RICE AND SUGAR IN GUYANA
GUYANA AGRICULTURAL SECTOR PLANNING PROJECT

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GLOSSARY OF ACRONYMS AND SPECIALIZED TERMS

BBP	Black Bush Polder
BG	prefix to rice variety, e.g., BG 79, a traditional variety developed in colonial times
brown rice	Guyanese term for parboiled rice as opposed to "white rice" or non-parboiled rice
CARICOM	Caribbean Common Market
CEC	cation exchange capacity
CIAT	Centro Internacional de Agricultura Tropical (Cali, Colombia)
CIMMYT	Centro Internacional para el Mejoriamento de Maiz y Trigo (research center in Mexico for corn and wheat)
DAP	days after planting (in other contexts, diammonium phosphate)
D & I	Drainage and Irrigation Board (of Hydraulic Division of Ministry of Agriculture)
GAIBANK	Guyana Agricultural and Industrial Development Bank
GMC	Guyana Marketing Corporation
GNTC	Guyana National Trading Corporation
GOG	Government of Guyana
GRB	Guyana Rice Board
GUYSUCO	Guyana Sugar Corporation
HYV	high-yielding varieties (of paddy)
ICRISAT	International Center for Research in Semi-arid Tropical Agriculture, India
ICTA	International Center for Tropical Agriculture (see CIAT)
IDB	Inter-American Development Bank
IITA	International Institute for Tropical Agriculture, Nigeria
IR	prefix to rice varieties developed by IRRI, e.g., IR 8 or IR 22.
IRI	International Research Institute (One Rockefeller Plaza, Room 1401, New York, NY 10020)
IRRI	International Rice Research Institute, Los Baños, Philippines
IWR	irrigation water requirement
koker	water control gate
LA	Local Authority for irrigation water control
LDC	less developed countries
MARDS	Mahaicony/Abari Rice Development Station
M of A	Ministry of Agriculture
MMA	Mahaica-Mahaicony Abari (irrigation project)
mmgos/cu	one millionth of a gram of salt per cubic centimeter of soil
NCFC	National Cane Farmers Committee
NPK	nitrogen, phosphorous, potash
PRC/ECI	Planning Research Consultants/Engineering Consultants, Inc., Denver, Colorado
RMB	Rice Marketing Board (predecessor to GRB)
RMP	Rice Modernization Program (AID-financed program started in 1967 as RMP I; followed by RMP II in 1977)
SMS	subject matter specialist, usually in reference to agricultural extension programs
Suriname	new name for Surinam
TC/TS	tons of cane per tone of sugar
TSP	triple superphosphate
T & V system	training and visit system for agricultural extension programs
USAID	United States Agency for International Development
WW II	World War II

EXECUTIVE SUMMARY

Importance of Rice and Sugar

This report assesses the performance and outlook of the rice and sugar industries in Guyana. The report was prepared in November 1982 by a short-term specialist in tropical agronomy, Ronald Baskett, under a USAID-financed contract with Checchi and Company of Washington, D.C. The report is intended to provide basic data and recommendations for inclusion in the Ministry of Agriculture's sector plan.

The report focuses on the rice and sugar industries because these industries are critical in generating foreign exchange for Guayana. In combination, rice and sugar have earned from 38 percent to 58 percent annually of total foreign exchange earnings during the period 1975 through 1981. (Guyana's residual foreign exchange earnings have been largely generated by exports of bauxite and alumina; see Table 4.1 on page 86.)

Organization of the Rice Industry

Rice is grown by private farmers operating farms located in the narrow strip of coastal lowlands extending inland about six miles.

Rice farms require drainage at low tide and must be protected by sea walls at high tide. The population supported principally by rice farming consisted of 225,059 persons according to the 1970 census, and is projected to grow at an annual average rate of 1.0 percent to about 273,950 persons by 1990 (Checchi and Company, "Rice II -- Second Rice Modernization Project, Feasibility Study and Report, Socio-Economic Data Base," March 1979.)

While the actual farming is in private hands, services that support the rice farmer are provided by the Government, through the Guyana Rice Board (GRB). Eighty percent of the paddy is processed by government-owned and operated mills. Fertilizers and other farm chemicals are sold by the Government. Until very recently, the entire paddy crop was purchased by the Government at fixed prices and the rice sold to the domestic and export markets by the GRB.

Performance of the Rice Industry

Yields of paddy per acre have risen quite steadily in recent years from 1,666 pounds per acre in 1970 to 2,688 pounds in 1981. Expressed in terms of 140-pound bags, this increase was from 11.9 bags in 1970 to 19.2 bags per acre in 1981. This is the result of higher yielding varieties and the increase in farm size as small farmers rent to large-scale farmers.

However, Guyana's yields are low by world standards. In California, Korea, and Australia, yields are well above 6,000 pounds per acre. In parts of Indonesia (Sulawesi), yields are sometimes 3,571 pounds per acre (four tons per hectare).

Despite the improvement in yields, there is evidence that Guyana's rice industry is performing far below its potential. For example, 500,000 acres of paddy could be planted per year as compared with the current 220,000 to 370,000 acres. Yields could be obtained ranging up to 3,500 pounds per acre as compared with the present figure of 2,688 pounds. Potentially, there could be an exportable surplus of 300,000 tons annually as compared with the present 80,000 tons.

There is also evidence that the industry is on the verge of a serious downturn; this is especially regrettable in the light of AID's highly successful Rice Modernization Program (RMP I) that continued for ten years (1967-78). The RMP I program introduced modern, high yielding, easily milled varieties, established new storage and drying facilities, and placed Guyana in a competitive position for supplying rice to the Caribbean and beyond.

Loss of Export Markets

Despite historical ties through CARICOM and short steaming distances, the Caribbean markets are increasingly turning to sources of rice other than Guyana. Underlying this switch are such shortcomings in Guyana rice as the lack of uniformity, the presence of "red rice" and foreign matter,

the high percentage of damaged and broken kernels, and the discontinuation of parboiling which has reduced Guyana's sales to Trinidad where the population of East Indian ethnic origin has a traditional preference for parboiled rice.

The reduced size of Guyana's export markets can be traced to several interrelated problems summarized below. The report which follows comments on each problem and presents recommendations for remedial action (Chapter 3).

Problems Affecting the Rice Industry

- The Guyana Rice Board's procurement policy allows for no premium payments to the farmer for certain varieties of superior paddy and imposes no penalty for inferior varieties.
- The prices paid by the GRB to mills also do not give recognition to the costs incurred in parboiling and drying; therefore, the few private mills selling to the GRB have no incentive to improve their facilities nor to build new parboiling facilities.
- The seriously depreciated machinery of rice mills, the shortage of foreign exchange to purchase spare parts, especially rubber rollers, and the lack of quality control on milled rice has brought about a sharp deterioration in the quality of rice offered to Caribbean customers.
- The depreciation and only partial utilization of drying and storage facilities financed under RMP I has reduced the milling and grain qualities of paddy.
- The management of irrigation water has been complicated in recent months by the decentralization of authority and by the continuing absence of farmer participation in decisions affecting the allocation of irrigation water.
- The purity of paddy seed varieties (such as Starbonnet) introduced under RMP I is being lost and Guyana needs to resume its search - abandoned in the 1970's - for varieties that offer the best disease resistant, grain, and milling characteristics.
- Rice research programs need to be strengthened by rehabilitating and restaffing the rice development station (MARDS) originally financed through AID's RMP I.

- Extension services need to be strengthened and the successful extension practice of "training and visit" recommended by the World Bank should be introduced.

- Only 110 pounds of urea are allowed per acre by the GRB, whereas at least a doubling of this quantity could raise yields by over 50 percent.

- In recent years, the mechanization of rice farming has advanced rapidly, but mechanization has evolved in such a way as to seriously handicap the small farmer. The 35 to 40 HP tractor, formerly in wide use, has now been replaced by the 75-80 HP tractor which is too big for small farms, cannot be moved from plot to plot without damage to the fields, and is too expensive for the small farmer to buy and maintain. Lessons in mechanization and in the transport of paddy, already learned by IRRI in the Philippines, should be considered for Guyana.

- About one-third of Guyana's fleet of 450 combines and about one-fifth of the tractors are no longer operational. Many more are on the verge of breakdown due to a shortage of parts, batteries, or tires.

- Foreign exchange expenditures should be concentrated on the purchase of spare parts rather than on new machines.

- Repairs for agricultural equipment should be handled by privately-owned workshops, which should have access to foreign exchange to import parts.

- The sale of fertilizers, agricultural chemicals, spare parts, sprayers should be in the hands of private dealers and adequate inventories encouraged to assure prompt deliveries to farmers. However, the quality of products stocked by dealers should be spot-checked and the adulteration of chemicals penalized.

- Rice milling should be phased over to private millers and such millers should be paid on the basis of quality and the timing of deliveries. Private millers should be encouraged to bid on milling contracts and they should be allocated foreign exchange for spare parts. Long-term loans should be extended to improve or construct parboiling facilities at the mills. Training should be provided to assure high quality standards for parboiled rice. Regulations should be enforced to ensure the use of unpolluted, odor-free water used in the parboiling process.

Sugar Plantings and Yields

The sugar industry is supplied with cane by 10 sugar estates with average plantings of 14,000 acres each and by private outgrowers who operate cane fields located close to the estates.

The total acreage of sugarcane harvested has been rising and reached 143,078 acres in 1981. (This compares with the rice acreage planted in the same year of 219,962; see pages 17 and 94.)

While rice farming is almost entirely in private hands, the growing of sugarcane is largely the responsibility of the government through GUYSUCO; specifically, 86 percent of the cane acreage is owned and operated by GUYSUCO and only 14 percent by private farmers.

The grinding of cane and the production and sale of sugar is 100 percent under GUYSUCO control; sugar mills are located on the 10 estates, close to the cane growing area so as to avoid long distance hauls that would cause a loss of sucrose content. Some repairs and castings for replacement parts are the responsibility of the Demerara Iron Works.

The sugar industry is suffering from a variety of problems: (a) under-budgeting, (b) deferred maintenance of irrigation and drainage systems; (c) shortages of machinery and parts, (d) a steady attrition of the professional staff for management and research, (e) continuing labor unrest, (f) discontent on the part of outgrowers, (g) the lowest world prices in decades (6.48 U.S. cents per pound on March 29, 1983), (h) the national average yield of sugar per acre has declined from 3.39 tons in 1960 to 2.1 tons in 1981, and (i) the percentage of sucrose in harvested cane has declined from 9.1 percent in 1960 to 7.3 percent in 1981.

Sales of Sugar

Thanks to a favorable EEC agreement, Guyana has an export quota of 160,000 tons to the U.K. or about half the exportable tonnage. Other consuming areas have also assigned quotas to Guyana, the CARICOM, about

15 tons; Canada, 40,000 tons; and the U.S. 53,000 tons. Domestic sales are about 35,000 tons.

Although these sales appear satisfactory, they are being achieved at a major cost to GUYSUCO. The cost of production of sugar is about G$0.57/pound, whereas, sales on the world market are bringing about G$0.40 to G$0.50/pound, a much lower price than in other Caribbean islands. The domestic sales bring only G$0.25/lb.

Slippage in Capital Expenditures

The GUYSUCO annual deficit for capital expenditures has sharply deteriorated as shown in the following table (for details, see page 115, Table 5.1):

CAPITAL EXPENDITURES 1977 - 1982
GUYANA SUGAR CORPORATION LIMITED
(000 G$)

Year	Budgeted	Deficit	Deficit, as a Percent of Budgeted Amount
1977	18,898	5,984	31.7
1978	26,752	2,983	11.2
1979	20,000	6,670	33.4
1980	26,000	10,509	40.4
1981	43,000	27,234	63.3
1982	67,700	50,500	74.6

Source: Table 5.1

Recommended Actions

To preserve the sugar industry as a national asset, the report which follows presents a series of recommendations summarized below:

- As a major source of foreign exchange earnings, GUYSUCO should have more access to the foreign exchange it generates. This money should be used to arrest the rapid deterioration of plant and equipment.

- GUYSUCO should then give priority to the purchase of replacement parts to reactivate equipment that is now broken down or malfunctioning.

- Excessively long periods of ratooning are reducing the sugar and sucrose yields. As against a standard of five years, GUYSUCO's estates are ratooned for seven to eight years; and the fields of private planters are ratooned for 10 to 12 years. Therefore, tractor fleets must be reactivated to assure regular replanting every five years.

- Outside assistance and training are needed to rehabilitate the machinery repair shops and the Demerara Iron Works where some castings can be made.

- Relationships between (a) private cane farmers and (b) the sugar estates should be continuously reviewed, and a system developed to assure the cane farmers of a voice in decisions that affect them. Issues that cannot be resolved at the local level should be referred to a formally constituted board of arbitration at the national level.

- The domestic retail price of sugar is one-third to one-sixth of prices typical of the other Caribbean islands. This means that GUYSUCO is subsidizing consumers to the extent of G$35 million annually.

- Cane farmers should be promptly paid in a lump sum rather than in four installments. The amount paid to each farmer should be based on a sample drawn from the same farmer's cane..

- The sugarcane experiment station at the LBI estate has done excellent work and its staff and equipment should be increased and pay scales raised. Strengthening of the experiment station is the only prudent way to prevent or mitigate crop losses from disease and infestation.

- Where private cane farmers are faced with doubts about their future viability, a program should be developed whereby they could substitute tropical sorghum for sugarcane. This will require an extension program, preferably staffed and managed by GUYSUCO.

(Executive summary ends here.)

Chapter 1

INTRODUCTION

The Checchi and Company contract, a component of the Agricultural Sector Planning Project, required that a series of studies of agricultural subsectors be carried out by short-term specialists. The purpose of these studies was to gather and analyze data and information and to make recommendations that would constitute the information base in formulating the Agricultural Sector Plan.

The Tropical Agronomist, Mr. Ronald Baskett, the fourth short-term specialist to be assigend under the Checchi contract, covered the rice and sugar subsectors. Terms of reference for the assignment were as follows:

> Purpose of activities: The specialist shall develop policy alternatives for increasing output of rice and sugar. The background material and alternatives must be integrable into the Agricultural Sector Plan. The specialist will also develop suggestions for output increases in the short-term. All interviews and research will be carried out with a counterpart assigned by the Planning Department.
>
> Activities shall include the following:
>
> 1. Bring to Guyana any technical materials necessary for interpretation of observations of irrigated rice and sugar production.
>
> 2. Review in Guyana locally-generated reports of rice, sugar, and other agricultural production.
>
> 3. Interview appropriate officials and consultants of the Ministry of Agriculture, GUYSUCO, GRB, GAIBANK, GMC, and other relevant entities in Guyana.
>
> 4. Interview rice and sugar farmers of all sizes using a standardized questionnaire. This questionnaire will be developed by the specialist and will be approved by the Agricultural Planning Advisor and Chief Agricultural Planner. The questionnaires will generate the following information:

(a) Current status of production, state-of-the-art in water control, appropriate technology, mechanization, infrastructure, labor employed, inputs utilized and credit used. Constraints on technology and scale will be determined.

(b) Price structure.

(c) Costs of production.

(d) Marketing channels, regulations, costs, and payment arrangements.

(e) Involvement and impact of soils and other resources, land tenure, and other factors on production, marketing and farmer income, and the interaction of demographic and sociocultural variables.

(f) Involvement (actual and potential) of cooperatives.

(g) Activities of extension and research.

(h) Constraints to higher production occurring at the farm level, the local or community level, the national or policy level, or resulting from the climate, the Guyanese constitutions, or the support system.

5. Analyze all primary and secondary data and develop policy alternatives for increasing output in light of constraints. The alternatives will be constructed to provide higher and lower-cost options that would be expected to produce higher and lower levels of output. Specific recommendations will be made concerning application of appropriate technologies. This analytical report will discuss status of and need for additional water control projects.

6. Develop recommendations for immediate actions to increase output.

Rice and sugar production are by far the most important agricultural enterprises in Guyana and, along with bauxite, provide almost all of the foreign exchange earnings for the country.

Rice Assessment

All of the major rice-growing areas of Guyana (except the Essequibo Islands) were visited. Guyana Rice Board (GRB) and irrigation project personnel were interviewed in most areas. Agricultural extension programs were reviewed at two project locations viz. Tapakuma and Mahaica-Mahaicony-Abari (MMA). Visits were made with the IRI agricultural consultants at Black Bush Polder (BBP), their reports reviewed, and some field plots observed. Many rice farmers were visited and interviewed in each area. The guide for interviewing and a questionnaire used in these interviews is given in Appendix II. Farmers interviewed were in non-irrigated (rainfed), flood prone, irrigated, and project irrigated areas. (Extensive interviewing of rice farmers had already been accomplished on four out of five previous visits to Guyana.)

One GRB receiving, storing, and processing facility was visited and the manger interviewed. All other such facilities managed by GRB in Guyana had been visited during five previous trips to the country in various capacities and types of assignment. The rice research station at the Mahaicony/Abari Rice Development Station (MARDS) had also been visited previously on two occasions, one of them within the last two years. Up-to-date information as to the experiment station's present status was available from other consultants during the period of this assignment.

A few private rice millers were visited but their plight had been more thoroughly investigated on the visit to Guyana just previous to this one. Several private rice mills were visited and the present serious problems of the millers discussed.

Conferences were held with GRB general manager, Mr. Lionel Dundas, and production manager, Mr. Le Roy Small. Agriculture staff members at the Inter-American Development Bank (IDB) were also visited and their activities related to rice projects in Guyana briefly reviewed.

The resident USAID agriculturists were very helpful in providing information, contacts, and reference material.

My counterpart, Mr. Ernest Nelson of the Planning Division, Ministry of Agriculture, and his assistants, Philip and Cheryl, accompanied me on most field trips, provided background information, production figures, and other information that contributed to this report.

Sugar Assessment

Discussions were held at seven of the ten sugar estates in the country, and the cooperation of the estate officers and staff was excellent. A leitmotif in all interviews and discussions was the deep and serious concern felt by all respondents about the future of the industry. The chief administrative officer at each estate, his engineering and agricultural staff willingly offered information to us.

At some estates, the personnel manager also contributed information regarding staffing, labor, and related problems. At two of the estates, tours were made of the fields where irrigation, transport, and drainage systems were observed as well as all operations in progress at the time. Two factories and one laboratory had been visited on previous trips to the country so time was not taken for this during the nine-week assignment.

Directors Mr. Vibert Young-Kong and Mr. B. Chandra of the Guyana Sugar Corporation (GUYSUCO) in Georgetown provided much information and arranged for visits and field trips. Mr. S. Bahjkhan was also consulted on GUYSUCO's alternate cropping program. Mr. Hamid Nassir accompanied us on nearly all estate visits. He is the Chief Liaison Officer of GUYSUCO and is acquainted with all of the personnel in the estates thus providing us with entrees and contacts for our visits. He also made all necessary arrangements to visit private grower groups and individual growers in several instances. Some grower groups met us with prepared letters and presentations describing

their problems. (Two of these letters are provided in Appendix III.) All private sugarcane growers as individuals or members of a cooperative group are having severe economic problems with sugarcane production and their real concerns were noted.

Mr. Nassir also arranged a meeting with the staff at the Sugar Cane Experiment Station which was very profitable and informative.

The president of the National Cane Farmers Committee, Mr. John Ramessar, was interviewed and an invitation to attend a regular meeting of the committee was accepted.

Chapter 2

RICE ASSESSMENT

2.1 Background

Rice is the basic food staple in Guyana, and plays a crucial role in the economy of that country. It is the third largest earner of foreign exchange, after bauxite and sugar. The crop provides a source of income to almost two-thirds of all the farm households, and the per capita consumption of rice in Guyana is an estimated 90 kilograms (198 pounds).

Where rice is grown in Guyana, it is almost 100 percent a monoculture because other crops are not rotated with rice. Abandoned or unplanted fields usually are not used for anything, but may sometimes be grazed. Rarely are vegetables or other crops grown on the ditch banks or other areas. Some coconuts for local consumption are planted along ditches or dams. In Black Bush Polder (BBP) some years ago, a few farmers converted rice lands to beds for vegetables, but this was stopped by those in charge of the BBP project. However, fruits and vegetables are grown in the household lots in BBP and along the banks of the main drainage canals.

About 60 percent of the farm households in the country are engaged in rice farming. The rice farms are small private farms, with 86 percent of them being less than 15 acres. The majority of the rice farmers earn about half their income from non-farm activities. Fifty-four percent of the farms are owned by farmers themselves; 35 percent are held on long-term leases, and the rest by short-term leases or other forms of tenure.

Only 27 percent of the farmers own tractors and two percent have combines. The rice machinery fleet is older than normal; replacements are coming too slowly and spare parts are in very short supply. The majority of the farmers depend on hired machinery, which is not always available at the appropriate time, causing available land to lie fallow or crops to be lost.

The policy environment in rice has a significant effect on the rice farmer. It has at times tended to limit his output rather than promote it. Although actual production of paddy is primarily in the hands of the private sector, the government, through the GRB, determines the pr e the farmer will recieve; supplies fertilizer, seeds and agro-chemicals; and purchases the rice for milling and export. GRB is divesting itself of some of these functions, but they probably will still remain within the jurisdiction of other government entities.

2.2 History of Rice Production in Guyana

Rice has been grown in Guyana for over 100 years. In the beginning in the mid 19th century, rice culture was started by the East Indians (indentured servants) as small plots around their homes. As the Indians began to move off the sugar estates in the late 19th century, they started growing rice more extensively. By the end of the 19th century, rice production had reached a significant level in the country. By 1918, Guyana became self-sufficient in rice, and has been ever since.

Rice was produced in those early years by following traditional Asi practices, i.e., animal power was used for land preparation; transplantin and harvesting was manual; paddy was threshed by hand or with the help of oxen.

There was boom in exports to the West Indian Islands during the first World War. After the war, output declined because there was a resumption of supplies from Asia.

The second World War (WW II) was a more permanent stimulus to the industry as the colonial government strove to increase output at all costs. Asian sources had been cut off or greatly diminished. The decision was made to involve mechanized cultivation for the first time, and mechanization was practiced on a large scale at the Mahaicony/Abary Rice Development Scheme.

Large amounts of rice for the war effort were produced, although the scheme never became economically viable. However, it had been shown that the mechanized cultivation of rice was possible in Guyana. This had major long-term consequences.

Another benefit to Guyana of this wartime effort was the protected market gained by the cut-off of supplies from Asia. As a result, it was decided as a matter of policy, that Guyana should be the principal supplier of rice for the British West Indian Colonies. This position was expressed in formal agreements after the war and has continued to the present time. Throughout the 1950's, the acreage under rice doubled, the output doubled, and the price paid to farmers more than doubled.

During the WW II period, the colonial government established the Rice Marketing Board (RMB) as a central purchasing agency for all rice offered for sale. The RMB would also arrange the supply for the domestic and expor markets at fixed prices. This role of a government agency (now the GRB) as sole purchaser and effective arbiter of the rice industry remains true today, although the role is questioned by some in the light of the present depressed economic situation.

The mechanization that started during WW II and developed so rapidly thereafter has been termed phenomenal. Production was converted, in a short period of time, from the Indian rice farmers' traditional cutlure as a small peasant enterprise involving family labor on small plots, with only oxen to assist, to mechanization with tractors and combines.

At present, the production of rice is almost totally mechanized even though the majority of the farms are still small holdings. Eric Hanley stated in 1979, "The mechanization has resulted in farmers being irrevocabl committed to a mode of production which is increasingly unprofitable and which they are powerless to change." This is not believed to be entirely true; it is discussed further in Chapter 3, "Mechanization and Size of Farms," page 59.

The mechanization started with 30 to 35 HP tractors for land preparation and small 10 to 12-foot tractor-mounted harvesters. The tractor sizes have been increasing. The latest group imported were mostly in the 75 to 80 HP range. The majority of the tractors have disk plows but some use moldboard plows. They have disk harrows, drag type harrows or logs to use with the tractors in land preparation and smoothing. Large capacity combines are now imported and used for harvesting (reaping). These are usually the 14-foot-cut size.

Traditionally, Guyana had been a producer of "brown" or parboiled rice, though not a very high quality. With the opening up of the Caribbean markets in the post-war period, there had been a switch to high-prestige white rice in a number of islands, particularly Jamaica. The Guyanese industry had tried to break into this more profitable market, but without much success. Guyana's white rice consisted of mixed varieties, had too many damaged kernels, and was heavy with red rice.

In 1967, USAID approved a series of projects designed to raise the industry's capability to benefit from market opportunities. Firstly, the industry was to switch to new varieties as much as possible. These would be more suitable for making white rice. Starbonnet was the principal variety brought in for this purpose, along with some Bluebelle with its earlier maturity for late plantings. Secondly, six new storage complexes were to be constructed throughout the rice growing areas to buy paddy, dry it, and store it until it could be milled in new mills attached to the silos. This would enable the rice to be milled upon demand and shipped to markets in peak condition, instead of being stored for any period of time as milled rice. Finally, there was to be a new rice breeding station established (later called MARDS and adjacent to one of the silo complexes), to continue the work of improving quality. This series of projects was called the Rice Modernization Program (RMP).

In 1978, an evaluation mission came to Guyana to evaluate the effectiveness of RMP and to see if further projects or phases were needed. In general, they found that the majority of the technical objectives of the project had been achieved. Thus they went on to propose a further project, RMP II. This was to consist of more storage facilities like the ones originally constructed in order to extend the receiving area to almost all parts of the rice growing areas. Associated with these silos, were to be additional mills and a set of new facilities at the GRB headquarters in Georgetown, where the rice is processed for export. The proposals included a series of technical training programs for operational and managerial personnel.

RMP I was considered a great success. Guyana has been typically exporting 80,000 tons of rice for the last seven years. It was expected that Guyana would soon be producing more than the West Indian (CARICOM) market could consume and there would be a need to start seeking new markets elsewhere. It was envisioned that the new handling facilities would be invaluable by being in place for this situation. But there are definite signs now of some real problems ahead. Exports will fall far below 80,000 tons in 1982, and most of the plants established by the project are operating at less than capacity, inefficiently, or not at all because of poor management and underbudgeting.

Rice production began (and continues today) where there is drainage. Without drainage, the planting of rice can be risky. In some areas, rice is planted without good drainage and is a gamble. Rice is grown exclusively along the coastal plain of the country. This is low-lying, flat, and for the most part below sea level at high tide. Good water control for rice requires a system of sea defenses, drainage canals, and gates (kokers) so as to be able to properly discharge excess water at low tide. Facade drains and pumps are being installed as part of the drainage works in some projects.

Rice is produced in seven major areas in the low-lying coastlands. These areas are:

Essequibo Coast
Leguan
Wakenam
West Demerara
East Demerara
West Berbice
East Berbice

Although none of the statistics used in publications now available in Guyana show yields and production back in the 1940's, it is claimed that yields per acre then were higher than in recent years. And this was achieved with varieties of lower yield potential, but transplanted and hand-harvested. Mechanization has reduced the manpower used in rice production, but many other problems face the modern-day rice farmer. These are discussed in the following sections.

2.3 Climate, Soils, and Water

The climate in Guyana is tropical, and suitable for year-round rice production. Mean monthly minimum and maximum temperatures occur in a narrow range between about 72°and 90° F. The humidity is also remarkably uniform throughout the year, at around 80 percent. Excessive winds are rare, and the hurricane belt is to the north of the country.

The rainfall pattern fits into two rainy periods and two dry periods, and these have a great effect on when rice can be grown with mechanization. One rainy season is long and one short. There is also one long and one short dry season, as follows:

Rainy Seasons

(1) Long (120 days) mid-April to mid-August (50 percent of annual rainfall);
(2) Short (90 days) mid-november to mid-February (30 percent of annual rainfall); and

Dry Periods (1) Long (90 days) mid-August to mid-November (September and October are driest);
(2) Short (60 days) mid-March to mid-April.

It should be noted that 20 percent of the rain does not fall in either of the two wet seasons, but comes in the dry seasons. The above is based on normal rainfall expectancy; actual rainfall patterns can deviate widely in Guyana. The short dry season may not be a true dry season at all in some years. Conversely, in some years there may be little rain in the short rainy season. The long rainy season and the long dry season are more reliable as to the expected rainfall or lack of it. The variations from normal occur about 40 percent of the time for the spring crop (short rainy season) and 20 percent of the time for the autumn crop (long rainy season).

Roughly, the 60-year average rainfall varies in the country as follows (inches per year):

New Amsterdam - East Berbice	- 80
Georgetown	- 90
Essequibo	- 100
Northwest*	- 110
Rupununi*	- 60
Forest Zone*	- 140

* not rice areas

The extremes recorded at Georgetown are 59 inches lowest rainfall and 139 inches highest.

From the above, it can be seen that irrigation would be required more for the spring crop than the autumn crop, although it could conceivably be the reverse with abnormal rainfall patterns.

As pointed out in the discussion in Section 3.2 ("Irrigation, Drainage, and Water Management"), by starting either the autumn crop or the spring crop early (during the last part of the preceding dry season), the c

will grow and mature taking full advantage of all rainfall in the rainy season, assuming the rainfall pattern does not greatly deviate from normal.

The soils in the rice growing regions of Guyana are some of the heaviest in all the rice areas of the world. Clay content can be as high as 60 percent with all of them over 30 percent. Silt content runs from 30 to 60 percent or more in all soils. The sand fraction is always less than 10 percent. These soils have very low infiltration rates and low permeability. This is not a problem in rice growing, but can be when the soils need to be drained. The rice soils are quite acid at the surface, with pH readings of 4.5 to 5.0.

The acidity is less in the lower subsoil (pH 5.5 to 6.5). Toxicity problems do not normally occur for two reasons:

(1) Rice is grown under flooded conditions where the pH tends to move towards neutral; and

(2) The base saturations of the soils are high. Some soils have an unusual calcium/magnesium ratio in that Mg to Ca is 4 to 1 instead of the usual 2 to 1. This has not created any proven problems in rice.

Lime is needed for other crops at times. Salinity is no problem in the rice areas of Guyana with readings less than 1.0 mmgos/cm (one millionth of a gram of salt per cubic centimeter of soil). Cation Exchange Capacities (CEC) are not high in the surface soils but are adequate (15 to 20 meq/100 ml). The soils are borderline on phosphorus - at the level where response from use of phosphorus fertilizers is probable but also uneconomic. Farmers normally use half a bag of TSP per acre (23 P_2O_5). The potassium levels in the rice soils of Guyana appear to be adequate by soil analysis, and potash deficiency symptoms are not observed during the growth of the rice.

Guyana is called "the land of many waters" which is a true description, but for irrigation at the lower elevations water is not always easily managed. To pump water would be too expensive, so ways to deliver it by gravity are

preferred. In the lowland areas, irrigation water may come from sources which are only a few feet higher than the places of intended use. Back dams that create conservancies are sometimes at a low elevation, with the conservency itself covering a large area of relatively shallow water. So far, Guyana is using its low-lying rivers and conservancies for irrigation, but larger projects in the future may require some upstream-type water control, such as dams.

The quality of the water for irrigation is good in the streams, except where salt water may have intruded. This happens after low rainfall, periods which result in low stream flow. The low stream flow coupled with high tides will allow salt water intrusion upstream.

Where irrigation water is not reaching them, more and more farmers are using their tractors to pump water from drains or any source available to them.

2.4 Rice Acreage, Production, and Yields

The GOG has been seeking increased production, so that greater tonnages of milled rice for export would be available to earn foreign exchange. Guyana has a freight and tariff advantage over other rice exporters with its CARICOM customers, which amounts to at least 15 percent. Guyana has the largest area available and the greatest potential for rice production in all of the Caribbean. In spite of this, Guyana has been providing less than 75 percent of the potential market in the last few years, and by all indications (as of September) will fall far short of even this in 1982. The exports of milled rice (in long tons) for the last seven years are given below.

Year	CARICOM	Others	Total
1975	73,629	9,729	83,358
1976	71,720	98	71,818
1977	66,914	-	66,914
1978	85,754	19,007	104,761
1979	75,002	9,078	84,080
1980	68,538	3,037	71,575
1981	80,000	n/a	80,000
1982			24,000 (as of Sept. 1)

Domestic consumption has been running between about 35,000 and 40,000 tons per year.

In only one year (1977) has Guyana been able to reach its goal of producing 200,000 long tons of milled rice. The production of paddy that year was 351,151 long tons (see Table 2.4). Milled rice production figures are calculated from paddy production data using an arbitrary conversion rate of 60 percent.

In Section 2.2 of this Chapter, it was described how the RMP I brought the new rice varieties, Starbonnet and Bluebelle, into Guyana for the first time. With the rapid growth of Starbonnet in the early 1970's and a campaig to control red rice, Guyana was able to capture some of the white rice marke in the CARICOM. By the choice of varieties in the last few years, with no program for maintaining a pure line seed of Starbonnet for 10 years, by not permitting the introduction of quality rice varieties from abroad, and because of the poor milling performance of GRB, Guyana is again approaching the same position regarding quality of white milled rice for export that they found themselves in before RMP I. This is further complicated by the decline and almost complete disappearance of parboiling of rice for export. Some CARICOM customers, notably Trinidad, prefer parboiled rice and are now getting it from other countries. Guyana's parboiling problem is the breakdown of GRB facilities at Anna Regina and Burma, plus the reluctance to parboil on the part of private millers because of the inadequate price they are allowed.

The potential for rice production in Guyana with existing acreage is conservatively estimated at 250,000 tons of milled rice annually. This is assuming a cropping intensity of 1.4 (140 percent) and a yield of 20 bags per acre (1981 average was 19.2 bags). With the development of new and rehabilitated irrigation systems, more nitrogenous fertilizers, the potential will even be higher. A World Bank consultant ventures, "There are no major physical reasons why Guyana cannot plant up to 500,000 acres of rice a year (in two seasons), obtain yields of from 20 to 25 bags (2,800-3,500

pounds) per acre of paddy, produce a total of from 600,000 to 700,000 tons of paddy yielding from 360,000 to 420,000 tons of milled rice, and have surplus for export of 300,000 tons or more milled rice annually." He added that although this was reasonably possible, it is not likely to occur in the foreseeable future.

Nearly 70 percent of the total production is exported, providing over 10 percent of the country's total export earnings.

If Guyana should increase its output of milled rice, markets outside of the CARICOM would need to be developed. This would be in direct competition with other rice exporters, except for possible favorable concessions from other socialist countries (such as Libya). Guyana will have to greatly improve their quality in order to compete in the open rice export market of the world.

The total acreage, total production, and average yield per acre for rice in Guyana is given in Table 2.4, and is graphically portrayed in Figure 2.4. Rice production has fluctuated widely from year to year in the last 21 years. The acreage planted has been even more erratic due to the effect of weather. Yields per acre show a downward trend from 1960 to 1972, but from 1973 to 1981, there is a marked upswing to the high in 1981 of 19.2 bags per acre. The exception in this recent trend was 1976, when adverse weather resulted in significant decrease in acreage planted and also in yield. The recent yield is attributable to improved varieties with higher yield potential. It is interesting to note that the acreages in the three years (1979, 1980, 1981) are far below the average for the 21-year period, but the production is holding up above the 21-year average because of the increased yield per acre. According to early estimates, the decline in area planted continued in 1982.

Table 2.4

PADDY ACREAGE, PRODUCTION AND YIELD IN GUYANA, 1960-1981

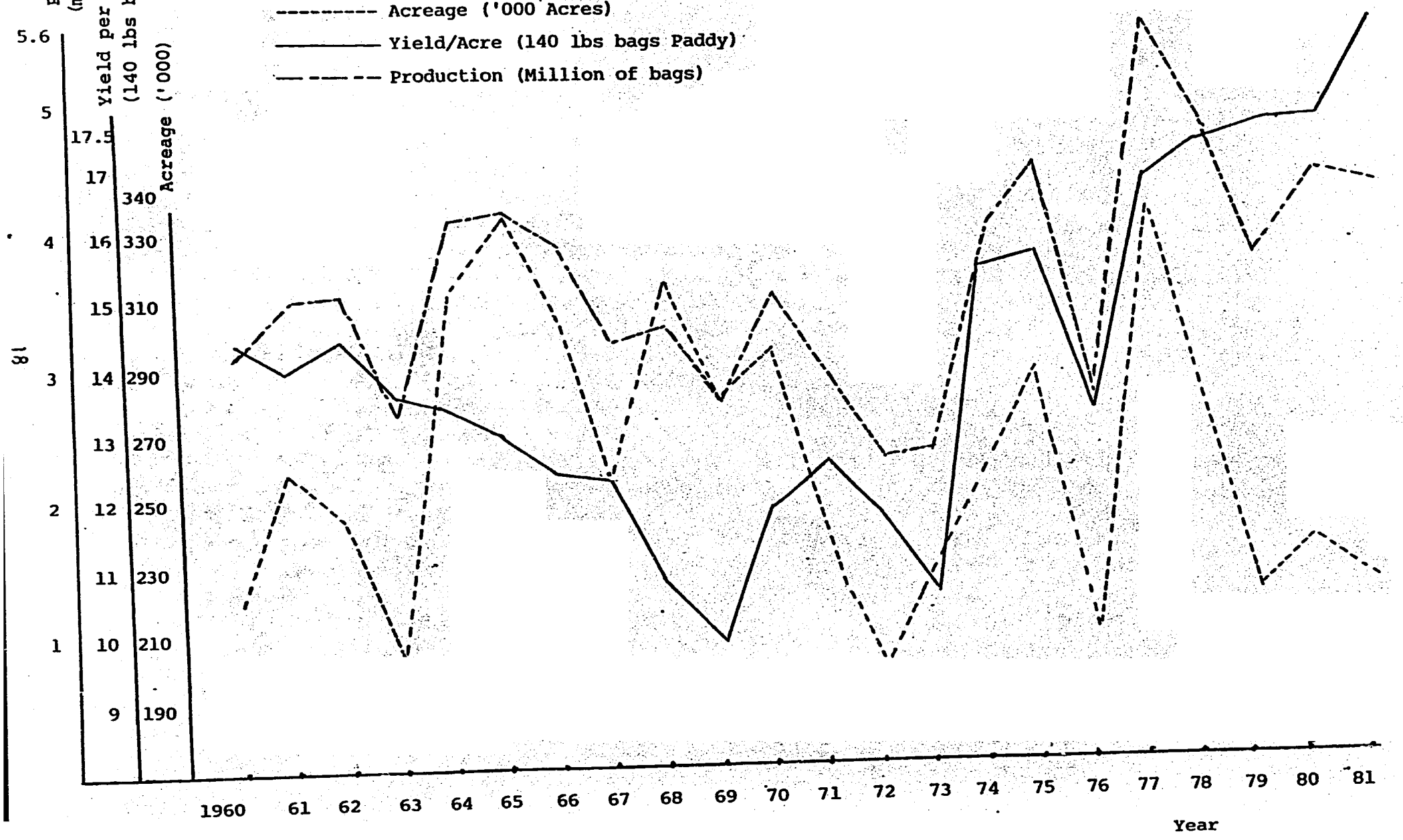
Year	Total Acreage	Total Production Bags*	Yields, Bags Per Acre*
1960	220,207	3,192,192	14.5
1961	261,349	3,551,984	14.0
1962	245,973	3,573,408	14.5
1963	201,145	2,743,584	13.6
1964	311,417	4,158,032	13.4
1965	337,231	4,397,312	13.0
1966	308,395	3,928,432	12.4
1967	253,499	3,124,064	12.3
1968	313,135	3,364,672	10.7
1969	279,303	2,728,784	9.8
1970	294,280	3,502,400	11.9
1971	233,550	2,952,480	12.6
1072	196,270	2,316,480	11.8
1973	229,270	2,398,784	10.5
1974	261,180	4,028,512	15.4
1975	287,861	4,574,208	15.9
1976	207,546	2,722,416	13.1
1977	337,322	5,617,936	16.7
1978	283,672	4,851,743	17.1
1979	222,863	3,787,072	17.6
1980	237,100	4,437.200	17.6
1981	219,962	4,345,760	19.2

* One Bag = 140 pounds

Source: 1) Guyana Rice Board
2) Ministry of Agriculture, R.D. & P. Division

Figure 2.4

PADDY: ACREAGE, PRODUCTION AND YIELD PER ACRE, 1960-1981



2.4.1 Land Preparation

Inadequate or poor land preparation can have a significant effect on yield. A poor job of land preparation will negate any subsequent good farming practices. Satisfactory land preparation, then, is a basic essential for good yields. Land preparation must be done in a limited period of time before each crop. The shortage of tractors has a direct effect on how much land can be readied for a crop during that period. The normal period available to rice farmers for land preparation is about 60 days for the spring crop and 40 to 45 days for the autumn crop. The "crunch" or critical time comes in the preparation for the larger autumn crop.

Ninety-five percent of the tractors used in rice production are privately owned and five percent are owned by GRB. The GRB has just announced they will be disposing of their farm machinery, but it has not been done so far. About 17 percent of the privately owned tractors are non-operational, but one-third of those owned by GRB are not in working condition. About two-thirds of the tractors in Guyana are ten years old or older. The proportion of older tractors is much greater for privately owned tractors (69 percent) than for GRB tractors (20 percent). Only 16 percent of the small farmers (15 acres or less) own a tractor; this group represents 79 percent of the total number of rice farms. So the great majority of small farmers must depend on tractors for hire to do their land preparation. Fifty-five percent of the 16-25 acre size farms own tractors. These account for 12 percent of the total number of rice farms. The two larger-sized farmer groups (25 to 50, and 50 acres plus) are much smaller in numbers, of course, but 86 and 94 percent, respectively, of them own their own tractors. The large family-type farms are getting larger as they rent more land from those who cannot farm it themselves, and they buy more and larger tractors. These large farms are increasing to 500-1,000 acres in size.

Less than two percent of the small farmers receive loans to purchase machinery, but their number is 48 percent of all the farmers who do receive loans. Many of the large farmers buy the tractors without the assistance of

a government loan. A further complication for the small farmer in obtaining a tractor is the size of the tractors now imported. Whereas the mechanization of rice in the country started with 30 to 35 HP tractors, and 45 to 55 HP tractors were in demand in the late 1960's and 1970's, more than two-thirds of the tractors now imported are 70 HP or more.

In land preparation, one dry ploughing is considered important for the control of some weed species and for soil aeration. It is preceded by burning as much of the straw as possible. A second dry ploughing is not widely practiced, but it may be desirable where the "first cut" was not thorough or complete. There may not always be time for a second dry cut. Harrowing (disking) can be done after the dry cuts if the dry ploughed seed bed is not too rough or too dry.

Wet ploughing is done after heavy rains or irrigation, just ahead of the planned time of planting. "Wet" conditions are either surface soil saturation or actual inundation. At least one "wet cut" is always employed to kill vegetation and incorporate residues. A second cut may be made if there is time and the tractor is available. Each wet ploughing is followed by a wet harrowing or a ramping. Ramping means running the tractor across the field; the wheels mash the soil under the wet or submerged conditions. It breaks up clods, incorporates residues, and may result in some smoothing. There is also a puddling effect from this operation, but it costs less than ploughing and harrowing.

Just before planting, a smoothing of the field is done with a large plank, log, or metal frame. This can be done with a tractor, but more and more of the tractor-less farmers are using animal power for this operation.

Ideally, every rice field should be leveled to grade when it is dry, but this is more expensive than "wet" leveling. Where leveling is being done with tractors, it is with the use of back blades or scoops. This work is almost always done in partially flooded fields. Traction is curtailed

under these conditions and thus, even though the cuts are made accurately, the fills are erratic. Generally, the cuts taken are shallow so that only a small amount of topsoil is removed at any one time.

A properly leveled field with adequate drainage will facilitate good water management, where weeds and red rice can be controlled and the potential for high yields can be realized. In one instance, the MMA project plans call for providing leveling equipment to assist farmers in properly preparing their fields before the irrigation water from the project arrives. Financial assistance will be required to implement this program. It also includes some land consolidation, which is desirable.

The great majority of plows used in land preparation are disk plows. A few of the small tractor owners have moldboard plows. They require a more exacting soil moisture content to be used, but they do a better job than the disk plow.

2.4.2 Seeding

Rice farmers in Guyana now broadcast all their seed by hand (shying). This is either into water 2 to 5 inches deep or onto wet exposed soil. In rare instances, seed is broadcast on dry soil awaiting rainfall or irrigation water to germinate it. Those sowing in wet conditions presoak the seed 48 to 72 hours. The seed has begun to sprout by the time it is broadcast.

If the rice can be sown into the water and the water left on the soil for 21 days or longer, good control of red rice, most weeds, and drop seed (volunteers) is attainable. Leaving the water on the soil requires two conditions that the majority of the farmers do not have. One is that the water must be clear and not muddy. The other is that chemicals are on hand in case snails develop in the flooded fields. Snails can be easily controlled with the simple chemical copper sulphate, but GRB has not been reliable in furnishing it on time or having alternate (and more expensive)

chemicals available. So the usual practice is to drain the fields one to two days after seeding, which in turn increases the risk of facing the problems mentioned above that flooding would have eliminated. It is estimated that less than 10 percent of the farmers are able to keep their fields flooded after sowing.

The newer paddy varieties can all emerge through the water after sowing. Starbonnet has been good in this characteristic. However, the older traditional varieties, such as B.G. 79 and Ledger, cannot do this, so the fields must be drained after sowing, or planted on exposed soil.

Different seeding rates are recommended for different varieties according to their tillering abilities, but most farmers plant one bag (140 pounds) per acre, regardless. For further discussion on seeding rates see Section 3.3.

2.4.3 Varieties

The short-statured variety, Rustic, is grown widely in the irrigation areas of Essequibo, West Demerara, and Cane Grove, with some scattered planting elsewhere. The Rustic variety has some yield advantage over Starbonnet, but is short for combining, may shatter after maturity, and has little seed dormancy. The kernel is large and bold, so it has a lower milling output than Starbonnet. Growers like the improved yields and, since they receive the same price as for Starbonnet, they will continue to grow it. The variety "N" is found in the same areas as Rustic but on a smaller acreage. It also is short and has some nitrogen responsiveness. "N" is reported to lodge and also shatter after ripening. Its grain quality is also not as good as Starbonnet.

Rustic and "N" were released from the MARDS experiment station five to seven years ago. They are about 120-day varieties (i.e., mature in 120 days).

Starbonnet is still the predominant variety in the Corentyne, BBP, and East Berbice areas. It has excellent quality and has high mill output. It is meidum height, and takes about 130 days to mature. It has the advantage in Guyana for the small farmer of being able to stand in the field up to one month after maturity.

Another variety has been grown for some time in the Corentyne area. This is IR 22, released from the International Rice Research Institute of the Philippines in the late 1960's. When released, it had excellent kernel quality and good yield potential. It has a thin, fine kernel that was well accepted in Asia for its taste. Growers in the Corentyne started to use it many years ago; they have kept the variety going because they like its yielding ability, and it is preferred in parboiling for domestic consumption. IR 22 did not even enjoy the privilege of being called an "approved variety," although it was superior to some of those that were. For this reason, no attention has been paid to keeping the seed line pure, and it has probably declined in quality from the original variety as released.

An area on the Mahaicony branch road has a few farmers still growing Hybrid "B". It is short-statured like Rustic and "N", but it was not possible to compare its yielding ability. This is another case where farmers obtained a small amount of seed some time ago and have kept the variety going in their locality. Hybrid "B" is reputed to have very good quality and is liked by the growers of the area. Fields observed were badly mixed with other varieties.

In areas where there is no irrigation or where some flooding may occur, the traditional varieties are grown in the autumn crop period on a one-crop-a-year basis. BG 79 is the most widely planted variety; Ledger and a few others are also used. The traditional varieties are planted in some of the MMA areas, Frontlands, the Essequibo Islands, and other scattered locations.

More detailed and further discussions on varieties are found in Section 3.3.

2.4.4 Fertilizers

The use of fertilizer on rice in Guyana is dictated (or set) by what GRB allows a farmer to buy. This is generally one bag (110 pounds) of urea and one-half bag (55 pounds) of treble super phosphate per acre. This amounts to 50.5 N and 23 P_2O_5 in actual nutrients. To the question asked farmers in interviews, "How much would you buy if you could have all you want?," the majority responded two bags of urea or a little more. This would come closer to fitting the yield potential of the present varieties, but would still be below the level needed for more modern high-yielding varieties (HYV) not yet used in Guyana.

No fertilizer is allowed for the traditional varieties. This makes some sense when considering their yielding ability compared to the nitrogen-responsive varieties; but on the other hand, the farmer who must grow traditional varieties in the situation described in paragraph 2.3 (above) is already in a tenuous position, and a little fertilizer would give his crop a boost.

Farmers discrimiante against IR 22 for another reason: growers of this variety can receive only half a bag of urea per acre. This approach to variety allotment of fertilizer is not justified because IR 22 is more nitrogen-responsive than most of the varieties receiving the one-bag allotment. No reason is known for this irrational approach to fertilizer allocation.

Before the (about 50 percent) subsidy on fertilizer was removed in 1981, there was some movement of urea to Suriname; urea was also sold to food crop growers for a higher price than the rice farmer had paid for it. The latter may still be practiced by farmers who can accumulate some extra fertilizer, or choose not to use it all on their crops. The great majority of farmers do use the fertilizer on their rice crops because they realize it is not as much as they should be using for best results.

A few farmers interviewed can somehow obtain more than one bag of urea per acre to use on some fields. It is never explained where it comes from, but it may be from shifting allotments from other fields, or by holding back some fertilizer not used on a previous crop. Fertilizer deliveries are sometimes late, and farmers could correctly decide to wait and use that fertilizer on the next crop than apply it too late on the present crop.

Only one farmer interviewed had used more than two bags of urea per acre and he was the Deputy to the Regional Chairman. His yield was a respectable 31 bags per acre (4.8 t/ha).

Rice farmers apply their TSP either at planting time or 14 days after planting (DAP). The urea is applied in two applications. Forty pounds are top-dressed 14-21 DAP and 70 pounds at 56 to 60 DAP. The fertilizer is all put on by hand. If the rice is flooded at the time, the water is lowered to about two inches. Many farmers completely drain their fields at time of urea application, but this is not recommended. The water should be left on the soil and even raised to prevent as much denitrification as possible.

As seen from the air, many fertilizer applications have a herring-bone pattern. The applicators are applying it in streaks with each handful or thrust. This means the heavy streak area will have a rate of fertilizer two to three times the intended rate and adjacent areas in between will be half or less. If rice farmers should ever be allotted their two bags per acre, they will need to be more careful and deliberate in the application of fertilizer. Also, some studies would be needed to more closely determine the optimum time of application and the loss of nitrogen to denitrification by top-dressing.

2.4.5 Insect, Disease, and Pest Control

In addition to the previously-mentioned snail pest, there are three major insect problems in the rice fields of Guyana. A fourth insect, according to some agricultural experts, may be causing much more damage than

is recognized. This is the water weevil. Farmers formerly used seed treatment for control of the water weevil. Seed treatment for this problem and also the use of fungicide has been abandoned by farmers. The extent of damage needs to be studied to determine if control is again necessary.

Leaf miner (heartworm), stemborer, and paddy bug are all recognized by farmers as capable of causing heavy crop losses and, thus, receive specific attention. Two applications are made for leaf miner control, at 14 DAP and 30 to 40 DAP. Folithion (Fenitrothion) is used. The chemical also gives control of any caterpillars present. Most farmers spray at 65 to 70 DAP with monocrotophos (Azodrin) as a preventative control measure for stemborers, even though this particular insect may not be a problem in every crop or during every year. Furadan is the most widely used chemical around the world, and is accepted as giving the most reliable control of stemborers, but Guyana has not yet adopted this chemical. Its main advantage is that it can be applied as granules and is systematic. Monocrotophos is also systematic but must be applied as a liquid.

Normally, paddy bug has been known to occur as an economical pest about 50 percent of the time. When it was encountered in the past, farmers would spray with monocrotophos soon after the crop reached the milk stage. This also controlled other insects that might be present at the time, such as hoppers and caterpillars. The outbreak of paddy bug in late 1981 and the two crops of 1982 is also discussed in Section 3.8. Outbreaks have occurred before, but farmers interviewed do not recall one as serious as the present one. Investigations are urgently needed by competent professionals to determine the extent of damage and the cause for such a heavy build-up of the insect.

Guyana is fortunate not to have some of the destructive disease-carrying insects of Asia, and thus varieties resistant to, for example, the brown planthopper, are not needed.

Diseases are not as serious a constraint to rice production in Guyana as they are in most other tropical rice-growing areas in the world. The most damaging disease is late infections of blast which causes sheath or neck rot. This problem shows up after several days of high humidity (90 percent) and heavy dew in the fields. Damage can be severe if these weather conditions happen when the rice is just beginning to head out and the foliage is dense. An adequate rice extension staff could monitor such situations closely and warn farmers when neck or sheath blast is most likely to develop. By spraying at an early stage of the development, the disease can be controlled with Kitazin or Hinosan. If spraying is delayed until disease is already established, the treatment will help cut down damage but will not control the disease. Spraying after the disease has developed is usually a waste of money. Kitazin and Hinosan are expensive chemicals, so should be used wisely.

Where there are qualified extension staff to provide farmers with warnings that weather conditions favor an outbreak, only 15 to 25 percent of the farmers have used control measures. When considering the inadequate coverage of rice extension programs in the country, the potential exists for a serious outbreak of this disease in the country.

A few farmers have mentioned that rats can be a problem in dry years, but except for sporadic localized outbreaks, they are not a serious pest in rice in Guyana. Farmers who encounter this pest use poisoned baits for rat control.

GRB, as the supplier of agro-chemicals, has in the last few years been furnishing about 80 percent of the chemicals requested by farmers. In the last two years, allotments have fallen below this level.

2.4.6 Irrigation and Water Management

A properly-operated irrigation system in Guyana, which included full cooperation of farmers, would be able to deliver water for land preparation to a given block or distributory on a fair rotational basis, supply

crop water requirements to each field for continuous flood (in conjunction with effective rainfall utilization by each farmer), keep drainage from fields to an absolute minimum, and have all ditches, drains, and the needed structures well maintained and operating. This situation rarely exists. The lack of water control by the irrigation managers and farmers themselves is a major factor in limiting yields. In addition to the deficiencies in irrigation management, some fields are too high or too uneven for reliable irrigation performance. Farmers do not coordinate their field activities by blocks or irrigation outlets, and some make unauthorized use of facilities. There is also much water waste by farmers. In addition, they do not generally pay for the water used.

Rice acreage can be increased, yields improved, and the efficiency of water use greatly increased with better water management. The present approach is inadequate. This is of particular concern to those involved with projects where a limited source of water is involved, such as run-of-river water sources found in Guyana irrigation projects. Efficient water management in the irrigation systems and at the farm level will greatly increase the area that can be served by a given water source. It is not unreasonable to suggest that a doubling of both rice yields and the potential irrigable area could be attained with proper water management and the provision of necessary inputs in all of the irrigated areas of Guyana.

2.4.7 Harvesting and Transport

Almost all of the rice in Guyana is harvested with combine harvesters. A small number of farmers cut the rice by hand and haul it to concrete floors or to the highway, where tractors are used to "tread thresh" it. The usually stated reasons for using this second method are that (1) the field was too poorly drained to support a combine harvester, or that (2) the crop was so poor that combine operators refused to enter the field.

The Harza report (1975) quoted a USAID estimate that there was a 30 percent loss in harvesting in Guyana due to shattering, and incorrect

combine settings and use. This estimate may be high, but substantial losses can occur from any one or a combination of factors:

(1) Late harvest due to combine availability;

(2) Problems associated with particular varieties such as lodging, shattering after maturity, short stature;

(3) Improper combine settings and operation.

Approximately one-third of the 438 combines in Guyana are inoperable. But there are many problems facing the combine owner or operator besides the persistent shortage of spare parts and other problems of machine operation. Fields poorly drained in preparation for harvest result in wet areas that hinder efficient machine operation. Where planting has not been coordinated by area or block, individual fields that do contain the proper moisture for best harvesting may be widely separated. Harvesting thus requires moves with heavy equipment for what are at times small harvestable acreages. Fields not ready for harvest may have to be crossed with the machinery so that mature fields can be reached. As a result, many fields are harvested at inappropriate times. It should also be noted that some varieties have significant shatter losses in the field if not harvested soon after maturity.

Nearly two-thirds of the combines in Guyana are at least ten years old, with an average age of 12.5 years for those owned by farmers. Two-thirds are owned by farmers, but combine owners comprise only two percent of the total number of farmers in Guyana.

GRB, owning one-third of the combines in the country, is more involved in combine operation for hire than in the use of tractors for land preparation. Therefore, large numbers of farmers must depend on the custom hire of GRB combines for harvesting.

Farmers are charged a per-bag fee for the harvesting of their rice crops. The GRB has been charging a lower (subsidized) price than private operators. Variations in fees charged are due to differences encountered in field conditions, accessibility, etc. When charged by the bag, it is

not surprising to find that farmers use the largest bags available. The determination of yields per acre thus becomes confusing unless actual weights are used or bag yield is converted to the 140-pound bag standard.

There are still many Case 10 and 12-foot cut combines operating even though their manufacture ceased eight years ago. All of the new combines are 14-foot cut with increased operating capacities. All of the old machines and some of the new ones have sacking devices attached. Many of the newer combines have bulk bins. During harvesting, a crew of men will await the combine at the end of the field (near a road if possible) and sack the rice as it comes from the grain spout of the bulk bin. The harvest period at the end of each of the two annual crops can last 40 days or more. Combines are often required to operate for longer periods in order to complete the harvest.

The newer 14-foot cut harvesters can combine up to 20 acres in an eight-hour day. At the national average yield of 19.2 140-pound bags per acre, the output would be about 380 bags per combine per day. The old Case combines can do 50 to 60 percent of this amount. The newer combines are expected to harvest from 650 to 840 acres per crop.

Harvested rice is transported from the field to homes, private mills, or the GRB silos by tractor trailers. Timely transport allows drying to begin promptly. Furthermore, bagged rice left in the field may become rain-soaked if not covered; this will result in deterioration of the rice quality. Currently, there is a shortage of trailers for hauling rice, but damage is kept to a minimum through their full utilization when it is possible. The charge for transport from the field varies with distance, but even more widely when road conditions are bad.

2.4.8 Weed Control

Effective weed control techniques are available to rice farmers in Guyana. But not all farmers employ them. Red rice continues to be a problem also. An effective weed control program must include a combination

of cultural practices and the use of herbicides. Red rice competes with the planted rice. It may shatter before harvest and not contribute to the yield output. However, if it is harvested (reaped) with the crop, it reduces the quality of milled rice. The use of red rice-free seed, puddling during seedbed preparation, seeding in the water, and maintenance of a continuous flood are the most effective techniques to control red rice, since this cannot be done chemically. Farmers who save their own seed would do well to carefully rogue for red rice in the seed-producing portions of their fields.

Many species of broadleaf weeds, grasses, and sedges are found in Guyana. Only a few are of major concern. The most serious weed pest, because of its severe competition with rice, is muraina grass (called "rock steady" in some areas). It can be controlled by flooding at planting time, but when fields are drained, it will germinate and grow so vigorously that rice can be completely crowded out. Muraina grass seed also ends up in harvested rice and must be cleaned out. Jhussia, a small sedge, follows a similar course of development.

Propanil is an expensive chemical whose cost was heavily subsidized before 1981. It will selectively kill grasses in growing rice. However, only about 60 percent of the farmer-requested seed can be met. Most farmers spray, as a minimum, the higher portions of their fields. This is normally about one-third of the total area.

Some barnyard grass is also found in rice fields in Guyana, as are a few other grasses. Other sedges include molasses grass and small bisi-bisi. Those sedges that do emerge through the water can be controlled or retarded with the phenoxy compounds.

Special species of broadleaf weeds occur in rice in Guyana also. These can be controlled by using phenoxy sprays (2,4-D, MCPA, or mixtures of the two). The normal time to spray is six weeks after planting, but this may vary depending on the stage of growth of rice and weeds. The practice of Guyanese farmers is to spot-spray where infestations are heavy, instead of giving complete coverage to a field.

2.5 Production Costs and Net Income

Although the rice farmers in Guyana are private producers who are motivated by profit, the government through GRB has absolute control over prices to be paid for the product, cost of inputs, and the sales and marketing of the rice. GRB determines the price of milled rice for the domestic market and handles all sales for export. The net earnings are used for operating costs, with the surplus intended to produce foreign exchange for the government.

The government used to subsidize fertilizer sales and also several chemicals (including the expensive Propanil) until 1981, when all subsidies were removed. The price paid to farmers for paddy was raised periodically from 1975 to 1981, in no prescribed pattern but presumably to respond to producers' increased costs and inflation, since the prices were below what farmers would have received under a free market system. From 1975 to 1979, there was a minimal 10 percent increase in prices for farmers' paddy, but during the high-inflation period of 1980 to 1982, the increase was approximately 30 percent. The late-1981 increases were considered to be in response to the loss of the input subsidies.

Since about 1977, several cost studies and crop budgets have been prepared on rice production in Guyana. Most of them showed cost of production at different yield levels. In general, it required a yield of about 25 bags per acre for a profitable enterprise. This yield level is well above the national average since 1977 and up to the present. With the low profitability of rice farming indicated in these studies, and the removal of subsidies, there has been increased interest to determine the price of rice now needed to give farmers a fair income. One study recently completed showed that although prices for paddy had been increased significantly since 1977, real income for the producer had declined. There has been a 15 percent increase in prices since that study. Further studies are not available to determine whether or not this meets the need of rice farmers to maintain a parity based on 1977 income.

With the world market price for milled rice now declining, and GRB faced with inefficient operations, the outlook for higher prices for the producers of paddy appears dim.

There is a recognized need to increase the net income for rice farmers in Guyana, not only for his benefit but also to stimulate much-needed production at this time. Increased prices to the farmer would be expected to prevent the leakages of revenue and foreign exchange that are occurring at present via illegal domestic and foreign sales.

Finally, the increase in the price of rice to the farmer is important, but it is not considered the absolute solution for the rice producer. Removing all the constraints mentioned previously in this report and discussed in more detail in Chapter 3, could substantially increase per acre production and thus the net income for the rice farmer.

2.6 Supporting Services

As pointed out, government agencies play a major role in all aspects of rice farming in Guyana. Private rice millers formerly handled a large share of the crop but their participation has been declining rapidly in the last few years (see Section 3.7). Actually, rice production in Guyana is now almost solely dependent upon government agencies for supporting services. The role of private industry is practically nil.

The supporting services of research, extension, and seed production are discussed in Section 3.4. However, agricultural credit is not covered in Chapter 3. Credit is an important element in all types of farming almost anywhere in the world. Credit available for rice farmers in Guyana has been declining rather rapidly in recent years. The GRB was formerly an important source of short-term production credit for rice farmers. That agency was able to handle 50 percent or more of the needs about 10 years ago, but this has declined to 20 percent or less now. Rice farmers who require credit to

continue farming must turn to relatives, friends or neighbors, commercial banks, merchants, or money lenders. Using these sources of financing, they must pay a much higher interest rate than the 10 percent charged by the GRB. Another problem with the credit that is available at the GRB is the amount of paper work required for the loan processing and the delay in loan approvals.

The Guyana Cooperative Agricultural and Industrial Development Bank (GAIBANK) provides some loans for the purchase of land and machinery. GAIBANK occasionally makes cash loans to farmers for land preparation and harvesting where repayment is assured on a short-term basis.

Chapter 3

POLICY RECOMMENDATIONS FOR RICE

3.1 Introductory Comment

Rice has been a consistent earner of foreign exchange and has a good export potential considered better in the long run than that for sugar. Rice is the most important commodity in the Guyanese diet. Rice production affects more farm families in the country than any other commodity, yet the income from the crop itself is not sufficient to fully sustain the majority of them. Rice production, unlike the two other foreign exchange earners (bauxite and sugar), is controlled by small private farmers. Therefore, the rice subsector should receive a different approach in policy considerations. Policies affecting the rice subsector should be supportive and should be price and market oriented.

Given the extensive knowledge, experience, and interest rice farmers of Guyana have in rice production, and their ambition and desire to produce the maximum, there exists an untapped potential of production in the country in the event the Guyanese rice farmer is provided with the following:

(1) irrigation water for land preparation one month before each wet season;

(2) irrigation water when needed (at intervals of not more then two weeks);

(3) operable drainage facilities at all times;

(4) spare parts for tractors in stock at easily accessible locations, and sold at fair prices;

(5) two to 2.5 bags of urea (or more) per acre in stock and available at the start of each crop season, with stores open six days a week at least ten hours per day; and finally

(6) a high yielding, good quality variety of paddy with good standability and some seed dormancy:

then, he will produce at least 32 bags per acre (5.0 t/ha) in the autumn crop and 35 bags per acre (5.4 t/ha) in the spring crop, or an average yield of about 50 percent above current yields.

In light of the above potential, it seems advisable in policy considerations for the country to give attention first and foremost to the welfare and support of the small rice farmer.

A critical need in the country at present, and particularly to accompany any such boost in production as suggested above, would be roads. As many all-weather roads as possible are needed, but admittedly they are expensive. Stabilizing the road beds in the rice areas with locally-available materials is said to be possible. Improvement of roads needs study and cost estimates, and a concerted national follow-up program. Even the possibility of narrow-gauge railroads with tractor or oxen power as all-weather methods to move produce out and inputs in to rice areas, may be feasible even though the original investment is high.

In the following sections of this Chapter, the areas or subsectors of the rice industry that have problems and needs are discussed. Recommendations are offered for consideration to be included in the Agricultural Sector Plan for Guyana.

3.2 Irrigation, Drainage, and Water Management

3.2.1 Problems of Maintenance Administration

Nearly all of the agriculture and 90 percent of the people of Guyana are in the coastal plain of the country. This area comprises only 14 percent of the total land area. The coastal plain is low-lying and needs protection from the sea. The gradient of the main rivers is only one foot per mile. Tides affect inland waters for 40 to 50 miles where river or stream openings are not blocked by sandbars. Overall natural drainage is poor, so drainage systems must be installed before crops can

be grown. Drainage is a basic requirement for producing crops in the low-lying, relatively flat coastal plain of Guyana.

Used irrigation water or water to be drained (from storms or accumulated sources) is now removed by gravity or pumps at low tide along most of the coastal plain. Tides and rainstorms have a considerable effect on coastal drainage systems.

The irrigation and drainage systems for sugar estates were built in the 18th and 19th centuries. Each estate has an elaborate system of dikes, dams ("back dams" also), and irrigation and drainage canals. These systems take up as much as one-eighth of the total land, but are necessary to grow and transport such a crop as sugarcane on these low-lying soils. It is estimated that there are over 5,000 miles of canals in the sugar estates of Guyana alone.

Irrigation and drainage systems for rice areas are not as well designed or laid out as for the sugar estates except where well-financed projects have been completed. Some areas that did not have organized and planned systems have since been abandoned. These usually also lacked farmer coordination of activities and receive little attention from the Local Authority or from the Drainage and Irrigation Board (Hydraulics Division, Ministry of Agriculture).

In some cases, well constructed irrigation and drainage systems have deteriorated or are no longer operational. In other areas, such as the West Demerara, rice is being irrigated below the sugar estates using the estates' "back dams" as sources of water. This has been generally successful, but water is needed by the two crops at widely varying times and coordination is difficult.

Interviews were held with the Acting Chief Hydraulics Officer in charge of Drainage and Irrigation (D & I), and with the Local Authority (LA) Officer in charge of the coastal region in the Regional Development Ministry.

The former interview was held in the company of fellow consultant M. S. Hanrahan. Team Leader, Dr. R. M. Reeser, participated in the latter interviews.

The National Drainage and Irrigation Board has been preparing estimates each year in "designated irrigated areas" as to the expected costs for drainage and irrigation. The Drainage and Irrigation Board is run by the Hydraulics Division of the MOA. GUYSUCO makes estimates for their sugar areas and for surrounding farmers who get water from them. The Local Authority (LA) covers the other areas needing either irrigation or drainage.

Hydraulics, Ministry of Agriculture

Hydraulics identifies each item of work to be done and the acreage involved in the area. The rate in a given area is the total cost divided by the acreage. This gives a rate per acre to be billed to the farmer. There are many problems in collection. About one-third of the farmers do not pay at all, and many more do not pay the full rate. There are problems collecting in the development schemes (Black Bush Polder, Cane Grove, etc.). The collections are supposed to be made by the LA but, according to the Hydraulics Officer, the LA's look after their own interest first and sometimes remit nothing to the D & I. The LA charges their rates in addition to what is charged by the D & I Board. The D & I Board has a collection unit, but the job is just too massive to properly manage.

For instance, the Black Bush Polder (BBP) assessment is $1.5 million but collection is only $0.5 million. The D & I assessment has been $7.50 per acre since 1962, but now with the LA addition, it is $17.50 per acre. This created problems for D & I in collecting any amount of the assessment and the LA takes their cut first. The government helps out when the situation becomes critical or drastic by providing funds for works in critical areas. Collections fell to new lows in 1982.

Because of the uncertainty of funds coming in, D & I has not been able to employ specialized people on a permanent basis. As a result, they hire people on-the-spot when money becomes available so they cannot be too selective about whom they hire. This affects the quality of the job they can do.

D & I can take private landowners to court for non-payment, but judgments are difficult to obtain because of technicalities (such as having the exact registration for land). Those in land development schemes are exempt from this type of action.

The new regionalization (i.e., decentralization) of all agencies has the Hydraulics Division in a quandary. At this time, it is not known whether the D & I Board will be abolished. The civil servants of the D & I at the regional level will be under a local agency influenced by local politics. They have not in the past been faced with managing their own finances, and may not be equipped to do so. At this time, it is difficult to predict who will be responsible for drainage and irrigation functions in the regions. This will have to be settled in the near future. Delays or mis-management will result in the farmer being the ultimate loser.

Projects directly managed by Hydraulics, such as Tapakuma, BBP, Cane Grove, sea defenses, etc., will probably continue on the same basis as before. Hydraulics has given priority to large projects. It is necessary to have someone directly in charge and responsible in order to satisfy the international lending institutions. Also some projects or problems are national in scope and would not work under local or regional control. An example cited was sea defenses. It was expressed by the Hydraulics Officer that the regions will not be able to handle many of the day-to-day operational functions of D & I. If they cannot, it may mean that many important tasks will be neglected.

In the past, major canals and drains were the responsibility of D & I. Secondary canals and drains were the responsibility of the LA. It may be

that more self-help in the latter can result from regionalization, according to the Hydraulics Officer.

Engineers are needed to manage the mechanics of irrigation and drainage systems. Each region would not be able to provide these engineers, so a group of technical people (engineers) will need to be based in Georgetown to assist regions with their problems.

Local Authority, Ministry of Regional Development

The Local Authority (LA) make a levy (or rate) on a farmer on the basis of the evaluation of his land and buildings. The rate is based on expected expenditures. The LA incorporates D & I rates into their own rates. The money must be received before any work can be done. Farmers give a low priority to paying their assessments; some do not pay at all and others pay only part of the money. When the total received is less than the LA assessment, then nothing is remitted to D & I. They do not have a system of sharing with D & I; rather, D & I will only receive money once LA has been satisfied. (This is not a satisfactory way of collecting assessments - one agency collecting for two agencies and looking out for its own interests first.)

A local village or district LA office typically would have a staff of an overseer, an assistant overseer, a ranger, and a typist. Except in the larger cities (Georgetown, New Amsterdam, Linden), the LA's do not have equipment; they rent private equipment or pay D & I for work requested from them. The LA's did at one time start to accumulate an equipment pool, but that equipment has since been reallocated to the Ministry. Equipment to get the work done is scarce and difficult to find. The sugar estates have been coming to the assistance of the LA in some places by making machinery available in their off-season. Their machinery situation is becoming more critical, so such aid from the sugar estates is likely to decline or be completely stopped in the future. The equipment made available by the

Hydraulics Division in the past will also become scarcer with the overall machinery crisis in the country, plus the effect of regionalization on the Hydraulics Division.

The LA's are in charge of the kokers outside of the D & I areas, while those in the D & I areas are run by the Hydraulics Division.

The Local Authority system has been in operation for over 100 years. Rate collections historically were apparently good, but in the last 10-12 years, collections have dropped to 40-50 percent. The LA has three methods of recovering from deliquents: (1) through the courts, but they are all so slow and cumbersome that for practical purposes, they do not work; (2) LA's have made some collections recently through the GRB in the Essequibo area; and (3) under regionalization, regional councils will become responsible for collections. No one is predicting at this time how successful the regional councils will be.

It is interesting that the LA official felt that a D & I policy board was still very much needed, and should not be abolished with the regionalization process. He stated this in spite of their problems in rate collection and conflicting functions.

The LA official felt that regionalization may result in an improvement in the LA's operations and functions. He was ambiguous, however, and admitted this may not be the result. He felt that the regional control would have a more "local" character or approach to irrigation and drainage problems, as compared to the central government control of the past. He suggested that government employees in regions may get more pay, and that more responsible performance would result from this. According to the LA official, there has been a great need for farmers to be better informed and to understand the problems facing the LA and D & I.

Conservancy rates are also collected by the LA. These are usually (but not always) under the control of sugar estates. Farmers must pay

even if they do not get water. The irrigation sources and systems in these cases are designed and geared to estate needs more than for other crops and outside farmers.

When farmers provide their own work in drains and canals, there is a "labor rate system" through which they can get credit against their assessments.

3.2.2 Farmer Problems

In every area visited in the rice growing sections of Guyana, there were complaints about irrigation water problems and lack of adequate drainage. Only one farmer said he got water on a regular basis (every two weeks) and that his drainage was adequate. (And his rice yield was 24 bags (3,360 pounds) per acre or 3.8 mt/ha). There are undoubtedly others in this same situation, but by far the majority of farmers have problems to air about the irrigation and drainage situation in their locality. The general attitude expressed was that nothing is done on drainage even if they pay the LA.

For some farmers, the lack of adequate drainage may mean a crop cannot be planted, or they experience damage to their crop as a result of inadequate drainage. Also, they are, in some cases, assessed for irrigation even when the water is never delivered or does not reach them. These are probably some of the reasons (justified or not) that farmers have for not paying their assessments. As stated in the Hanrahan report* on Food Crops, "The position of the farmers is that they are victims of this system of diffuse, overlapping authority and responsibility." On the other hand, the rice farmers of Guyana tend to be very individualistic in their concerns and actions regarding irrigation and drainage. A complication is the diversity

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* Checchi and Company specialist's report by Michael Hanrahan, July 21, 1982, "Expanded Production of Food Crops."

of religious, ethnic, and cultural backgrounds of the Indo-Guyanese farmers. Too many times they handle their own water situation on their plots to suit their needs with complete disregard for those around them.

Another problem is that farmers who do pay their rates feel that this completely divests them of any responsibility to do anything about drainage or to take part in any joint efforts whatsoever. Everything is left up to the LA or D & I from there on. This is self-defeating, especially if the LA and D & I are not able to provide the help. One fairly large area visited had a very small portion of it in rice for the autumn crop of 1982. This was due to a lack of drainage. This area was all in rice in years past. The farmers complained that the LA in this case was doing nothing, so they were without a rice crop. Also, they were paying lend rant even when a crop was not grown, and the landlord was unwilling to help. They could not see that they would be much better off to cooperate and clean the drain themselves. The difference would be having a crop vs. no crop, but the tendency once rates are paid is for farmers to rationalize that someone else is responsible and they do nothing for themselves. Admittedly, in some situations, the needed work may either require heavy machinery, or be done more rapidly with heavy machinery, but in many instances, farmers can do the tasks themselves.

Farmers near the main canals of Polder Number Two Drain complained that the dragline that used to keep the drain clean is not operable and there has been no replacement. The canal is filled with vegetation resulting in the flooding of many farms and causing heavy crop losses. The manatee would be an ideal solution to this problem. When it was suggested to a group of sugarcane farmers (whose crops are being damaged) that manatees be put in the ditch and protected, the suggestion was met with laughter. It is a sad comment in farmer cooperation and discipline when the eating of a few manatees can be more important than growing crops for a livelihood. A community that could organize its members to undertake such an approach, and that could voluntarily police themselves and punish those who did not comply, would be much stronger and would find they could accomplish many more needed projects cooperatively.

3.2.3 Reduction of Irrigation Water Requirement

Another problem in irrigation and drainage in rice culture in Guyana is the lack of understanding or concern on the part of irrigation engineers and managers of irrigation systems about the farmers' crop and its needs. Farmers' complaints about the managing of irrigation systems are that they cannot get the water when they want it, but do get water when they don't want it.

Engineers tend to believe that it is up to the farmer to get the rice crop going, and then they will provide water for the crop. The greatest benefit of an irrigation project to a rice farmer is to supply water two to four weeks before the rainy season normally starts. This allows the farmer to prepare his wet land, plant his rice and have it already growing well when the rainy season commences. In this way, his crop will take full advantage of the precipitation during the major part of the growing period, greatly reducing the total irrigation water requirement (IWR) of the crop. Irrigation water requirement studies by PRC/ECI consultants in the BBP Frontlands, Block III project demonstrated that by supplying water for early planting, the rice crop in the autumn season would get 75 to 80 percent of its IWR from rainfall, compared to only 60 percent where no water is supplied until the crop has been started by rainfall. The latter is the normal practice. With no irrigation water supplied for land preparation and planting, farmers must wait until there is sufficient rainfall to get their rice crop going. The later-planted rice then matures later, in the dry season, requiring more irrigation water than an earlier planted crop.

The same principle is true for the spring crop, except that the difference between the early (46 percent of water needs supplied by rainfall) and later planting after rains (50 percent from rainfall) is not as great as with the autumn crop. The rainy season supporting the spring crop is shorter, and the total amount of rainfall (27 inches) is less than what normally occurs in the longer autumn crop season (35 inches) (Georgetown data).

The IWR for the spring crop can also be greatly reduced by early planting of early maturing varieties. Farmers and irrigation engineers alike are unaware of the potential for reducing IWR.

With more efficient use of irrigation water, the total requirement can be reduced. The size of the irrigation works can be reduced, or the water available can irrigate a larger area.

Irrigation engineers should understand the crop needs and the farmers' operations. The farmers should cooperate fully in taking water deliveries and releasing excess water (drainage). There is a great need for closer coordination and liaison between those responsible for running the irrigation works and the users or farmers (see further comments below).

3.2.4 Water Management

There is much room for improvement in the water management practices of rice farmers in Guyana. Farmers do not coordinate their irrigation and field activities by water distributaries, irrigation outlets, or blocks. Some make unauthorized use of water or drain water at an unfavorable time for those below them. Some fields have high areas or uneven land that should be leveled for efficient use of irrigation water. During the growing season, many farmers do not have an understanding of maximizing the use of rainfall for crop production. They drain fields of rainfall that should be trapped and held in the field. This causes a strain on the drainage facilities at the time, and results in a greater reliance on irrigation water later, which would not be necessary if the rain water had been "saved."

Water management by small rice farmers in irrigation schemes is receiving special attention and much increased interest and activity around the world. IRRI has instigated many studies; the Asian Development Bank has prepared a publication on the subject. and the World Bank has increased the concern for better water management in the extensive irrigation projects they finance. An example of the World Bank concern is their insistence

that farmers in all the irrigation projects in India form "warabundi" organizations at each chok (irrigation outlet). These warabundi are self-governed farmer groups who determine how the water will be distributed on each farmer's field. The farmers' warabundi group is responsible for the maintenance of all ditches and drains within their warabundi.

Some of the oldest organized and managed irrigation systems in the world are found on the island of Bali in Indonesia. Decisions are made by village councils as to who gets water, and when. The council leaders are also the religious leaders, but village farmers are consulted and the decisions are mutually agreed upon. There is a shortage of water on Bali so some of the areas must go without crop water for one crop period on a rotational basis. This is all worked out to the mutual satisfaction of everyone. Water is efficiently distributed and maximum use made of it. The villages and farmers have been running their irrigation systems for centuries without government assistance.

In the Philippines and Indonesia, pilot farms are set up in communities where irrigation projects exist or are being built. Such farms may be 20 to 40 ha. (50-100 acres) but is usually the area served by an irrigation outlet, and is made up of the fields of several individual farmers. All ditches and structures are installed to properly distribute the water. Farmers all agree to keep ditches clean and to abide by the decisions of those in charge of the project.

A general plan is agreed upon before the project starts and the farmers are to be consulted when decisions are to be made on any changes in the water distribution plan. All needed inputs are arranged for and the projects may have land preparation or harvest machinery to test or demonstrate. The extension service is usually an active participant, along with the government irrigation personnel who are in charge. Accurate records are kept as to rainfall evapo-transpiration, percolation, seepage, and all data pertinent to crop water use. Water delivered is measured and recorded for each field. Recommended rice varieties and fertilizer levels

are used on the pilot farm. Surrounding farmers are called in for field meetings and demonstrations. The goal is to have all farmers in the project area organize the work in a similar manner.

Thailand is embarking on a similar program since they have large areas coming under World Bank and Asian Development Bank-financed irrigation projects. They have a well-organized and strong Royal Irrigation Department to conduct or organize projects, plus the national extension program that is developing rapidly and is assisting in organizing farmers.

The Hanrahan report (pages IV-10 and IV-11; see footnote on page 41), cites three other examples where farmer participation is the key to successful irrigation water management, viz. Bolivia, Upper Volta, and Bangladesh.

Irrigation and drainage is so vitally important to rice production in Guyana that all avenues leading to potentially better and more efficient water management should be explored.

The following recommendations are made:

(1) In order to develop and implement a workable solution for the drainage and irrigation needs of the rice areas of Guyana, where the present system intermingling D & I and Local Authority is not working, an international team of irrigation and drainage experts should be obtained to prepare and present to the GOG a plan that would assure that these functions are properly coordinated, equipped, administered, and financed. Farmer participation should be included in any plan formulated.

(2) A water management specialist should be appointed in the M of A. He should be one who has personally experienced the handling of irrigation water in rice production. He would be sent to IRRI for six months to a year for training in water management. While there, he would be able to collect a library of all the publications and leaflets. In Guyana, he should assemble at one location all library materials concerning water management in the country. The water management specialist should, if possible, have assistants in each irrigation project; additional assistants would be needed in some areas not served by projects. These assistants should be a part of the national extension organization. They would

act as a liaison between farmers and the irrigation project officers, and would organize farmers for efficient water use (block, water course, distributary). They would conduct meetings and educate farmers in water management. The training should also include the irrigation project engineers.

(3) The water management studies and findings of the irrigation team of BBP should be published or made into a manual, before the termination of that contract.

(4) All irrigation projects should have an advisory board of farmers that would consult with the irrigation engineers at least one month before each rainy season and at least once during the growing season. This farmer consultant board should have representatives from all the areas in a given project. The advisory board could also be used to convey complaints of farmers about the irrigation system to those in charge, and to help arbitrate in the settlement of these complaints.

(5) Demonstration of block planting (pilot farm) or some system of farmer cooperation, control, and action in distributing water and in drainage should be conducted in all irrigated areas throughout the country. Every effort should be made eventually to involve all farmers in this type of program.

3.3 Rice Varieties, Yield, and Quality

In the late 1960's, Guyana had reached a favored position in the CARICOM countries as a supplier of parboiled rice and some white rice. With the countries making economic progress after World War II, the demand for white rice began to replace some of the traditional demand for parboiled rice. Production of quality white rice requires varieties with good milling characteristics, since parboiling can correct or "cover up" some deficiencies. Taste and other "fine" quality features are not as important to rice consumers in the CARICOM as they are in, for instance, the Asian area. Eve though their preference for the good white rice quality characteristics may not be as distinct as that of the Asians, CARICOM customers have developed a knowledge of these characteristics. This awareness eventually leads to a greater preference for quality in rice.

Rice varieties in Guyana prior to 1969 were the traditional type: tall, leafy, lodging-prone, and blast-susceptible. Most had fairly desirable kernel quality characteristics, but all were low in yield potential and were photoperiod sensitive. Under the RMP I program to meet the export demand for quality white rice, the variety Starbonnet was introduced into Guyana. It is a long grain rice of excellent milling quality, good standability after maturity, and some seed dormancy, with good emergence from sowing in the water and a plant type suitable for combine harvesting. Being thus adapted to the type of mechanized cultivation used in the country, Starbonnet became well established. Following its introduction and implementation of a program to reduce red rice, the position of Guyana in the CARICOM export market improved.

The development of short, stiff-strawed, nitrogen-responsive rice varieties that were non-photoperiod sensitive and blast-resistant was also taking place in the late 1960's. This began at the International Rice Research Institute (IRRI) in the Philippines. It rapidly spread to other countries in the rice-growing regions of the world. IRRI's first varietal introduction (IR 8) had tremendous yield potential but possessed poor milling and eating qualities. In Asia, it was rejected for the latter reason quite early after introduction in 1966-67. The IRRI researchers immediately turned to gene pools in their breeding for desired kernel quality characteristics to combine with the yield potential of IR 8 of similar varieties.

Guyana's rice hybridization program also began in the late 1960's as part of the RMP I financing. The gene pool that made up IR 8 at IRRI was used to hybridize with BG 79 and other Guyanese traditional varieties. By 1971, promising lines were being tested. These were short, stiff-strawed, non-photoperiod sensitive and had greater yield potential than the established Starbonnet. Unfortunately, the new Guyanese varieties had poor milling and kernel characteristics similar to IR 8, but in some cases not as bad as IR 8. In addition, most of the varieltes are actually too short for good combining, and others had shattering or inadequate seed dormancy problems after maturity. The latter results in field losses if harvesting is not timely.

Varieties of rice and rice genetic materials available around the world have proliferated immensely as a result of the research activities at IRRI and extension of this into rice producing countries. A very large pool of material is now available to everyone. Guyana has not taken advantage of this, partly because of the loss of personnel in the rice breeding program to administrative duties, but also due to the policies developed in GRB. In the last five to seven years, Guyana has chosen to promote the Guyanese varieties developed earlier, while retaining Starbonnet. Concurrently, nothing has been done since 1969 to upgrade or maintain the seed quality of Starbonnet, and it has deteriorated markedly. (This effort was recently taken up by consultant Dr. Jeff Wang working at BBP.) The recent policies were to promote Guyanese varieties by giving them favored status in the prices paid for paddy, even though their grain and milling qualities were not good or even poor. Varieties from IRRI or other countries have not been made available to farmers, and the IR 22 that had "escaped" to growers in one area was discriminated against in price and allowable fertilizer for that variety.

Farmers quickly discovered that the new hybrid varieties outyield Starbonnet and that the paddy can be sold for the same price, so they have widely accepted these varieties in areas where some irrigation is available. The net result for the country as a whole is that the milling and grain quality of rice has declined, and Guyana finds itself in the same situation in the export market as it faced in the late 1960's. CARICOM markets are actually being lost to other suppliers who have quality rice to sell.

Many factors can affect the quality and milling yield of rice that are normally (but not always) controllable. Rice researchers in this field list many of these factors, but the most important are given as follows:

(1) Seeding rates, i.e., thickness of stand;
(2) Level of nitrogen fertilization;
(3) Fertility variation within a field;
(4) Weather at the time of seed filling and maturation;

(5) Soil moisture during maturation period, as affected by timing of draining fields, rainfall, or irrigation;

(6) Timing and technique of harvesting;

(7) Time and methods of drying;

(8) Storage conditions; and

(9) Milling efficiencies.

Even though this list is large and imposing, the starting point and needed foundation for obtaining milling and grain quality objectives in rice is the variety. The essential desirable characteristics must first be inherent in the variety. As the familiar saying goes, "You cannot make a silk purse out of a sow's ear." One private miller in Guyana recently stated that if he were allowed to market milled rice in the export market, he could make as much profit from 25 bags of Starbonnet as he could from 40 bags of Rustic. Rustic has a large bold kernel but has poor milling and grain quality. It is used for parboiling, however.

In light of the above discussion, the following recommendations are made for guidance in the making of policies involving varieties, yield, and quality of rice in Guyana:

(1) Farmers must be paid for their paddy on the basis of quality first and physical factors second. Premiums should be paid for the highest quality of paddy delivered. Farmers will readily turn to quality rice varieties even at some yield sacrifice under these circumstances. The overall market will be a much better product that is competitive in the export market.

(2) Varieties should be immediately sought out from any source available around the world, in order to find high-yielding, good quality rice adaptable to Guyana. Due to the present emergency (i.e., loss of markets), the most promising variety or varieties should be released and made available to farmers as soon as possible without the thorough testing that is normally done. Follow-up testing investigations can sort out any possible problems a variety may have. Future testing of rice varieties in Guyana should be extended to regional and on-farm trials throughout the rice areas of the country. In the interest of bettering the country's position in the rice

export market, efforts should be made to correct or remove the stigma that has been put on non-Guyanese varieties. Superior varieties are already available that should be in use in Guyana.

(3) Rice breeding in Guyana for varieties adapted to local conditions should not be discarded, but it should be secondary to the goals of recommendation (2) above, for the present. Not only may a country take pride in having its own variety or varieties, but many times special varieties are needed to fit particular local conditions. The fact should be faced, however, that it may take five to ten years to develop, test, and release a new variety. To wait on development of indigenous varieties would be further damaging to Guyana's present situation, in view of the immediacy of the need to improve the quality of marketable rice for the export market.

3.4 Research, Extention, and Seed Production

3.4.1 Research

MARDS - the Malcony-Abary Rice Development Station - was financed by an AID loan and opened in the early 1970's. It was well equipped and had adequate buildings and laboratories plus 600 acres of land. Research work has been carried on in the fields of variety breeding and screening, weed control, crop fertility, pest control, and agricultural engineering.

The original intent was to supply the station with water from a large drain ditch by gravity or pumping. As it has turned out, when farmers are using water from this ditch, there may be none available for the station; this is usually at the time it is needed most. Water control is essential to well-conducted experimental work in the field. Shortage of water at critical times has hampered the experimental work at MARDS. This has not been the major concern, however; the inability to provide and keep well-qualified staff has been the real problem. Staff members in past years have left or moved up to administrative positions. Research work at the station has been meager and limited in the last few years. Of the nine research staff positions at the station, only three are presently filled. Two staff members have recently left for Jamaica.

In the last few years, the main accomplishment of the station has been to produce breeders and foundation seed of approved varieties. Land area that would normally be in experimental plots has been used for seed production. They have tested varieties furnished by CIAT and IRRI have been tested at MARDS, and several found to be promising. However, no attempt has been made to further test them or get them out in locations around the country. This simple step could have been a very significant contribution by the station, even with limited staff.

There has been some discussion about turning over the rice research to GUYSUCO, but this is not the solution because of GUYSUCO's precarious financial position and lack of rice experience. GUYSUCO has had a very successful research program with meager facilities, whereas MARDS has had very limited success with good facilities. Making GUYSUCO responsible would only discourage that staff who are already in need of more support and finances. Plans should be designed to solve the MARDS research problems, rather than to transfer these problems to someone else. The key to the problem (as witnessed by GUYSUCO's success in the past) is qualified staff who are well supported administratively, and who receive adequate salaries and financial support for their research.

3.4.2 Extension

Vigorous, well organized, well financed extension services are rapidly being expanded in many LDC's particularly in Asia but also in other LDC's, for example, in the Middle East. The first step in establishing a strong extension service is for the government or its responsible agencies to recognize and understand the need, and to visualize the contributions than can be realized. Without this, monies and efforts spent to establish an extension program are wasted. That is what has happened in some instances in Guyana in recent years. The World Bank, in some countries, has insisted that a strong and vibrant extension program be established before multi-millions in money will be released. Their reasoning is that farmers need help, advice, and organizing guidance to fully make use of the potential of the project for increases in production.

Other steps being taken in organizing and implementing extension programs in other countries have first been to free extension agents of the menial tasks many were saddled with in the past, and to turn these tasks over to the proper agencies. A good example is the gathering of crop statistics, but there are many more and they vary from country to country. The image of the extension agent must first be raised from that of "chore boy" to information specialist and promoter of new and better production practices. The next step is to provide a corps of specialists who can train and inform the agents on a regular basis. Another goal of extension programs is to make the agents mobile with jeeps, motorcycles, or bicycles. Buildings are also needed, as centers for storing equipment and information leaflets, holding training sessions, and conducting meetings for farmers. These extension centers are sometimes very simple buildings, but they can be more extensive and even include some housing for the overnight stays of farmers who come from long distances by foot.

Many of the new extension services in the LDC's have a rigid Training and Visit (T & V) system. Training sessions are held every two weeks, and scheduled visits are made with farmers who are used as contact (progressive) farmers with demonstrations or experiments to pass information on to other farmers. This T & V system has a pyramid effect in reaching larger numbers of farmers through the extension agent. Being well trained regularly by the SMS (Subject Matter Specialist), the extension agent has useful and practical current information to pass on to farmers. He thus gains rapport and respect. This puts him in position to gain the confidence of the farmer and thus to be more effective as an extension agent.

Although the Ministry of Agriculture in Guyana has been doing some planning and talking about a national extension program for several years now, nothing has been done. One reason could be the "first step" cited on page 52, and another may be the government's reluctance to make the needed investment at this time. One thing is certain: that a national extension program would need to be free of control by regional agencies. Otherwise, it would depend on each and every one of them having a thorough understanding of the extension

programs and agreeing not to interfere. This has already been demonstrated in Guyana as not workable for extension.

A successful extension program was established on a small scale in the Tapakuma Project area. The extension agents were organized into a close-knit, cooperating group, and were well trained by an expatriate. They have an excellent "espirit de corps." Each extension agent was provided a motorcycle. They became very active in putting on demonstrations in farmers' fields to show the results being realized by a rice research consultant and his extension helpers at the project. They also organized and demonstrated block planting for the farmers in the project. By 1978-79, it was estimated that the extension and research programs had been responsible for $15 million more value of production in the area even when only 20 percent of the irrigation project works had been completed.

All the motorcycles of the extension agents at Tapakuma have since become inoperable - mostly for lack of minor spare parts. Spare parts have been on order for three to four years, but apparently no attention is being given to the need. The extension program there came under GRB after the irrigation project works were completed, but GRB has not shown much support for or direction of the program. And now regionalization has proven that the regional office is completely unsympathetic to the program. The original enthusiasm for doing a good job and realizing progress has not vanished, but it has been seriously damaged.

An extension program is being developed in the MMA project. The leader and trainer in this program left for Barbados over a year ago, and no one has been appointed to replace him. Six extension agents have been appointed and they all have motorcycles. The benefits of the project works have not been realized as yet, but the agents are becoming acquainted and established in the area. However, they will need more guidance and training in the future.

A program to train extension agents at BBP by IRI consultants has not been fully supported by GRB. At the present time, only three out of 16 scheduled and budgeted extension agents have been assigned. More are expected soon. Some training and issuance of motorcycles has taken place, but benefits from this have been lost by transfer of personnel or by the firing of trained men and using untrained people in their place.

The GRB has not had a national approach to its extension program. Training meetings have not been held for years. Little information other than that required by regulations (example: prices of agricultural chemicals) has been communicated to GRB rice extension agents. The management of the agents has been left to the whim of the GRB regional managers who, in some cases, have no conception of extension and its functions. The result has been less than productive, has caused fragmentation, and has practically decimated the extension program in rice, except in the two projects mentioned above. There has also been a lack of leadership, coordination, and guidance for the extension people under the Ministry of Agriculture. This involves the AO's (agricultural officers) in the Food Crops Program and those in other programs, such as livestock. Some of the individuals have kept themselves well informed in their own area, however, and are doing creditable jobs.

Lack of trained personnel hampers the finding of people to fill the extension positions. Also, too many times trained people hired as extension agents end up involved in other responsibilities and activities, such as the distribution of inputs. This may leave them little time for educational functions. Correction of this is one of the basic needs discussed in the preceding paragraphs.

The lack of trained personnel can be overcome in an extension program by using well qualified and trained Subject Matter Specialists as trainers for less qualified staff. Many countries adopting the new T & V system use secondary level graduates (with or without one to two years agricultural school) as extension agents. The training by the Subject Matter Specialists is then intense and all program-oriented. These "less qualified" people have generally done very good jobs under this system.

3.4.3 Seed Production

Seed production for farmer use has been carried out by GRB on its three seed farms. The plan for handling seed production in the future is not known. In the past, MARDS has supplied foundation seed to the three seed farms. The largest is Burma which is adjacent to MARDS and has 3,000 acres. The others are McNabb in the Tapakuma Project area and one in Black Bush. McNabb has over 800 acres and Black Bush somewhat less. The seed farms are hampered by a lack of funds, drying, storing, and cleaning facilities. Some of the farms have had good management in the past, but not always.

The quality of the seed is sometimes not known or not determined. The program has sought to rogue seed fields for red rice and other varieties, but just how well this is done is not checked by any authority or agency. There have been reputed instances of poor quality seed with low germination rates resulting from improper storage. Guyanese farmers are remarkably well accustomed to renewing their seed periodically or buying only a fraction of their seed needs for each crop. This is a good practice, although unusual for a developing country; many LDC's strive to attain this but never do. The reason or background for this widespread practice in Guyana is not known, but it does point out the need for a well-managed and supervised seed production system in the country to produce quality seed for farmers.

In the Tapakuma project, a seed analytical laboratory was set up and a seed technician trained in the USA. He learned the procedures in his six-week course and began examining samples from the seed offered for sale by GRB. Many samples were shown to be substandard for one reason or another. Substandard seed sold to farmers can result in significant crop losses. The sample analysis is thus important to the farmers, but unfortunately the laboratory work has since diminished and very little analysis is now taking place.

The farmer tends to use extra seed to take care of unforeseen eventualities. This is not so difficult a decision when the price he receives for

his rice is low. If he were to get a higher price for his rice, he would take an even closer look at his high seeding rate.

3.4.4 Recommendations

The following recommendations are presented for inclusion in the future agricultural sector plan:

a. Research

(1) The research on rice at MARDS should be placed under the Ministry of Agriculture in a division set up to coordinate all agriculture research (sugar, questionable but possible). This division would be separate from extension, but should work in close liaison.

(2) Financing should be arranged for the recruitment of expatriate staff to reactivate the MARDS rice experiment station. This would require three to four people, or more, in the major disciplines of rice research. They might be well qualified third-world expatriates (if it would mean monetary savings) who have had training at IRRI (Philippines) or CIAT (Colombia). At the same time, monies should be provided to send Guyanese counterparts to the international institutions for practical training in rice research (with the obtaining of degrees not necessarily the major goal). Improved financing for support equipment and materials should be arranged. Long-term work objectives will be needed for the staff to enjoy job satisfaction. Impulsive directives from administrators and the abrupt, unexplained shifting of personnel and assignments should be avoided, in order to get rice research "back on the track" in Guyana.

(3) A reliable water source should be obtained for MARDS, at least for a reasonably sized experimental test plot area if not for the full 600 acres. This may need to be a well if "ditch water" is not available.

b. Extension

(1) All extension activities in agriculture should be under the jurisdiction and supervision of a division of the Ministry of Agriculture. Extension programs in regions, districts, and villages need to be free of the domination or control of these entities, but should cooperate with them. A strong national extension administrative unit in the Ministry of Agriculture will be essential to organize and coordinate a national program.

(2) World Bank assistance should be requested in setting up a national extension program. The T & V system should be explored for possible use in Guyana. Assistance will be needed in preparing a proposal for such a loan since personnel, equipment, buildings, and supply requirements would be different from those experienced previously in the country.

c. Seed Production

(1) A National Certified Seed Agency should be set up in the Ministry of Agriculture to administer the certified seed program of the country. A central laboratory for seed analysis should be established in Georgetown, with smaller labs at Tapakuma and Black Bush. (An operable one already exists at Tapakuma.)

(2) At least two more persons should be sent to the United States (Mississippi State University) for training in seed analysis. Two more should also be sent if monies are available, or plans should be made to send them later.

(3) MARDS should continue to furnish the three seed farms with breeders or foundation seed. The seed farms would grow enough registered seed to supply contract farmers, selling the excess to other farmers as seed if it meets minimum seed standards.

(4) Contract farmers would be located in each village or district. They would agree to use clean land, have a source of water for irrigation, and would rogue or weed fields as needed to produce certified seed. At least two field inspections should be made of each contract farmer's seed field after heading time and before harvesting.

(5) The standards that these fields must meet should be fairly high and uniformly enforced. A field not meeting minimum standards should not be allowed to be a source of seed. The inspection of the fields must be done by a qualified inspector from the Ministry of Agriculture. The extension agent of that area should accompany the inspector, but should not be responsible for any final decisions.

(6) A sample taken from the paddy harvested by the contract grower should be examined in the laboratory. Laboratory procedures should be fast and efficient so that there is no delay in obtaining the sample results.

(7) Paddy that meets minimum seed requirements for genetic purity, weed seeds, red rice, and germination should then have seals and tags put on the bags showing they are certified seed.

The farmer would be allowed to sell his seed at seed prices, but he should be charged a small fee for each bag sold, to cover the costs of tags, seals, etc.

3.5 Mechanization and Size of Farms

3.5.1 Background: History of Development Programs

International financing institutions around the world have, in the last 12 to 15 years, emphasized agricultural projects that would increase food production in the developing countries as fast as possible. In the early and mid-1960's, population rates of increase were beginning to far outdistance increases being made in food production. The need was recognized for international research centers to develop basic agricultural information necessary to meet the food needs of the rapidly rising world population.

This led to the establishment of such institutions as CIMMYT (wheat and maize) in Mexico, IRRI (rice) in the Philippines, CIAT and IITA (tropical agriculture) in Colombia and Nigeria, ICRISAT (semi-arid tropical agriculture) in India, plus others or affiliates. Many of these institutions were initially started by the Rockefeller and Ford Foundation funds, but now receive support from other sources, viz. USAID, World Bank, and other funds or countries. The initial contribution of these institutions was in the development of high-yielding (in most cases, nitrogen-responsive) varieties. These could revolutionize agriculture, but needed companion developments in the LDC's such as irrigation projects, infrastructure, and support organizations (including extension) to facilitate the change from traditional ways that was later called the "Green Revolution." This is where the international financing institutions stepped in to help with large sums of money. These funds were mustered from supporting countries or redirected from the types of projects financed previously (large dams, railroads, ports, industry, etc.).

As the large international financing instutions progressed and gained experience in these supportive projects, they concluded that all these funds

must eventually benefit the small farmer. Few countries in the world, especially the oil-importing ones, have enough industry or other ways to employ people leaving the farm for already over-populated cities, so the policy emphasis has been placed on maximizing benefits for the small farmer, and keeping as many people in agriculture as economically possible.

3.5.2 Machinery Size and Use -- Tractors

a. Tractors

Tractor size is an example of the need for change. The size of tractors now being imported for rice (75-80 HP) is much larger than was used when rice first became mechanized in Guyana. A small farmer cannot afford to buy the larger and more expensive tractor. The larger farmer who can afford the tractor buys it, and then does not want to (and usually does not) do any land preparation for others, including the small farmer. His valid reason would be that in view of the bleak outlook for spare parts availability in the future, he cannot contribute to the depreciation of his tractor by renting to others.

The small farmer who cannot farm his own land may rent it to the large farmer. The larger farmer then feels he can use his tractor on this land. The net result, of course, is that some farmers who can pay for the large size tractor (or tractors) can increase the size of their farms, while small farmers must get out of rice production. The small rice farmer in the past has demonstrated that he can keep rice production going with a 35 to 40 HP tractor. The way they have kept some of these small tractors going for many years beyond their normal life expectancy is amazing, and points out quite clearly that the small farmer should be in the No. 1 position for receiving machinery support to fit his needs, which means smaller tractors and spare parts.

It is interesting to note that in the United States farmers have been for some years moving towards larger and more sophisticated (and expensive) tractors and farm machines. Now with the oil price crisis and the worsening economic situation for agriculture, U.S. farmers are taking a second look at

this machinery trend. A recent study in the wheat country of the northwestern United States showed that the old and slower crawler type tractor (80 HP) was more fuel-efficient in preparing the soil than the newer, much faster 150-200 HP four-wheel-drive tractor. (Two of the latter have been purchased by the Tapakuma Irrigation Project recently).

There may be some situations in Guyana where large tractors would be beneficial. However, changes in tillage methods probably would contribute more to efficiency than would increases in size and power. Studies by Farm Development Officer, Henry Dolphin, at Tapakuma have shown that excellent land preparation can be obtained in rice fields with a D4 or D6 crawler-type tractor and a Rome harrow (disk). Soil moisture conditions need to be suitable, but land can be prepared much faster and with less cost than with the conventional methods now used (dry and wet ploughing). Here again, the size of the tractor involved is beyond the reach of the small farmer. Ideally, several small farmers could band together (or form a co-op) and make use of such a tractor at a substantial savings to them, but traditionally, farmers in Guyana have not joined forces with their neighbors, and do not seem to be able to cooperate in such ventures. This is unfortunate in light of the opportunities that could be taken advantage of through cooperative endeavors.

The ever-increasing rice areas in Guyana that do not get planted is evidence of the decline in the number of operational tractors available and, as mentioned above, of the disinclination of farmers with tractors to hire out for others. According to the 1978 Rural Farm Household Survey by Robert R. Nathan Associates, only one-fourth of the rice farms in Guyana have tractors. The importation of new tractors in 1981 improved the situation, but these were the larger 75-80 HP tractors and were purchased by large farmers.

The average annual importation of tractors since 1977 has shown a drastic decline, to about 40 percent of that for the period just previous (1965-76). For many farmers, whether they get a rice crop planted or not will continue to depend on the availability of for-hire tractors. Small-size tractors, discussed in a later section, might provide a viable alternative for these farmers (see 3.5.3 on the next page).

b. Combines

The combines in the country are in the hands of even fewer farmers; only two percent of the rice farmers own a combine. Over half of the combines are owned by farmers with 50 acres or more, so the small farmer is even more dependent on for-hire machinery to get his crop harvested than for land preparation. Of the combines in the country (including those held by GRB), 63 percent are ten years old or older. For private combines, the figure is even higher at 74 percent. The average age of the approximately 450 combines in Guyana is 12.5 years, but fully one-third of them are non-operational. An interesting fact is that Case combines still comprise 28 percent of all the combines in the country even though the company has not been making combines for ten years. Spare parts are still being imported now for Case combines, but how much longer these will be available is uncertain.

A national committee was formed in 1979 to study the farm machinery situation in the rice industry. It concluded in its report, "The overall national farm machinery picture, then, is one of an aging fleet with an inherent reduction in capacity, coupled with a greater demand for spare parts that is not being adequately met." That conclusion is still valid.

3.5.3 Mechanization Alternatives

Many countries in Asia have made large strides in the mechanization of rice production in recent years. Much of this is the direct result of the small farm machinery project at the International Rice Research Institute (IRRI) in the Philippines. The machines they have designed are small, unsophisticated types that could be fabricated or assembled in the rice countries of Asia. They require a minimum of power, have low fuel consumption, are easy to operate, and require less maintenance and repair than larger and more sophisticated machinery.

a. Land Preparation

IRRI has developed simple tractors for land preparation, that are little more than a gear box and mounted motor. The motor can be taken off to run a

thresher, to pump water from a ditch or well, or to serve other uses where power is needed.

It is not certain that the IRRI-type tractor would be practical for land preparation in Guyana which has some of the heaviest clay soils in the world. The IRRI tractor definitely would not be able to dry-plow, but it should be tested and tried to determine what wet land work it could accomplish satisfactorily. Also, the economics of this tractor and its use should be studied.

An agricultural engineering consultant with the MMA project, Frank Butcher, made investigations and inquiries into possible small, unsophisticated type tractors that might be used for land preparation in Guyana. This information has been included in his final report, made before leaving Guyana. Butcher found that at least three types were available in Europe and the United States. One did not even require an electrical system. All were one or two cylinder tractors in the 20-25 HP range. They are proving to be of practical use on small farms in other parts of the world, but would need testing on the heavy clay soils of Guyana. The important features of these machines are their minimum requirement for upkeep and spare parts since they are quite unsophisticated in design. Butcher was confident that some or all of these machines would be of practical use in Guyana for small farmers.

b. Harvesting

IRRI has also developed harvesting machinery suited to small farms. Threshers designed and tested by IRRI are spike-tooth, axial-flow cylinder types that are fed by hand. Sieves do some screening, and a simple air fan winnows the paddy. These threshers are being used in about four sizes in Asia. The smallest can be hand carried by two to four men from field to field or placed on a trailer or platform behind a tractor; thus, it can be moved about, even in a wet field. The other three sizes are mounted on trailers ranging in size from a small two-wheel trailer to a larger four-wheel trailer. The trailers can be towed along dams or in dry fields to the location of the paddy to be threshed. Motor sizes and threshing capacities

increase with the larger sizes. By being fabricated or manufactured locally, these machines are reasonably priced. A small farmer can afford the small sizes. The larger sizes could be used by several small farmers banded together or used as a for-hire threshing machine.

These small threshers are all hand fed, so the paddy would need to be cut by hand or moved and carried to the thresher. The small thresher, being portable, is adapted to use even in fields too wet for tractors. Under wet conditions, the trailer-mounted threshers would need to stay on dams or along the edge of the fields.

Labor is becoming more expensive and difficult to find at critical times in the rice areas. However, the number of man-days (both family and hired) used is very low with the present highly mechanized rice production methods in Guyana. It is in the range of five to ten man-days per acre/crop. (Compare this with the 32-40 man-days per acre used in Asia). Thus, the rice farmer in Guyana is engaged in the actual farming of his crop for a small portion of his time, unless he has a large farm. The under-employment of family labor results in sons growing up and leaving the farm or seeking other employment, while the farmer may actually need to hire labor at sowing, fertilizing, and harvesting times. More use of small farm machinery in Guyana would involve many more people and man-days in rice production.

The hand cutting of rice for threshing would require all the family labor available. The females of the family could be utilized, as in Asia. But for any sizeable field, additional labor would still be required. Some small farmers with 15 acres or less could use family, relatives, and neighbors for cutting, take two to three weeks or more to thresh, and still have ample time to prepare for the next crop. Many small farmers interviewed said they have to wait two to four weeks in any event for the combine to arrive after the crop is mature.

Mechanized cutters or mowers to cut the rice and leave it in swaths have also been designed at IRRI. These are light-weight, inexpensive machines that would be faster and less costly than hand cutting. The paddy

would still need to be carried to the thresher. An economic study should be made of hand cutting or mowing and threshing of rice, compared to combine harvesting.

It is reported by some that the loss from combine harvesting can be as high as four to five bags per acre. Combines often run too fast, or operate under poor field conditions and with improper adjustments. Losses do occur, and the amount of loss needs to be accurately determined to use in the comparisons with hand harvesting. For instance, the blank hulls or badly damaged kernels resulting from paddy bug feeding are usually blown out the back of the combine machines during harvesting. At first glance, these hulls would be suspected to be harvesting losses, when they actually are crop losses that occurred before harvest. Hand cutting and mowing and threshing of the paddy would result in very minimal crop loss, and thus would be a crop savings over combine harvesting.

Another advantage of hand cutting or mowing of the paddy is that it can be done two to three days or more before the crop is ready to be threshed. If the weather is favorable, considerable drying of the paddy can be realized. This cuts down the need and expense of artifical drying at the receiving station. This will in turn aid in speeding up the delivery of the paddy, since the driers are the bottleneck that cause the long periods of waiting. This drying in the field would require a variety with medium straw length and good straw strength. The cut paddy must be supported off the ground, especially if the field is not completely dry. The varieties Rustic and "N" are too short to fit this situation. Starbonnet, Bluebelle, and CICA eight or nine have much better straw length than Rustic or "N".

There are some other advantages that should be mentioned for small farm machinery compared to the large, heavy and expensive types. Many farmers in Guyana do not have their landholdings or lands farmed on one piece or location. Some small farmers have as many as six to seven tracts. In getting around to these fields, small farm machinery would have definite advantages. A small field could be cultivated or harvested at the correct time, even though nearby or adjacent fields were in a different stage of

activity. With the present system, where large machines are required, one farmer may affect those on both sides of him in his planting and harvesting schedules. In some cases, farmers have been prevented from planting or from harvesting at the proper time because of the conflicting activities in adjacent fields.

Another advantage of smaller machines and less complete mechanization lies in the possibility of increasing the intensity of cropping. Many areas in Indonesia are now quite successfully growing three crops of rice per calendar year. These crops are, of course, all hand harvested. Pedal threshers or small machine threshers are being used extensively. If maturity occurs during a period when rains normally occur, the crop is cut and carried off the fields during "breaks" in the weather, or harvested in the fields between rains. The three-crop system is aided by the use of early maturing non-photosensitive varieltes. Where year-round irrigation is available in Guyana, the weather would be suitable for three crops of rice per calendar year. A farmer with small farm machinery accomplishing this could increase his annual income significantly. However, three crops of rice per year would be practically impossible where tractors and heavy combines are used. At least one crop would mature during a rainy season, and combine harvesting would not be feasible.

The disadvantages of heavy machines may be cited as advantages of lighter, more flexible alternatives. Some farmers use large tractors as transport vehicles and the dams as access roads when making visits to their fields, even though the dams are too wet. This results in unnecessary damage to the dams. Substantial and heavy log-type crossings are required for combines to reach fields. An expensive crossing cannot be put across a ditch to each field, so combines have to traverse other fields to reach their destination. The fields crossed may not be ready for harvest and are thus demaged. All these problems would be avoided completely or be much reduced with small farm machinery.

c. Transport

A spinoff from the development of small farm machinery in Asia is the motorized wagon. It can be manufactured locally and is inexpensive. The air-cooled motors used on threshers or on the IRRI-type rice tractor can be transferred to the motorized wagons when needed. These wagons are simple four-wheeled, rubber-tired vehicles with a gear box drive. They have only reverse and forward gears. Speed is controlled by clutching or braking; this is their main disadvantage. They are therefore limited in city traffic, but can do well on roads or highways. The motorized wagons are catching on very fast in Thailand. Farmers haul their paddy to market, haul inputs to the farm, and use the wagon as a family car at times.

Small farmers who have previously been without transportation are delighted to be motorized, even though the vehicle is not fancy or very fast. Such a wagon could fit many needs in Guyana with a much lower investment than the farm tractor. It could lessen the dependence of small farmers upon tractors and trailers to haul their paddy and for other transport needs. The loads carried by the motorized wagons would necessarily have to be smaller, so more trips would have to be made. However, the cost per mile would still be much less than with the tractor. A tie-up in the lines waiting to unload paddy at the GRB facilities would be less costly with the inexpensive motorized wagons than with tractors and trailers.

Small farm machinery, with its lower level of investment and lessened requirements for spare parts, would fit the present need of small farmers in Guyana, and would be a quick way to get many abandoned lands back into production. Much less foreign exchange would be required than for the large machinery now being imported. Local manufacturers should be allowed to fabricate the machines for a profit; this would require less foreign exchange than importing the ready-made machines. Blueprints and engineering designs are available free or at a minimal cost for all of the IRRI equipment.

It is recognized that the Asian mechanization of rice production is much different and less expensive than the present form of mechanization in Guyana. It is also more recent, compared to the Guyana mechanization which has been carried on for a much longer period of time (25-30 years). A first reaction might be that the small farm machinery approach would not fit rice production in Guyana or be accepted by farmers. Interviews with many small farmers over the last four to five years have clearly shown that they are very desirous of getting equipment support (machinery and spare parts) to produce rice. The government has been slow and inadequate in responding to their needs, resulting in the abandonment of rice lands that formerly produced a crop. For many farmers, it has meant looking for other employment or other means of making a living. The Guyanese rice farmer basically is eager to produce a crop and does not give up easily.

The government of Guyana is not keeping up with the machinery needs for the rice industry. The high proportion of old equipment is related to the relatively high proportion (18 percent) of non-operational tractors. The proportion is even higher for GRB, which has a third of its fleet out of order.

In light of all this, the present world economic situation, and especially the plight of Guyana with its present foreign exchange problems, it is time to reconsider whether the current farm machinery is appropriate in the long run, and if perhaps small farm machinery is, or could be, a viable alternative.

d. Small Farm Mechanization -- A Proposed Study

Because of the potential importance to Guyana rice production of an alternative system of mechanized farming, a discussion is provided below of the requirements for developing such a system.

Immediate action should be taken to prepare plans and proposals and to seek grants or international financing for the establishment of a small farm mechanization research station. The program of this station would be to conduct an intensive study of machinery and machinery use, adapted to small farms in Guyana.

The trials and studies would require that conditions of water supply, water management, and drainage at the station all be controllable and adequate. The amount of land for such an endeavor would not be great, but it should be representative of the majority of the soils in Guyana. A small storage and machine repair shop would be needed. Locations for these studies in project areas (MMA, Tapakuma, etc.) or research stations such as MARDS are already available, but an assured water supply by pumping or other means must be arranged. Transport facilities for moving equipment from one site to another would be needed.

The financing of such a study should include the procurement of all the types of machinery that need to be tested under Guyana conditions, and the trucks, tractors, and trailers needed to transport the equipment. Finances for support materials and inputs for crop production, as well as for personnel and operating costs, would be needed.

IRRI has cooperated in the past in some countries with studies and trials with small machinery. They have furnished staff members and provided some of the costs. In recent conversations with them, they indicate they can no longer do this because of lack of funds designated for such projects. CIAT in Colombia is in the same position: they would assist and provide guidance in cooperation with IRRI, since they are "sister" institutions.

The leadership of the project should be provided by an agricultural engineer who has had experience in this field. IRRI has former staff members or trainees who have the qualifications needed. The person should be one who has the perspective and understanding of how such equipment is used and how it could fit the needs of Guyana. Such perspective and understanding is also vitally needed by those in Guyana who would promote and back such a project, in order to convince interested financial institutions or donors. By the same token, those representing the financial institutions would need to have the necessary vision and perspective to properly understand the urgency and the need for such a project. This is particularly important since the concept is being brought from the other side of the world, and local knowledge or understanding of it may be limited. A debunking "it won't

work" attitude could defeat the project at the first step and prevent its ever being realized. It is to be hoped that, with understanding, such an attitude would be avoided.

Depending upon the financing available for this type of project. A second expatriate agricultural engineer would be desirable but not absolutely necessary. Other expatriate staff to round out the team in such an effort would be a rice agronomist, an agricultural economist, and a machinery mechanic. The latter need not be a degree man, but should have experience in operating, maintaining, and repairing farm machinery.

Guyanese rice farmers would watch closely the progress of such a project, and although there would naturally be skepticism, they would readily take up any type of machinery or activity that they think would assist them in producing more rice at a profit. It is apparent that it is time to retrench and consolidate in all of agriculture in Guyana, and the small farm machinery approach could well be the answer for rice production. A study to explore this potentially helpful and new approach would be a good investment.

If finances were available and the staffing sufficient, two other studies could be conducted under controlled conditions. One would be to determine if minimum or no-tillage practices could be used in rice production. The other would be to study the potential for ratooning rice. IRRI has a program on ratooning rice and varieties would be available for trials.

3.5.4 Renting of Land

For the farmer who cannot cope with problems of farming, the option of renting his land presents a bleak prospect. This is because of inequities in the rental system.

There is an urgent need in Guyana to develop an equitable rental system to provide a fair return to owners of rice land. Such a rental system would need to be studied and explored thoroughly by agricultural economists with as practical an approach as possible, and certainly not from a "desk" or "academic" point of view.

Any devised rental system should have some flexibility for varying conditions, and should carry escape clauses for the renter for unavoidable situations where no crop is produced or where yields are drastically reduced through no fault of the farmer. In many situations in Guyana now, a farmer (who may be a small farmer) may be renting land that cannot be farmed because of, for instance, lack of drainage. The landlord gives no quarter in these situations and many times does not "lift a finger" to alleviate or solve the problems. Typically, however, he does insist on rent being paid, even though no crop is produced, and threatens loss of lease if rent is not paid.

Rental systems vary widely in different countries and regions and under different systems of farming. Ideally, the terms of a lease should reward the owner and the operator according to their inputs, and not only land and labor should be considered but also investments in facilities for drainage and irrigation; investments in machinery; expenses for seed, fertilizer, chemicals, fuel and water, and managerial skill.

It is realized that rice production is Guyana, at present, has a low level of net return to the producer, especially at low yield levels. On the other hand, when yields reach 25 bags per acre or higher, the net income increases significantly. The leasing or rental system should encourage the kind of farming and the level of inputs that result in high levels of yield and profit.

3.5.5 Recommendations

The following recommendations are made:

(1) Tractors and Spare Parts -- The importation of 75 to 100 HP tractors should be limited drastically or stopped in favor of smaller 35-45 HP tractors that can be afforded by small farmers. Also, much greater emphasis should be placed on the use of foreign exchange for spare parts rather than for new tractors.

(2) Land Rental -- A thorough and well-planned study should be made by the GOG to determine or develop a fair land rental system for land used for the production of one crop or two crops of rice per year. The results of this study should be presented to farmers' representatives from all regions of

Guyana for approval or changes after which appropriate steps should be taken, possibly by changes in the land tenure laws, so that the new rental system would become widely accepted and commonly used.

(3) Small Farm Machinery -- Action should be taken in the immediate future to prepare plans and proposals and to seek international financing or grants for an intensive two to three-year study of the potential for small farm machinery in Guyana rice production. The general approach should be to focus on research at experiment stations, but on-farm trials should also be conducted. The studies would include performance and capacities of the machinery and the economics of its use and ownership.

3.6 Supply and Availability of Inputs

Timeliness is of utmost importance with farming anywhere in the world. A farmer must do many of his operations at the right time or suffer the consequences. Farmers generally know the proper times for taking important steps to produce a crop. The right time may be established through experience or custom in a given area, or determined by expected climatic conditions. In some cases, farmers have had the proper timing demonstrated or given to them by extension or research. The more successful farmers are those who get things done at the right time and are alert to solve problems as they arise. The unsuccessful farmer is many times the opposite and he may not survive in farming as a result.

In Guyana, farmers are often prevented from acting on time. This is counter-productive and inexcusable. Forced delays in farm operations affects not only the livelihood and welfare of the farmer, but the nation as a whole. This is the situation for rice farmers in Guyana with respect to supply of fertilizers and agro-chemicals.

The rice variety Rustic is fairly good in its nitrogen response, but as Dr. Jeff Wang of IRI has found, there are others that can produce as much as 25 percent more than Rustic, given higher applications of fertilizer. Yields of 58.5 bags per acre (8,190 pounds)(9.2 mt/ha) have been obtained in test plots at BBP. This is three times the present national average. This kind of yield could not be attained as an average for the country, but

it does show the potential of nitrogen-responsive rice varieties. The higher yielding varieties tested also had superior quality compared to Rustic.

The present rate of urea "allowed" for use in rice is 50 percent or less of what is needed for good production with a short, stiff-strawed, nitrogen-responsive rice. This means that farmers should be using 2 to 2.5 bags of urea per acre, instead of one bag per acre. Even more can be used with some of the better varieties not yet grown in Guyana. An average yield of 30 to 35 bags per acre would mean more net profit to the rice farmers of the country.

It may be argued that it takes too much foreign exchange to buy 2 to 2.5 bags of urea for every acre of rice in Guyana. This argument is short-sighted. One bag of urea per acre over the one bag now used should produce ten additional bags of paddy. The arithmetic is simple: nitrogen on rice increases production permitting greater export which increases foreign exchange. There is, of course, a limit to this production increase potential and the return per unit investment in fertilizer. Good fertilizer trials were conducted at MARDS two years ago, but they have never been summarized, analyzed, or reported. A nitrogen response curve is needed for promising varieties to determine at what nitrogen level the greatest net return can be realized. The optimal level of nitrogen use is, without doubt, well above the one bag per acre 110 pounds, (50 N) level of present use.

In order to make the most effective use of nitrogen fertilizer, it must be applied early in the development of the crop. An application made too late will result in inefficient use of the fertilizer and reduced response. The outlay of foreign exchange therefore does not contribute its full potential to production, resulting in a two-way loss: the cost of the fertilizer and the loss of (or failure to produce) potential crop. The loss of crop is a direct loss of potential foreign exchange. Under the present, sometimes cumbersome supply system, farmers say they usually have delays in getting urea fertilizer. In addition to losses from lack of timeliness,

losses are sometimes incurred from lack of quality: some fertilizer storage buildings have roofs that leak, and the fertilizer is damaged or even lost. These losses of potential even under the present system of supply and handling should be corrected.

An insect infestation or a disease infection must be controlled at the correct time, that is, at the threshold of expected economic damage. This is a general statement; "the correct time" varies widely with the insect or disease. Use of chemicals too early can sometimes result in the need for a second application. But the use of control materials too late is much more serious: loss of crop, crop damage, or both. An example of the latter is the paddy bug which is presently causing large crop losses in Guyana. The handling of agro-chemicals has been inefficient, and this inefficiency causes many difficulties and problems for the rice farmer. Many times he cannot get the chemicals on time, or he has to make three to four trips to get them. He ends up obtaining them too late to control the pest. Chemicals are not properly handled at the GRB outlets. A dangerous chemical, such as monocrotophos (Azodrin), is poured from a 55-gallon drum into the farmer's container. It should be handled in smaller, easy-to-manage containers, or containerized for direct sale. Storage facilities are inadequate and poorly maintained.

Another method used in the past that has caused the delay in supplying inputs to farmers is that of estimating needs before each crop and then ordering the inputs (fertilizer and agro-chemicals). The extension agents and others would prepare an elaborate, detailed report for each crop based on farmers' plans to plant. This system is too slow, and it results in the inputs arriving too late. It is much simpler to make estimates based on the last season, with adjustments relying on the knowledge of the local staff and using crop planting projections.

GRB is turning over its handling of inputs to GNTC. This may be an improvement and it may not. There is very likely to be at least a period of adjustment and familiarization by GNTC, and this will affect the rice

farmer directly. It is not expected that the change of agencies will be any real solution of the problem. If private dealers were allowed to sell fertilizers and chemicals, they would supply some service to the farmer.

The following recommendations are made:

(1) Private dealers, as well as the government, should be allowed to sell fertilizers and agro-chemicals. They should be allowed to provide a wide system of outlets that would be accessible to all farmers. The dealers should be allowed to stockpile their supplies one full calendar year in advance of each crop (autumn and spring). This would enable them to keep ahead of needs by one crop, which would result in the farmer having his materials available when needed.

(2) Since the subsidy has been removed on fertilizer, rice farmers should be allowed to purchase all the urea they want, up to 2.5 bags per acre. Fertilizer should be stockpiled at outlets, one crop season in advance. This should be closely observed and monitored so that supplies move smoothly and on time.

(3) Strict laws are needed, if not already on the books, against dilution of chemicals or adulteration of fertilizers. Such activities are detrimental to attempts at a successful program. Violators should be severely punished and banned from further sale or handling of fertilizers or agro-chemicals.

3.7 The Milling and Parboiling of Rice

In 1965, there were reported to be 208 rice mills in Guyana. This was before the Rice Modernization Program (RMP) which brought the government into the rice milling picture. USAID financed RMP I, and a second stage, RMP II. AID officials have stated that it was not their intent that the government should attempt or strive to take over all the milling of rice in Guyana.

The essence of RMP I and RMP II was to provide drying and storage for paddy until it could be milled. The private industry mills would still be needed to handle 50 percent or more of the crop for an orderly processing of the crop. This was also the stated intent of GRB over the last five years. But for some reason - either policy, economic, or some other - their actions have not borne this out, and have in fact been just the opposite. By all

actions and appearances, GRB is trying to mill either all of the rice in Guyana or as much of it as possible. They are now reputed to be milling 80 percent of the crop, and have moved paddy from one facility to another, only contracting out to private mills that portion which they cannot complete in time to meet export commitments, or cannot mill in a given locality.

If GRB had the most modern, best equipped, properly adjusted, and best managed milling facilities in the country, then handling the majority of the crop or nearly all of it might be reasonable. But according to a recent report on a survey of the milling situation in Guyana, a consultant stated, "There is a lack of accountability in the GRB for quality control in the milling of rice. Some mills grind out a low quality product with a broken grain percentage of 40 percent." He points out that GRB mills are poorly adjusted, run, and managed, with no quality control program. There are no rewards for good performance and no penalties for a poor one, so the job is done with minimal care. After all, a poor quality product can be re-milled at the Georgetown facility in preparation for export (at considerable added cost, however).

GRB's irresponsible attitude toward the milling of paddy is just the opposite from what a private miller must have to survive. Private millers all claim they can produce a much higher quality of product than the GRB mills, and yet they are being almost systematically forced out of business. A big part of the problem is the refusal of the government-controlled industry to recognize and take action on quality problems. This involves, for example, variety grading and payment on the basis of quality.

By 1976-1977, only about one-half of the mills that were in existence in 1965 were still operating. This may be in part a result of the trend of the times. Many of those original mills were single-stage and characterized by low output of milled rice and inefficient recovery of by-products. These would normally have been phased out of commercial milling and only a few retained for milling rice for domestic use at those geographic locations some distance from multi-staged, larger mills. But at present, and as a result of GRB's drive in the last five years to increase its milling

activities, private milling has been drastically reduced. There are no figures immediately available as to just how many private mills are still operating. Those that still do some milling for farmers and on contract with GRB are operating at much less than full capacity. At least one practically new mill is not running at all.

Private millers state their primary problem is that the price allowed for milling is too low. The price does not allow for a margin of profit or the upkeep and replacement of their equipment. An added recent complication is the roughness of Rustic compared to Starbonnet. Rustic has a rough hull, whereas Starbonnet has a smooth hull. The rough hulled varieties wear the rubber rollers much faster. Even if the price allowed for milling rough-hulled varieties were increased to correct this situation, there is still great difficulty in getting spare parts and needed normal replacements, such as rubber rollers. Even when they can get new rollers, the delay is great.

The CARICOM market, especially Trinidad, still has a demand for parboiled rice, relatively aroma-free and with a low percentage of broken grains. The GRB parboiling facility at Anna Regina has been closed down for repairs for a few years, but is expected to begin operations with the autumn crop of this year - 1982. They will not be at full capacity again, and the exact capacity will not be known until operations begin.

Private millers with parboiling facilities have been operating only to satisfy domestic needs, because of the low rate allowed them by GRB for milling and parboiling. The private millers could parboil a significant portion of the needs for this type of rice for export with their present facilities, and could expand their capacities with a minimum of investment. This would be a hedge against the reliance by GRB on its Anna Regina facility.

There are some problems with parboiling by some of the smaller private mills, and these should be corrected or guarded against when turning to them for this process. One is that a poor quality of water is used for the soaking of the paddy to be parboiled. It is reported that this water is

sometimes from drain ditches and of low quality to start with. In addition, there have been occasions where this same low quality qater is reused more than once. This can lead to a product that has an undesirable odor and/or taste. The result is a reduced value, reduced marketability, or an adverse effect on the reputation of those marketing the product.

Another problem in the parboiling of rice by private millers is the inadequate or non-uniform steaming of rice. Parboiling is a gelatinization process, and it takes knowledge and experience to achieve high quality.

The following recommendations are made:

(1) The milling fee allowed to private millers should be raised to at least $10.00 per bag. This will be more than double the present price of $4.50. All other handling fees and allowances should be increased according to economic studies or cost-of-production figures that are commensurate with the recommended fees. Private millers should be freely allowed to bid for milling contracts.

(2) The private milling industry should be given equal consideration with GRB in the importation of needed spare parts and especially rubber rollers. Foreign exchange should be made available to obtain the rollers and parts that private mills require because the mills will be directly contributing to increased rice exportation through the improved quality of the product.

(3) The fee allowed for parboiling rice by private millers should be increased. The amount needed for a profit and upkeep and maintenance of equipment should be determined by an economic cost study, or with a consensus of the private millers and an impartial arbitrator.

(4) Long-term, low interest-rate loans should be made available to private millers for boilers, tanks, drying slabs, and storage sheds to handle paddy in the parboiling process. These loans should be made to millers in strategic locations throughout the country so that facilities would be reasonably available to all farmers.

(5) After private millers have received help in setting up or improving their parboiling facilities, a short course or seminar should be held to familiarize them with the technical and practical knowledge needed to produce a high quality parboiled rice.

(6) Regulations should be enforced to assure minimum standards for the water source used for parboiling paddy, in order to ensure a quality product. The reuse of steeping water should not be permitted. The finished product after milling should be examined for any undesirable odor or taste resulting from the parboiling process, and export of substandard products should not be allowed. A system for monitoring and controlling the parboiling of rice would need to be created through some existing agency in the Ministry of Agriculture. It would need to rely mainly on the honesty of the miller, but with spot checking, and should provide severe penalties for non-compliance. This monitoring program should involve a minimum of red tape, and should not involve such strong policing as to slow down or inhibit the parboiling of rice in Guyana.

3.8 Economic Entomological Support

The present epidemic of paddy bug in the Guyana rice fields is causing untold damage in several ways. The insect which has at least two other common names - "Bush" and "Ghandi" - attacks the newly-formed kernels in the milk stage up to the hard dough stage of development. Losses occur in several ways as a result of paddy bug action. Kernels of rice damaged early may not fully form and are "blown out" of the combine during harvest. Kernels that the bug feeds upon in later stages may be partially damaged. These kernels break up easily in milling, and even the smallest of feeding area will show up as dark or black areas when the rice is parboiled. A farmer can have loss of yield which is a direct loss, but much rice is given a "C" grade causing heavy losses to farmers. This reduces the price they receive for their paddy by 29 to 35 percent. If Guyana could assess the total damage in the 1982 crop, losses would be in the millions of dollars. There is no team of entomologists or experts available to make this assessment.

There are many explanations as to why the paddy bug is so epidemic at this time - some of the explanations may be valid or at least partially so. Among the explanations are:

(1) A full season of good rainfall has increased the vegetation along dams, ditches, and other areas surrounding the rice fields, providing cover and breeding grounds for paddy bug.

(2) There is a shortage of motor blowers and knapsack sprayers for applying chemicals. GRB has many inoperable sprayers that were formerly rented out, but spare parts cannot be obtained to repair them. The same is true for privately-owned spraying equipment.

(3) Farmers do not apply the chemicals evenly. They try to cover too wide a swath. Under the sprayer, the rates of application are too heavy, but the coverage at the outer edge of the swath is too light. With many insects, such variation provides the environment for a build-up of resistance to the chemical.

(4) Since farmers say they make as many as three or four applications of chemicals and still do not get satisfactory control, they feel the chemicals sold to them have been diluted or may not be the chemical they paid for at all.

The "salt in the wound" feature of the paddy bug is that it appears and attacks late in the rice crop's development. All other crop inputs have been expended, and they may have been at the level required for a good crop. These are wasted when the paddy bug causes such severe damage so late. In addition to what losses the individual farmer has as a result of the paddy bug, the rice to be milled suffers further losses. The black spots on parboiled rice have a great effect on the value of that product. Removal of the damaged kernels from the product must be done by electric sorting or by hand. Both of these processes are expensive.

GRB has an entomology section, but the position for a trained entomologist in charge is not filled. The only trained entomologist in GRB is involved with storage and marketing. The person in charge presently is a research aide; the others are research helpers. This staffing is woefully inadequate for a scientific and practical attack against something like the present paddy bug epidemic.

A GRB official feels that GUYSUCO, being staffed with one professional in each major area (including entomology) has expertise that could be more fully utilized if the entomologist dealt with rice problems. This would be unwise since the sugar industry has its own problems to study and combat, and the sugar effort should not be diluted by adding on such major jobs as insect control in rice. The Ministry of Agriculture is apparently also not in a position to help.

Ways to aerially spray large areas of paddy bug-infested areas (where the crop was fairly near the same stage of maturity) were studied in the autumn crop-growing season. A difficulty here is the almost impossible goal of getting all farmers in the area to agree to the aerial spraying and to pay their share (or rate per acre). Ways were considered to go ahead and spray and later collect from the farmers. But the real problem that finally ruled out aerial spraying was that they would have to use GUYSUCO aircraft. Of GUYSUCO's three aerial applicators, two were inoperable, awaiting spare parts, and the only airplane working was hard pressed to complete GUYSUCO's own spraying schedule.

More than one person has said that if an entire area were sprayed by air for paddy bug, the insect would not be a problem for six to seven years. This opinion sounds too extreme, but there may be an element of truth in it. Were it true, the savings would pay for aerial applications.

In light of the above discussions, the following recommendations are made:

(1) Guyana should send abroad for university training in basic and applied entomology, two to three highly qualified people who have indicated an interest in a career in entomology. They should attend an institution that can provide the above plus train them in integrated pest control management.

The candidates should be selected on the basis of their academic ability, practical knowledge of agriculture, farm background, and their understanding of farmers' problems in Guyana. The desire to be of help to farmers should be a trait of the candidates and the basis for final selection.

(2) Private dealers should be allowed to import small applicator equipment for sale to rice farmers. Great emphasis should be placed on their permission to import spare parts or repair kits for these applicators and have shops for repairs. Much equipment is lying in disrepair that could easily be made serviceable. Private dealers should be allowed to buy, repair, and resell sprayers. With the lack of spares, the attitude has been too much toward considering an inoperable applicator as "disposable" and then seeking a new one as replacement. This approach is inefficient and expensive.

(3) One to three airplanes should be purchased for use in the rice industry. An alternative approach would be to provide an adequate budget for the rental of private aircraft. Systems or methods of charging farmers for the applications by air should be studied and worked out to allow the aircrafts' timely use in arresting a widespread insect outbreak. The airplanes could also be used for seeding rice or applying granular insecticides.

3.9 Spare Parts

Provision of new machinery for the rice industry in Guyana would require large amounts of foreign exchange or borrowings. Except in rather limited amounts, this is impossible at present. Therefore, keeping the present machinery operable is essential to the production of rice in Guyana. Financing of spare parts would have an immediate and highly favorable impact on the rice industry.

As pointed out in the R.R. Nathan Associates report on farm machinery in Guyana, 64 percent of the tractors and 63 percent of the combines are 10 or more years old. Eighteen percent of the tractors and 31 percent of the combines are not operational. The present situation is characterized by (a) an aging fleet of farm machinery, (b) drastic reductions in the importation of new machines, and (c) woefully inadequate supplies of the replacement parts needed for reactivating inoperative machines.

The standard solution to a shortage of machinery is to try to obtain new machinery. In Guyana's present financial situation, the greatest emphasis should be placed on repairing inoperable machines and keeping all other machines operating. The cost of such an approach would be far less than attempting to procure enough new machines to satisfy the needs of the rice growers in Guyana. Guyanese rice farmers have shown a remarkable ability to keep old machinery running, if provided replacement parts first and then maintenance parts. Farmers repair tractors and combines under their houses, under a tree, or almost anywhere, and have in some cases kept machines operating for a period of time twice that which would normally be expected.

GRB have recently stated that they would soon abandon their tractor and combine rental programs. GRB have only five percent of the tractors in the country, but 13 percent of the combines. A greater portion of the GRB machines are inoperative than is the case with privately-owned machines. GRB machines also tended to break down sooner than the private machines. The GRB fleet, then, when made available to private farmers, would not be as old on the average as the machines held by the private farmers themselves. Also, many of the GRB inoperative machines, especially combines, that have been stored or standing at GRB facilities for some time are old in years but not in use. Put in the hands of private operators and with the needed replacement parts made available, these machines could have many remaining years of productive life.

Replacement parts would need to be ordered specifically for each machine that can be repaired. These parts must be designated for that specific machine and that machine only, and a procurement and distribution system set up that would preclude tampering, delays, or misuse of the parts. There are many problems under the present system. Those financing or donating replacement parts should insist on a new or separate system for handling the parts, or should set up a system of their own, under their own control. This would be necessary to insure the efficient use of funds in such a project.

Some large farmers have well-equipped machine shops. These farmers should be allowed to purchase, repair, and resell GRB farm machinery to farmers. They should be given the same opportunity as an individual farmer to procure replacement parts for each machine. In reselling the machinery, they should be allowed a reasonable profit after considering all of their costs, but the market should be regulated in order to prevent over-pricing of the machinery.

With the scarcity and inadequate supply of maintenance parts in Guyana, machine operators have great difficulty in keeping tractors and combines operating. Many times, the operators must go long distances, stand in line for long periods of time, and then usually deal with disinterested government clerks just to buy their maintenance parts. There is even more difficulty

and delay in procuring replacement parts. One farmer expressed great fear of going into Georgetown and being unduly exposed to possible robbery because of the amount of money he would need and the time required to accomplish his mission. Another farmer had to use the influence of several people he knew to buy a G$20 replacement to keep his tractor going; it cost him G$200 by the time he was able to obtain the part. The same is true with batteries; some tractors are left running idle for long periods of time because of the difficulty of restarting a tractor which has no battery.

An adequate supply of maintenance parts would alleviate some of these ills and eventual high cost to the farmer, but serious corrections and changes also need to be made in the system of handling maintenance parts in Guyana. Maintenance parts are of greatest value when they are in stock at reasonably accessible outlets and fairly priced. The present situation and conditions have directly contributed to the decline in rice production in the country, besides contributing to the distrust, dismay, and general lowering of morale of rice farmers.

The following recommendations are made:

(1) For the present, rather than purchase new machinery, all financing for farm machinery should be concentrated on maintenance spare parts.

(2) A system should be organized to order, procure, and distribute replacement parts for specific machines, and allow no deviation from the original designation as to recipient of the part. Eliminate long and unnecessary delays in procurement and distribution resulting from problems of import licensing and customs clearances.

(3) In all regaions of the country and at locations easily accessible to farmers, distribution points or outlets should be established where maintenance parts are stocked. Private businesses should be given the opportunity to handle these parts, and allowed a reasonable profit margin. However, ceiling prices should be set for the parts and sales monitored.

3.10 Other Issues

Several other subjects of concern to the rice industry of Guyana were not addressed during this assignment, because background information needed

was not available. The needs are apparent, however, and any long-range planning should address them. The necessary background information and economic data should be obtained to support and facilitate the following studies:

(1) Domestic Rice Price. With rice farming now providing small returns, it is recommended that the subsidization of the price of rice for domestic consumption be phased out as soon as possible. Most of the extra revenue generated through raising the price of rice should be returned to farmers in the form of higher prices paid for their paddy. Provision of all needed supporting services to the rice industry would result in greater rice production. At some higher level of production and export, domestic rice prices could again be subsidized. Economic studies should be conducted on a continuing basis to determine the amount of such subsidy the rice industry could afford each year. The burden of this subsidy should not be borne by the rice farmers.

(2) GRB Receiving, Drying, Storing, and Processing Facilities. A very large investment has been made in Guyana in the last decade, much of it by AID, to provide facilities for more efficient receiving and handling of paddy. These facilities have permitted the orderly processing of rice with minimal losses. Facilities with modern equipment were installed at several locations. In most cases, the equipment is not currently functioning at full capacity, and in some cases, it is not being used at all. It is recommended that these underutilized facilities be sold or rented to private operators who have the capital to make them operational. Rental arrangements would need to allow for the initial outlay of capital necessary to rehabilitate the facilities, as well as the operating costs once the facilities are in full use.

Chapter 4

ASSESSMENT OF THE SUGAR INDUSTRY

4.1 Introductory Comment

Sugar has long been the mainstay of the economy of Guyana. The sugar estates and their products were the main justification for Dutch and English colonization that started in the late 16th century. Sugar remains the largest agricultural export. Table 4.1 shows the value of exports of sugar, rice, bauxite, and alumina annually since 1975. Sugar makes up about three quarters of the value of agricultural exports, and about 30 percent of total exports.

Table 4.1

PRINCIPAL EXPORTS FROM GUYANA

(millions of Guyana dollars)

	1975	1976	1977	1978	1979	1980	1981	1982 1st Qtr.
Sugar	413.1	258.7	185.7	234.6	230.6	307.6	284.6	43.4
Rice	84.8	73.6	66.8	96.0	80.8	87.5	110.0	9.0
Agriculture*	497.9	332.3	252.5	330.6	311.4	395.1	394.6	52.4
Bauxite	204.3	224.2	252.7	250.3	273.8	367.8	335.5	66.6
Alumina	67.9	64.4	78.1	82.0	53.7	111.4	91.9	23.2
Exports	858.1	711.3	661.2	753.8	746.4	991.6	1033.0	167.1
Sugar as % of Agriculture*	83.0	77.9	73.5	71.0	74.1	77.9	72.1	82.8
Sugar as % of Exports	47/0	36.4	28.1	31.1	30.9	31.0	27.6	26.0

* Other unspecified exports amount to 10 to 20 percent of total exports. Some of these are agricultural in origin, a fact that is ignored in the calculation of the lines indicated *.

Source: International Monetary Fund, International Finance Statistics, Vol. XXXV, Number 9, Sept. 1982.

Recently, world prices of sugar have been discouragingly low, and the resulting low value of sugar exports, coupled with weak demand for bauxite, has led to serious shortages of foreign exchange. As a consequence, machinery, chemicals, and other items needed for production have been in short supply, and the production of rice and foodcrops as well as sugar has been adversely affected.

Sugarcane is grown, and sugar produced from it, on large sugar estates. Before independence, these estates were owned and operated by British companies until the sugar industry was nationalized. Private farmers also produce some cane which is sold to and processed by the estates. Production of sugar from cane by farmers or as a cottage industry is negligible in Guyana.

The sugar estates are managed by a Government agency, Guyana Sugar Corporation (GUYSUCO) and all the estates are located in the coastal region of Guyana on heavy soils that are below sea level at high tides. Drainage and agricultural use of these lands depends on exclusion of sea water by means of seawalls and gates called kokers that are closed at high tides, and opened a at low tide to permit outflow of drain water. The estates have complex and highly developed systems of internal canals that serve three functions: supply of irrigation water, drainage, and transportation. Boats called "punts" are towed through the canals to transport cane from the fields to the factory at harvest time.

Sugarcane is a perennial crop. Once a field is established, cane can be harvested from it for years, as the roots "ratoon," or send up new growth after the stalk is cut off. However, the yield declines progressively with ratooning, and the decision as to when to replant the field must involve weighing the costs of replanting against the decline in production if it is not done.

Land preparation at the time of replanting cane is usually done with tractor-drawn machinery. Little tillage is required at any other time. Chemical fertilizer is applied by broadcasting. The application of chemicals for disease and pest control is typically done by airplane. Use of airplanes is quite efficient because of the large areas of cane in contiguous fields,

that are all under the same management and control.

Harvesting of cane in Guyana is done by hand. The fields are first burned to dispose of the unwanted vegetation (leaves), after which the cane is cut by hand and loaded onto punts or trailers for transport to the factory. The large amount of hand labor required for cane harvesting is a very important source of employment.

Vigorous efforts must be made to strengthen the competitive position of GUYSUCO. The short-term outlook for the sugar industry is unfavorable because: (a) world market prives are seriously depressed, 6.52 U.S.¢ per pound in early 1983, (b) the cost of production now exceeds market prices, (c) the sugar estates managed by GUYSUCO are steadily losing money. Thus a major effort is needed to assure recovery of the industry by the time prices rise as projected for late 1983 and beyond.

4.2 Development of Sugarcane Growing and Processing in Guyana

4.2.1 Processing

In the early days of the sugar industry in Guyana, all field operations and even those in the mills were entirely manual. Even the juice was expressed manually with rollers, then boiled over fires and shipped in hogsheads. Later, the mills were driven by horse or water power until the present steam-operated mills were introduced. The vacuum pan process introduced as early as 1832 made it possible to separate most of the molasses from the sugar. The "Mescovado" sugar produced by the old method contained about two-fifths molasses and three-fifths sugar.

New machinery in factories made it possible to extract a higher percentage of the juice from cane and produced a better quality product. Some of the first installed units of the sugar processing equipment in the present factories are over a century old. Many factories may even now have some of these older components mixed or combined with newer ones plus even the latest type of equipment. Only one factory in Guyana was completely built in modern times.

In 1920, crystallizers were introduced and this resulted in an increased recovery of sugar from cane by four percent. The old inefficient fire-heating evaporation method required about three weeks for cooling. Today, a factory equipped with a crystallizer requires only four or five days for cooling and in a factory which has a modern water-cooled crystallizer, the process takes only about 24 hours. The modern vacuum filter requires one operator as against three to six used in the filter press process.

High speed centrifugal machines have reduced the personnel required from eight to two. Improved machinery through the years has resulted in a savings in labor requirements. Guyana's present typical recovery rate of between 85 to 86 percent compares favorably with that of other sugar factories in the Caribbean. Should the present trend of inadequate capitalization continue of worsen, industry's performance will decline.

4.2.2 Sugarcane Production

It has been said that the soils and climatic conditions of Guyana are about the worst that can be found in the tropics for production of sugarcane. this comment is somewhat exaggerated, but does contain a kernel of truth. Certainly the soils of the coastal plains are not loose well-drained deep loams and there is no prolonged dry season where the cane can "mature" (store sucrose in the stalk) and be harvested during dry soil conditions. The constant high temperatures of Guyana are not conducive to the buildup of sucrose in the plant. Good growth and tonnages are possible, but a high sucrose content for Guyana -- about 9.5 percent -- is below expected levels in more favorable climates. For example, Australia can attain a 14.5 percent sucrose level in sugarcane. A part of this phenomenon is the lower amount of solar radiation under the cloud cover typical in Guyana.

The cane-growing sites of Guyana with heavy soils and a climate with two shortened dry periods were probably chosen by the early Dutch and English settlers merely because of their geographic proximity to ocean ports. The settlers were probably not cognizant of the climatic and soil criteria for selecting sites for sugarcane production.

The vigor and ingenuity of the early plantation owners resulted in a method of growing sugarcane despite the heavy soil, and poor drainage conditions of the Guyanese coastal plain. The owners devised a system to avoid transporting bulky cane over wet, sticky clay roads by providing a canal system of water transport. The basic systems they designed and installed in the 18th and 19th centuries are still in use today.

Typical fields are laid out in 10-acre units. A deep drain runs down the center of each field connecting to a main or secondary canal of the drainage system for the entire estate. Transport canals with embankments are at opposite sides of each field and parallel to the center drain which runs the length of the rectangular field. All four sides of the cane field have a levee or embankment. The cane is planted on the levees as well.

The field drain outlet goes underneath a levee via a gated culvert or outlet. The fields are laid out 1,200 feet long and 363 feet wide. Cambered beds are formed from the drain to the canal and are thus about 180 feet long (allowing three feet for the drain in the center). These cambered beds are 30 to 36 inches high and 35 to 50 feet wide. They have sloping sides to smaller drains on each side that feed into the center drain. Longitudinally the beds slope from the lower elevation of the center drain up to the canal embankment. This unique arrangement allows production of sugarcane in very heavy soil on drained beds, cutters carrying the cane a maximum of 180 feet, and the cane transported in punts by water to the mill. Tractors instead of mules now pull the punts in the canals to the mill.

About eight percent of the land is required under such a system for the canals, drains, and roadways, but space and availability of land has never been a problem for the industry.

The Guyanese system for growing sugarcane requires constant maintenance, to operate efficiently. This is a concern of estate management in the face of the current economic crisis the estates are facing.

There is one favorable feature for sugarcane in the otherwise adverse weather and soils situation in Guyana. With the amount and distribution of

rainfall, the cane may require no irrigation. The exceptions to this are just after planting, after harvesting a ratoon crop and before the new ratoon crop is beginning to grow. A shortage of moisture at these critical times may require one or possibly two applications of irrigation water.

4.3 Crop Husbandry

In recent times, heavy crawler type tractors are being used to tear out old plantings, till the soil, and loosen soil by chiseling. This rehabilitation method is planned for every fifth year. New plantings occur in year 1 and ratooning is practiced in years 2 through 5. Sufficient machinery has been available in the past to accomplish this on private and cooperative fields in addition to the estate fields. Now the lack of funds has resulted in the estates doing very little or no rehabilitation work for the private farmers off the estates and the estates are falling behind in work on their own fields.

After years of experiments, it was found that the flooding of fallow cane fields (they are surrounded by levees or embankments) for six to nine months after the last harvest resulted in certain chemical changes in the soil and changes in insect and weed growth. The flooding completely submerges the fields with 12-18 inches of water. This procedure enhances subsequent yields by 40 percent. The unique sugarcane field layouts make this practice possible.

Recent technological advancements in weed and insect control have improved cane growing and also reduced requirements for labor. The sugarcane research work in Guyana has been excellent. As a result, the country has high yielding varieties with resistance to diseases. In the mid-1970's a destructive smut disease appeared for the first time in Guyana and the highest yielding veriety was quite susceptible. The experiment station tackled the problem immediately and obtained resistant cane varieties before the situation became disastrous. These efforts were of great value and benefit not only in Guyana but in the other sugar producing countries of the Caribbean which later experienced the smut disease as well. One island, Barbados, had

switched to resistant varieties before the disease arrived.

The new smut-resistant varieties did not have the yield of the older varieties. Some factories also reported problems with their bagasse burning properly. A second stage of developing resistant varieties will soon result in varieties not only smut-resistant but with high yield potential as well. Some of these varieties have already been released and are being introduced on the estates.

Some estates presently grow as many as 20 or more varieties, but most of acreage is planted in about four to six varieties.

Sugarcane is still planted and fertilized by hand. Some hand weeding is done by small farmers but very little hand weeding is done in the estate fields.

Complete (N - P - K) fertilizers are used at planting time but the standard practice in fertilizing subsequent crops (ratoons) is to apply 400 pounds of ammonium sulphate per acre. Lime is applied on new plantings in whatever quantities are available. There is never enough to achieve the needed reduction in soil acidity.

Insect and rat attacks on sugarcane fields of the estates are constantly monitored to prevent damage. The insect pests of sugarcane do not appear regularly or each year and may be quite unpredictable so no preventitive type of applications of chemicals are made. The same is true for rat infestations or localized outbreaks. Supervisors regularly patrol and inspect fields from the high platform or from the backs of a Land Rover and enter suspicious areas for a closer examination. GUYSUCO has three agricultural aircraft but only one is operable at present. It is thus behind schedule and kept very busy in trying to meet the needs of all 10 estates. The aircraft operators also serve as observers for problems as they fly over cane fields. This function is lessened when only one airplane is operating and it is on a heavy schedule of applying pest control chemicals.

The sugarcane is burned before harvesting to rid the fields of leaves, trash, insects, rats and snakes. Harvesting should ideally be accomplished as soon after burning as possible. Delays in delivery should also be avoided or minimized. The sucrose content in the cane begins to decline markedly about 24 hours after burning. Good coordination is required between (a) burning, (b) delivering cane cutters to the field, (c) having punts on location and in sufficient number to handle all the crop, and (d) tractors to move punts quickly to the factory. With the latter, road conditions become a factor Any delays or mishandling of the arriving punts at the mill may also reduce sucrose content.

The cane is cut by hand and carried to the punts, and piled on top of chains spread in the bottom of the punt. These chains are attached to a sling hoist at the factory and lifted to the weighing platform from which the cane enters the crushing rollers.

Each punt holds six to seven tons of cane. Most canals are just deep enough for a normal load of cane in a punt. Overloading by some cutters thus causes problems in transport. Cane piled too high in the punts can cause problems at overhead road or ditch crossings on the canals.

4.4 Yields and Production Trends

Total acreage harvested, and sugar produced is shown in Table 4.4. The acreage, production, and yield per acre are shown graphically in Figure 4.4. Sugar production has declined about 20 percent but the yield of sugar per acre has declined even more, or about 35 percent.

The tons of cane to produce one ton of sugar (TC/TS) has increased in the last 20-22 years by 25 percent. The only way the country has been able to maintain sugar production at around the 300,000 ton level in recent years has been via increasing of acreage harvested. However further expansion of acreage would require capital investments and enough capital to meet production and factory needs is not available so the industry's chances of producing more sugar for export lie in increasing yield per acre and bringing down the TC/TS.

Table 4.4

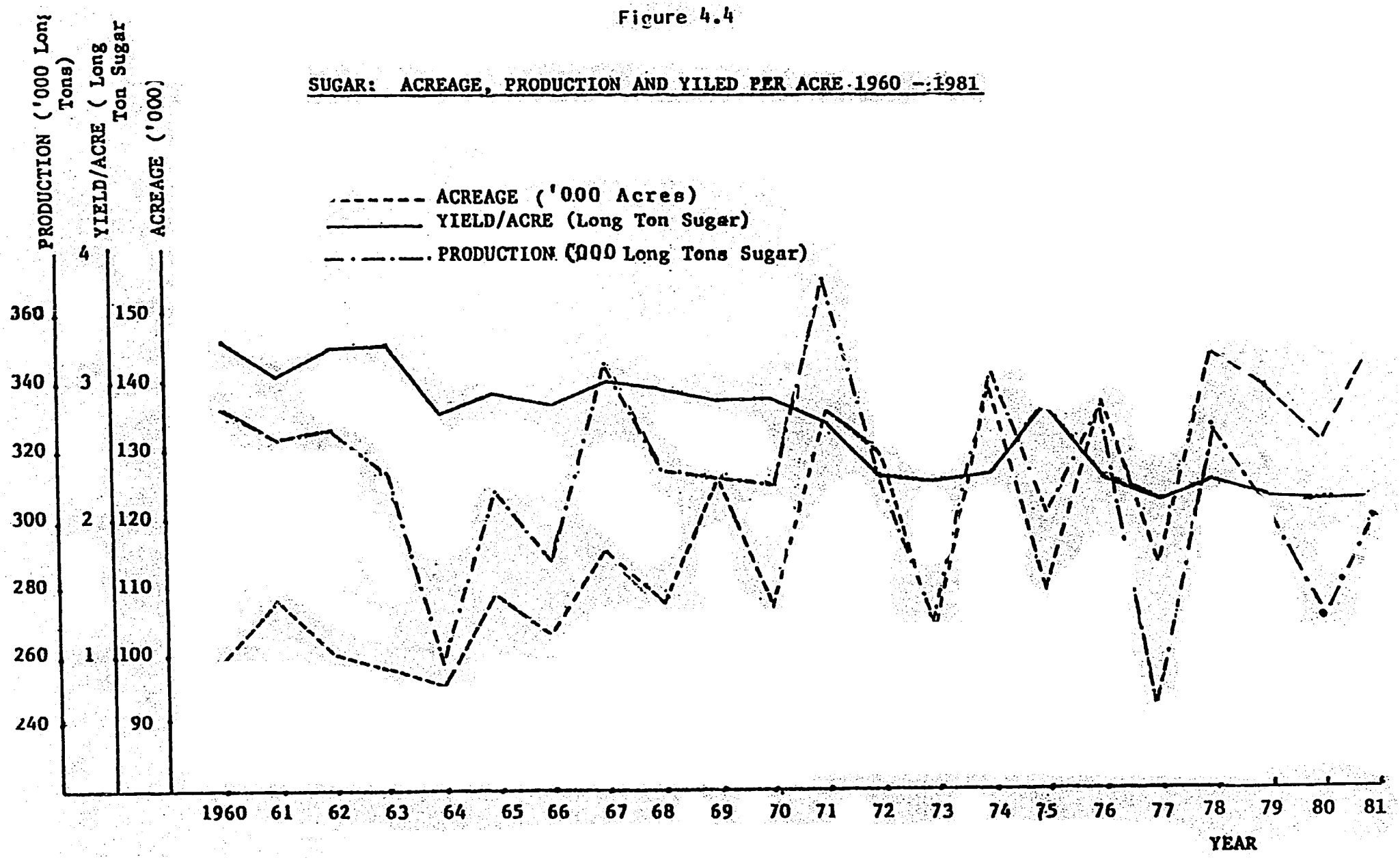
GUYANA: TOTAL ACREAGE REAPED, CANE HARVESTED AND SUGAR PRODUCED 1960 - 19

YEAR	ACREAGE REAPED (ENG. ACRES)	CANE HARVESTED (LONG TON)	SUGAR PRODUCED (LONG TON)	YIELD CANE/ACRE (LONG TON)	YIELD SUGAR/ACRE (LONG TON)	TON CANE PER TON SUGAR (LONG TON)
1960	98,598[1]	3,737,890[2]	334,441[3]	37.91[4]	3.39[5]	11.18[6]
1961	107,780	3,561,677	324,745	33.05	3.01	10.97
1962	100,277	3,444,200	326,023	34.35	3.25	10.56
1963	97,151	3,416,229	317,137	35.17	3.26	10.77
1964	95,127	3,002,979	258,378	31.57	2.72	11.62
1965	107,908	3,405,046	309,445	31.56	2.87	11.00
1966	103,716	3,318,300	288,869	31.99	2.79	11.49
1967	115,000	3,771,018	343,922	12.79	2.99	10.96
1968	107,392	3,502,424	316,848	32.61	2.95	11.05
1969	125,962	4,112,321	314,465	32.65	2.89	11.28
1970	107,126	3,712,035	311,149	34.65	2.90	11.93
1971	136,539	4,244,900	368,843	31.09	2.70	11.51
1972	129,500	3,595,777	314,600	27.77	2.43	11.43
1973	112,900	3,270,179	265,704	28.97	2.35	12.31
1974	139,250	4,099,176	340,815	29.44	2.45	12.03
1975	108,200	3,474,596	300,350	32.11	2.78	11.57
1976	137,798	4,037,314	332,457	29.30	2.41	12.14
1977	113,762	3,108,378	241,527	27.32	2.12	12.87
1978	144,410	4,218,302	324,805	29.21	2.25	12.99
1979	140,785	3,892,022	298,268	27.65	2.12	13.05
1980	129,349	3,600,855	269,634	27.84	2.08	13.35
1981	143,078	4,125,154	300,790	28.83	2.10	13.71

SOURCE: Guyana Sugar Corporation Limited

Figure 4.4

SUGAR: ACREAGE, PRODUCTION AND YILED PER ACRE 1960 – 1981



In the case of the latter, it is interesting to note that the 13.71 TC/TS for 1981 is the equivalent of 7.3 percent sucrose whereas the 1960-61 level was about nine percent. With some limitations placed on the possibility of increasing the sucrose content as discussed above, the most important potential then is yield of cane per acre.

The decline in yields and sugar produced per acre is mostly attributable to the rapid deterioration now going on with field equipment used in the rehabilitation of old plantings. Ratooned fields on the estates are becoming older than the desired five years and individual cane farmers are in some cases still harvesting fields that have been ratooned for 15 years.

Other causes of declines in yield and sugar produced per acre are: (1) the attack of the smut disease in the 1970's; (2) increasing costs combined with lower returns resulting in lower rates of inputs, and (3) cycles of unusual weather combined with labor difficulties that have retarded harvesting in some years.

Eighty-five percent of Guyana's sugar is grown on the 10 estates controlled by GUYSUCO. The remainder is grown by private cane farmers who deliver their cane to mills on the estates for purchase and processing by GUYSUCO. Yields by private farmers are generally lower than estate yields due mainly to the lower investments in fertilizer, re-planting, and other practices. Although private farmers produce 15 percent of the sugar in Guyana, their share of fertilizer used is only seven to eight percent. A few progressive and well-financed private farmers get yields well in excess of the average estate yields.

4.5 Marketing

Under a favorable EEC agreement, Guyana has a quota of 165,000 tons that can be sold at a subsidized price. In 1982, the price was initially set at 260 pounds sterling per ton, or approximately three times the world price of sugar. A July price increase of 9 1/2 percent was expected, but it is not known if it actually materialized. Most of the EEC sugar goes to the United

Kingdom. The 165,000 tons is about 55 percent of Guyana's normal exportable surplus.

An additional five percent of the total export supplies normally moves to the CARICOM countries also at a protected price higher than the world market price. These sales are to the non-sugar producing islands. Prices are determined by a composite index of EEC, world market, and local domestic prices. Last year, Guyana did not ship her full quota of 4,200 tons due to purchases elsewhere at lower world prices by the CARICOM countries.

Canada has bought from Guyana at world market prices in the past. In 1982, Canada has been overstocked with sugar and has offered to buy only at 10 pounds a ton below world prices. Canada's purchases over the past five years have averaged about 40,000 tons per year.

U.S. policies on sugar imports have fluctuated since the 1974 expiration of the sugar act with its system of quotas and sales at U.S. domestic prices. From 1979 through 1981, U.S. imports of Guyana sugar were duty-free but at world market prices. These imports averaged about 53,000 tons per year. In 1982, the U.S. has reverted to a quota system based on the history of imports over the past seven years, but the price is close to U.S. domestic prices and thus 70-80 percent higher than world market prices. The resulting dollar volume of sales, then, will not be much different than in recent years.

Domestic sales have increased slightly over the last five years to 35,000 tons in 1981 and the same level is expected in 1982. The domestic price is highly subsidized at 12.5 cents a pound retail. This is only 22 percent of the GUYSUCO cost of production of 57 cents a pound. Guyana sugar consumers received in 1981 a subsidy from GUYSUCO of G$35 million.

With the recent decline in the CARICOM, Canadian, and U.S. sales, Guyana may be faced with as much as 50,000 tons to sell on the world market in 1982. The world market price will be substantially lower than the cost of production.

GUYSUCO lost G$80 million in 1981 and losses are expected to be higher for 1982. This figure includes losses attributable to the domestic price subsidy, exchange rate losses, interest payments, and additional personnel benefits. Operationally, it can be said that GUYSUCO broke even, but management is understandably concerned. It is obvious to them that only a small amount of their foreign exchange earnings are being made availabe to them in the face of ever-pressing capital needs.

4.6 Present Organization of Sugar Estates

After amalgamation of the smaller holdings, two large companies emerged and controlled all of the estates up to the time of the nationalization. Of these two companies, Bookers was by far the larger. Both companies had well structured and organized functional departments. Each separate estate was organized as a cost center and a separate entity, but was adminstered by a head office in Georgetown. Each estate performed all the functions of production, harvesting, processing, and testing within its own organizational structure and received only administrative and technical assistance from headquarters in Georgetown. All staff were professionals and trained for their positions. Labor and personnel affairs were all handled within each estate.

When independence for Guyana was nearing reality, the various political parties in the country began vying for power in anticipation of the event. There were three political parties at the time and each voiced its own conception of the future of the sugar industry after independence. There was discussion of the sugar industry "belonging to the people of Guyana" and of being divided up among the present farmers. However, one party stated, "Government participation would not affect existing managerial arrangements; government activities would only be advisory." The leader of one party stated at the time (1964) that he was an amateur as regards the sugar industry and did not claim to be anything else. Perhaps fortunately, the government became owners of the sugar industry, formed the company, GUYSUCO, but

did not change the structural running of the industry at first. The first change after nationalization, however, was to place all income from the sugar industry under government control by depositing the money in the general fund. In order to continue operations, GUYSUCO then had to request from and justify its budgetary needs to the government every year.

The second change made by government was to take control of the Demerara Iron Works (foundry) which had previously been owned and controlled by Bookers, the largest of the colonial sugar companies, but the foundry was used by the entire sugar industry. The monies all going through the general fund did not significantly affect GUYSUCO to begin with. With hindsight, however, it can be said that the government erred by using up all the sugar earnings during the high-price period of the mid-1970's and not creating a set-aside for such difficult times as the industry now faces. In the last few years, with no control over its own funds, GUYSUCO has been rapidly falling behind in meeting its requirements to maintain facilities.

GUYSUCO now states that their lack of control of the Demerara Iron Works is detrimental to the sugar industry. The rollers and crushers at the beginning of the sugar extraction process in each factory are vital to the efficient removal of sugar from the cane. Rollers must be replaced or rehabilitated regularly to do a good job and withstand the hydraulic pressures used for high extraction percentages. With a shortage of capital to buy new rollers, the rehabilitation of the old rollers is all the more important. GUYSUCO's present problem with the government-controlled iron works is that the repair and replacement of machinery is late and unreliable largely because the foundry takes on work for others instead of dedicating its efforts to the sugar industry only.

The Guyanization of management of the sugar industry was one goal of the ruling party after independence. The process was well underway by the colonial companies even before nationalization and continued to progress rather rapidly and in a fairly orderly manner after nationalization. Guyanese continued to manage the industry with some Bookers assistance in the interim,

but now only once a year visits are made by Bookers' advisors - an engineer and an agronomist.

All of the Guyanese management personnel had "grown up" with the organization and as they moved up in rank, they received training for the specific job responsibilities. In recent years, more and more of the experienced, knowledgeable and dedicated staff have left GUYSUCO in search of better pay, to leave the country, or for other reasons. As expressed by one officer in GUYSUCO, the ranks are becoming very thin and replacements to move up into vacancies are becoming more scarce or even non-existent. Thus the shortage of trained staff poses serious problems and the industry will suffer greatly with any further loss of key personnel. As mentioned by one officer, the salary scale has not been changed since 1974.

One consultant in Guyana recently stated (in dicussing needs of the sugar industry) that "a program of incentives is needed to encourage skilled employees and attract new people." He further said, "First, a salary schedule comparable to that paid in the sugar industries of Trinidad and Jamaica is needed. Next should come a series of perquisites including improved housing, transporattion, and travel allowances. Finally, a bonus payment system should be installed based on a small percentage of net profits, when profits are realized."

If possible, such changes should be attractive enough to entice some of the personnel who have already left GUYSUCO - even to return to Guyana from abroad. In other words, the former "favored status" of staff in the sugar industry should be restored. It has been stated that the supply of qualified personnel in the country is diminished and is no longer a reliable source for new or replacement staff.

The two functional directors presently with GUYSUCO who are involved with the agricultural production aspects of the company are doing excellent work. Should they leave or be lost to the organization, replacing them will be most difficult. They complain about too many meetings and time spent preparing reports. This keeps them from "being in the field" as much as they would like and feel they should be.

A production committee includes three people from GUYSUCO's headquarters and two regional directors. Three-year plans are made which are updated each year and carried forward. These plans consist largely of detailed budgets and investment needs, as well as broad production plans expressed in terms of acreage and replanting goals. Production projections are based on information provided in the plan. These plans are made by Agricultural Operations Director B. Chandra, and Agricultural Research and Development Director V. Young-Kong.

All cane fields in the estates are monitored in Georgetown by Mr. Young-Kong's office. The soil type and characteristics of each field are known. Varieties are recommended to suit each field. Drainage criteria are sent to each estate in order to determine the proper time to harvest each field. Time is usually short for getting field work done for replanting so close coordination is essential. Information is furnished the estates on the required machine hours for each field operation so that equipment needs can be calculated and planned. Detailed fertilizer and weed control recommendations are also sent to each estate plus complete guidelines for all agricultural operations.

Goals of the Agricultural Department of GUYSUCO are 40 tons of cane per acre with plant care and replanting 20 percent per year. This is not being realized at present but the preceding paragraphs illustrate the well organized efforts now being made in the production of cane by GUYSUCO.

Each estate is given weekly quotas for sugar production. Quotas are not set entirely within the management of GUYSUCO. A recent government intervention was for certain estates to start their harvest season early in order to earn urgently needed foreign exchange. The early harvest encountered difficult burning conditions, muddy roads to transport cutters, the dams for towing the punts were also too wet, and the bagasse was hard to burn in the factory. Probably the most serious problem in the long run was harvesting fields under wet conditions which compacts the heavy clay soils. This in turn will reduce the yield of the next ratoon crop.

Some estates were also instructed to harvest for a six-month period in the spring harvest. As one estate manager commented, "We start in the rain and finish in the rain." Ideally, harvesting should take place only in rain-free periods. The normal, more extended harvest periods will also reduce the "downtime" of factories which have to repair and rehabilitate their already depreciated equipment. As far as the sugar industry is concerned, the principal of early or extended harvest is wrong and contrary to proven management practices.

Each estate has had, and will continue to have, occasional labor problems and equipment failures that affect the production of sugar. Serious field losses occur when cane has been burned but cannot be harvested or delivered. Each estate attempts to deal with such problems on their own, but nearly all estate managers feel that more assistance is needed from the national level and government especially as regards labor disputes. A uniform policy and standardized methods of dealing with labor problems are needed.

Besides the above problems, some of the everyday operational difficulties of the industry should be mentioned. Each estate manager (Administrative Officer) interviewed was asked to describe his most pressing needs. They all have the labor problems mentioned and a need to increase efficiency in their factories, but the other most frequently listed needs or deficiencies mentioned were as follows:

(1) There is an acute shortage of tillage equipment. The estates cannot keep up with rehabilitation schedules or extend help to private farmers.

(2) There is a shortage of spare parts for all equipment. It was stated that the non-availability of $15 worth of parts resulted in a $500,000 production loss.

(3) Drainage is essential to growing cane. Excavators and draglines break down and are not replaced. Labor to do drainage work is becoming increasingly scarce.

(4) Fertilizers and pesticides arrive too late and the effectiveness of such inputs is greatly diminished.

(5) Roads, dams, bridges are deteriorating and in need of repair. More and better roads are needed.

(6) There is a shortage of punts, and recent replacements are of inferior quality.

(7) A shortage of chemicals reduces laboratory work.

(8) The lime supply is sporadic and no reserves are built up for emergencies.

(9) The release of funds and materials is too slow.

There are communities located near or adjacent to factories and estates, and an interdependency has developed. Businesses, banks, and other services are geared to the needs of these communities and their work schedules. In most instances, the people of the communities enjoy the advantage of medical dispensaries or clinics furnished by the estates. The sugar-associated communities have a long history of ties to the estates. Should the industry be allowed to collapse or greatly reduce its activities in a given locality, it would have a drastic effect on the nearby communities. There would be few if any alternatives for income immediately. Replacement programs or some help would be needed on an emergency basis.

4.7 Assessment of Private Cane Farmers

A brief history or background of private cane farming in Guyana and an assessment of the present situation is presented below.

A small effort to settle sugarcane field workers on the land was made during the crises at the turn of the century. The large plantation owners could not expand their acreage due to the depressed sugar market at the time, so encouraging peasant farmers to grow cane was thought to be a solution. Grants in aid were made to peasant farmers. Arrangements were worked out on some estates for delivery of the cane by private growers. Lands

were originally allocated rent free, but by 1918, farmers were suddenly (without notice) charged an acreage rental fee. That marked the advent of farmer-estate confrontations which have continued off and on down to the present time.

The early start of private cane production was not large nor did it increase to any extent because private cane acreage up to 1970 was only two percent of the total.

1963 was the critical year for increasing and developing private cane farming in Guyana. There were several factors that brought this about, viz:

(1) The changing political climate for independence and the opinion held by many that favored transfer of land and government functions to the people.

(2) The two experiments set up in 1954 and 1956 by British Guyana had proven successful. These experiments were to test whether cane farming by peasants could succeed under centralized control. One experiment was at Lochaber in the Berbice and the other at Bellevue on the Wales estate. Both areas are producing at present. The farmers were former cane cutters and their successful farming activities improved their income sbustantially.

(3) Factory capacities were increased at several estates.

(4) The estates began encouraging farmers adjacent to the estates to grow cane to increase the volume of cane needed to satisfy the increased capacities.

In 1965, the National Sugar Act was passed by Parliament and the National Cane Farmers Committee was created. By 1966, the party in control also expressed a policy of encouraging private cane farming in areas of the estates that were not being cultivated. The leasing of this land to private farmers was to take the place of any needed or planned expansion of acreage by the estates. Many people wanted to start cane farming at the time but most did not have the necessary capital.

In 1964, the private cane farmers' share of the sugar acreage had increased to 3.6 percent. The rate of growth of private cane farming was quite rapid after that and has increased up to the present level of 13 percent to 15 percent, and the private cane farmer has now become a significant contributor to the sugar industry.

Private cane farmers in the past complained that they felt they were always on the periphery of the industry. The estates told them what variety they must plant, were the only buyers for their cane, provided fertilizer, provided cane tops and prohibited the farmers from using their own, were usually the only source for plowing services, and decided when cane could be harvested. They charged interest on unpaid bills for fertilizer and other itmes, but did not pay interest on the value of sugar held for several months before final payment was made.

The publication, "An Analysis of Sugar Production in a Changing Political Environment," Barrett and Della Vallee, 1971, was written to evaluate the economic consequences of a major shift in government policy on sugar production with the termination of the colonial status of Guyana. Specifically, the authors were concerned about the increased emphasis on sugarcane production on small farms at the expense of the large corporate estates and the example offered to other developing economies who might also be considering a larger role for small-scale, private farming. Among the findings and conclusions, the authors stated, "The increased employment resulting from the rapid expansion of small cane farms was at the expense of improved efficiency and productivity...Since estate production exceeds that of small cane farms, the action reduced the efficiency of the industry as a whole."

The authors further concluded that the estates are more efficient than the small cane farms, but they offered a compromise proposal to expand the size and number of small cane farms while not reducing the size and number of estates. This is essentially what has happened in Guyana, but is also the basis for major problems now facing the industry.

The 15 percent of the total production by private cane farmers in Guyana is widely scattered. Estates have different volumes of cane coming from private cane farmers, but the largest volume in a single area is around the Wales estate where 25 percent of cane produced comes from private farmers and cooperatives.

At the present time, private cane farm sizes range from one acre to 200 or more. Five acres have been considered the subsistence level, but this was before the recent plunge in sugar prices. There are several large holdings, groupings of individuals or co-ops varying in size from 850 to 3,000 acres. All but five percent of the farmers belong to the National Cane Farmers Committee (NCFC). This five percent consists of the old established "Pioneer Cane Farmers" who still have free punt service and other privileges from the estates and are reluctant to join the NCFC.

Some of the small farmers may also be employees of an estate. They work on the estate four days a week in order to qualify for retirement benefits. These growers usually do not give their cane plantings proper attention, continuing to harvest as long as any cane continues to grow. These and the other small inefficient farmers will probably not be able to continue under the present economic conditions. There has been some abandonment of fields since 1976, and the rate is expected to increase rapidly. On the other hand, some farmers have well managed and efficiently run cane farms with good to excellent production. Although the overall average yield of the private cane farmers' fields are lower than those of the estates - some individuals and co-ops have higher yields than the estates - for example, at Skeldon and Rosehall.

With the critical economic crises, the private cane farmers now argue that they were encouraged to start cane production originally to help the industry meet its production goals and that now they should not be abandoned by the industry and/or government. At present sugar prices, there is probably no sugar industry in the world that is viable. Where the industry is being subsidized or in socialistic countries such as Guyana, losses will

have to be absorbed by the government (at least for the present) if the industry is to continue. The estates are government-owned, but where does that leave the private cane farmer? He rightly feels he is in a tenuous position and is concerned for his future. If he continues to lose money growing cane and receives no government help to at least meet his costs of production, he cannot continue to produce sugarcane. The inefficient, low-budget farmers will be forced out of production in the next few years, but the well-established larger farmer may have a sizeable investment in his plantings or farm layout. The same principle is true for those who have become part of a cooperative sugar growing group. In addition, no program is being organized to give cane farmers help, advice, and guidance in seeking alternate crops.

Private cane farmers who are already losing money should not be expected to be a part of the subsidization of the price for domestic sugar (see Section 5.5). One suggestion has been made in the event that the subsidy were to be discontinued: some of the funds realized could be diverted to assist the private cane farmers in diversification.

The conditions under which the private cane farmer sells his cane to GUYSUCO are regulated by the National Cane Farmers Committee. One of the functions the Committee is supposed to have is control of the sampling methods used by GUYSUCO to determine TC/TS. In the first place, the growers do not approve of the antiquated bulking method of determining sugar produced from cane. Several individual deliveries are bulked together to get the sample. Thus, there is no reward for high quality cane nor is there any penalty for poor quality. Sugarcane farmers also feel that each farmer's lot should be sampled separately and the farmer paid for his cane on the basis of the sucrose percentage (after dockage and trash determinations). This is the method used in nearly all of the sugar producing countries of the world. Guyana's antiquated sampling system was inherited from the colonial companies. For them, it gave an indication and quantitative picture of how yields and sugar extraction was progressing. It is not

an adequate method in dealing with individual private cane farmer deliveries which need more exact and individualized grading procedures.

Private cane farmers at each estate elect a Cane Farmers Liaison Committee. This Committee meets once a month with representatives of the state management to review grower problems and to coordinate activities between the farmers and the estate.

Each estate has at least one Cane Farmer Liaison Officer on the staff. They may have assistants or fieldmen under them, depending on the number of growers involved. This liaison system is similar to the extension service found in agriculture in many countries. The liaison officer goes out to meet with farmers and help with their husbandry problems, arrange for fertilizers and chemicals, arrange for the rehabilitation of fields if possible, and assist in coordination of harvesting activities.

Sometimes the Cane Farmer Liaison Committee meets only with the Liaison Officer with whom they are already well acquainted. They feel they should be consulted more in the affairs of the estate but in actuality, they have no say at all. The general complaint of cane farmers is that they are treated as "outside parties" and not partners.

The Cane Farmer Committees elect a representative to the National Cane Farming Committee which also meets once a month. Seven are elected to the National Committee so all estates are not represented at a given time. A rotation system is used to include all estates over time.

The National Cane Farmers Committee is headed by a sugarcane farmer. Besides the seven farmer respresentatives, there are eight others on the Committee. The eight other representatives are from the various government agencies involved with the cane industry. This includes two representatives from GUYSUCO and the Cane Farming Manager who also heads up the Cane Farmer Liaison Officer program in GUYSUCO. The Committee is a liaison between the cane farmers and the govrnment and is responsible for seeing that the

provisions of the NCFC Act are carried out. The Committee meets once a month in Georgetown. The Committee is given national recognition and is overworked because of the many pressing problems with which it must deal.

Cane farmers have numerous other complaints and problems. They feel that GUYSUCO as sole purchaser of their sugar, operator of the water transport system by which most cane is delivered, and owner of all the rehabilitation equipment, dictates terms to them. GUSUCO is owned by the government, but the cane farmers feel they have not been taken as partners. They accuse GUYSUCO of still having a "Bookers mentality" toward them. GUYSUCO officers, on the other hand, feel they bend over backwards to try to help and deal with the farmers. A strong and able mediator or management specialist vested with the proper powers to act, could help the industry in seeking a workable solution.

The strongest resentment the cane farmers have about the present system is that they should be paid promptly for their cane. They feel that they should have a voice in or some control of the processing and selling of the sugar because they are charged 30 percent of the sales price of sugar. Some of the factories are becoming inefficient and have excessive losses in the processing of the sugar. The farmers can do nothing about it. They also have no opportunity to analyze the 30 percent charge for processing and handling and verify if it is fairly computed. Growers rationalize then, that they are in fact subsidizing the estates under the present system.

Another dissatisfaction voiced by farmers relates to the present system of payment for their cane in four installments. GUYSUCO makes a conservative estimate of the average price it will receive on the world market. Based on this, the farmers are given an advance payment when the cane is delivered. This payment is intended to give the farmer enough cash to cover his harvesting and delivery costs. The advance payment was raised from 65 percent to 75 percent in 1981. However, the world open market prices declined in 1982 and costs of harvesting and delivery again were not being covered by the advance payment.

A second payment is made several months later after GUYSUCO sales prices are verified, followed by two final and smaller payments. Many farmers do not understand GUYSUCO's complex system for determining how they are paid even though they are free to examine sales data at any time. This also contributes to their desire for a single payment at the time of delivery.

Due to the shortage of equipment at the estates, the estates' replant programs are falling behind, and the estates can rarely help the farmer with his field rehabilitation needs. The result is that the age of the farmer's ratoons is increasing each year and yields and quality are declining.

Farmers face problems in obtaining loans from GAIBANK for rehabilitation expenses. Under the present system, they must furnish collateral. Small farmers were unable to do this. Cane farmers contend that GUYSUCO should be guarantors for the loans and take repayment in the form of cane deliveries as was done in the past. If the availability of equipment is restored in the future to its former level, farmers believe the financing problem should receive high priority.

Following is a list of some of the other problems and complaints expressed by cane farmers or farmer groups. In some cases, we were met by cane farmers with prepared statements and documents. Two of these are shown in Appendix III.

(1) Drainage of cane fields is not as well coordianted for cane farmers as it is for the estates. Also some estates now charge for drainage - a new practice.

(2) Punts do not arrive on time or in sufficient numbers to handle the cane that has been burned in preparation for harvesting, resulting in a loss of sugar content.

(3) Many roads are so bad farmers cannot move their cane when they depend on deliveries by trailer.

(4) Growers work on the estate canal system to prevent deterioration, but receive no pay nor credit.

(5) Canals which are the responsibility of D & I are maintained by farmers, but the farmers are still charged by D & I for the use of the canals.

(6) Cane tops which have to be taken from GUYSUCO are no longer guaranteed to be disease-free.

(7) More bridges are needed to get machinery to farmers' fields.

(8) When farmers do use estate equipment, the rate charged is unfairly high.

(9) Fertilizers and chemicals (particularly herbicides) are difficult for farmers to obtain at all, let alone on time.

(10) Cane farmers do not receive medical services at the estates despite claims by the estates to the contrary.

(11) All costs have increased rapidly in the last two years.

Through deduction from the payments for their cane, sugarcane farmers contribute to three funds. One of these funds began as far back as 1946. This is the price stabilization fund. And now at the time when it is needed most, cane farmers have discovered that several years ago, without their knowledge or consent, the fund has been diverted to the sugar workers pension fund. Another fund has been used to finance houses for sugar workers and some rice farmers have used the monies. A fund intended for use in the rehabilitation of farmers' fields has been diverted by some estates to dams and bridges.

It is understandable that sugarcane farmers in Guyana have a deep-seated resentment and feeling of betrayal about what has happened to their funds plus a feeling of helplessness in dealing with the problems.

4.8 Mechanization and Labor

From its beginning to the present, labor inefficiency has characterized the sugar industry. With ever-occuring labor problems, the industry has considered more intensive mechanization at several points in its history.

In 1948, a commission was appointed to study the possibility of greater mechanization. The rice industry was just then venturing into mechanization and is now almost fully mechanized. As a result of the commission's findings, a decision was made that mechanization would replace labor in the sugar industry and this would have undesirable economic and social effects.

The 1963 encouragement of the expansion in the number of small cane farmers was partly in response to a growing interest in mechanization that had arisen. Again, displacement of labor was considered undesirable. As a result, the total employment of labor increased, but productivity in cane growing diminished.

The Burnham administration in early 1966 issued a circular urging employers generally not to introduce mechanization schemes without prior permission of the government because of the undesirable displacement of labor.

Labor in the sugar industry has maintained a favorable position for itself up to the last few years by means of strikes and work stoppages. Formerly, there was a "stigma" attached to cane cutting, but now many white-collar workers, rice farmers, and others work in the cane fields on week-ends or on a part-time basis. The competition for labor is becoming an important factor. Farmers compete with the estates for labor at critical times as well as with each other. This sometimes pushes the price of labor up since there is now an actual shortage of labor.

In reaction to this evolving situation, the agricultural management in GUYSUCO has decided it is time to embark on a program of pilot projects with a sugarcane harvestor. About 1,800 acres are already converted to the "ridge and furrow" system and harvestors are being procured from the United States. The program will be expanded as experience is gained and progress made. Some engineers say that a machine may have to be developed especially to fit the unusual climate and soil conditions of Guyana.

4.9 Conclusion

The sugar industry in Guyana today is faced with some serious problems and unless they are dealt with constructively by government, the industry could conceivably face collapse. With large and pressing need for foreign exchange, it is in the best interests of the nation for the industry to be maintained and strengthened. Sector plans tend to be directed at long-term goals but with the sugar industry, any planning should place priority on the immediate, short-term problems as quickly as possible.

Chapter 5

POLICY RECOMMENDATIONS FOR SUGAR

5.1 Introductory Comment

Sugar in Guyana, even more than rice, is controlled by the government. Most of cane production, as well as of sugar processing and marketing, is handled by GUYSUCO. Along with rice and bauxite, sugar is one of the big three earners of foreign exchange. Since 1977, sugar has accounted for 28 to 31 percent of total foreign exchange earnings. The technical and financial success of sugar production is of great national importance.

The policy recommendations presented in this chapter are the consultant's perception of changes needed to move the industry toward future viability and away from current losses.

5.2 Capital Requirements of GUYSUCO

Some machinery in the sugar refineries is many decades old, and some elements date from more than a century ago. All plants do have some new and improved machinery mixed with the older units. On the average, the sugar refineries in the country are badly depreciated and antiquated. the replacement needs are a major reason for the rising capital requirements in Table 5.1.

Another area where capital expenditures are needed is the replacement of tractors for land preparation and ditch maintenance. Large crawler-type tractors are needed to rehabilitate the cambered beds for replanting cane in the GUYSUCO fields and to assist private farmers in their replanting needs also.

The same situation is true for other equipment used on the sugar estates, such as draglines for ditch work, trucks where hauling by road is needed, and small tractors for pulling punts or other work.

GUYSUCO is an export industry that earns foreign exchange for the country, but GUYSUCO has no opportunity to use those earnings for capital and import needs. Instead, these earnings go to the general fund, and GUYSUCO's needs must be requested each year. The budgets are well prepared and documented, but six months typically elapse before approval is received through the bureaucracy.

The unfilled needs of GUYSUCO are accumulating at an alarming rate as shown in the following table:

Table 5.1

CAPITAL EXPENDITURES 1977 - 1982,
GUYANA SUGAR CORPORATION LIMITED
(000 G$)

Year	Budgeted	Actual Allocation	Actual, as a Percent of Budgeted Amount	Deficit	Deficit, as a Percent of Budgeted Amount
1977	18,898	12,914	68.3	5,984	31.7
1978	26,752	23,769	88.8	2,983	11.2
1979	20,000	13,330	66.6	6,670	33.4
1980	26,000	15,491	59.6	10,509	40.4
1981	43,000	15,766	36.7	27,234	63.3
1982	67,700	17,200*	25.4	50,500	74.6

* Estimated in August. Actual to June was 10,528.

The rapid rate of increase in budgets for 1981 and 1982 reflects the fact that the Corporation is falling behind more each year.

Without a dramatic increase in the world price of sugar in the near future or a change in policy within the government, the industry may be lost to the country.

The following recommendation is made:

Government policy objectives should include the guarantee that at least part of the foreign exchange earnings from sugar be allotted directly to GUYSUCO, to be used for their capital needs as they see them, and no time limit should be imposed on the use of the funds. GUYSUCO is the most responsible and most audited government entity in the country. Giving GUYSUCO more control over its own capital expenditures and reinvestment would allow better maintenance of the industrial plant, and should stimulate developments and improvements for the future.

5.3 Production Decline

Since 1960, there has been a gradual decline in yield of sugar per acre and an increase in the tons of cane per ton of sugar (TC/TS). The national average yield of sugar per acre has declined from 3.39 tons in 1960 to 2.10 tons in 1981. This is a 38 percent reduction. The tons of cane per ton of sugar has increased from 11.0 to 13.7 in that same period. The latter is about a 20 percent increase in TC/TS. When expressed as percentage of sucrose in the harvested cane, a corresponding decrease, from 9.1 percent sucrose to 7.3 percent, is noted.

The yield and quality decline has been due to several factors, but the principal cause is the inability of GUYSUCO to rehabilitate their fields on schedule, i.e., every five years. This is due to the increasing shortage of replacement farm machinery and the deteriorating condition of the present equipment. GUYSUCO cannot keep up with their own rehabilitation needs, so the private farmers receive very little or no assistance from the estate machinery to rehabilitate their fields. The situation is getting worse and, if not solved, will result in even greater declines in productivity in the next few years. GUYSUCO ratoon crops now average seven to eight years in age compared to the desired five years, but fields of private farmers average much older. A national average age for private farmers' fields is not available, but is estimated to be 10 to 12 years.

Since sugar is the largest agricultural source of foreign exchange, and since the cost to develop new lands for cane production is now prohibitive, every effort should be made to reverse the trend of declining cane yields and increasing TC/TS.

It is recommended that:

(1) The Government of Guyana give high priority to replacement and spare parts in order to reactivate old but useable equipment.

(2) Enough new tractors should be procured to bring all tractor fleets for land preparation (including rehabilited older tractors) up to full strength at all estates, so that all estate and private farmer cane fields can be rehabilitated on schedule.

(3) Expatriate assistance should be obtained to revitalize and rehabilitate all machinery repair shops in GUYSUCO. Instruction and training courses should be conducted for the mechanics responsible for upkeep and maintenance of the farm machinery.

5.4 Relationships Between Sugar Estates and Private Cane Farmers

The problems between estate management and private cane farmers are not being resolved, as discussed in Chapter 4.

Farmers are not rewarded for delivering high quality nor penalized for delivering low quality cane. They are penalized for poor processing and marketing over which they have no control.

The following recommendations are made:

(1) A system needs to be devised where farmers have a voice and are consulted in major decisions that affect them regarding the production of sugarcane in an estate area. Attempts should be made by the advisory or consultative group to solve all problems at the local (estate) level, but an arbitration office or group at the national level should have power to step in and settle disputes and dictate what is to be done, when local settlement procedures are ineffective.

(2) Should the practice of paying cane farmers for sugar continue, comparable action should be taken to give farmers a voice in the processing of sugar as well.

5.5 Domestic Price of Sugar

Domestic consumption of sugar in Guyana has been gradually increasing over the last five years, and reached about 35,000 tons in 1981. About 85 percent of the domestic sugar is consumed as unrefined brown sugar, which sells at retail for the very low price of G$0.125 per pound. The rest is semi-refined white sugar. Comparable prices in neighboring countries are three to six times these figures. GUYSUCO's production costs are much higher, so the sugar consumers receive a subsidy from GUYSUCO and the farmers. The subsidy is estimated to be G$30 million per year.

The following recommendations are made:

(1) The subsidization of the domestic price of sugar should be ended. This may result in a temporary reduction in total consumption, but it would be expected that at least G$30 million extra would be available to GUYSUCO for capital and operating expenditures.

(2) GUYSUCO should be allowed to use funds realized from the domestic sale of sugar to purchase tractors and equipment for use in restoring the lowered yield and quality levels of sugarcane, particularly those of the private cane farmers

5.6 Method of Paying Cane Farmers

Cane farmers are dissatisfied with the "four installments" method of payment for their crop. In order to pay farmers in advance of the actual sale of sugar on the world markets, GUYSUCO now makes a conservative estimate of the average price which it expects to receive, and bases payments to farmers on that price. The initial payment is calculated at 75 percent of the estimated price.

A second payment is made several months later after GUYSUCO earnings are more precisely determined. Two final payments are made toward the end of the marketing season, one to cover the balance of the sugar value and a final payment for the value of the molasses and any by-products. In 1981, the last three payments were 15, 8, and 2 percent respectively.

The initial payment was formerly 65 percent of the estimated value of the sugar, but farmers complained that this payment did not cover harvesting labor costs. In 1982, with the world price for sugar at an all-time low, farmers are finding that even 75 percent does not cover harvesting labor costs. Many farmers are not fully aware of just how low the world market price has dropped, or of their dependence on it, but simply complain that GUYSUCO should pay them more. Some cooperative groups also claimed during field visits that the first payments were slow in reaching the bank. Most farmers had to "reach in their pockets" in 1982 to pay their harvest costs.

Even when sugarcane farming is profitable to the private farmer, he needs enough money soon after harvest to prepare his field and procure inputs for the next crop.

The following recommendations are made regarding payments to farmers:

(1) Farmers should be paid for each punt load, trailer load, or total delivery, based on weight and a sample of the cane to determine deductions for foreign matter, leaves, etc. Refractometer (or some similar quick and simple test) readings can be made on the sample to determine the percent of sucrose. The farmer should be paid for his cane on the basis of this delivery sampling and what GUYSUCO calculates they can afford to pay considering their sugar yield, value of by-products and molasses, and their costs.

(2) The sugarcane farmer should be paid the full price within two weeks if possible, and no later than one month after delivery.

5.7 Strengthening of the Experiment Station

The work of the Guyana sugar experiment station has provided a significant contribution to cane production in Guyana for many years. Workers at this station developed improved varieties with resistance to diseases. A leaf scald outbreak in the 1950's was solved with varietal resistance. The most notable contribution followed the appearance in the 1970's of the destructive smut disease. Most varieties in existence at that time were susceptible. Resistance had to be found in a short time to avoid possible disastrous effects on production. Resistance was found, to the credit of sugarcane researchers in Guyana.

Guyana was the first country to be faced with the smut disease problem. The work done by the Guyana sugar experiment station has been of great importance not only to Guyana but to all of the Caribbean region. Barbados, for example, had switched to resistant varieties developed in Guyana before the disease struck that island. Cane varieties now need resistance to at least four diseases.

At the present time, the main functions of the station located at the LBI estate are plant breeding and plant protection. More disciplines or fields of work should be covered, and more staff members are needed. The cane experiment station has been doing its excellent work with very limited facilities, staff, and equipment. Personnel shortages now compound the difficulties, as researchers are lost to administrative jobs and staff members leave the country. Salaries were formerly attractive to staff members, but this is no longer the case, and morale is low.

The following recommendation is made:

> GUYSUCO should be given some of the funds from the sale of domestic sugar when subsidies are lessened or removed. These funds should be used to vastly improve the support of the experiment station, increase the number of staff, and raise their salaries to a level that will attract the highly competent staff the station deserves and needs.

5.8 Alternative Crops for Small Cane Farmers

A few private cane farmers in Guyana have fairly large holdings, but the vast majority of the cane farmers have small plantings, typically two to ten acres. These small farmers are at the mercy of GUYSUCO for any rehabilitation of their fields, but GUYSUCO cannot even meet the needs of the sugar estates much less the needs of the small holders. The result is that small farmers continue to ratoon their plantings year after year, and declining yields are accompanied and worsened by less care and fertilization. With the present very low price of sugar coupled with the poor condition of their plantings, the income of small farmers from their cane harvest is marginal.

Private farmers within the transport and irrigation system of the estates plant their cane on cambered beds. If alternative crops can be grown on these beds without destroying or altering beds, the farmer could then resume cane production when and if sugarcane growing becomes profitable again. Removal of the cane may need to be done manually or with the help of oxen. Tractors for hire will be scarce, and there would be difficulties in moving tractors into cane fields that are surrounded by either canals or drainage ditches.

Assuming such problems could be overcome in certain areas, an excellent alternative crop for these cambered beds would be grain sorghum. It can be ratooned several times from one planting (as with sugarcane), and it can supply carbohydrate feedstuffs presently in great demand by the livestock industry. Nitrogen fertilizer would be needed for sorghum production; that now allocated for cane could be used but a higher application per acre would be desirable.

Much information would be needed on the production of grain sorghum in Guyana such as the best varieties, rate of fertilization, insect and weed control, bird control, etc. This would require an applied research approach and the help of extension agents. There is enough world experience in tropical grain sorghum production to develop a program rapidly.

Another possibility that could be explored is the production of a sorghum for human consumption, such as white durra - known as "Bajra" in India. It can be made into a flour with which roti or unleavened bread can be prepared. Roti is widely used in India and Pakistan and would probably be accepted by the Into-Guyanese, especially since wheat flour and bread are no longer imported by Guyana.

It is recommended that:

(1) External financing should be sought for a program to develop information on tropical sorghum production, and to promote this program if pilot efforts are successful.

(2) The extension portion of a sorghum promotion program would require trained liaison officers who would help small cane farmers to start sorghum. Since the Ministry of Agriculture does not have a strong extension program, GUYSUCO should form a group of liaison officers and train them for this work.

APPENDIX

I. Bibliography

II. Guyana Rice Farmer Interview Guide - 1982

III. Letters from Cane Farmers Cooperative Marketing Societies

Appendix I

BIBLIOGRAPHY

U.S. Department of State, Area Handbook for Guyana, DA Dam 550-82, Nov. 1969.

RRNA, The Income and Production of Guyana Rural Farm Households, 1980.

RRNA, Rural Household Survey, 1978-79.

O.P. Blaich, Agriculture in Guyana. Census 1952.

Checchi and Company, Rice II: Second Guyana Rice Modernization Project, 1979.

Report of Committee on "Field Machinery Required for the Rice Industry," 1979.

GAIBANK, "An Examination of the Effect of the Increased Prices for Paddy on the Return to Rice Farmers," 1980.

RRNA, Assessment of Key Aspects of a Proposed A.I.D. Project to Provide Credit to Guyana Small Rice Farmers for the Purchase of Farm Machinery, 1980.

PRC Engineering Consultants, Feasibility Report, Cooperative Area, Correntyne, 1981.

IDB, Project Report, Guyana Agriculture Sector, 1981.

IRI Research Institute, Inc., Quarterly Report, 1 May 1982.

RRNA, Assessment of Key Aspects of a Proposed A.I.D. Project to Provide Credit to Guyana Small Rice Farmers for the Purchase of Farm Machinery, 1980.

USAID, U.S. Assistance and the Guyana Rice Board, 1981.

IICA, Crop and Livestock Statistics in Guyana, Resource Development and Planning Dept., M.O.A., 1980 updated.

IDB, Project Report, Agricultural Sector Loan, 1981.

Eric Hanley, Mechanized Rice Cultivation: The Experience of an East Indian Community in Guyana, 1979.

Eric Hanley, The Guyana Rice Industry and USAID, 1981.

Appendix II

GUYANA RICE FARMER INTERVIEW GUIDE - 1982

Instructions:

When you meet the rice farmer whom you will interview, tell who you are and introduce those accompanying you. Describe the purpose of your visit, need for information, and possible or actual use to be made of it. Promote confidence, familiarity, common ground, etc., with farmer.

General

Location?_____. Where interviewed?_____.

Name?_____. Land owned?_____. No. of Pieces?_____.

Land rented?_____. No. of pieces?_____. How much paid for land rented?

_____. How much land in rice last crop period? _____. Autumn or

Spring?_____. How many in family?_____. Number of family members available for work on farm?_____. At what time or for what operations are they needed?

_____

_____.

Do you own a tractor?_____: Size?_____(HP). Age?_____(years)

What implements do you have with tractor?_____.

Do you need more implements or do you have enough?_____. Do you perform any "for hire" work with your tractor?_____. How many acres in a crop period?

_____. Do you own a combine?_____. Size and make?_____.

Acres cut per crop?_____. If no combine owned, how do you get your crop

harvested? _____.

Last Crop

How many acres rice in last crop (Autumn or Spring)?_____.

When planted?_____. Variety?_____. When harvested?_____.

Fertilizer used per acre?_____. Yield (bags per acre)?_____.

Price received per bag?_____. Grade or grades?_____. Any serious

pests or weed problems that affected production?_____

_____.

How many chemical treatments did you use?_____.

Present Crop

(Practices employed with this crop plus usual practices)

How many acres planted or to be planted?_____.

Amount of seed used per acre?_____. Source of seed?_____.

Cost of seed per bag?_____. Do you treat your seed? _____. If so, chemical used, and rate?_____. Describe land preparation, dry and wet cuts, disk harrowing, others?_____

_____.

Own tractor or hired?_____. Cost of each operation if hired?_____

_____

_____.

If hired, who performed the work?_____. On time?_____.

Satisfactory job?_____. Any differences in Spring and Autumn land preparation costs or difficulties?_____

_____

What variety do you plant?_____. Why?_____.

Is it your first choice?_____. Do you broadcast your seed in the water?

_____. What depth?_____. Or in the mud?_____.

Or other condition at seeding time?_____. Do you lower your water level at seeding?_____. If so, at what time?_____. Are snails a problem at the seedling stage?_____. If so, can you get copper sulphate or other chemicals in time to control them?_____. If you can, would you leave water on rice during seedling stage?_____. Why?_____.

What kinds of fertilizer do you use?_____(Urea, TSP, others). Time you apply each and amount per acre?_____.

Is the amount of Urea you use: (1) All you are allowed, (2) All you think you really need, (3) All you can afford? If you were allowed all the Urea you

wanted and could pay for it, how much would you use per acre in your present situation?_____.

How much if you had all other inputs needed, good land preparation, reliable water source and good drainage, plus better variety of rice, then how much Urea would you use?_____. What yield do you think you would then be able to get?

_____ (bags per acre).

Pest Control:

What pests do you have in your area? How much damage do they cause to the crop? Do they cause problems every crop? If not, what is the frequency of their occurrence in damaging proportions:

Insect or Pest	Time Usually Occur	% Crop Damage If Not Controlled	Frequency of Occurrence	Chemicals Used	Rate Per Acre	Names Used By Farmers
(1) Leaf Miner						White Leaf
(2) Stem Borer						Heartworm
(3) Paddy Bug						Gandi Bug
(4) Caterpillars						
(5) Grasshoppers						
(6)						
(7)						
(8)						

Note: Indicate 2x, 3x, etc. if more than one treatment used to control a single insect or pest.

Do you use chemicals when pests have caused damage, when they appear to be about to cause damage, or as a preventative measure before you expect them to cause damage to your crop?_____.

(Note to yourself (opinion), Was farmer generally familiar with insect problems of rice in his area, when and how to control them?_____)

Do rats ever damage your crop?_____. If so, how often?_____.

How much damage do they do?_____. What control methods do you use, if any?_____. Do you ever use Kitasan to control neck blast?_____. How do you know when to treat?_____. Does extension agent help on this?_____.

Weed Control:

What weeds do you have problems with?_____. Is Muriana grass a problem in any of your fields?_____. If so, to what extent, % of area, crop loss, etc.?_____. How do you deal with Muriana grass problems?_____. Is Red Rice a problem in any of your fields?_____. If so, what do you do to control it?_____. Do you do any hand weeding?_____. How many times?_____. Man-days per acre in hand weeding?_____. Do you use chemicals for weed control? _____. Weeds controlled, chemical used, timing?_____

_____

If chemical weed control used, do you spray entire field or only heavily infested areas?_____. What % of the total area do you spray if it is "spot" sprayed?_____. Do you have any equipment for applying chemicals?_____. Kind and cost?_____. Acres per day you can cover?_____. Cost to rent or hire if you do not own a sprayer or applicator?_____. Where do you buy your farm chemicals and fertilizers?_____. Do they provide credit or allow buying on time? _____. On what terms?_____ _____. Do they have inputs on hand and on time for your needs?_____. How many man-days per acre are required to apply granules or seed?_____.

Harvesting and Marketing

Was your last crop harvested by private or GRB combine?_____. Cost per bag?_____. How long after your crop was ready to harvest before

combine arrived?_____. Was paddy sacked on the machine or at end of field?_____. Man-days required to sack at end of field?_____. (convert to md/AC). Were bags furnished by GRB? _____. If not, what do bags cost you and how many crops do they last?_____.

Drying: Is your crop dried mechanically?_____. If so, by whom?_____ _____. What was moisture content of your last crop?_____. Cost per bag to dry mechanically?_____. Or do you dry your crop in the sun along highway or elsewhere?_____. How many man-days does this take per bag or for total number of bags dried?_____. How many times was rice spread, stirred and resacked?_____. Is this done with family or hired labor? _____.

Transport: How far to market or road do you transport your paddy?_____. Are the roads or dams usually in good condition at the time of transport?_____. Who transports your rice from the field?_____. What is the cost per bag?_____. How long do you usually have to wait to have your paddy transported from the field?_____. Has your paddy ever become wet and damaged from rain while waiting to be transported from the field?_____.

Delivery Station: Where do you deliver your paddy?_____. (GRB, private miller, or other). Is there a delay (long line) at the weighing and unloading station?_____. What is the longest time you have had to wait with your paddy? _____. What is the shortest?_____. What would you say is the average or usual waiting period? _____. Has your paddy ever been rained on while waiting at the receiving station for weighing or unloading?_____. Do you own or have you ever been provided with a plastic or canvas cover for your paddy in the field during transport or at the receiving station?_____. Do you own one? _____.

Grades - Grading: What grade or grades did you get for your last crop?_____. Do you think the grade was correct or fair?_____. If not, why not?_____. Have you ever appealed a grade you have been given for your paddy?_____. What was the result?_____. From your experience (or what you have heard from others), do rice farmers get a fair hearing with an appeal of grade?_____. Does it take long?_____. Are appeals handled fairly promptly?_____. Were you paid promptly for your paddy after it was delivered?_____. If not, how long did it take?_____. Was a reason given for the delay?_____. What do you think was the reason?_____. Did delay in payment cause you to be in a position of lacking sufficient finances for the necessary inputs for the next crop in time to get the crop planted?_____. Did you abandon planting, have to borrow money to establish your crop, or rent land out as a result of not being paid for your paddy?_____

Labor: (Additional general questions not covered previously). At what times or for what operations with your rice crop did you need to have additional labor and man-days required for each?_____. How much was direct hire and how much was trade-off with relatives or neighbors?_____. What rate per day did you pay for labor?_____. Do you provide any meals?_____. Do you or any of your family have outside jobs?_____. Full time, part time, etc.?_____.

Irrigation and Drainage

Are you in a government-declared Irrigation and Drainage area?_____. What is its name?_____. What rate per acre was assessed last year for D. & I?_____.

Are local authority assessments made in addition to this?_____. How much?_____. If you were in a declared area, did you get water when you needed it? _____. If not, what problems did you encounter in water delivery?_____. What effect did this have on your crop potential or crop-related activities? _____. What is needed so that you would get water at the right time in sufficient amounts for your rice crops?_____ _____ _____. Do you have any excess water or drain problems with your rice crops?_____. Is there anything being done by government to alleviate or correct these problems? _____. Do you suffer any crop loss, crop disruptions, or other problems as a result of inadequate of no drainage?_____. What should be done about drainage in your area?_____. If you are not in a government-declared D & I area, do you have irrigation water available to you?_____. If so, what is the source and is it reliable? _____. If you have your own pump or delivery system, do you have any figures or esimates on the costs per acre, per crop, per unit of water, or some other measure on the irrigation water used?_____. Is the water supply adequate for your autumn crop?_____. Spring crop?_____.

Credit

Have you ever obtained a GRB production loan?_____. Was there a delay or problem in getting it?_____. Did you get the loan soon enough to meet your production cost on time?_____. What was the loan for?_____. Could you have used a larger loan than the one given you?_____. Why? _____. What was the time length of the loan, and what rate of interest did they charge?_____.

Did you pay back the loan on time or were you faced with some difficulty in repaying?_____.

Are GRB production loans adequate, readily available, and well managed?_____.

If not, what are the problems?_____.

Have you ever had production credit loans from private sources?_____.

Was the source a relative or friend?_____. What was the period of the loan and the interest rate?_____.

Have you ever applied for a GAIBANK loan?_____. If so, did you get it?_____.

If so, what was it for?_____. Amount and terms?_____.

Would you be able to increase your rice operations and production if credit were more readily available and in quantity needed?_____.

If so, how much more credit would you need?_____.

Extension

Do you know the local extension agent?_____. If not, do you know of him?_____. Has he ever visited your farm?_____. Have you ever been in to see him or visited with him?_____. What was the purpose of your contact with him, if any?_____.

Have you ever attended a field meeting, seminar or short course conducted by the extension staff?_____. If yes, about how long ago was this?_____.

What was the subject or subjects covered?_____.

Was the subject matter of use to you?_____. If so, how useful?_____.

How do you decide when it is time to spray for insects and what to use?_____. Does the extension agent give you this information?_____.

Or do you get it from others such as commercial dealers?_____.

Do you have problems or questions to ask and cannot get help from extension or other government people?_____. Do you think the extension staff

should be strengthened, given more transportation, and more support in order for them to function more effectively and to be of more help to farmers?_____

_____

Cooperatives

Are you a member of any Cooperative group?_____. If so, what kind of a cooperative and its name?_____.

If yes - has the cooperative been active lately?_____.

If yes - has it been of any benefit to you?_____. What are the changes needed (if any) in your cooperative or other cooperatives you know about?

_____

_____.

General Comment

What is needed most by rice farmers so that they can make a good standard of living in Guyana for their families?_____

_____

_____.

Can this be done on 15 acres when everything is favorable for rice farming?

_____. If not, how much acreage would be needed to support a family?

_____.

Appendix III

LETTERS FROM CANE FARMERS COOPERATIVE MARKETING SOCIETIES

Copies of two letters submitted to the author on visits in the field to farmers cooperative groups are included in this appendix. The preparation of these letters when the farmers heard of our impending visit, and the sizable groups of farmers who assembled especially to meet with us graphically portrayed the great concern on the part of the farmers for their present plight and their urgent need for help from any source such as Guysuco, government agencies, or outside benefactors.

No attempt has been made to change the grammar and the only editing we have undertaken is to clarify the meaning of the original writers.

Good-Intent and Sisters Cane Farmers
Co-operative Society, Limited

Registration No. 884

26 July 1982

TO: The Visiting Team

Gentlemen of the Visiting Team, we the farmers of the above Society have been told that a visiting team will be coming to listen to us describe our problems. The problems facing us at this time arise largely from the rapidly falling production. We hope some kind of assistance will be given to us as a result. The problems facing us are as follows:

(1) Our tons of cane per ton of sugar is very high ranging from 14 to 17 and sometimes as high as 20 to 22 tons of cane per ton of sugar. These are figures for the first crop and account for our not getting enough money to pay even for the harvesting of the cane and the transporting of cane to the factory at the time of the first payment. At the time of the second payment, the money was insufficient to pay for input. In fact, we owe the estate. Maintenance is nil for the crop that has already been harvested. What is needed is extensive rehabilitation of the sugar mill and a reduced price for inputs such as weedicides and insecticides.

(2) The cane fields are characterized by poor drainage and irrigation, bad dams and trenches. We do not earn enough money to pay the maintenance fees to the District Council for Maintenance. This Council is responsible for the bad condition of the drainage and irrigation facilities. For us to overcome the water control problems, we badly need a small dragline, a small bulldozer (a D-6), a slasher, and a Dundi (?).

If the above assistance is given to us, production and productivity will be increased tremendously. The Wales Estate through its administration has been assisting the farmers a great deal, but they are also in the same plight as we are.

Our membership consists of 140 farmers and the area we cultivate in sugarcane is about 446 acres with an additional 156 acres now lying fallow. We are therefore appealing to you in the hope that the needed assistance will be given to us whereby maintenance for dams and trenches in Good Intent-Sisters and Free and Easy can be properly maintained in both areas by the two societies working together. We thank you for your visit and for your consideration of assistance to us.

Yours Cooperatively,

The Secretary (illegible)
Post 49, Sisters Village
West Bank, Demerara

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La Grange Cane Farmers Cooperative
Marketing Society, Limited

Registration No. 876

May 21, 1982

Dear Comrade,

For quite sometime now, we have been complaining about the constant late deposits of our cane payments to our account with the GNCB at Vreed-en-Hoop. However, no one seems to feel that we are being adversely affected. Our examination of the accounts at the Vreed-en-Hoop GNCB indicated the following:

A check dated March 26, 1982 for $8,823.60 was deposited on April 10, 1982.

A check dated April 2, 1982 for $8.074.80 was deposited on April 20, 1982.

A check dated April 9, 1982 for $5,097.60 was deposited on April 27, 1982.

A check dated April 16, 1982 for $10,411.20 was deposited on April 30, 1982.

A check dated April 23, 1982 for $12,250.80 was deposited on June 15, 1982.

A check dated April 30, 1982 for $15,501.60 was deposited on May 15, 1982.

A check dated May 7, 1982 for $20.952.00 was deposited on May 22, 1982.

Our last check dated May 14, 1982 for $8,143.20 has not been deposited to date.

The above shows that all our payments were deposited late. These are, however, only a few recent cases.

Because of the late deposits of our payments, our overdraft interest has been mounting. The amount now stands at $1,410.02, and this is solely because of late deposits.

In February, there was charge of $133.92, an increased penalty and in March there was a further charge of $92.51.

Comrade, we are all unhappy over this situation. Our committee has decided that the Estate should promptly deposit our payments into our account (CA010 at the GNCB in Vreed-en-Hoop). This we feel is the only way out.

We are requesting that this be done with effect from the next crop for we see no sense in marketing sugarcane and paying such high overdraft interest. We do hope to have some genuine understanding and consideration on this matter.

Thank you.

Yours Cooperatively.

The Secretary (illegible)

cc: Administration Manager, Wales Estate, C.F.L.O., Wales Estate
N.C.F.C., Secretary
Cane Farming Manager
Chief Accountant, GUYSUCO
Chairman, GUYSUCO
Secretary, C.F.L.C., Wales Estate

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