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RESEARCH AND DEVELOPMENT  
AT THE  
EBINI LIVESTOCK STATION  
BY THE

UNIVERSITY OF FLORIDA TECHNICAL TEAM

PIO/T No. 504-039-3-70035

March 1, 1969.

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Reference Center  
Room 1656 MS

Report to the Ministry of Agriculture  
The Government of Guyana

Research and Development at the  
Ebini Livestock Station  
by the  
University of Florida Technical Team  
March 1, 1969

An earlier report by a University of Florida team (October 1968) emphasized the preferential access which Guyana has to the Caribbean Free Trade Association as a beef export market. They indicated that the intermediate savannahs appear to have the greatest potential for the long-run expansion of the Guyana beef cattle industry. Two unique features of this area are a near ideal climate for the production of grass and a potential production of feed crops. The principal factors limiting the development of this area are soil fertility, a limitation which can be alleviated by appropriate inputs of technology, and adequate knowledge of the techniques needed for livestock development in the area.

The purpose of this assignment was to review the progress and development of the Ebini livestock station and to make recommendations to the Government of Guyana for future research and development that will allow Guyana to realize her potential for self sufficiency and eventual export of beef. The team representing the Center for Tropical Agriculture of the University of Florida consisted of Dr. John Glenn, animal physiologist; Dr. M. Koger, animal geneticist; Dr. C.B. Ammerman, animal nutritionist, and Dr. G.O. Mott, forage and pasture specialist and team leader. Some specific objectives of this assignment were as follows:

1. Inventory the resources available at the Ebini station such as land, kinds of pasture breeds, ages and numbers of cattle, corrals, machinery and other equipment.
2. Advise the Ministry of Agriculture as to the needed development of personnel and facilities at Ebini for more efficient function as a data gathering and demonstration center.
3. Advise the Ministry of Agriculture regarding the animal breeding program and develop a system of breeding which will produce cattle adapted to the conditions of the intermediate savannahs.
4. Develop testing procedures to screen the germplasm of grasses, legumes and feed crops potentially useful as feed for beef cattle.
5. Advise the Ministry of Agriculture with respect to experimental procedures to determine the fertility limiting factors for crop production in the savannah areas.
6. Ascertain the principal nutritional limiting factors for the health and well being of the brood cow and for the production of slaughter cattle.

Personnel and Additional Resources Required

1. Personnel:
  - Staff and Training Schedule
  - Job Descriptions of Professional and Field Assistant Staffs
2. Buildings
3. Machinery
4. Miscellaneous
  - Schedule of acquisition and estimated costs of Buildings, Machinery and Miscellaneous
5. Land and Pasture
6. Cattle
7. Additional Inputs for the Ministry of Agriculture.

Research Programs

1. Soil Fertility and Agronomic Studies
  - a. Perennial Grasses and Legumes
  - b. Supplemental Feed Crops
  - c. Fertility Studies to determine necessary inputs of fertilizer for pasture and feed crops.
  - d. Fertility and reseeding studies on natural ranges
2. Grazing Trials - with growing young stock
  - a. Grass and Grass-Legume Mixtures
  - b. Nitrogen Level Studies
  - c. Grazing Pressure Studies
  - d. Nutrition studies on native and improved pastures.

3. Cattle Breeding - Feeding Management Systems

Native Pasture vs Improved pasture

Straightbred: Santa Gertrudis, Zebu

Crossbred: Brahma/Santa Gertrudis

Brahma/Holstein

Santa Gertrudis/Holstein

Brahma/Holstein

Comparison of calves raised on improved vs native pasture

Comparison of three supplements on native pasture.

Staff Involvement from the University of Florida

Acknowledgement

Publications and Reports Reviewed

Outline of Report to  
The Ministry of Agriculture, Government of Guyana  
and  
The U.S. Agency for International Development

Research and Development at the Ebini Livestock Station  
by the  
University of Florida Technical Team

Purpose of Assignment

Characterization of the Region

1. Location
2. Size
3. Climate
4. Soils
5. Natural Vegetation
6. Potential for Improved Grasslands
7. Potential for the Production of Feed Crops

Resources of the Ebini Livestock Station

1. Personnel
2. Buildings
3. Machinery
4. Miscellaneous
5. Pastures
6. Cattle

Characterization of the Intermediate Savannahs\*

1. The Ebini Livestock Station is located in the region known as the Intermediate Savannahs of northeast Guyana. The station is about 80 miles south of Georgetown and the station headquarters is about 7 miles south of the Ebini landing on the Berbice river. The isolation of the station is of particular significance since supplies to the ranch must be transported by steamer on the Berbice river, which arrives weekly or by air. The station has its own airstrip which will accommodate a DC3.
2. The area in which the savannahs are located consists of about 3500 square miles but of this only about 300 square miles are actually savannah, the remainder being covered with forest vegetation.
3. The area has a mean annual rainfall of 90 inches and is usually classified as a rain forest climate. The distribution of the rainfall however is bimodal and there is considerable variation in the rainfall pattern from year to year. The general trend is that there are two wet and two dry seasons per year. They are as follows:

Long wet season	-	Mid April to Mid August
Long dry season	-	Mid August to Mid November
Short wet season	-	Mid November to Mid January
Short dry season	-	Mid January to Mid April

The mean annual temperature is about 80°F with a high in October of about 83°F and a low in January of about 78°F. The diurnal variation in temperature is about 17°F which is quite large and probably due to the rather constant trade winds from the north east.

The location of the station at 5° 40'N means that the maximum variation in the length of day is only 3 minutes.

4. The intermediate savannah soils, like similar ecological areas of the western hemisphere tropics are universally very deficient in nitrogen, available phosphorous, calcium magnesium, potassium and several trace minerals necessary for crop and forage production. Many of these soils are also high in soluble aluminum and manganese which may be toxic to many plant species and also render some of the essential elements unavailable.
5. The natural vegetation on the savannahs consists mainly of highly fibrous and unpalatable grasses. The principal genus is Trachypogon in association with several species in the genera Panicum, Paspalum and Andropogon. A few scattered shrubs and trees occur in the savannahs and in some areas there are islands of bushes and small trees.

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\*Wilson (1967), Goode (1958), Wagenaar (1966), Hogg (1953).

6. The factor which is mainly limiting the establishment and production of improved pasture is the low fertility level of the soil. Since this is a limitation which can be corrected with proper use of lime and fertilizer and the selection of grasses and legumes adapted to the region the potential production of the pastures of the intermediate savannahs is indeed very great.

7. As for forage and pasture production the principal limiting factor for the production of many feed crops such as corn, sorghum, soybeans and peanuts is the low fertility level of the soil. With the application of the present technology in plant nutrition and soil science and the selection of varieties of many of the feed crops adapted to this region, the production potential for beef can be greatly increased.

#### Resources of the Ebini Livestock Station

Following is an incomplete inventory of the resources of the livestock station since only a very limited time was available but in most sectors listed herein it is believed that the major facilities and resources were recorded.

1. The only professional staff presently located at the station is Mr. S. Legg, a livestock specialist who has the responsibility for supervising the entire operation.

There are approximately 34 workers employed at the station and 3 sub-professional individuals who supervise the various activities on the station under Mr. Legg's direction.

#### 2. Buildings:

- 5 - technical level staff houses, one of which is used as a guest house.
- 5 - workers houses which are new and not yet occupied with running water and baths.
- 5 - old workers houses which do not have running water.
- 1 - workers camp which is a shed for sleeping.

(Note - The present housing facilities appear to be well built but apparently very inadequate in number for the quantity of personnel employed. Some of the workers do not live on the ranch but in their own houses along the river).

- 1 - machinery shed, workshop and general storage.
- 1 - feed, seed, mineral and fertilizer shed.
- 1 - electric generator shed.
- 1 - radio shed
- 1 - livestock office.

3. Machinery:

- 2 - 45 hp Massey Ferguson Tractors, 1 yr. old, condition good.
- 1 - 65 hp " " Tractor , 1 yr. old, condition good.
- 1 - 40 hp " " " Out of use, for lack of repair parts.
- 3 - 2 wheel trailers 9 x 4 ft. good condition.
- 2 - field cultivators
- 1 - home made 2 row grass sprigger.
- 1 - 4 row rice planter, never been used at Ebini.
- 1 - rotary mower, not in working order due to lack of repair parts.  
Various tandem discs, disc plows, hydraulic blades, scoop shovels etc. which are not being used because of lack of repair parts or are not needed.
- 1 - 15 KWH generator, diesel, temporarily not functioning properly.
- 1 - two way radio, out of order.
- 2 - Landrovers, average condition.
- 1 - cement block plant.
- 1 - water pump for houses and corrals.

4. Miscellaneous:

- 0 - livestock watering facilities in the pastures do not exist. A priority item.
- 1 - corrals, only one now available, in very poor condition. Includes three holding pens, a working chute with 3 sliding gates, individual animal scales, but no cattle squeeze or spray race.

5. Pastures:

- a. The large areas of native pastures consisting of several square miles in each pasture are only partially fenced. The forests and rivers serve as boundaries.
- b. In the improved pasture area there are about 140 pastures varying in size from about 8 to 15 acres each. The fences in most of these are in good repair but no water system has been installed in this area.
- c. There are a large number of holding pastures of a few acres each close to the corrals.

6. The Beef Herds:

A detailed inventory of the cattle was not available at the time of our visit. The approximate number of females of breeding age were indicated by Mr. Legg as follows:

1000 Santa Gertrudis and Santa Gertrudis crosses  
100 Brahma  
150 Sahiwal

These figures may be compared with those quoted by Wilson 1967 at which time a total of 2100 head were on the ranch consisting of approximately 60% cows bred to Santa Gertrudis and Santa Gertrudis crosses, 25% Brahma and Brahma crosses and 15% Sahiwal and crosses.

Except for the Brahma and a few sire Santa Gertrudis, the herd traces to Brahma -Native type foundation females that have been mated mostly to Santa Gertrudis-Cross bulls. During recent years, artificial insemination has been used to produce crosses sired by Polled Shorthorn, Jersey, Angus and Hereford bulls. A few Holstein crosses were noted also. While not a critical test, these animals are of interest as indicators of general adaptability and productivity of such crosses for commercial beef production in Guyana.

A sizeable number of bulls of variable blood composition and quality were available for sale to private producers. Available also were a number of other animals in varying degrees of readiness for slaughter.

Personnel and Additional Resources Required

1. Job Descriptions and Justification of new Ministry Personnel

In order to upgrade the quality of research and the amount and efficiency of collection of research data in the agronomic and animal production programs, the number of qualified technical level personnel will need to be increased. A well developed plan for the training of local personnel during the next 5 years must be initiated now to provide for competent personnel if the program of research and development at the Ebini station is to be a source of useful information for the agricultural improvement of the region.

Ministry of Agriculture, GOG - Resident Staff and Personnel Training Schedule

Year	In Residence		In Training	
	Professional*	Field Assistant	Professional*	Field Assistant
1969	Administrator (1) Agronomist (2) Livestock Specialist (3)	Crops Livestock	Forage Specialist (5) Crop production specialist (6) Animal Breeder (7) Animal Nutritionist (8) Soils Specialist (9) Fruits and Vegetable Crops (10)	Forage Crops Field Crops Livestock Herdsman Livestock Herdsman Fruits and Vegetable Crops Soils Assistant
1970	Administrator (1) Agronomist (2) Livestock Specialist (3) Animal Nutritionist (4)	Field Crops Forage Crops Livestock Herdsman Livestock Herdsman	Forage Specialist (5) Crop Production Specialist (6) Animal Breeder (7) Animal Nutritionist (8) Soils Specialist (9) Fruits and Vegetable Crops (10) Forestry Specialist (11)	Forage Crops Field Crops Livestock Herdsman Livestock Herdsman Fruits and Vegetable Crops Soils Assistant Forestry Assistant
1971	Director (18) Forage Specialist (5) Crop Production (6) Animal Breeder (7) Animal Nutritionist (4) (8) Soils Specialist (9) Fruits and Vegetable Crops (10)	Field Crops Forage Crops Livestock Herdsman Livestock Herdsman Soils Assistant Fruits and Vegetable Assistant	Forage Production (2) Forage Breeder (13) Soils Specialist (14) Crop Production (15) Animal Breeder (3) Animal Nutritionist (12) Fruit and Vegetable Crops (16) Forestry Specialist (11)	Another group of high school graduates should start their training in similar areas as in 1970. Upon graduation they may become replacements or work some other place in the Ministry. Part of these might be trained in the U.S. or on-the-job training in Guyana.

Year	In Residence		In Training	
	Professional*	Field Assistant	Professional*	Field Assistant
1972	Director (18) Forage Specialist (5) Crop Production (6) Animal Breeder (7) Animal Nutritionist (4) (8) Soils Specialist (9) Fruit and Vegetable Crops (10) Forestry Specialist (11)	Same as 1971 and Forestry Assistant	Forage Production (2) Forage Breeder (13) Soils Specialist (14) Crop Production (15) Animal Breeder (3) Animal Nutrition (12) Fruit and Vegetable Crops (16) Forestry Specialist (17)	Same as 1970-71
1973	Director (18) Forage Production (2) (5) Forage Breeder (13) Soils Specialist (9) (14) Crop Production (6) (15) Animal Breeder (3) (7) Animal Nutrition (4) (12) Fruits and Vegetable Crops (10) (16) Forestry Specialist (11)	Same as 1972	Same as in 1972 to replace resignations and movement to other positions	Same as 1970-71
1974	Director (18) Forage Production (2) (5) Forage Breeder (13) Soils Specialist (9) (14) Crop Production (6) (15) Animal Breeder (3) (7) Animal Nutrition (4) (12) Fruits and Vegetable Crops (10) (16) Forestry Specialist (11) (17)	Same as 1972	Same as in 1972 to replace resignations and movement to other positions	Same as 1970-71

\*Numbers in parenthesis are keyed to the job descriptions on pages 8 - 12. Where more than one number appears after a position one or two individuals will be employed in the area of research or one will be available for a similar job at another location.

Job Descriptions for Professional Positions

(Refer to Schedule on pages 6 and 7)

Position No.

1. This person would be in charge of the general operation of the station and supervisor of the labor force. He would assist the subject matter specialists in providing them with necessary labor equipment, supplies, and other resources necessary for carrying out their specific projects. He will be responsible for budgetary matters, purchases, financial records and administrative reports to the Ministry of Agriculture. He will have administrative responsibility for the operation of the station but will not be responsible for technical decisions associated with the conduct of the research projects and demonstrations. These decisions will be the responsibility of the project leaders.  
  
The person filling this position may become the Director of the station if qualified or he may be replaced when a qualified individual becomes available (position 18).
2. An Agronomist with training and experience in forage production and management is needed. If a qualified individual is not available from the present ministry staff or out of the group of advanced students returning from study abroad in June then an individual should be nominated who would be sent immediately to the University of Florida for training. He would receive special instruction in field techniques in forage production research for a three to four months period. A man with a College diploma and capable of post-graduate studies which will allow him to undertake a master's program in a few years is very much preferred.
3. An Animal Production Specialist with training and experience in animal production should be selected and sent immediately to the University of Florida to spend three to four months at the main station at Gainesville and various branch stations. This period of time will be utilized to acquaint this specialist with management and research techniques on private ranches and experiment stations. Upon return to Guyana he will go directly to Ebini to assume leadership of the livestock projects.
4. An Animal Nutritionist with training at the B.Sc. or M.S. level in the nutritional requirements of the ruminant animal should be made available at the Ebini station as soon as possible. Several individuals are now overseas in training and one of these may be qualified to take this position in late 1969 or 1970. This specialist would become project leader on studies of mineral, energy and protein requirements of beef animals on native savannahs and improved pastures.

Position No.

- 5 An individual with an interest in forage production and management should be nominated to undertake an M.S. program in a U.S. university beginning in September 1969. He should have the equivalent of the B.Sc. degree and preferably some farm production experience. Unless his present undergraduate training is deficient he should complete the M.S. program in 2 years, and be ready to assume some responsibilities at Ebini in 1971.
  
- 6 A Crop Production Specialist with a special interest in the production of one or more potential feed crops should be nominated to start a graduate program in September 1969. A general interest in factors effecting crop production would be required but the individual might have a special interest in any one of the following crops: corn, sorghum, cassava, soybeans, sweet potatoes or members of the legume family.
  
- 7 An individual trained in the professional field of Animal Breeding has top priority in this program because of the complexity of the problem associated with the development of beef cattle adapted to the savannah areas of the tropics. An individual should be nominated for this training program who has a special aptitude and interest in mathematics, statistics and genetics. This is a difficult field and requires a high level of scholarship.
  
8. The Animal Nutritionist should have a special aptitude in the areas of biology and chemistry and an interest in applying these disciplines to the nutrition of the ruminant animal.
  
- 9 Since certain soils problems are unique to the savannahs and are basic to crop and animal production an individual should be nominated for the position of Soils Specialist. A basic undergraduate training in physics, chemistry, biology and mathematics is essential to a graduate program in soils. This training program should begin in September 1969 so that he becomes available as soon as possible for work at the Ebini station.
  
- 10 A Fruit and Vegetable Specialist is needed to study the potential for producing commercially, vegetables and fruits which may find a local market or a market in the Caribbean area. The production of cash crops in the intermediate savannahs would assist in the diversification of the agriculture and offer other sources of income.

Position No.

- 11 Since much of the intermediate savannah region is now in natural forest the training of a professional Forestry Specialist seems desirable to assist in the development of the forest resources of the region which can be an added source of income for the region. The potential of the Caribbean pine as a source of pulp wood appears very promising for the savannahs. The individual selected for this position should start his training program in September 1969.
- 12 A second Animal Nutritionist with a similar job description as for position 4 should start his training program in September 1971.
- 13 An individual should be selected to start a graduate program in Forage Crops Breeding in September 1971. By this time after two years of screening grass and legume introductions the most promising species will have been selected for more intensive development and adaptation to the intermediate savannahs. This position will require a particular aptitude in mathematics, statistics and genetics.
- 14 A second Soils Specialist should be trained in one of the following areas: soil chemistry, soil physics or soil microbiology.
- 15 Another Crop Production Specialist should begin training in September 1971 since by that time more intensive studies on crops showing promise for the area may require the services of two professional staff members. Qualifications will be similar to position 6 but may require a higher degree of specialization depending upon previous findings.
- 16 A second individual should be nominated for advanced training in 1971 in the Fruit and Vegetable Area. This person may specialize on certain crops which indicate a particular adaptation to the region from previous research. If a number of fruits and/or vegetables show promise the establishment of two positions in this general area may be indicated.
- 17 Since much of the land in the region is now in forest and the possibility exists for the development of pine tree plantation, a second individual trained in Forest Management should be trained to develop competence in this area.
- 18 A station Director should be appointed as soon as a qualified individual is available. He should be professionally competent in his chosen field. It is the opinion of the University of Florida team that the director should have training and experience in livestock production but of greater importance is his administrative ability. With a research staff of six

Position No.

18  
(Cont'd)

or more positions it is extremely important that he allow each individual staff member to develop his own area of research and be responsible for the technical decisions. The administrative officer will be expected to coordinate all the activities of the station and allocate the available resources of land, labor, equipment and other facilities in an equitable manner.

The above job descriptions are those which seem most reasonable at the time of writing this report but the positions indicated should be reviewed at least annually and modifications made as developments and results of research dictate. The building of a research team as outlined here, adequately supported, could have a big impact upon the agriculture of the intermediate savannahs and upon the economy of the entire country of Guyana.

2. Buildings:

- a. New fertilizer, seed and feed storage building - The present building, since it has other potential useful functions (see c), and is not adequate to protect materials from rodent and moisture damage, should be replaced. This is particularly important if the LSD of the Ministry can be utilized to transport materials on the river to Ebini in bulk when it is to carry steers to Georgetown. 1970.
- b. Bunkhouse for single workers - To alleviate the problem of continual changes in personnel of the labor class, the facilities should be provided for more comfortable housing for bachelors or individuals with families on the river. This will vacate present technical staff housing and workers housing for more efficient use.
- c. Milking barn - Modify present fertilizer shed for milking barn to supply milk to workers and as a general hardware storage.
- d. Additional workers houses - These will be needed when more permanent staff with their families are living in Ebini.
- e. Five staff houses - All of these houses will be needed for professional staff and thus should not be considered for labor.
- f. Installation of plumbing in remainder of workers houses - This is necessary in order to have all laborers houses on a more or less equal basis.

### 3. Machinery

- a. Standby generator - With the installation of an increased number of technical staff and facilities, more reliable electrical service is needed. This can only be provided with a standby generator.
- b. Fertilizer spreader - At present, all fertilizer is being distributed by hand, a tremendous manpower requirement plus decreased accuracy in application of the chemicals.
- c. Two 4-wheel drive trucks - Not only are the two present vehicles old but also the increased research and management activity will require more vehicles.
- d. One 100 hp tractor with front end blade - In order to renew the studies on native pastures, the small trees and brush should be cleared. The large tractor and Argentine roller (see item 1) are the most effective items for accomplishing this. There will also be increased tractor utilization for large forage mowing. In case a decision is made in future years to chop plant materials for silage, this tractor would be ideal for a P.T.O. operated forage chopper.
- e. Two rotary mowers - Many of the studies to be initiated will require pasture mowing. One large rotary mower (main mower plus two extensions) and a regular mower will be needed for this. The present mower is in average to poor condition.
- f. Assorted tractor implements - It is impossible at this time to anticipate all implement needs for the livestock and crops program and this miscellaneous item should be included for buying a few additional implements.
- g. Five short wave, 2-way walkie talkie - These are inexpensive items but ones which will save more than their costs in reduced time and vehicle usage. The station is approximately 12 miles long and 6 miles wide at present and could possibly grow to a larger size. These radios could be used to call for additional supplies or help as well as to route individuals in the field rather than have them come to headquarters and send them back out.
- h. Welding machine and portable generator - A welding machine is a necessary item for a multitude of functions such as machinery repair on an isolated post such as Ebini.
- i. Spray races - Ticks are a major problem during certain parts of the year and cattle must be sprayed regularly. A spray race gives a more complete coverage of cattle and conserves chemical as compared to an open corral sprayer.

- j. Squeeze Chute - For routine and special handling of cattle, the quickest and safest way for both the animal and laborers is to immobilize them in a squeeze chute. One is needed before the work of palpating all of the cattle for culling of the present cow herd can be carried out.
- k. No research can be done without adequate scales for weighing cattle periodically to measure animal performance.
- l. Argentine roller - See justification under item D.
- m. Power chain saws - The tremendous number of posts which must be cut for fencing will be done more rapidly with this item of equipment.

4. Miscellaneous:

- a. Windmills - Water facilities - This is the number one priority in facilities and equipment for Ebini. The loss of man hours and animal energy involved in the present system of watering at the headquarters and creeks should not be continued. We urge the utilization of windmills because of their cost, efficiency and low maintenance requirements.
- b. Watering tanks - Watering tanks, one for each two pastures, can be constructed on the farm from cement blocks, plastered inside and out with cement.
- c. Plastic Tubing - The tubing is necessary to carry water from the elevated tanks to the individual watering troughs.
- d. Water storage tanks - For maintaining a reserve water supply.
- e. Corrals - The present set of corrals is in such poor condition and the arrangement is such that a complete rebuilding is necessary. This will serve for the working of the cattle on improved pasture.

A second corral will be needed in a central area within the native pasture studies.

The weigh pen for pasture trials should be located as near to the actual paddocks as possible for quick weighing of all animals with minimum exercise. This is necessary for accurate research of the type to be conducted.

These three corrals are being recommended to increase the efficiency of animal management, decrease labor requirements and prevent excessive animal movement which causes slower weight gains.

Their costs will be repaid many times by the increased efficiency. These justifications also apply to items i, j and k under equipment. These should not be constructed until a careful study has been made of various types of corral plans and the most effective ones chosen.

- f. Fencing - The native pasture area must be fenced and crossfenced in order to initiate the studies outlined in this project. Since labor and posts can be supplied locally, the outside costs will include only wire and staples.
- g. Fertilizers - The deficiencies with respect to plant nutrients can be only approximately estimated based upon soils studies contained in published reports. To grow improved pastures and feed and food crops a high level of fertilizer input will be required.
- h. Seeds - Almost no work has been done at the Ebini station on tropical forage legumes. Many species and varieties grown under similar condition elsewhere in the world should prove useful in the intermediate savannahs of Guyana.

5. Schedule of Acquisition and Estimated Cost of Capital Items:

<u>Quantity</u>	<u>Item</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
<u>BUILDINGS</u>				
1	Fertilizer seed and feed storage	X		
1	Bunkhouse for single workers	X		
1	Milking barn	X		
5	Workers houses	2	2	1
5	Staff houses	1	2	2
	Plumbing	X		
<u>MACHINERY</u>				
1	Standby generator - 30 kwh	2000		
1	Fertilizer spreader	500		
2	4-wheel drive pick up trucks	2500	2500	
1	100 hp tractor with blade	10000		
2	Rotary mowers	750	750	
	Assorted tractor implements	2500	2500	
5	Short wave 2-way walkie-talkie	300		
1	Welding machine & portable generator	US Surplus		
2	Spray races	500	500	
2	Squeeze chutes	1000	1000	
2	Cattle scales - metric	1200	1200	
1	Argentine roller	2000		
1	Power chain saw with 6 chains	500		
SUB-TOTAL		23750	8450	

<u>Quantity</u>	<u>Item</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
<u>MISCELLANEOUS</u>				
5	Windmills with wells @ \$1000 each	2000	3000	
80	Watering troughs constructed on site @ \$20.00	800	800	
70,000 ft.	Plastic tubing 3/4" @ .20¢	1000	400	
2	Elevated tanks for water storage @ \$20.00	2000	2000	
1	Corral with cutting chute at headquarters	1000		
1	Corral with cutting chute in native pasture		1000	
1	Corral with scales & cutting chute and small holding pens		2000	
	Barbed wire fencing material for 28 miles of 3-strand fence	5000		
	Fertilizers	5000	10000	20000
	Seed	1000	5000	10000
	SUB-TOTAL	17800	24200	30000
	TOTAL	41550	32650	30000

5. Land and Pasture:

The area of land available is adequate for extensive native pasture studies and about 1500 acres of improved pasture area is well fenced with convenient corridors for moving cattle. A large part of the improved pasture area has recently been prepared for planting so at present there is no pasture on these paddocks.

6. Cattle:

The number and kind of cattle that are available are adequate to provide experimental animals for the trials outlined in this report. It should be emphasized that other breeds might have been selected to carry out this program but they would have been no better and the ones selected are readily available and will require the least investment.

7. Additional inputs for the Ministry of Agriculture:

In order to establish this program of research and development at the Ebini station, the Ministry of Agriculture will need to increase gradually their professional staff until it reaches nine full time staff in 1973. These people will require staff housing and other fringe benefits commensurate with their level of training and competence. Beyond the machinery and research equipment recommended in this report, no additional capital investment in land or cattle will be needed. The present labor force should be adequate to handle most of the research as soon as the machinery and power equipment is available which will greatly reduce the man hours now required to handle many jobs.

### Research Programs

#### 1. Soil Fertility and Agronomic Studies:

- a. Perennial grasses and legumes for pasture and harvested feeds.
  - (1) Many genera of tropical grasses and legumes have been tested for use in the tropical savannah areas throughout the world. Small plots of various species and ecotypes of Digitaria, Brachiaria, Paspalum, Hyparrhinia, Panicum and Cynodon should be established under different fertilizer regimes to test their adaptation to the region. These plots will be mechanically harvested so as to determine dry matter yields and samples of selected grasses will be taken for in vitro cellulose digestion studies.
  - (2) Simultaneously with 1a. above small plots of the same grasses will be established in a fenced enclosure so that they may be mob grazed at intervals to determine their response to the grazing animal.
  - (3) Several species in the genera Stylosanctus, Desmodium, Centrosema, Glycine, Calapogonium, Lotononis, and Leucaena have shown varying adaptation to savannah environments and should be tested under the conditions of the intermediate savannahs of Guyana. Since many tropical legumes occur naturally in the savannahs the chances of finding legumes adapted to the low fertility levels of the intermediate savannahs should be very good. These should be tested under similar conditions as that outlined in 1a. and 1b. above with and without an associated grass species.
- b. Supplemental feed crops.
  - (1) Active breeding projects are underway on corn sorghum peanuts and soybeans to develop adapted varieties for the tropical areas of the world. Since all of these are potential feed crops for beef cattle to meet their energy and protein requirements the most promising germplasm of these crops should be tested in the intermediate savannahs. It is proposed to introduce the varieties which have been selected for these climatic and soil conditions and conduct adaptation trials at Ebini.
  - (2) Other crops which have more recently received some attention are cassava, plantain and sweet potatoes. As many strains and varieties of these crops will also be studied to determine the most favorable cultural practices including date of planting and fertilizer treatment.
- c. Fertility studies. Some work has been done at Ebini (Wagenaar 1965) on the fertility requirements of several crops. Most of this work was abandoned but additional studies are needed to more clearly define the limiting factors for crop production. Studies in which grasses

and legumes are included in a rotation system to increase the organic matter content of the soil are also badly needed. The purpose of this reasearch would be to study different cropping sequences at several fertility levels to determine the response in the cultivated crops.

- d. Fertility and reseeding studies on the natural range. The natural range of the intermediate savannahs are almost completely devoid of any tropical legumes. Mr. Legg has found under the influence of some fertilizer application that a species of *Desmodium* has become quite common in the pastures. This observation suggests that many of the tropical legumes may be introduced into the savannahs with proper fertilization and management. Experiments will be conducted to determine whether different species of tropical legumes can be established in the native range.

## 2. Grazing trials - with growing young stock.

Growing animals can be used to evaluate the production of forages when the trials are properly designed and managed. There are three important measurements to be taken in grazing trials. These are (a) the gain/animal which is a measure of the quality of the pasture, (b) the carrying capacity in terms of animals/acre, and (c) the amount of liveweight gain/acre. The latter two are both measured of the amount of feed produced/acre. The grazing trial is very effective in measuring the effect of certain variables which cannot be reliably measured when the forage is harvested mechanically.

- a. Grass-legume mixtures grown for pasture must be studied with the grazing animal since the selective grazing of the animals has an important bearing on the balance of the association. Trials will be established to determine the persistence of the grass and legume components of several legume-grass mixtures.
- b. Nitrogen fertilization cannot be studied under mechanical harvesting and expect to obtain results applicable to the grazing situation. This is because much of the nitrogen is recycled in the soil-plant-animal system so that the nitrogen may be used several times over as it is returned to the pasture in the urine and manure. Very little research has been done on this phenomenon under tropical pasture conditions and it could have particular significance in savannah pastures where the nitrogen level is extremely low. Trials will be installed to study several levels of nitrogen under grazing conditions.
- c. As resources permit the optimum stocking rates for both improved and natural pastures should be studied. It is suspected that one of the reasons that pastures are stocked at such a low rate in the savannah is because of mineral deficiencies and not because of shortage of feed. With the feeding of mineral supplements and a little protein supplement much higher stocking rates may be possible.

- d. **Nutrition Trials on native and improved pasture.** Since it has long been recognized that native savannah pasture does not provide an adequate ration for normal beef cattle production, facilities are needed to study some of the nutritional deficiencies common to this area. It is proposed that about one square mile of typical Trachypogon dominant savannah be allocated for this research in which ten 50-acre pastures would be fenced and provided with water and other facilities necessary for conducting nutrition trials. These facilities would be used to study the effect of various mineral, vitamin, energy and protein supplements upon the performance young growing animals. Similar trials will also be conducted on improved pasture to determine the differential response to supplemental feeding on native vs improved pasture.

3. Cattle Breeding - Feeding Management System:

It is recommended that all of the cattle at the station be entered into a systematic straightbreeding or crossbreeding program in which will be imposed an intensive selection pressure for traits of economic importance for beef production in Guyana.

Considering the breeds of cattle available at the Ebini station and their proven usefulness in both straightbreeding and crossbreeding schemes the following straightbred groups are recommended for continuation:

- (a) 60 cows Zebu (Brahma & Sahiwal)
- (b) 60 cows Grade Santa Gertrudis

It is suggested that the Brahma and Sahiwal cattle presently on the station be pooled and the superior animals on the basis of production performance, or phenotype of their offspring be selected to form a 2-sire herd of 60 cows of breeding age. Likewise a foundation herd of 60 head of grade Santa Gertrudis females would be selected from the Santa Gertrudis and Santa Gertrudis crosses on hand. Only high quality bulls of superior performance should be used in these herds. Insofar as feasible, the bulls for the crossbred experimental herds should be produced from this foundation herd. However, it will be necessary to introduce periodically, sires from outside sources to avoid inbreeding.

The crossbred groups could include logically any breed combinations that hold promise for the area. On the basis of what is known, any Zebu-European cross would be expected to do well. The comparative performance of various breeds in combination with the Zebu would be a good point for investigation. Considering the need for information, the cattle available for foundation stock and availability of bulls to maintain crossbreeding programs, it is recommended that four crossbreeding schemes be incorporated into the project. These to include four two-breed rotations of sires as follows: (See schematic page 20).

1. Brahma -Santa Gertrudis
2. Brahma -Holstein
3. Santa Gertrudis-Holstein
4. Brahma -Charolais

The Jersey cross females should be retained for providing milk for the station personnel.

Sale of Breeding Stock:

It is suggested that bulls sold as breeding stock be only of high quality, from highly productive cows and well grown before release to farmers. To achieve this goal it is proposed that all male calves born in the Brahman and Santa Gertrudis herds be left as bulls until weaning. At this time the bulls should be rigorously culled for poor weaning weight or unsoundness of any type. The remaining bulls should then be grown on improved pasture and a moderate amount of supplemental feed given to achieve rapid development to 20-23 months of age at which time the poorer performing bulls should again be culled and sold for slaughter. Bulls needed for the breeding project should be selected from the superior animals and the remainder sold as breeding stock.

A limited number of truly superior bulls from the crossbred groups could also be sold. However, the majority of the male calves born in these groups will need to be castrated to evaluate the program. It is suggested that the superior males be obtained as follows: Shortly after weaning of calves, 25% of the cows with the highest production records will be designated and bull calves born to these cows the following year would then be left as intact bulls. At weaning time and thereafter the crossbred bulls would be managed in the same way as purebred bulls with the exception that selection standards for crossbred bulls be maintained at a higher level than for purebreds.

Schematic of Cattle Breeding - Feeding Management Systems

<u>Breed Groups</u>	Improved Pasture <u>+Mineral</u>	<u>Native Pasture</u>		
		<u>+Mineral</u>	<u>+Mineral</u> <u>+Protein</u>	<u>+Mineral</u> <u>+Improved pasture</u>
Brahma	60	-	-	-
Santa Gertrudis	60	-	-	-
Brahma/Santa Gertrudis	60	60 30+ 30+	60 30+ 30+	60 30+ 30+
Brahma/Holstein	60	-	60 30+ 30+	-
Santa Gertrudis/Holstein	60	-	60 30+ 30+	-
Brahma/Charolais	60	-	60 30+ 30+	-

+Out of each group of 30 calves, one-half the females will be raised after weaning on improved pastures and the other one-half on the same native pasture regime as their dams.

Staff Involvement from the University of Florida

Staff Specialty	1969	1970	1971	1972	1973
	Estimated Man Days				
Soil Fertility	14	14	28	14	14
Forage Grass Breeder	14	14	14	14	14
Corn-Sorghum Breeder	14	14	14	14	7
Crop Production	14	14	14	14	7
Peanut-Soybean Breeder	14	14	14	14	7
Pasture Management	14	28	28	28	28
Animal Breeder	14	28	28	28	28
Animal Production	14	28	28	28	28
Animal Nutrition	14	14	14	14	14
Vegetable Crops	14	14	28	28	28
Fruit Crops	14	14	28	28	28
Forestry	14	14	14	28	28
Agricultural Economics	-	-	14	28	28
Total Man Days	168	210	266	280	259

The above schedule is a very rough estimate and will be revised as the project develops. Some areas indicated may be completely deleted if technical or economic limitations seem to preclude their development. Other areas may develop much more rapidly than now anticipated and if that be the case then the inputs of man days may be much greater than indicated.

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