SHORT-TERM PRODUCTION ORIENTED RICE RESEARCH PROGRAMME THIRD QUARTERLY REPORT

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by

VIVIAN CHIN
RICE PRODUCTION SPECIALIST
IICA/JAMAICA

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1. INTRODUCTION

This report is prepared in accordance with Article 6, Section 6.01 of the Agreement between the Black River Upper Morass Development Company Limited (BRUMDEC) and the Inter-American Institute for Cooperation on Agriculture (IICA).

The period covered by this report is October 27, 1981 to January 26, 1982.

2. ACTIVITIES AND OBSERVATIONS

During the period under this report the following activities were carried out in the programme:-

October 27		Sampling of plants for analysis from experiment R1/1/81.
October 28	(a)	Top-dressing experiment R1/1/81 with nitrogen and potassium fertilizers.
	(b)	Addressing the BRUMDEC Board of Directors on alternative systems of field layout based on spot level data for the mineral soil area (Fields 1 - 9) supplied by Hue Lyew Chin Associates.
October 30-31		Removal of roots from samples prior to dispatching for analysis.
November 2	(a)	Levelling and removal of trash from Morass Peat Site of experiment R5/1/81.
	(b)	R1/1/81 and R2/1/81 checked for water, weeds and pests.
	(c)	Weeding of seed purification plot.
November 3-5	(a)	Levelling and removal of trash from Morass Peat Site of experiment R5/1/81 continued.
	(b)	Weeding of seed purification plot continued.
November 5		Attended BRUMDEC's Management Meeting at Administrative Manager's request and was infromed that

the decision has been made for BRUMDEC to go ahead producing as quickly as possible:-

250 acres of rice on the mineral soil area (Fields 1 - 9) as best as possible with present equipment available;

50 acres of rice on Morass Peat.

November 6 — Sampling of plants of experiment R2/1/81 for analysis.

November 9
(a) Fertilizing and experiment R5/1/81 on Morass Peat. Heavy rainfall from approximately 2.00 p.m. stopped all field operations for the remainder of the day.
(b) Soil samples taken for analysis from experiment R2/1/81.

November 10
(a) Completed fertilizing and sowing experiment R5/1/81 second replicate.
(b) Fertilizer top-dressing applied to experiment R2/1/81.

November 11
(a) Fertilized seed purification plot.
(b) Level constructed around experiment R5/1/81 on Morass Peat.
(c) R1/1/81 weeded and irrigated.

November 12 — R2/1/81 weeded and irrigated.

November 16 — Experiment R5/1/81 seriously short of irrigation water. No pump available yet.

Some plots trampled by cows during weekend period November 14-15. Nursery sown on peat also grazed.

November 17
(a) Additional plots trampled by cows on night of November 16.
(b) R2/1/81 weeded.
(c) Seeds for resowing damaged of R5/1/81 soaked.

November 18-19
(a) R2/1/81 weeding continued.

(b) Weeding of purification plot.

(c) Fencing of R5/1/81 started today.

November 20 (a) Re-sowing of damaged and unestablished plots of R5/1/81.

(b) 50% heading of R1/1/81.

November 23 No water available for R5/1/81.

November 26 (a) Second re-sowing of unestablished plots of R5/1/81. No water for irrigation available up to date.

(b) R2/1/81 weeding and irrigation.

Plant samples taken from R2/1/81 for analysis.

December 1 (a) Removal of volunteer rice plants in R2/1/81 in progress.

(b) Still no pump available to irrigate R5/1/81.

(c) Final top-dressing of nitrogen applied to R2/1/81.

Mr. Andrew Nam - Research Assistant, resigned as from today.

December 2 Orientation of Mr. Rogers.

December 3 (a) Attended meeting with Mr. Logan, Managing Director and Mr. Robert Stephens. Decision taken to use approximately two (2) tons of CICA 8 seed from Japan Jamaica Government's Project on the Peat area and to use CICA 9 seed on the Clay area. Source of CICA 9 seed to be the ADC.

(b) Irrigation pump not yet available for water supply to experiment R5/1/81 on the Peat.

December 7 Cattle damage to experiments R1/1/81 and R2/1/81 on night of December 7.

December 8 Cattle damade to experiment R1/1/81 during the previous weekend.

December 9 (a) Cattle damage to experiments R1/1/81 and R2/1/81 on night of December 8.

(b) Attended Meeting between IICA and BRUMDEC.

December 14	Some plots in experiments R1/1/81 and R2/1/81 began lodging, plot numbers noted along with % lodging.
December 21	Experiment R1/1/81 reaped today.
January 3, 1982	R5/1/81 irrigated today.
January 6	Single plant selections taken from seed purification plot today by self and Research Assistants Rogers and Bowen.
January 7	F/Seed of three rice varieties from Guyana received today.
January 11	Seed purification plot reaped today for bulked seed for multiplication.
January 18	R5/1/81 sprayed with 2,4-D for weed control. Plants in most plots show symptoms of blast disease. No fungicide spraying planned. CICA 8 is resistant to blast disease.
January 21	R2/1/81 reaped today.
January 26	R5/1/81 irrigated today.

3. PROGRESS REPORT ON EXPERIMENTS

Up to the end of the period under report only fertilizer experiments have been sown. The first fertilizer experiment with CICA 8 was sown on the Morass Peat Area during this period. The objective of the experiments is to identify quickly the fertilizer factors which individually or in combination enhance the growth and grain production of the rice plant, and to develop response curves which can be used as guides in the planning of future experiments and in the planning of fertilizers of production fields of the rice crop grown in the project area.

3.1 Experiment R1/1/81

This experiment was sown on August 25, 1981 and reaped 118 days after on December 21, 1982. This experiment was designed to test the response of CICA 8 to three (3) levels each of nitrogen, phosphate and potash, and four (4) levels of micronutrient mixture.

This 3x3x3x4 factorial study was laid out in the field as a randomized complete block design with two (2) replications. The levels N, P_2O_5, K_2O, and micronutrient mixture of Fe, Mn, and Zn tested have been detailed in Table 2 of the Second Quarterly Report.

RESULTS

Table 1. Analysis of Variance of Grain/Straw Ratio

Source of Variance	df	ss		
Replications	1	3.739335	3.739335	19.7**
Treatments	107	25.682281	0.240021	
Error	106	20.150465	0.221329 (corrected) 0.190099	1.16ns
Total	214	49.572081		

This experiment suffered grazing damage in several plots, the undamaged areas of those plots were inadequate to provide estimates of grain yield, but could be used to provide estimates of grain/straw ratio.

One missing plot for grain/straw ratio occurred in the experiment. An estimate of the missing plot data was calculated using the method of Yates given in Cochran and Cox (1957) and the treatment mean square was appropriately corrected.

No significant difference between the effects of treatments on grain/straw ratio were observed. Mean grain/straw ratio observed in the study was 1.25; plants were cut approximately 25 cm (10 inches) above ground level. Lodging scores recorded at 111 days after sowing. When lodging first occurred, it ranged from less than 5% to 100%, and occurred only in replicate I. Of the 10 plots which showed 100% lodging, three of those plots had not received any nitrogen fertilization. Of the 54 plots which ranged from just less than 5% lodging,19 plots had received no nitrogen, 18 plots had received 56 kg N/ha. (50 lbs. N/acre), and 17 plots had received 112 kg N/ha (100 lbs. N/acre). There appeared to be no relationship in this case between the amount of nitrogen fertilizer applied and the amount of lodging observed. Of the 45 plots in the lowest portion of Replicate I where flooding depths were greatest, lodging occurred in 34 of those plots. On this site no symptoms of deficiency of iron, zinc or manganese were seen in plots which were untreated.

Experiment R2/1/81

This experiment was sown on September 4, 1981, and harvested on January 21, 1982. Harvesting was delayed by approximately three weeks due to the unavailability of the plot thresher which was being used at that time for the threshing of sorghum. In this experiment lodging occurred in 44 of the 54 plots and ranged from less than 5% to approximately 90%.

This experiment tested the grain yield response of rice to three levels of each of the nutrients - nitrogen, phosphate and potash. The experiment was a 3x3x3 factorial with partial confounding of the NPK interaction laid out in incomplete blocks of 9 plots each, and with two replications.

The levels of nitrogen, phosphate and potash used in this experiment are given in Table 2.

Table 2. Levels of N, P_2O_5, and K_2O used in fertilizer study on Cashew Clay. Rates per acre in parentheses.

Level	Amount of fertilizer nutrient kg/ha (lb./ac.)		
	N	P_2O_5	K_2O
0	0 (0)	0 (0)	0 (0)
1	56 (50)	28 (25)	30 (26.8)
2	112 (100)	56 (50)	60 (53.6)

The timings of N, P_2O_5, and K_2O fertilization are given in Table 3.

Table 3. Timings of N, P_2O_5, and K_2O fertilization used in fertilizer study on Cashew Clay.

Fertilizer	Timing
N	- One-third at 21 days after sowing. - One-third at 67 days after sowing, approximately 3 - 4 days after panicle initiation. - One-third at 88 days after sowing, at heading.
P_2O_5	- One-half just before sowing. - One-half at 67 days after sowing.
K_2O	- One-half at 21 days after sowing. - One-half at 67 days after sowing

RESULTS

The average response to nitrogen, phosphate and potash are shown in Figures 1, 2 and 3 respectively.

Only two significant effects were identified. These were:-

(a) the quadratic effect of potash (K'') with a value of 1.33 $\pm$ 0.44 tonnes/hectare (0.59 $\pm$ 0.20 short tons/acre) indicating that the average grain yield response to the single level (30 kg.K_2O/ha.) or 26.8 lb K_2O/acre) is much less than the response to no potash or to the double level (60 kg. K_2O/ha. or 53.6 lb. K_2O/acre). The average effect of the double level, 60 kg. K_2O/hectare, was less than that of no potash being applied.

(b) the linear x linear, nitrogen x phosphate interaction (N'P') with a value of - 0.74 $\pm$ 0.31 tonnes/hectare (- 0.33 $\pm$ 0.14 short tons/acre).
A negative N'P' interaction occurs when the algebraic sum of the yields from plots treated with the combined double levels of nitrogen and phosphate is less than the sum of the yields from plots which received only double level of nitrogen or double level of phosphate, over all potash levels. This indicates that it would not be beneficial to use 112 kg. P_2O_5 per hectare (100 lb. N and 50 lb. P_2O_5 per acre) for fertilizing the rice crop on Cashew Clay, with or without potash, compared to either 112 kg N per hectare or 56 kg P_2O_5 per hectare singly.

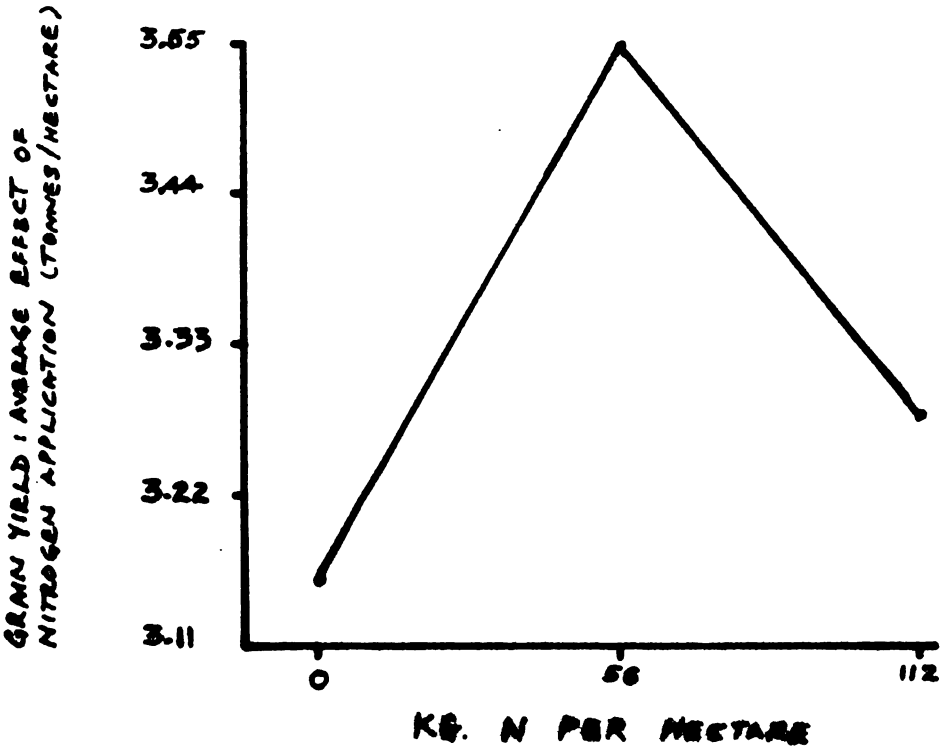

FIGURE 1. AVERAGE EFFECT OF NITROGEN APPLICATION ON RICE GROWN ON CASHEW CLAY: TONNES DRIED PADDY PER HECTARE AT 0, 56, AND 112 KG. NITROGEN PER HECTARE.

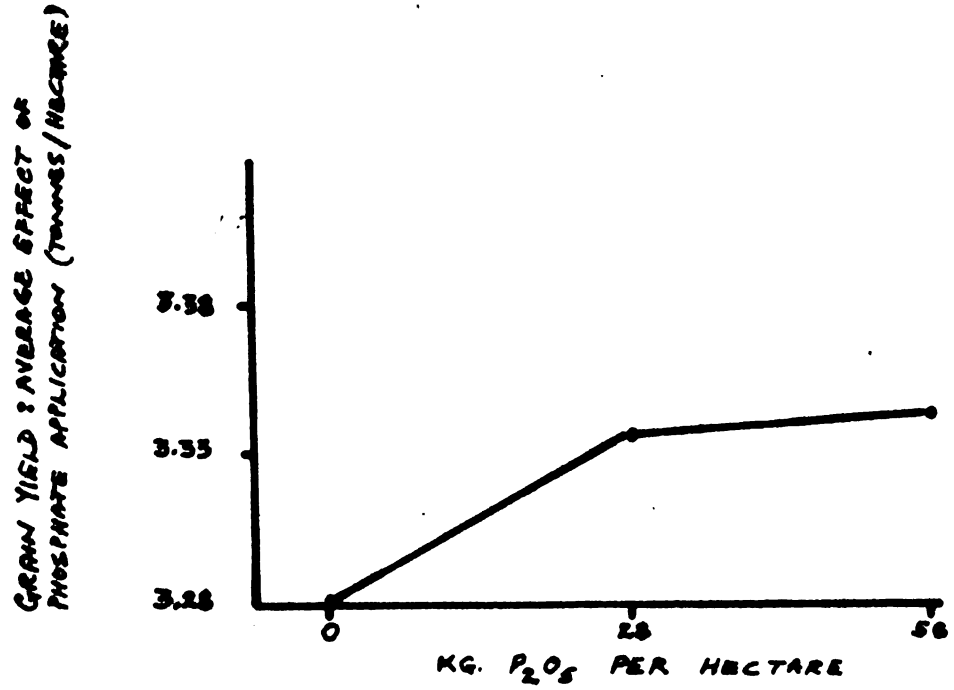

FIGURE 2. AVERAGE EFFECT OF PHOSPHATE APPLICATION ON RICE GROWN ON CASHEW CLAY: TONNES DRIED PADDY PER HECTARE AT 0, 28, AND 56 KG. PHOSPHATE PER HECTARE.

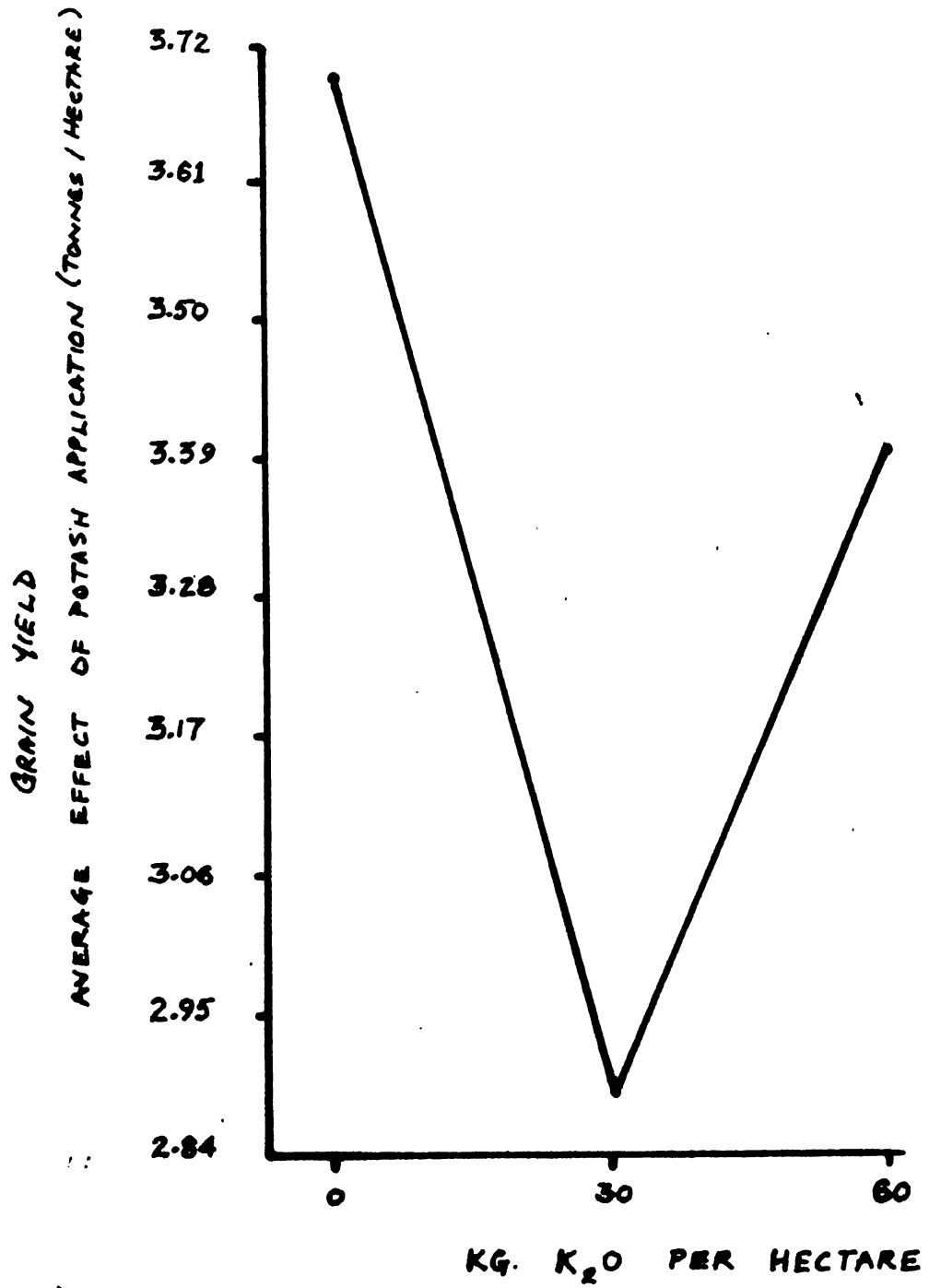

FIGURE 3. AVERAGE EFFECT OF POTASH APPLICATION ON RICE GROWN ON CASHEW CLAY: TONNES DRIED PADDY PER HECTARE AT 0, 30, AND 60 KG. K_2O PER HECTARE.

The table of mean yield is presented in Table 4. The first 8 treatments listed are not significantly different in their effect on grain yield of the variety CICA 8. The statistical grouping were determined by using Duncan's Multiple Range Test.

Table 4. Mean grain yield of CICA 8 at different levels of N, P_2O_5, and K_2O.

LEVEL OF			GRAIN YIELD		STATISTICAL
N	P	K	Tonnes/Ha.	Short tons/Ac.	GROUPINGS
2	1	0	5.41	2.41	a
1	2	0	4.91	2.19	ab
0	2	0	4.12	1.84	abc
1	0	2	4.02	1.79	abc
2	0	0	3.98	1.78	abc
1	1	0	3.80	1.70	abc
0	1	2	3.73	1.66	abc
2	0	2	3.66	1.63	abc
0	2	2	3.51	1.57	bc
1	1	1	3.49	1.56	bc
1	1	1	3.48	1.55	bc
2	1	2	3.33	1.49	bc
1	0	0	3.29	1.47	bc
1	2	1	3.25	1.45	bc
0	0	1	3.12	1.39	bc
0	0	0	3.01	1.34	c
1	1	1	2.99	1.33	c
0	2	1	2.98	1.33	c
2	0	1	2.95	1.32	c
2	2	1	2.85	1.27	c
1	0	1	2.78	1.24	c
0	0	2	2.74	1.22	c
0	1	1	2.70	1.20	c
2	2	2	2.62	1.17	c
2	2	0	2.43	1.08	c
2	1	1	2.32	1.03	c
0	1	0	2.31	1.03	c

Standard error of a treatment mean = 0.54 tonnes/hectare
(0.24 short tons/acre)

The mean yield of the best eight treatments which were not significantly different from each other was 4.20 tonnes per hectare or 1.87 short tonnes per acre. These eight treatments are to be compared with each other in a separate study.

The fertilizer levels represented by these eight treatments range in cost, including application cost, from J72.97 per hectare (J$29.53 per acre) to J$186.29 per hectare (J$75.39 per acre).

The grain production from the two treatments:

(i) 112 kg N/hectare (100 lb N/acre)
28 kg P_2O_5/hectare (25 lb P_2O_5/acre)

(ii) 56 kg N/hectare (50 lb N/acre)
56 kg P_2O_5/hectare (50 lb P_2O_5/acre)

were significantly different from that produced in the unfertilized plots. The value of the grain produced less the cost of the fertilizers and application costs were J$1143 and J$899 per hectare respectively (J$462 and J$365 per acre respectively). From these margins it will be necessary to deduct the additional costs of reaping, transporting 2.40 tonnes/hectare (1.07 short tons/acre) and 1.90 tonnes/hectare (0.85 short tons/acre) respectively, in order to obtain an indication of the benefits of fertilizing the rice crop using the rates stated at (i) and (ii) above. The subsequent testing of the eight best treatments will provide an indication of the degree of repeatability of the results.

The average responses to nitrogen, phosphate, and potash applications as illustrated in Figures 1,2 and 3 indicate that there is a tendency for grain yield to decrease at levels of nitrogen application greater than 56 kg nitrogen per hectare (50 lbs nitrogen per acre), and at potash application levels of 30 and 60 kg. K_2O per hectare (26.8 and 53.6 lbs K_2O per acre). However, the presence of the significant nitrogen x phosphate interaction is of over-riding importance since it implies that the response to nitrogen application varies at different levels of phosphate application and vice versa. Consequently, it has been necessary to examine specific combinations of the nutrients tested. This was done and the results were presented in Table 4.

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Experiment R5/1/81

In the exploratory rice fertilization study on the Morass Peat three levels each of nitrogen, phosphate, and potash and four levels of copper were combined in all possible combinations and tested in a simple randomized complete block experiment. The rice variety used was CICA 8.

The levels of these nutrients tested were:-

N: 0, 11.2, 22.4 kg/ha (0, 10, 20 lbs/acre)
P_2O_5 0, 28, 56 kg/ha (0, 25, 50 lbs/acre)
K_2O 0, 30, 60 kg/ha (0, 26.8, 53.6 lbs/acre)
Cu 0, 2.24, 4.48, 6.72 kg/ha (0, 2, 4, 6 lbs/acre)

In the fertilized plots, one-half of the potash and all of the phosphate were applied prior to sowing. The remainder of the potash and all of the nitrogen and copper were applied at the panicle initiation stage.

During the first 5-6 weeks after sowing the vegetative growth development of the plants appeared similarly vigorous in fertilized and unfertilized plots. At 6-7 weeks sowing leaf infection by the Blast disease organism, Pyricularia oryzae, commenced. It was decided by the Rice Production Specialist that the experiment should not be sprayed to control the incidence of this disease since the variety CICA 8 was known to be highly resistant to Blast disease in many countries and was being used as the resistant check variety in Blast disease nurseries in Guyana at a site where this disease occurs throughout the year.

By the end of the period under report the infection level had increased in all plots except in plots 9 and 18. These two plots were located at the south eastern corner of the experiment where the underlying clay came near to the surface and had become mixed with the peat during land preparation to produce in those two plots a peaty-clay soil.

This observation of Blast disease incidence in this experiment indicates that it will be necessary to identify a variety of rice that is better adapted than CICA 8 to cultivation on the Morass Peat. The level of infection observed indicates that several costly sprayings would be needed to keep this disease under control during a season when weather conditions are favourable for the development of the disease organism.

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