

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
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Batch # 34

1. SUBJECT CLASSIFICATION	A. PRIMARY Serials	Y-AL30-5200-GG50
	B. SECONDARY Agriculture--Animal nutrition--Ruminants--Tropics	

2. TITLE AND SUBTITLE
Ruminant livestock development programs for the tropics, with emphasis on nutrition and forage production and use; annual report, 1973/1974

3. AUTHOR(S)
(101) Fla. Univ.

4. DOCUMENT DATE 1974	5. NUMBER OF PAGES 94p.	6. ARC NUMBER ARC
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7. REFERENCE ORGANIZATION NAME AND ADDRESS
Fla.

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publisher, Availability)
(Activity summary)

9. ABSTRACT

10. CONTROL NUMBER PN-AAB-929	11. PRICE OF DOCUMENT
12. DESCRIPTORS Feeding stuffs Livestock Tropics	13. PROJECT NUMBER
	14. CONTRACT NUMBER CSD-3684 211(d)
	15. TYPE OF DOCUMENT

211(d) ANNUAL REPORT
University of Florida
1 July 1973 to 30 June 1974

**A Grant to Strengthen the Capabilities in
Ruminant Livestock Development Programs
for the Tropics: With Emphasis on
Nutrition and Forage Production and Use**

Grantee:

**Animal Science Department
Agronomy Department
Center for Tropical Agriculture
Institute of Food and Agricultural Sciences
University of Florida, Gainesville, FL 32611**

Title: "A Grant to Strengthen the Capabilities in Ruminant Livestock Development Programs for the Tropics: With Emphasis on Nutrition and Forage Production and Use."

Grantee: Animal Science Department
Agronomy Department
Center for Tropical Agriculture
Institute of Food and Agricultural Sciences
University of Florida, Gainesville, FL 32611

Director: H. L. Popenoe, Director, Center for Tropical Agriculture
T. J. Cunha, Chairman, Department of Animal Science
D. E. McCloud, Chairman, Department of Agronomy
Senior Scientist - Joe H. Conrad, Professor of Animal Nutrition and Coordinator of Tropical Animal Science Programs
Senior Scientist - G. O. Mott, Professor of Tropical Forage Crop Management and Coordinator of Tropical Forage Programs

A. Statistical Summary:

Period of Grant: 1 July 1972 to 30 June 1977

Amount of Grant: \$500,00, of which \$250,000 is to the Animal Science and \$250,000 is to the Department of Agronomy.

Expenditures: For current reporting period of 1973-1974, Animal Science and Agronomy (Pasture and Forage) accumulated expenditures were \$133,550.10; those anticipated next year are \$143,500.00.

B. Narrative Summary:

The 211(d) Tropical Livestock Consortium made good progress in its overall objectives during 1973-74. Both Animal Science and Agronomy Department representatives participated fully in the activities of the consortium composed of representatives from the University of Florida, Tuskegee Institute, Texas A & M University, and Purdue University.

During the first year, the consortium met for five one- to two-day informative exchange seminars and planning meetings. In addition, a six-day livestock symposium was conducted in Guyana.

During 1973-74, one-day meetings were held in Washington, D.C., Memphis, and Atlanta. Dr. Carl Sierk and the consortium chairman were in Guyana January 14-19 to work out a satisfactory working arrangement between the Ministry of National Development and Agriculture and the four consortium

members. The consortium participated in a three-week trip to become familiar with livestock production systems in the Sahel region of Central West Africa. One representative from each of the four universities made the trip at the request of AID to provide an informative base for the consortium's participation in a Central West African livestock seminar which was being planned for the fall of 1974. These activities are outlined in Appendix A.

The University of Florida had an AID contract in Guyana from 1967 to 1973. During this time, a major effort was made to help develop the beef cattle and forage program at the Ebini Research Station in the intermediate savannahs of Guyana. During this time, 51 trips were made to Guyana which involved 472 man days. This research provided excellent information for assessing the potential for beef production in Guyana. These data have been summarized in five Annual Reports, three scientific reports presented at the 4th meeting of the Latin American Association of Animal Production, and a report on "Estimated Resource Requirements, Costs and Returns for Five Beef Production Alternatives" based on experimental data from the trials. In addition, research information from the Ebini Research Station was used in a Master's thesis by Noel Holder, Livestock Officer and Director of the Ebini Research Station.

Results of grasses and legume introductions in Guyana and several other tropical countries by University of Florida personnel resulted in the release of Transvala digitgrass, a tropical forage resistant to sting nematode and Pangola Stunt Virus. Digestibility studies, both in vitro and in vivo, have been conducted with several tropical forages during different stages of maturity.

Research resulting in theses during the past year are listed under objective three, and the abstracts are presented in the Appendix. Some of these titles include the compatibility, persistence and nutritive value of grass-legume associations in the wet-dry tropics of coastal Ecuador; phosphorus and trace mineral status of beef cattle in the Guanacaste region of Costa Rica; nutrient value of water hyacinth silage for cattle and sheep; and forage intake and its relation to the chemical composition of the diet and some physiological factors in sheep.

Therefore, the University of Florida has been generating and furnishing to the consortium nutritional, pasture and forage, as well as cattle production information. This information is based on research data which can be applied to developing micromodels suitable for evaluating production systems at the herd level and cattle development systems at the country level using macromodels.

The Departments of Animal Science and Agronomy have strong, tropically oriented teaching programs, in addition to the tropical research orientation. Courses for academic credit during the past year were taught in Animal Production in the Tropics, Tropical Pasture and Forage Science, and Tropical Soils. Moreover, many other courses have a strong tropical bias, such as Animal Nutrition, Forage and Pasture Science, Beef Cattle Science, Reproduction in Farm Animals, Dairy Cattle Nutrition and Management, Physiology of Reproduction, Genetics of Animal Improvement, and Mineral Nutrition and Metabolism. The fact that the majority of Animal Science and Agronomy

faculty have had tropical experience, the semi-tropical conditions of Florida and the large number of students from tropical areas outside the U.S. not only make this tropical bias relevant but also imperative,

Seminars and short courses, as a means of disseminating the latest information in animal science and tropical forages, continue to be among the most effective activities of tropical animal science programs at the University of Florida. The 23rd Annual Beef Cattle Short Course held on May 1, 2, and 3, 1974, was attended by over 900 people. There were 56 people from 15 foreign countries and 60 people from 14 states other than Florida. This was followed by the 8th Annual Conference on Livestock and Poultry in Latin America on May 6-10, 1974. This conference was presented in Spanish and 268 attended from 16 foreign countries. Twenty-four University of Florida professors, four scientists from other countries and twenty-three Spanish-speaking students participated in the writing, translation, and presentation of the latest information to the participants. Most of the information was concerned with beef and dairy production and tropical pastures and forages.

The Central American Livestock Exposition Committee (EXPICA) requested that the Department of Animal Science at the University of Florida assist them in the organization and presentation of an intensive two-day Beef and Dairy Cattle Short Course. The Third EXPICA Short Course was held March 11 and 12, 1974, in Tegucigalpa, Honduras, in which over 500 livestock producers participated. Six professors from the University of Florida presented papers.

The First Annual Seminar and Laboratory on Meats Classification, Sanitation and Zoonosis Control in Latin America was presented in Spanish at the University of Florida from July 8-21, 1973. Thirty-five participants from 10 countries attended. Over five man months of faculty and graduate student time was required to develop and present this material. This intensive course was presented in Spanish with the primary objective of helping Latin America improve its meat quality and sanitation programs.

The four above mentioned programs are all planned for 1974-75.

Partial travel expenses were paid from 211(d) funds for Drs. Marvin Koger and Joe Conrad to attend the Seminar at C.I.A.T., Colombia, on Tropical America: Potential to Increase Beef Production. This seminar was held in Cali, Colombia, February 18-21, 1974, and was attended by over 200 scientists interested in improving livestock production in the tropics. Partial expenses were paid for Dr. Lee McDowell and Mr. Carlos Lang to conduct research in Costa Rica for the latter's M.S. degree. This resulted in a thesis entitled "Phosphorus and trace mineral status of beef cattle in the Guanacaste Region of Costa Rica. Nine other theses were completed during the year which were directly related to tropical animal nutrition and tropical forage.

Expenses were paid from 211(d) funds for Dr. Joe Conrad to participate in the Ruminant Livestock Consortium trip to Central West Africa May 18 to June 9, 1974.

During the reporting period, the faculty of the Department of Animal Science and Agronomy have had cooperative research and development programs in tropical animal science and tropical forages with the Ministry of Agriculture in Brazil, INIAP in Ecuador, AID-Ministry of Agriculture in El Salvador, Panamerican Agricultural School in Honduras, and AID-Ministry of Education in Vietnam. Faculty members have assisted with the execution and review of these projects. In addition, Dr. H. L. Chepman, Animal Nutritionist and Director of the Range Cattle Experiment Station at Ona, Florida, participated in an AID sponsored, 30-day study of Livestock Production and Marketing in Pakistan. Dr. G. O. Mott, Professor of Tropical Pasture and Forages, studied the Natural Grassland Ecosystem and Livestock Development on Marajó Island, Brazil, at the request of the Organization of American States.

The University of Florida AID Livestock Project AID/csd-2498 entitled "Survey and Analysis of the Problem of Cattle Feeding Systems in the Wet/Dry and Humid Tropics of Latin America" was terminated December 31, 1973. At the termination of this project, 616 manuals, 388 chemical and biological method books and 915 books of source forms had been distributed in 28 Latin American and Caribbean countries. During the project, over 35,000 completed source forms were received from 69 laboratories in 21 countries. This information was published as Latin American Feed Tables and was based on 27,196 source forms. The atlas publication contained 3,390 feeds and the abridged edition contained 650 feeds. After December 31, 1973, some 211(d) funds were used for the support of personnel and some of the publishing costs associated with project AID/csd-2498. Details of the accomplishments of this project are found in the Final Report which was submitted to AID in Washington.

Numerous scientists from Africa, Australia, Central and South America and Southeast Asia have visited with University of Florida faculty at Gainesville regarding ruminant nutrition and tropical forage programs. Over 336 visitors in 29 groups visited with faculty about international livestock and forage programs. Many of them also visited one or more of the six research centers in Florida where research programs are in progress with beef and tropical pastures.

C. Detailed Report

I. General Background and Purpose of the Grant

Ruminants include beef cattle, dairy cattle, sheep, goats and many game animals. They have a four compartment stomach and the ability to convert grass, forage, cereal crop residue and fibrous by-products into high quality protein foods for human diets. All of these animals and products are prevalent in the tropics. Most of these products are grown on land areas which are unsuitable for cereal grain production. Consequently, the best use of this land is to produce feed for ruminants. Ruminant livestock is both a source of protein food for the general population and a source of employment for large sub-sectors. In numerous situations, entire societies live directly from livestock.

Livestock plays important roles in economies which range from subsistence to highly developed. As economic development occurs, the demand for livestock products increases, in contrast to the demand for many crops which decrease as consumers can afford better diets. For this reason, in some LDCs, livestock could become a stable earner of foreign exchange.

This grant is one of four for activities which are exploring the livestock industry from a total systems viewpoint on the assumption that piecemeal attacks on a complex problem (nutrition, breeding, disease control or credit) have been inadequate.

Primary objective of this set of grants is to strengthen capabilities of four U.S. universities to identify opportunities for significant livestock development in LDCs, to analyze constraints to and resources for such development, and to design programs to overcome constraints through an integrated, multi-disciplinary team approach.

At the University of Florida, this grant is providing funds for cooperation with other consortium members in determining geographical foci for the problems, in identifying the bottlenecks to livestock development and, particularly, where these fall into the area of animal nutrition, the funds will be used to find ways to overcome these deficiencies. In this way, the University of Florida's competence will be enhanced in working across disciplines and with other universities generally and in working in the area of animal nutrition, with special emphasis on tropical feeds and forages. Current training within the Center for Tropical Agriculture at the University and abroad will be strengthened. An ongoing AID supported program to collect analytical feed and forage data from laboratories in Latin America has been strengthened.

II. Objectives of the Grant

1. Objective Restated

The four universities already have established institutional commitments to agricultural programs in the developing nations. The universities have agreed that it is to their advantage, as well as to the benefit of the U.S. Foreign Assistance Program, to cooperate in the development of an approach to research and technical assistance focused on ruminant livestock systems for the wet/dry tropics. To achieve this objective within the limitations of available resources, they propose, during the five-year period of the grant, to engage in interdisciplinary and inter-institutional activities such as the following:

- a. To develop a staff corps within each university structure which will:
 - i) Identify viable projects aimed toward understanding management requirements and systems in tropical animal agriculture;
 - ii) Provide for an interchange of staff among the cooperating universities to develop integrated, functional programs applicable to tropical animal agricultural development;

- iii) Utilize the expertise of visiting scientists from other universities for special requirements;
 - iv) Develop collaborative workshop activities in specialized disciplines pertinent to tropical animal agricultural development.
- To provide opportunities for education and training of the manpower required for development of the production potential of animals in wet/dry tropics, including:
- i) Orientation of resident instruction for in-depth training on the characteristics of animal agriculture and forage production in the tropics;
 - ii) Establishment of student exchange mechanisms to permit sharing of the strengths of the various institutions and to provide practical experience in the wet/dry tropical environment;
 - iii) Development of courses and research in tropical animal agriculture designed to hasten the training and maturity of U.S. and foreign scientists; and
 - iv) Development of non-degree short courses and training seminars.
- c. To develop and maintain active research on animal agriculture in the wet/dry tropics as a team effort.
- i) Provide staff experience and competence necessary for effective training; and
 - ii) Provide opportunity for student involvement in research as an essential part of training.
- d. To accommodate requests for technical assistance and for consulting services relevant to animal agriculture in the wet/dry tropics:
- i) Release of staff for assignments in specialized areas of animal agriculture; and
 - ii) Assignment of qualified students for activities which would contribute to their training.
- e. To make available institutional physical resources, including office space, laboratories, equipment, and land for accommodation of activities of:
- i) Resident staff and students;
 - ii) Exchange staff and students; and
 - iii) Visiting staff and scientists.

2. Review of Objectives

The objective of this grant approach is to improve the capacity of the University of Florida to assist the Agency for International Development, other developmental agencies and countries in ruminant nutrition and forage production as part of total livestock production and marketing systems. Such capacity will contribute to a systems approach in the

design, organization, planning and implementation of research, training and teaching programs. This approach will improve the ability to adapt the system or "package" to tropical environments.

Scope of activities under this grant will include training for regular staff, increase in faculty, experience and research to develop a capability for a systems analysis approach to ruminant livestock development through effective linkages with members of the consortium, LDC institutions and other organizations.

Within this scope of activities, first attention will be given to faculty development, development of work plans with other members (grantees) and defining with more precision areas within the LDCs wherein grant activities will be concentrated.

Contribution of the University of Florida team to the objectives of the 211(d) consortium "Systems Approach to Ruminant Livestock Development."

The University of Florida has the responsibility of providing information in the area of animal nutrition with special emphasis on tropical feeds and forages which is relevant for the model of ruminant livestock development in the tropics.

The scope of this grant is such that there will not be sufficient funds nor time to generate production parameters through field research. Therefore, results of research which has already been conducted or is being conducted will serve as the primary source of information. Production parameters from a number of published reports will also be generated. This includes, but is not restricted to:

- a. Providing information concerning adapted species and varieties of legumes and grasses for various ecological zones of the tropics.
- b. Making estimates from research information concerning the nutrient requirements of various feed (including forage) crops and their response to fertilizer nutrient inputs into the system.
- c. Making recommendations on appropriate grazing management systems to maintain a balance of legumes and grasses in mixed swards.
- d. Providing information on cropping systems (including fertilizer inputs and cultural practices) which will produce economical levels of production with a broad spectrum of potential supplemental feeds-- corn, sorghum, soybean, peanuts, cassava, etc.
- e. Making estimates of the quality of both native and introduced forages and their potential animal production.
- f. Providing information concerning the response to mineral supplementation and to protein-energy feeds as supplements in feeding systems on native range and improved pastures.
- g. Nutrients and nutritional level are known to affect fertility, calf survival, rate of gain, age at slaughter and economics of production. Making estimates of the direct effects (of various inputs into the system) upon these production parameters will be a part of the responsibility of the University of Florida team.

III. Accomplishments

Objective 1: "To develop a staff corp within each university structure which will...."

Dr. Joe H. Conrad, Professor of Animal Nutrition, and Dr. G. O. Mott, Professor of Tropical Forage Crop Management, have been designated as the two principal senior scientists at the University of Florida to participate in the activities of the consortium. These two men have participated fully in the activities of the consortium.

These men have assisted the consortium to:

1. Identify viable projects aimed toward understanding management requirements and systems in tropical animal agriculture;
2. Provide for an interchange of staff among the cooperating universities to develop integrated, functional programs applicable to tropical animal agricultural development;
3. Utilize the expertise of visiting scientists from other universities for special requirements;
4. Develop collaborative workshop activities in specialized disciplines pertinent to tropical animal agricultural development.

Objective 2: "To provide opportunities for education and training of the manpower required for development of the production potential of animals in wet/dry tropics, including...."

1. Resident instruction for in-depth training on characteristics of animal agriculture and forage production in the tropics. The following courses have direct application and were taught this past year by professors with extensive tropical experience:

Course No.	Name	No. Credits
ADP 322	Principles of Animal Breeding	5
AL 411	Beef Cattle Science	5
AL 527	Animal Nutrition	5
ADP 535	Animal Production in the Tropics	4
ADP 507	Reproduction in Farm Animals	4
AY 536	Tropical Pasture and Forage Science	3
AY 647	Crop Plants in Tropical Environments	12
FRE 411	Management of Farms in Tropical Areas	3
FRE 646	Agriculture's Role in the Growth of Latin American Nations	4
SLS 325	Tropical Soils and Their Environment	3
SLS 525	Tropical Soils	3
VV 663	Parasitic Diseases in the Tropics and Subtropics	5

2. **Establishment of student exchange mechanisms.** Approximately 35 percent of the graduate students in the Institute of Food and Agricultural Science are from other countries. Twenty-three Spanish speaking students from seven different countries translated and presented papers at the 8th Annual Conference on Livestock and Poultry in Latin America May 6-10, 1974. Four scientists, Paul Kandel from Puerto Rico, Roland Poultney from Ecuador, Joe Ritson from Guyana, and Fideas Rodríguez from Venezuela, presented papers at this conference.

A cooperative exchange program involving professors and graduate students is in effect with the University of Antioquia, Faculty of Veterinary Science and Animal Science, Medellin, Republic of Colombia.

3. **Development of courses and research in tropical animal agriculture.** A Tropical Agriculture Committee, in their report to the Dean of Resident Instruction, suggested that new courses be developed in the following areas:
- a. Forage-Livestock Feeding Systems
 - b. Cropping Systems in the Tropics
 - c. Agriculture and Rural Development Administration

In addition to the above suggested courses, it was recommended that "each department review its current course offerings and place more emphasis on application of the information to tropical environments." This committee also studied and suggested improvements in "Tropical Agriculture Specializations" for students to qualify for a "Certificate in Tropical Agriculture" or a "Certificate of Tropical Studies."

4. **Development of non-degree short courses and training seminars.** The 8th Annual Conference on Livestock and Poultry in Latin America was presented in Spanish at the University of Florida during May 6-10, 1974. Twenty-four University of Florida professors, four scientists from other countries, and twenty-three Spanish speaking students participated in the writing, translation and presentation of the latest information at this conference. Attendance was the largest to date with 268 people with 16 foreign countries represented. A nominal fee of \$25 per participant was charged to cover costs of printing the materials and of transportation. A considerable amount of University of Florida IFAS faculty time went into the preparation of the Conference Proceedings and the conduct of the conference. However, no financial assistance was provided from 221(d) or University of Florida funds to participants of this conference.

The Latin American Conference was preceded by the Beef Cattle Short Course on May 1, 2 and 3, 1974, in which over 900 people participated. Of this total, 56 people attended from 15 foreign countries and 60 people attended from 14 states other than Florida.

Three years ago, the Central American Livestock Exposition Committee requested that the Department of Animal Science at the University of Florida assist them in the organization and presentation of an intensive two-day EXPICA Beef and Dairy Cattle Short Course. The first one was held in Guatemala City on March 13 and 14, 1972, at which over 500 livestock producers paid \$25.00 each to attend. The Second EXPICA Short Course was held March 19 and 20, 1973, at David, Panama, with an attendance of about 100. The change of meeting place during the week preceding the Short Course, the United Nations Security Council meeting in Panama City at the same time, and other organizational factors contributed to the low attendance. However, five University of Florida professors and two members of the Florida Department of Agriculture presented papers and participated in this short course. The Third EXPICA Beef and Dairy Cattle Short Course was held March 11 and 12 in Tegucigalpa, Honduras, in which over 500 livestock producers participated. At this well attended short course, six professors from the University of Florida presented papers. The excellent success of these short courses is making a valuable contribution toward getting the latest information to the livestock producer. All of these talks are reproduced in Spanish and presented to all of those attending. Additional copies are in great demand. Mr. Adolfo Midence, one of the members of the board of trustees of the Pan American School at Zamorano, Honduras, had additional copies made for the graduating seniors. In 1975, another excellent EXPICA Short Course is anticipated at San José, Costa Rica.

In addition to the three major short courses and conferences, a new one was added. Department of Animal Science faculty anticipated a need for a seminar in meats designed primarily to meet the specific Latin American interest in improving meat quality and sanitation programs. Planning for this seminar began in January 1973 and was greatly facilitated by the addition of an another Meat Scientist to the Animal Science faculty in February through 211(d) funding. The First Annual Seminar and Laboratory on Meats Classification, Sanitation, and Zoonosis Control in Latin America was presented in Spanish at the University of Florida from July 8 to July 27, 1973. Thirty-five participants from 10 countries attended. Over five months of faculty and graduate student time was required to develop and present this material. Participants at this course are required to pay a registration fee, travel and per diem. The primary expense to the Department of Animal Science is faculty time which can be justified on the basis of a full time Meat Scientist whose salary is being paid from 211(d) funds.

Agronomy, Statistics and Animal Science sponsored a Seminar by Dr. H. L. Lucas, Director of Biostatistics at North Carolina State University on January 21-25, 1974. Dr. Lucas, a leading authority in Biostatistics, presented seminars on the following topics: Modeling forage animal systems--the sward aspects, modeling forage animal systems--the animal aspects, and mathematical modeling in nutrition and ecology. This was well attended by a number of faculty and graduate students.

Objective 3: "To develop and maintain active research on animal agriculture in the wet/dry tropics as a team effort."

The Departments of Animal Science and Agronomy have had, and currently do have, major research efforts in a number of countries in the areas of tropical livestock and tropical pasture and forage. During the period from July 1, 1973, to June 30, 1974, the contracts were in effect with the man months of scientific input in livestock and pasture and forage programs as follows:

<u>Country</u>	<u>Contract</u>	<u>Funds</u>	<u>Dates</u>	1973-74 <u>Livestock Related Man Months</u>
Brazil	EMBRAPA Ministry of Agriculture	EMBRAPA Ministry of Agriculture	10/72-06/75	48
Ecuador	INIAP	IDB to GOE	01/71-12/75	48
El Salvador	AID	USAID/El Salvador	04/69-12/75	6
Latin America	AIDcsd-2498	AID Washington	06/69-12/73	18
Vietnam	AIDcsd-3594	AID Washington	01/69-03/75	12

In the Departments of Animal Science and Agronomy, a large proportion of the faculty have had overseas experience. During the period of this report, six faculty members affiliated with Animal Science and four faculty members affiliated with pastures and forages were on permanent overseas assignments. These were as follows:

Brazil Contract: Dr. Don D. Hargrove
Dr. Richard Houser
Dr. A.F. Jilek
Dr. Stanley Schank

Ecuador: Dr. John P. Bishop
Dr. Roland G. Poultney
Dr. Luis Tergas
Dr. John Southcombe

El Salvador: Dr. Clarence Reaves (6 months)

Vietnam: Dr. M. A. Boone

Eleven of the 30 faculty members of the Department of Animal Science at Gainesville were on one or more international short term consulting trips, a majority of which were backstopping activities affiliated with ongoing contracts. In addition, three of the Animal Science faculty at the Branch Stations were on short term assignments in the tropics.

Dr. Herbert L. Chapman, Jr., Animal Nutritionist and Director of the Range Cattle Experiment Station at Ona, Florida, participated in an AID sponsored, 30-day study of Livestock Production and Marketing in Pakistan

at the request of the Government of Pakistan. This took place between July 20 and August 20, 1973, and a brief report is included in Appendix B.

Drs. Joe Conrad, Marvin Koger and G. O. Mott participated in a review of the pasture and livestock research program in Ecuador from October 10 to 20, 1973. A brief report of this review is included in Appendix C.

Drs. Joe Conrad, Tony Cunha, G. O. Mott and H. L. Popenoe participated in a review of the National Cattle Project in Brazil as part of the contract between the Ministry of Agriculture in Brazil and the University of Florida. This review took place between November 23 and December 22, 1973, with only two of the team members--Drs. Conrad and Mott--staying in Brazil the full time indicated above.

Partial travel expenses were paid from 211(d) funds for Dr. Joe Conrad and Dr. Marvin Koger to attend the Seminar at C.I.A.T. on Tropical America: Potential to Increase Beef Production. This seminar was held at Cali, Colombia, February 18 to 21, 1974, and was attended by over 200 scientists interested in improving ruminant livestock production in the tropics. Five days of meetings and workshops were followed by tours to two major research centers in Colombia. ICA-CIAT research centers were visited at Turipanã near Cordoba on the North Coast and at Carimagua in the Eastern Llanos area of Colombia.

Dr. G. O. Mott studied the Natural Grassland Ecosystem and Livestock Development on Marajó Island, Brazil, at the request of the Organization of American States. A part of his report--Alternative Schemes for Improving Livestock Production--is included in Appendix D.

Insufficient research on tropical pastures and forages has been conducted to determine the response of a complex pasture to different grazing management systems. A research project was initiated by Dr. G. O. Mott and associates at the Beef Cattle Research Unit in the summer of 1973, with the following objectives:

1. To determine the response of a complex pasture mixture to varying levels of the variables grazing days, resting periods and grazing pressure.
2. To express yields in terms of dry matter production, carrying capacity, as well as determine changes in botanical composition over time as influenced by treatment effects.
3. To estimate liveweight changes in the grazing animals and estimate the TDN consumption from the pasture.
4. To generate coefficients from the response surface design which will be useful in developing forage-livestock feeding systems and provide information for further research.

More details of this research are presented in Appendix E.

Students are encouraged to conduct research overseas when satisfactory arrangements can be developed. During the past year, the following theses have been completed from research conducted in other countries:

Robert Earl Hudgens (Ecuador). 1973. The Compatibility, Persistence, and Nutritive Value of Grass-Legume Associations in the Wet-Dry Tropics of Coastal Ecuador. M.S.A. thesis. Major Professor: Dr. G. O. Mott.

Carlos Lang Rojas (Costa Rica). 1974. Phosphorus and Trace Mineral Status of Beef Cattle in the Guanacaste Region of Costa Rica. M.S.A. thesis. Major Professor: Dr. L. R. McDowell.

Fernando Calderón Laguna (Colombia). 1973. Evaluation of the Nitrogen fraction of the Cassava Root and Factors Affecting Its Biological Value. M.S.A. thesis. Major Professor: Dr. H. D. Wallace.

A number of other theses and publications based on research conducted at the University of Florida have been completed or published during the past year. These are directly applicable to the University of Florida's competence in tropical animal science and tropical pastures and forages. Some of these are listed below:

Baldwin, John A. 1973. Utilization of Ensiled Water Hyacinths in Ruminant Diets. M.S. thesis. Major Professor: J. F. Hentges.

Byron, Thomas Henry. 1973. Nutrient Value of Water Hyacinth Silage for Cattle and Sheep. M.S. thesis. Major Professor: J. F. Hentges.

Gebre-Meskel, Teffera. 1973. Reproductive and Weaning Performance of Angus, Brahman, Hereford and Santa Gertrudis Crossbred and Straightbred Cattle on Three Clover-Grass Pastures. M.S. thesis. Major Professor: M. Koger.

Golding, Edward J. 1973. Formulation of Hay:Grain Diets Based on Predicted Qualities of Four Bermudagrass Hays for Ruminants. M.S. thesis. Major Professor: J. E. Moore.

Mendoza, Pablo. 1974. Establishment of Tropical Legumes. M.S. thesis. Major Professor: G. O. Mott.

Velásquez, José A. 1974. Prediction of In Vivo Digestibility in Warm-Season Grasses by Summative Equations and In Vitro Digestions. M.S. thesis. Major Professor: J. E. Moore.

Ventura, Max. 1973. Forage Intake and Its Relation to the Chemical Composition of the Diet and Some Physiological Factors in Sheep. Ph.D. thesis. Major Professor: J. E. Moore

Abstracts of these theses are presented in Appendix F.

IV. Impact of Grant Supported Activities in Development Institutional Capabilities

The University of Florida had an ongoing program in Ruminant Livestock Development and Tropical Pastures and Forage prior to the awarding of the 211(d) grant to the Departments of Animal Science and Agronomy. Thus, the 211(d) grant has permitted flexibility in furthering the development of these two programs.

The Department of Animal Science has been able to use these funds for developing a stronger and broader Tropical Animal Science Program. It has been able to provide learning and research experiences for both professors and graduate research assistants which were previously not possible. In addition, they have been able to strengthen the meats teaching and research area which is highly essential for a ruminant livestock development program. Furthermore, they have been able to provide the scientific expertise required to contribute to nutritional inputs and parameters necessary for a multi-disciplinary team approach to ruminant livestock development in wet/dry tropical environments.

The Department of Agronomy has been able to use these funds for the strengthening and expansion of tropical pasture and forage management teaching and research programs. It has been able to provide learning and research experience for both professors and graduate research assistants which were previously not possible. A full time assistant has been added in the area of tropical pasture and forage management. The awarding of the 211(d) funds has made it possible to backstop the program which was already underway and to expand the tropical pasture and forage program. With these funds, it has been possible to provide the scientific expertise required to contribute pasture and forage inputs and parameters necessary for a multi-disciplinary team approach to ruminant livestock development in wet/dry tropical environments.

Utilization of Institutional Resources in Development.

Under Section III, Objective 3, six contracts were listed which were in effect during the current reporting period. These livestock development contracts are in Brazil, Ecuador, El Salvador, Honduras, Nicaragua, and Vietnam. In addition, a Feed Composition Contract encompassing all of Latin America was in effect until December 31, 1973. During the past year, 120 man months of faculty time have gone into these livestock, pasture and forage programs. In addition, a large number of man-days from the University of Florida faculty have been utilized in short term consulting which was not covered by formal contracts.

In September 1973, thirty-one of a total of fifty-four graduate students in the Department of Animal Science were international students from seventeen different countries. These students were from Australia, Brazil, Cameroon, Colombia, Costa Rica, Ecuador, Egypt, El Salvador, Ethiopia, Honduras, Jamaica, Mexico, Indonesia, Nigeria, Taiwan, Vietnam and Venezuela. Eleven of these foreign students were working in the area of animal nutrition.

Foreign visitors and those interested in International Programs who have visited the Department of Animal Science and the Department of Agronomy (Pastures and Forages) between July 1, 1973, and June 30, 1974, were as follows:

<u>Date</u>	<u>Names</u>	<u>Country and Organization</u>	<u>Sponsor</u>
07/09- 07/27	First Annual Seminar and Laboratory on Meats Classification, Sanitation and Zoonosis Control in Latin America. This was attended by 44 participants from 12 foreign countries		
07/15	Orlando de Sola W.	El Salvador	Self
07/16	Prof. Derblay Galvão, Federal University of Santa Maria	Brazil	FAO
07/17	Shehu U. Abbas Sunday Awolalu Agom Eze Joe Garba Mbura Ndanusa Braiman Mijandadi Thomas Kolawole Ojuolape Godwin O. Okerentugba Muhammadu Zakari	Nigeria	G.A.I. (All visitors in this group were Nigerian Agricultural Cooperative Officials and participants in the International Visitors Program of the Department of State).
08/27	Mr. Prasong Kanchanadul Lt. Cmdr. Chalong Wongdontri Mr. Roong Mekhsophone Mr. Rangsam Sammasut	Thailand	USDA/AID
09/11- 09/12	Miss Winifred Mary Cherry, Editor, Euro-Farm Business	Great Britain	G.A.I.
10/01- 10/03	Dr. R. D. Chester, Stanbroke Pastoral Co. Pty, Ltd. Mr. Brian J. Oxenford, Gambamora Stud	Australia	Self
10/08	Mr. Bernardo Ocana V., Director of International Programs	Panama	USDA/AID
10/08	Dr. A. D. Tillman, The Rockefeller Foundation, P. O. Box 63, Yogyakarta,	Indonesia	
10/21- 10/24	Mr. Jean Le Dividich Dr. Seve Dr. Aumaitre	Guadeloupe France France	

<u>Date</u>	<u>Names</u>	<u>Country and Organization</u>	<u>Sponsor</u>
10/24	Mr. Alfred Banninger, Finca Pozo Azul, Playon de Parrita	Costa Rica	Self
10/25	Mr. Noel Somarriba, Minister of Agri- culture	Nicaragua	G.A.I.
10/29	Mr. Michel Chenost	Guadeloupe	
11/15	Mr. Eugene Grasberg, Special Advisor, The Agribusiness Council Inc., New York	New York	
11/19	Dr. S. Magona Mr. T. F. Kaba Mr. Kenneth Kangoma Mr. I. B. Kamara	Sierra Leone (Livestock Development Group)	G.A.I.
11/27- 12/17	Mr. Eduardo Jalles	Argentina	
02/11	Dr. John Pino, The Rockefeller Founda- tion	New York	
03/18- 03/20	Ing. Percy Pacheco Díaz, Chief Sais- pampa Colonization Project	Peru	FA/USDA
03/27	Belgium Faculty of Agricultural Sciences student group--38 students and 5 professors	Belgium	
04/03	Jacinto Varas Arteaga, International Development Foundation	Ecuador	
04/03	Dr. Jorge P. Silva, Vice President, Instituto de Investigaciones Agrope- cuarias, Santiago	Chile	
04/29	Jorge Valdez Balta, INIABEC	Peru	
05/01- 05/03	Beef Cattle Short Course, 45 people from 15 foreign countries		
05/06- 05/10	The Eighth Annual Conference on Livestock and Poultry in Latin America was attended by 268 people. Sixteen countries were represented by a total of 163 people. Forty-six of the participants were from Venezuela and 45 from Nicaragua		

<u>Date</u>	<u>Names</u>	<u>Country and Organization</u>	<u>Sponsor</u>
06/03	Mr. J. S. Balderstone, Mgr. Director Stanbroke Mr. Ken Coombe, Mgr. Stanbroke Stud	Australia	
06/09	Mr. Sami Gabriel Jafet, São Paulo	Brazil	
06/25	Mr. Garold M. LaRue	Nicaragua	
06/26	Dr. J. H. Lombard	South Africa.	

In summary, over 336 visitors in 29 groups came to the University of Florida to discuss tropical livestock and pasture and forage programs.

VI. Other Resources for Grant-Related Activities

An extensive program in ruminant livestock development with emphasis on animal nutrition and forage production and use has been underway at the University of Florida for many years. Currently, there are eight ruminant nutritionists and four pasture and forage specialists who are devoting at least 20 percent or more of their time in this area. Two professors are devoting approximately full time to this program with only part of the salary being paid from 211(d) funds.

Out of state tuition is currently \$1,400 per year. Approximately ten fee waivers between the two departments are used for graduate students whose research is related to the overall objectives of the program.

Only a fraction of the travel expenses are paid from 211(d) funds. None of these funds are used to pay travel to consult on contracts with Brazil, Ecuador, El Salvador, Vietnam or the Latin American Feed Composition Project AIDcsd-2498.

Equipment, supplies, materials and publication costs are continually being incurred by the animal nutrition laboratory, the forage evaluation laboratory, AID contract csd 2498, the Departments of Animal Science and Agronomy and the Center for Tropical Agriculture.

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

Anticipated expenditures for the fiscal year 1974-75 are listed in Tables 1 and 2.

University of Florida will continue to give full cooperation to the consortium by generating and supplying the necessary information based on pasture, forage and nutritional research. These parameters will be supplied to Texas A & M University for their micromodeling and to Purdue University for their macromodeling. Parameters are being generated to apply to specific environmental and regional ruminant livestock situations,

since each country will have substantial regional variation. The consortium will continue to use Guyana as a specific country from which to develop its models. Other possible cooperating countries will be selected either in Africa or South America.

The consortium will sponsor a seminar workshop which will focus on the current status of its capabilities in designing and executing ruminant livestock development programs in the tropics. One should be held in the U.S. to test the model and then another should be held in Guyana to demonstrate to the Guyanese the applicability of these models to their conditions.

Mineral research will be initiated by the Department of Animal Science through an Agency for International Development grant to determine essential mineral supplements for grazing livestock in Latin America. The objective is to increase the efficiency of meat and milk production systems by correcting the mineral deficiencies which exist in pastures and forages. Research will be conducted in cooperation with certain Latin American institutions in Brazil, Colombia, Costa Rica and Guatemala. Other countries will be included as interest, time and funds permit.

Seminar and short course activities are planned as follows:

July 8 to 19, 1974: Second Annual Seminar and Laboratory on Meats Classification, Sanitation and Zoonosis Control in Latin America at the University of Florida.

September 2 to 6, 1974: Conference on Beef Cattle Production in Developing Countries, University of Edinburgh, Scotland.

December 2 to 6, 1974: International Conference on Nutrition and Agriculture and Economic Development in the Tropics, INCAP, Guatemala.

December 16 to 20, 1974: Modeling Forage and Livestock Feeding Systems by Dr. H. L. Lucas, University of Florida.

March 10 to 11, 1975: Fourth Short Course on Beef and Dairy Cattle in Central America and Panama, San José, Costa Rica.

April 6 to 18, 1975: Seminar on the Utilization of Tropical Feed Ingredients in Animal Feeding and Nutrition, Kingston, Jamaica.

May 1 to 3, 1975: 24th Annual Beef Cattle Short Course, University of Florida.

May 5 to 9, 1975: 9th Annual Conference on Livestock and Poultry in Latin America, University of Florida.

In Tropical Pasture and Forages, funds will be used to support partial salary of a professor, full support for a graduate research associate, a

graduate research assistant and clerical support. Funds will also be used to support research activities designed to determine the response of complex pastures to different grazing and management systems.

In Ruminant Nutrition, funds will be used to support partial salaries of two professors, research activities and clerical support for tropical animal science programs. Funds for equipment, supplies and materials will be used to support and expand the ruminant nutrition and tropical pasture and forage programs in line with the consortium objectives to strengthen the capabilities in ruminant livestock development programs for the tropics.

TABLE I

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

Review Period 1 July 1973 to 30 June 1974

Grant Related Activities	211(d) Expenditures			Non 211(d) Funding Amount	
	Period Under Review	Cumulative Total	Projected Next Year		Projected to End of Grant
Salaries for Research and Teaching	74,826.45	115,883.31	100,000	384,500	68,000
Tuition and Fees	-	-	500	1,500	14,000
Travel	7,759.33	12,767.02	12,000	50,000	20,000
Equipment	-	600.00	1,000	4,000	10,000
Supplies and Materials	4,299.77	4,299.77	30,000	60,000	20,000
TOTAL	86,885.55	133,550.10	143,500	500,000	132,000

*These figures are our best estimates.

TABLE II

Expenditure Report (Actual & Projected)

Under Institutional Grant #AID/csd-211(d) 3684

Review Period 1 July 1973 to 30 June 1974

Budget Items	Expenditures to Date		Projected Expenditures			Total Budget
	1973-1974 Period Under Review	Cumulative Total 'Same'	1974-1975 3	1975-1976 4	1976-1977 5	
Salaries	\$74,826.45	\$115,883.31	\$100,000	\$100,000	\$68,616.69	\$384,500
Tuition & Fees	-	-	500	500	500.00	1,500
Travel	7,759.33	12,767.02	12,000	12,000	13,232.98	50,000
Equipment	-	600.00	1,000	1,000	1,400.00	4,000
Supplies & Material	4,299.77	4,299.77	30,000	15,000	10,700.23	60,000
TOTAL	\$86,885.55	\$133,550.10	\$143,500	\$128,500	\$94,449.90	\$500,000

LIST OF APPENDICES

- Appendix A** Specific activities and meetings directly related to the 211(d) Ruminant Livestock Consortium.
- Appendix B** Livestock Production and Marketing in Pakistan by H. L. Chapman, August 1973.
- Appendix C** Report of Consulting Trip to Ecuador by J. H. Conrad, Marvin Koger and G. O. Mott, October 10 to 20, 1973.
- Appendix D** Report of Marajó Project: The Natural Grassland Ecosystem and Livestock Development by G. O. Mott, March 1974.
- Appendix E** Plan of Research to Study the Response of a Complex Mixture to Different Grazing Management Systems by G. E. Maraschin and G. O. Mott.
- Appendix F** Abstracts of theses completed during the past year which are directly applicable to the University of Florida's competence in tropical animal science and tropical forages.

A. INTRODUCTION

The following information is provided for your information and is not intended to be used as a basis for any action.

APPENDIX A

APPENDIX A

Specific Activities and Meetings Directly Related to 211(d) Consortium

A meeting was held in Washington, D.C., October 30, 1973, in the Latin American Conference Room, State Department Building Room 2248.

Notes on the 211(d) Tropical Livestock Consortium Meeting in Washington, October 30, 1973:

Present from Consortium

Joe Conrad, University of Florida
Gerald Mott, University of Florida
George Cooper, Tuskegee
Dr. Moore, Tuskegee
Arlo Minden, Purdue University
Kelly White, Purdue University
Bruce McCarland, Purdue University
Ralph May, Purdue University
T. C. Cartwright, Texas A & M University

Dr. Carl Sierk was in charge for AID and had made arrangements for Drs. Long and McDermott and others to meet with the consortium members.

Joe Conrad asked each institution representative to give a brief summary of his past activities.

Dr. Kelly commented that the members reporting referred to a systems approach and asked for a clarification of who was responsible for constructing operational models and for the inputs. After a brief explanation that Texas was working on the production systems model and Purdue on the larger micro considerations, Dr. Kelly suggested that operational guidelines be established among the consortium members for their own use and for AID. Dr. Kelly also commented that the project will have a full time monitor within about 30 days to work 1/3 to 1/2 time on this project. The purpose is not to tell universities how to run their business, but the monitor may have suggestions. The functions of the monitor will be: 1) to have an intimate knowledge of what each institution is doing and 2) to take care of the chores of reporting, etc.

Purdue is to have the responsibility of coordinating the inputs into the model. The monitor is to facilitate the communications among members and with TAB and other agencies. Also, the monitor will be responsible for speaking for AID. All matters other than fiscal flow through the monitor. However, consortium members should feel free to talk to others in AID, such as the Latin American desk, etc.

Ken McDermott then commented noting that his office is manager of the grant which, in this case, is discharged at a very low level since the consortium provides its own direction. The contract officer is responsible for technical budget changes.

Joe Conrad asked why a monitor was being assigned to this project when it was not usual. Kelly answered that the reason this consortium is to get a 1/3 to 1/2 time monitor is because all grants should receive more monitoring. This particular project is more difficult than usual because four institutions are asked to focus on a broad question. This project was in process of approval for three years because of feelings that the unified cooperation of four institutions would not be possible, and that each would go its separate way. Dr. Kelly commented that it was probably a mistake to ask the consortium to comment on a monitor because this was simply an AID function which should have been handled by them internally.

Dr. Kelly commented that he felt it was wise that at least one additional country in Africa should be identified as a point of focus for the consortium. He did express his opinion that the consortium should not attempt to cover too much ground geographically. Beyond one African country, other countries would be more for the purpose of having alternatives rather than to broaden experience. Possibilities of other countries which were mentioned were Costa Rica, Dominican Republic, Colombia, and a country in West Africa. In response to a question about what he expected the consortium to accomplish, Dr. Kelly commented that the consortium should come out with a full set of recommendations for at least one country. These recommendations should reflect a coordinated systems approach for the country.

John Cooper gave a briefing on Africa. It was his opinion that it was basic to technical livestock assistance in Africa to consider the two centers, and the concepts of an International Livestock Network must be developed. Irrigations must have outlets into the International Network. He mentioned the Consultative Group on International Agricultural Research (CGIAR) which meets twice a year to pool information on food production problems (and only food). There are two new livestock centers in Africa. One in Nairobi, the International Lab for Research on Animal Diseases, focuses on Trypanosomiasis and East Coast Fever. Dr. Hodgson is on their board. They are working closely with the University of Nairobi.

The International Livestock Center for Africa (ILCA) has headquarters in Ababa, Ethiopia. This consortium is likely to be more in contact with the livestock center. This center is not to focus on a single narrow problem, but more on development of the livestock industry in African countries. This center is also unique in that it relates to social problems of implementation. A lot of effort went into setting up this center because of the diverse nature of geographical areas and social problems of implementation. It is, therefore, a departure from other centers. It is balanced between the Francophone and Anglophone countries and this is very important. There will probably be field stations in Ethiopia, Mali and Nigeria. The systems approach is to be their entire emphasis, and this consortium is very likely to be involved with general health problems, forage, extension and so forth.

The question about choosing a country for focus of the consortium should consider the balance between the Franco- and Anglophone countries. The regional look is very important since it is not feasible for the United States to think in terms of bilateral relationships such as can be done with countries such as Kenya. The Francophone countries are simply not distinct, viable, economic entities within themselves.

Lloyd Clyburn commented that the Francophone countries have placed considerable emphasis on livestock production. Mali would be a country of interest. The French language and transportation would be real problems in these countries. More than three people visiting at one time would tend to stress their facilities.

Comments on the situation in East Africa indicated the best approach would be to supplement present work either in Tanzania or Kenya. Tanzania was the favored of these two. Some comment was made about the Massai range development project which was similar to a lot of development in Kenya. It involved drilling wells, building ponds, setting boundaries and so forth. The program included consideration of credit, marketing, small ranches, village ranches, tsetse fly control, etc. The suggestion was that only one member of the consortium go in and contact AID to set up visits and field trips and to sell the program on the basis of supplementing ongoing programs. Everyone seemed to agree that, particularly after our Guyanese experience, it would be best to go in with a low profile. The feeling was expressed here and several times later that these economically poorer developing countries should not be asked to do things for the consortium and that, in fact, they would likely look askance at any request for us to come in.

Cooper commented again on the seminars in West Africa and on the fact that the possibility of a workshop in East Africa was being considered. The livestock leaders of Africa plan to come to the United States. The consortium trip to Africa is to help interact with them and to help develop competence in our institutions for technical assistance in Africa. Lloyd Clyburn commented on some of the principal problems of West Africa, particularly that of tsetse fly. The idea of the Africa mini seminar is to prepare the consortium to present seminars in the United States when Africans come to the United States. We were advised to do more observing rather than asking questions until we get directly with the cattle people in Africa. The directors of services are often not well acquainted with local problems. The feeling was expressed that "eyeball research" is what was needed--that if scales were needed the differences were too small to worry about. It was emphasized that small groups would be better than large groups, especially for initial contacts. The idea is to get familiar with African problems so that we can relate with Africa people. A few comments were made about the N' Doma cattle and the JVL Ranch (Joules Von Lanker). Also the point was made that project managers in the United States on home leave from Kenya, Tanzania and other places should make an effort to visit the consortium members. The consortium ended with a discussion of Latin American countries with Mr. Breitenbach from the Latin American desk, but the conversation seemed to shed little light on choosing an alternative country for the consortium. It is clear from exchanges between Cartwright and Breitenbach that the role of 211(d) grants is not appreciated and not welcome among many of those responsible for operation in AID and, es-

The final item of business was to confirm, by unanimous vote of members present, Joe Conrad as Chairman of the consortium for 1973-1974.

Names of those attending the 211(d) meeting and their Bureau affiliation.

<u>Name</u>	<u>Bureau</u>
Omer J. Kelley	Technical Assistance/Agriculture/Director
Carl F. Sierk	Technical Assistance/Livestock
C. Edmund Shuart	Technical Assistance/Livestock
Frank H. Madden	Technical Assistance/Livestock
John B. Cordaro	Technical Assistance/Programs
James K. McDermott	Technical Assistance/Research and Institutional Grants
Miloslav Rechcigl	Technical Assistance/Research and Institutional Grants
Stefan Krashevski	Technical Assistance/Economic and Sector Planning
Donald Anderson	Technical Assistance/Economic and Sector Planning
John L. Cooper	Africa/Development Services
Harold Kugler	Africa/East and South/Agriculture
Lloyd Clyburn	Africa/Central and West/Agriculture
Everett Headrick	Africa/East and South/Agriculture
Paul Brown	Africa/Central West/Agriculture
Henry Van Blake	Africa/Central West/Agriculture
Woodrow Leake	Africa/North/Agriculture
Boyd Ivory	Asia/Technical Support/Agriculture
Clyde Wilder	Asia/Technical Support/Agriculture
Boyd Whittle	Latin America/Agriculture
Charles Breitenbach	Latin America/Agriculture

A misunderstanding developed between the Ministry of National Development and Agriculture in Guyana and the 211(d) Tropical Livestock Consortium. Dr. Carl Sierk and Dr. Joe Conrad, Consortium Chairman for 1973-1974, were in Guyana from January 14 to 19, 1974, to resolve the problem. A memorandum and the minutes have been reproduced below.

M E M O R A N D U M

TO : 211(d) Livestock Consortium Members: T. C. Cartwright, Fred Maurer, George Cooper, T. Kell, White and G. O. Mott

FROM: J. H. Conrad, Chairman 1973-74

DATE: January 28, 1974

RE : Approval to Cooperate with the Ministry of National Development and Agriculture in Guyana

Enclosed, please find the approved and signed minutes of meetings which Dr. Carl Sierk, Mr. George Eason and I had with Mr. Ben Carter, Dr. Peter Fernandes and other members of the Ministry during our recent trip to Guyana.

On pages 4 to 7 are outlined the responsibilities of the various groups. In addition to this outline, there are a number of items which need to be discussed in detail. To do this, I am recommending that we meet in Memphis, Tennessee, at 3:00 P.M., at the Sheraton-Peabody Hotel on Monday, February 4, 1974. This is during the Southern Agricultural Workers Convention. If more time is needed, we can meet again Monday evening.

In general, we are definitely welcome to use Guyana as a real life laboratory situation. However, we will need to operate in a way which is not burdensome to the Ministry of Guyana. This means going there in small groups, making most of our own in-country arrangements, paying all of our own expenses, etc.

We are being asked by AID Washington to send one member from each University, for a total of 4 people only, to go to West Africa for 3 weeks in February or March. This would be the preliminary to holding a livestock conference for the West Africans here in the U.S. in July. We need to discuss this.

JHC/mej.

cc: T. J. Cunha
H. L. Popenoe
Carl Sierk
Omar Kelly
Darrel Fienup

MINUTES OF MEETINGS BETWEEN MINISTRY OF NATIONAL DEVELOPMENT AND AGRICULTURE, AID/211(d) LIVESTOCK CONSORTIUM--REPRESENTING UNIVERSITIES OF FLORIDA, PURDUE, TEXAS A & M, AND TUSKEGEE INSTITUTE, AND USAID

GEORGETOWN, GUYANA

JANUARY 15 to 17, 1974

These Minutes recognize that the Government of Guyana has specific objectives for the development of its agricultural sector which are briefly quoted as follows:

"The Guyana Agricultural Sector Development Goals for the planning period 1972-1976 are: (1) to increase the production and marketing of specified agricultural commodities to a level of domestic self-sufficiency, (2) to maximize the export of agricultural commodities for which Guyana has a competitive advantage with emphasis upon the CARICOM marketing community, (3) to allocate development investments equitably among the geographic regions of Guyana, (4) to create 10,000 new agricultural employment opportunities, and (5) to increase and distribute income in the agricultural sector more equitably between smaller and larger agricultural producers."

Furthermore, these Minutes recognize that grants have been made by the United States Agency for International Development to the University of Florida, Purdue University, Texas A & M University and Tuskegee Institute. The basic purpose of these grants is to improve the capabilities of these recipient U.S. institutions to design ruminant livestock development and improvement programs through a multi-disciplinary approach. This multi-disciplinary approach can best be developed and tested in a real life situation. Consequently, the Ministry of National Development and Agriculture and the members of the 211(d) Livestock Consortium have agreed that Guyana is an excellent country in which to develop and test this multi-disciplinary livestock development approach.

Work Plan Components

The two major components of the work plan are:

- (1) Computer "micro" models of ruminant livestock production on an individual herd basis for each of Guyana's major ecological zones which are (a) Coastal Area including Matthews ridge, (b) Intermediate Savannahs, and (c) the Rupununi Area.
- (2) A "macro" model of ruminant livestock (beef, dairy, goats, and sheep) production possibilities in the major ecological zones and consideration of the overall limitations to development (diseases, pastures and forages, nutrition, breeding stock, available capital, trained personnel, etc.).

Supplementary:

- (a) Veterinary Study. A survey of the more serious bovine parasites, and diagnosis of bovine babesiasis, anaplasmosis and trypanosomiasis, together with equine piroplasmosis and bovine brucellosis, tuberculosis and leptospirosis. If laboratory facilities permit, tests will be made to determine the presence of these diseases in sheep and goats.
- (b) Breed Evaluation. Existing data relevant to breed evaluation will be collected and analyzed and proposals made for further breed evaluation work.
- (c) Animal Nutrition and Beef Cattle Management. To generate coefficients relevant to the models; review data collected in Guyana and make proposals for further evaluation.
- (d) Export Market Survey. The extent of regional markets for Guyanese ruminant livestock products will be reviewed.
- (e) Extension Review. The adequacy of existing extension programs will be studied, together with their success in reaching special interest groups (e.g., young adults, part-time farmers, cooperatives, etc.). Changes within the extension program will be considered.
- (f) Producer Profile. A "sociological" survey will be conducted to study the role of livestock in producers' life patterns, and the characteristics of existing livestock producers. This will describe both economic (size of enterprise, resources, location, etc.) and sociological (family size, work force participation, educational level, goals, etc.) factors.

These work plan components will provide basic information with which to develop and evaluate the "micro" and "macro" models related to the potential for livestock production and development in Guyana. This information will assist the Government of Guyana in assessing its ruminant development prospects, in terms of:

1. What to produce? The competitive advantage of beef, dairy, sheep and goats.
2. Where to produce? The development potential of the various regions of Guyana which are (a) the coastal area including Matthews Ridge, (b) the Intermediate Savannahs and (c) Rupununi.
3. How to produce? What tropical grasses, legumes and crops to grow for forage purposes. What livestock management techniques to use, herd size, ranch size, breeds to recommend, veterinary and extension practices to emphasize and methods of marketing and distribution.

Responsibilities of Various Groups

It is fully recognized that the final result of these activities will be mutually beneficial to all cooperating groups. However, personnel, finances and time are limiting resources. Therefore, we have attempted to outline a division of responsibilities which will not be an undue burden on any one group and to utilize the currently existing organizations.

Guyana Ministry of National Development and Agriculture

1. The Guyana Ministry of National Development and Agriculture, as represented by Bernard W. Carter, Chief Agriculture Officer, will name a Coordinator and a specific counterpart in each of the subject matter areas of interest to the project:

These will be as follows:

Coordinator	Peter Fernandes*
Pasture and Forage Production University of Florida****	Peter Fernandes
Animal Nutrition University of Florida	Peter Fernandes
Animal Breeding Texas A & M University	Peter Fernandes
Veterinary Science Texas A & M University	Peter Fernandes
Extension Tuskegee Institute	John Browmann**
Sociology Tuskegee Institute	John Browman
Agricultural Economics and Computer Programing Purdue University	- Irwin Telfer***

*Peter Fernandes, D.V.M., is Principal Agriculture Officer, Veterinary and Livestock Science.

**John Browman is Principal Agriculture Officer, Extension and Education

***Irwin Telfer is Principal Agriculture Officer, Resource Development and Planning.

****Consortium institution responsible for subject matter area.

2. The counterparts will assist in arranging contacts and helping to obtain the desired information. When possible, they will accompany the Consortium members on visits and assist with interviews.

211(d) Livestock Consortium Members

1. The Consortium members will advise Peter Fernandes, Coordinator, their counterpart, and George Eason, AID/Guyana Food and Agriculture Officer at least one month in advance of their proposed visit. This will include proposed arrival and departure times, brief work plan and purpose of visit. After final plans are completed, AID/W will officially notify AID/Guyana, who will subsequently notify the Coordinator.
2. All written technical communications must be cleared with the appropriate counterpart.
3. Each Consortium member will be responsible for the payment of all expenses which he incurs while in Guyana. This includes taxi fares, rental cars and driver, airway fares, office space, secretarial fees and other logistical support. Currently, these are approximately as follows in U.S. dollars: car and driver per day, \$18; Matthews Ridge air fare, \$40 per person; Lethem, Rupununi, \$50; Ebini private rental plane, one trip out and one trip back, \$150 with maximum of 4 people. Secretarial fees are \$1.50 to \$2.00 per hour.
4. The Ministry and AID/Guyana can reasonably accommodate two people at a time. Special arrangements by the Consortium members will be necessary for larger groups.
5. Reports. It has been agreed that each visiting Consortium group will prepare a brief summary of observations, places visited, etc., and submit this to the Chief Agriculture Officer before leaving the country. In addition, 6-month reports beginning with the period January 1 to June 30, 1974, and a final report will be submitted by the Livestock Consortium. The final report will summarize the complete findings of the Consortium and include all summaries, analyses, conclusions, recommendations, etc. Ten copies of the semi-annual report and 25 copies of the final report will be submitted to the Coordinator for distribution and use by the Ministry of National Development and Agriculture.

AID/Guyana

To the extent possible, assistance will be given, but is greatly dependent on time and facilities available:

1. If advised in advance, they will arrange for Consortium members to be met at the airport, assist with clearance through Customs and provide round-trip transportation.

2. Assist with communications between personnel of the Ministry and Consortium.
3. Provide limited office space for one and limited secretarial assistance.

Period of Cooperation

The cooperative arrangement outlined in these Minutes are primarily concerned with the period between January 1, 1974, and December 31, 1975. However, these cooperative activities may be extended with the concurrence of all groups represented.

SIGNED BY:

Bernard W. Carter
Chief Agricultural Officer
Ministry of National
Development and Agriculture

Joe H. Conrad
Chairman, 1973/74
211(d) Consortium

George S. Eason
Food and Agriculture
Officer, AID/Guyana

Carl F. Sierk
211(d) Livestock Project Officer
AID/Washington

On February 3, 1974, a Consortium meeting was held at Memphis, Tennessee, in conjunction with the Southern Agricultural Workers Convention. A summary of the conclusions reached at this meeting are outlined in the following letter from Dr. Joe Conrad to Dr. Omer J. Kelly.

February 12, 1974

Dr. Omer J. Kelly, Director
Office of Agriculture
Bureau for Technical Assistance
USAID, New State Building
Washington, D.C. 20523

Dear Dr. Kelly:

During the past year, the 211(d) Tropical Livestock Consortium has been concerned with getting our activities underway in Guyana. Since our meeting in Washington, we believe that this objective is being accomplished. As you know, Dr. Carl Sierk and I met with Guyanese Ministry of Agriculture Officials and AID/G the week of January 14. We found the people in Georgetown very cooperative and sympathetic to the objectives of the Consortium.

We have just concluded a 211(d) meeting in Memphis, February 3, in conjunction with the Annual Meeting of the Southern Association of Agricultural Scientists. At this meeting we discussed in detail our operating procedures for our activities in Guyana. All of the members are in complete agreement and have their Consortium activities planned for the next few months in Guyana.

We are also in agreement that these activities in Guyana should be given top priority since we have selected this activity as a real life situation and proving ground for the Consortium activities. In addition, our work in Guyana has been under consideration for more than a year and was greatly delayed because of some early misunderstanding between the Government of Guyana and the Consortium as to what our function would be in Guyana. Consequently, our opinion is that we should get this phase of our activities underway prior to embarking on another Consortium activity.

We understand that the African Bureau would like for the Consortium to send one person from each institution to Central West Africa for three weeks to become better acquainted with the ruminant livestock situation in that area. Subsequently, the 211(d) Tropical Livestock Consortium would then plan a seminar for West African Officials here in the United States.

The Consortium is interested in participating in this activity because we understand the political and economical importance of it and believe we have the expertise with which to conduct a meaningful Tropical Livestock Seminar for the West Africans.

However, the Consortium members believe that they are fully committed to other activities related to the Consortium, as well as to the activities in Guyana for the next three months. Therefore, we are requesting that the West African trip be postponed until the latter part of May or the first part of June. We would like to suggest the week of May 19 as the earliest date on which representatives of the four universities could participate in the trip to West Africa. Furthermore, the tentative outline for the seminar could be planned during this trip.

A copy of the "Revised Proposal for Supplemental Support" from Purdue has been received by the Consortium. Copies are being distributed to other members for any comments they may have.

Sincerely,

SIGNED

Joe H. Conrad
Consortium Chairman
for 1973/74

JHC/mf

cc: T. C. Cartwright
George Cooper
Fred Maurer
G. O. Mott
T. Kelly White
T. J. Cunha
H. L. Popenoe
Carl Sierk

On March 5, 1974, Dr. Conrad met with various groups in Washington to develop plans for the Consortium trip to Africa and the proposed seminar. These plans were outlined in the following memorandum from Lloyd E. Clyburn to Fermino J. Spencer.

United States Government
MEMORANDUM

TO : Fermino J. Spencer, AFR/CWR
DATE: March 4, 1974

FROM : Lloyd E. Clyburn, AFR/CWR

SUBJECT: Livestock Seminar

Joe Conrad, president of the 211d consortium for animal science, met with TA/AG, AFR/DS and AFR/CWR this morning to pursue plans for the seminar for Central and West African livestock interests. This is where we come out:

1. The consortium is pleased to pursue the activities along the lines we identified--i.e. policies and strategies in range tenure administration. They see the possibility of the need of outside talent, in which case they would notify us and request that we retain such persons as consultants.
2. The consortium can provide four professors to make field observations after May 19. They see September the earliest date for the stateside seminar.
3. As we envisage the trip to Africa, they would spend about three days among the herds in Mali, probably around Kayes, three days or so in Upper Volta, and about the same length of time in the CA Livestock Project. They would be briefed at Dakar, Ouagadougou and N'Djamena.

We plan to apprise Dr. Robinet of the trip and determine whether he can join and guide them in their visit to Ouagadougou and possibly Lake Chad Basin. If he cannot, then we will try to arrange for them to see him in Paris.

We have tentatively arranged for IT to manage the participants, including meetings, orientation and interior travel.

It was established in the meeting that Dr. Carl Sierk will continue to be the action officer for TA/AG, and I will be action officer for AFR.

Copies to:

AFR/CWR:O. Cylke
C. Capoferri
L. S. Peek
D. Baker
J. McLaughlin
F. Miller

AFR/DS:P. Lyman
J. Blumgart
F. Abercrombie
SER/IT:N. Farris
TA/AGR:M. Galli
C. F. Sierk

On April 5, the 211(d) Livestock Consortium met in Atlanta to discuss the coordination of its activities in Guyana, its proposed trip to Africa, and its participation in the African workshop-seminar. This is outlined in the letter from Dr. Conrad to Dr. Kelly, dated April 17, and Dr. Kelly's reply of April 30.

April 17, 1974

Dr. Omer J. Kelly, Director
Office of Agriculture
Bureau for Technical Assistance
USAID, New State Building
Washington, D.C. 20523

Dear Dr. Kelly:

On Friday, April 5, the 211(d) Livestock Consortium met in Atlanta, Georgia, to discuss the coordination of its activities in Guyana and to discuss 211(d) activities with regard to Central and West Africa livestock interests as expressed by AFR/Central West Regional and AFR/Development Services. We are in complete agreement with our continued activities in Guyana, but, as a consortium, we would like to raise a number of questions concerning our participation in the African workshop-seminar.

During the 211(d) meeting in Washington on October 30, 1973, we received a briefing on Africa. One of the things discussed was the possibility of selecting an African country for our "Systems Approach to Ruminant Livestock Development in the Tropics." A number of countries in both East and West Africa were discussed, but it was agreed that we should first try to become operational in Guyana. This we have been able to do.

It was pointed out to us that it would be desirable for a number of the livestock leaders of Central West Africa to come to the U.S. Furthermore, a trip by the Consortium members to Africa would help develop competence in our institutions for technical assistance in Africa. Therefore, the idea of the African trip would help the Consortium assist in presenting seminars in the U.S. when the Africans come to the United States.

As Chairman of the 211(d) Livestock Consortium for 1973/74, I met with TA/AG, AFR/DR and AFR/CWR in Washington on March 4, 1974. We agreed it would be possible for the Consortium to provide four professors--one from each University--to go to Africa to make field observations after May 19. Each of the four would pay his own airfare, per diem and travel expenses from our own 211(d) grants.

In a memorandum of April 4 from Mr. F. J. Spencer AFR/CWR to Mr. Howard Helman, American Embassy-Paris, the Central West African Seminar was discussed in some detail.

In this memorandum, it is stated that "we took this up with TAB--the idea of inviting Central and West African leaders in livestock development to come to the U.S. for two or three weeks--who, in turn, discussed it with the 211(d) Consortium. The Consortium has expressed the willingness to invite the Central and West African leaders, as well as other interested persons, to spend two or three weeks here visiting and studying extensive livestock management systems."

In addition, the memorandum concerning the African workshop in the U.S. states that "our objectives are to lead the participants to (1) see and comprehend the ecological principles of range management, including its inherent output leverages; (2) see, discuss and understand communal rangeland administration; and (3) discuss and draft model, provisional national policies for the development and administration of their rangelands. As we see it, half to two-thirds of the exercise would be in the field and the rest would be spent in workshop sessions. In the workshop, they would see further explanation of what they will have seen, hear alternative approaches to the common Central and West African problems of range administration, and discuss strategies which might have adaptive value for African livestock development. Workshop range problems would be developed and resolved by the committee approach."

Specifically, the Consortium is raising the following points:

1. We do not believe it is the function of the Consortium to invite, organize, and conduct workshop-seminars of this type. Therefore, we do not think we should assume the leadership for this seminar.
2. The Consortium does not have expertise in a number of areas which are being emphasized by AFR/CWR which are a) ecological principles of range management, b) communal rangeland administration, and c) national policies on development and administration of rangeland. Therefore, these subject matter areas been to be developed by experts who are not members of the Consortium.
3. The Consortium is not in a position to develop and recommend alternative approaches to the common Central and West African problems of range administration, etc., at this time, nor will we be in a position to do so after a brief three-week trip to three or four African countries.

However, we do believe the Consortium is in a position to make a valuable contribution to workshop-seminars which emphasize the areas of our expertise. Among these are:

1. Tropical pasture and forage production and utilization.
2. Ruminant nutrition-protein, energy and mineral supplementation.
3. Improvement of tropical livestock through selection and breeding.
4. Identification and control of tropical livestock diseases.
5. The development and evaluation of the livestock extension program and the delivery systems.

6. Sociological factors which may affect the adoption of technology and the development of livestock production.
7. The development of models to simulate the production of beef for a defined set of environmental conditions and for given levels of resources.
8. The identification of opportunities for significant livestock development in LDCs, to analyze constraints to, and reasons for, such development and to design programs to overcome constraints through an integrated, multi-disciplinary team approach.

The Africa/CWR group in Washington has indicated that they are primarily interested in the African livestock leaders visiting western Texas and New Mexico. Therefore, it appears to the Consortium that AFR/CWR should develop its workshop seminar with the institutions in these geographical areas and that members of the Consortium be invited to participate in subject matter areas where expertise exists.

The assistance of TAB/AGR in clarifying the points the Consortium has raised would be greatly appreciated.

The Consortium is agreeable to sending one member from each of the four universities to Central West Africa between the periods May 18 to June 9. Under this arrangement, each member would pay his own transportation, per diem and expenses. A specific request from AID/W to participate in this activity would be hopeful in obtaining official University approval.

Sincerely,

SIGNED

Joe H. Conrad, Chairman
211(d) Livestock Consortium
for 1973-74

JHC/mf

cc: Dr. J. K. McDermott, AID/W
Dr. H. L. Popenoe
Dr. T. J. Cunha
Dr. G. O. Mott
Dr. Carl Sierk, AID/W
Dr. T. C. Cartwright, Texas A & M
Dr. F. D. Maurer, Texas A & M
Dr. George Cooper, Tuskegee
Dr. Kelly White, Purdue

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

April 30, 1974

Dr. J. H. Conrad
Institute of Food and
Agricultural Sciences
University of Florida
Gainesville, Florida 32611

Dear Dr. Conrad:

Your letter of April 17, raising several points related to the U.S. seminar (workshop) for African livestock leaders, has been reviewed in TA/AGR and discussed with CWR/AFR.

There is general agreement in AID/W that the Spencer/Helman memo of April 4 is somewhat restricted in seminar content than was originally considered. Since CWR/AFR strongly feels the seminar should emphasize range management and administration, the Africa Bureau will develop a proposal for consideration by Texas A & M for organizing and conducting the seminar.

We are all appreciative of the willingness of the consortium to cooperate in developing the seminar program. The specific points the consortium raised merit discussion.

- Point 1. The development of a conceptual outline for a seminar or workshop could be at the initiative of the consortium. (This initiative will no doubt be taken as capability and experience are acquired.) The invitation for country participation of this seminar is the responsibility of the Africa Bureau. The visit to African countries will place the consortium in a leadership role that will be difficult to shed.
- Point 2. The areas that will not be covered by the consortium are recognized, and the Africa Bureau is preparing to secure personnel to address problems relating to rangelands.
- Point 3. TA/AGR and the Africa Bureau staff are aware that the consortium is not in a position to recommend alternative approaches to the range problems that are common in West Africa. The Africa Bureau is in the process of reviewing and planning programs that could result in improving the forage resource base in selected countries.

Arrangements for the consortium personnel visit to Africa are proceeding as planned. Dr. Sierk will advise you on details.

Sincerely yours,
SIGNED Omer J. Kelly
Director, Office of Agriculture
Technical Assistance Bureau

The following is a report of the 211(d) Ruminant Livestock Consortium trip to West Africa--May 18 to June 9, 1974.

Participants: Dr. T. C. Cartwright, Texas A & M University
 Dr. Joe H. Conrad, University of Florida
 Dr. George Cooper, Tuskegee Institute
 Dr. T. Kelly White, Purdue University

Objectives: To familiarize members of the consortium with livestock-production-marketing in Central West Africa,
 To discuss with African livestock officials the forthcoming seminar for Africans on management systems for arid rangeland in the U.S. to determine their priorities for content and focus, and
 To provide a basis for consortium participation in seminar on management of arid range land.

Chronological Summary of Activities:

May 18 Departed for Paris.

May 19 Arrived Paris, France, early Sunday morning. Mr. Helman, USAID, was contacted and we were informed of an appointment with Dr. Robinet on Monday morning.

May 20 Met with Dr. Robinet for a brief discussion of conditions and problems in the Sahel of Africa. Our program for the trip was discussed and arrangements were made for Dr. Robinet to join the group on May 28 in Ouagadougou, Upper Volta. Departed Paris at noon and arrived at Bamako, Mali, in early evening.

May 21 Met Mr. Rex Henry (USAID/Dakar) at airport with intention of flying to Kayes as per schedule. Henry informed us of a change in schedule. During the remainder of the morning and most of the afternoon, we discussed the livestock situation, drought, development plans and programs and our best use of the time in Mali. Visited Dr. Diaoure, Chief Veterinary and Animal Industry Officer in Mali. He briefed us on the situation and government plans and programs, and suggested that we cancel the trip to Kayes and travel instead by car into the cattle areas north of Bamako.

May 22 Morning was spent trying to arrange for a Landrover for the trip. Afternoon drove to Segou, visited with personnel in the local Livestock Office and visited a feedlot being operated by the government. Continued on to Niono.

May 23 Visited the Livestock Service experiment station at Niono. Discussed research program of the station and conditions in the region. Toured a ranch operated by the station, observing range conditions and condition of cattle. Also observed confinement feeding experiments being conducted and bulls being used for herd improvement.

- In the afternoon drove to Nara stopping along the way to visit with migratory herdsmen, to observe range conditions and watering points.
- May 24 Met with personnel of the regional livestock office for a general discussion of livestock production and marketing in the area. Observed a herd which had been brought in for vaccination and interviewed the owner of the herd. Returned to Bamako observing range, water and livestock (both nomadic and sedentary herds) conditions along the way.
- May 25 Visited the large livestock market at Kati. Observed age and sex composition of animals on the market, collected information on price, origin and destination of cattle being sold, and interviewed a veterinarian and a group of cattle owners. Rex Henry returned to Dakar after having traveled with us for a week.
- May 26 Sunday was a free day, but we did visit the small goat and sheep market in the city. Also visited two city markets (fruit, vegetables, meat, fish, clothing, etc.)--one an outdoor market and the other an indoor market.
- May 27 Visited the Sotuba Livestock Research Station near Bamako. Observed breeding and feeding experiments and obtained data of feeding experiments. Also observed a pilot silage operation.
- May 28 Departed Bamako and arrived in Ouagadougou, Upper Volta, at noon. During the afternoon, we met with U.S. Embassy personnel for a briefing on the livestock situation and to plan our activities while in Upper Volta. We were given access to background materials from embassy files and spent some time reviewing these materials. Dr. Robinet arrived from Paris and joined us for the remainder of the trip.
- May 29 A short planning session was held with embassy personnel to make necessary in-country travel arrangements. We had conferences with a number of officials in the national livestock service, visited the old (operating) slaughterhouse and associated hide processing facility, visited the new slaughterhouse which is nearing completion, and visited the government school for training veterinary assistants.
- May 30 We flew by small plane to Gorom-Gorom where the local livestock market was visited and two French veterinarians were interviewed who were conducting a study for the USAID-MIT contract. We then drove to Markoy, a ranch established by USAID to demonstrate range improvement and controlled grazing. There, we toured the ranch, observed the striking contrast between range and conditions inside and outside the ranch and interviewed the National Director of Livestock and Veterinary Services who was also visiting the ranch.

- May 31** Traveled by car from Markoy to Dori where we attended a meeting at which government officials were explaining government programs for drought relief and responding to criticism from local people. We attended a luncheon given by the local military commander and had a brief session with the Minister of Agriculture. We returned by plane to Ouagadougou.
- June 1** Traveled from Ouagadougou to Yaounde, Cameroon. We had an opportunity to talk about an hour to Dr. Bill Morris of Purdue University at the airport in Abidjan.
- June 2** Sunday--free time.
- June 3** Met with AID personnel to discuss plans and for discussion of livestock situation. Visited with the director of animal production in the Ministry. Discussed livestock production and marketing and general economic situation with Dr. Ferguson, member of Southern University AID contract in Yaounde. We took the overnight train from Yaounde to Ngaoundere.
- June 4** Visited the Wakwa Experiment Station near Ngaoundere. We were briefed on the research and extension programs of the station, and the general livestock situation in the region. A number of pasture management experiments were observed, as were results of breeding work and forage trials. We departed Ngaoundere for N'Djamena, Chad.
- June 5** Met with embassy personnel to arrange schedule in Chad. We expressed a strong desire to visit two areas in the interior of the country, but, after much effort, these plans had to be abandoned because of government red tape and political unrest in the country. We had very informative meetings with representatives of the French Mission and with the director of livestock services in Chad. We visited and talked with a number of scientists at the Farcha Laboratories. A meeting was held with members of the staff of the Lake Chad Basin Commission, an international organization for the purpose of stimulating regional development.
- June 6** The group toured the feed mill operated by the Livestock Service and interviewed the director of the mill, had a second meeting with the director of livestock services for Chad, visited the Executive Director of the Lake Chad Basin Commission and two members of his staff, and toured the livestock market at Massaguet, about fifty miles from N'Djamena. On the return trip, we stopped at a watering point and interviewed a local cattle owner.
- June 7** Toured the slaughterhouse and cold storage facility and interviewed the manager. We visited the school for veterinary assistants and interviewed the director. The afternoon was utilized to write a report requested by the embassy.

- June 8 A final meeting was held with embassy personnel and our report on activities in Chad was submitted. We departed for Paris at noon and arrived in Paris late in the afternoon.
- June 9 Departed Paris for U.S.

List of Names and Addresses of People Contacted

Paris

Mr. Howard Helman
USAID/Paris
c/o American Embassy
Paris, France
Tel: (office) 265-7460, Ext. 7225
(home) 224-0688

Dv. André H. Robinet, Chief
(Office) Livestock and Fisheries Department
French Ministry of Foreign Affairs
20 Rue Monsieur
75007 Paris, France
Tel: SUF 79-70, Ext. 147
SUF 46-71, Ext. 147

(Home) 8 Rue Foury
92310 Sevres, France
Tel: 027-5356

Bamako, Mali

Mr. Rex Henry, Project Manager, Regional Livestock
USAID/Dakar

Dr. Alassane Diaoure, Chief Veterinary and Animal Industry Officer

Dr. Bobacar Sy, Head Meat Marketing Board

Dr. N'Galo Traore, Head Economics Institute

Niono, Mali

Livestock Experiment Station
Dr. Taoure, Sector Veterinarian
Dr. Magi, Veterinarian in Charge of Experiment Station

Nara, Mali

Livestock Station
Dr. Tall, Sector Veterinarian

Institut d'Élevage et de Médecine Veterinaire des Pays Tropicaux - I.E.M.V.T.

Centre de Wakaw, Ngao, Indere, Cameroon

N'Djamena, Chad

Ambassador Edward W. Mulcahy
Mr. Donald Hester, Vice Consul, also AID
Mr. René Guilbaud, Chief French AID Mission (Mission D'Aide et de Cooperation)
N'Gardoum Djidingan, Minister of Agriculture (did not meet)

- Dr. Mahamat Touade, Director of Livestock
- Dr. Albert Mamadou, Director of Slaughterhouse and Cattle Export
- Dr. Maver. Drought Coordinator at Ati

Lake Chad Basin Commission (Commission du Basin du Lac Chad)

- Mr. Benson O. Towne, Executive Secretary (Nigerian)
- Dr. Renard, Chief of the Livestock Sector
- Dr. Crouail, Director Assale-Serbewel Project
- Dr. Vallat, Chief Assale Sector Project (Chad)
- Mr. Scotty Deffendol, Chief Serbewel Project (Cameroon)

Dr. Jean Vandebussche (Feed Mill)
 Directeur du Centre de Modernisation des Productions Animales
 Farcha

Farcha Laboratories

- Dr. G. Tacher, Deputy Director (Directeur Adjoint)
 Newly appointed deputy director of International Livestock
 Center for Africa (ILCA) at Addis Ababa, Ethiopia
- Nokoury, DVM, Deputy Director
- Mr. A. Gaston, Agrostologist
- Dr. J. Gruvel, Entomologist studying tsetse fly

Laboratoire de Recherche Veterinaire et Zootechniques de Farcha (or)

Laboratoire de Farcha
 B. P. 433
 N'Djamena, Tchad

Institut d'Élevage et de Médecine Veterinaire - I.E.M.V.T.
 10, Rue Pierre Curie
 74700 Maisons-Alfort
 France

Summary Observations and Conclusions--Courtesy of Dr. Kelly White

1. We were in Africa at the very end of the dry season. Rains were just beginning. Thus, forage conditions were poor, but we were informed that this is not abnormal. Most cattle observed were in surprisingly good condition given the apparent shortage of forage. We were informed that cattle were in better condition than at same time the year before because grazing pressure had been reduced.
2. Estimate of reduction in cattle herd due to drought are generally in the neighborhood of 30%. The reduction includes loss from death, forced sale for slaughter and migration to the south where feed is more available. Actual death loss is believed to account for less than half of the herd reduction. The long-run effects of drought induced herd reduction cannot yet be determined. It is generally believed that present cattle numbers

- are more nearly in line with range resources than was the pre-drought herd. The age and sex composition of the herd has been changed by reduced calf crops and death and slaughter of younger stock and females.
3. There is difference of opinion as to which is more limiting--feed or water. However, it is obvious that, where water is available, the range is badly overgrazed and, where water is not available, there is unused forage. It appears that more water, without a means of controlling grazing, will lead to more overstocking and overgrazing.
 4. Most government officials talk of plans for restocking the range. This action must be carefully evaluated and a means of controlling stocking rates and managing forage found. Otherwise, this action will lead to another crisis.
 5. The current crisis and the associated encroachment of the desert often is attributed to mismanagement of resources. Recent weather has not been abnormal for the region. Too much pressure had been placed on the ecological system.
 6. There are striking examples of what can be done when good management practices are employed. The practices necessary are rather obvious. What is not obvious is a set of policies which will lead to adoption of these practices. One of the most serious obstacles appears to be that land is considered to be community property so that there is no way for the individual herdsman to reap the return from better range management or range improvement.
 7. Research and extension activities under the French system has been concentrated on disease control. Its success in this area has partially contributed to the overstocking problem. Much good basic research has been conducted. There is an apparent failure to train local people to replace the French technicians. There is a great need for broader and more practical research and extension programs--a total systems approach.
 8. Tax policies have made effective extension programs difficult because herdsmen distrust all government officials. The head tax on cattle does nothing to encourage more economic marketing of cattle.
 9. Nomadic herdsmen consider cattle more a store of wealth than a productive enterprise. This leads to retaining old, less productive animals and reduces productivity of range resources. Forced sedentarization of nomads is often proposed as a solution to this problem. This would appear to have inherent risk since much of the range is better suited to nomadic grazing. There may also be high social cost to such a forced change.
 10. The market system seems to be operating relatively efficiently. However, government market interference has in cases led to severe distortions.
 11. It is essential that the systems approach be utilized in formulation and evaluation of future policy toward livestock in this part of Africa.

APPENDIX B

MINISTRY OF EDUCATION AND SCIENCE

APPENDIX B

APPENDIX B

Livestock Production and Marketing in Pakistan

August 1973

At the request of the Government of Pakistan, USAID assembled a consultant livestock team with international experience to make a preliminary survey of the production and marketing of livestock and their products. The resulting report was concerned with four major meat and milk producing kinds of ruminant livestock--cattle, buffaloes, sheep and goats. The scope of the report covers feed and forage livestock diseases and pests, livestock nutrition and management, and economics of production and marketing.

The four members of the team were:

Calvin C. Boykin, Economist, USDA and Texas A & M University

Herbert L. Chapman, Jr., Nutrition and Management, Director Ona Range Cattle Research Station and University of Florida

Fred D. Maurer, Director Institute of Tropical Veterinary Medicine, Texas A & M University

Howard W. Ream, Professor of Forage Crops, University of Wisconsin

Dr. Chapman wrote a chapter on the Evaluation of Livestock Management Practices in Pakistan. A brief résumé follows, but the full text can be found in the final AID Report.

Appraisal of Public Programs of Research, Extension and Related Livestock-Oriented Activities

Extension

Livestock extension has emphasized disease control for some twenty years. In recent years it has added artificial insemination to the programs; these are both very worthy programs. However, one thing that was repeatedly emphasized by people we interviewed was the need for an extension program that would cover all aspects of livestock production.

Research

At the present time the majority of research programs are located in Punjab and Sind provinces. These programs are staffed by very capable people who have good insights on the problems they are facing. However, there are inadequate numbers of research faculty. Most physical plants appeared adequate, but some units were having difficulty filling vacant research positions.

Most of the present research facilities are rather large in scope. There appears to be a need for a number of small, strategically located research centers in various locations throughout the country to deal with specific commodity, geographical or socio-economic problems.

Suggested Action Programs Needed for Pakistan's Livestock Industry

The action programs can be classified into two categories: those with potential for providing fairly quick results; and those that require a long period of time to produce results. The management-related programs that should be undertaken are listed below.

Action Programs That Could Yield Quick Results (1-3 years)

Establishment of forage research centers in each province. This should have a very high priority and should include variety tests, fertilizer and management tests, etc.

Develop forage extension programs to accelerate increased forage production with known tested varieties, fertilizer and management practices.

Establish compulsory control of brucellosis and tuberculosis. A test and slaughter program would quickly eliminate perhaps 10 to 15 percent of the current animal inventory, thus reducing the overstocking problem, and also would eliminate a serious human health problem.

Develop program for salvaging milk cows and bullocks for meat production.

Develop program for growing out unwanted buffalo and cattle calves.

Evaluate biuret-mineral supplements for each class of livestock.

Utilize foreign demand as a price incentive for improved production of livestock and livestock products.

Feasibility of Commercial Meat Production in Pakistan

The principal constraints currently limiting commercial meat production in Pakistan are:

1. low production capabilities of indigenous livestock;
2. lack of systematic animal replacement system;
3. lack of understanding of fodder crop potential and failure to employ improved fodder and range management practices;
4. inadequate nutrition for livestock;
5. inadequate disease and parasite control;
6. lack of adequate marketing and slaughtering facilities;
7. lack of an understanding of economic inputs in relation to potential outputs;

8. price structure of beef, mutton, goat and poultry;
9. lack of a good production system geared primarily for meat;
10. small size of operating units in respect to livestock.

While the cumulative effect of the above factors are very formidable, the potential for commercial meat production in Pakistan is outstanding, even with the indigenous breeds, and will be more outstanding if improved germplasm is introduced. However, if this potential is to be reached, it will require firm attention to reduce and/or eliminate the effect of each of the above constraints. This will not be a simple undertaking, will require a massive education program and a major shift in thinking of the people.

For example, steps that could be taken, immediately, that would provide quick meat production include:

1. initiating improved production procedures on fodder. This could increase amount of available fodder 2 or 3 times present yield.
2. replacing 20 percent of adult buffalo and cattle females each year, on the basis of reproduction, milk performance and health;
3. selling bullocks after the 4th or 5th year for meat, replacing them with younger males;
4. replacing 30 percent of adult sheep and goat females annually, based on reproduction, milk yield and health;
5. growing buffalo calves out to one year of age and sell for beef;
6. feeding a mineral mixture.

The simple step of culling cows and bullocks before they die would let these animals be salvaged for meat and add a great deal to the meat supplies and economy of Pakistan. Tables 2 and 3 present some estimates of the amounts of meat that could be generated simply by selecting animals for sale, before they die. Actually, these figures are conservative.

A very important side benefit from this practice will be that culling the poor producers will cause the average production of cows and buffaloes to increase and mortality will be greatly reduced because the animals will be salvaged instead of being allowed to die. The beef from these animals will not be as good as that from young animals, but will still be quite satisfactory for speciality items.

Similar results can be obtained by proper culling goats and sheep and this will further increase meat production with no capital outlay.

However, a cow or buffalo should not be culled merely because she has dried up, between calves. She should be culled only because she is over 8 years old, or because she gives a low milk yield during the last lactation, or because she fails to conceive. Outstanding females may be lost if they are slaughtered simply because they have dried up, preparatory to having another calf. Be sure to breed milking buffaloes and cattle so they can calve on a regular basis.

Another step that could add a considerable amount to Pakistan beef production would be to grow out the buffalo male calves to about 12 months of age. The calves would weigh about 600 pounds at that age. It is estimated that there are 1,000,000 of these calves a year, but it would appear there should be around 1,400,000. If a million could be raised, it would add about another 300,000,000 pounds of carcass beef per year.

These examples are presented as three relatively easy steps that could provide about 2,000,000,000 pounds of beef per year without a great deal of expense. As the constraints listed earlier are removed, the amount will increase. There are a number of other factors that will increase meat production, such as increased fodder production, increased livestock quality, supplemental feeding in conjunction with fodder, etc. These factors will follow as a natural cause if the other suggestions are carried out.

In closing, it is important to re-emphasize that the future potential for meat production in Pakistan appears to be almost unlimited--providing the constraining factors can be modified or eliminated.

APPENDIX C

REPORT OF CONSIDERING THE TO CONDO

John H. Gorman, Animal Nutrition
Melvin Koster, Animal Nutrition and Production
C. H. Holt, Research and Forestry

APPENDIX C

APPENDIX C

REPORT OF CONSULTING TRIP TO ECUADOR

by

Joe H. Conrad, Animal Nutrition
Marvin Koger, Animal Breeding and Production
G. O. Mott, Pastures and Forages

October 10-20, 1973

Objective: To review pasture and livestock research program between INIAP and University of Florida

Dates and places visited

- Oct. 11 and 12 - INIAP Experimental Station, Pichilingue
- Oct. 13 and 14 - INIAP Experimental Station, Portoviejo; also Manta area and Andrade Ranches near Chone
- Oct. 15, 16 and 17 - INIAP Experimental Station, Santa Catalina
- Oct. 18 and 19 - INIAP Experimental Station, Pichilingue

We were met at the airport in Guayaquil by Drs. Kamal Dow, John Bishop, and Luis Tergas. After we had lunch together, Kamal Dow returned to Quito, and all the others went to Pichilingue. At INIAP, Pichilingue, we reviewed all of the pasture and animal research in progress at the station. These two and one-half days were spent both in the field and in the classroom. We were very favorably impressed by the excellent progress which was being made by the research team in pasture and forage and animal production.

Some basic concepts:

1. The INIAP Pichilingue station is located in a relatively high, but seasonal rainfall area. However, the rainfall varies from less than 500 mm to nearly 4,000 mm in the region served by this station.
2. Quality pasture and pasture management appear to be much more limiting than quantity of pasture and forage in the Pichilingue area.
3. Some averages for cattle production in the area are (a) only 45-50% of females wean calves; (b) cattle reach slaughter weight at 4-5 years of age; and (c) milk production is about 2.4 liters/day.

Current research in progress at INIAP Pichilingue and INIAP Santa Catalina was reviewed by the Livestock Steering Committee at meetings at both stations between October 16 and 19. Director Portilla, INIAP, CIAT, and University of Florida Contract personnel were in attendance at all of these meetings. Research objectives and outlines, field and laboratory trials, as well as factors limiting research were discussed in detail during these four days. Copies of these research objectives and outlines are available from INIAP. Consequently, there is no need to reiterate these in detail in this brief report. However, a few issues will be outlined and discussed.

1. We were very favorably impressed by the excellent research progress that has been made by INIAP and Florida personnel during the time of the contract. In general, objectives of the contract are being met and the results appear to be having a mutually beneficial effect. As a result, the constructive criticism which we express is relatively minor when viewed within the overall context of the complete program.

2. Since the rainfall varies from less than 500 mm to nearly 4,000 mm in the region to be served by Pichilingue, a number of ecological zones are created, each of which requires detailed agronomic adaption studies. The resources are not available for regional trials and progress in developing new species and adapted legume-grass associations will be severely restricted. Transportation, manpower, and facilities for small-plot grazing trials are essential for this evaluation program.

The forage research program at Pichilingue is well planned to cover the initial phases of forage evaluation. Resources are needed to evaluate new forage grasses and legume-grass associations with growing animals and to measure animal production.

3. Numerous individuals expressed the view that cattle reproduction was one of the most important problems that had to be solved before cattle production could be substantially increased. A complete production-management system has been developed in great detail by D. Bishop and the INIAP personnel. However, very little if any demonstration or field trial research is underway to obtain the answers to increasing reproduction in the cattle herds. It is true that many assumptions had to be made in the development of this cattle production and management program. However, research and demonstra-

tion trials with cattle need to be conducted to verify the importance of these assumptions. Results need to be obtained which the cattle producers in the area can use.

Some of the details that should be considered are:

- a) When do lactating cows normally conceive in this region?
- b) Calving should start about 6 weeks ahead of good feed.
- c) Following a breeding season simplifies management.
- d) Start breeding about 6 weeks after good feed becomes available.
- e) Genetics and management are interrelated and they should be considered together.
- f) Breed effects may be one of the most important things to be studied in increasing reproduction.
- g) A few important key breed and breed crosses should be studied among which are Criollo, Brahman, Holstein, and Brown Swiss.
- h) Criollo cattle have passed through hundreds of years of natural selection with adaptability being the first priority and production second, and they will respond to selection pressure.
- i) INIAP and cattle producers should be encouraged to maintain a few good Criollo cattle herds for production of cattle to be used in crossbreeding programs.
- j) Fertility in both Brahmans and Criollos may be relatively low, but the F_1 cross often has a fertility level of up to 90%.
- k) A rigid culling program should be encouraged and followed to increase the reproductive rate.

4. There appeared to be general agreement that quality of forage was much more limiting than quantity of forage. The rainy season begins the middle of December in the Pichilingue area, yet there was abundant forage available in late October, which was less than two months before the beginning of the rains.

Research in the southern U.S. and areas of the tropics has shown that when low quality forage is available, the first limiting nutrient is probably digestible energy rather than protein or phosphorus. Even a small amount of supplemental energy, protein, and phosphorus may be sufficient to shift the reproduction pattern from an alternate year calving to an annual calving. One must then ask the following: what are the constraints to reproduction, and what are the minimum inputs needed to increase reproduction, and are these economical under the price relationships which exist in Ecuador? Research needs to be initiated to find answers to these questions.

5. More animal oriented field research should be designed and conducted as soon as possible. A few important constraints to reproduction should be studied within a limited number of cow-calf production systems. It is true that only a few variables can be studied, but results from this type of research are needed in the area to convince cattle producers as to the feasibility of adopting recommended practices. Of course, this research is also needed to verify some of the important assumptions that have had to be made.
6. Closer cooperation between INIAP Quito-Santa Catalina and INIAP Pichilingue should be encouraged. Although radio communications work quite effectively, it is apparent that personal communications leave much to be desired. This

was discussed in some detail and, hopefully, it has improved. However, closer cooperation and support are greatly needed in the areas of soils, pasture evaluation, and agricultural economics.

- A number of the technical livestock people in Ecuador, Colombia, and Venezuela who were in livestock research are now affiliated with livestock loan programs in their countries. Cooperation between these technical livestock people in the loan programs and the research people at the experimental stations should be encouraged. In-depth studies of the production practices used by the better livestock producers in these bank loan programs will give excellent insights into some good economical practices which are already being used in the country. Because of flexibility, initiative, and funds, there are always a few private livestock producers who are either up with or ahead of the research that is being conducted at the experimental stations. Likewise, the technical livestock loan people frequently need to obtain the latest information and ideas from the experimental stations. Therefore, this association can be mutually beneficial and extremely important to livestock development.

- 8. Logistical and monetary support were constraints to research at Pichilingue. It was our understanding and observation that an inefficient, slow, and cumbersome purchasing system had to be followed in order to obtain some of the relatively small items needed for research. When this was brought to the attention of Director Portilla, he immediately established a revolving fund at Pichilingue for the purchase of the necessary items. It was established that when these funds were exhausted and fully accounted for that additional funds would be authorized. All indications are that this is working satisfactorily.

Transportation in support of the research program was found to be unsatisfactory. It was understood that a vehicle had been promised months earlier, but had not been delivered to the contract personnel at Pichilingue. It was our observation that this shortage of transportation has having an adverse effect on the research effort. However, it is our understanding that subsequent to our visit, adequate transportation is being furnished.

APPENDIX D

Department of the Interior
Bureau of Land Management
Washington, D.C. 20250

APPENDIX D

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**Report to the
General Secretariat
Organization of American States**

**THE MARAJÓ PROJECT
THE NATURAL GRASSLAND ECOSYSTEM
AND LIVESTOCK DEVELOPMENT**

**G. O. Mott
Professor of Agronomy
University of Florida
Gainesville, Florida**

March 30, 1974

ALTERNATIVE SCHEMES FOR IMPROVING LIVESTOCK PRODUCTION

There are many weaknesses in the present systems of cattle management on the ranches of Marajó Island. These have been dealt with in the livestock report. The ultimate result of the weaknesses in the systems is reflected in the estimated low extraction rate of 8.55%. The following discussion will indicate some possible alternatives which, if implemented, could greatly increase the output of beef of Marajó and also improve the quality of the product. Improvement of beef cattle production is finally reflected in an increase in extraction rate.

Effect of Supplying Artificial Pastures for Finishing Young Stock for Slaughter

One of the most serious weaknesses of the present system of cattle management is the large quantity of feed resources which is spent for maintenance of the animals on the range. The branding percentage of 54 percent means that the maintenance cost of almost two cows is required to produce one calf each year. The three to five years required to produce a slaughter animal means that nearly 90 percent of the feed consumed by growing-finishing animals is used up for maintenance (see Table 4). The pattern of liveweight of growing animals on the ranges of Marajó is illustrated in Figure 3. This shows that the animals are gaining weight for about eight months each year and losing weight for about four months. The overall effect is to produce an animal weighing approximately 300 kg at about 4-1/2 years of age.

The dotted lines in Figure 3 illustrate the pattern of liveweight increase which can be expected by supplying improved artificial pastures at the end of

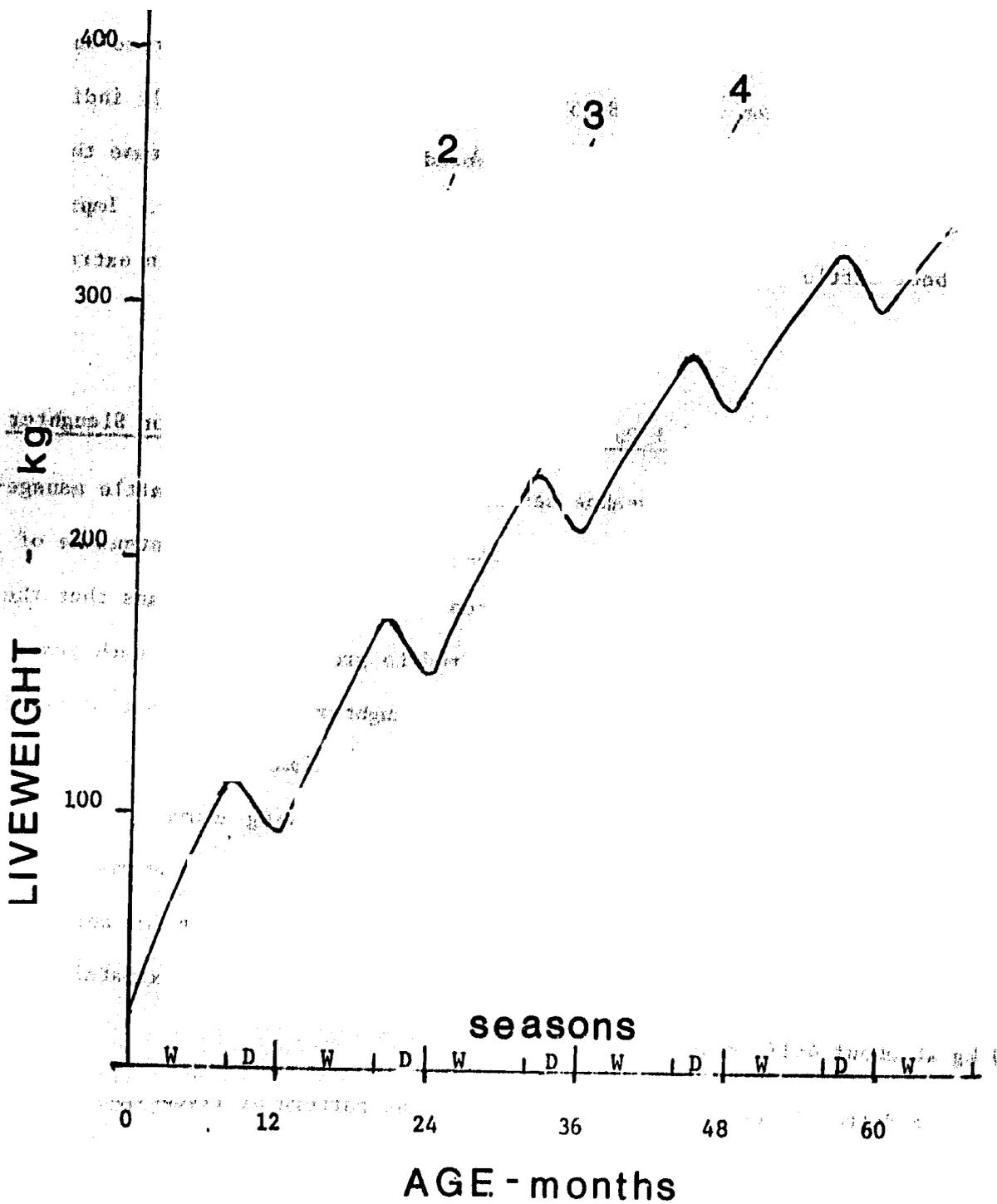


Figure 3. Estimated Seasonal Growth Pattern of Growing-Fattening Steers on Native Range of Marajó Island
Dotted lines indicate the growth pattern which might be expected when artificial pastures are supplied at different ages to produce a slaughter animal at 2, 3 and 4 years of age.

the first, second and third wet seasons. If the young stock are removed from the herd and placed on improved pastures when they are eight months of age, it is not unreasonable to expect them to reach a weight of 350 kg at two years of age. This would require an average daily gain of 0.5 kg/day for a period of 16 months. Similar patterns of increase in liveweight can be expected if the young stock are removed at 20 and 32 months of age and placed on artificial pastures. Slightly heavier weights would be expected at the end of a 16 month finishing period, but the average daily gains would be lower for the older animals than for the calves.

If artificial pastures can be made available either on the ranch which produces the calves or within a reasonable shipping distance from the ranch, then the rancher has several alternatives available. The following are some of the alternatives:

1. Establish a small area of improved artificial pasture on the most fertile site on the ranch and maintain these pastures in highly productive condition by fertilization and good grazing management. At eight months of age, the calves would be removed from the herd and grazed on the improved pasture on the ranch for four, eight or sixteen months (see Table 7) depending upon the amount of pasture available. On most ranches, only a small area may be available in which case the best alternative may be to keep the eight-month old calves on the ranch for about four months after which they would be strong enough to be moved to improved pastures in a finishing area. Other alternatives for eight-month old calves would be to move them directly to the finishing area. Whichever alternative

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Table 7. Alternative Systems for the Use of Artificial Pastures for Growing-Finishing Stock From the Beef Herds of Marajó

	Months on artificial pasture	Age of young stock when removed from herd							
		Months							
		8	8	8	8	20	20	32	32
Artificial pasture on ranch	4	↓	↓	↓	↓	↓	↓	↓	↓
	12	↓	↓	↓	↓	↓	↓	↓	↓
	16	↓	↓	↓	↓	↓	↓	↓	↓
Artificial pasture off ranch - finishing area	4	↓	↓	↓	↓	↓	↓	↓	↓
	12	↓	↓	↓	↓	↓	↓	↓	↓
	16	↓	↓	↓	↓	↓	↓	↓	↓

is selected, a total of about 16 months will be required for the finishing process and the choice will depend upon the amount of pasture available on the ranch and in the finishing area off the ranch. If the calves are left on the ranch for only 4 months to graze the improved pasture, the improved pasture would then be available to graze the young replacement heifers or the cows during the remaining 8 months.

2. Since the 20- and 32-month old stock would be strong enough to be transported, the rancher would have the alternative of retaining these animals on the ranch if sufficient artificial pasture is available or shipping them to a finishing area.

Artificial Pastures in a Cattle Finishing Area - Southeast Coastal Area

One of the most promising areas for the development of artificial pastures is on the medium textured yellow latosols, the well drained hydromorphic laterites, and the red yellow sandy quartz scils on the southeast coastal areas. There appears to be more than adequate areas of these three soils for the establishment of sufficient artificial pasture to provide high quality feed for finishing all the young stock from Marajó. This area has the advantage of having the breeding area of native pastures on one side and the population center of Belém and a ready market on the other. The distances are relatively short and both the movement of the young stock to the finishing area and the shipment of the finished animals to the slaughter house can be accomplished by boat (see Figure 4). This alternative should be investigated, particularly the establishment of high producing, high quality pastures in this region. If artificial pastures can be established and preliminary studies by IPEAN indicate their feasibility, the entire enterprise of beef cattle production on Marajó Island can be made highly efficient without the use of any supplemental energy or protein concentrate.

Effect of Removing Young Stock Upon the Composition of the Herd

If one of the alternatives proposed in the previous section is adopted, the effect upon the cow herd, the composition of the entire herd and the consequences upon calving percentage, death loss, branding percentage, and extraction rate are examined in Table 8. The first column of figures uses as assumptions some of the parameters obtained from a study of beef herds on Marajó. These are a branding percentage of 54, an annual death rate of 10 percent and a breeder replacement rate of 10 percent. For purposes of projection and calculation, it was assumed that, as the rancher began removing animals from the herd at a younger

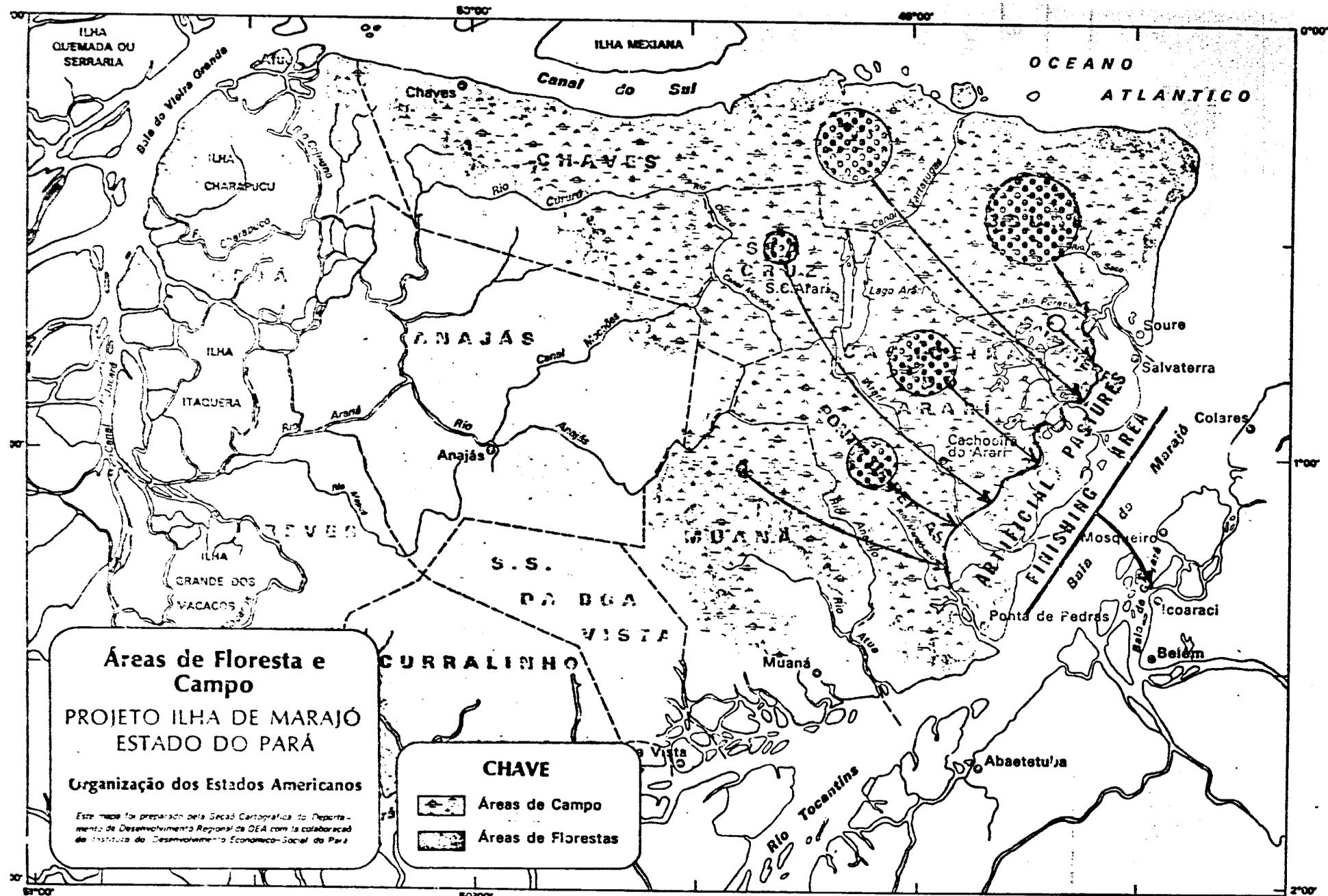


Figure 4. Finishing Area Showing Movement of Young Stock From Native Pasture and to the Market Area

Table 8. Estimated Changes in Herd Composition When Growing-Fattening Animals Are Marketed at Various Ages. (Adapted from McDowell, 1966)
Fixed area of land - approximately 6500 hectares of range land, Marajó

	Age of Sale (months)				
	56	44	32	20	8
Cows (3 years and older)	500	600	720	864	1036
Herd bulls (3 years and older)	25	32	40	50	65
Animals in other age groups:					
44 - 56 months	126/58 ¹	-	-	-	-
32 - 44 months	198	270(82) ²	121 ³	162 ³	224 ³
20 - 32 months	220	294	394	163 ³	228 ³
8 - 20 months	244	320	420	546	233 ³
0 - 8 months	270	348	446	570	726
Total animals in herd - all ages	1583	1864	2141	2355	2512
Number of animals sold					
Age 56 months	126				
44 months	-	188			
32 months	-	-	273		
20 months	-	-	-	383	
8 months	-	-	-	-	488
Cull animals	58	82	121	162	224
Total animals sold - all ages	184	270	394	545	712
Extraction rate		14.5	18.4	23.1	28.3
Assumptions:					
Branding percentage/year %	54	58	62	66	70
Annual death rate after weaning %	10	8	6	4	2
Breeder replacement/year %	10	12	15	17	20

¹ 58 head of 4-year olds already moved to breeding herd (included in 500 cow herd).

² 82 head of 3-year olds ready to be moved to breeding herd (not included in 600 cow herd).

³ Replacement heifers and bulls.

age, he would also improve many components of management. These innovations would include more rigorous culling of the cow herd, feeding of mineral supplements, protecting the herd from flood waters which would result in increased branding percentages, decreased death losses, an increase in breeder replacement and a marked increase in extraction rate. The figures might suggest that the only factor operating in the various systems is the "age of sale" of the young stock, but this is not the case. It is assumed that a package of improvements is operating as the young stock are sold at a lower age.

An examination of the data shows that when the young stock are sold at 56 months compared with 8 months, the number of breeding cows is increased from 500 to 1036, the total number of animals on a fixed acreage increases from about 600 to 2500, number of animals sold increases from 184 to 712, and extraction rate increases from 11.6 to 28.3.

It is obvious that the animals sold at the ages indicated must be supplied feed from some other source, so the success of any of these plans is contingent upon the establishment of artificial fattening pastures on the ranch or at some other location. The southeastern coastal area appears to be the most promising location.

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APPENDIX E

FORN PLAN OF RESEARCH
FOR THE NATION

MAY 1950

APPENDIX E

APPENDIX E

WORK PLAN OF RESEARCH
FORAGE EVALUATION

May 1974

1) - Name of the Project

Response of a Complex Pasture Mixture to Different Grazing Management Systems.

2) - Project Leaders

Gerzy E. Maraschin - Graduate Student
Gerald O. Mott - Professor of Agronomy

3) - Cooperators

a) - Personnel: D. E. McCloud, Professor of Agronomy
J. E. Moore, Professor of Animal Science
J. H. Conrad, Professor of Animal Science
C. J. Wilcox, Professor of Dairy Science
R. C. Littel, Professor of Statistics

b) - Institutions:

- Agronomy Department: Beef Research Unit and laboratories.
- Animal Science Department: Facilities at the Beef Research Unit and Nutrition Laboratories.
- Agency for International Development, sponsor of the training program and the scholarship toward advanced degree.

4) - Location

This project will be conducted at the Beef Research Unit, University of Florida, in an area of approximately 5 ha., together with the facilities for handling cattle, weighing facilities, and the existing facilities at the Nutrition Laboratory.

5) - Date

The project will begin in the Summer of 1973, and the experimental period will start in the Spring of 1974.

6) - Duration

Collection of data will be during Spring, Summer and Fall of 1974.

7) - Objectives

- a) - To determine the response of a complex pasture mixture to varying levels of the variables Grazing Days, Resting Periods and Grazing Pressure;
- b) - To express yields in terms of dry matter production, carrying capacity, as well as determining changes in botanical composition over time as influenced by treatment effects.
- c) - To estimate liveweight changes in the grazing animals and estimate the TDN consumption from the pasture.
- d) - To generate coefficients from the response surface design which will be useful in developing forage-livestock feeding systems and provide information for further research.

8) - Importance

Forage-livestock feeding systems are mainly concerned with the quantity of saleable animal products produced. Little or no attention has been given to the factors inherent in the system which affect forage production and persistence of the species in the association. In the evaluation of forage species under grazing, different pastures are usually maintained at equal grazing pressures, so that pasture comparisons are not biased by differences in grazing pressure. However, when developing a management system for a given pasture, a study of different grazing pressures may be necessary if a compromise between the optimum for the plant and animal is to be determined.

The three major components of grazing management are (1) length of grazing period (grazing days), (2) length of rest period, and (3) grazing pressure. In legume-grass associations, it is very important to determine the independent effects and the interactions between these three components. The individual species response, as well as the dynamics of the equilibrium between species must be known to formulate mixtures which will be productive under various sets of circumstances. Agronomic measurements on the behavior of tropical forage legumes grown in association with grass species are of primary importance in assessing the actual value of a pasture.

The tropical forage legumes with their broad spectrum of adaptation and, if properly maintained as an active component of a pasture mixture, can be viewed as a source of nitrogen to the soil and a higher nutritive value for the animal feed supply. Successful legume-grass associations should result in low cost animal production.

9) - Previous Work and Present Outlook

An evaluation of pastures in terms of animal production alone provides no direct information about the changes in botanical composition, productivity and availability of the pasture resulting from grazing management systems (5). Rotational grazing causes different effects on sward composition from those caused by continuous grazing (4).

Estimation of botanical composition has always been a problem in grazing management studies. Increased grazing pressure results in differences in botanical composition (3). Methods and techniques for estimating botanical composition (1) and for tracing changes during a course of an experiment (9) have been presented. Number and size of sampling units for botanical composition studies are quite variable according to the objective methods used (3, 5, 7, 11).

Estimates of forage yield have been made either by direct measurements (2, 4, 7, 15), by adjusting grazing pressure (10) or by indirect measurements (12, 14, 16). When soil fertility is not a limiting factor, no evidence of fertility transfer between paddocks could be detected (11).

Improvements in techniques for studying grazing management systems have made possible the use of small paddocks in pasture evaluation studies (6, 7, 11). New experimental designs have made possible the use of factorial arrangements of treatments with considerable reduction in the number of experimental units, reducing costs and allowing for increased information for the same period of time. Data obtained in such evaluation trials are useful in formulating new pasture mixtures, developing improved management systems and improvement of pasture yield. Liveweight changes and carrying capacity of the pasture can be estimated from these trials and an estimate of the TDN consumption obtained.

Abstract of the Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Agriculture

THE COMPARATIVE, TEMPERATURE, AND
WHOLE VALUE OF GRASS-LEGUME ASSOCIATIONS
IN THE WET-DRY TROPICS OR COASTAL HIGHLANDS

Robert Earl Hodgson

August 1973

Chairman: Dr. W. S. Hoar
Major Department: Agronomy

The comparative and nutritive value of 12 grass-legume associations and the
effect of temperature and quality resulting from the inclusion of a legume
grass into the system was studied from 1971 to February 1973 on the coast

APPENDIX F

of Florida. Three and six week clipping treatments were used on *Panicum*
maximum (P.), *Brachiaria distachya* (B.), *Stylosanthes bifida* (S.), and *Centropogon*
distachya (C.). Each of which was subjected to five treatments. The
control and a fertilizer treatment were on pure stands of each grass species,
while the legumes *Centropogon pubescens* (C.), *Macrochloa atropurpurea*, and
Pennisetum polystachyon (P.) were incorporated with the grass species in
the remaining three treatments. *P. polystachyon* outyielded ($P < 0.01$) the other
grass species, followed by *P. maximum*, during the wet and dry seasons of each
clipping frequency, while there was no difference ($P > 0.05$) between the
highest yielding *P. polystachyon* and *C. pubescens* treatments. Although *P. polystachyon*
yielded in a greater overall production of dry matter, the incor-
poration of a susceptible legume resulted in a higher quality feed in
terms of crude protein values.

Abstract of the Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Agriculture

THE COMPATIBILITY, PERSISTENCE, AND
NUTRITIVE VALUE OF GRASS-LEGUME ASSOCIATIONS
IN THE WET-DRY TROPICS OF COASTAL ECUADOR

by

Robert Earl Hudgens

August 1973

Chairman: Dr. G. O. Mott
Major Department: Agronomy

The compatibility and persistence of 18 grass-legume associations and the effect on forage production and quality resulting from the inclusion of a legume into the sward was studied from May 1972 to February 1973 on the coast of Ecuador. Three and six week clipping frequencies were used on Panicum maximum Jacq., Pennisetum purpureum Schumach, Hyparrhenia rufa (Nees) Stapf., Digitaria decumbens Stent., Cynodon plectostachyus (Schum.) Pilger, and Cenchrus ciliaris (L.) Link, each of which was subjected to five treatments. The control and N fertilized treatments were on pure stands of each grass species, while the legumes Centrosema pubescens Benth, Macroptilium atropurpureum, and Desmodium intortum (Mill.) Urb. were incorporated with the grass species in the remaining three treatments. P. purpureum outyielded ($P < 0.01$) the other grass species, followed by P. maximum, during the wet and dry seasons of each clipping frequency, while there was no difference ($P > 0.05$) between the highest yielding N fertilized and C. pubescens treatments. Although N fertilization resulted in a greater overall production of dry matter, the incorporation of a compatible adapted legume resulted in a higher quality sward in terms of crude protein yields.

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Agriculture

PHOSPHORUS AND TRACE MINERAL STATUS OF BEEF CATTLE
IN THE GUANACASTE REGION OF COSTA RICA

by

Carlos Enrique Lang Rojas
April 1974

Chairman: Lee R. McDowell
Major Department: Animal Science

The objective of this experiment was to obtain information on the mineral status of grazing cattle in the Guanacaste region of Costa Rica. Liver and blood samples of 3 to 4 year old steers were obtained from farms located in five counties. From each county, three farms were selected and, from each farm, 10 liver samples and five blood samples were collected. Liver tissue was analyzed for copper (Cu), iron (Fe), manganese (Mn), zinc (Zn) and selenium (Se). Blood plasma was analyzed for phosphorus (P).

There was no significant difference in tissue mineral concentration due to county location, with the exception of mean Se for one county. Mean Cu, Fe, and Zn for the five counties were in the normal range. Manganese, Se and P means were borderline to deficient in 5, 2 and 3 counties, respectively. Significant differences ($P < .01$) among farms were found for all six minerals. Copper, Fe, Mn, Zn, Se and P means were borderline to deficient in 4, 4, 10, 4, 2 and 10 farms, respectively. There were significant ($P < .01$) farm within county differences for all trace minerals and plasma P. Of the total cattle livers analyzed, approximately 40%, 31%, 63%, 33% and 24% were borderline to deficient in Cu, Fe, Mn, Se and Zn, respectively. Sixty-one percent of the total blood samples had Pplasma values which were considered borderline to deficient.

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Agriculture

EVALUATION OF THE NITROGEN FRACTION OF THE CASSAVA
ROOTS AND FACTORS AFFECTING ITS BIOLOGICAL VALUE

by

Fernando Calderón Laguna

August 1973

Chairman: Dr. H. D. Wallace

Major Department: Animal Science

A series of experiments were conducted to chemically and biologically evaluate the nitrogen fraction of cassava roots. Approximately 60% of the total nitrogen was determined as amino acid nitrogen; hydrocyanic acid plus nitrates-nitrites made up less than one percent of the nitrogen fraction and only 50% of the total nitrogen was utilizable by the growing rat. Although differences in tolerance to dietary cyanide were observed, 3200 ppm or higher levels of cyanide added to the diets as KCN were lethal for growing rats and levels of 2400 ppm or lower, although not lethal, reduced rat performance. Supplemental methionine, besides improving the protein quality of cassava meal based diets, also appeared to exert an effect on the detoxication of cyanide. Dietary cyanide, from either cassava meal or KCN, induced high levels of urinary thiocyanate excretion. A decrease in growth as well as a significant decrease in urinary thiocyanate excretion was exhibited by rats fed an iodine deficient bitter cassava meal based diet supplemented with methionine. Pigs fed iodine supplemented bitter cassava meal based diets without methionine supplementation had higher plasma thiocyanate concentration than those fed supplemented methionine diets.

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Agriculture

UTILIZATION OF ENSILED WATER HYACINTH IN RUMINANT DIETS

by

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August 1973

Chairman: Dr. J. F. Hentges, Jr.
Major Department: Animal Science

Water hyacinth (Eichhornia crassipes, Mart) was evaluated in regards to ensilability and animal acceptability of the silage. The hyacinths were ensiled with three levels of dried citrus pulp (DCP) and standard cane molasses (SCM) as preservatives during five experiments utilizing laboratory scale silos and cattle. Voluntary feed intake and digestibility of hyacinth silage and a land forage silage, pangolagrass (Digitaria decubens, Stent), ensiled in cover pilot silos, were measured in two digestion experiments using sheep in a 2 x 2 crossover design.

The most acceptable of the silage treatments had 4 kg DCP and 1 kg SCM per 100 kg water hyacinth press residue (WHPR), lowest pH, lowest ash and least spoilage. The more preservative in the silage the greater the acidity.

Silages with 4 kg or 2 kg DCP per 100 kg WHPR revealed no effect of preservative level on the digestibility of dry matter (DM), crude protein (CP) or energy by sheep. No differences were observed for the intake of DM, organic matter (OM), CP, digestible protein or digestible energy.

A second sheep digestion experiment compared ensiled WHPR and pangolagrass with each silage having 4 kg DCP and 0.5 kg SCM per 100 kg fresh plant material. The DM and OM intakes of pangolagrass silage were higher ($P < .05$) than the treated hyacinth silage. Digestibilities of DM and OM in both in vivo and in vitro trials were also greater for the land forage silage, pangolagrass, ($P < .01$ and $P < .05$, respectively).

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Agriculture

NUTRITIVE VALUE OF WATER HYACINTH SILAGE
FOR CATTLE AND SHEEP

by

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December 1973

Chairman: Dr. J. F. Herdges, Jr.
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Organic acids were evaluated as preservatives for water hyacinth silage (WHS) in laboratory scale silage. Treatments were two levels, high (H), 0.5%, and low (L), 0.25%, of formic acid (F), acetic acid (A) and ChemStor (CS), an 80:20 mixture of propionic and acetic acids. Preservation of WHS was satisfactory for all treatments as measured by silage acidity (pH), temperature and spoilage. Acceptability of silage treatments by cattle decreased as silage lactic acid content decreased and silage pH increased. HCS, HF, LCS were significantly ($P < .05$) more acceptable than control, H, and LA with no significant difference between LCS and

Balance experiments were conducted with cattle and sheep to measure the digestible nutrient intake from WHS and with a basal concentrate supplement.

Gross energy (GE), digestible energy (DE), crude protein (CP) and digestible protein (DP), expressed in units per kg body weight for sheep were 31.37 kcal GE, 6.13 kcal DE, 0.63 g CP and 0.15 g DP, and for cattle were 22.19 kcal of GE, 1.24 kcal DE, 0.45 g CP and 0.00 g DP.

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science

REPRODUCTIVE AND WEANING PERFORMANCE OF ANGUS,
BRAHMAN, HEREFORD AND SANTA GERTRUDIS CROSSBRED AND
STRAIGHTBRED CATTLE ON THREE CLOVER-GRASS PASTURES

by

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August 1973

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Improved pasture programs along with suitable breeding systems are recognized as one means of increasing production in the beef cattle industry. Objectives of this study were to determine the reproductive and weaning performance of Angus, Brahman, Hereford and Santa Gertrudis crossbred and straightbred cattle as affected by three clover-grass pasture programs and other environmental factors. Data were collected from BRU, Gainesville, Fla., over a nine-year period. It included pregnancy rate for 1001 cows, survival rate for 1067 calves, and 1009 records for birth weight, weaning weight, 205-day weight and condition score. Least squares analysis of variance showed significant pasture effects ($P < .05$) only on condition score. No significant effects of year and breed were apparent on pregnancy rate while year showed a significant effect ($P < .01$) on survival rate. Birth weight, weaning weight and 205-day weight were affected ($P < .01$) by year, breed and sex of calf. Effects of year and sex of calf were also significant ($P < .01$) for condition score. Linear regression of age of calf on weaning weight and condition score were significant ($P < .01$). The quadratic regression of age of calf was significant ($P < .05$) for 205-day weight and condition score.

Results indicated that responses of pregnancy rate, survival rate, birth weight, weaning weight and 205-day weight did not vary significantly between the three clover-grass pastures programs. Program differences in economy of production occurred, however, because of variation in costs of production.

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Agriculture

FORMULATION OF HAY:GRAIN DIETS
BASED ON PREDICTED QUALITIES
OF FOUR BERMUDAGRASS HAYS FOR RUMINANTS

by

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August 1973

Chairman: Dr. John E. Moore
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In a two-phase study, mixed diets for ruminants were formulated, using different quality hays, to contain a specified amount of digestible energy intake (DEI) as concentrate. In phase one, DEIs of 4, 6, 8 and 10 wk second regrowth bermudagrass hays were predicted with multiple regression equations generated from bermudagrass samples of known chemical composition and in vivo intake and digestibility. The predicted DEIs and reported replacement values of concentrate energy for forage energy were used to formulate mixed diets in which corn meal provided 50% of total DEI. During phase two, sheep were fed the hays ad libitum either with or without the specified quantity of corn meal. Intake, digestibility and replacement values were measured. Digestibility predictions were accurate ($P < 0.05$) for three hays, though in vitro organic matter digestibility would have better predicted this parameter. Actual intake of hay fed with concentrate was higher than predicted, thus the DEI attained in the form of concentrate ranged from 33 to 40% of total. Total DEI was higher ($P < 0.05$) when mixed diets were fed, though energy digestibility of hay was lowered ($P < 0.05$) in three of these diets. Replacement values increased from 0.03 to 0.76 as forage quality increased. When fed in mixed diets, there was no effect ($P > 0.05$) of maturity on hay intake.

Abstract of the Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Agriculture

ESTABLISHMENT OF TROPICAL LEGUMES

by

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June 1974

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The effect of phosphorus, potassium and trace minerals on the establishment of Desmodium intortum (Mill.) Urb., Lotononis bainesii Baker and Siratro (Macrotilium atropurpureum) on two soils, at the Beef Research Unit near Gainesville Florida, was studied. The three legume species were planted alone and in all possible associations of two and three species making a total of seven treatments. Five levels of P, K, and trace minerals were superimposed over each of the seven treatments in a central composite design. The legumes were planted at the end of the summer in September 1973. Plant density counts were made in September, October and November 1973. Changes in the legume population during the three month period were estimated. The two soils produced different responses to fertilization. There was a response to K and trace minerals on one soil and to P and K on the other. High seedling mortality was associated with Desmodium intortum. No changes in plant population for Siratro and Lotononis bainesii were recorded over the three month period. Desmodium intortum and Lotononis bainesii were more competitive than Siratro.

Abstract of Thesis Presented to the Graduate Council
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Agriculture

PREDICTION OF IN VIVO DIGESTIBILITY IN WARM-SEASON
GRASSES BY SUMMATIVE EQUATIONS AND IN VITRO DIGESTIONS

by

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June 1974

Chairman: Dr. John E. Moore
Major Department: Animal Science

The objective of this study was to compare several methods of predicting in vivo organic matter (OM) digestibility using chemical and in vitro analyses. Forty samples of grasses having known in vivo OM digestibility were studied, including 13 Pensacola bahiagrass (Paspalum notatum Flugge), 16 Suwannee bermudagrass (Cynodon dactylon (L) Pers.) and 11 Pangola digitgrass (Digitaria decumbens Stent). In vivo OM digestibility was correlated with in vivo neutral detergent fiber (NDF) digestibility ($r = .96$). The true digestibility of neutral detergent solubles was 75% and the metabolic fecal OM excretion was 5.4% of OM intake. The chemical and in vitro predictors of in vivo NDF digestibility giving the lowest Standard Errors of the Estimate (SEE) were log lignin and in vitro NDF digestion (72 hr), respectively. Substituting the appropriate prediction equations for NDF digestibility in a summative equation gave predictions of in vivo OM digestibility with the following SEE: log lignin, 5.13; in vitro NDF digestion (72 hr), 2.75. In comparison, in vitro digestions of OM or NDF after either 48 or 72 hr predicted in vivo OM digestibility directly with SEE ranging from 2.41 to 2.82.

Abstract of Dissertation Presented to the
Graduate Council of the University of Florida
in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

FORAGE INTAKE AND ITS RELATION TO THE CHEMICAL
COMPOSITION OF THE DIET AND SOME PHYSIOLOGICAL FACTORS
IN SHEEP

by

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December 1973

Chairman: Dr. John E. Moore
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Factors associated with changes in forage intake by sheep fed Pangola digitgrass (Digitaria decumbens Stent.) hays were investigated. In experiment I, hays of 2, 4, 6, 8, 10 and 12 weeks of age were used to study the effect of maturity on intake and digestibility. Organic matter (OM) intake decreased with age from 2 to 6 weeks of age (68.5 to 57.1 g/d/kg^{.75}, $P < .05$) and from 6 to 8 weeks (57.1 to 40.6 g/d/kg^{.75}, $P < .05$), but remained constant thereafter. The OM digestibility showed a somewhat different pattern with age than did OM intake. A reduction in OM digestibility was observed from 2 to 4 weeks, from 6 to 8 weeks and from 8 to 10 weeks of age.

In experiment II, hays of 4, 6, 8.5 and 11 weeks of age were fed with and without 75 g of soybean meal (50% crude protein) daily. A depression in OM intake was observed when the 4- and 6-week hays were supplemented, but supplementation of the 8.5- and 11-week hays resulted in higher intake. Digestibility of cell wall constituents (CWC) of the 8.5-week hay was increased by supplement ($P < .05$).