeDef = Fe deficiency PDef = P deficiency; MnDef = Mn deficiency; Org = Organic.

d. IrP = Irrigation problesm; Dra = Drainage problems

e. Av. = Avilability; Ned = Needs

* 1 = Severe; 2 = Moderate; 3 = Light.

TABLE 9.18. Predominant problems of climate, soils, water management and machinery in rice for the low-lying flooded zones of Latin America and the Caribbean during the 1983/1984 harvest.

	Weeds a/				Climate b/			Soils c/									Water management d/		Machinery e	
Country	Gra	Cyp	HA	RR	ColT	Drt	DeepW	AC	Sal	Alk	FeTox	AlTox	FeDef	PDef	MnDef	Org	IrP	Dra	Av.	Ned
Brazil	*1	1	1	3			3	3						2			2	2		
Ecuador						3	1		3											
Jamaica									1											
Panama	1		2	2		3	2											1	1	1
Trinidad & Tobago	3	3	3			3	2		3								2	2		

a. Gra = Gramineas; Cyp = Cyperaceas; HA = Broad-leafed; RR = Red rice.

b. ColT = Low temperatures; Drt = Drought; DeepW = Deep waters.

c. AC = Acidity; Sal = Salinity; Alk = Alkalinity; FeTox = Fe toxicity; AlTox = Al toxicity; FeDef = Fe deficiency PDef = P deficiency; MnDef = Mn deficiency; Org = Organic.

d. IrP = Irrigation problesm; Dra = Drainage problems

e. Av. = Avilability; Ned = Needs

* 1 = Severe; 2 = Moderate; 3 = Light.

CUADRO 9.19. Summary of the costs of production of rice in Latin America and the Caribaben in the irrigated and favored upland ecosystems.

Country	Harvest	Irrigated US$/ha	Irrigated US$/ton	Upland US$/ha	Upland US$/ton	Rate of exchange
Argentina	1984/85	691.0	198.0			
Belize	1982			646.6		
Bolivia	1983/84			119.9	34.2	
Brazil						
Santa Catarina	1983/84	567.0	126.0			6000.0
Rio Grande do Sul	1984/85	925.0	215.0			4000.0
Rio de Janeiro	1983/84			280.8	195.0	
Chile	1984/85	586.0	90.0			144.60
Colombia	1984	1296.5	204.5	801.0	191.0	94.70
Costa Rica	1984			938.6		50.25
Dominican Rep.	1983/84	800.0	140.0			3.15
Ecuador	1983/84	747.0 [a]	214.0 [a]	522.5	174.2	120.0
	1984/85	715.0	179.0			100.0
Guyana	1983/84	259.0	79.0			4.30
Honduras	1983/84	657.0	110.0			2.00
Mexico	1984	676.0	150.0	334.8	130.8	192.56
Panama	1983	932.0	169.0	790.0	176.0	1.00
	1984			829.0	223.0	1.00
Paraguay	1983/84	469.0	94.0			320.00
Peru	1983/84	702.0 [a]	99.0 [a]			3466.90
Surinam	1983/84	384.2	91.5			1.80
Uruguay	1983/84	759.0	169.0			54.0
Venezuela	1983/84	438.0	110.0			7.90

a. Irrigated-transplanted

TABLE 9.20 Training needs for short courses for personnel in the National Programs of Latin America and the Caribbean.

Country	Agron.	Phytopath.	Entom.	Breeding	Total
Argentina					
Belize	2				2
Bolivia				1	1
Brazil	1	1			2
Chile					
Colombia	3	2	2	3	10
Costa Rica	1	1		1	3
Cuba					
Dominican Rep.	1		1		2
Ecuador	1				1
El Salvador	1				1
Guatemala	1				1
Guyana	1				1
Haiti	1				1
Honduras	1				1
Jamaica	4				4
Mexico	4	1		3	8
Nicaragua	2		1		3
Panama		1			1
Paraguay	1	1		2	4
Peru	1		1	1	3
Surinam	1			1	2
Trinidad y Tobago	1	1		1	3
Uruguay	1			1	2
Venezuela					
T O T A L	29	8	5	14	56

TABLE 9.21. Post-graduate training needs for personnel of the National Rice Programs in Latin America and the Caribbean.

Country	M.Sc.					Ph.D				
	Agron.	Phytopat.	Entom.	Breeding	Total	Agron.	Phytopat.	Entom.	Breeding	Total
Argentina	1				1					
Brazil	2				2					
Chile	1				1				1	1
Colombia	3	2	2	3	10		1			1
Dominican Rep.				1	1					
Ecuador	1			1	2					
Guatemala				1	1					
Mexico	5	2		4	11	3			6	9
Nicaragua		1		1	2					
Panama	2			1	3					
Paraguay	1				1					
Peru		1		1	2					
Uruguay				1	1					
Venezuela				1	1					
T O T A L	16	6	2	15	39	3	1		7	11

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