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9. ABSTRACT

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DEPARTMENT OF AGRICULTURAL ECONOMICS

Purdue University

Lafayette Indiana

211(d) Annual Report

June 30, 1973

Title: Expansion of Competence in the Design and Execution of Ruminant Livestock Development Programs for the Tropics: With Emphasis on the Analysis of Systems of Production and Marketing.

Grantee: Purdue University, Lafayette, Indiana

Director: Wilfred Candler

A. Statistical Summary:

Period of Grant: June 29, 1972 to June 28, 1977. Amount of Grant: \$350,000

Expenditure for Reported Year - \$32,000 Accumulated - \$32,000

Anticipated for next year - \$50,000 or \$88,000.

B. Narrative Summary:

The objective section of the grant document notes that Purdue will need to A-(1) "adapt the systems analytical techniques to other institutions, (2) improve analytical methodology, and (3) increase the number of faculty economists and others in the consortium, with experience in the area", and B-"First attention will be given to selection of (1) countries and (2) problems in which further work needs to be done".

Most progress has been made on A(3), B(1) and B(2) above. The background and experience of Florida and Tuskegee (together with English language, small size, and existence of I.R.B.D. Cattle Development loan) led to selection of Guyana as the first country for the consortium to attempt to cooperate in. Appendix 4, "Report on the Ruminant Production Situation and Prospects in Guyana", gives an appreciation of the cattle development problems of Guyana as perceived from a literature search. This appendix is offered as evidence that Purdue has developed its ability to look at the overall problems of a country's cattle development in a way

which we never could have attained without the assistance of the 211(d) grant.

Purdue's analysis of the contribution which economists could make to the study of Guyana's cattle development problems is outlined in our proposal for our contribution to the consortium's work in Guyana:

"Purdue will expect to commit four (4) months of U.S. professional input and up to one (1) man year of counter-part professional involvement over the next two (2) years; activity beyond this period will be negotiated in the light of the progress made in the first two years.

The Purdue involvement will be as follows:

- a) Descriptive Cost Studies: Assemble information on the typical costs for land development and livestock production (beef and dairy cattle, sheep and goats) in the Rupununi, Ebini, Canje, Coastal and Matthew's Ridge areas. The beef information will be integrated into the Texas A and M production system model.
- b) Location of Production: The results from (a) will be used in a regional model to determine the most suitable areas for development for the alternative enterprises. This evaluation would be carried out in consultation with personnel from the Ministry of National Development and Agriculture.
- c) Size of Enterprise: The information collected in (a) will be used to study the optimum economic size for each enterprise in each region.
- d) Overseas Markets: Review the extent of the CARIFTA market for Guyanese dairy and pork products."

Naturally we are disappointed at the time the consortium has taken to win acceptance in Guyana, since we (Purdue) believe that timeliness is an important component of the ability to respond to the needs of LDC's. Nevertheless this delay has taught us a lot about the organizational problems of working with LDC's. Notably we have learned that the author of this report, other university academics, administrators, AID personnel, and host country government personnel may, at any time switch from being part of the solution, to part of the problem. The personality problems of applying the systems approach are much more substantial than the impersonal methodological, or data problems.

Notable achievements of the consortium include:

- a) An increased awareness of the importance of the separate disciplines,
- b) Improved professional respect amongst consortium members,
- c) Agreement to have Texas take leadership of micro-systems modelling while Purdue concentrates on macro-systems modelling. All participants in the consortium have indicated the desire to contribute data to these models.

We, at Purdue have had our hypothesis that \$50,000 p.a. of economists cannot begin to keep up with \$250,000 p.a. of biological scientists. We had hoped that the systems approach meant the avoidance of this type of major imbalance within development programs.

C. Detailed Report:

I. General Background and Purpose of the Grant

The purpose of Purdue's 211(d) grant still seems well summarized in the following quotes from the grant document.

Purdue's grant is one of four that "would explore the livestock industry from a total systems viewpoint, on the assumption that piece-meal attacks on a complex problem (nutrition, breeding, disease control, or credit) have been inadequate".

The primary objective of Purdue's grant is to strengthen our capability "to identify opportunities for significant livestock developments in LDC's, to analyze constraints to, and reasons for, such development and to design programs to overcome constraints through an integrated, multi-disciplinary team approach".

II. Objectives of the Grant

1. Objectives Restated:

The grant is designed to improve Purdue's capacity to use the systems approach in the analysis of tropical ruminant livestock production possibilities, including identification of limitational

factors on institutions, and to convert this analysis into relevant research priorities.

Steps to be taken to achieve these objectives include:

- i) Adapt systems approach to a specified tropical ruminant livestock production situation,
- ii) Improve our analytical methodology,
- iii) Increase the number of faculty with relevant experience (in systems analysis and tropical ruminant livestock production),
- iv) To select a country, and
- v) Analyze its livestock industry, so as to achieve (i) through (iii) above.

2. Review of Objectives

The above objectives still seem relevant and well stated. In the light of the first year's experience with the consortium, it might have been helpful to have emphasized three sub-headings of (i) above:

- ia) To establish organizational and procedural patterns which will facilitate (rather than impede) the rapid implementation of the systems approach.
- ib) To explore alternative ways of using the systems approach to establish explicit research and investment priorities. To use the systems approach to provide development administrators with ranked lists of expenditure items with associated costs and benefits.
- ic) As a corollary to (ib) to explore approaches to professional and objective evaluation of alternative research/investment projects across disciplines.

III. Accomplishments

Accomplishments under the 411(a) grant may perhaps best be discussed under the (i) to (v) headings of the objectives in Section II, with the addition of headings "other" and "frustrations".

1) Adaption of Systems Approach (Estimated expenses \$10,000)

Three staff members (Candler, Morris and Minden) and a graduate student (May) spent a week in Guyana with other members of the consortium, talking with Guyanese Government officials (and some private entrepreneurs) and visiting the various ecological regions of Guyana.

This was sufficient to allow Purdue to make the research activity proposals listed in B, which were accepted by the Guyanese, essentially without modification, as desirable elements of a consortium research program in Guyana.

Given the focus on Guyana, we have conducted a literature review (much of it summarized in the appendix) of factors which should feature in a systems analysis, and available data sources and previous studies.

We have spent considerable time interacting with other consortium members (especially Tom Cartwright's animal breeding group) on important components of a systems model; and have negotiated that Tom Cartwright take the leadership on a micro (herd level) systems simulator for cattle production in the various ecological zones of Guyana.

Purdue has, on the other hand, accepted responsibility for a macro-systems model which will attempt to tie together our knowledge of the various Guyanese ecological zones.

ii) Improved Analytical Methodology (Estimated expenses \$1,000)

This topic has not received much attention, principally because

we have not yet received permission to work in Guyana, hence inadequacies of our existing methodology, have not become evident.

A one-day seminar on modelling tropical beef production systems was organized for consortium members at Purdue; a paper by Ike Van Der Wettering of Iowa State University, was particularly pertinent. This paper did not advocate a model structure, but emphasized discussions of the development process which would need to be included in any development model.

A paper, "Notes on Modeling As An Aid to Setting Research Priorities in the Context of the Guyanian Livestock Economy", was presented at the consortium's Georgetown Seminar. A copy is also attached.

iii) Faculty With Relevant Experience (Estimated expenses \$6,000).

Arlo Minden, Bill Morris, Will Candler and Ralph May attended the Consortium meeting in Guyana with side visits to Mexico (Will Candler), Honduras, Panama, Colombia, Venezuela (Minden and May), and Surinam and British West Indies (Morris).

Bill Morris has been indefatigable since the decision to work in Guyana. This has taken him to the Netherlands and to the former Dutch colony of Surinam (since it is the eastern neighbor of Guyana), and hence many research results and husbandry practices can be extrapolated to Guyana. He has visited the United Kingdom and Canada which have a long history of research in Guyana, and has also visited around the Caribbean, which is both a potential market, and a source of information on relevant technology. It is the experience from these travels which has allowed Bill Morris to prepare his summary of consideration relevant to the construction of a systems model of the Guyanese livestock economy.

One very significant dimension in which staff experience has been increased, is in the procedures needed to work with AID and host government officials. The importance of time leads required for projected travel, the constant battle to keep all relevant people informed of plans and progress, the various "checks and balances" within AID organizational structure, have all become much clearer to us as we went to Guyana, or attempted to go.

iv) Choice of Location for Work (Estimated expenses \$5,000).

Guyana has been selected as the major geographical focus for the consortium. A number of other countries were considered but Guyana seemed a logical choice since:

- a) Tuskegee and Florida already had experience in the country and relations with the Government of Guyana were thought to be excellent. (The Minister of Agriculture and National Development, Dr. Reid, is an ex-graduate student of Dr. Ed Braye of Tuskegee, and first year's consortium chairman).
- b) There is a substantial base of agricultural research, and of qualified veterinarians.
- c) The English language means that it will not be necessary for consortium members to learn an additional language to be effective.
- d) The country is small enough that you can easily collect required information, yet it is sufficiently ecologically diverse for complex priority problems to exist.
- e) It is amongst the least expensive LDC's to travel to.

It is plain that our initial expectations of easy, smooth and expeditious working relations with the Guyanese have not been

fully met. Yet, the indecision which we have met, indicates that we were right to give emphasis to likely official working relationships, in our choice of a country to work in.

v) Analysis of Livestock Industry (Estimated expenses \$10,000)

As indicated in the appendix we have completed a fairly exhaustive literature review of the major problems of the Guyanese livestock industry. The delay in getting official approval for the consortium to work in Guyana had prevented us from making major progress in this objective.

vi) Other. (Expenses included above)

Actually getting scientists from disparate disciplines to work together was not stated as an explicit objective of the consortium, but it has proved to be an important part of our work. Getting high level professional interaction across disciplines has not been easy. (Indeed, it might be stated as one of the challenges which will be with us for the life of the consortium).

ii) Frustrations (Costs included above)

While I continue to endorse the original consortium concept of bringing contributions across disciplines and institutions to bear on a complex problem, there can be no doubt that we have had some "diseconomies of scale".

Purdue was denied permission to visit Guyana in the week 10th to 17th of December, 1972, and has been ready to initiate field work in Guyana since March 13th, 1973. This forced inactivity (which stems from the need of the Guyanese Government to accept the consortium research program as a whole), is both

extremely inefficient and demoralizing. I have no easy solutions to this problem (or they would have been suggested), but clearly if Purdue were working alone we would by now be working in Guyana, or actively seeking another country.

IV. Development of Institutional Capabilities

The development of institutional capabilities has largely been covered in the accomplishments section III, and is illustrated in section V.

The benefits to Purdue from the 211(d) grant have probably been restricted to the Department of Agricultural Economics, but within the department we are much better prepared to contribute to inter-disciplinary systems teams looking at agricultural development problems. The benefit is not restricted to tropical cattle production alone.

We are much more aware of the behavioral (people and inter-institutional) problem component than we were; and of the contribution the host Government can make to getting, or not getting the advice that normally it's requesting.

V. Utilization of Institutional Resources in Development

i) General University Contribution

A significant proportion of the School of Agriculture's international activities has been involved in assisting in the development of the livestock sector in developing nations. These efforts are capsulized in the following paragraphs.

AID Contract 639 - Purdue-Brazil Technical Assistance Project

Since the early 1950's, staff from Purdue's Department of Animal Sciences have played an important role in initiating and developing teaching, research, and extension programs in animal sciences at the Federal University of Vicosa (UFV). This has

included work in animal genetics, nutrition, production management, and range and pasture management. In the early 1950's the UFV (then the UREMG)^{1/} initiated a Master of Science program in Animal Sciences. In 1973 a Ph.D. program was begun in this discipline. Eleven members of the Purdue staff have been directly involved in these successful efforts. Under the participant program several Brazilians have received M.S. and/or Ph.D. degrees at Purdue and other U.S. universities. Most of these have returned to the UFV where they are engaged in teaching and research activities.

Instituto de Laticínios "Candido Tostes" (Dairy Technical School) at Juiz de Fora

Under the auspices of the AID Contract 639, Purdue's School of Agriculture also provided assistance to this post-secondary technical school. This assistance was provided in recognition of the acute shortage of trained Brazilian manpower in the area of dairy product processing and handling. Purdue staff assisted in curriculum development, teaching and initiation of a very applied research effort. New processing equipment was purchased, installed and the staff and students trained in its proper use. In cooperation with the dairy industry a successful work study program was begun. As in the case of the UFV project a major emphasis was placed on staff development with several participants receiving B.S. and graduate training in the U.S. A member of the Instituto staff (Mr. Samuel Hosken) is currently in residence at Purdue working towards an M.S. in Agricultural Economics.

1/ Universidade Rural do Estado de Minas Gerais.

Ford Foundation Grant - Institutional Development Program at the National University of the South, Argentina

An important objective of this grant was to assist the Faculty of Agronomy of this university in developing a teaching and research program in range and pasture management and animal nutrition. Four Purdue staff members were involved in this endeavor. Much of the research dealt with the potential of introducing and establishing improved varieties of grasses that would increase the carrying capacity of pastures in this semi-arid region. Funds made available by this project, the Organization of American States and various other sources supported the graduate study of several students from the University of the South at selected universities in the United States, Australia, and Europe.

Other Related Activities

1. Dr. Carl Noller of the Purdue Department of Animal Sciences, was instrumental in initiating the Animal Science program at the Federal University of Vicosa. Annually, Dr. Noller returns to Brazil on short-term assignments to advise on the establishment of research priorities in animal agriculture, assist in research program planning and provide guidance in the further development of graduate programs.
2. In recent years two award-winning theses have been written in the Department of Agricultural Economics. These are:

Nores, Gustavo, An Econometric Model of the Argentina Beef Cattle Economy (M.S. Thesis)

Nores, Gustavo, Quarterly Structure of the Argentine Beef Cattle Economy: A Short Term Model, 1960-1970, (Ph.D. Dissertation).

The above examples are indicative of Purdue's long-run involvement in international livestock development programs. This has resulted in a corps of professional manpower having interest and first-hand experience in this area. Building on this institutional base, the 211(d) grant program enables Purdue to further increase its competence and ability to identify and assist in the solution of priority problems confronting the livestock sector of the developing nations.

ii) Specific Consortium Related Work

Will Candler has spent short periods in Mexico as a consultant to the World Bank assisting in the formulation of two regional livestock models.

Bill Morris spent 6 weeks in Mali as part of a University of Florida team advising USAID on the economics of additional cattle slaughtering facilities.

Bill Morris will spend the next year as a consultant to AID in looking at development priorities for Mali.

Arlo Minden has done consulting work with groups interested in the economics of feed-lot operations in Honduras and Nicaragua.

VI. Other Resources for Grant Related Activities

Physical facilities and general administrative overhead are provided by the University without charge. Incidental consulting with other staff members is also provided as a University contribution.

VII. Next Year's Plan of Work and Anticipated Expenditures

Purdue has requested a supplemental grant, so that some of our plans are contingent upon this funding decision. With the existing 211(d) grant, we plan:

- a) Consortium Chairmanship (\$5,000). Will Candler has been elected to follow Dr. Ed Braye of Tuskegee as consortium chairman for

1973/74. We anticipate that this will involve at least two trips to Guyana to facilitate relationships with the Government there; and may involve a visit to Africa to assist in the selection of another area of joint consortium interest.

b) Field Work in Guyan (\$38,000). The scope of this work has been reported in Section B. We hope to get permission to use a half-time (i.e., six-month) Guyanese professional counterpart to allow us:

i) To gain experience in how far we can go in using counterpart personnel while maintaining a high level of professional performance, and

ii) To reduce cost and time of highly paid U.S. personnel.

c) African Seminar (\$8,000). This seminar will be organized predominantly by Bill Morris as part of his work for REDSO. The Proposal for this seminar is attached. It is anticipated that this seminar will have three important results:

i) Provide an initial awareness amongst consortium members of an important but substantially different method of tropical livestock production, as compared to South America or South East Asia.

ii) Prepare for the consortium to contribute to a U.S. Seminar for Francophone African cattle experts, which is planned by the African Bureau, for September, 1974.

iii) Possibly the selection of an African country to work in, as a supplement to our Guyanese experience.

If we get the requested additional funding, Purdue will:

d) Second Country (\$20,000). Contribute actively to consortium work in a second country.

- e) Initiate a Graduate Training Program (\$12,000) for graduate students interested in the systems approach to the assessment of development problems with particular reference to African tropical ruminant production, these graduate students will be required to learn French, and
- f) Visit Australia (\$6,000). Visit the tropical cattle production areas of Australia, to look at general production technology, and pasture/legume research.

VIII. Other

I have three major worries about the success of the consortium:

- a) Delay. Delays directly attributable to the slowness of responses from Guyana have essentially resulted in our (Purdue's) taking a year to do six month's work. (This is particularly reflected in the budget where we have spent less than expected). This is very expensive, because salaries continue to be paid, and is extremely bad for morale.

I believe something has to be done, so that we can leave Guyana and/or get on with the job.

- b) Professional Communication. Since we have not yet had the acid test of really trying to help an LDC, it is too early to say whether there will be problems in professional communication. I think it is clear that the several schools came into the consortium (rightly or wrongly, because of, or despite conversations with AID) with quite dissimilar expectations as to what the consortium was about. (And, the views within one school are by no means unanimous). This means that even after a year it's not clear how closely we will find we are able to work together.

- c) Inadequate Funding. The potential professional communication problem is accentuated by the fact that the (economics-marketing-farm management) area is only funded one-fifth the level of biological science. This means that in a very real sense Purdue is "swamped" by the expertise of the other colleges, and unable to really capitalize on the cooperation that is available.

I have one major satisfaction in having worked the past year on the consortium. I have found personal relations amongst all participants, Purdue, AID, other colleges, Government of Guyana, etc., to be excellent and constructive. If personal attitudes alone were the measure of success, I would be confident that this would be one of AID's best 211(d) experiences.

Table Ia

Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding - Existing Grant

Review Period 1 July, 1972 to 30 June, 1973

(List all grant related activities)	211(d) Expenditures				Non 211(d) Funding Amount
	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant	
Research	25,000	25,000	38,700	209,000	55,000
Teaching					20,000
Libraries	150	150	200	1,000	6,000
Publication	20	20	100	5,000	5,000
Seminars	5,830	5,830	7,000	30,000	
Administration (Consortium Chairmanship)			5,000	5,000	
TOTAL	31,000	31,000	51,000	250,000	

Table Ib

Distribution of 211(d) Grant Funds and Contributions From Other Sources of Funding on Assumption of Revised Grant
 Review Period 1 July, 1972 to 30 June, 1973

(List all grant related activities)	211(d) Expenditures				Non 211(d) Funding Amount
	Period Under Review	Cumulative Total	Projected Next Year	Projected to End of Grant	
Research	25,000	25,000	64,700	359,000	55,000
Teaching			12,000	50,000	20,000
Libraries	150	150	200	1,000	6,000
Publication	20	20	100	5,000	5,000
Seminars	5,830	5,830	7,000	30,000	
Administrative (Consortium Chairmanship)			5,000	5,000	
TOTAL	31,000	31,000	89,000	450,000	

Table IIa
 Expenditure Report
 (Actual & Projected - For Existing Grant)
 Under Institutional Grant #AID/csd-211d 3675
 Review Period 1 July, 1972 to 30 June, 1973

Budget Items	Expenditures to Date		Projected Expenditures				Total Budget
	'72-'73 Period Under Review	Cumulative Total 'same'	'73-'74 2	'74-'75 3	'75-'76 4	'76-'77 5	
Salaries	20,534		33,930	35,965	38,115	40,405	168,949
Consultants	1,230		2,000	2,000	2,000	1,007	8,237
Travel	8,144		8,000	9,000	8,500	8,000	41,644
Supplies, data Processing	1,170		7,000	8,000	8,000	7,000	31,170
TOTAL	31,078		50,930	54,965	56,615	56,412	250,000

Table IIb

Expenditure Report
(Actual & Projected - On Assumption of Revised Grant)

Under Institutional Grant #AID/csd-211d 3675

Review Period 1 July, 1972 to 30 June, 1973

Budget Items	Expenditures to Date		Projected Expenditures				Total Budget
	'72-'73 Period Under Review	Cumulative Total 'same'	'73-'74 2	'74-'75 3	'75-'76 4	'76-'77 5	
Salaries	20,534		58,414	62,918	65,622	69,616	277,104
Consultants	1,230		2,000	3,000	3,000	1,606	8,836
Travel	8,144		14,500	21,500	18,500	14,500	75,144
Supplies, Data Processing	1,170		8,000	13,000	15,000	8,000	45,170
Graduate Assistantships	0		10,000	10,600	11,236	11,910	43,746
TOTAL	31,078		88,914	111,018	113,358	105,632	450,000

Appendices

Appendix

Description

- 1 Program for Consortium Seminar At Purdue University
- 2 Proposal for Seminar on West African Livestock Production Problems
- 3 Paper Presented to Consortium Seminar in Georgetown, Guyana
- 4 Report on the Ruminant Production Situation and Prospects in
Guyana

Appendix 1

PROGRAM

AID TROPICAL CATTLE RESEARCH CONSORTIUM MEETING

Purdue University, West Lafayette, Indiana

August 31 and September 1, 1972

All Meetings will be held in Room 311 - Stewart Center

THURSDAY, AUGUST 31

- 9:00 - 9:15 A.M. Background Review of Tuskegee Meeting - Will Candler,
Temporary Chairman
- 9:15 - 10:45 Brief Biographical Sketches by Meeting Participants -
(training, professional experience, and professional
interest in the Consortium - 10-15 minutes each)
- 10:45 - 11:00 Coffee (available in Room 222 - Stewart Center)
- 11:00 - 12:00 Factors to Be Included in a Systems Model of Peruvian
Beef Production - Van der Wettering, Jr., Iowa
State University.
- 12:00 - 12:30 P.M. Discussion
- 12:30 - 1:30 Lunch - Sagamore Room, Memorial Union
- 1:30 - 3:00 Discussion of alternative countries which could be a
common focus of the Consortium work.
- 3:00 - 3:15 Coffee
- 3:15 - 4:00 Experience With a Systems Model of Beef Production - Tom
Cartwright, Texas A & M
- 4:00 - 4:30 Discussion
- 7:30 Dinner

FRIDAY, SEPTEMBER 1

- 9:00 - 10:00 Experience With a Systems Model of Venezuelan Beef
Production - Al Halter, Oregon State University
- 10:00-10:30 Discussion
- 10:30 - 10:45 Coffee
- 10:45 - 12:00 Further Discussion of Systems Models and Arrangements
for Future Cooperation

ROSTER

AID TROPICAL CATTLE RESEARCH CONSORTIUM MEETING

<u>NAME</u>	<u>STATUS</u>	<u>UNIVERSITY</u>
Ike Van der Wettering	Consultant	Iowa State University Ames, Iowa 51110
Al Halter	Consultant	Oregon State University Corvallis, Oregon 97331
Joe Conrad	Participant	} University of Florida, Gainesville, Florida 32601
Gerry Mott	Participant	
Fred Maurer	Participant	} Texas A & M University College Station, Texas 77843
Tom Cartwright	Participant	
Ed Bray	Participant	} Tuskegee Institute, Tuskegee, Alabama 36088
Carney Manning	Participant	
Wilfred Candler	Participant	} Purdue University
Arlo Minden	Participant	
Wm. Morris	Participant	
Ralph May	Research Asst.	Purdue University
Ludwig Eisgruber	Administrator	} Purdue University
Charles French	Administrator	
D. Woods Thomas	Administrator	
Michael Galli	Administrator	} Washington, D. C.
Carl Sierk	Participant	

8/30/72

Appendix 2

Pro Forma Proposal for:

A SEMINAR ON AFRICAN TROPICAL LIVESTOCK PRODUCTION PROBLEMS

The objectives of the proposed seminar would be:

1. To acquaint the members of the consortium with the systems of production, transportation, marketing and distribution of tropical ruminants in subsaharan Africa (major emphasis on West and Central Africa) and with the types of intervention (successful and less successful) used in the development of the systems.
2. To attempt to use the systems approach to identify the bottlenecks to development and to evaluate the means to relax the bottlenecks.
3. To evaluate the research capacity and infrastructure of indigenous institutions and the suitability of other means for getting research done.
4. To provide an opportunity for the 211d consortium to meet and interact with the professionals in West Africa, local, expatriate and in foreign organizations.
5. To provide African and expatriate livestock production and meat marketing specialists with an opportunity for discussion of different U.S. approaches to the problems of increasing ruminant production and meat supply.

Location

Tentatively the location will include:

- i) Senegal (Dakar) - OMVS Region
- ii) Mali (Bamako)
- iii) Ivory Coast (Abidjan and Bouake) - Entente Region
- iv) Nigeria (Zaria)

Time

March 1974, 2 to 3 weeks.

Participation

The consortium is expected to send a team of 15 plus a USAID advisor. USAID might wish to send two or three other participants. Other donors would be expected to send about 15 people. In each location -- Dakar, Bamako, Abidjan, Ibadan and Zaria -- at least 15 local participants could be expected including expatriates.

Program

The program would include:

1. Written background material placed in the hands of the participants.
2. Presentations by local professionals (including expatriates where necessary), significant interventions, investments and research and their roles in the livestock production and meat distribution system, either by visits on the ground or using visual aids.
3. Production of a written consensus after interdisciplinary discussions. This consensus should cover both the relative importance of the restraints identified, and suggested priorities (or "packages") for the relaxation of these restraints.

The program would involve a series of four seminars (Dakar, Bamako, Abidjan, and Zaria (Ahmadu Bello University)). Problems of accommodation might cause changes in this schedule.

Proceedings

It is proposed that participants be provided with introductory materials, written papers or at least written data, and, at a later date, summary of discussion and conclusions. Additional copies will be available for donors in limited quantity.

Cost

Cost per U.S. participant is estimated at about \$1,900 if the seminar lasted three weeks. This includes:

<u>Three weeks:</u>	\$120	fares in U.S.
	650	fare as far as Nigeria
	630	subsistence and personal expenses (e.g., taxis)
	500	local travel, conference rooms, and preparation of proceedings.
	<u> </u>	
	\$1900	

Assumptions in costing:

1. USAID/AFR pays the cost of preparing the materials and setting up the seminar.
2. 211d consortium pay their own travel and subsistence and pay a pro-rata share of the cost of facilities and seminar travel (excursions by ground and air) and of consultants.

3. Donors pay their own or each others' costs.
4. Participants would pay pro-rata for the production of the proceedings.

Items to be discussed are to be agreed by donors in consultation with others such as Dr. Barry Nestel. They might include some of the following:

Dakar, Senegal

Production area
 Bambilor feedlot
 Concept of quarantine area for export
 Dakar/Hann Veterinary Lab and Research Station
 UNDP Project
 OMVS Regional organization
 Cattle market
 Abattoir
 Meat markets
 Demand studies
 Dara-Djoloff and Sanfalkam IEMVT } - pasture research
 ORSTOM
 Doli and Onadi Rimi ranches including agrostology, budgets
 Ferlo FAC/IEMVT production project (SEDES study)
 Drought problems
Mauretanian
 Drought problems
 Kedi FAC Pilot zone
 Irrigated ranch proposal on Senegal River

Bamako, Mali

Mali livestock study and background data, peculiarities of Malian situation
 UNDP team -- Animal Science, Agricultural Economics, Sociology
 CVL and Abattoir (to see animal quality), Bamako
 Sotuba Research Station
 Visit sedentary livestock production including work animals in tsetse zone, intermediate and tsetse-free zone
 Visit herders (nomadic) in Mopti area, cattle market

Slides:

See results of Goa Diwi water development project
 Discuss Yanfolila N'dama project
 Niono ranch
 Dougabougou feedlot
 FAC calf health program
 Station de Sahel (Niono)
 Trek routes and cattle transport
 Demand studies

Niamey, Niger

- Ekrafane and Sanam ranches
- Kirkissoye research station
- Toukounos ranch and lab
- Ranch at Zinder (closed)
- (Ayourou market - Sunday)
- Niamey abattoir
- Research station for goats, Maradi
- Maradi abattoir
- Trek routes
- Pasture research; Niamey, Maradi, Kirkissoye
- Veterinary research
- New search for ranch sites

Ivory Coast

- Coastal market
- Trek routes
- Bouake research station (Minankro)
- ORSTOM Adiopodume
- Abokouamerko and Sipilou Ranches
- Demand studies
- Cattle market
- Abattoir
- Meat markets

Upper Volta

- Council of the Entente
- Base study on livestock (SCET)
- Trek routes from Markoye
- Markoye Ranch
- Hydro pastoral research -- Ord du Sahel
- FAC research on Zebu cattle finishing
- Rail transport of cattle

Chad

- Extension of Fort Lamy abattoir and the organization of the meat export
- South Chad (FAC/FED) integrated livestock development project
- Assale and Cameroun - program to improve livestock production
- USAID/UNDP project
- Farcha lab and research station including sheep
- Glossina studies at Fort Lamy
- Pasture research BPPA at Mandoul, Farcha and ONDR Mission
- Lake Chad Basin Commission

Cameroon

Serbewel (see Assale, Chad)
 Wakwa animal and forage research station including AI
 Bambui pasture research
 Wum/Bamenaa grassland research program

Togo

Cattle market study
 CBPP program

Dahomey

Marketing of cattle and meat including new abattoir at Cotonou and its
 feasibility study
 Markets at Cotonou and Porto Novo

Nigeria

Nigerian Livestock and Meat Board (Kaduna)
 Tsetse eradication project (Kaduna) FE7033 German
 IBRD Ranch Proposals and Ranches
 Mokwa Ranch
 Bauchi Ranch and meat plant
 Ahmadu Bello University and Samaru Research Station (Zaria)
 Ibadan and Ife Universities
 IITA pasture research (Ibadan)
 Vom Research Station and Veterinary Lab
 Abattoirs and meat markets in Ibadan, Kaduna, Kano, etc.

Project Sketch:

A sizeable proportion of the beef produced in Guyana is reared on the highly populated coastal area. Pressures from an increasing need for housing, the growth of rice production and potentials for expanded vegetable acreage present the need for a change in the traditional cattle production in the area.

Traditionally, cattle are reared on pasture and rice land during non-critical periods for rice production. When feed supplies and/or land is restricted cattle are sent to slaughter. Little supplemental feeding of cows or calves is performed with the result that many animals arrive at slaughter in poor finish and health.

It is proposed that the "modern" system of cattle production in the coastal areas be economically evaluated with the addition of certain supplemental and confined feeding programs.

Costs, rates of gain, calf mortality, calf crop, feed supplies (type and amount) breeding schedules, grazing schedule, investment, labor requirements and utilization, markets and marketing schedule and resultant effect on meat supply (quantity and quality) will be determined for the "modern" cattle production system in the coastal areas.

Generally described the system includes 1) controlled breeding schedule, 2) grazing and/or supplemental feeding for cows and calves until weaning, 3) supplemental and/or confined feeding of calves and 4) scheduled marketing. Supplemental and/or confined feeding may take place on the farms before sale or after sale and before slaughter depending on the physical condition of the cattle.

Economic aspects of the "modern" system will be compared with those of the traditional system and will provide an input into the regional production - marketing model to be developed under the 211d project.

Appendix 3

NOTES ON MODELING AS AN AID TO SETTING RESEARCH PRIORITIES IN THE CONTEXT OF THE GUYANIAN LIVESTOCK ECONOMY*

Wilfred Candler**
Purdue University

Introduction

This paper is entitled "notes" and this is indeed what I intend to present. The formulation of a useful model (or models) is a highly interactive business. Usually this is an interaction between the user and the modeler. Even when I am modeling something I know something about (unfortunately a good example does not come to mind), there is some interaction within me - my left lobe saying "this is what I would like to represent", while my right lobe says "well this is the nearest I can get along those lines".

For people new to formal modeling, there can be a long warm-up period before fruitful dialogue is established. In particular, a lot of time can be spent on the "what can you do?", "what do you want?", hang-up. The participants in this exchange typically talk past each other, since the modeler find difficulty in explaining the characteristics of his modeling skills in the absence of a concrete example relevant to the current topic, while the potential user feels inhibited from defining his needs in the absence of some knowledge of which of these needs can indeed be met by the model to be developed.

I am going to attempt to contribute to our eventual fruitful interaction by presenting these notes. Again I emphasize that at least some of these initial ideas will need to be scrapped in the light of groups final consensus on the features of the Guyanian cattle economy (i.e., production-marketing system) which need to be reflected in our model(s).

Objectives

My understanding of the objectives of the consortium, is that we should attempt to develop our skills in the assessment of research priorities in tropical cattle production; and we hope that Guyana will provide us with a suitably complex, but managable, area in which to develop these skills.

It is important, therefore, to recognize that model development is not an end in itself; but rather a tool to be used in attempting to quantify pay-off's from alternative lines of research. Those of us with more experience of formal modeling may have a special contribution of this skill to the consortium, but this experience does not give us any special insight as to what should be modeled, nor does it give us any special authority in deciding what is an adequate model. I have some ideas, most of which I discuss below, but the point is that these ideas should be treated with the same skepticism each of us reserves for co-workers in our own special areas of expertise.

How Far Do We Look?

Our terms of reference refer to tropical cattle production. How widely can/should this be interpreted? Obviously we should look at cattle production; but not to the point of consciously ignoring other opportunities of which we may become aware. Setting of research and investment priorities is the prerogative of the Government. It is not our job to second-guess these types of decision which may stem from subtle political considerations far removed from the simple technical types of information on which consortium members can claim expertise. It is not our job to second guess the government, but it is our job to inform them of the full cost (so far as we are aware of it) of decisions they may be making.

Suppose, for instance, in looking at potential cattle production systems around Ebini we budgeted extensive pastoral, intensive pastoral and cropping systems, and found the cropping based system was profitable while the pastoral systems were not; and further we discovered that cropping farms without cattle were even more profitable than farms with cattle, then I say that this latter type of information needs to be reported to government along with information on the most profitable way of producing cattle.

In the same way the government deserves to be told not only the highest pay-off use of veterinarians in fostering a beef industry, but also (if the advisors become aware of it) the productive uses for these same talents elsewhere in livestock production. That is, I think it would be irresponsible for an advisor to only make reference to cattle in his report to the host government but to say to a friend on return to the States "Well, we told them the best place to use their veterinary talent in beef production but, of course, what they should be doing is concentrating all their veterinary skills on poultry for the next five years".

In short we should not go looking for alternatives outside cattle production (to do this is to open Pandora's box); but if we become aware of other high pay-off uses for scarce talent outside of cattle production, those high pay-offs should also be brought to the attention of the host government.

Macro versus Micro

In the special terminology (alias jargon) of economics, Macro refers to economy wide phenomena, while Micro refers to an individual firm or production process. Macro is about the forest while Micro is about the trees.

In principle there is a continuum from Macro to Micro and vice-versa (as we add more detail to the Macro model we approach Micro, while as we add additional firms, or production processes a Micro model we approach the Macro), but in practice there are few, if any, models which can be claimed to be directly useful at both levels.

A Macro model (or models) would allow us particularly to look at effects of changing production and income levels on the price of beef, effects of aggressive investment in cattle production facilities on the rate of interest in Guyana, balance of payments effects, and the like. A Micro-model allows us to choose between production processes at the firm level; to trace out the impact, for a particular farm, of reduced death losses; to examine how fast a herd can grow; calculate net investment needs for a given farm development plan, and so on.

Both Macro and Micro questions are important. Consider a "typical" development goal of raising calving rate from 40% to 80%. At the farm level this implies a whole new herd structure, may require substantial investment and some re-scheduling of the annual cycle of operations. For given prices it will substantially affect the profitability of ranching. All of these are Micro questions. But with this sort of change we could not "take prices as given". A doubling of calving rates would so substantially affect beef production, that prices themselves would be affected. These overall, industry wide, price effects really require a Macro model for their satisfactory analysis.

Micro-models have one substantial advantage over Macro-models, they deal with individual firms, and direct physical production relationships which can (at least in principle) be verified by reference to experienced producers, or

suitably deflated experimental results - I don't want to fall into the trap of advocating that, like the drunk looking for his quarter, that we search where the searching is easiest, I merely note that macro models are largely about "economic concepts" while micro models are about engineering and biological production processes.

Before our tour, my guess is that the most useful models we could produce would be micro-models. One each for the Rupinini, Ebene, and the coastal region. I believe these three regions would involve substantially different husbandry practices, hence the three models.

What About Time?

There are three easily recognized methods of dealing with time. It can be ignored, it can be handled for an "average" year, or it can be dealt with explicitly. Let me explain.

When an economist decides to ignore time, he describes this as doing an equilibrium analysis. An equilibrium analysis referring to a situation in which all dynamic elements have worked themselves out. And using this technique we can, for example, conveniently look at a herd structure with 40% calving, and a herd structure with 80% calving, and hence get a before and after picture of the impact of the technological change.

By an "average" treatment of time (economists refer to it as "Hicksian Dynamic"), we would look at a year where calving percentage had improved by 5% 10%. It would represent, in some sense, a "typical" year on the way from 40 to 80 percent calving.

A full treatment, of time effect, would have an opening inventory of cattle on hand, and trace this inventory through for each of, say, the next 5 years.

In the Guyanian situation, again before our tour, I would think that we should strive for both equilibrium models (before and after) and a detailed dynamic model tracing out the herd structure. We want to be sure our suggestions would be profitable in the long run, and that we don't starve in the meantime!

Visibility of Results

One sometimes hears the comment that models should produce "highly visible results". I would just make the comment that obviously we would like any model results to be easily communicable. Communicability is not generally a feature of the model per se, but rather of the way results are presented. Though, of course, if we want the sort of results Al Halter showed us (i.e., all curves ending up with a strong north-easterly, or south-easterly trend after 5 years), we have to have a model that will generate a time path of development.

First we need a sound, internally consistent, model then we need to get a set of felt-marking pens, so that everybody can understand our results.

Summary

Before our tour, I would suggest that one of our first orders of business should be to get a clear picture of equilibrium (timeless) cattle production alternatives in each of the three geographic areas of Guyana. By clear picture, I mean a linear programming model.

Logic of Linear Programming

It is no more possible to explain linear programming at the end of a paper on modeling, than it is to explain the Analysis of Variance at the end of a paper on the scientific method.

Nevertheless there are certain features of the way a linear programmer views

the world, which it may be worth mentioning.

To the linear programmer, the world is made up of activities (or alternatives, or opportunities) and restraints (or scarce resources, or requirements). We write our activities as columns and our restraints as rows.

Thus anytime you ask a linear programmer could he include this, that, or the other feature of the real world in his model (after saying yes, he can) he will have to think "but is this a new activity, or is it a new restraint?".

Let's try and give you an idea of this "row and column thinking". Consider the question of whether to use the next 15 minutes for a coffee-break. Immediately this question occurs to me in terms of what are the alternatives? And in my mind I lay them out as:

<u>Column 1</u>	<u>Column 2</u>	<u>Column 3</u>
Keep Talking	Questions	Coffee

That is, I can identify at least 3 possibilities. Under the guidance of our chairman, I can keep talking, I can open up for questions, or I can be stopped for coffee. Then I think: What forces us to make a choice amongst these alternatives? (Why not do all?) And I see these as restrictions, which force a decision as rows, say:

Row 1 Time Available

Row 2 Meaningful Dialogue

Row 3 Comfort

That is, we can only use the next 15 minutes for one of these three alternatives, and we would like to be as comfortable as possible while achieving a high level of meaningful dialogue.

The interaction of these rows and columns gives us a matrix, and the coefficients appearing in this matrix provide our insight into the construction

of a "good" plan.

Before I infer something about the numbers the chairman has in his coffee/question matrix, let me make one final point:

No matter how little you know about modeling with linear programming, you can get a first insight into the adequacy of a model for your purposes. This comes from looking to see if it contains columns labeled for the activities (pet project) that interest you; and if it contains row labeled for the real life restrictions, that you think makes your problem tick.

As a confirmed programmer, I am going to spend the next five days looking for row and column labels.

Footnotes

- * Paper prepared for presentation at the AID 211(d) Tropical Cattle Consortium Meeting in Georgetown, Guyana, December 3rd, 1972.
- ** Wilfred Candler is Professor of Agricultural Economics, at Purdue University.

Draft
9/19/73

Appendix 4

REPORT ON THE RUMINANT PRODUCTION
SITUATION AND PROSPECTS IN GUYANA

Prepared by

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July, 1973

No attempt has been made in this review to bring the materials up to date. This will be done if and when it is decided to do further work in the area.

Table of Contents

Report of the Ruminant Production Situation and Prospects in Guyana

	<u>Page</u>
A. The Present Situation	
1. Introduction	1
2. Present Situation in Guyana	6
3. Transportation of Meat	8
4. Imports of Meat	8
5. Feeding of Cattle Before Slaughter	9
6. Modern Beef Cattle Production	9
7. Other High Class Land Areas	10
8. The Intermediate Savannahs	11
9. The Rupununi Savannahs	13
B. Possibilities for Intensification of Production	
10. Production Potential	17
11. Limitations by Region	21
(a) Rupununi	21
(b) Intermediate Savannahs	24
(c) The Coastal Region	26
12. Cattle Potential	31
13. Limitations on Production	32
14. Feeds and Feeding	34
15. Demand for Meat and Meat Products	35
16. Governmental Policy	37

Table of Contents (continued)

	<u>Page</u>
17. Protection of Rural Property	42
18. Domestic Prices	42
19. Other Suitable Land Areas	43
20. The Caribbean Meat Market	44
21. CARIFTA Agricultural Marketing Protocol (AMP)	46
22. Studies of the Ebini Livestock Station, Guyana	48
23. Systems of Management	51
24. Water Buffalo as a Source of "Beef" in the Caribbean	63
25. Feedlot Feeding	65
26. Venezuelan Cattle Production	67
27. Proposed Technological Assessments	69
(a) Dairy Beef	69
(b) Land Clearing	71
(c) Transportation and the Rupununi	71
(d) Coastal Feedlot	72
(e) Cane Feeding	73

Appendix 1 Bibliography

- 2 Bookers Holdings at Kabawer and Gold Diggins (to be completed later).

Index of Tables

	<u>Page</u>
1. Commonwealth Caribbean - Per Capita Consumption of Locally Produced Beef and Veal, 1956-1967, in Pounds.	2
2. Production Consumption Imports of Beef, Poultry, Eggs and Pork in Guyana.	3
3. Guyana Ruminant Numbers and Beef Production	5
4. Estimated Live-weight Production Per Breeding Cow Per Annum	14
5. Investment in Facilities for Ranching, Guyana	17
6. Losses Due to Various Causes for All the Animals on the Ebini Livestock Station.	18
7. Performance Expected on Rupununi Ranches with Development	22
8. Budgeted Performance on 10,000 Acre Coastal Ranches and Livestock Development Company Ranch.	28
9. Comparative Estimates of Guyanese Production, Consumption and Trade in Meat (Meyer's and Reid's Data)	30
10. Costs Per Acre on Natural and Improved Pastures, Ebini	52
11. Costs of Setting Up 1000 Acre Units with Varying Amounts of Range and Planted Pasture	53
12. Output for 1000-Acre Systems, Three Breeds, Ebini	54
13. Lb. Carcass Weight by Age and Breed	55
14. Number of Observations, Mean Age at Slaughter, Pre-Slaughter Weights, Hot Carcass Weights, Dressing Percentages, and Coefficients of Variation of the Steers Slaughtered at Ebini	56
15. Labor Requirements and Cost for Different Sized Cow Herds (25% Planted Pasture, Sahiwal)	57
16. Budget for 1920 Acre Unit, 25% Planted, 277 Cows and 5 Men	57
17. Guyana Crop Production	58
18. Guyana: Trade in Major Agricultural Commodities	59
19. Some Statistics on Guyana	60
20. Herd Composition and Yield for Different Systems and breeds	61

SUMMARY

The following points are pertinent to the expansion of ruminant production in Guyana.

- 1) Guyana is currently a low cost beef producer, and GOG policy seems to favor retention of beef prices below import parity.
- 2) Something in the neighborhood of half the cattle research resources in Guyana have been spent at Ebini, in the intermediate savannah, without producing an economically viable method of livestock production.
- 3) At existing price levels, cattle production is marginally profitable for current producers, but no clearly profitable areas for expansion exist.
- 4) Cattle appear to be slaughtered at very low weights, partly due to the likelihood of theft, and partly due to the lack of a differentiated market for finished beef.
- 5) The IRBD loan means that plans already exist for expansion of beef production at close to maximum speed. This means that the Guyanese are now particularly interested in the development of other types of ruminant.
- 6) Though Guyana has a large land base, intensive production systems have only been developed for the coastal clays. Profitable exploitation of the remaining land areas, other than in a very extensive manner, awaits the development of appropriate production systems.

A. THE PRESENT SITUATION

1. Introduction

The per capita consumption of locally produced beef and veal in the "Commonwealth Caribbean" has been declining for the last 15 years. For the period 1956-67 the estimates have been made by Mayers [114], Table 1. This decline is strongly shown in Jamaica and Trinidad (the two countries with the greatest population). In Guyana, the third largest by population, there has been no distinct trend to increase or to decrease in the per capita consumption of carcass beef and veal. In Guyana increases in per capita consumption of pork have been maintained in the last 5-6 years in spite of a decline in the imports (mostly smoked and salt pork). Per capita consumption of poultry in Guyana has increased markedly but not as much as in Jamaica and Trinidad. This leaves, in 1971, the annual per capita consumption of all meats and meat products in Guyana at about 36 1/2 lb., among the lowest in the Commonwealth Caribbean and with about 30% of this supplied by poultry.

For the Commonwealth Caribbean the production of beef is not keeping pace with population and there is believed to be a considerable unsatisfied demand.* About 1/3 of the value of food imports into the region in 1970 was meat.

The beef cattle development plan in Guyana is estimated to increase the production by 45% of the 1971 level by 1982. Even if this is fulfilled, it will only maintain the per capita supply of locally produced beef at slightly below the 1965-1970 average and the ban on imports if maintained would provide a total per capita beef consumption about 20% below the 1965-1970 level.

* That is, the average per capita consumption in the region showed no increase with the increase in GNP/capita and, in Trinidad and Jamaica the per capita consumption declined.

Table 1. Commonwealth Caribbean - Per Capita Consumption of Locally Produced Beef and Veal, 1956-1967, in Pounds.

Year	Antigua	Barbados	British Honduras	Dominica	Grenada	Guyana	Jamaica	Montserrat	St. Kitts-Nevis-Anguilla	St. Lucia	St. Vincent	Trinidad and Tobago	Total ^{1/}	Average
1956	8.99	4.09	10.48	1.70	6.15	12.19	17.24	10.32	5.84	7.01	n.a.	3.56	87.57	9.63
1957	10.52	3.58	9.65	2.15	5.92	13.47	14.72	9.18	5.90	6.98	n.a.	4.42	86.49	10.55
1958	8.70	3.70	9.32	2.36	6.08	13.34	14.07	9.77	7.96	7.15	n.a.	4.26	86.71	10.22
1959	9.80	3.83	8.10	3.43	5.84	12.15	13.76	n.a.	5.10	6.87	n.a.	4.12	73.00	9.87
1960	8.54	3.75	9.47	2.84	5.40	12.25	13.69	10.23	6.78	6.62	n.a.	3.61	83.18	9.71
1961	10.10	4.14	8.50	2.41	5.86	12.65	15.99	12.44	5.68	6.67	n.a.	3.59	88.03	10.77
1962	6.46	2.97	9.92	2.14	6.18	11.99	14.81	10.93	5.24	6.71	5.51	3.31	86.17	9.85
1963	7.67	3.37	10.55	1.94	6.29	11.26	14.48	9.80	6.36	6.92	5.61	3.14	87.39	9.65
1964	9.90	3.75	10.10	1.70	n.a.	12.09	14.78	12.61	6.72	7.12	5.91	2.97	87.65	9.93
1965	8.24	2.92	10.14	1.41	6.07	12.65	13.77	11.27	6.82	6.29	7.28	3.03	90.33	9.53
1966	8.66	3.34	10.76	1.58	7.81	14.33	13.91	15.08	5.68	7.40	9.87	3.74	102.16	10.20
1967	5.68	2.41	9.87	2.16	n.a.	13.34	13.43	12.73	4.64	6.13	9.82	2.48	83.69	9.61

^{1/} Excludes estimates for St. Vincent for the years 1956 to 1961, Grenada for 1964 and 1967; and Montserrat for 1959.

Note: This table represents a summary of similar tables contained herein for the individual territories of the Commonwealth Caribbean.

Source: Mayers [114, Table 14].

Table 2. Production Consumption Imports of Beef, Poultry, Eggs and Pork in Guyana.

	Unit	1965	1966	1967	1968	1969	1970	1971
BEEF:								
Production ^{1/}	lbs.	9,254,680	10,422,681	9,648,441	9,782,762	10,361,726	9,839,846	4
Imports ^{2/}	lbs.	2,334,471	2,015,245	2,125,329	1,540,184	1,288,678	2,110,977	
Exports	lbs.	818,287	303,852	750	57,997	153,448	360	
Consumption	lbs.	10,770,864	12,134,074	11,773,020	11,264,949	11,496,956	11,950,463	
Value of Imports	\$	1,119,298	1,149,906	1,118,184	1,240,653	984,947	618,761	
Value of Exports	\$	353,703	198,586	541	30,551	127,295	265	
PORK:								
Production	lbs.	920,200	1,282,261	1,516,687	1,953,697	2,388,016	2,645,133	3.3
Imports	lbs.	1,148,407	1,408,555	1,250,704	677,921	51,170	34,800	
Exports	lbs.	1,554	1,004	288			3,247	
Consumption	lbs.	2,067,053	2,689,812	2,767,103	2,631,618	2,439,186	2,676,686	
Value of Imports	\$	460,345	718,057	439,890	266,713	67,566	13,085	
Value of Exports	\$	1,187	774	219			3,009	
POULTRY:								
Production	lbs.	2,103,960	4,178,860	5,473,421	5,923,006	5,962,642	7,456,719	8.7
Imports	lbs.	43,036	30,001	48,071	33,891	31,893	34,327	
Exports	lbs.	1,577	808	190		60	33	
Consumption	lbs.	2,145,419	4,208,053	5,521,302	5,956,867	5,994,475	7,491,013	
Value of Imports	\$	40,071	27,688	38,839	39,462	31,885	34,378	
Value of Exports	\$	1,423	754	198		51	31	
Population	000	655	677	698	719	742	764	786

Source: Reid, P. A., [83].

In a review of the development plans for the livestock industry for 1966-72 Mongul[72] suggests that "the cattle population was diminishing (see Table 3) and that poor fertility and reproductive performance (following the outbreak of foot-and-mouth disease in the Rupununi) together with rabies, larceny, predators and the conversion of pasture fields into rice fields have all had an adverse effect."

Guyana, which has a much larger land base in relation to its population than the other countries in the region, naturally considers that it should be able to fulfill its own demand for beef and also have a substantial surplus for export.

Table 3

GUYANA RUMINANT NUMBERSAND BEEF PRODUCTION

	1948-52	1961-65	1965	1966	1967	1968	1969	1970
CATTLE ('000 Head)	181	245	350	315	306	250	257	258
SHEEP ('000 Head)	46	56	87	83	100	98	99	99
GOATS ('000 Head)	15	19	33	31	42	38	39	37
BEEF PRODUCTION (Million lbs.)	4.4	8.9	8.9	8.9	8.9	8.9	8.9	8.9
BEEF PRODUCTION (Per capita)			9.3	10.4	9.6	9.783	10.3	9.8
POPULATION ('000 People)			655	677	698	719	742	764

Source: Reid, [83].

2. Present Situation in Guyana

At present the national Guyanese herd is about 260,000 head of Creole and Creole-Zebu crosses, down from a peak of about 300,000 head in 1965. The off take is about 10%. About 180,000 head are in the coastal region, almost all in dairy herds, and about 60,000 are in the Rupununi Savannahs, which is kept in extensive beef production schemes with a relatively low off take but also little in the way of inputs.

The majority of the slaughter takes place either in Georgetown or in the Lethem abattoir (Rupununi) from which carcasses are flown out warm, and cooled on arrival in Georgetown. A compact meat cannery and by-product plant is to be built at Lethem in 1973. It will be designed to produce canned soups, meats, bean and meat combinations, as well as tomato and tripe combinations, and bone meal flour.

The present beef production then comprises about 2-1/2 million pounds from the Rupununi and 7-1/2 million mainly from the coastal regions. In the latter case, although there are a few beef cattle ranches, the beef produced is mainly a by-product of the dairy herd. A depressing effect on production of beef has been the generally low level of profitability of dairying until the recent (1973) increase in milk price.

The dairy industry comprises a large traditional sector and a small modern sector. The traditional sector has a large number of small herds owned by rice farmers^{1/} on the coastal belt of marine clays. The cattle graze and manure the

^{1/} In the balance of this report this ethnic group will be referred to as Hindustani (predominantly of Asian Indiana descent). They comprise the major portion of farmers. In contrast Guyanese of predominantly African descent will be referred to as Creoles. Creoles tend to predominate in the public sector.

rice stubbles^{2/} and at other times of the year graze on the public domain or on rather poorly managed communal pastures located on the sandy strips in the marine clays or in the areas unsuitable for rice production just inland from the irrigated clays.

The traditional socio-cultural value of cattle as a form of wealth still exists and to some extent retards the development of beef production.

There is little doubt that a considerable possibility of increasing the beef produced from the traditional dairy herds exists both in terms of a much needed increase in the cow herd and milk supply, resulting from an increase in milk price and from improved pastures and nutrition, and also from better feeding of the cull females and of the steers resulting in a higher meat yield per carcass.

A major problem in increasing milk production is assembly. At present most of the fluid milk has to be brought to Georgetown by truck, boat, cart or bicycle. Milk plants have been proposed for other areas. However, conventional milk plants have such a high overhead that it is difficult to develop sufficient supply rapidly in a new area. The possibility of adding a UHT pasteurization unit to a sugar factory with no increase in managerial or laboratory service would overcome this; and the long shelf-life of the resulting sterile dairy product would avoid problems of getting the milk to the market.

Experience in other markets (e.g., Vicosa, M.G., Brazil) indicate that there may be a considerable "latent" supply of milk, which can be drawn into a milk plant once the cash market is established.

There is also a small modern dairy sector including a state unit at Mon Repos (potential for 1,000 cows) and the private dairy of Bookers just south of Georgetown (Appendix 1). These demonstrate the feasibility of modern

^{2/} The increasing area used for producing a second rice crop in the year reduces the time available for grazing stubble.

dairying and projects are planned. The largest of these projects involves 9,000 cows in 60 x 200 acre cooperative dairy units, each with 150 cows. Past experience with cooperatives among the Hindustani farmers have not been very successful and it is doubtful that this proposal can be executed. However, it is possible that in private or corporate form, given land tenure, protection from larceny, and credit, a substantial number of new modern dairy units could be established.

There is little use of cattle for power and so it is believed that this needs no consideration.

3. Transportation of Meat

Meat from the interior (Rupununi) has to be flown to Georgetown. Guyana Airways makes regular flights to pick up freshly slaughtered meat and deliver it to Georgetown. The freight rate is 18¢G/lb. to which the GOG contributes 12¢G/lb. Only steer and heifer beef is shipped.^{3/} Cow beef is disposed of locally in the Rupununi. Presumably the product of the newly installed cannery at Lethem will also be flown out.

Cattle used to be trekked out from the Rupununi to the Berbice River and shipped to Georgetown. These cattle recuperated from their trek on range land in the area of Ebini. The danger of foot-and-mouth contamination has led to the closing of this trail.

River transport permits good access to much of the intermediate savannah area, but for other reasons this area has not been settled for agricultural purposes.

4. Imports of Meat

It is believed that meat imports have been stopped. Their volume and value is shown in Table 2 (Reid, [83]). Only in beef was the importation in recent

^{3/} But, offals and low value beef products are covered by the subsidy, so that some beef products are flown out which have market value less than 18¢G when delivered in Georgetown.

years a significant part of the total (17.67% in 1970). The decline in the import of pork, from 55.56% in 1965 to 1.3% in 1970 is spectacular, domestic production almost tripled in this period.

5. Feeding of Cattle Before Slaughter

The size of cattle observed in the Georgetown abattoir (a single observation) was very small. There has been, for a long time, a decline in the carcass weight. The weekly slaughter was about 300 head, averaging 150-200 lb. carcass weight. This suggests the need for a system for feeding the cattle before slaughter.

While there may be some reluctance on the part of the farmers to sell cattle to an intermediary for feeding (and no facilities for the dairy farmers to do much feeding themselves) there was evidence that substantial groups of cattle could be assembled for finishing.

It should be noted however, that feedlot finishing, while technically feasible, is not usually observed in the Commonwealth Caribbean (and in other parts of the world with a strong traditional production sector) unless a premium can be obtained for the finished carcass and its higher killing out percentage. Thus, permitting those who wish to buy a higher quality of meat to pay a higher price is probably all that is needed to stimulate a feedlot industry in Guyana. Jamaica already has over 100 feedlots whose output is sold at a premium.

6. Modern Beef Cattle Production

In the coastal and riverain areas there are several places, where the soils are good but either because the irrigation and drainage system has not been adequately developed or because they are subject to flood, they are not cropped and can produce good year-round natural or artificial pastures for beef cattle production. Urea/molasses supplements are used in these areas.

Almost all the grazing land now belongs to the government which grants annual renewable grazing leases. However, under the IBRD cattle project ranch leases could be granted for 25 year terms.

The Kabawer and Gold Digging units of Bookers, visited during the Consortium Seminar, are described in Appendix 2. They showed the technical production possibilities, including the possibility of pasture improvement. The Kabawa unit is vulnerable to flooding and theft. Cattle can be saved during the floods by building mounds on which they can gather and by not carrying too many cattle for the available space on high ground. The theft can be combatted by a rural constabulary (which is being started) and a change in the law to make it an offense for an outsider to rope an animal on a ranch. At present no offense is committed until the animal has been removed from the property and the thief must be caught with the animal in his care.

The high cost of complete land clearance is an economic obstacle but Bookers has overcome this by hand clearing of small brush and leaving the large trees.

The economic feasibility of a modern feedlot to finish animals from the traditional sector has not been demonstrated. A study by Adelatec [1, 1968] indicates that it should be economically feasible to finish calves purchased from dairy farmers using a stocking rate of 1.6 head per acre on improved grassland with rotational grazing and supplementing this with urea, molasses and other products for the last three months. In one year calves are expected to grow from 500 lb. to 900 lb. live weight.

7. Other High Class Land Areas

The soil survey of Guyana shows a number of areas with good soils that are not under cultivation. A major problem is the high capital investment if the ranch has to be made by draining a grassy area or deforesting and fencing (from \$G200 to \$G270 an animal unit). With an off-take of 20% this

requires five times this investment per head off-take.

The technical possibilities at Matthews Ridge are considered to be good and it has been proposed to set up a small dairy unit there. It is quite possible however, that at present cattle prices, the investment cannot be amortized.

The Canje River area also has land suitable for cattle production. It even has areas which could be used undrained and unfertilized for cattle production using urea-molasses mineral supplements. No immediate explanation is available for the failure of the cattle industry to develop this area, though larceny and lack of security of title to land may be partial explanations.

8. The Intermediate Savannahs

Most of the research on beef cattle production in Guyana has been centered at Ebini. Ebini was originally a staging station, the end of the trail from the Rupununi where the cattle were rested and loaded on boats. Prolonged grazing (over 2-3 months) at Ebini was observed to produce fertility problems and a high mortality rate. In 1941 a research station was set up to study this and other problems, with a view to providing the basis for economic cattle production in the Intermediate Savannahs. The initial recommendation was to feed a mineral mix and this was found to overcome the major problems of reproduction and survival.

In 1957 another approach was started which has been continued to date, research and development of a highly intensive system of production based on improved or exotic pastures.

The data from Ebini were analyzed by Haricharan [35] (subsequently reported by Mahedevan and others [61]) and this was used as the basis for economic evaluations by J. M. Mayers [114] and Professor D. T. Edwards (U.W.I., Trinidad) on behalf of the GOG. Further analyses have been done by Noel Holder [40], Paul

Hooker [41] and by Boyd, Dickey and Eddleman [10]. A review has also been made but not published by Holman Williams, Head of the Animal Science Department, U.W.I., Trinidad [98].

These reports are somewhat conflicting in their conclusions. To date, no profitable system of ranching has been proposed for this region, despite the 30 years of work at the Ebini Station. The improved pasture stands out like a beautiful oasis and the exotic cattle breeds (e.g., Santa Gertrudis) cannot survive without it.

The underlying problems in the intermediate savannahs are that land clearance and pasture establishment and maintenance costs are high and there are other soil types which would yield better returns. Fertilizer costs are high and so far profitable combinations of grasses and legumes have not been identified. Pangola grass production, especially under low levels of fertilization, has been depressed by the stunt virus, and unfortunately, the calving rate on the Pangola pastures were relatively low.

On the natural range land, the cost of ranch development is still quite high per head of off-take. The calf mortality and calf disappearance as well as deaths in the cows greatly lowers the potential yield and depresses the live-weight production per breeding cow per year (Table 4.). Information on these data is contained in Harricharan [35]. Nutritional deficiencies were responsible for 64% of the mortality and prenatal deaths 14%.

Boyd, Dickey and Eddleman [10] base their results on two years' of data, 1970 and 1971. While there were certain changes in management in 1970, Harricharan's data show the variability between years 1957-1966. Therefore, two years' data and estimates "consistent with those obtained for beef herds under similar conditions in other sub-tropical (especially S. Florida) and tropical environments" (sic) may not provide an adequate basis for planning.

Boyd, Dickey and Eddleman [10] conclude that improved pastures, although they produce more beef do not provide a profitable system. The only profitable systems involve a mixture of native range and improved pasture (6 1/2 acres of improved pasture per 100 acres of range) and molasses supplement in the finishing ration.

When the seminar group visited the ranch all the animals were on the improved pasture. While there were some possibilities, and the existing unit might be operated commercially at a profit if all past investment in the area was written off, there was little enthusiasm from the seminar group for attempting to develop further ranches in these areas of white and brown sands.

Hooker [41] reports that cash crops can be grown successfully in the area and could support a beef production enterprise. However, the net income would be greater without beef. Unreliable rainfall may make crop production too risky for the intermediate savannahs; for example, the crops observed at Kibilibiri this year were a disaster.

The GOG wants to settle the intermediate savannah area but cattle ranches do not seem to be an appropriate mode.

9. The Rupununi Savannahs

The Rupununi Savannahs in the Southwest comprises an area of 5,000 square miles of low fertility soils with low nutritional status and low base exchange capacity. The FAO soil survey reports "No intensification of agriculture can take place in the immediate future on the Rupununi Savannahs." [23] In contradiction to this view, the World Bank is experimenting with Townsville Lucerne, in the hope of substantial increase in carrying capacity.

Cattle were introduced from Brazil in about 1860 using an open range system of production. The cattle used to be driven along the trail to Ebini and shipped from there to Gerogetown at a cost of about \$G3/head. Now the higher

Table 4. Estimated Live-weight Production Per Breeding Cow Per Annum

Classification Breed or Cross		Estimated Calf Crop	Survival at 1 Year of Age	No. of Animals Surviving at 1 Year of Age	Adjusted Yearling Weight	Estimated Production of Live Weight Per Cow Per Annum
Dam	Sire	(%)	(%)		(kg)	(kg)
* Native						
Native	SG	62	84	52	169	88
1/2 Native	SG	64	87	56	184	103
1/4 Native	SG	66	85	56	182	102
1/2 Native	3/4 SG	64	86	55	183	101
1/4 Native	3/4 SG	66	70	46	200	92
SG	SG	81	85	69	220	152
Mixed	SG	63	77	49	173	85
Total		63	84	53	186	99
SAH						
Native	SAH	57	78	44	163	72
1/2 Native	SAH	68	87	59	148	87
Mixed	SAH	58	85	49	156	77
Sahiwal	SAH	69	84	58	140	81
Total		62	83	51	152	78
BRAH						
Native	BRAH	54	85	45	151	68
1/2 Native	BRAH	57	81	46	145	67
Mixed	BRAH	56	88	49	183	89
Brahman	BRAH	57	81	46	164	75
Total		55	83	46	161	74

* Native means animals consisting of a mixture of Spanish Longhorn and Zebu blood.

Source: Mahadevan, P., H. Haricharan, and B. G. F. Springer, [61].

grade carcasses are flown out by DC3 "warm" to Georgetown at a cost of about \$G30/carcass. Lower grade carcasses are consumed locally. The by-products have not been well utilized, but the new meat cannery should improve this.

The Rupununi trail has been blocked to prevent the movement of cattle from the foot-and-mouth prone area to the area free from this disease in the intermediate and coastal regions. The last outbreak occurred in the Rupununi in 1969.

In the future the Rupununi will be accessible by road from Boa Vista, Brazil, and also later by road from Georgetown. However, the shipment of live cattle to the coast from the Rupununi is not likely to be permitted if Guyana is to export meat to the Commonwealth Caribbean. Spread of foot-and-mouth disease to the coastal dairy herd would have a very serious effect on production.

The new roads will greatly reduce the cost of getting inputs to the Rupununi (i.e., by boat and Boa Vista-Lethem highway and Georgetown-Lethem highway).

The natural pastures in the Rupununi have the typical problem of tropical pastures with a long dry season, that their protein content is insufficient for a major part of the year. Attempts to introduce Pangola grass has been unsuccessful and with fertilizer having to be flown in, its use is not practical. So far tropical legumes have not been successful but attempts to establish them are being continued. There is a research station at St. Ignatius, currently more or less inactive, at which much of the research has been done. Carcasses of 400 lb. plus have been produced at 3 1/2 years of age.

There are about 60,000 head of cattle in the region and the off-take reaching Georgetown is about 6,000 head a year (2.7 million lb. in 1969), about 40% of the supply in Georgetown.

A herd of 60,000 head might be expected to have the following composition,

mortality and sales (IBRD Guyana Beef Project, 1970 Annex 10 [45])

	<u>Herd</u>	<u>Mortality</u>	<u>Sales</u>
Cows	24,000	1,700	1,250
Bulls	1,250	100	50
Calves weaned	9,300		
Heifers 12-24 mo.	4,650	300	200 237 on 60,000 AU
24-36 mo.	4,350	300	200 237 on 60,000 AU
Steers 12-24 mo.	4,650	300	
24-36 mo.	4,350	300	4,260 on 60,000 AU
36-48 mo.	4,050	300	3,600 (900 lb. lw.)
48+ mo.	<u>2,800</u>	<u>150</u>	
Average	60,000	3,450	5,010
	50,700 AU		

Note that the cull cows are probably mostly consumed locally, so that by this estimate from IBRD only 75% of the estimated supply (6,000 head) would come from 60,000 head of cattle in the Rupununi, under present conditions, effective calving rate 38%, mortality rate of adults 7%, and culling rate for cows and heifers 5%. The meat canning plant will be able to use cull cows and provide canned meat for the Georgetown market.

There is evidence that the management of the cattle ranches in the Rupununi could be improved and the largest ranch has recently (January, 1973) employed a new manager. Currently, because of the very low annual variable cost (supplement \$G1.50 and vaccines and veterinary \$G1 per head) and modest fixed cost \$G6.50/AU, a small net revenue of about \$G6.50/AU remains.

An added problem is the prevalence of bat-transmitted rabies which causes more fatalities than any other disease. [98]

B. POSSIBILITIES FOR INTENSIFICATION OF PRODUCTION

O. Production Potential

Our discussion is mainly on cattle but it should be remembered that there are real prospects for sheep and goat production. Sheep production was suggested by Mongul for the Rupununi. Goat production has been found difficult in the relatively "wild" areas because of losses caused by predators; in the coastal region large scale sheep and goat production would not be practical until larceny was under control. The complementary grazing of cattle, sheep and goats and the great potential increase in meat production makes it desirable to study the role of small ruminants in future development.

The potential for cattle production is different in each of the above described geographic areas.

The major problem in development of cattle production in Guyana is the high capital investment facilities (Table 5). A second major problem in the interior ranches is who is going to operate them and where is the labor force to come from.

Table 5. Investment in Facilities for Ranching, Guyana [52].

Region	Ranch Area	\$G/Head	\$G/AU	\$G/Steer Equivalent Sold
Rupununi	2,500 sq. mi.	11.54	14.42	107.00
	200 sq. mi.	32	41	235
	50 sq. mi.	53.60	62	446
	30 sq. mi.	70	84	444
St. Ignatius (Rupununi)	53 sq. mi.	204	280	1,615
Kabawer	13,000 a.	23.65	28.03	153.75
Kabawer, if drained	2,500 a.	208	259	1,405
Deforested riverain	100 a. units	182	238	1,083
Ebini or McKenzie	100 a. units	142	192	640

The high capital cost may arise from:

1. Fencing - the lower the stocking capacity, the greater the amount of fence per AU.
2. Land clearance.
3. Planting pasture.
4. In the case of coastal land, poldering and drainage.

In the more remote areas (i.e., those other than the coastal belt in the eastern part of the country and some riverain areas) losses from predators are alleged to be high. However, Harricharan reports that losses from nutritional deficiencies at Ebini were eight times the losses from predators and those from prenatal deaths (presumably in part by nutritional problems almost double - Table 6).

Table 6. Losses Due to Various Causes for All the Animals on the Ebini Livestock Station [35].

Year	Causes							Total Dead	Per cent of total died
	Pre-natal deaths	Missing after birth	Predators	Accidents	Tick Fever	Old Age	Nutritional deficiencies		
1957	4	-	5	5	2	2	24	42	3.7
1958	14	6	5	5	-	-	34	62	5.5
1959	17	7	4	8	-	-	59	95	8.4
1960	24	-	1	19	-	1	74	109	9.6
1961	26	11	3	10	-	-	84	143	12.7
1962	3	2	6	19	-	-	32	53	4.7
1963	17	5	11	9	-	-	88	140	12.4
1964	11	5	12	6	-	-	100	137	12.1
1965	14	4	9	12	-	-	83	116	10.3
1966	30	12	32	4	-	-	146	232	20.5
Total	160	52	88	102	2	3	722	1129	--
Per cent of total died	14.2	4.6	7.8	9.0	0.2	0.3	63.9	--	100.0

In the more populous areas losses of adult cattle from larceny are so serious as to discourage commercial operations. However, changes in the law on cattle theft and the formation of a rural constabulary may reduce these losses.

Fencing seems to be essential in all but the most remote areas (e.g., parts of the Rupununi). Reduction in the cost of fencing, apart from the use of intermediate spacers and setting posts further apart, is difficult and the more remote the area the higher the cost of getting the wire.

Land clearance is a complicated subject, because there is a time-cost relationship. The land may be completely cleared, freed from stumps, and the timber burned in one operation, the most costly method, and one often resulting in serious disturbance of the "fragile" topsoil. The brush may be removed, leaving the trees standing for shade. The trees may be killed standing, which takes several years.

The costs and returns from the different methods within this range needs further study. Unfortunately, tropical forests rarely contain enough valuable species to cover the cost of clearing.

The cost of planting pastures comes from both the cost of planting, since most desirable tropical grasses are propagated vegetatively, and the cost of fertilization or liming necessary to obtain and maintain a stand. Tropical legumes may be seeded and then the seed cost as well as, perhaps, more exacting fertilizer requirements must be considered. Of course, the costs are usually higher (because of higher fertilizer needs) and the returns lower in the poorer and drier soil areas.

The cost of the drainage necessary before the empoldered coastal clay soils can be used makes it uneconomic for pasture production. However, the development of more farm land does provide more by-products for cattle production, especially rice (the most common crop in these areas) is grown. Rice straw and the milling by-products of rice are used as animal feeds.

Sociological factors may also be limiting in cattle production. There appear to be Amerindians in the Rupununi who could work as cowboys, but there are not many skilled managers available there and the returns from most of the ranches have not been sufficient to attract high class managers in the past. However, improved practices might spread from one or two good managers in the region.

The concept in the IBRD loan of developing cooperative ranches among the Amerindians seems somewhat risky. There are few, if any, Amerindians in Guyana with the knowledge and experience required to run a successful ranch and the Amerindians present are used to working cattle under a manager. The proposal includes training Amerindian ranchers on a large Livestock Development Company Ranch.

In the intermediate savannahs the few indigenous inhabitants are not used to keeping cattle and so the labor and management for a ranch would have to migrate into the region. The Hindustani and Creoles have no tradition for extensive cattle ranching and so Amerindians would need to be found.

In the coastal region the attempt to develop cooperative ranches among the indigenous Hindustani has moved very slowly. One cooperative formed some time ago has wasted away to a single family before there was any activity in cattle production. The Hindustani traditionally cooperate on a family basis but, both in the Caribbean and in India, have been reluctant to form cooperatives with a broader base. The widening of the criteria for the "IBRD loan" ranches from cooperative to include family, private and corporate organization is much more likely to produce some ranches.

Obviously, a substantial increase in the cattle prices would greatly change the economic feasibility of production in the different regions.

11. Limitations by Region

a) Rupununi

The IBRD has published a feasibility study for the Rupununi including 64,000 (100 sq. mile) and 200,000 (300 sq. mile) acre examples. The budgets are based upon the ability to increase the stocking rate from 63 acres per AU to 23 acres in the smaller and 29 acres on the larger ranches. The effective calving rate should be 65 and 70% respectively and the extraction rate 23 and 18%.

This will require range improvement, some planted pastures, and use of meat and bone meal produced locally at the Lethem abattoir as a mineral supplement, as well as a new level of management and a trained cadre of managers.

Within 10 years it may well be possible to truck refrigerated meat out of the Rupununi or, if the foot-and-mouth disease problem is overcome, to truck or drive out immature cattle to finish in areas with more abundant feed.

As far as the Rupununi region is concerned, there is real doubt that legume grass-mixtures can be established and maintained at a cost that is profitable even when fertilizer can be shipped in via Brazil or later directly by road from Georgetown.

Williams [98] reports that "no introduced grass species were found to survive in the various ecological zones in which they were tried without high levels of applied fertilizer. Normal conditions of marked infertility and seasonal drought killed out most of the introduced species."

"Little success has attended efforts to introduce pangola grass which has shown the best promise of all introductions. Annual applications of

Table 7. Performance Expected on Rupununi Ranches with Development [43]

	Existing Condition	66,000 a unit after 5 years	66,000 a unit after 11 years	200,000 a unit after 5 years	200,000 a unit after 11 years
Effective calving %	38	65	65	70	70
Mortality, adults %	7	3	3	3	3
Extraction rate*	10.0	14.2	23.1	7.6	18.0
Culling rate--cows	5	10	10	10	10
bulls	5	10	10	10	10
heifers	5	5	5	5	5
Stocking rate acres/AU	63	40	23	34	29

*Sales as percentage of total herd including purchased cows and excluding purchased steers.

not less than 6 cwt. of a mixed fertilizer, spread over the rainy season, have been found necessary for reasonable growth. Little growth takes place in the dry season; it will just survive without rain. By the end of the rains, the plants show extreme nitrogen deficiency symptoms. As far as the major soil types and ecological zones of the Rupununi are concerned, the indications are that it will be extremely difficult to plant improved pastures. Natural grasses require a period of at least 3 months for recovery but indications are that 1 or 2 years may be necessary. The crude protein content of such grasses during the wet season is inadequate for growth of stock. It appears that species available only in the dry season have much higher nutritive value."

The cost of flying in mineral supplements is currently too high; however, the reduction in transport cost when other routes become available may lower the price to make a normal level of use profitable.

Getting a continuous supply of meat and bone meal from the Lethem abattoir may be easier said than done. To maintain a by-product plant in operation requires constant supervision and a high level of management.

If transportation costs are quite low it may be feasible to truck in biuret, minerals, and grain by-products^{1/} in the form of blocks, to supplement the protein and mineral diet in the dry season and to reduce the usual weight loss.

Mongul [72] suggests that, apart from using the Rupununi as a source of feeder cattle, sheep farming should be introduced and consideration of a meat processing plant producing canned beef for export. The last does

^{1/} Perhaps rice polishings.

not seem to be a suitable development because of the scale of operation, the inaccessability and high transportation cost, and the competitive nature of the world canned beef market. However, in 1973 a compact meat cannery unit and by-product plant is to be installed. It will be designed to produce canned soups, meats, bean and meat combinations as well as tomato and tripe combinations.

The IBRD [43] report was probably correct in its assessment that "The key to development of the Guyana Beef Industry is increased production from the coastal area". It is clear that the fixed investment in the Rupununi should be maintained and its productivity developed but there do seem to be more promising areas in Guyana for investment in beef cattle production and for research in resolving bottlenecks in cattle production.

b) Intermediate Savannahs

The Ebini Livestock Station has been established in the Intermediate Savannahs since 1941. The original problem of lack of thriftiness, failure to reproduce and mortality was solved quite quickly by provision of mineral supplements. Indeed, the diagnosis had been correctly made before the station was established.

It is possible that the station was set up in a place that was not representative of the better areas of the Intermediate Savannahs, since it was established at the termination of the old Rupununi trek route to river transport.

One major goal of the establishment of the station was to provide "the

basis for economic cattle production" in this region. There have been many problems in the operation of the station and the directors have not always seemed to have the goal of developing an economic system in mind.

As has been mentioned earlier, study of the results of the Ebini Station by the staff and students of UWI (Trinidad), Harricharan, Mayers, Edwards, Mahadevan, and Williams, indicates that it is doubtful "whether any commercially feasible system is likely to emerge in the immediate future, even with the help of problem-oriented research". And "It is possible that investigations directed to other beef or crop problems in other areas should have priority over the revised investigational programme for the development of the Intermediate Savannahs".

The work of the station during the period in which it has been assisted by personnel from the University of Florida is reported by Boyd, Dickey, and Eddleman [10] to have dramatically improved beef production at the Ebini station within a two-year period. Improved breeding methods, nutrition, pasture programs, and management practices were instituted.

The Florida authors present two tables "based on data collected at the Ebini Station in 1970 and 71". These "estimates" they say in the next sentence "are consistent with those obtained from beef herds under similar conditions in other sub-tropical (especial S. Florida) and tropical environments."

These "estimates" may be compared with Harricharan's data, [35], and Table 6.

It is also interesting to note that the estimated net calving rate on coastal ranches in the IBRD budgets [43] is only 65%, reached after four years, with an extraction rate of 19.7% (after 10 years). For the Livestock Development Company's Coastal Ranch the rates are 70% and 20.5% respectively,

but this is not a commercial operation.

Even with these estimates the systems on all improved pasture, which was, at the time of our visit, the only system under study at Ebini, was not profitable. The only profitable systems reported were those with part native range and part improved pasture, assuming a 71% net calving rate, a 350 lb. weaning weight (shown to be highly dependent on season by Harricharan) and 1 lb. a day average gain after weaning. The rate of gain is far superior to what has been achieved in the past for weaned Brahman cattle, which are the best performers on this type of pasture combination. Holder reports 0.85 lb./day for heifers and 1.20 for bulls in 280 day grazing trials with pangola grass unsupplemented.

Research by Noel L. Holder on cattle feeding and Paul J. Hooker on mixed farming does not make us or the IBRD project team any more enthusiastic about cattle production at present day prices in the intermediate savannahs.

After careful review and some preliminary effort to stimulate ranching in the area, the intermediate savannahs have been dropped as a target region in the IBRD cattle production project. This appears to be a correct decision.

c) The Coastal Region

The coastal region of Guyana consists of a series of empoldered and drained clay areas intersected by rivers. This land has been reclaimed at a considerable cost and has a considerable annual maintenance cost. The major part of the Guyanan coastal clays are under cultivation. There are a few sandy areas (especially in the east) on which coconuts are grown, which are also suitable for grazing. There is a small area that tends to be affected by salinity along the coast within the dyke and there are areas

at the rear of the clays where the land has often not been drained and where problems of aluminum toxicity are likely to occur if fertilizer is applied without the addition of lime. Some abandoned rice land is also believed to be available.

After the rice harvest there has been a considerable amount of grazing of the stubbles. The adoption of double cropping of rice reduces the time available for this. However, it would still seem that the straw could be saved for the cattle. Rice bran and rice polishings are also available although they can also be used for pigs and poultry.

Discussion with R. Brinkman, who participated in the soil survey of Guyana, indicated that the area between the Canje and Courentyne Rivers has the highest potential for development for cattle production. A survey for FAO of the agricultural potential by Hunting Technical Service [22] describes the possibility of an irrigated crop and livestock development. At that time there were 31,000 head of cattle in the Canje scheme area, 11% of the national herd.

The report states that in the dry spell in 1963/64 many cattle died from starvation and/or thirst and in the wet season much of the grazing land is inundated. The cattle using it then poach the soil severely. The Creole cattle have a limited production potential but could be improved by the use of better bulls. Mon Repos Station is too far away to provide AI service.

In 1965 Hunting recommended building a milk condensery and drying plant in the area for the local milk production. Beef production was also recommended on a smaller scale.

River valleys in the coastal region subject to flood can, if carefully managed, be satisfactory for cattle production. There remains a risk of

loss when the water level rises rapidly.

The IBRD study [43] budgets the following performance data for the coastal region ranches.

Table 8. Budgeted Performance on 10,000 Acre Coastal Ranches and Livestock Development Company Ranch [43].

	Current	Developed Ranches			
		10,000 Acre		LDC Commercial	
		after		after	
		5 year	10 year	5 year	10 year
Effective calving %	30	65	65	70	70
Mortality, adult %	7	3	3	3	3
Culling rate -cows %	5	7	12	7	15
-bulls%	10	10	12	15	15
-heifers%	15	10	10	10	10
Extraction rate %	12.0	11.7	19.7	8.4	20.3
Stocking rate a/AU	4	2.1	1.8	2.2	2.0

The direct costs (fixed and variable) are budgeted at .2672/\$G1 of sales (compared with .6686 in the Rupununi).

The original IBRD proposal for the coastal region [43] was to form a typical cooperative with 250 members each averaging 8 head. However, smaller number of cooperators with a pool of 3,000 head of cattle could also obtain a cooperative ranch. There were to be 15 ranches of 10,000 acres, with 7,500 developed; these were to be the major part of the project and "upon them develops (sic) the feasibility of the project."

Land would be leased on a 25 year basis with renewal rights. Initial stocking would be 4 acres per AU.

The original proposal included 15 cooperative ranches, 5 individually owned ranches and 3 company ranches, each of about the same size.

It has not proved to be possible to get many of the planned cooperative ranches in the coastal region to date. Only 2 or 3 are expected to start within the next few years and the criteria of organization have been relaxed.

The original plan called for outside (foreign) investors on the private coastal ranches proposed, but these have not materialized.

There are several reasons for the lack of enthusiasm demonstrated. The first is that losses by theft have been a continual problem. A change in legislation and the formation of a new rural police force may reduce these losses.

The Hindustani, as mentioned earlier, are not cooperatively oriented.

The most obvious system for getting into production is to find some riverain land, and, with minimum clearance and building of mounds to protect cattle in case of floods, to stock it. However, the 14,000 acre Kabawer Ranch, where this has been done quite well, has not been a financial success; though the prospects are still sufficiently good that Bookers plan to maintain it. It may develop into a cow-calf unit.

The possibility of using improved water buffalo (e.g., Caroni Water Buffalo from Trinidad) for meat and milk production in riverain areas has considerable promise. Experience in Trinidad and Tobago indicates that the meat is very acceptable in the supermarket.

A second, and perhaps, more encouraging demonstration is Booker's much smaller, 1,200 acre Good Digging unit. Here low cost clearance of brush while leaving the trees standing can be seen. Four years of screening trials of 36 grass varieties have been carried out. Legumes are not being

included. Four grass strains are being considered for further development, and urea-molasses supplements are being used.

Gold Digging will also serve as a heifer growing unit for Booker's East Coast Dairy and as a finishing unit for the bull calves.

Table 9. Comparative Estimates of Guyanese Production, Consumption and Trade in Meat.

Mayers' Data [114]								
Year	Per Capita Consumption Meat & Meat Products	Beef & Veal		Pork		Local Production all Mutton & Lamb Poultry		Net elsewhere State
		Imports	Local	Imports	Local			
1956	24.92	2.77	12.19	2.68	1.82	.25	1.00	4.21
1957	25.11	2.15	13.47	1.91	2.18	.17	.86	4.37
1958	25.92	2.43	13.34	2.29	1.96	.18	1.41	4.31
1959	23.43	1.60	12.15	2.55	1.22	.18	1.58	4.15
1960	24.46	1.87	12.25	2.49	1.21	.20	2.01	4.43
1961	26.02	2.26	12.65	2.57	1.19	.20	2.70	4.45
1962	24.91	2.09	11.99	2.26	1.50	.22	2.38	4.47
1963	23.84	2.26	11.26	2.23	1.70	.24	1.88	4.27
1964	26.60	1.65	12.09	2.36	1.77	.29	3.36	5.10
1965	29.74	2.25	12.65	2.09	1.81	.27	5.01	5.66
1966	33.70	1.86	14.33	2.42	2.40	.29	6.66	5.74
1967	34.55	1.89	13.34	2.08	2.89	.36	8.52	5.47

Reid's Data[83]							
Year	Beef			Pork		Poultry	Eggs
	Domestic Production	Total Consumption	Imports	Total Consumption	Imports		
1965	12.88	16.44	3.56	3.16	1.75	3.27	274
1966	14.94	17.92	2.98	3.97	2.08	6.21	296
1967	13.83	16.87	3.04	3.96	1.79	7.91	225
1968	13.53	15.67	2.14	3.66	.94	8.28	292
1969	13.75	15.49	1.74	3.29	.07	8.08	296
1970	12.88	15.64	2.76	3.50	.05	9.76	409
1971				4.20		11.07	407

12. Cattle Potential

The decline in the Guyanan cattle herd (table 3) must reflect a decline in the number of dairy cows. Traditionally the Hindustani rice farmers kept a few head of dairy cattle partly for milk, but also to manure the rice fields, and perhaps chiefly as a sign of wealth and to use for paying "bride price". Indeed, cattle did provide a means of accumulating and productively storing "net worth". Small ruminants played a similar but lesser role.

The cattle grazed the rice stubbles and at other times of the year, if there was no fallow, they were either grazed on the road and ditch sides or sent in village or family groups to common pastureland. The common pasture was usually not maintained in a very productive state. Forage for the cattle is becoming more difficult to obtain and, until recently, the milk price was unfavorable. Milk assembly is rather primitive except close to the few major towns, and processing facilities are very few. Yet there is a substantial importation of milk products, which also has a depressing effect on domestic milk prices.

There is very little modern dairying, possibly because of the low milk price.

There is need for a new system of keeping dairy cows, intermediate between the traditional and the large modern units, with a system of assembly and processing suitable for the coastal region. The system requires better organized pasture production and management, perhaps on a family or a village basis, supplementation with by-products and mineral-vitamin blocks and some means of increasing the carcass weight of the steers and the culls. This can probably be done within the village organization.

It is not known whether the marketing system needs to be modified. However, it is probable that "feeder cattle" will be sold at the meat market price -- a lower price per pound than finished meat--which does not encourage farmers to sell the cattle to put into a commercial feedlot.

The Creole cattle could probably be upgraded and suitable bulls with an AI system already exist within Guyana. Wider distribution and local storage of semen would probably need to be organized.

The number of cows required to supply the import deficit is estimated by Reid to be 16,500 [83]. The number of cows estimated to already be in production is 27,167 (i.e., 21,000 tons of milk + 773 kg. average annual yield). In fact, with perhaps 180,000 head of cattle involved in the coastal region there should be at least 60,000 cows and heifers having calved. This would suggest that with better assembly of the available supply, there should be more than enough milk for domestic consumption of milk and milk products.

13. Limitations on Production

The stagnation of production of "commercial meat" (excluding poultry) and of milk indicate some very real limitations on production.

A major cause is undoubtedly the generally low levels of technology in the traditional sector, a poor assembly and marketing system (especially for milk), and the low price paid for the product.

A marketing system which pays a premium for the grade of meat desired by the expatriate and wealthy locals typically attracts its own supply. The major problem is to supply the mass demand.

A suitable scheme for small scale production in the coastal areas accompanied by the necessary marketing development (perhaps by cooperatives) would probably go a long way to satisfy the local demand for milk and milk

products and also the deficit in beef caused by cutting off imports.

However, the technology for this development has not been worked out but the essential components may be available. Any improved system must conform to the value system of the Hindustani if it is to be adopted.

This type of development brings profits to individuals and does not result in a spectacle; for this reason it may not be politically attractive. However, effective marketing of most of the milk produced and a significant increase in the carcass weight of cattle slaughtered might add more product with a lower investment cost than the more spectacular development of large ranches. It would also have a much better effect on income distribution.

Production in the areas with poor soils and long dry seasons will require costly additional inputs and their position as a priority area for investment needs careful study.

The disease situation in the Rupununi--rabies and the risk of foot and mouth disease from Brazil--present serious barriers. Accessibility will improve with time and investment in roads, and the threat of disease transfer will be correspondingly increased.

In the coastal region modern cattle production seems feasible but until prices can respond, beef production is likely to suffer from the price being established by the by-product cattle from the dairy industry, in spite of the superior grade of the product from beef herds.

At present there are almost no indigenous trained managers who can start up and maintain modern cattle and dairy operations. The overhead cost of an expatriate manager and his benefits is more than most of the ranches could support with the present prices.

14. Feeds and Feeding

Agricultural by-products are available from four major crops, 120,000 ha. of rice, 50,000 ha. of sugar cane, 1,000 ha. of manioc, and 20,000 ha. of coconuts.

The supply should be approximately as follows:

	tons/year
Rice straw	?
bran	?
polishings	?
Cane tops	?
mollasses	?
Spent copra	?

Also citrus meal, brewers grains, wheat middlings, cassava and plantains may be considered. The new process for obtaining cattle feed from sugar cane could alter the picture.^{1/}

The rice bran and polishings are also of value for poultry and pigs. All of these products except rice straw and cane tops can be exported.

Tropical native and improved grasses and forage legumes could be produced.

The vines of peanuts, cow peas, and other tropical food legumes and of soybeans, may be available in the future.

Soybean extraction plants are planned for Kibilibiri & Matthews Ridge by 1976 but it seems doubtful that these will materialize in these locations by this date.

^{1/} Cane yield is from 0.65-0.85 tons refined/ha.; rice yield 2 tons/ha./year probably fractionally over 1 crop), plus straw; beef yield on cane is reported [?] to be 3.4 tons/ha. or 1.7-1.8 tons of meat/ha.

A rice oil extraction plant is also scheduled for construction. This would provide a supply of bran that could be stored for year round use without the danger of rancidity.

15. Demand for Meat and Meat Products

No domestic demand study as such has been found. However, the trend in per capita consumption, both for domestic and imported meat is available both from Mayers [114] and Reid [83], see Tables 1-2.

Mayers reports that the demand for meat in the Commonwealth Caribbean is rising and shows no sign of stabilizing. The increase in meat consumption has been appreciably higher than for food in general, which is typical of a rise in standard of living.

The component from beef and veal while still strong is giving away to poultry in terms of increase in consumption. Poultry was 1/14 of the consumption in 1956 and 1/3 in 1967.

Mayers characterizes the demand as follows:

1. Lower income groups tend to consume more poultry, mutton and offals, than of the other meats. Much of these meats are obtained in the fresh state at prices which are generally lower than those of the other meats. The middle and higher income groups tend to consume more beef, poultry, meat preparations and pork.
2. Religion and ethnic origin often determine the type of meat consumed.
3. The type of meat which is most commonly produced locally is the highest consumed. The imports of other meats have never resulted in the consumption of those meats increasing to such an extent as to be greater in per capita consumption. Thus more beef is consumed in Guyana and Jamaica and more poultry meat in Trinidad.
4. Little mutton and lamb is consumed and its importance is diminishing.
5. Overall beef consumption is on a moderate decline, but there is a greater proportion of choice cuts sold each year in the larger supermarkets.

6. Pork and pork products have shown a slight decline in consumption. There is a tendency for consumption to follow the cyclical pattern of local production.
7. There has been a steady increase in the consumption of processed meats.
8. There has been a large increase in poultry consumption throughout the region. There has been increasing local production as well as increasing imports. Much of the imports has been in the form of cheap parts. Chicken is also the most popular meat consumed on eating out by the lower income groups, e.g., chicken and chips, fried chicken, chicken roti.
9. In addition to income and prices, the degree of urbanization, size and age distribution of the family, occupation and season of the year also affect the kinds of meat consumed and the per capita consumption of each kind.

Mayer reports that there is considerable substitution between the different meats and that there is a very strong unsatisfied demand for beef. Unless beef production in the region expands the proportion of imported meat will increase well beyond the current 65% level.

It should be pointed out that after the outbreak of foot and mouth disease in the Rupununi, beef exports were stopped; currently vesicular stomatitis is obstructing imports to Jamaica from Belize and to Trinidad from Guyana.

Studies have also been made by Mayers and the Economics Intelligence Unit (London) of export potential and by Deans of the Jamaican and Trinidadian markets.

Projection of demand including the substitution possibilities is very hazardous. The per capita consumption of meat in Guyana is rather low in comparison to other countries in the Commonwealth Caribbean and in some of the other countries it is rising more rapidly. The Guyanese have traditionally eaten more beef than the Trinidadians but about the same amount as the

Jamaicans. The tremendous increase in the consumption of poultry meat, in which Guyana has lagged behind Trinidad and Jamaica, seems to provide the major increase in meat consumption in the region.

The demand for meat in Guyana will be mainly affected by:

disposable income and its distribution,

urbanization,

breakdown of religious restrictions on meat consumption in the Hindustani,

increase in population;

price of meat and competing products.

The consumption cannot be accurately measured because of the lack of records of rural and small town slaughter. In Surinam the beef consumption is reported to have increased from 1958-1970 at a rate of 5.4% a year including a 3% annual increase in population, a 1.9 to 2% annual increase in GNP and an increase of 0.4-0.5% caused by non-Hindus in the Hindustani group [?].

The IBRD meat marketing study may cast some light on the consumption differential pricing which is considered necessary to the development of the beef market.

16. Governmental Policy

Guyana, since the British handed over the government in 1947, has suffered some serious political upheavals; the suspension of the constitution in 1953, the general strikes of 1962 and 1964. Since 1966 there has been a stable government by the Peoples National Congress under Prime Minister Forbes Burnham and in 1970 Guyana became a Republic within the British Commonwealth.

The name of the "Cooperative Republic of Guyana" stresses the cooperative theme.

There is an underlying racial problem because of the different ethnic backgrounds of the people. In 1967 the breakdown was:

East Indian (Hindustani)	50.8
African (Creole)	30.6
Mixed	12.2
Chinese	6.4
Amerindian	4.6
Portuguese	0.9
Other European	0.2

Since 1931 no new freehold titles have been available for farm land. The policy was to lease short term "permissions" of a year but 21-25 year leases are common in many areas and are now being introduced for grazing land. Since 1966 it has been policy to grant some freehold titles with adequate safeguards against aggregation, fragmentation and misuse. Security of tenure will also be made law but the right will not automatically pass to the heir.

The 1966-72 seven-year plan [?] included a goal of achieving a greater degree of self-sufficiency in food production, including livestock and livestock production.

The dairy industry was expected to increase its output to cover increase in demand and to reduce imports. More research, at the Central Agricultural Station, Mon Repos, call for (\$700,000).

Sheep and goat production was to be increased especially in the drier, higher parts of the country (Intermediate and Rupununi Savannahs). This was to be supported by a small research program at Mon Repos (\$48,000). Goats will be studied as a source of cheap meat from otherwise unuseable sandy savannahs and scrubland.

Beef cattle production was considered to have outstanding short- and long-run possibilities for expansion. A substantial increase in the herd took place between 1948-52 and 1965 (almost doubled). A logical program of research on pasture and stock breeding (\$700,000), as well as a program of evaluation on the "areas for the most economic beef cattle production in the country, when weighed against the capital investment required." "Exploitation of native range will be thoroughly explored and exploited before undertaking the costly programme of establishment and maintenance of artificial pastures. Before large areas are set aside for intensive grazing the utilization of the irrigated rice areas in an improved pasture rotation cycle will be carefully studied."

Guyana was considered to have an opportunity of a substantial place in the Caribbean meat market on the basis of price rather than quality, with consequent implications on the type of operations to be developed. However, there is no sign of acceptability of Guyanese beef except in Surinam.

In 1971 it was decided that agricultural development was lagging and a program "Agriculture in Action" was developed, shortly followed by the Charge by Congress to Feed, Clothe, and House ourselves by 1976. In agriculture this involved replacing \$40 million of imports. The program involved is described by Dr. P. Reid in "Our Agricultural Revolution", April 5, 1972 [83].

The main thrust in beef cattle development is to be centered on the IBRD Livestock Development Project [43]. A region in the intermediate savannahs, Barim-Mara-Abary, just north of Ebini, but just behind the coastal plain has been designated for cattle production.

At full development in the 11th year this will increase the value of beef produced to 145% of the 1972 level, and is expected to enable Guyana to become a regular beef exporter. In fact, with the present rate of increase in population, this would provide a per capita domestic beef production of 13.33 lb., slightly lower than the domestic level of consumption plus imports in the early 1960's making no allowance for export.

Development of the dairy industry is to replace 60 million pounds of imported milk equivalent, compared with the current FAO figure of about 45 million pounds produced a year. It is believed that 16,000 high grade dairy cows could meet this goal. However, funds may not be available to meet this need in the short term.

The proposals for attention in 1972 included:

1. The establishment of a dairy farm in the Atakaka/Kaituma area to produce about 30,000 gallons milk per year by 1976.
2. The establishment of a 1,200 acre Co-op. Dairy Farm in the Kairuni/Moblissa area along the Soesdyke/Linden Highway to produce about 125,000 gallons by 1976.
3. The establishment of a Government 1,000 herd intensive dairy farm either at Mon Repos or along the Soesdyke/Linden Highway to produce around 850,000 gallons milk per year.
4. Government is in the process of identifying one or two large areas for intensive dairy farming at a fully integrated level. Attention will be paid to the location of these farms in order to minimize transportation cost of the dairy produce.

The government will also provide imported bulk skim milk powder for packaging and retail distribution at a price below local fluid and also evaporated milk. The milk pasteurizing plant is planning to increase supplies and to extend its distribution network.

The emphasis in cattle and milk production is heavily on large modern, cooperative units, although the restrictions on financing under the IBRD loan have been relaxed to permit family and corporate operations. Apparently, development of production by small farmers and of techniques for feeding cattle for small farmers, families or villages are not envisioned.

The land areas to be used seem to be flexible but progress in setting up ranches and developing production is slow. There is some evidence that less emphasis will be placed on the intermediate savannahs and more on the coastal clays and riverain areas.

Implicit in the original selection of the land areas was a desire to spread the population into the interior, to occupy the land. When the facts are all on the table it seems the resources will not be invested to do this unless the projects are expected to be economically viable.

The "people" problem is also complicated in this area (Guyana, Surinam and Trinidad) by the farming being in the hands of the Hindustani (and, in Surinam, the Javanese), but there being a scarcity of labor because of urban migration by this group. Meanwhile, in the urban areas there are large groups of unemployed Creoles, who may participate in such activities as sugar cane cutting, but who are not interested in setting up as farmers.

A second ethnic problem arises because the Hindustani, mainly represented by the Peoples Progressive Party, distrust the intentions of the Peoples National Congress Party, which mainly represents the Creoles. When the PPP was in power, the converse was also true. In fact, the Minister of State for Agriculture, Mr. M. Kassim, is a Hindustani, and the Principal Veterinary Officer is of Portuguese origin.

17. Protection of Rural Property

A rural constabulary has been established (1973) for the security of rural property. It is believed that the law on cattle theft will be changed to make it illegal to "control" cattle that do not belong to you or your employer. That is, it will be a felony if a rustler is caught on the ranch with a rope on a beast. In the past, it was not an offence until the beast was removed from the property and the rustler had to be caught with the animal.

18. Domestic Prices

The price of milk is set by the milk processing plant, presumably in consultation with the Government. This includes the farm price and the retail price. However, there is a demand for fresh milk at the farm at a higher price. There is no differentiation in the city market between domestically produced fluid milk and reconstituted milk and blends. There has recently been an increase in the milk price (Bookers dairy now receives 16¢/pint compared with 12¢ before).

Meat prices are not directly controlled. In Georgetown, with a large part of the better quality (heavier) carcasses coming from the abattoir at Letham with a subsidized air freight rate, it is hard to believe that there is no government pressure to prevent prices rising. The fact that meat prices did not rise after the government cut off imports (18% of the supply) is further evidence of some direction of prices. Exports of meat at the time were negligible and the export of cattle (on the hoof to Surinam) was not affected. The common practice is for wholesale butchers to go around buying cattle and then to sell carcasses or parts of carcasses to retail butchers. The market has different prices for different cuts of meat.

An increase in price should have a considerable effect on increasing production. Live cattle prices are generally assumed to be about 30¢G/lb. and dressing out ranges from the low 40's to 52 or 53%.

Inputs are generally not directly subsidized but fertilizers, crop chemicals, seeds and planting materials are imported duty free. Agricultural machinery and implements and their spare parts are imported duty free and retail prices are controlled. Ingredients for manufacturing livestock feeds are also imported duty free.

Equipment is to be imported for "chain" clearing of coastal lands for pasture. This will probably subsidize the cost of land clearance.

A new agricultural credit institution has been opened, funded by outside agencies such as the Caribbean Development Bank in addition to local capital. This institution will combine the Commodity Credit groups (e.g., rice and sugar cane), perhaps including the Livestock Project Division of the Bank of Guyana (which administers the IBRD loan).

This institution, apart from acting as an agricultural credit bank, is also to provide "related advisory services on a nationwide basis for the development of agricultural activities..." [?] .

Loans are also available for construction of rural housing.

The new program also calls for tax concessions (up to a maximum of five years) for farmers producing approved crops in approved areas, especially for export. Presumably this could include cattle production.

19. Other Suitable Land Areas

There are several other accessible areas where the soil capability is good and extensive drainage is not needed, for example, Matthews Ridge. There is obvious potential for cattle production but unless the cost of clearing the land, establishing pasture, and fencing are sufficiently low, at

current beef prices the investment is not likely to be profitable.

Low cost techniques of land clearance, such as those seen at Gold Digging, could be used. Some trees would be kept for shade. The most promising pasture plants could be planted. The minimal fencing needs should be established. In some cases cattle can be kept with a herded per 100 head with no fences; cattle kept in this way are much easier to handle but are also more susceptible to theft.

20. The Caribbean Meat Market

John M. Mayers (UWI, Barbados) has been studying the supply and demand for meat in the Commonwealth Caribbean for many years. He has published a substantial collation of data on the local production, import, and tariffs [114] and is, even if slowly, working on a Ph.D. dissertation on demand. In 1971 he presented a paper on the subject at the regional agricultural economics meeting in Georgetown [114].

A major problem in the analysis is the difficulty caused by the dual market--the tourists and residents from overseas and the local population. In some islands with a good tourist industry, the consumption by tourists is clearly the major part of the total, but exactly how much of the imported meat is consumed by the tourists is not known.

However, a start is being made on the effect of the tourist industry in Jamaica by McGill University personnel (Lundgren, 1977), in which the effect of the hotels' purchases on the marketing system as well as the composition of the purchases is being studied. The importance of livestock products in the food bill (63.5% with the inclusion of seafoods) indicates the significant effect of tourists on the demand for meat.

Mayers had trouble in trying to estimate price and income elasticities from the time series data. Household surveys are now being studied and the results are more meaningful.

The average per capita consumption of meat increased at an annual rate of 3.2 to 33.2% over the period 1956-67 with an increase in population of about 2.1%, and an unknown change in the number of tourists. Thus, the increase in consumption over the 12 years was 85.6% or 5.3% a year.

For beef and veal the average per capita consumption of locally produced meat was the same in 1967 as it was in 1956 while total import of beef increased by 7% over the period but the per capita consumption of imported beef declined by 16% over the period. The volume imported tended to be erratic.

A level of imports of beef and veal of the order of 19-22 million pounds provides a substantial market but provides little indication of what the consumption would be if the Caribbean region could import unlimited supplies at the Guyanan price.

The Caribbean market is not a single homogeneous entity. The Jamaican market with 43% of the region's population received 39% of the imported beef in 1967 and is most readily supplied from Belize. The Trinidadian market in the same year, with 23% of the population, received 29% of the imported beef (5.4 million pounds) equal to about 62.4% of the Guyanan production in that year. Assuming that the Guyanese can satisfy the importers on the sanitary state of their beef in relation to foot and mouth disease and vesicular stomatitis, the Trinidadian and also the Surinamese are their obvious markets. Their neighboring competitors, Brazil and Venezuela, both have endemic foot-and-mouth disease.

The countries in the CARIFTA region with substantial production potential are:

Dominica	1,150,000 head	24,000 tons of beef/year
Jamaica	270,000	13,000
Guyana	258,000	4,400
Trinidad and Tobago	65,000	2,000
Belize	38,000	2,000

Poultry consumption in Trinidad reached 50% of the total consumption of meat in 1967, from 18% in 1956. In 1970 (the last year for which we have statistics) the production of poultry in Trinidad increased 27% over that in 1967. The annual rate of increase did decline in 1969 and even more so in 1970 over that in 1967 and 1968. Mayers [114] suggests that at the poultry consumption levels reached in Trinidad (20-30 lb. per capita/year) little further increase in the percentage of the meat consumption in the form of poultry is likely.

In each of the major population groups in this area considered (Jamaica, Trinidad and Guyana) the GDP/capita and the private consumption/capita is rising, with consequent effects on demand.

21. CARIFTA Agricultural Marketing Protocol (AMP)

The CARIFTA Marketing Protocol has been described by the Hon. J. E. Mitchell [117], the Minister of Agriculture, Trade and Tourism of St. Vincents. CARIFTA came into being in May 1968 and the Agricultural Marketing Protocol, AMP, came into operation on the same date with the objective of "ensuring that commodities capable of being produced in the area are in fact produced and distributed at prices remunerative to growers and reasonable to consumers." All the major commonwealth Caribbean Countries are members. Barbados is not a member and Belize only joined in 1972.

The commodities of the AMP included mainly fruit and vegetables, pork, pork products, poultry meat, and eggs. Beef was not included.

Information is exchanged on the supplies available for export, the import requirements, and the prices. The estimates of supply and demand to be of value must be "before the fact" in the case of most of the commodities involved, and this has presented problems because of the production being mainly in the hands of peasants and weather variability.

There have also been discussions on the prices that are remunerative to growers yet reasonable to consumers. Price controls in some countries contravene the protocol because of attempts to protect against inflation as it relates to world market prices.

There has been some response in trying to produce the listed crops and the guaranteed market has helped the marketing boards in production campaigns.

However, the AMP is still only in its infancy. The AMP is in conflict with GATT; questions have been raised on the effect of AMP on exports of poultry meat and pork and pork products from third countries.

In the case of poultry meat there is a high content of import not only in the case of the feed but also the chicks and the housing and equipment. In the case of pork, movement is severely limited by veterinary regulations. In fact, imports of pork and poultry meat from third countries have increased although probably mainly because supply has not been forthcoming or freely movable in the case of pork.

The most serious problem affecting the AMP is inadequate production. Each winter the tourist trade increases, increasing the demand for fresh

fruit, vegetables and animal products; but it also stimulates the demand for construction and service, drawing labor out of agriculture, decreasing production of food. In this way, the demand for imported food for the local population is increased. So much of the increase in foreign spending is taken up by importing more food.

In summary, the effect of the AMP on trade in meat has been negligible. Tariff barriers often discriminate preferentially in favor of CARIFTA nations. For example, Trinidad places a preferential 2 1/2% ad valorem tax on beef and veal, compared with a 10% general level; Jamaica has 15% ad valorem for "preferential" rate and 30% for the general rate. A similar situation exists in the case of lamb, pork, and poultry.

Cattle Numbers in Other Caribbean Countries
(FAO, 1977), thousand head

Costa Rica	1,520	Honduras	960
Cuba	7,000	Nicaragua	1,240
El Salvador	1,492	Puerto Rico	530
Haiti	960	Venezuela	8,499

22. Studies of the Ebini Livestock Station, Guyana

USAID Guyana Memory Bank Catalog [?] lists 18 reports on the Guyana Beef Industry (see page 19 and 20) as of March 1972. Several of these are general but a number relate specifically to Ebini. We have not yet had access to the two FAO reports, and have not seen some of the Florida Ebini project proposals and reports.

However, we have studied Harricharan's dissertation "Genetic and Phenotypic Parameters of Santa Gertrudis, Sahiwal, Brahman, and Crossbred Animals Reared in the Intermediate Savannas, Guyana", Ph.D., UWI, Trinidad, January 1971 [35] and the first resulting paper in J. Agric. Sci. in 1972 by Mahedevan, Harricharan and Springer [61]. A report on the economics of beef production at Ebini Livestock Station was written by J. M. Mayers at UWI Trinidad in 1968; a more recent report came out from the same institution in March 1968.

These reports from UWI, Trinidad coincided and were related to the review in 1967 of the Ebini Station by the British Development Division in the Caribbean, on behalf of the Ministry of Overseas Development, and the GOG's review.

The manager of the station until the Florida University Project was started, had little interest in economics and invested most of his budget in the development of a herd of purebred with some crossbred animals on improved Pangola grass pastures. So the UWI work, originally done by Harricharan and Mayers at Ebini (under the direction of Dean Mahedevan and Professor Edwards) was the first real attempt to collate and analyze the data.

The economic analysis was made of the collated and analyzed data to establish (1) as far as possible whether there is any prospect for profitable cattle production in the Intermediate Savannas and (2) whether there are any systems of cattle production that were sufficiently promising to justify the establishment of pilot farms. The study was hindered by the fact that financial accounts were only available for 1966 and 1967 and that

the variations between the years were difficult or impossible to explain.

The data available at Ebini only covered a very restricted number of systems and so some extrapolation was and still is necessary.

The physical characteristics of the intermediate savannahs are that they lie inland from the 10 to 40 mile deep coastal and riverain clay belt in the eastern part of the country. The intermediate savannahs are dissected by rivers and creeks with belts of forest along the banks. The savannah away from these forest belts is largely devoid of trees but has shrubby growth especially on the numerous, deserted ant hills. The natural grasses are sparse, tufted and of poor feeding value. The vegetation is not dense enough to prevent erosion and only in the depressions is there much topsoil with a satisfactory organic content.

There have been two private ranches; the Warenama and the Dubulay. The Warenama is a 70 sq. mile ranch which was used to rest the animals trekked out of the Rupununi; it lies west of the Berbice River. These two ranches carry about 7 head/sq. mile and have problems with mineral deficiencies, predators, and shipping to markets. With reference to Ebini it has been said: "In the wilderness one finds an oasis of planted pasture carrying well over 1,000 head" in apparently good condition.[19].

The mean annual rainfall at Ebini is 84.7"(range 57" - 118"), 60% occurring between April and August and 22% between November and January. But the wet seasons are unreliable and may not appear at all.

The mean annual temperature is 80°F with a peak daily mean of 90° in September/October and a 78°F in February/March. There is a constant trade wind blowing from the northeast. The evaporation is about 4-6mm/day.

Although rain fed crops could be grown in the long rainy season, the small reserve of available moisture in the soil and the highly variable rainfall, especially in the short rainy season, makes the production of annual crops too risky (vide our observation of the crops at Kibilibiri in January).

The soils are described in Volume VI of the 1966 FAO Soil Survey [23].

23. Systems of Management

The different herds at Ebini have had different systems of management. Some herds have had access to little improved pasture and much range and vice versa. In January 1973 no cattle were seen on the natural range. In 1966 the station "lost" \$G92,454 and in 1967 \$G104,866. All of the systems running at that time were losing money and the low productivity could not reasonably be blamed on the research program.

In 1968 a 4-month survey was made to establish the practices used and the labor consumption.

Investment costs at that time were:

- Fencing -- \$640/mile
- Water and mineral lick shed -- \$60/sq. mile
- Establishing a 1 sq. mile area with a 70 a. paddock included -- \$3,240
- Division of existing 1 sq. mile fenced area into 4 equal units -- \$3,840
- Improving pasture, including cutting brush, burning it and leveling ant hills -- \$46/acre
- Planting improved pasture including materials -- \$200/acre
- Weed control took 23% of the expense of maintaining pasture.

If it were decided to sell year-old weaned calves there would generally be an added loss (except for the Sahiwal on 5% improved and 0% improved pastures). In fact, with the Sahiwal selling calves from open range production produces about \$G47/cow towards the labor cost.

Table 10. Costs Per Acre on Natural and Improved Pasture; Ebini.

Open Range				Planted			
Area	Paddocks	Establish	Maintain	Area	Paddocks	Establish	Maintain
108	?	17.96	1.85	180	6	314.60	96.67
215	1	12.23	1.37	108	8	303.33	95.70
215	2	12.51	1.37	160	13	307.99	91.66
215	1	11.02	1.37	215	15	312.05	95.54
320	1	10.34	1.41	320	22	302.54	91.19
320	3	11.59	1.41	400	27	301.89	96.50
640	1	8.69	1.17	480	32	303.45	95.23
640	4	9.63	1.17	640	43	303.52	90.41

Source: ?

Table 11. Costs of Setting Up 1000 Acre Units With Varying Amounts
of Range and Planted Pasture

Area		Estab- lish \$G000	Recurrent	Annual Cost*	AU Carried	Annual Cost per AU	Estab- lishment Cost/AU
Range	Planted						
0	1000	302	90,400	105,495	1000	105.49	301.89
250	750	229	68,595	80,028	756	105.86	302.50
500	500	156	46,185	54,010	512	105.48	305.66
750	250	84	23,679	27,893	269	103.69	313.42
800	200	69	19,200	22,664	220	103.02	314.89
850	150	55	14,703	17,435	171	101.96	319.53
900	100	40	10,070	12,080	122	99.02	329.53
950	50	26	5,670	6,948	74	93.81	345.50
1000	0	11	1,170	1,725	25	69.00	444.00

*Recurrent cost plus 5% establishment cost.

Source: ?

Table 12. Output for 1000-Acre Systems, Three Breeds, Ebini

Percent Pangola	Dollar Loss	Number of Cows	Lw. Lb./a/yr.	Meat Lb./a/yr.	Cost/lb. Meat	Loss Per Lb. Meat	Added Loss from Sale of Year-Old Calves
			<u>Santa Gertrudis</u>				
100	50,404	467	153	72	1.10	.70	3050
75	43,462	369	104	49	1.29	.89	5800
50	32,823	261	62	29	1.43	1.13	8000
			<u>Brahma</u>				
50	34,566	310	57	26	1.72	1.32	4030
25	19,836	172	25	11	2.16	1.76	5050
20	15,716	145	19	9	2.18	1.78	3250
			<u>Sahiwal</u>				
25	14,000	144.5	34	18	1.19	.79	
20	10,296	99	21	10	1.48	1.08	
15	7,585	76	13	6	1.72	1.32	1860
5	4,672	49	6	3	2.03	1.63	-200
0	1,103	18	2	.8	1.82	1.42	-9500

*Sales at 40¢/lb. lw. net on farms.

Source: ?

Table 13. Lb. Carcass Weight by Age and Breed

<u>Breed</u>	<u>Age by Months</u>						
	18	21	24	27	30	33	36
Santa Gertrudis	231	248	265	282	299	316	333
Brahmen	208	220	232	244	256	268	280
Sahiwal	212	226	240	254	268	282	297

Source: ?

Table 14. Number of Observations, Mean Age at Slaughter, Pre-Slaughter Weights, Hot Carcass Weights, Dressing Percentages, and Coefficients of Variation of the Steers Slaughtered at Ebini.

Year of birth	No. of animals slaughtered	Mean age (months)	Pre-slaughter weight		Hot Carcass weight		Dressing	
			Mean lb.	C.V. %	Mean lb.	C.V. %	Mean %	C.V. %
1957	56	31	769.1	11	408.9	17	53.2	13
1958	62	29	712.4	12	377.0	11	53.7	10
1959	50	28	753.0	13	390.9	12	51.9	5
1960	65	23	680.9	13	331.1	13	48.7	5
1961	136	24	633.5	13	305.9	14	48.3	5
1962	123	28	584.4	14	262.6	16	44.9	5
1963	132	27	586.9	13	276.4	14	47.1	5
1964	101	25	523.8	16	244.4	19	46.3	7
1965	58	21	513.7	28	246.7	32	47.6	8
All steers	783	26	622.6	19	300.4	23	48.2	9

Source: ?

Table 15. Labor Requirements and Cost for Different Sized Cow Herds (25% Planted Pasture, Sahiwal)

Acres	830	1211	1556	1903	2214	2490
No of Cows	120	175	225	275	320	360
Manager at \$6000	1	1	1	1	1	1
Men at \$1500	2	3	4	5	6	7
Administration\$	500	500	500	500	600	600
Manager + Labor + administration	9500	11000	12500	14000	15600	17100
Overhead \$/cw	79	62	56	51	49	48

Source: ?

Table 16. Budget for 1920 Acre Unit, 25% Planted, 277 Cows and 5 Men

Variable Costs	
Fertilizer	21,000
Vet & Med	3,000
Labor	13,500
Machinery op.	3,800
Misc.	3,000
	<u>49,300</u>
Fixed Costs	
Machinery Dep.	2,800
Ranch Dep.*	4,000
Interest	20,000
	<u>26,800</u>
Total Expenses	71,100
*Investment \$161,280	

Source: ?

Table 17. Guyana Crop Production

Year	1948-52	1961-65	1965	1966	1967	1968	1969	1970	1971
Rice									
Area - 000 ha.	45	108		125	103	127	113	120	117
Production - 000 T.	101	239		249	198	210	171	230	136
Yield - 100 Kg/ha.	22.2	22.2		20.0	19.3	16.6	15.1	19.2	
All Cereals	46	109		126	104	128	114	121	
Sugar Cane									
Area - 000 ha.	29	41		42	47	43	51	48	49.6
Production - 000 T.	2552	3334		3367	3831	3558	4178	3900	
Yield	894	818		802	821	818	819	813	677
Sugar - 000 T.	218	305		349	322	370	351	320	369
Sweet Potatoes									
Area - 000 ha.	3	1	1	1	1	1	2		
Production - 000 T.	9	5	5	5	5	5	5		
Yield - 100 Kg/ha.	27	35	36	36	37	37	35		
Cassava									
Area - 000 ha.	1	1	1	1	1	1	1		
Production - 000 T.	10	10	10	10	10	10	12		
Yield - 100 Kg/ha.	100	100	100	100	100	100	120		
Oranges & Tangerines									
000 mt.	3	10		8	9	10	10	10	
Lemons									
000 mt.	2	2		2	2	2	2	2	
Bananas									
Area - 000 ha.	1	1	1	1	1	1	1		
Production - 000 T.	5	5	4	5	5	5	6		
Yield - 100 Kg/ha.	31	91	76	73	60	62	48		
Pineapples									
000 mt.		2	1	2	2	1	1		
Groundnuts	--	--	--	--	--	--	--	--	--
Coconuts									
Million nuts	44	46	36	44	36	55	61		
Copra									
00 mt.	32	60	59	50	71	76	76		
Coffee									
00 mt.	2	10	11	13	13	7	13		
Cocoa									
Tobacco									
Rum									

Source: ?

Table 18. Guyana: Trade in Major Agricultural Commodities

Year	1964	1965	1966	1967	1968	1969
<u>Export</u>						
<u>Rice</u>						
00 mt	788	951	1023	1016	957	744
US \$10,000	1274	1343	1366	1449	1307	984
<u>Sugar - raw & refined</u>						
00 mt	2384	3169	2833	2980	2983	3555
US \$10,000	3142	2554	2828	3132	2965	4188
<u>Meat</u>						
mt	120	372	137	--	26	69
US \$1,000	70	206	116	--	16	64
<u>Import</u>						
<u>Pulses</u>						
mt	3510	3560	3620	3680	4020	4110
US \$10,000	630	609	651	673	693	716
<u>Cereals*</u>						
00 mt		432	494	499	484	327
US \$10,000		369	416	437	419	266
<u>Milk Products</u>						
US \$1,000	2461	2640	3118	3035	2837	2916
<u>Meat dried or salted</u>						
mt	1030	1207	1219	1146	899	404
US \$1,000	601	752	897	688	523	265
<u>Meat, canned</u>						
mt	617	775	738	728	878	676
US \$100	645	732	791	738	753	683

* mainly wheat

Source: ?

Table 19. Some Statistics on Guyana
(Source: FAO Yearbooks)

Year	1948-52	1961-65	1965	1966	1967	1968	1969	1970	1971
				<u>Population</u>					
Total - 000	432	619	655	677	698	719	742	764	786
Agricultural - 000			314 (48%)						
Economically active			190						
Economically active in agriculture			87 (46%)						
			<u>Livestock 000's</u> Herds and Flocks						
Cattle	181	245	350	315	306	250	257	258	
Sheep	44	56	87	83	100	98	99	99	
Goats	15	19	33	31	42	38	39	37	
Pigs	28	50	65	68	83	79	81	82	
Chickens	404	2000	3000	3537	4562	5923	6450	7062	
Ducks	54	135	142	140	142	140	142	140	
Turkeys	6	5	5	5	5	5	5	5	
			<u>Commercial Slaughter^{1/} 000's</u>						
Cattle	16	23	27	29	28	29	33	33	
Av. dead wt. Kg.	(148)	(144)	(144)	(149)	(141)	(137)	(131)	(131)	(131) ^{2/}
Sheep	--	2	3	4	5	5	6	6	(11 kg) ^{2/}
Goats	3	--	--	--	--	--	--	--	(11 kg) ^{2/}
Pigs	12	12	15	15	18	23	28	28	(43 kg) ^{2/}
			<u>Commercial Meat Production 000 tons</u>						
Beef	2	4	4	4	4	4	4	4	
Pork	1	1	1	1	1	1	1	1	
Poultry and offals	--	1	1	1.2	2.5	2.7	2.7	3.4	
			<u>Others</u>						
Milk 000 mt	10	18	16	20	21	20	20	21	
kg/cow/yr.	703	773	773	773	773	773	770	773	
Eggs millions	8	13	20	19	21	21	21	23	

^{1/} Presumably excludes auto consumption and bush slaughter.

^{2/} Average carcass weight.

Table 20. Herd Composition and Yield for Different Systems and Breeds

% Planted	Cows/	Young Stock/Cow				Sales	
		0-1	1-2	2-3	AU/Cow	Fat	Culls
<u>1000a Santa Gertrudis</u>							
100	467.3	.57	.55	.20	2.14	158.9	70.9
75	368.8	.48	.47	.20	2.05	95.9	55.3
50	261.2	.40	.39	.20	1.96	47.0	39.2
<u>Brahma</u>							
50	310.3	.36	.35	.16	1.65	55.9	36.2
25	172.4	.30	.29	.14	1.56	24.1	15.5
20	144.7	.29	.28	.13	1.52	20.2	11.3
<u>Sahiwal</u>							
25	144.5	.52	.49	.20	1.86	47.2	21.7
20	99.4	.40	.38	.20	1.73	16.9	14.9
15	75.8	.34	.33	.15	1.61	12.9	7.4
5	48.7	.28	.27	.13	1.32	6.3	3.8
0	17.6	.23	.22	.10	1.42	1.9	0.9

Source: ?

The least loss system, apart from selling yearling calves from Sahiwal on open range, is reported to be 1,920 acres, 1/4 planted, 277 Sahiwal cows, slaughtering steers at 2 years, with a labor force of 6 men.

This study could be criticized for the low annual use cost of capital, for using the 1963-7 killing out percentages which were lower than those obtained earlier in the study, and for using a selling price of 40¢/lb. live weight (most studies use 30¢). However, the losses incurred indicate so little prospect for profitable operation with partially improved systems in the intermediate savannahs that these items do not make a difference. Substantial increases on meat price to a level above that of the world market for this grade would be needed before any of these systems would become profitable.

The studies under the Florida University Project (see page 25) have used other coefficients, whose source is not clear. Their results show marginal profitability, using their coefficients, for some combinations of natural range and planted pasture, but at the time of our visit we were told that all the cattle were on planted pasture.

The IBRD project has been revised to exclude trying to organize ranches in the intermediate savannahs, and, it was our impression, that no ranches had been organized in this area.

24. Water Buffalo as a Source of "Beef" in the Caribbean^{1/}

Water buffalo are most widely used in South Asia as a source of power and milk. They were introduced into Trinidad (now about 6,000 head) as a source of draft power and there are a few hundred head in Guyana. In North Brazil there are a number of large herds for milk and beef production (perhaps 80-100,000 head).

A type similar to the Bhadawari from Uttar Pradesh has been bred from the traditional draft animals for beef production. The form is like the Bhadawari but the early maturity and straight back line is like the Surti of North Gujerat and the beefy type and strong legs like the Murrah (the most numerous breed in India). The breeding is under the guidance of Dr. S. Bennet of Caroni Ltd. and the animals are known as Buffalypso. The meat, not designated beef, has been very well accepted in supermarkets in Port of Spain, Trinidad.

Some animals were observed on coconut plantations in Tobago and they were obviously heavier and seemed "beefier" than the Zebu cattle with them. These animals were grazing on partly planted grasses in the groves. All the cattle are wild and were not usually caught, in part of a defence against rustling.

Buffalo cows usually have their first calf at 2-4 years of age preferably weighing about 360 Kg. when served. Gestation averages 316 days and under good management the average calving interval is under 400 days. The cows live an average 11 years but may live 20. They produce 1,000 kg. or so of milk in 280 days of lactation; records of 5,000 Kg. are shown. The butterfat is 6-8% and snf 9-11%.

^{1/} Mainly based upon discussion with S. J. Cowlinsaw and his paper on water buffalo.

Rates of gain of 0.9 Kg. a day are obtainable with good feeding. In Trinidad the Buffalypso reach 360 Kg. live weight in 2 years.

Buffaloes are said to have higher coefficients of digestibility of forages than cattle. Objective reports indicate that the buffalo is more efficient in digesting poor quality forage and that lignification has less effect on digestibility of forages by buffaloes (Devendra, 1971).

The muscle fibres are thicker and the nuclei more abundant than in cattle and there is little marbling fat. The body fat is white with no carotene pigment.

Cowlinshaw (?) reports "the quality of young buffalo meat is equal to that of first grade beef, and only an expert can distinguish them."

The average dressing out of young buffalo is 48% range 44-50%. There is a relatively heavy hide and head compared to cattle (9.2% and 6% of live weight compared to 6-8% and 2.5% in cattle).

The tanned hides are easily used.

Buffalo are susceptible to liver flukes because they thrive in swampy areas. They generally have fewer ticks but are more prone to biting by flies than cattle. They are more resistant to tuberculosis and foot and mouth disease than cattle. Diphtheria, pneumonia, and diarrhoeas are the most common troubles in calves. Buffaloes often do not respond to cattle vaccines, indicating a poor antibody response.

It is suggested that the Buffalypso has considerable potential in swampy regions in Guyana as a source of milk and especially meat. The breeding stock is in short supply.

The Guyanese were not enthusiastic about the possibilities of Buffalo in general. However, the observations of the Buffalypso and of work at

EPEAN at Belem with Buffalo, suggests that the animals are well adapted to certain areas that are not easily or economically suited to bovines.

25. Feedlot Feeding

Observations in Caribbean and African countries demonstrate uniformly that animals finished in feedlots must fetch a premium price over the normal run of cattle from native range land or pasture in order for the feedlots to be profitable. When prices are set in a traditional way, in equilibrium with production costs, and when the market does not want finished cattle but just stew meat, a period in a feedlot increases the price of this product.

There are a few exceptions. For example, a nearly free or free-for-transport-cost supply of suitable by-products (such as copra meal or sugar cane tops and molasses) obviously provides a very low cost feed which may compete in cost with native pasture.

Feedlot finishing increases this year round average dressing-out percentage. However, at times when the animals are being slaughtered off good pasture (towards the end of the rainy season and for a month or so thereafter), their quality may be about as good as feedlot fed animals.

In most of the Caribbean countries a year round supply of fed cattle could be marketed to those who want to buy better grade refrigerated meat or it could be exported to such markets if sanitary standards were satisfied. Sometimes only the rear quarters will obtain the premium and the fronts have to be marketed on the traditional market.

The traditional market often has no refrigeration; the customers have no refrigeration and want a small quantity of flavorful meat to make a

stew to mix with their carbohydrate, in this region rice or various types of potato. A young, tender delicately flavored piece of meat does not fulfill these needs.

In Jamaica, as soon a premium was paid for feedlot finished cattle, a whole new industry sprung up in about two years. There are now over 100 feedlots and the carcass weight at slaughter is, of course, increased.

Improved pastures, by-products, and urea-molasses-mineral mixtures are available in Guyana, although the by-products and molasses often have alternative markets.

For several years research has been carried out at UWI, Trinidad with E. F. Unsworth and S. J. Cowlinshaw doing the work on the grasses and Unsworth, C. Devendra^{1/} and S. J. A. Williams doing the work on utilization of Caribbean by-products. The concept of Preston, when he was in Cuba, to feed 80% or more of the ration in the form of urea, has been tested; the UWI results show that very high levels of molasses can be fed but not quite as high as those fed by Preston. Wilkins (during the Georgetown Seminar) reported that cattle under 18 months do not respond well to urea-molasses mixtures.

Two other possibilities are of interest, a cattle feeding variety of sugar cane reported by Dion from Barbados, a sugar cane stripping machine developed by the Canadian International Development Agency team, making the cane digestible; (a yield of 3,000 lb. of beef per acre of cane per year is claimed, i.e., 4 steers grown out per year). This is of great significance if the Commonwealth Caribbean loses its preferential sugar market in Britain.

^{1/} Now at FAO.

26. Venezuelan Cattle Production

Dow (102) working with a committee including Drs. John Glenn (Animal Science), Gerald Mott (Agronomy) and William Blue (Soils), reported on a survey of 25 ranches in the Western Llanos of Venezuela, and synthesized and programmed different types of cattle ranches in the wet-dry tropics.

He first discusses limitations on production:

1. Poor management by hired managers is a serious problem especially when there is an absentee landlord who does not depend upon the ranch for income. Ranches are frequently considered as a hedge against inflation and a symbol of social status, rather than as a source of immediate income. A similar impression has been gained of the ranches being developed in the region of Venezuela close to the Guyana border; foreign investors are developing ranches which do not seem to have much possibility of making operating profits. The investors can travel to the ranch, stay there for a while, and cover any losses by profits in other enterprises. Dow also remarks that investments in other enterprises would be more profitable but that this is irrelevant under the circumstances.

2. Overgrazing occurs either due to an excessive number of animals for the land resources or around the water points (due to poor distribution of water points and lack of fencing). Improved pastures are little used principally because of low managerial level, cost and lack of research data to show levels of increased production and economic returns. Recent research results indicates, however, that low levels of fertilization may be profitable in terms of the increase in stocking rate possible.

3. Low culling rates result from a failure to distinguish productive from non-productive heifers and cows. This results in a low calving rate

and no possibilities for selection. Only a few ranches actually cull non-productive or old cows; they mostly die on the range.

4. Lack of planned calving results from uncontrolled breeding. This increases calf losses and makes more difficult the treatment of calves for parasites. Calving is, to some extent, controlled by the flushing of cows during the good pasture season, but lack of fencing makes it difficult to keep the bulls away from the cows.

5. Inadequate veterinary care leads to high mortality rates and low production rates.

6. Poor performance by the bulls which cannot be corrected for due to lack of information on individual performance.

7. Nutritional deficiencies occur in the dry season. Salt is the only supplement. Added protein is not used.

8. Lack of fencing, hinders management and makes theft easier.

9. Lack of infrastructure, transportation, communication, credit, extension, low cost marketing system, etc., all militate against an intensification of production.

In his synthesized models Dow found that for the typical low input system with a weaning rate of 30% the return on capital was .52%. A reasonable return on capital could not be obtained even with 50% higher cattle prices (return was then 4.0%).

With his second system, involving more inputs including improved pasture and a higher level of management, the return on investment was 2.78%. Weaning rate was 55% in this case.

The highly intensive, improved pasture and best managed system made a loss at current prices but a return of 7.2% with cattle prices 50% higher.

The fattening system using improved pastures and some protein, mineral, and molasses supplement, and a medium intensive system from 250 Kg. to 500 Kg. live weight in 8 1/2 months, brought a profit of 9.56% on investment.

Intensive fattening on irrigated improved pastures with similar supplements again turned out not to be profitable.

These results are probably transferable to the Rupununi and Intermediate Savannahs or Guyana, though they could profitably be reworked with more appropriate prices.

27. Proposed Technological Assessments

The above literature review, together with a brief visit to Guyana, suggests some tentative hypotheses as to changes in Guyanese livestock technology which should be examined for feasibility and profitability.

The first of these areas has already been explored in some depth, as part of the Florida contract, namely an attempt to develop a profitable cattle production system in the Intermediate Savannah based on the results from Ebini. These studies have not been successful in showing how beef can be produced profitably in the Intermediate Savannah at present prices, see Table 12. Even where beef-cropping combinations have been shown to be profitable, these same calculations show that straight cropping would be even more profitable.

These studies under the Florida contract, point to the need to clearly define the likely economic cost of any political commitment to settle the Intermediate Savannah for cattle production, or to even continue cattle research at Ebini.

Additional technological assessments which appear to deserve some degree of priority include

a) Dairy Beef

In Guyana and Surinam the majority of the cattle are held in the coastal belt

by peasant farmers for milk production. To some extent cattle are held as an item of wealth. Males and cull females are purchased by wholesale butchers who sell the meat to retail butchers. The cattle which we saw in Guyana were mostly of the fairly small Creole breed. In Surinam more Holstein influence was visible.

The question at issue is the supply of immature and mature cattle from the dairy industry and the cost of production. The price of dairy cows is reported to be much higher than that of beef cows.

It is reported that double cropping of rice is reducing the time available for the cows to graze the stubbles and that, apparently the straw is not being collected and fed to cattle and the manure is not being returned to the field.

There are, however, some areas not suitable for rice production in the marine clays, where pasture could be improved and used for cattle. In some cases this land has been traditionally used cooperatively with little care being given to the pasture.

The recent increase in the price of milk by 1/3 should, ceteris paribus, increase production. However, assembly is such that many areas are excluded and there is little incentive to increase production in these areas.

The national agricultural development plans calls for an increase in the modern dairy sector and does not seem to consider the possibility of expanding the traditional sector.

In this context there are a large number of husbandry/institutional arrangements which deserve attention as potentially improving the productivity of this peasant sector. These include:

- i) Security of ownership, as an incentive to increasing herd size,
- ii) Supply of veterinary (or veterinary technician) services, for artificial breeding, pregnancy diagnosis, and advice on major diseases,

- iii) Possibility of specialized ranches to raise replacement stock,
- iv) Institutional arrangements which would allow better husbandry of communal pastures, and
- v) The economies of supplementary feed (particularly with rice-straw and other crop by-products).

If dairy cattle production (and hence dairy beef production) by the traditional sector could be improved, this has potential for a major impact on animal protein supplies in Guyana.

b) Land Clearing

While Guyana has large reserves of unused land, it has little, if any, land immediately suitable for farming which is unused. Thus plans to expand the area of cultivated land, imply an investment in land clearing.

The trade-offs between time and cost in extensive versus intensive clearing techniques need to be studied, as do the relative costs (per unit of output or per person settled) in different areas of the country.

In the particular context of cattle production, the merits of partial land clearing with, or without, ring barking of the remaining large trees needs to be examined.

c) Transportation and the Rupununi

The IRBD development plans for the Rupununi ranches call for a doubling of stocking rate (see Table 7) from about 60A/AU to about 30A/AU and at least a 50% increase in off-take percentage. This pre-supposes successful establishment of a tropical legume (such as Townsville Stylo) in the Rupununi, with or without phosphate fertilization. Experiments are in progress to establish the technical feasibility of this higher stocking rate.

The economics of any such technical development are crucially affected by

the cost of getting inputs into the Rupununi and products out. Furthermore there are substantial economies of scale (a bridge will serve 100 trucks a week as easily (or easier?) than 1 truck); and major fixed investment decisions. While only small volumes are to be handled air-freight has an obvious advantage. At another scale it might be economic to maximize river transport, while another configuration might point to a road. Each of these different transport arrangements has something to say about the form in which inputs and products should be used and produced.

It seems desirable to put some major cost parameters on the whole proposed "system" of Rupununi beef expansion as soon as possible.

d) Coastal Feedlot

With current prices the finishing of cattle in Guyana in more intensive systems, either on pasture or using urea-molasses or other non-protein nitrogen supplement is not likely to be profitable.^{1/}

In Guyana finishing of cattle has been carried out at Mon Repos. Intensive feedlot feeding is not presently demonstrated in Guyana although it can be seen in Surinam.

A feedlot possibility study would need to include a phase on the availability of feeders. Since the average carcass weight in Georgetown abattoir is 150-200 lbs., there is clearly need for a finishing phase in the system.

The cost of cattle to enter the finishing system at present prices and at the prices that are likely to develop if this extra phase is developed within the system needs to be studied.

The costs of the different systems of rations, ranging from improved pastures with supplements to feedlot feeding, should be estimated using research results

^{1/} Can feeding using the Barbados processing system might be an exception.

from the Caribbean. The possibility of using processed sugar canes should also be included. Basically it will be found that 1 lb. gain requires so much energy and the price of meat will establish the maximum cost of feed per unit for profitable operation.

The most difficult phase is estimating the returns from feeding cattle. There will be an improvement in the carcass yield of the cattle, which can be estimated. However, the price that can be realized for the higher grade meat in the domestic and in the export market place is more difficult to estimate.

On the domestic market the improved grade may be sold at a government agreed price.

Because one substantial feedlot selling 1,000 to 1,200 head of cattle at 900 to 1,000 lbs. live weight per month could supply half of the meat consumed in Guyana and Rupununi is reported to supply 40% of the Georgetown market, an oligopolistic situation will exist. Price prediction, in view of past price behavior, may be largely a matter of predicting government response.

A feedlot of this size would add about 25% to the supply (say doubling the meat available on about 25% of the cattle supplied). This would more than fill the deficit caused by shutting off imports.

e) Cane Feeding

The Canadian International Development Agency has developed a cane-stripping machine in Barbados [101], which allows the core of sugar cane to be used for cattle feeding. Spectacular results have been claimed, and some assessment of the applicability of these results for Guyana would appear to be a high priority in any investigation of possibilities for expansion of cattle production.

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