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APPLIED RESEARCH

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IRI RESEARCH INSTITUTE, INC.

CONSULTANTS TO GUYANA RICE BOARD

## APPLIED RESEARCH

### I. SUMMARY

#### A. HIGHLIGHT

Diwani may increase Guyanese farmers' income by 26.7 million dollars (US\$8.9M) and newly identified Diwani strain may further increase Guyana Rice Mills' income by 17.1 million dollars (US\$5.7M) annually!

Diwani, screened from more than 260 high yielding varieties, was found to be always the highest or occasionally second highest yielding at research plots in 7 tests over the past four consecutive crops (spring crop 1982 through autumn crop 1983). Its high yielding capacity, wide adaptation throughout Guyana and resistance against the major diseases have been confirmed also in the past two crops in regional tests under the commercial production scale. On the average, Diwani outyielded Rustic or other Guyanese varieties by 10 bags/acre in regional tests.

A decision was made by GRB to plant 1,000 acres of Diwani for seed production in this coming spring crop 1984. We expect that Diwani will occupy 50 to 60% of Guyana paddies a year from now, and this eventually will reach 80 to 90% a few years after. The increase in income for Guyana rice industry because of the yield increase may reach 26.7 million dollars (G\$). The major beneficiaries are farmers.

More important, we have made a breakthrough to improve the head rice milling yield of Diwani. We have identified two new strains of Diwani out of more than 1,000 lines examined. These two new strains have grain quality comparable to or

better than US long grain rices such as Starbonnet and Bluebelle. Their yielding capacity is as good as or even better than standard extra long Diwani. They are long grained and outyielded Diwani in head rice milling return by 10 to 20%. These new strains, because of high milling return, may further boost the income of Guyana rice industry by 17.1 million dollars annually. The major beneficiaries will be Guyana Rice Board and private mills. We expect that at least 3 more crops will be needed to develop the new strains for commercial production.

B. MAJOR ACTIVITIES

1. Carried out routine maintenance of the field trials laid out for autumn crop 1983 at 3 locations - Black Bush Polder, HARDS and Guyana School of Agriculture in Mon Repos. The last harvest will be completed by the middle of January next year.
2. Monitored and collected the results of regional tests on determination of Diwani's adaptation under a variety of conditions throughout Guyana.
3. Made a study on the anticipated nation wide yield increase and income increase of farmers in the next four years, because of new variety Diwani.
4. Made a breakthrough research to improve the head rice milling return of diwani --- identification of two new strains of Diwani which have milling return better than Starbonnet. These two new Diwani strains

also out yielded standard Diwani by 15% in paddy yield in a preliminary test.

5. Made a study on the anticipated income increase for Guyana Rice Industry because of substantially higher milling return of new Diwani strain.
6. Imported more than 300 promising high yielding rice selections collected from all over the world through CIAT, Columbia to keep up the varietal improvement research.
7. The specialist was on leave from the project between August 14 and September 24 to attend the annual meeting of American Society of Agronomy in Washington DC and for a home-leave.

## II. OUTSTANDING ACHIEVEMENTS

Several outstanding achievements were obtained in this report period. They are as follows:

- A. Confirmation of High Yield Capacity and Wide Adaptation of Diwani Throughout Guyana,
- B. Diwani May Boost Guyanese Farmers' Income by 26.7 Million Dollars,
- C. A Breakthrough in Improving Head Rice Milling Return of Diwani -- "Identification of New Strains of Diwani", and
- D. New Diwani Strain May Further Boost Guyana Rice Board and Private Mills' Income by 17.1 Million Dollars.

A. CONFIRMATION OF HIGH YIELD CAPACITY AND WIDE  
ADAPTATION OF DIWANI THROUGHOUT GUYANA

Diwani, screened from more than 260 high yielding rice varieties tested at Black Bush Polder, has been found to be the highest or occasionally second highest yielding in 7 variety yield tests over 2 years of 4 consecutive seasons (spring crop 1981 through autumn crop 1983). Table 1 gives the results of these seven tests. Because of its high yield capacity and high resistance to the major diseases, it was recommended to replace a Guyanese variety Rustic, also an extra long rice, in August 1982 (IRI Quarterly Progress Report No. 8, August 1982).

The test to determine Diwani performance under commercial production scale was first conducted at Black Bush Polder State Farm in autumn crop 1982. Table 2 gives the results. In this test Diwani (1.5 acre size) produced 6.30 t/ha (40 bag/acre) whereas the control varieties Rustic and Starbonnet, respectively, produced 4.25 t/ha (27 bag/acre) and 3.77 t/ha (24 bag/acre). Diwani outyielded the local varieties by 48 up to 67%.

In spring crop 1983, such commercial production test was expanded to East Denerara (Bel Field) and Essequibo State Farms. The plot sizes of Diwani were 5 acres up to 12 acres. Table 3 gives the results. Diwani produced 5.19 to 6.60 t/ha (33 to 42 bag/acre) depending on locations whereas Rustic produced 4.09 to 4.56 t/ha (26 to 29 bag/acre). Diwani outyielded Rustic by 27 up to 45%.

In autumn crop this year, the commercial production tests were greatly expanded to a number of locations throughout the whole of Guyana. The size of plots varied from 3.75 acre up to more than 100 acres, which, indeed, covered small farms and large farms commonly

Table 1.

Yields of Diwani Compared with Rustic, Starbonnet and Others in Seven Variety Yield Tests at Research Plots of Black Bush Polder and Mon Repos, Guyana, Spring Crop 1982 Through Autumn Crop 1983.

1982			1982			1982			1983			1983			1983			1983		
Spring Crop -(BBP)-			Autumn Crop -(BBP)-			Late Autumn Crop -(BBP)-			Spring Crop -(BBP)-			Late Spring Crop -(BBP)-			Autumn Crop -(BBP)-			Autumn Crop -(Mon Repos)-		
Yield			Yield			Yield			Yield			Yield			Yield			Yield		
Variety	t/ha	% <sup>a</sup>	Variety	t/ha	% <sup>a</sup>	Variety	t/ha	% <sup>a</sup>	Variety	t/ha	% <sup>a</sup>	Variety	t/ha	% <sup>a</sup>	Variety	t/ha	% <sup>a</sup>	Variety	t/ha	% <sup>a</sup>
Diwani	9.28	136.4	CICA 8	7.29		Diwani	7.01	106.5	Diwani	8.59	103.5	Diwani	7.38	107.7	Diwani	9.02	137.7	J367	4.91	
CICA 4	9.20		Diwani	7.24	106.0	J386	6.80		Rustic	8.30	100.0	Rustic	6.85	100.0	J358	8.70		Diwani	4.89	100.4
Eloni	8.63		CICA 4	7.16		J229	6.54		Champion	7.80		Viral-T#13 <sup>b</sup>	6.41		J229	8.45		Rustic	4.66	100.0
CICA 8	8.55		N	6.87		J229	6.54		CICA 8	7.67		Viral-T#20 <sup>b</sup>	6.00		IR22	7.31		J229	4.63	
CICA 6	8.44		Rustic	6.83	100.0	J229	6.54		N	7.64		Viral-T#30 <sup>b</sup>	5.74		J367	7.24		J369	4.53	
75490	8.34		75490	6.75		J229	6.54		IR22	7.56		" #9 <sup>b</sup>	5.59		J367	7.24		J358	4.37	
N	8.00		IR22	6.70		J229	6.54		Eloni	7.43		" #24 <sup>b</sup>	5.47		J383	7.07		IR22	4.27	
75406	8.00		Eloni	6.61		J229	6.54		CICA 9	6.93		" #3 <sup>b</sup>	5.37		J369	6.83		S/B	4.25	91.2
J266	7.82		CICA 6	6.61		J229	6.54		S/B	4.70	56.6	" #19 <sup>b</sup>	5.19		Rustic	6.55	100.0	CICA 9	4.11	
CICA 9	7.19		J266	6.59		J229	6.54		Bellem	3.89		" #8 <sup>b</sup>	5.15		CICA 9	6.45		J383	3.93	
GR277-2	7.00		CICA 9	6.27		J229	6.54					" #19 <sup>b</sup>	5.16		S/B	5.61		J383	3.21	
84426	6.87		75406	6.20		J229	6.54					" #8 <sup>b</sup>	5.15		S/B	5.15	78.6	J385	3.21	
Champion	6.84		Champion	6.05		J229	6.54					" #8 <sup>b</sup>	5.15		J385	4.20		J386	3.12	
Rustic	6.80	100.0	GR277-2	6.01		J229	6.54					S/B	4.80	70.0	J385	4.20				
S/B	6.72	98.8	S/B	4.85	71.0	J229	6.54													

a: The yield of Rustic is used as the base (100.0%) to indicate the relative yield % of Diwani and Starbonnet (S/B).

b: The medium maturation rice selections imported from CIAT, Colombia. Only eight out of 30 selections showing good head rice yields are listed here.

## 6.

Table 2.

Yields of Diwani and Control Varieties - Rustic and Starbonnet Under Commercial Scale Production, Autumn Crop 1982, Black Bush Polder.

<u>Variety</u>	Plot Size -Acres-	Yield (14% moisture)		
		-t/ha-	-Bag/acre-	-%
Diwani	1.5	6.3	40	140.1
Rustic	-	4.25	27	100.0
Starbonnet	-	3.77	24	88.9

Table 3.

Yields of Diwani and Control Varieties - Rustic, N and Starbonnet Under Commercial Scale Production in Three Regions, Spring Crop 1983.

<u>Region</u>	Plot Size of Diwani Ha (Acre)	<u>Varieties</u>							
		<u>Diwani</u>		<u>Rustic</u>		<u>N</u>		<u>Star- bonnet</u>	
		t/ha	Bag/ acre	t/ha	Bag/ acre	t/ha	Bag/ acre	t/ha	Bag/acr
Black Bush Polder	4.86(12)	5.97	38	4.40	28				
East Benerara	2.23(5.5)	5.66	36	4.09	26				
Essequibo Coast	3.24(8)	6.60	42	4.56	29	4.40	28	3.77	24
Average		6.11	38.9	4.35	27.7	4.40	28	3.77	24
%			140.4		100.0				88

\* The yield of control variety Rustic is used as the base (100.0%)

## 7.

seen in Guyana. In most cases, Rustic was used as the control variety, but in a few cases other varieties, Starbonnet, N, T or BG-79, were also used as the control. Diwani and the control variety were grown side by side or within a very short distance. The influence of variation in microclimatic and soils conditions was minimized.

The conditions under which Diwani was tested included:

1. fertile and very favourable microclimatic conditions for rice culture,
2. areas very conducive to the incidence of blast and/or brown leaf spots,
3. salty soil,
4. high land without adequate irrigation,
5. culture without fertilizer inputs,
6. water shortage, and
7. poor water management and weed control.

Indeed, should Diwani perform well under such a variety of conditions, it should be regarded a variety of wide adaptation in Guyana.

The results of the tests are given in Table 4. As can be seen from the results, Diwani produced 3.12 t/ha (19.8 bag/acre) up to 6.04 t/ha (38.4 bag/acre) whereas the control variety Rustic produced between 1.57 t/ha (10 bag/acre) and 4.84 t/ha (30.8 bag/acre). Thus, Diwani outyielded the local varieties by 11.3 up to more than 100%. On the average, Diwani outyielded Rustic by 48.5% or 1.56 t/ha (10 bag/acre) almost incredible!

Diwani outyielded Rustic more obviously at the locations where some adverse conditions exist such as conducive to disease incidence, water shortage or salty.

Table 4.

Yields of Diwani and Control Varieties - Rustic, N, Starbonnet, T  
and BG-79 Under Commercial Scale Production Throughout Guyana, Autumn  
Crop 1983

Locations	Conditions	Plot Size of Diwani Ha	Paddy Yield <sup>a</sup>					
			Diwani	Rustic	t/ha (Bag/acre)		S/B	BG-79
Essequibo State Farm	Blast & leaf brown spot often serious	27.92 (69)	4.43 (28.2)	2.35 (15)	1.89 (12)	T	2.31 (14.7)	
E/bo Private Farm	Water shortage in early stage, but no disease constraints	3.24 (8)	3.24 (20.6)	1.57 (10)				
E/bo Cooperative Farm	Water management and weed control less ideal	8.90 (22)	3.11 (19.8)				1.89 (12)	
West Demerara	Notorious for blast incidence	17.00 (42)	6.04 (38.4)		4.47 (28.4)			
East Demerara	Salty conditions	1.52 (3.75)	5.46 (34.7)	4.84 (30.3)		3.93 (25)		
East Demerara	Blast sometimes serious	14.57 (36)	5.46 (34.7)	3.55 (22.6)				
Cane Grove	Blast sometimes serious	4.05 (10)	5.03 (32)	3.77 (24)				
Frontland, B'ce	Highland, no fertilizer in- put and ideal irrigation not maintained	2.43 (6)	3.54 (22.5)					2.72 (17.3)
Black Bush Polder	Blast sometimes serious	4.43 (6)	4.52 (28.8)				3.14 (20)	
Average t/ha (Bag/acre)			4.78 <sup>c</sup> (30.41)	3.22 <sup>d</sup> (20.43)				
% <sup>b</sup>			148.5	100.0				

a: The yield data were supplied by the cooperating farmers in combine bag per acre, and one combine bag weighed between 150 and 180 pounds. However, in our calculation, all of the bags are assumed to weigh 140 pounds per bag, so that inflated data are avoided.

b: The yield of control variety, Rustic is used the base (100%).

c: Average yield calculated from the sum of total acreage.

d: Average yield calculated from the five figures listed in this table.

The yield difference becomes less significant where the conditions are more ideal. Under the ideal condition we assume the maximum yield capacity is expressed. This suggests that Rustic is more sensitive to the environmental conditions than Diwani and explains why Rustic is not stable.

At Essequibo State Farm where in autumn crop seasons rice often suffers from serious blast and brown leaf spot diseases damages, Diwani produced 4.43 t/ha (28.2 bag/acre) whereas Rustic produced 2.35 t/ha (15 bag/acre). The low yield of Rustic was caused by the serious damages of neck rot (blast) and brown leaf spots. Diwani in this crop also suffered from some fungus diseases (brown spots) on the leaves, however, the diseases became obvious after the grains were filled.

At a private farm close to the coast in Essequibo, Diwani produced 3.24 t/ha (20.6 bag/acre) whereas Rustic produced 1.57 t/ha (10 bag/acre). At this location diseases were not constraints, but the field had water shortage until 42 days after seeding. For this reason, both Diwani and Rustic were stunted at harvesting time. The big yield difference suggests that Rustic is more prone to water shortage than Diwani. This is supported by significantly deeper root development of diwani than Rustic, which was observed by the State Farm Manager, GRB, Essequibo.

At a co-operative farm in Essequibo, Diwani produced 436 bags of Diwani paddy on 22 acres of new field (19.8 bag/acre) whereas a nearby farm yielded 12 bag/acre of Starbonnet paddy. The cooperative farm was new to rice cultivation, and for this reason, their water management and weed control was not maintained at satisfactory conditions. Under such less than ideal management conditions Diwani out-yielded Starbonnet by more than 65% indicating the former can tolerate adverse management conditions more than the

latter. Berbice farmers claim that the same is true with IR22 over Starbonnet. They have learned of this from their experience over a number of years. Because of this, IR22 has over taken Starbonnet and become the most prevalent variety (75%) in Berbice. IR22 has never been released officially.

At a private farm in West Demerara, Diwani produced 6.0 t/ha (33.4 bag/acre) whereas N produced 4.47 t/ha (23.4 bag/acre). The area is notorious for blast disease incidence. Its geographic location is similar to Caledonia where GMB used to carry out the blast tests because of very heavy incidence of the diseases. The cooperating farmer claimed that if he had planted Rustic, he probably could not get more than 2.35 t/ha (15 bag/acre). His experience suggested that Rustic is more susceptible to the blast diseases than N. For this reason N was used. The N rice still suffered from obvious blast disease and received fungicide spray whereas Diwani did not.

At a location by the coast (Bel field) where the soils often become salty, Diwani produced 5.46 t/ha (34.7 bag/acre) whereas Rustic also produced fairly well 4.34 t/ha (30.3 bag/acre). Nevertheless, Diwani outyielded Rustic by 11.3%. At this location disease incidence was not observed. Under the conditions (at our research plot) in which disease incidence was not observed, Diwani out-yields Rustic by 4 up to 8%. Apparently, the salty soil has widen the yield difference by 3.3 up to 7.3%. This would suggest Rustic is more sensitive to salt or in other words, Diwani is more salt tolerant. The salt tolerant Guyanese variety T produced 3.93 t/ha (25 bag/acre) at this particular location.

At a location approximately 2 to 3 miles from the coast in East Demerara (Bel Field), Diwani produced 5.46 t/ha (34.7 bag/acre) whereas Rustic at the nearby location produced 3.55 t/ha (22.6 bag/acre). At this location incidence of blast diseases sometimes may occur in autumn crop seasons.

At a location approximately 5 to 6 miles from the coast in Cane Grove, Diwani produced 5.03 t/ha (32 bag/acre) whereas Rustic produced 5.03 t/ha (24 bag/acre). Because of blast disease incidence the cooperating farmer sprayed fungicide for Rustic and other local varieties (N and IR22) but not for Diwani. Diwani did not suffer from the blast disease attack. The cost of the fungicide spray was approximately \$10.00 per acre.

At a location in Frontland of Berbice where the field is situated in highland area, and for this reason proper irrigation was not maintained, Diwani produced 3.54 t/ha (22.5 bag/acre) without any fertilizer inputs. Under the same condition, BG-79 produced 2.72 t/ha (17.3 bag/acre). Many farmers plant BG-79 on the land of less ideal condition. They claim that this traditional variety does not need high inputs and can stand adverse conditions better than improved high yielding varieties. The results of this test may clarify the incorrect belief of many farmers, agronomists, and government officials, that all of high yielding varieties produced well only under the ideal conditions and high inputs.

Suriname and Guyana have very similar climate and soils. However, Suriname does not recommend TSP for their varieties including Diwani. Whereas most Guyanese farmers strongly insist that half bag per acre of TSP be needed, although GRB has recommended that TSP be applied every

other crop, most farmers do not seem to follow such recommendation. Their strong belief in TSP effect has probably come from their experience with Starbonnet. The fact that Suriname farmers outyielded Guyanese farmers by 40% (9 bag/acre) without TSP would suggest that Suriname's varieties (including Diwani) may exploit the native soil phosphorous more effectively than Guyanese varieties. Our fertilizer tests over the past two years in Black Bush Polder also demonstrate that the rice yield in most farms can be maintained without TSP. In view of these results, when Diwani is recommended for commercial production, we may reduce TSP by half from half bag per acre to a quarter bag per acre. This recommendation applies to most farms where TSP has been already applied each crop for a number of years. For some particular soils or area where TSP plays a critical role to maintain the yield, such a recommendation may not apply. Either extension workers or local farmers may locate such specific areas by their experience and/or soil tests. However, such areas occupy only a small fraction.

B. DIWANI MAY BOOST GUYANESE RICE FARMERS' INCOME BY

26.7 MILLION DOLLARS ANNUALLY

In a recent meeting of GRB on seed production for 1984 (1983-11-25), a decision was made to sow 1,000 acres at the three State Farms of GRB to produce the seed of Diwani in this coming spring crop 1984. The seed produced from this can be used to sow 20,000 to 30,000 acres of Diwani in autumn crop of 1984. In 1985 we expect that between 140,000 acres (two crops combined together) will be planted to Diwani as shown in Table 5. This projection is made based on the trend in which N and Rustic spread in the whole Guyana and IR22 in Berbice region. Table 5 also shows the projection up to 1987.

Table 5

Increase in Net Income due to Replacement of Guyanese Commercial Varieties  
with Diwani and New Diwani Strain

Crop Year	Acreage of Paddies in Whole Guyana <sup>f</sup>			Increase in Net Income due to Diwa- ni and New Diwani Strain <sup>a</sup> -M dollars (G\$)-	Increase in Net Income due to New Diwani Strain <sup>b</sup> -M dollars (G\$)-	Total Increase in Income Annually -M dollars (G\$)-
	Total <sup>d</sup>	Diwani <sup>c</sup>	New Diwani Strain <sup>e</sup>			
	-----Acres-----					
Spring 1984	113 000	3 000	-	0.36	-	-
Autumn 1984	133 000	31 500	4	3.62	-	-
Total 1984	246 000	34 500	4	4.18	-	4.18
Spring 1985	113 000	65 000	120	7.68	-	-
Autumn 1985	133 000	75 000	3 600	9.09	-	-
Total 1985	246 000	140 000	3 720	16.97	-	16.97
Spring 1986	113 000	30 000	70 000	12.13 <sup>c</sup>	5.99	-
Autumn 1986	133 000	10 000	90 000	12.13 <sup>c</sup>	7.70	-
Total 1986	246 000	40 000	160 000	24.26 <sup>c</sup>	13.69	37.95
Spring 1987	113 000	10 000	100 000	13.34 <sup>c</sup>	8.55	-
Autumn 1987	133 000	10 000	100 000	13.34 <sup>c</sup>	8.55	-
Total 1987	246 000	20 000	200 000	26.68 <sup>c</sup>	17.10	43.78

- a. Increase in net income due to Diwani over the previous year in which no Diwani was planted, assuming Diwani will outyield by 5 bag per acre. The major beneficiaries are farmers.
- b. Increase in net income due to New Diwani Strain because of higher milling return of this strain, assuming New Diwani Strain produces as well as Diwani. The major beneficiaries are GRB and private mills.
- c. The figure includes those due to Diwani and New Diwani Strain because of yield increase over Rustic. It is assumed that Diwani produces as well as New Diwani Strain.
- d. Based on the target acreage projected by Guyana Rice Board.
- e. Based on Jeff C. H. Wang (IRI Research Specialist's) estimation with which L.G. Small (Manager, Production, Research and Extension, GRB) has concurred.
- f. Based on Jeff C. H. Wang's estimation.

From the presentation in the previous section it is quite conservative to expect that a yield increase of 5 bags per acre can be obtained. As was mentioned earlier Surinam farmers outyielded Guyanese farmers by approximately 9 bag/acre of paddy. In the specialist's opinion, at least 4 to 5 bag/acre may be attributed to varietal difference while the balance is attributed to the difference in the culture practices and husbandry between the two neighbouring countries. Our test results indicate that a yield increase of 6.34 bag/acre in test plots and that of more than 10 bag/acre in regional tests were obtained. This would support that anticipation of an increase of 5 bag/acre is quite conservative.

Based on this assumption, it is estimated that the increase in net income be \$121.25 per acre. The calculation is based on that :

- (1) One bag paddy sells \$30,
- (2) The harvesting costs are \$8.00 per bag,
- (3) Half of the total savings due to reduction of TSP from half bag to a quarter bag per acre (\$12.50) and omitting of one fungicide spray (\$10) is accounted for the cost reduction.

Thus the calculation is as follows:

5 bag x \$30/bag	=	\$150 00
-5 bag x \$8/bag	=	\$ 40 00
<u>+½ (\$12 50 + \$10)</u>	=	<u>\$ 11 25</u>
Net increase	=	\$121 25/acre

In figuring out the cost reduction, half of the total savings (TSP and fungicide spray) is used because fungicide spray is not a very common practice for many small farmers and many farmers may not be willing to reduce the TSP to a quarter bag per acre initially.

Translating the above figure into the national scale we project that in the next two years we can boost the rice farmers' income by 21.158M dollars. Once Diwani starts to occupy approximately 57%, the increase in income will be 17M dollars (US\$5.67M) annually in 1985. This figure will reach \$26.7M (US\$8.9M) annually if 90% of Guyanese paddies are occupied by Diwani. Thus the total expenses of IRI operation (\$8.1M) over more than 3 years in the past can be paid off within a very short period of time.

C. A BREAKTHROUGH IN IMPROVING HEAD RICE MILLING RETURN OF DIWANI - IDENTIFICATION OF NEW STRAINS OF DIWANI

Extra long rices like Diwani and Rustic, though attractive in shape, do not produce good milling return. In Suriname, selection of extra long rice is traditionally required, but recent reports from there indicate this does not pay economically. As was pointed out by the specialist in an earlier report, in order to improve the head rice milling, selection of extra long rices should be avoided.

Having confirmed high and stable yield capacity of Diwani and its wide adaptation in Guyana, ideally we would like to have a Diwani which retains Diwani's yield capacity, wide adaptation and disease resistance but which are long grained and has substantially higher head rice milling return. In reality, we have identified a few such strains from a multiplication plot in Black Bush Polder. The plot was laid out according to head-rows method and involved more than 1,000 head rows.

These strains may have been developed from:

- (1) Segregation
- (2) Natural crosses with other varieties
- (3) Mutation and
- (4) Contamination of other off-type varieties

Morphologically they are very similar to the standard

Table 6

Agronomic characteristics of Standard Extra Long Diwani and Several New Diwani Strains Autumn Crop 1963, Black Bush Polder

Diwani Type	Height -cm-	Maturation		Panicle # %/hill	Pubescent or Glabrous	Yield	
		Flowering -days-	Harvest -days-			-t/ha-	(Bag/acre)
Standard Diwani	112.2	90	130	9.3	G	6.50	(41.3)
IDS#33	101.3	84	128	10.0	P	4.88	(31.0)
IDS#66	109.3	80	120	12.0	P	5.49	(34.9)
IDS#404	100.3	83	123	7.0	P	4.85	(30.8)
IDS#551	118.7	86	126	10.0	P & G <sup>a</sup>	7.77	(49.4)
IDS#569	101.3	87	127	10.0	P & G <sup>a</sup>	7.28	(46.3)
IDS#622	106.1	84	124	10.0	P	6.24	(39.7)

a: Mixture of both pubescent and glabrous grains were found in the same head row, resulting from segregation.

Table 7.

Rice Qualities of Standard Extra Long Diwani, New Diwani Strains and Two Control Varieties Rustic, Starbonnet and Bluebelle

Variety	Grain Type	Amylose %	Grain		Length White mm	Hilling Yield		Chalkiness %
			Paddy mm	Cargo mm		TL %	HR %	
Starbonnet	L.	24-26 <sup>a</sup>	9.2 <sup>a</sup>	7.2 <sup>a</sup>	6.7 <sup>a</sup>	71	62	8.5
Bluebelle	L.	24-26 <sup>a</sup>	9.6 <sup>a</sup>	7.5 <sup>a</sup>	6.9 <sup>a</sup>	70 <sup>a</sup>	60 <sup>a</sup>	-
Rustic	E.L.	28	11.3	9.0	8.0	71	45-55	2.4
Standard Diwani	E.L.	23-26	11.0	8.5	8.0	70	45-58	8.18
NDS#33 (P)	L.	-	8.8	6.7	6.4	72	70	4.3
NDS#66 (P)	L.	-	8.9	6.7	6.4	70	68	4.3
NDS#404 (P)	L.	-	8.9	6.6	6.4	70	68	2.8
NDS#551 (P)	L.	-	9.4	7.1	-	-	-	-
					7.1 <sup>b</sup>	72 <sup>b</sup>	68 <sup>b</sup>	3.4 <sup>b</sup>
NDS#551 (G)	L.	-	9.8	7.4	-	-	-	-
NDS#589 (P)	E.L./L.	-	10.1	7.8	7.2	72	65	6.8
NDS#589 (G)	L.	-	9.3	6.9	-	-	-	-
NDS#822 (P)	L.	-	9.0	6.7	6.3	70	69	0.8

a: Data from USDA Handbook No. 289 "Rice in the United States: Varieties and Production". June 1973.

b: Data obtained from the mixture of Pubscent and glabrous NDS#551.

extra long Diwani. The major differences of these strains from the standard Diwani, apparently, are in their grain length and milling qualities. It is very likely that they have been developed from the segregation though the other mechanisms cannot be excluded. Tables 6 and 7, respectively, give their agronomic characteristics and the qualities.

As can be seen from Table 6, these strains all have 3 up to 10 days shorter maturation than the standard Diwani. This shortening of maturation, when compared with standard Diwani, is desirable for Guyanese farmers since the standard Diwani has a few days longer maturation than Starbonnet. Their tillering capacity is nearly the same as the standard Diwani. In this preliminary test, two strains (IDS #551 and IDS #589) appeared to have higher yielding capacity while the other four strains (IDS #3, #66, #404 and #622) had slightly lower to moderately lower yielding capacities. The standard Diwani are glabrous. It was, however, interesting to find out that the grains from the four lower yielding strains are all pubescent while approximately 80% of the grains from the two higher yielding strains (#551 and #589) are pubescent. Obviously, the two higher yielding strains are still in segregation stage with respect to glabrousness. Since glabrousness is controlled by a single recessive gene, the glabrous strains of #551 and 589 will not segregate further while the pubescent ones may do so.

The most existing finding was that these new strains have substantially higher head rice milling return (65 up to 69%) than the standard extra long Diwani (45-58%). Obviously the increase in head rice milling return resulted from the reduction in kernel's length from 6.5mm (brown rice or cargo rice in Guyanese) in the standard Diwani to 6.6 - 7.6mm in the new strains. The two higher yielding strains (#551 and #589) have

the length comparable or slightly longer than that of Bluebelle, one of its ancestors. While the kernels of the four lower yielding strains (6.7 mm) are approximately 15% shorter than those of Bluebelle (7.5m). Nevertheless, these four strains can be classified as long grain rice.

It was also interesting to note that the chalkiness in these strains reduced drastically to 0.8 - 6.8% from 6 - 18% of that in the standard Diwani. Thus the improvement was not only obtained in milling return but also in reduction of chalkiness, an important parameter to downgrade the rice quality in the market.

The amylose content, the most important parameter which controls the cooking quality, of these strains remains to be analysed. From the parentage of Diwani, we expect they should be in the range between 23 and 25%. Should rice have an amylose in this range it is dry and fluffy after cooked.

The qualities (head rice, chalkiness and color) of these strains are comparable to or better than Starbonnot (Table 7). Identification of these strains may be claimed as a breakthrough in breeding of tropical high yielding varieties which have as high qualities as do US long grain rices. This was supported by one of the most authoritative rice breeders (founder of the miracle rice IR8) in the world, Dr. Peter R. Jennings. He reported that so far no tropical high yielding varieties which can compete with US long grain rices in qualities have been developed. He made such a report in a seminar when he visited Guyana in May 1983.

It is expected that these new Diwani strains retain all the other properties of the standard Diwani such as yield capacity, disease resistance, wide adaptation

and cooking quality. This may be especially so for the two higher yielding glabrous strains #551 and #582. Thus, the chance to find out such strains was 2 in 1,000.

The specialist experience with Diwani tests over the past two years would indicate that at least 3 more crop time (a year and half)/be needed to develop the new Diwani strain for commercial production. Should we follow the most conventional method (crossing) to attain the same improvement, at least 5 years are needed. It took, in fact, 10 years and 8 years to release Rustic and Diwani, respectively, from the initial crosses. How lucky we are! We must take the full advantage of this finding to develop them to commercial varieties because the length of time required is only one fifth of the conventional method.

D. NEW DIWANI STRAIN MAY BOOST GUYANA RICE BOARD AND PRIVATE MILL'S INCOME BY 17.1 MILLION DOLLARS ANNUALLY

The specialist was the first to point out that the poor milling return of N and Rustic might be one of the attributing factors making GRB operation not profitable (IRI Quarterly Progress Report No. 3, May 1981).

Using the data obtained from the experiment plot at Black Bush Polder, the specialist figured out GRB might lose 2M dollars because of poor milling quality of Rustic and suggested GRB management to review the problem.

The specialist recommended Diwani to replace Rustic because of the former's high and stable yield. The milling yield of Diwani is only slightly better than Rustic. It is interesting to study the magnitude of the profits which may arise from the high milling rice, new Diwani strain, for GRB and the private mills.

In this study four rice varieties harvested from the

research plot - Starbonnet, Rustic, Diwani and New Diwani Strains #551 and #582 were used as the materials.

The laboratory mill set up at Black Bush Polder was used to determine the milling yields (total white rice, head rice and broken rice). The results are shown in Table 8. Using these results we can calculate the prices of total finished products (head rice and broken rice) of the four rice varieties after one bag of paddy is processed. Table 9 gives the results.

As can be seen from Table 9, when one bag of paddy is milled, Starbonnet, Rustic, Diwani and New Diwani Strain, respectively, produce \$37.44, 34.87, 35.01 and 38.43 dollars of finished products. Here, it is assumed that one bag (180 pound) of head rice sells \$70.60 (current price of White B rice) while one bag broken rice sells \$44.80. The results thus indicate one bag of new Diwani strain will generate \$38.43 - 35.01 = \$3.42 more than standard extra long Diwani. Standard extra long Diwani out-produces Rustic by \$0.14, while new Diwani strain out-produces Starbonnet by \$0.99.

Since an increase of 5 bag/acre is assumed, we can safely estimate that an average yield of 25 bag/acre be obtained in the nationwide scale. Therefore, the increase in the income for GRB and private mills due to higher milling new Diwani strain will be:

$$\$3.42 \times 25 = \$85.50 \text{ per acre.}$$

Using this figure, we can calculate the increase due to new Diwani strain in 1986 will be:

$$\$85.50/\text{acre} \times 160,000 \text{ acres} = 13.68 \text{ million dollars.}$$

Here it is assumed that 160,000 acres (2 crops combined together) be planted to New Diwani Strains.

The income increase may reach \$17 M if 200,000 acres (2 crops combines) or 81.3% of Guyana's paddies are planted to new Diwani strain (Table 5).

Table 8

## Laboratory Milling Yields of Four Rice Varieties from Autumn Crop 1983

<u>Variety</u>	<u>Total rice</u>	<u>Milling Yield</u>		<u>Total head rice equivalent*</u>
		<u>Head rice</u>	<u>Broken rice</u>	
Starbonnet	71.4	64.5	6.9	68.9
Rustic	71.3	50.5	20.8	63.5
Divani	70.2	53.5	16.7	64.1
New Divani Strain	71.8	66.8	5.0	70.0

\* Sum of head rice and broken rice in which broken rice is converted to head rice equivalent according to the market price. In Guyana the price of broken rice is somewhere between 63.6 and 67.7% of white rice's. In this particular case we have used 63.6%.

Table 9.

Total Prices of Finished Products (Head Rice and Broken Rice) of  
Four Rice Varieties after Milling of One Bag (140 Pound) of Paddy

Variety	Bag of Paddy Processed	Head	Rice	Broken	Rice	Total Price of
		Bag (180 lb)	G\$*	Bag (180 lb)	G\$*	Head Rice & Bkn. Rice G\$
Starbonnet	One	0.502	35.44	0.054	2.40	37.82
Rustic	One	0.393	27.75	0.159	7.12	34.87
Divani	One	0.416	29.37	0.126	5.64	35.01
How Divani Strain	One	0.520	36.71	0.033	1.72	38.43

\*Based on the assumption that one bag (180 pound) of Head rice sells G\$70.60 (current price for white rice B), while the broken rice is assumed to sell G\$44.00 per bag (180 pound).

In summary, if 220,000 acres of paddies out of 246,000 acres or 89.4% can be planted to Diwani and New Diwani strains, an increase of \$43.78M income can be obtained for Guyanese farmers (\$26.68M) and Guyana rice mills (\$17.10M) in 1987 (Table 5). This fully demonstrates how important rice research is to Guyana rice industry. Indeed, the rice research expenses are very humble when compared with the return from the research work.

### III. RESULTS OR RICE RESEARCH IN 1983

As was reported earlier, in 1983 the research programmes have been expanded to the whole Guyana from Black Bush Polder. The research plots which could meet the requirement of the level of the international standard were laid out at Black Bush Polder, MARDS, Rice Research Station and Lion Repos Guyana School of Agriculture, while the plots of applied research type (in large plot size and without replication) were laid out at the State Farm of Essequibo.

At the time when this report was being prepared, one of the variety yield trials which involved 24 promising rice selections screened from 200 selections imported in 1982/1983 was not completed. The harvest of this trial will be completed by the middle of January 1984.

Several outstanding research completed in this report period was presented in the previous section, while the results which cover the whole year of 1983 (spring crop and autumn crop) will be compiled in a separated report sometime in January 1984.

### IV. TEMTATIVE PLAN OF RICE RESEARCH IN SPRING CROP 1984

#### A VARIETAL IMPROVEMENTS

1. Development of New Diwani Strain of High Milling Return for Commercial Production.

2. First Screening of High Yielding Varieties from Germplasms Newly Imported from All Over the World.
3. Refining the Screening of High Yielding Varieties.
4. Regional Tests of Promising Varieties.
5. Multiplication of Promising Varieties through Head-Rows Selection Method.

B. SOILS AND FERTILITY MANAGEMENT

1. A Study of Improving Nitrogen Fertilizer Efficiency.
2. Soil Phosphorous Fertility Survey and Varietal Difference in Phosphorous Fertilizer Requirements.

EXTRACT FROM 1984 BUDGET SPEECH

NEW INSTITUTIONAL FRAMEWORK FOR THE RICE INDUSTRY:

The new institutional framework which is being established this year includes the following:

1. A rationalisation of the management activities of the Guyana Rice Board (GRB) by clearly separating into different institutions the two principal activities, milling and marketing.

- (a) The Guyana Rice Board, divested of its drying, milling and storing responsibilities will be transformed into the Guyana Rice Export Board (GREB) with basis responsibilities for:

- (i) Negotiating and entering into Government to Government and Government to non-Government contracts. GREB will be a principal in these contracts.

- (ii) Fulfilling these contracts: GREB will procure its rice for export by way of Suppliers' Contracts, where necessary.

- (iii) Monitoring and guiding the development of the domestic rice sector in response to trends and changes in the export markets for rice and rice products.

- (iv) Advising the Government and the Industry in general on marketing prospects. It will be involved on an on-going basis in marketing research and analysis, establishing trends and preferences in export markets with a view to developing an information base adequate for strategic planning of production and exports of rice and rice products.
  
- (v) Certifying exporters wishing to enter into contracts for the export of rice as well as advising on all matters pertaining to these arrangements. Private exporters will be permitted to export rice that is surplus to the requirements of the CARICOM market and other markets subject to Government to Government contracts.
  
- (vi) Certifying the export quality of rice.

The export Storage facilities will be operated under the supervision of the GREB. Responsibility for overseeing the storage and preparation of rice for export, especially to those markets for which GREB is the exporter will be with the GREB.

Private exporters, who have negotiated their own markets will be paid the full price negotiated less the agency fee charged by the GREB. These exporters will have to pay for the services provided by the GREB.

The GREB will finance its operating costs by these fees which will be based on a percentage of the value of the export contracts. Its buying and selling operations will be managed through a separate trading account on behalf of the Government.

- (b) The rice drying/milling/storage activities will be transferred to a new specialised institution, the Guyana Rice Milling Corporation (GRMC), responsible for conducting such activities on a commercially viable basis.

This new Corporation, in addition to providing rice to the GREB for export, will be the sole body responsible for marketing rice on the domestic market. In discharging this responsibility, the GRMC could nominate individual private millers and other appropriate entities as agents responsible for supplying rice to particular local areas. It will also have the authority to procure rice from millers under Suppliers' Contracts.

- 2. A functionally autonomous Grading Authority will be created to maintain technical standards, consistent with international classifications, for grading paddy and rice. This Authority will be the sole entity for certifying grades of paddy and rice. The basic functions of the Grading authority will be:

- (a) To grade and certify all paddy arriving at the mills;
- (b) To grade and certify all rice milled for sale both locally and overseas;

- (c) To assemble and disseminate to the Industry all relevant data on grading and quality control;
- (d) To train, certify and license graders; and
- (e) To license mills, and to inspect their operations with a view to facilitating improvement in their quality control and other operations.

In addition, steps will be taken to rationalise the industry's research and extension facilities. An Agricultural Research Institute will be established. Due attention will be paid to all aspects of rice production, including the development of improved varieties and the establishment of an effective extension service.

Research and extension activities will be the responsibility of the Central Government.

The revenue from rice exports in excess of operating costs including the agency fee, will be used by the Central Government to assist in financing development.

#### The Price Determination Mechanism

The Planning Department of the Ministry of Agriculture will be responsible for the annual review of these prices. These reviews will take place before the second rice crop and the new prices will be announced before the end of August of the same year.

The cost of production will be based on the actual costs obtaining at the end of the first crop and the estimated costs for the second crop.

The new formula for determining the price of paddy will ensure compensation of small farmers for those costs of production over which they have no control. It is recognised that farmers owning machinery will benefit more since the rates at which they hire out their machines are higher than the economic costs of these services. Their approach, however, safeguards small farmers against the unavoidable rental rates which they have to pay to machinery owners. Also to the extent that small farmers improve on those elements of the cost of production over which they have control (i.e. increase their production efficiencies) their overall revenue earnings will be greater. The formula also has the added advantage for farmers in that the yield is based on the actual average for the previous year and therefore any improvement in yield which the present level of technology permits will entail additional income to farmers for the current year.

The price of rice will be determined by adding to the price of paddy an adequate margin for the costs of milling and other associated conversion costs. The domestic retail price of rice will be determined by ensuring adequate retail margins for retailers.

The policies and the pricing mechanism outlined above will be, of course, subject to periodic review in order to assess their efficacy and to serve as a basis for necessary improvement.

## RICE RESEARCH WORK PLAN

1984 JULY - 1985 JUNE

ACTIVITIES	1984						1985					
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1. VARIETAL IMPROVEMENTS DEVELOPMENT OF NEW DIWANI STRAINS												
- SELECTION	-----					-----					-----	
- PERFORMANCE TEST	-----					-----					-----	
-QUALITY ANALYSIS				-----						-----		
-MULTIPLICATION	-----					-----					-----	
2. INITIAL SCREEN TESTS FOR NEW RICE SELECTIONS INTRODUCED FROM OUTSIDE OF THE COUNTRY	-----											
3. REFINING THE SCREEN TESTS FOR THE PROMISING VARIETIES/LINES IDENTIFIED EARLIER	-----											
4. REGIONAL TESTS FOR THE MOST PROMISING VARIETIES/LINES	-----					-----					-----	
5. VARIETAL MULTIPLICATION												
-DIWANI	-----					-----					-----	
-OTHER PROMISING VARIETIES/LINES	-----					-----					-----	
6. SOILS & FERTILIZATION STUDIES												
-COLLECTION OF SOIL SAMPLES AND SOIL ANALYSIS				-----					-----			
-POT TRIALS FOR SOIL PHOSPHORUS VARIETIES/LINE	-----					-----					-----	
-FERTILIZER TRIALS	-----					-----					-----	
7. TRAINING OF COUNTERPART STAFF	-----											
8. VISITING FARMERS & FARMS ROUTINELY TO COLLECT AND ANALYZE THE INFOR- MATION ON THE YIELD CONSTRAINTS WHICH CAN BE SOLVED BY AGRONO. RES.	-----											

SEED PRODUCTION - WORK PLAN1984 JULY - 1985 JUNE

ACTIVITIES	1984					1985							
	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	
1. Implement procedures for the production of breeder and foundation seed	-----												
2. Implement procedures for the production of registered seed	-----												
3. Implement system of quality control		-----							-----				
4. On the job training of seed delivery personnel	-----												
5. Establishing seed testing laboratories		-----											
6. Revitalizing seed processing of facilities	-----												

RICE GRADING

ANNEX 4 (c)

PLAN OF IMPLEMENTATION TASKS

DATE:

Month:	Day:	Development/Implementation 1/	Training 2/	Specific Regulations 3/	Administration/Operations 4/
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1984

8	1	Draft OIA completed by GOC and forwarded to appropriate authorities as determined by GOC. Estimated date unknown, but assume 60 to 120 days.			Evaluate possible facilities at Georgetown and Corriverton for export inspection, weighing, training, final appeals, and administration.
		Begin drafting general regulations, format and content.			
8	13	Select and order inspection, weighing and training equipment required for phase 2. Arrange training programs in the U.S. Develop operating budgets. Review facility proposals.	Select two people to be sent to U.S. for training.		Draft job descriptions, performance standards, pay scales, and hiring procedure. Develop operating budget estimates, fee schedules, record-keeping procedure.
9	1	Arrange training program for Guyana.		<u>Standards</u> Begin developing standards for inspection and weighing equipment and procedures; packaging standards; proposed revision of rice standards.	Design accounting, legal, and operating documents. Evaluate staff requirements and guidelines and submit list of recommendations/applicants.
9	5	Coordinate U.S. training, monitor progress. Complete equipment shipments and training items. Review personnel needs.	Training for two persons; one for three weeks in Kansas City; the other for three weeks in New Orleans, La.		Develop employment package for presentation at training session.
9	26	Coordinate in-country training, review operating budget.	Training ends and return to Guyana. Set up in-country training. Select personnel for training.	Complete standards work (24 days TA)	Develop record system for statistics on shipments, samples, inspections, weights, sanitation.

DATE:

Month:	Day:	Development/Implementation	Training	Specific Regulations	Administration/Operations
10	15	Approve draft standards and send to QOC for final review. Review staff requirements and list of applicants.		<u>Certifications</u> Design inspection certificate, develop operating program to include legal, accountability and security aspects. Complete certification program (10 days TA)	
10	6	Coordinate standards implementation. Approve draft certification regulations.	Expatriate training team of two people arrives to begin two sessions of one week each. Total time in-country eighteen days. (60 days TA)		
10	27	In-country assessment of phase 2.			
11	1	Implementation of GIA and start of GIS for export inspection ; domestic appeals.			
11	7	Assessment report and draft work plans for phase 3.			
		<u>Start Phase</u>			
11	31	Develop domestic supervision/monitoring inspection program.	Develop training materials for GIS licensing of grain graders.	<u>Licensing</u> Develop licensing program for rice inspection and facilities. Complete licensing program (10 days TA)	Evaluate facilities for domestic monitoring. Draft job description performance standards, wage rates and hiring procedures.
12	19	Approve licensing program and complete draft regulations.	Set up training schedule, locations, equipment requirements and prepare materials.		Develop operating guidelines. Prepare budget estimates. fee schedules record keeping procedures, billing and payment invoices.

DATE:				Specific Regulations	Administration/Operations
Month:	Day:	Development/Implementation	Training		
<u>1985</u>					
1	5	Approve training program, purchase and ship training equipment required for phase 3. Review facility recommendations.			Appraise record keeping. Evaluate staff requirements. Submit list of applicants. Develop accounting documents security procedures, planning and accountability documents.
2	9	Review operating guidelines and 1st quarter performance.	Begin training sessions for licensing grain inspection and GIS personnel.		Complete work assignments.
	13	In-country assessment of phase 3. Review staff requirements and applicants.	Evaluate training, issue licenses, determine training needs for 1984.		Complete assignment, (9 months half time) (TA)
	27	Implementation of GIS supervision/monitoring for domestic inspection.	Ongoing training as required to be provided by GIS.		
	16	Review of second quarter performance. Assessment of program.			

1/ Development/Implementation- Manage the project, direct activities, coordinate required technical assistance and resources, provide evaluation and assessment at completion of each phase.

2/ Training- Provide schedules, location, and training topics for two Guyanese to train in the United States with an assessment report at the completion of training. Provide two courses including training materials and instructors at Georgetown. One course to consist of one week's instruction on general rice inspection. The second course to consist of week's training on supervision of an inspection service. Each course to train up to fifteen student selected by GDD and USAID.

3/ Specific Regulations- Provide technical material to support the Grain Inspection Act covering necessary functions of standards, regulations, certification, and licensing.

4/ Administration/Operations- Provide technical support in operational activities and administration of Grain Inspection Service implementation program.

DETAILED STAFFING PATTERN

(a) Applied Research:

	<u>Present</u>	<u>Projected</u>
<u>Professional Staff</u>		
Plant Breeder	1	1
Agronomist	<u>-</u>	<u>1</u>
Sub-total	<u>1</u>	<u>2</u>
 <u>Sub-Professional Staff</u>		
Technical field Officers	4	8
Junior Technical field officers	<u>2</u>	<u>2</u>
Sub-total	<u>6</u>	<u>10</u>
 <u>Clerical and Other Support Staff</u>		
Typist/Clerk	1	1
Driver	1	1
Laborers	<u>12</u>	<u>32</u>
Sub-total	<u>14</u>	<u>34</u>
 GRAND TOTAL	 <u>21</u>	 <u>46</u>

(b) Seed Production:

Projected

Professional Staff

Seed Production Officer

1

Sub-Professional Staff

Assistant Seed Production Officer

3

Seed Production Assistant

3

Seed Technician

3

Seed Certification Inspector

3

Sub-total

12

Clerical and Other Support Staff

Plant Operator

3

Driver

1

Typist/Clerk

1

Laborers (casual)

18

Sub-total

23

GRAND TOTAL

36

(c) Rice Grading:

	<u>Projected</u>
<u>Professional Staff</u>	
Director	1
Assistant Director	1
Chief, Operations	1
Chief, Standardization	<u>1</u>
Sub-total	<u>4</u>
 <u>Sub-professional Staff</u>	
Secretary	1
Clerk/Typist	1
Grading Officer	4
Grading Assistants	<u>4</u>
Sub-total	<u>10</u>
GRAND TOTAL	<u>14</u>

ALLOCATION OF FIELD COMMODITIES PURCHASED UNDER THE IRI CONTRACT

COMMODITY DESCRIPTION	PRESENT LOCATION	ALLOCATED TO			COMMENTS
		RESEARCH	SEED MULTIPLICATION	RICE GRADING	
1-Measuring Wheel	Research	X			
3-Tape, 30m	"	X			
6-BMB Knapsack Sprayer	"	X			
3-Motor-cycles	In-storage		X		
1-Air Elast Seed Cleaner, Almaco Model ABSC	Research	X			
1-Seed Blower Table, with tube set	"	X			
1-Boerher Seed Divider	"	X			
1-Toledo Scale - Model 4181C	"	X			
1-Toledo Scale - Model 4030	"	X			
Diesel Power Generating Unit 10 KVA	EBP	X			To be re-installed at MARDS
Centrifugal Pump, 3 HP with accessories	Research	X			
Land Rover, SWB, PBB 5984	GRB		X		
Jeep, CJ 7, PBB 6079	IRI Head Office	MARDS			} To be repaired and shared } with seed production at the } locations.
Jeep, CJ 7, PBB 6080	"	BBP			
Jeep, CJ 7, PBB 6081	"	Esseq.			
Toyota, Sedan PBB 63919	IRI Head Office	X			Shared with seed production
Toyota, Sedan PBB 6320	GRB			X	For use by Consultants
Madza, Sudan, PBB 6522	Research	X			For use by Specialist
Madza, Sudan, PBB 6523	Seed Prod.		X		For use by Specialist
Land Rover, LWB, PBB 6924	Research	X			
Land Rover, LWB, PBB 6925	Hope Estate			X	

COMMODITY DESCRIPTION	PRESENT LOCATION	ALLOCATED TO			COMMENTS
		RESEARCH	SEED MULTIPLICATION	RICE GRADING	
1-McGill Miller #2	Research	X			
1-McGill Sample Sheller	"	X			
2-Dole Moisture Tester	"	X			
2-Vogel Bundle Thresher, 18"	"	X			
3-Aramitsu Power Sprayer	"	X			
1-Soil Grinder with Screens and Sieves	"	X			
1-Optical Range - Tape measure	"	X			
1-Germinating Cabinet	"	X			
2-Sudbury Soil Test Kit	"	X			
1-PH Meter with case, adapter conductivity bridge and cells	"	X			
1-Torsion Balance DLM-2 with weights	"	X			
1-O Haus Solution Balance	"	X			
1-O Haus Dial - Gram Balance	"	X			
1-Blender	"	X			
2-Gram Scale	"	X			
1-Swift Microscope	"	X			
1-Gator Submersible Lo-life Pump, 12"	BBP State Farm	X			To be used at MARDS Research Center and shared with seed production
1-Mower, 3 pt Hitch, 6 ft. cutting width	"	X			"
1-Levee (Mere) Squeeze Plow	"	X			"

COMMODITY DESCRIPTION	PRESENT LOCATION	ALLOCATED TO			COMMENTS
		RESEARCH	SEED MULTIPLICATION	RICE GRADING	
1-Brillion Plow Packer with offset Hitch	BBP State Farm	X			To be used at MARDS Research Center and shared with Seed production
1-Marden Triplex Weed Cutter	"	X			"
1-Niplo Power Harrow	"	X			"
1-Vicon Power Harrow	"	X			"
1-Rome Disc Ridger with heavy duty tool bar	"	X			"
1-Rome Model TCQ 24-24 Wheel Type Harrow	"	X			"
1-Rome/Gurries Leveller GL-8	"	X			"
1-Rome/Reynolds Model 6C Scraper	"	X			"
5-MF 290 Tractors Nos. 13683-7	"	X			3 for MARDS, 1 Esseq. and 1 BBP, to be shared with Seed production.
1-Caterpillar Tractor, D4E with angle blade	"	X			To be used at MARDS and shared with seed production.

AMENDMENT NUMBER ONE  
TO THE  
PROJECT AUTHORIZATION

NAME OF COUNTRY: Guyana  
NAME OF PROJECT: Rice Modernization II  
NUMBER OF PROJECT: 504-0072

1. Pursuant to Part I, Chapter 1, Section 103 of the Foreign Assistance Act, as amended, the Rice Modernization II Project for Guyana was authorized on August 28, 1978. That authorization is hereby amended to add the following Condition Precedent to Disbursement:

Conditions Precedent to Disbursement of funds during Project Extension Period (June 30, 1984 to June 30, 1985)

a. Rice Grading Authority:

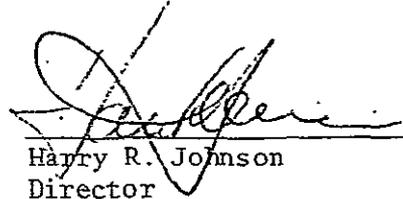
Except as A.I.D. may otherwise agree in writing, prior to the disbursement under the Grant, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made for the element of the Project supporting the establishment of a Rice Grading Authority, the Grantee will furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that satisfactory progress has been made in the implementation of changes in the rice sub-sector agreed to by the Grantee and the Inter-American Development Bank (IDB) as part of the Agricultural Sector Loan 660/SF-GY being funded by IDB.

b. Technical Assistance and Commodities:

Prior to any disbursement under the Grant, or to issuance by A.I.D. of documentation pursuant to which disbursements will be made for technical assistance and commodities after sixty (60) days from the date of this Agreement to the extent not irrevocably committed to third parties, the Grantee will, except as the parties may otherwise agree in writing, furnish in form and substance satisfactory to A.I.D.:

- 1) Evidence that adequate counterpart staff, in accordance with Annex I of this Amendment, have been assigned to the Project;
- 2) Evidence that it has assigned two Project Managers, acceptable to A.I.D., to manage this Project -- one from the Agricultural Research Institute and one from the Rice Grading Authority;
- 3) A time-phased Implementation Plan for the balance of the Project;
- 4) A statement of the name of the person holding or acting in the office of the Grantee specified in Section 8.2 of the Agreement, and of any additional representatives, together with a specimen signature of each person specified in such statement.

2. The authorization cited above remains in force except as hereby amended.



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Harry R. Johnson  
Director  
US AID Mission to Guyana

6/29/84  
Date