RESEARCH TRIANGLE INSTITUTE

RTI/1527-00-08F

June 1978

Detailed Program Plan
for the
Small Ruminants
Collaborative Research Support Program

Appendix
Detailed Research Component Plans

RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709

Intensive and Extensive Systems

TITLE: Social Constraints to Increased Small Ruminant Production in Four LDCs (New Project)

GRANTEE: Small Ruminant Management Entity
Board of Curators, University of Missouri

PRINCIPAL INVESTIGATOR: Michael F. Nolan

CO-PRINCIPAL INVESTIGATOR: Jere Lee Gilles

OTHER PARTICIPATING SCIENTISTS: James B. Kliebenstein
Rex R. Campbell
William D. Heffernan

DURATION: 5 years with intention to renew

TOTAL ESTIMATED COSTS BY YEARS:

	FY79	FY80	FY81	FY82	FY83
AID	175,000	175,000	175,000	175,000	175,000
U of MO.	87,985	94,415	94,415	94,415	94,415
LDC	0	20	20	20	20

PRIOR FUNDING: None

AID Project Manager:

APPROVAL: Elmer R. Kiehl

Elmer R. Kiehl
Dean, College of Agriculture
Director, Missouri Agricultural Experiment Station

SOCIAL CONSTRAINTS TO INCREASED SMALL RUMINANT PRODUCTION IN FOUR LDC'S

ABSTRACT

By systematically studying the societies in which the small ruminant research program will be working, it will be possible to develop an understanding of the social constraints to small ruminant production in four areas of the world. This research will have three principal goals: (1) to characterize the existing system of small ruminant production; (2) to identify who will benefit from proposed interventions resulting from this project, particularly how the poor will benefit; and (3) to anticipate the problems one can anticipate when programs to improve the production and use of small ruminants are implemented. Study objectives focus on the village and the individual producer, but linkages with national and regional systems will be included. The present study is guided by a systems perspective that emphasizes close collaboration with biological scientists, economists and systems analysts connected with the project. Results of this study will be useful to production scientists working in this area and to governments interested in sheep and goat production. Research will include a series of short-term studies and surveys and long-term field investigations, subject to the availability of resources and the needs of particular research sites.

PROJECT DESCRIPTION

The Problem

The introduction of the Winrock "state of the arts" report on sheep and goats states, "Sheep and Goat production systems are determined by social and economic factors, tradition and most importantly by available resources" (p. I-11). The report goes on to note that local producers and their animals have adapted remarkably well to local conditions and few outsiders fully understand the codes and traditions these societies have developed to protect their grazing rights and animal use. Throughout the Winrock report, regardless of the ecozone discussed, social and economic constraints to production are given high priority. By systematically studying societies in the three ecozones delineated in the RFP, a humid/subhumid area, an arid/semiarid area, and a highland area, we propose to develop the understanding of the social constraints to small ruminant production, that the authors' of Winrock report felt were lacking.

The RFP acknowledged a well established relationship - changes in agricultural production systems have wide-ranging impacts on the societies as a whole. The history of green revolution programs demonstrates that the burden of these changes falls disproportionately on small producers, often to the extent of making it impossible for them to stay on the land. Simply put, technological solutions to production problems have often worsened, rather than improved, the lot of small farmers.

Since much of sheep and goat production is carried out by small producers in the areas we propose to study, it is particularly important that the consequences of new production strategies be anticipated so small producers will derive maximum benefit from improved production practices. A well done analysis of the kind we propose would go a long way toward meeting that objective.

Objectives

Our primary objective is to document the role that social and cultural factors play in the overall system of small ruminant production in two intensive and two expensive production systems. By doing this we should be in a position to address two broad questions: (1) Who will benefit from the proposed production interventions; and (2) What are the likely problems one can anticipate in trying to implement the interventions.

In order to evaluate beneficiaries and anticipate problems, it is necessary to develop an understanding of the system of small ruminant production. This in turn requires us to identify the components of the system and specify the distinctive patterns of activity within the system. Included in our analysis of the current system of production would be factors such as status-prestige, religious-cultural traditions, consumption patterns, land tenure, role of women and children and herd management practices and production strategies.

While our analysis will tend to focus on local production units (e.g., farms) or clusters of units (e.g., villages), we also intend to explore some of the linkages between the local production system and the larger society. Included here would be the agricultural credit system, government policy toward small ruminant production and small farmers, extent and effectiveness of governmental outreach program (e.g., extension) particularly with regard to small farmers, and the organization of the agricultural infrastructure (e.g., input supplies, pricing of products, etc).

Summarized our objectives are as follows:

(1) To develop an understanding of the current system of production and consumption of small ruminants and their products.

(2) To perform a beneficiary analysis of the interventions suggested by the production projects in order to predict whether they help or hurt small producers.

(3) To analyze each production intervention in terms of the constraints one is likely to encounter in trying to implement it on a broad scale.

In general terms each of the objectives will address the social acceptability of the proposed production intervention. Any constraint to increased production will require solutions which are not only technologically sound and economically feasible but socially acceptable as well. By interacting closely with the production scientists we have to be able to contribute to the development of those kinds of solutions.

Project Approach

During the life of the project we propose to utilize a variety of approaches to address our stated objectives. Initially we intend to send a two person team to each country for five weeks in order to obtain an evaluation and early impression of the system of small ruminant production in each society. The reports produced by each team will provide a basis for an initial understanding of the system of production and suggest specific priorities for future projects in the region. Given the funds available, priorities will have to be given to certain projects over others. In addition we will devote considerable effort to reviewing past research on sheep and goat production in LDC's so that we do not unnecessarily duplicate what has already been done. The results of this literature review and early appraisal will be shared with all other projects.

Once through the initial start-up period, our data collection procedures will rely on two approaches. First, we hope to undertake both short (2-3 months) and long term (12-15 months) field observations in each country. The short term arrangements would include an economic anthropoligical analysis, observations on the system of stratification and an analysis of the organizational infrastructure of agriculture as it affects small ruminant production. The long term assignment

would involve placing a field worker in the project area so that an entire seasonal cropping cycle could be observed. We think this kind of in-depth field work is essential if some of the more subtle social factors affecting small ruminant production are to be adequately understood.

We also propose to collect survey data from groups who will be affected most directly by the program outputs. This data will provide a breadth of coverage and should complement the in-depth field observations discussed above. It is our intent that the two will interface with each other in the sense that the observation will help guide the construction of survey instruments and that findings arising from the surveys may suggest areas for future field observations. However, it must be stressed that the high costs of primary data collection for the social sciences (i.e., an estimate of $100-200/interview is not unreasonable) will make this kind of undertaking an infrequent occurrence, although we do intend to collect survey data topics such as risk aversion, consumption patterns, management practices, proneness to change, land tenure/distribution, and reasons for farming.

We have included a graduate training component in our budget. Initially these positions would be filled by U.S. students who will collect much of the primary long-term field data as part of their thesis or dissertation research. In the later years of the project we hope to be able to identify LDC students who we can bring to the states for training.

We also intend to work closely with LDC social scientists. The nature of this relationship will depend in part on the countries which are eventually selected, as social science skills are not uniformly distributed. Nevertheless we anticipate that in some countries good collaborative relationships can be developed and that the LDC social scientists will assume major responsibilities.

Throughout, our intent will be to collaborate closely with all other scientists working in the program. We will try to accomodate their requests for information

and we will make similar requests of them from time to time. Similiarly, we will work closely with the economic project in developing an understanding of the agricultural infrastructure (e.g. credit) and production strategies.

The length of time proposed for this project also needs to be clarified. Sociology, along with the economics and systems analysis components, serves, in a general sense, as the overall evaluators/integrators of the entire program. As such, it seems necessary that our project be extended as long as any of the production projects (e.g., the range management proposal talked of a ten-year project) so that we will be in a position to evaluate their proposals as they become available.

Conditions that Will Indicate that Objectives have been Achieved

A number of criteria on which the project can be evaluated in light of the stated objectives can be proposed. They are as follows:

1. The development by the production projects (e.g., nutrition, range management, health, etc.) of research strategies and production interventions appropriate to the needs and constraints of small producers.
2. Social assessment reports early in the project which will provide an overview of the system of production and guide the selection of more specific projects to follow.
3. Monographs on the socio-economic aspects of small ruminant production and consumption in the intensive and extensive research sites.
4. Special reports on particular aspects of small ruminant production such as risk, credit, role of women and children, role of prestige in production, and other topics deemed to merit consideration as the project develops.

5. Production of a monograph that analyzes social constraints to small reminant production on a world-wide basis.
6. Monographs/reports on the social constraints to small ruminant production in each of the research sites.
7. Periodic social assessments of specific production interventions.
8. Training of some U.S. and LDC Professionals in Sociology and in particular in the social impacts of agricultural technology.

Assumptions on Achievement of Objectives (Externalities)

Numerous factors will play a role in determining whether or not the objectives we've outlined can be fulfilled. Some of the principal assumptions follow:

Funding Assumptions:

1. That Title XII funding will continue during the duration of the project period at levels at least as great as indicated on the attached budget.
2. That phasing research in a manner so as to limit efforts to only 2 sites per year is acceptable.

Socio-Politieal Physical Assumptions:

1. That administrative/political problems within the U.S. and LDC governments will not prevent the research from being conducted according to schedule.
2. That host country governments and institutions will be interested in small ruminant research and will provide support throughout the project period.
3. That competent LDC social scientists can be identified in each country who are interested in participating in the research project.
4. That the project develops into a truly interdisciplinary venture with a free and frequent exchange of ideas and comments among the various researchers.

5. That natural disasters, famine, drought, wars or other "Acts of God" do not cause the project or livestock production to be interrupted or curtailed.

If one or more of the above assumptions are not met, the output of the project for that particular area will be altered dramatically. Some research may be possible, but its form and the content would probably be quite different.

Assumptions that Achieving Objectives will Solve the Problems

This project is unique in that is is a non-production component of what is basically a production oriented research program. As such, the achievement of its objectives will in no way guarantee the overall success of the total program. At the same time, failure to meet the objectives may well doom the entire program.

It is by now a well accepted axiom of development that no solution to production or consumption problems, however feasible in a technical sense, can help people in LDC's if the prevailing social-institutional-cultural structure does not permit application of the solution. One of our principle objectives is to determine the appropriateness of a production intervention to the socio-cultural situation and institutional arrangements in a given society. It is assumed this kind of analysis will provide guidance in the selection of a strategy from among the alternatives available.

Traditionally, the "poorest of the poor" (our target group) in any country lack contact with traditional agricultural development programs. Because of this researchers are prone to ignore the needs of small producers and orient their research instead to the middle and larger peasantry. This frequently has had the result of actually hurting the small producers as witnessed by attempts to mechanize agriculture in areas where small farmers dominate. We hope that by achieving our objectives we would be able to head off those interventions which would worsen the lot of small farmers and perhaps even direct more research toward

their specific and often unique needs. It goes without saying that increased sheep and goat production will ultimately effect people. Whether their effect is positive, rather than negligible or negative, will hinge largely on the abilities of the "people sciences" (sociology and economics) to meet their stated objectives.

Outputs of Project

Many of the anticipated outputs of the project were enumerated earlier. In addition to the reports and monographs noted, we anticipate that a number of scholarly publications will result. (The ability to collect data from four distinct cultures would provide splendid opportunities for comparative analysis along with intra-country studies.)

We hope to be able to train a minimum of two-four foreign students (Master's level) during the time period of the project. Their research projects would be closely linked to the ongoing research in their countries.

It is also our wish that our LDC collaborators conduct research projects in their interest area consistent with the overall objectives of this project. We anticipate funding such projects within the constraint of our overall allocation.

FINANCIAL PLAN

The attached pages describe how we intend to spend the funds allocated to us. It should be noted that the LDC column is a very rough estimate of their projected contributions.

PRELIMINARY BUDGET: FY 1979

	U.AID (Title XII) U.S.	U.AID (Title XII) LDC	UMC & MAES
Personnel-Salary & Fringe			
UMC Faculty	27942		27942
M. F. Nolan (.75)			
J. G. Gilles (.50)			
R. R. Campbell (.25)			
W. D. Heffernan (.25)			
J. L. Kliebenstein (.25)			
Graduate Research Assts.	11000		11000
UMC Support Staff	18560		10440
Other Scientists (U.S. & LDC)		18560	
(TOTAL)	(57502)	(18560)	(49382)
Equipment/Facilities/Animals	1000		4200
Site Coordinator and Program Support		13150	
Travel and Per-diem			
Domestic			5000
International		36400	
LDC-In Country		7000	
(Total)		(43400)	(5000)
Other Direct Costs	2668	2500	5600
Indirect Costs (53.99% of total applicable S & W -$75,000)	36220		23803
TOTAL	97390	77610	87985

TOTAL PROJECT COST: 262985

UMC Contribution: 33.5%

6/9/78

PRELIMINARY BUDGET: FY 1980-FY1983

	AID (Title XII) U.S.	AID (Title XII) LDC	UMC & MAES	LDC
ersonnel (Salary & Fringe)				
UMC Faculty	27942		27942	
M. F. Nolan (.75)				
J. G. Gilles (.75)				
R. R. Campbell (.25)				
W. D. Heffernan (.25)				
J. T. Kliebenstein (.25)				
Graduate Research Assts.	11000		11000	
UMC Support Staff	18560		10440	
Other Scientists (U.S. & LDC)		20000		
LDC Professionals				20000
LDC Support		8000		
(TOTAL)	(57502)	(28000)	(49382)	(20000)
quipment/Facili ies/Animals			4100	
ite Coordinator and Program Support		13150		
ravel and Per-diem				
Domestic			5000	
International		28678		
LDC-In Country		5000		
(Total)		(33678)	(5000)	
ther Direct Costs			12130	
ndirect Costs (53.99% on applicable S & W -$75,000)	42670		23803	
OTAL	100172	74828	94415	20000

OTAL PROJECT COST: 269415

MC Contribution: 35%

6/9/78

TECHNICAL FEASIBILITY

The project as outlined can be done. The methodology is sound and no new technical apparatus will need to be developed. We have obtained commitments from a number of professional social scientists who are experienced in the areas proposed for study and we enjoy the support of our university administration.

It should be noted that while our department does not have existing sheep and goat research programs underway (it is doubtful that <u>any</u> rural sociology department would so qualify) we are not necessarily in a position of starting from scratch. The core personnel identified with the project have all done work in the several areas of the sociology of agriculture. Three (Nolan, Gilles, Heffernan) co-direct an AES project, the "Organizational Structure of Agriculture." In addition, the project personnel have expertise in the area of the social impacts of agricultural technology and several even have undergraduate degrees in one of the agricultural production fields.

The research to be undertaken here will mesh well with both our individual research and other departmental projects. Personnel on the project have already fielded projects on risk and farming strategies for small farmers. The small ruminant project should permit us to sharpen our skills in these areas as well as build on the foundation we have laid for a general methodology to assess the impacts of agricultural technology. At the departmental level, three Agricultural Experiment Station projects have objectives which overlap those of this project. They are: (1) Organizational Structure of Agriculture; (2) Knowledge Utilization; and (3) Community Development. These projects, combined, have a research budget amounting to approximately $190,000.

In sum, we feel that, given our substantive interests and our domestic research strengths, we can undertake an international project, such as the one proposed, without a major retooling. The cost will not be trivial as social

science research must of necessity be undertaken "on site". At the core, though, the project as proposed can be integrated into our ongoing research program, and it is our firm belief that we can participate fully in a Title XII program dedicated to "building strength on strength."

IMPLEMENTATION PLAN

Scope of Work

First Year

1. Establish project office; hire necessary personnel, etc.
2. Make initial contacts with four countries (this would involve selecting the countries and LDC social scientists).
3. Begin review of prior studies of agricultural production relevant to regions and countries selected. (This will continue throughout the project period.)
4. Begin recruitment of research assistants (e.g., former Peace Corps Volunteers) who could assume major responsibility for field data collection.
5. Initiate an agricultural assessment in all four countries by sending a two-person team of social scientists for five weeks.
6. Prepare initial reports for each country describing the present socio-cultural situation as it relates to agriculture and suggesting priorities for further studies.

Second Year

1. Continue collection and review of prior research and continue development of contacts with LDC social scientists.
2. Initiate moderate size field work project in Country I.
3. Initiate small scale field work project in Country II.
4. Maintain minimum contacts in Countries III and IV.
5. Report on results of small scale project in Country II.

Third Year

1. Finish moderate size project in Country I and prepare report on results.
2. Initiate moderate size project in Country II and small project in III.
3. Maintain minimum contacts with Country IV.

Fourth Year

1. Finish moderate size project in Country II and prepare report.
2. Moderate size project in Country III and small project in IV.
3. Maintain minimum contacts in Country I.

Fifth Year

1. Finish moderate size project in Country III and prepare report.
2. Initiate moderate size project in Country IV and small project in I.
3. Maintain minimum contacts with Country II.

Project Monitoring

We anticipate utilizing a number of approaches to monitor project tasks. First, each country coordinator would be expected to write an annual report outlining the accomplishments and problems in that country. In those years when there is little occurring in that country, these reports might be quite brief; in other years they would be more lengthy. It is not expected that such reports would replicate the research reports and monographs mentioned earlier. Rather they would concentrate on problems and accomplishments and as such provide a basis for allocating money to countries in future years.

Second, each country coordinator (or his/her representative) will visit their country at least once a year. While these visits will be brief, it will allow for an onsite evaluation of the research projects currently underway and an assessment of future research needs.

To insure coordination among countries we will hold monthly project meetings with the country coordinators and PI's participating. Special projects personnel will also be invited to participate. Finally, we also intend to establish some mechanism to obtain periodic feedback from our LDC collaborating institutions and social scientists on project results and plans.

ANNUAL REVIEW AND PLANNING

Given our funding level we do not anticipate establishing any formal review structure independent of that for the larger program. We do intend to establish an informal advisory committee composed of UMC production scientists to help us interpret the activities of the production projects and to suggest lines of future inquiry. We anticipate we will have many technical questions related to the work of these scientists and we believe a panel of experts on whom we can call from time-to-time will be very beneficial.

AID 1020-20 (3-79)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: Small Ruminant CRSP-Social Constraints to SR Production in Your LDCs

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: To analyze the system of small ruminant production in order to identify the socio-economic constraints to increased production among small holders. To identify potential effects of potential intervention strategies identified by production scientists on the poor.	Conditions that will indicate purpose has been achieved: End of project status. The development of research orientated to the needs of small farmers and appropriate to the conditions they face	Social science integrated in overall small ruminant research program. Cognizance of researchers to socio-economic factors.	Assumptions for achieving purpose: 1. Close collaboration with other disciplines will occur. 2. Achievement of project outputs 3. Project will run for the number of years indicated.
Outputs: Country reconnaissance paper, country monographs, special reports on women, family, risk, land tenure, consumption patterns, prestige, religion, etc. as they relate to small ruminant production, monograph/report on social-economic constraints to small ruminant production.	Magnitude of Outputs: 1 reconnaissance report 4 country/site monographs, annual review of country problems research needs, reports on specific aspects of 4 trained LDC social scientists, methodology for analyzing social constraints to production, general monograph on state of art	1. Review publications 2. Follow student progress	Assumptions for achieving outputs: 1) Administrative and political problems will not delay field work. 2) # of special reports will vary from country to country 3) Host country professionals and American grad students will participate in field. 4) Country research may be phased so that resources may be concentrated in 1-2 areas 5) pooling of data collection across discip. 6) ecological conditions permit study of small ruminant production
Inputs: 1) Title XII (USAID) funds to small ruminant management entity 2) contribution of a portion of UMC professional staff time plus other considerations (25% match) 3) contribution of a portion of professional staff time by LDC host institutions.	Implementation Target (Type and Quantity) Budget: $175,000 over ten years (USAID contribution) Implementation: Recon. Report, year 1; two research projects fielded annually after that (1 per country)	Evaluation process built into total Program.	Assumptions for providing inputs: 1) LDC's will have resources needed for cost sharing. 2) Title XII funds will be provided for duration of project. 3) Funds indicated are for direct costs.

VITA

Name: Michael F. Nolan

Current Position: Assistant to Associate Professor of Rural Sociology, University of Missouri-Columbia (January 1971 - Present)

Place and Date of Birth: [redacted]

Education:

	School	Dates Attended	Degrees
(1)	Muskingum College	1961-1963	None
(2)	Pennsylvania State University	1963-1965	B.A. - Sociology (History, minor)
		1965-1967	M.S. - Rural Sociology
		1968-1970	Ph.D. - Rural Sociology
(3)	Iowa State University (Ames, Iowa)	1967-1968	No Degree Sociology

Areas of Specialization: Rural Sociology; Social Organization of Agriculture; Social Policy Analysis; Methodology and Statistics

Assistantships:

Research - one-half time, Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University, September, 1965-September, 1967; June, 1968-December, 1970.

Research - one-half time, Department of Sociology, Iowa State University (Ames) September, 1967-June, 1968.

Research:

(1) Project Co-leader, Organizational Structure in Agriculture, Missouri Agricultural Experiment Station.
(2) Recipient, Special Assistance Grant, Missouri Agricultural Experiment Station, 1973-74.

Professional Organizations:

Midwest Sociological Society
Rural Sociological Society -
American Sociological Association
Society for International Development
AAAS

Honors:

Alpha Kappa Delta
Gamma Sigma Delta
Phi Kappa Phi

Publications:

(1) Master's Thesis - "An Evaluation of A Theory of Cognitive Consistency to A Survey Research Design: The Case of Consumer Reaction to the Use of Pesticides on Food Products."

(2) Ph.D. Dissertation - "The Application of Nonadditive Models and Contextual Analysis to Cross-National Research: A Study of Rates of Economic Growth."

(3) Andrew J. Sofranko and Michael F. Nolan, "Selected Characteristics, Participation Patterns and Attitudes of Hunters and Fishermen in Pennsylvania," Pennsylvania Agricultural Experiment Station Bulletin No. 770, July, 1970.

(4) Michael F. Nolan, et al, "Consumer Reaction to Farmer Use of Pesticides." Pennsylvania Agricultural Experiment Station, AE&RS 92, July, 1970.

(5) Andrew J. Sofranko and Michael F. Nolan, "Early Life Experiences and Adult Sports Participation." Journal of Leisure Research, Winter, 1972 pp. 6-18.

(6) Andrew J. Sofranko, Michael F. Nolan and Robert C. Bealer, "The Definition of Modernization as a Power Continuum and Some Concomitant Structural Differentiations: Data in Defense of a Maligned Conceptualization," Probe,1, December 1971, pp. 11-30.

(7) Michael F. Nolan and Andrew J. Sofranko, "Influence of Social, Economic, and Work-Related Factors on Levels of Sports Participation," Society and Leisure, 5, 1973, pp. 111-122.

(8) Michael F. Nolan and John F. Galliher, "Rural Sociological Research and Social Policy: Hard Data, Hard Times," Rural Sociology, 38, (Winter 1973), pp. 491-499.

(9) Michael F. Nolan and William D. Heffernan, "The Rural Development Act of 1972: A Skeptical View," Rural Sociology, 39 (Winter,1974), pp. 536-545.

(10) Andrew J. Sofranko, Michael F. Nolan and Robert C. Bealer, "Energy Consumption and Modernization," Sociology and Social Research, (July, 1975).

(11) Richard M. Hessler and Michael F. Nolan, "Intraethnic Diversity and Pathways to Medical Care." Human Organization, (Fall, 1975).

(12) Michael F. Nolan and Robert A. Hagan, "Rural Sociological Research, 1966-1974: Implications for Social Policy," Rural Sociology, (Winter, 1975).

(13) Michael F. Nolan, LaVeta A. Anderson and John L. Mowrer, "Faculty Attitudes Towards a Nontraditional Studies Program," Alternative Higher Education, (Fall, 1977).

Papers:

(1) "A Definition of Modernization as a Power Continuum and Some Concomitant Structural Differentiations." Paper presented at the annual meetings of The Rural Sociological Society, San Francisco, California, August 1967.

(2) "The Congruence in Sociological Analysis between Research Designs and Certain 'Guilding' Theoretical Assumptions." Paper presented at the annual meetings of the Rural Sociological Society, San Francisco, California, August 1967.

(3) "Some Critical Problems in Existing Research Evaluating the Theory of Cognitive Dissonance: Insights from A Study of Pesticides." Paper presented at the annual meetings of The Rural Sociological Society, Boston, Massachusetts, August 1968.

(4) "Interaction of Intrasocietal and Extrasocietal Determinants of Economic Growth in Unstable and Heterogeneous Environmental Contexts." Paper presented at the annual meetings of The Rural Sociological Society, Washington, D.C., August 1970.

(5) "Some Alternative Measures of National Development and Complexity: An Evaluation and Recommendation." Paper presented at the Third World Congress for Rural Sociology, Baton Rouge, Louisiana, August 1972.

(6) "Methodological Considerations for Problem Formation and Social Policy." Paper presented at Southern Sociological Society Meetings, April 1973.

(7) "Rural Sociological Research and Social Policy: Hard Data, Hard Times." Paper presented at Rural Sociological Society Meetings, August 1973.

(8) "The Rural Development Act of 1972: A Critical Analysis," Paper presented at Rural Sociological Society Meetings, August 1974.

Activities:

Departmental

(1) Chairperson Admissions and Awards Committee, 1974-1975

(2) Director of Graduate Studies, 1975-

(3) Member, Executive Committee, 1973-1977

College

(1) Member, Graduate Faculty, 1971-

(2) Member, Doctoral Faculty, 1975-

(3) Member, College of Agriculture Undergraduate Advising Committee

Profession

(1) Member, Membership Committee, Rural Sociological Society (1972-1973)

(2) Member, Development Committee, Rural Sociological Society; Chair of two subcommittees (1973-1976)

Community

(1) Board member, University YMCA; Vice President, 1975-1976; President, 1976-1977

(2) Board member, New Wave Corp.

1. Face Sheet Data

a. Project Title: Economic Analayses of Small Ruminant Production and Marketing Systems

b. Project Status: New

c. Grantee: Management entity/Winrock International

d. Principal Investigator: See enclosed Job Description, interim: H. A. Fitzhugh and M. E. Sarhan

e. Duration: 5 years with potential for continuation

f. Total Estimated Costs:*

	$000				
	Year 1	Year 2	Year 3	Year 4	Year 5
AID	175.0	175.0	175.0	175.0	175.0
Winrock International	146.7	147.0	142.5	149.4	149.4
LDC Institution	5.0	20.0	20.0	5.0	5.0

g. Prior Funding: None

h. AID Project Manager:

See Financial Plan

ABSTRACT

Economic data characterizing small ruminant production and market systems are generally lacking for developing countries. Such data are necessary to evaluate the current contributions of small ruminants at both subsistence and commerical market levels and to measure the economic consequences of improved practices resulting from Title XII CRSP efforts.

Economic analyses will involve identification and quantification of production, marketing and institutional factors and constraints which impact on product supply and demand. Benefit-cost analyses will assess the economic consequences of implementing recommended technical improvements.

Project staff will respond to the need for economic analyses in all parts of the small ruminant program and will assist in developing implementation plans of new production systems.

2. Detailed Description of Project:

a. Description of problem:

The lack of sufficient data base needed to generate economic guidelines for development and investment opportunities for small ruminants is an important research constraint faced by the economic analyst. Although there exists a reasonable amount of professional judgement that large potentials exist, the economic information is generally more qualitative than quantitative. This is true for both the demand and supply side of the economic problem.

The quantity demanded in the market at any given moment is functionally related to some form of price (regardless of the economic system). The level of this demand price is dependent upon tastes, preferences and habits of the consumer, levels of income, substitute products and numbers of people wanting the product. Balanced consideration of these variables is important to properly provide economic guidlines for the development process. Human cultural background is probably more important to the demand for small ruminant products than for most other agricultural commodities. An important researchable problem faced by the economic analyst is to provide reasonable demand estimates for evaluating the proposed production system. The development of new or modified production systems without adequate market clearing potentials on the demand side is fraught with peril. Demand parameters are generally more difficult to quantify than supply parameters but are of equal importance to the economic problem of viability for development and investment.

The quantity supplied in the market is, generally like demand, directly related to price. However in more centrally controlled economies the price variable response generally poses special problems to the economic analyst. The economic problem is usually couched in terms of "supply response" rather than in terms of the supply function. The supply side of the economic problem also involves processing and marketing issues. Proper consideration of the delivery system from the producer to the consumer is a central problem to the researchable economic problem of the small ruminant issue.

Quantitative data for small ruminant production systems are lacking for most developing countries. In addition, the machinery for collecting and analyzing such data is not well established or completely lacking.

In general, the economic problem is selecting among feasible biological production systems to determine those that are economically viable to the producer and for which the product can be processed and marketed in a form that is acceptable to the consumer. Further, there is need to estimate the costs and benefits to the human population in terms of income, nutrition and socio-economic stability for alternative production systems. Economic benchmarks must be established for estimating progress as production systems are energized in order to evaluate economic feasibility for expanding similar processes into larger target populations.

b. Objectives of project:

1. Estimate and quantify current macro-consumption patterns for small ruminant products to provide guidelines for selecting among feasible biological production systems which mesh with the market demand.

2. Estimate and quantify the current market supply response for small ruminant products.

3. Determine and identify processing and marketing constraints resulting from increased supplies of small ruminant products flowing from the improved production systems.

4. Identify institutional constraints such as credit sources, marketing, technical assistance capabilities and needs, and infrastructure barriers to proposed production systems.

5. Estimate the potential supply response from interaction with the production systems group of new or modified production systems suggested as feasible from a biological viewpoint.

6. Provide estimates of total production and resource use that would be expected from a given biologically feasible production system.

7. Establish benchmark indicators and estimate benefits and costs as new production systems are implemented, including the effects of land resource planning.

8. Conduct an economic analysis of the total technical packages for implementing new production systems into new and larger populations.

c. Project approach (procedure order below relate to the above objective numbers).

1. In many known cases, the consumption of small ruminant products (particularly meat) is strongly related to special time of the year. The importance of seasonal demand peaks is important to selecting among alternative production systems. Also, knowledge about potential consumption during periods other than peak consumption will need to be explored to fully exploit potential production opportunities. Excess supplies can seriously erode returns to producers and create serious pressures to exploit natural resources by small ruminants.

   Secondary data sources are generally available to provide rough estimates of annual production and consumption for agricultural products. However, for small ruminants, the information is relatively scanty and generally suspect. Therefore, the procedure will require that in-country non-published records be gleaned for added precision to published figures. Also, the Delphi process

for soliciting information from knowledgeable individuals will be attempted to further refine the early estimates. The analysis must also identify seasonality in consumption patterns.

2. To provide information on whether current production practices are responding to seasonable consumption demands or more toward seasonal resource availability. This is important to evaluating potentials for new or modified production systems.

3. In many cases, improvement in traditional processing and marketing systems would improve the quantity and quality of product flow. When suggesting improved or new production systems, the processing marketing component may act as the major capacitator constraint. It may require significant changes in traditional methods if the production system is to be operational.

4. Many constraints on feasible producer level production systems result from conditions imposed or from sources beyond the producers control. Government policies with respect to such items as capital availability, extension or technical assistance, transportation, market information and land use impact on whether a production system can be implemented by the producer.

5. It is very important that feasible biological production processes be considered within the context of producing the product at the right place at the right time. Also, it is important to determine how much increase in total supply can be expected from the resource base from alternative production systems and at what cost to the producers.

   This is basically the process of integrating economic parameters into the biological model to evaluate feasibility of the production system and select the best production management strategy.

6. To provide a basis for priority setting by governments among alternatives there is a need to have reasonable estimates of what impact, at the macro level, a given production system will have in terms of human nutrition, income, employment, resource requirements, monetary and fiscal items such as balance of payments. The research method is to take the micro level production system and aggregate over the resource base to determine expected costs and returns to the public and private sectors.

7. Monitoring and evaluating research adapted production systems is a key factor in judging the returns to the research effort and for identifying emerging researchable problems that could not be anticipated. This requires some knowledge about the current status of production and consumption levels in order to measure change. Since completion of earlier objectives will provide a fix on the current situation, certain indicators such as production levels, market flows and prices, income generated and others that can be quantified will be monitored and fed back

into the total system for evaluating progress and provide an alert system for research problem solving to remove emerging constraints.

8. Technology development left on the shelf or not adapted by larger populations than the initial focus of the research effort results in very low returns. Synthesizing the social, economic and biological research results into a workable and deliverable technical package is what is sought. This is the procedure and major justification for the consortium effort.

d. Conditions that will indicate objectives have been achieved:

1. Development of operational economic models applicable to small ruminant production systems.

2. Development of benefit cost ratios of technology packages developed under Title XII small ruminant projects.

3. Publication of reports on micro and macro economic situations.

e. Assumptions on achievement of objectives:

1. The data will be available at the LDC sites for initial macroeconomic analysis.

2. Data base will be created and/or already available for detailed micro- and macroeconomic analyses.

3. LDC government and research collaborators interest does exist for economic research in small ruminant production systems.

f. Assumption that achieving objectives will solve problems:

1. Knowledge of supply and demand situations as well as existing market structure will lead to development of effective and consistent production and marketing strategies.

2. Evaluation of economic and bio-technical feasibility for smallholders will provide basis for obtaining credit and technical support.

3. Establishment of economic data base and models will provide necessary information for evaluating economic impact of overall small ruminant consortium activities.

g. Outputs of project:

Same as 2-d above.

3. Technical Feasibility:

The research proposed utilizes well established economic tools. The analyses will be carried out by a staff with interests and involvement with research over a diverse range of economic research at the micro and macro levels. However, as LDC not yet chosen and since no assurance that the data will be available, technical feasibility of the project is 75 to 80 percent.

4. Financial Plan:

Year 1

	Title XII Funds					
	U.S.	LDC	Total AID	Winrock	Total AID + Winrock	LDC (estimate)
A. Salaries 1/ (2.35 SMY)	70,500		70,500		70,500	
H. A. Fitzhugh (.35)						
M. E. Sarhan (.75)						
Ag. Economist (.75) (new staff)						
E. K. Byington (.50)						
Other Scientists	10,875		10,875	8,000	18,875	
Site coordinator		13,125	13,125		13,125	
Secretarial & Clerical	7,500	5,000	12,500		12,500	
Technicians	10,000		10,000		10,000	5,000
Total Salaries	98,875	18,125	117,000	8,000	125,000	5,000
B. Equipment & Supplies 2/	4,000	1,000	5,000		5,000	
C. Travel and Per Diem 3/	7,500	42,500	50,000		50,000	
D. Other Direct Costs 4/	2,000	1,000	3,000		3,000	
Total Salaries and Direct Costs	112,375	62,625	175,000	8,000	183,000	5,000
E. Overhead on Title XII funds 5/						
1. Indirect costs (35% of salaries)				43,750	43,750	
2. Administration (10% of A+B+C+D and indirect costs)				22,675	22,675	
F. Winrock projects related to Title XII Small Ruminant CRSP objectives						
1. Winrock Project #205 6/				10,000	10,000	
2. Winrock Project #502 7/				45,000	45,000	
3. Winrock Project #220 8/				17,300	17,300	
G. Project Total	112,375	62,625	175,000	146,725	321,725	5,000

YEAR 2

	Title XII Funds					
	U.S.	LDC	Total AID	Winrock	Total AID + Winrock	LDC (estimate)
A. Salaries 1/ (2 SMY)	60,000		60,000		60,000	
H. A. Fitzhugh (.30)						
M. E. Sarhan (.70)						
Ag. Economist (.70) (new staff)						
E. K. Byington (.30)						
Other Scientists	10,875		10,875	8,000	18,875	
Site coordinator		13,125	13,125		13,125	
Secretarial & Clerical	7,500	5,000	12,500		12,500	
Technicians	8,500	5,000	13,500	2,000	15,500	5,000
Total Salaries	86,875	23,125	110,000	10,000	120,000	5,000
B. Equipment & Supplies 2/	6,000	1,000	7,000		7,000	
C. Travel and Per Diem 3/	4,500	15,000	19,500		19,500	
D. Other Direct Costs 4/	2,000	36,500	38,500		38,500	15,000
Total Salaries and Direct Costs	99,375	75,625	175,000	10,000	185,000	15,000
E. Overhead on Title XII funds 5/						
1. Indirect costs (35% of salaries)				42,000	42,000	
2. Administration (10% of A+B+C+D and indirect costs)				22,700	22,700	
F. Winrock projects related to Title XII Small Ruminant CRSP objectives						
1. Winrock Project #205 6/				10,000	10,000	
2. Winrock Project #502 7/				45,000	45,000	
3. Winrock Project #220 8/				17,300	17,300	
Project Total	99,375	75,625	175,000	147,000	322,000	20,000

YEAR 3

		Title XII Funds					
		U.S.	LDC	Total AID	Winrock	Total AID + Winrock	LDC (estimate)
A.	Salaries 1/ (1.7 SMY)	51,000		51,000		51.000	
	H. A. Fitzhugh (.25)						
	M. E. Sarhan (.60)						
	Ag. Economist (.65) (new staff)						
	E. K. Byington (.20)						
	Other Scientists	14,375		14,375	8,000	22,375	
	Site coordinator		13,125	13,125		13,125	
	Secretarial & Clerical	7,500	5,000	12,500		12,500	
	Technicians	10,000	5,000	15,000		15,000	5,000
	Total Salaries	82,875	23,125	106,000	8,000	114,000	5,000
B.	Equipment & Supplies 2/	7,000	1,000	8,000		8,000	
C.	Travel and Per Diem 3/	5,000	15,000	20,000		20,000	
D.	Other Direct Costs 4/	4,500	36,500	41,000		41,000	15,000
	Total Salaries and Direct Costs	99,375	75,625	175,000	8,000	183,000	15,000
E.	Overhead on Title XII funds 5/						
	1. Indirect costs (35% of salaries)				39,900	39,900	
	2. Administration (10% of A+B+C+D and indirect costs)				22,290	22,290	
F.	Winrock projects related to Title XII Small Ruminant CRSP objectives						
	1. Winrock Project #205 6/				10,000	10,000	
	2. Winrock Project #502 7/				45,000	45,000	
	3. Winrock Project #220 8/				17,300	17,300	
G.	Project Total	99,375	75,625	175,000	142,490	317,490	20,000

YEAR 4

		Title XII Funds					
		U.S.	LDC	Total AID	Winrock	Total AID + Winrock	LDC (estimate)
A.	Salaries 1/ (2.35 SMY)	70,500		70,500		70,500	
	H. A. Fitzhugh (.35)						
	M. E. Sarhan (.75)						
	Ag. Economist (.75) (new staff)						
	E. K. Byington (.50)						
	Other Scientists	12,875		12,875	8,000	20,875	
	Site coordinator		13,125	13,125		13,125	
	Secretarial & Clerical	7,500	5,000	12,500		12,500	
	Technicians	10,000	5,000	15,000		15,000	5,000
	Total Salaries	100,875	23,125	124,000	8,000	132,000	5,000
B.	Equipment & Supplies 2/	11,000	2,000	13,000		13,000	
C.	Travel and Per Diem 3/	7,500	22,500	30,000		30,000	
D.	Other Direct Costs 4/	6,500	1,500	8,000		8,000	
	Total Salaries and Direct Costs	125,875	49,125	175,000	8,000	183,000	5,000
E.	Overhead on Title XII funds 5/						
	1. Indirect costs (35% of salaries)				46,200	46,200	5,000
	2. Administration (10% of A+B+C+D and indirect costs)				22,920	22,920	
F.	Winrock projects related to Title XII Small Ruminant CRSP objectives						
	1. Winrock Project #205 6/				10,000	10,000	
	2. Winrock Project #502 7/				45,000	45,000	
	3. Winrock Project #220 8/				17,300	17,300	
G.	Project Total	125,875	49,125	175,000	149,420	324,420	5,000

YEAR 5

		Title XII Funds					
		U.S.	LDC	Total AID	Winrock	Total AID + Winrock	LDC (estimate)
A.	Salaries 1/ (2.35 SMY)	70,500		70,500		70,500	
	H. A. Fitzhugh (.35)						
	M. E. Sarhan (.75)						
	Ag. Economist (.75) (new staff)						
	E. K. Byington (.50)						
	Other Scientists	12,875		12,875	8,000	20,875	
	Site coordinator		13,125	13,125		13,125	
	Secretarial & Clerical	7,500	5,000	12,500		12,500	
	Technicians	10,000	5,000	15,000		15,000	5,000
	Total Salaries	100,875	23,125	124,000	8,000	132,000	5,000
B.	Equipment & Supplies 2/	11,000	2,000	13,000		13,000	
C.	Travel and Per Diem 3/	7,500	22,500	30,000		30,000	
D.	Other Direct Costs 4/	6,500	1,500	8,000		8,000	5,000
	Total Salaries and Direct Costs	125,875	49,125	175,000	8,000	183,000	5,000
E.	Overhead on Title XII funds 5/						
	1. Indirect costs (35% of salaries)				46,200	46,200	
	2. Administration (10% of A+B+C+D and indirect costs)				22,920	22,920	
F.	Winrock projects related to Title XII Small Ruminant CRSP objectives						
	1. Winrock Project #205 6/				10,000	10,000	
	2. Winrock Project #502 7/				45,000	45,000	
	3. Winrock Project #220 8/				17,300	17,300	
G.	Project Total	125,375	49,125	175,000	149,420	324,420	5,000

1/ Personnel (salaries & wages plus fringe)

a. All labor on project including direct hire labor, consultants, technicians and support.

b. Include student assistantships, stipends, Postdoctoral, etc.

2/ Equipment/Facilities/Supplies

Permanent equipment and facilities used in carrying out project, not already counted in computing overhead rate (if any): office space, furniture, non-expendable computing equipment, vehicles,etc.

3/ Travel and Per Diem

Air fares, per diem, automobile rental, local milage. LDC travel includes travel from the US to LDC sites as well as travel within LDC's.

4/ Report preparation, reproduction, publication, insurance for overseas travel, visas, immunizations, postage, telephone, allowances for US personnel relocated overseas (housing, education, salary post differential, temporary quarters), language training, translation services, books, maps, data collection (enumerators and related expenses during Years 2 and 3).

5/ Facilities, offices, office equipment, technical equipment, library and administrative overhead.

6/ Improvement of Ruminant Production Systems.

7/ Small Ruminant Resource Development Program.

8/ Small Ruminant Systems Appropriate to the Caribbean Region.

5. Implementation Plan

a. Work schedule

Year 1:

During the first year a significant portion of time will be required to travel within and outside the US for the purpose of establishing instutional and professional ties with interested collaborators. The macroeconomic analysis in regard to production, consumption and marketing of sheep and goat products will be initiated during this period. Also, research activity will include assisting other researchers to determine the appropriate research data that will be required for the macro- and microeconomic analyses. Objectives 1, 2 and 7 will receive the major focus.

Year 2:

Continue the macroeconomic analysis in production, consumption and marketing at one intensive and extensive site. This will include evaluating consumption patterns, crude demand estimates, market and non-market factors affecting the production and marketing of the products. Efforts will include survey and subjective evaluation (e.g., Delphi process). Coordination with other researchers and establishing contacts with LDC agencies will continue during this period. Objectives 3 and 4 will receive the major focus.

Year 3:

During the third year of the project the results collected from various projects will be used in conducting a preliminary benefit-cost analysis. This will provide a feedback process to other researchers and allow them to evaluate their program's procedures and objectives. By the end of this period preliminary reports will be presented for review. Objective 5 and 6 will receive the major focus.

Year 4:

Comments and suggestions from the reviews will be incorporated in the development of more refined production and consumption micro and macro analysis. Production models and standardized benefit/cost procedures will be developed for each specific project. Coordination will continue with other researchers in the US and LDC in order to publish preliminary reports on their respective research projects in conjunction with the economic analysis. Objectives 3, 4, 5, 6 and 7 will receive major attention and focus.

Year 5:

Evaluation of all research programs and the publication of final reports for the first five-year efforts. Initiate second phase of research based on results from first studies at each site. Objectives 7 and 8 will receive the major focus.

b. Project monitoring

Project director will be responsible for coordinating the monitoring of all project activities in LDC and US.

6. Annual Review and Planning Process:

Each project leader will be responsible for writing a project report annually with projected plans and budgets for the following year. Copies will be available to other project leaders and will be submitted for review as required under terms of the contract.

APPENDIX 1

Winrock Staff

AID 1020-28 (1-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: To provide decision makers; at the planning (government and private), research, and production level; with data base and methodology needed to evaluate benefits, costs, and constraints associated with the introduction of sheep and goat development programs.	Conditions that will indicate purpose has been achieved: End of project status. 1) Development of operational economic models applicable to small ruminant production systems. 2) Development of B/C ratios of technology packages. 3) Accumulation and publication of reports on micro and macroeconomic situations.	1) Established ties between U.S. and LDC's collaborators. 2) Development of research packages. 3) Validation of operational models. 4) Publication of research results	Assumptions for achieving purpose: 1) Suitable sites in LDC will be selected. 2) LDC interest does exist 3) Major production, marketing and institutional constraints will be resolved. 4) Outputs as specified are achieved.
Outputs: 1) Development of an economic data base for small ruminant production in LDC's. 2) Development of economic models for small ruminants. 3) Published progress reports and standardized evaluation methodology	Magnitude of Outputs: 1) Establish collaborative research network between U.S. and LDC institutions. 2) Collect information in 4 selected locations. 3) Preparation and distribution of progress reports and publication of research results.	1) Review of publication issued 2) Review of computer printouts and methodology	Assumptions for achieving outputs: 1) Data will be avialable at LDC sites for initial analysis. 2) Additional data will be created for further analysis at the micro and macro levels. 3) LDC government and research collaborative interest continues.
Inputs: 1) Data from collaborating U.S. and LDC institutions. 2) AID funding and assistance in project management. 3) Professional experience over diverse range of discipline.	Implementation Target (Type and Quantity) 1) Field survey at each site under Winrock professional supervision. 2) Winrock International in Arkansas-data processing, computer analysis etc.	Annual program review and evaluation techniques as regualr AID reporting requirements.	Assumptions for providing inputs: 1) Programs will be approved and funds provided under Title XII 2) Winrock International will continue to provide matching funds and staff 3) Data will be provided from U.S. and LDC research collaborators.

H. A. FITZHUGH Birth: July 2, 1939

Education:

B.S.	Animal Science, Texas A&M University,	1961
M.S.	Meats Science, Texas A&M University, (Minor Genetics)	1963
Ph.D.	Animal Breeding, Texas A&M University, (Minor Statistics)	1965

Postdoctorate, ARC Animal Breeding Research Organization, Institute of of Animal Genetics, Univ. of Edinburgh, Scotland, 1965-66

Selected Employment History:

1975-Date	Director of Research, Winrock International, Morrilton, Arkansas 72110.
1975	Research Geneticist; Coordinator, Cattle Germ Plasm Evaluation Program, U.S. Meat Animal Research Center, ARS/USDA, Clay Center, Nebraska.
1973-75	Executive Vice President; Director of Research and Operations; Member, Board of Directors, Agri-Link Corp., Irvine, California.
1966-73	Associate Professor, Animal Breeding Section, Animal Science Department, Texas A&M University, College Station, Texas.
1962	Research Coordinator, Estacion Experimental de los Llanos, Consejo Bienestar Rural, Venezuela.

Selected Professional Experiences:

Dr. Fitzhugh has authored or co-authored over 50 scientific and technical articles in the areas of animal breeding and management with emphasis on economic evaluation of livestock production systems. He has presented over 30 invitational speeches to academic and industrial organizations in 12 states and 3 foreign countries.

1975-Present -- Organized and adminstered research programs involving economic and biological evaluation of livestock production systems, emphasizing adaptation of scientific theory and technology for producers in underdeveloped countries and regions of developed nations.

1975 -- Directed operation of vertically integrated beef production, processing and retail marketing firm with over 20,000 cows on ranches in the west-northwestern states and over 40,000 cattle on feed in 18 states; total investment in production and marketing activities exceeded $20 million.

1970-72 -- Economic evaluation of land and livestock development and management programs for Ganado Rojo Ranches, a division of Superior Oil Company; using linear programming and computer simulation models.

1969-74 -- Advised on genetic improvement programs and designed computer programs to process performance data for American Brahman Breeders Assn., Houston, Texas; Red Angus Assn. of America, Denton, Texas; American Pooled Hereford Assn., Kansas City, Missouri.

1962 -- Coordinated research program in Llanos of Venezuela for improving range and cattle management under extensive, low investment conditions.

Foreign Experience:

Costa Rica, France, Germany, Great Britain, Italy, Mexico, Venezuela, Good reading and fair conversational knowledge of Spanish.

MOHAMED E. SARHAN

Birth: October 23, 1946

Education:

B.S.	Agronomy, University of Alexandria, Egypt,	1968
M.S.	Agricultural Economics, Univ. of California	1973
M.A.	Economics, University of California	1974
Ph.D.	Agricultural Economics, Univ. of California	1976

Fields of Special Interest:

Farm Management, Production Economics, Livestock Systems Analysis, Economic Development, International Economics

Selected Employment History:

1976-Date Agricultural Economist, Winrock International Livestock Research and Training Center, Route 3, Morrilton, Arkansas 72110.

1974-1976 Post-Graduate Research Agricultural Economist, Department of Agricultural Economics, University of California, Davis. Duties involved conducting the empirical investigation for my Ph.D. dissertation.

1972-1974 Research Assistant, Dept. of Agricultural Economics, University of California, Davis.

1971-1972 Work Study/Research Assistant, Department of Agricultural Economics, University of California, Davis. Duties included collecting, organizing and analyzing research data.

1969 Research Assistant, P-A-G Division, W. R. Grace and Co., Spencer Research Station, Spencer, Iowa. Duties included participation in the station's corn breeding program.

1965-1967 Research Assistant, Department of Agronomy and Plant Protection, Univ. of Alexandria, Egypt. Duties included participation in the agricultural education and development programs throughout the Nile delta and the eastern deserts land reclamation and irrigation projects.

Professional and Honor Societies:

American Agricultural Economics Association, American Economics Association, Omicron Delta Epsilon, Honor Society in Economics.

Relevant Reports

Economic Analysis of Livestock Production, Processing and Marketing Systems for the Navajo Indian Irrigation Project. Part I: Marketing Feasibility. A WILRTC Report. 1976.

Economic Analysis of Livestock Production, Processing and Marketing Systems for the Navajo Indian Irrigation Project. Part II: Production and Financial Analysis. A WILRTC Report. 1977.

Feasibility of integrated beef cattle activities on the Cheyenne River Sioux Reservation in South Dakota. A WILRTC Report. 1977.

Linear Programming Planning Model for the Navajo Livestock Activities: A User's Guide.

Objective and Constraints of Ruminant Livestock Production (with O. J. Scoville) World Review of Animal Production, Volume XIV, Number; January-March, 1978.

1. Face Sheet

Project Title: SYSTEMS ANALYSIS AND SYNTHESIS OF SMALL RUMINANT PRODUCTION

New or Extension: New

Grantee: Management Entity/Texas Agricultural Experiment Station (TAES)

Principal Investigators: T. C. Cartwright

J. W. Bassett

Total Estimated Costs, by Years	FY 79	FY 80	FY 81	FY 82	FY 83
AID	175,000	175,000	175,000	175,000	175,000
TAES*	100,282	105,584	103,655	109,337	113,950
LDC Institutions (4)	9,000	9,000	9,000	9,000	9,000
TOTAL	284,282	289,584	287,655	293,337	297,930

Proir Funding: None

AID Project Manager:

The annual Texas Agricultural Experiment Station budget for collaborative sheep and goat research was in excess of $700,000 for 1977 and 1978 and is expected to increase during the next 5 years.

2. Detailed Description Of Project

a. Description Of Problem

Generalized, comprehensive, biologically based, mathematical models for simulating sheep and goat production provide a systematic method for bringing knowledge relating to isolated production components together for the entire producing flock (or larger system) in an equilibrium or dynamic state. These models, and simulations from them, organize available information, identify knowledge voids, and provide a basis for determining critical research needs and for establishing priorities for technical assistance and development.

A great amount of adaptive or developmental research with live animals is not feasible in LDCs because of limited resources. Model simulations will provide a method for examining or predicting the effect of new practices and determining optimal combinations and sequences of implementing practices. Especially with the complex input x output x animal interactions, it is important to examine the effects, throughout the entire production system, of an intervention at a particular point in order to avoid unanticipated effects which could be counter-productive on the final biological or economic efficiency.

Factors having major effects on small ruminant production systems in LDCs include multi-species competition, diseases, parasites and lactation stress all interacting with nutrition and breeding which further interact with management, marketing, and other socio-economic effects. Techniques developed in operations research are designed to systematically organize and describe the dynamics of such complex systems through mathematical models. These models may be constructed at various levels of refinement and generality. The modelling proposed will be based on biological functions, applicable to each species in general, so that sets of input coefficients peculiar to a geographical area, breed or type of sheep (goat), management procedure, etc. can be conveniently applied to the general model. Thus,

these models are adaptable for simulating production systems in any LDC as well as the U.S.

b. Objectives Of Project

The broad objective of this project is to provide a method for increasing the effectiveness of research by establishing research priorities and by providing a method of effectively evaluating application of research results and other recommended practices in LDC's as well as the U.S. The specific objectives are:

(1) To develop a dynamic, comprehensive, mathematical model, based on biological functions, for sheep production systems with the individual animal as the modeling unit; and to develop a similar method for goat production systems.

(2) To collect production data and characterize production systems in each of the LDC ecozones locations; to validate the model and input parameters using these data and information from each ecozone; and to use these validation simulations as baseline simulations.

(3) To examine, through modeling and simulations, research needs and priorities required to develop technologies and procedures which more effectively accomplish specific objective functions.

(4) To supply input-output data of traditional and altered production systems for use in economic analysis and benefit/cost studies, and to interface the biological and economic models.

(5) To examine, through simulations, alternative production methods and to synthesize technologies or production systems for each specific ecozone.

(6) To interface the sheep and goat models and the Texas A&M University Beef Cattle Production Systems model in order to examine multiple species production systems.

c. Project Approach

The first objective, b.(1), is development of models. The models will be developed similar to the TAMU Beef Production Systems Model. The uniqueness and utility of this model results from its conceptual structure: the driving variables are quantity and quality of nutrient resources; biological responses are conditioned by animal genotype, management practices and other environmental variables; this simulation model closely emulates real world processes.

The first step in the development of a sheep production systems model is searching out and evaluating available data and research results relevant to model construction, including consultation with experienced specialists, both Consortium members (Consortium is used here to refer to all institutions involved in the Title XII Small Ruminants Program) and others. This information is then described by appropriate mathematical functions, fit into the model structure using difference equations and programmed for computer processing. This general modeling process has been successfully applied to the development of the TAMU Beef Cattle Model. An essential point is that mathematical functions are based on biological processes and are not simply curves fitted to a set of input-output data as is the case with normative models.

Building this model will be an active process involving interaction with all Consortium members for gaining input information and for feedback to them concerning information which is needed but is lacking or poorly understood and which they (the other Consortium members) can direct their efforts toward determining. That is, to aid in direction of research and setting priorities. The feedback process will begin early during the first year; the model is expected to be ready for preliminary runs during the second year.

A similar model of goat production systems will be initiated during the first year following the sheep model. The goat model is expected to follow comparable stages of the sheep model at about a 6 month to 1 year interval.

Even though the proposed form of the models have proven useful with beef cattle, major additional components are needed. One is an interacting, dynamic forage component; a second is a quantitative interacting disease-parasite component. Inputs from these areas are essential from the outset but these areas are not modeled as interacting components; that is, there is no feed back of animal performance to forage and disease-parasite components. This extension of the models would be anticipated to begin about the fourth year when more information has become available and wide experience obtained throughout the consortium.

The second objective, b.(2), which will begin as soon as LDC linkages are established, is to characterize sheep and goat production systems in each ecozone and to collect animal and production data for each system. These data, those collected and available in LDC's, and data from collaborative projects will provide information for use in synthesizing production systems, but first this information will be used for model validation and refinement.

After the working model is completed it will be subjected to validation tests which will include simulation of production systems existing in each LDC ecozone; that is, the existing (traditional) production will be simulated. A sequence of simulation, validation, model modification and new simulation will be necessary. This recurrent process is tedious, time consuming but absolutely essential. These validation runs also serve as baseline documentation against which recommended changes are to be compared. The sheep model is expected to be ready for validation during the second year, and validation completed and production simulations initiated during the third year. Simulations would continue during successive years.

The third objective, b.(3), is to be collaborative with the Program Director and other Consortium institutions in a coordinating role. It will be accomplished, in part, with the first two objectives during the process of gathering, organizing, and collating existing information and modeling production systems. Some knowledge voids or "fuzzy" points become obvious early; the significance of other points can be documented only after simulation. For example, if some parameter necessary to understanding (simulating) production is not known precisely, it can be varied through the logical possible range for a series of simulations. If changes in this parameter have important effects on outcome,then research should be directed toward obtaining more refined estimates. On the other hand, if changes in the parameter cause only little,or unimportant, effects on outcome, then low priority would be given to the related research.

This process and the function of bringing information from other collaborative projects together to fit into the total production system will be continued throughout the project tenure.

The fourth objective, b.(4), which is closely collaborative with the economic and sociology projects, will be to simulate specific sheep and/or goat production systems for each of the ecozones utilizing the baseline (validation) simulations to compare against simulations with some change imposed. The changes imposed will consist of practices recommended from collaborating projects, practices suggested by detailed examination of the simulation outputs to determine at what point production efficiency suffers the greatest, practices suggested by LDC livestock officers, and other types of changes. The changes examined would include such practices as improved range conditions, supplemental feeding, disease control, marketing at younger ages, limited breeding season, increased (or decreased) milking, introduction of exotic breeds, crossbreeding, one (or more) drouth year or quarantine.

These simulations would include effects on the total production systems and the input-output data would provide the base data required for economic analysis and for analysis for sociological feasibility and impact. These analyses will begin during the second year, intensify during the third, and continue throughout the project. It is especially critical to have livestock officers, Ministry of Agriculture officials, planning officers and other LDC personnel involved at this point.

At some point during the fourth or fifth years, the production systems model may be interfaced with economics models or components. This interfacing would lead to use of such techniques as linear programming to maximize some objective function such as net return, export product or nutritional value.

The fifth objective, b.(5), is closely related to the fourth objective and will be closely coordinated with it. This objective will particularly emphasize working cooperatively with LDC counterparts to examine bottle necks, constraints, etc. to present production systems and to formulate logical interventions and eventually synthesize technologies and/or production systems for settings in each of the LDC ecozones.

Simulations will be designed to examine the effect of various interventions on specific production systems and will begin after the models are completed and validated. Input data peculiar to each location and management system are required; these data relate to forage qualities through time, growth and lactation parameters, and management policies. Existing conditions will be simulated for validation, to instill confidence, and to serve as baselines. Biological efficiency will be evaluated through examination of effects on each production component across time. In this manner the constraints to efficiency can be more readily detected and analyzed, and prescriptive measures developed. In addition, overall biological

efficiency (e.g., offtake/unit input) will be evaluated and economic analyses applied, objective b.(4). These simulations will begin after model validation during the third year.

The sixth objective, b.(6), is to logically extend the sheep and goat production systems models to an interface with each other and with the present Texas A&M Cattle Production Systems Models. Much of the production of sheep and goats is accomplished through multiple species use of the forage resource. Since nutrient requirements, grazing habits and production objectives are different for each species, an interacting combination of the sheep, goat and cattle models is required. This combined model would be especially useful for examining range recovery from drought and overgrazing, herd structures for optimizing productivity, effects of increasing inventories, etc. The interfacing of the models is anticipated to begin, depending on research developments, by the end of the third or fourth year.

d. Conditions That Will Indicate Objectives Have Been Acheived.

The major conditions, in sequence, which must be met to acheive objectives are:

(1) Development of sheep and goat models which are comprehensive, general, biologically based, dynamic and programmed for computer use.

(2) Validation of these models against data collected in specific LDC settings (collected by this project, collaborating projects and/or LDC data banks)

(3) Synthesis of sheep and goat production systems which meet objective functions specified by LDC livestock officers, Ministry of Agriculture officers, planning officers, etc. in consultation with Consortium personnel.

A number of additional, less critical or less objective criteria, include development of feedback information for coordinating Consortium research; setting research priorities; interfacing sheep, goat and cattle production systems models; interfacing economic and production systems models; and extending the production systems model to include feedback interactions with forage and veterinary components. The latter three objectives are long term, depend on development of information from collaborative projects and are not expected to be completed, only initiated, during the five year period.

e. Assumptions On Achievement Of Objectives

The modeling objective can be attained and will be available for use in LDCs and the U.S.A. regardless of LDC capabilities and participation. However, application to specific ecozones by synthesizing systems and conducting economic analysis depends on the cooperation of LDCs. Expertise level and personnel commitment from LDC's are minimal. Data will be collected by project personnel if not already available; this activity will require introductions and a few days cooperation of a number of livestock officers in production areas. No physical requirements are essential although transportation and guides to remote areas would be helpful; it is assumed that transportation can be attained by hire through project funds if necessary. The most critical assumption is that principal livestock officers, planning officers and Ministry of Agriculture personnel would devote some time to explaining their perception of constraints and of their plans for development. The same would apply for personnel of expatriate organizations with interests in sheep and goat or related development.

f. Assumptions That Acheiving Objectives Will Solve Problem.

The major assumption is that sufficient knowledge exists in the world (and available to project) to construct quantitative models of sheep and goat production systems. A large ruminant model has been developed (The Texas A&M Cattle Production Systems Model) and successfully applied in LDC's. This success suggests with little doubt that similar small ruminant models can be developed; however, research data are not as extensive and sensitivity, especially in earlier versions, may be reduced. Data for use of browse and high milk yield by goats are probably the areas of least knowledge.

It is assumed that adequate models can be developed, and that these models are a comprehensive collection of scientific knowledge collated into consistent interrelated statements of the functions affecting the components of the production train of events. That is, this project proposes an organized manner of examining application of scientific information to sheep and goat production systems.

g. Outputs of Project

Scientific agricultural knowledge has been said to be exportable from the U.S. to LDCs, but effective application of such knowledge to livestock production (that is, the development of viable technologies) has been minimal and at times counterproductive. A principal, general objective of this project is to make use of available research knowledge, optimally integrated into production systems where physical, financial and sociological constraints may be formidable. After model development, there will be two principal applications or outputs:

1. To simulate production systems incorporating anticipated research results for the cost-benefit analyses and other uses of the coordination-administration project in guiding research priorities.
2. To simulate production systems for specific areas in order to predict the effects of implementation of new practices on various components of the system, or to determine optimal order and timing for establishing a series of proven practices.

The objective function, or goal, of small ruminant production systems may vary among LDC's. Goals may be examined through model simulation in terms of biological efficiency, economic efficiency, energy and protein production, export potential, financial returns to producer and other criteria. Thus information critical to decisions of producers and policy makers will be more readily available.

The general models and the techniques and expertise developed will be applicable and available for use in any LDC and the U.S.A.

3. Technical Feasibility

The technical feasibility of this project must be considered in two phases: (1) model development and validation and (2) simulation of LDC production systems and synthesis and examination of new systems.

The first phase consists of organizing knowledge about small ruminants into comprehensive, biologically based, dynamic, mathematical models and then validating the accuracy of the model against real life experience. The techniques of modeling have been adapted to livestock production systems by the Texas A&M systems analysis group and widely validated and used in LDC's (Guyana, Colombia and Botswana). Therefore the techniques, methods, and expertise are available.

Two basic models will be developed; one for sheep and one for goats. These models will include functions for accomodating parameters associated with fiber production (or lack thereof) and milk production (or lack thereof for uses other than suckling young) by various breeds and types in various environmental settings. All of the data and understandings required for model development are not presently available. Some of this information which is lacking will be developed by other projects of the Title XII Small Ruminants Program. Other information will have to come from estimation by experienced ruminant nutritionists, physiologists, etc. Regardless of this incomplete nature of available information, the models will be developed and are expected to represent the best understanding of total small ruminant production systems possible.

Validation of these models remains the only point of doubtful outcome. That is, restructuring and refining the models may have to continue beyond two or three years in order to obtain satisfactory correspondence between simulations of production systems and outcome of the actual production system.

The probability of attaining this first phase of the project at least in substantial amounts is almost certain. The part in greatest doubt is validation of goat production systems involving intensive milk production or meat goat production based largely on browse.

The second phase is that of simulating and synthesizing production systems in LDCs; that is, examining present systems and new recommended practices, methods, etc. Since this phase depends on data collection and/or data already collected in the LDC and cooperation of LDC livestock technicians and officers from the Ministry of Agriculture (or other organization), the probability of accomplishing these objectives in any particular country are less certain. However, the extent of examining various alternatives can be varied widely so that very minimal cooperation can still yield useful studies or reports. For example, if nothing else, the affect of a drowth on milk and meat production of sheep and goats in a given area, recovery rates, herd composition changes,etc. can be examined. That is, if the Small Ruminants Title XII Program established a linkage with an LDC, then the level of attainment of this second phase depends on the interest and cooperation of the LDC and on inputs generated by the other projects of the Program as well as this project. If there is interest and a good data base generated, the outputs of this project may form the basis for development of policies and programs of the LDC Ministry of Agriculture.

BUDGET FY 1979

	$ Total	AID Percent Time*	AID $ Amount	TAES Cost Share** Percent Time	TAES Cost Share** $ Amount	LDC Institution $ Cost Share
A. Personnel (S&W)						
U.S. (Texas Agric. Exp. Sta.)						
T. C. Cartwright, Prof.	$ 20,000	25(10)	$ 10,000	25	10,000	
J. W. Bassett, Prof.	16,000	25(10)	8,000	25	8,000	
T. C. Nelsen, Res. Assoc.	10,500	75(25)	10,500	--	-------	
J. O. Sanders, Asst. Prof.	10,000	25(10)	5,000	25	5,000	
Sheep and Goat Specialist	12,000	88(35)	12,000	--	-------	
Systems Analyst	26,000	100(10)	26,000	--	-------	
C. R. Long, Assoc. Prof.	6,840	15	3,600	15	3,240	
Graduate Students, 1-1/2	7,500	50 each	7,500	--	-------	
Secretary	2,880	40	2,880	--	-------	
Steno., Data Recorder	1,500	25	1,500	--	-------	
Programmer, Data Processor	2,400	20	2,400	--	-------	
Fringe benefits @ 13.5%	15,741	--	12,065	--	3,676	
LDCs						
Ministry of Agric. Officials and Officers, Consultation (@ $500/LDC)	2,000					$ 2,000
Livestock Technicians, Data Collection and Summary (@ $1,000/LDC)	4,000					4,000
Livestock Technicians, U.S. Training in Systems Analysis (@ $250/LDC)	2,000					2,000
Subtotal	$139,361		$101,445		$29,916	$8,000
B. Equipment/Facilities/Animals						
U.S.						
Offices, Conference Rooms, calcu-Tators etc. for 3.53 professionals, 2-4 Graduate Students and .65 Sec-Steno.	26,700				26,700	
Support for collaborative research by PI's on sheep, goats and systems analysis applied to ruminant production systems	43,666				43,666	
LDC - none						
Subtotal	70,366				$70,366	
C. Travel and Per Diem						
U.S.	2,500		2,500			
U.S./LDC	8,000		8,000			
LDC	4,600		3,600			1,000
Subtotal	$15,100		$14,100			$1,000
D. Other Direct Costs						
Data Processing Center, Texas A&M						
Model development, CPU time	7,600		7,600			
Simulation, DPU, time	700		700			
Paper and printing	300		300			
Data Summary and Analysis	650		650			
Key Punching	450		450			
Consultants, fees and expenses	1,200		1,200			
Communications	580		580			
Publication and Library Materials	480		480			
Office Supplies, Copying etc.	1,000		1,000			
Project Accounting And Financial Reporting	6,675		6,675			
Site Coordination and Program Support	13,125		13,125			
Subtotal	$32,760		$32,760			
E. Overhead @ 18% of total	26,695		26,695			
Project Total	$284,282		$175,000		$100,282	$9,000

* The figures in parentheses are percent time allocation estimates for each person to be spent in LDCs.

** The TAES (Texas Agricultural Experiment Station) annual budget for collaborative sheep and goat research was in excess of $700,000 for 1977 and for 1978 and is expected to increase during the next five years.

Budget FY 1980	$ Total	AID Percent Time*	AID $ Amount	TAES Cost Share** Percent Time	TAES Cost Share** $ Amount	LDC Institution $ Cost Share
A. Personnel (S&W)						
U.S. (Texas Agric. Exp. Sta.)						
T. C. Cartwright, Prof.	$ 21,000	25(10)	$ 10,500	25	$ 10,500	
J. W. Bassett, Prof	16,800	25(10)	8,400	25	8,400	
T. C. Nelsen, Res. Sci.	16,000	100(25)	16,000	--	---	
J. O. Sanders, Asst. Prof.	10,500	25(10)	5,250	25	5,250	
Sheep and Goat Specialist	12,000	88(35)	12,000	--	---	
Systems Analyst	16,380	60(10)	16,380	--	---	
C. R. Long, Assoc. Prof	7,560	15	3,780	15	3,780	
Graduate Students, 1-1/2	10,500	50 each	10,500	--	---	
Secretary	3,025	40	3,025	--	---	
Steno., Data Recorder	1,575	25	1,575	--	---	
Programmer, Data Processor	2,520	20	2,520	--	---	
Fringe benefits @ 13.5%	15,910	--	12,140	--	3,770	
LDCs						
Ministry of Agric. Officials and Officers, Consultation (@ $500/LDC)	2,000					$ 2,000
Livestock Technicians, Data Collection and Summary (@ $1,000/LDC)	4,000					4,000
Livestock Technicians, U.S. Training in Systems Analysis (@ $250/LDC)	2,000					2,000
Subtotal	$141,770		$102,070		$ 31,700	$ 8,000
B. Equipment/Facilities/Animals						
U.S.						
Offices, Conference Rooms, calculators etc. for 3.53 professionals, 2-4 Graduate students and .65 Sec.-Steno.	28,035				28,035	
Support for collaborative research by PI's on sheep, goats and systems analysis applied to ruminant production systems	45,849				45,849	
LDC - none						
Subtotal	$ 73,884				$ 73,884	
C. Travel and Per Diem						
U.S.	1,400		1,400			
U.S./LDC	7,200		7,200			
LDC	3,900		2,900			1,000
Subtotal	$ 12,500		$ 11,500			$1,000
D. Other Direct Costs						
Data Processing Center, Texas A&M Model Development, CPU time	4,800		4,800			
Simulation, CPU, time	4,800		4,800			
Paper and printing	400		400			
Data Summary and Analysis	750		750			
Key Punching	400		400			
Consultants, fees and expenses	1,200		1,200			
Communications	800		800			
Publication and Library Materials	585		585			
Office Supplies, Copying etc.	1,200		1,200			
Project Accounting And Financial Reporting	6,675		6,675			
Site Coordination and Program Support	13,125		13,125			
Subtotal	$ 34,735		$ 34,735			
E. Overhead @ 18% of total	26,695		26,695			
Project Total	$289,584		$175,000	$105,584		$9,000

* The figures in parentheses are percent time allocation estimates for each person to be spent in LDCs.

** The TAES (Texas Agricultural Experiment Station) annual budget for collaborative sheep and goat research was in excess of $700,000 for 1977 and for 1978 and is expected to increase during the next five years.

Budget FY 1981	$ Total	AID Percent Time*	AID $ Amount	TAES Cost Share** Percent Time	TAES Cost Share** $ Amount	LDC Institution $ Cost Share
A. Personnel (S&W)						
U.S. (Texas Agric. Exp. Sta.)						
T. C. Cartwright, Prof.	$ 13,230	15(5)	$ 6,615	15	$ 6,615	
J. W. Bassett, Prof.	22,932	40(20)	14,112	25	8,820	
T. C. Nelsen, Res. Sci.	16,800	100(25)	16,800	--		
J. O. Sanders, Asst. Prof.	6,616	15	3,308	25	3,308	
Sheep and Goat Specialist	16,000	100(35)	16,000			
C. R. Long, Assoc. Prof.	7,938	15	3,969		3,969	
Graduate Students, 1-1/2	22,050	50 each	22,050			
Secretary	3,175	40	3,175			
Steno., Data Recorder	1,654	25	1,654			
Programmer, Data Processor	2,646	20	2,646			
Fringe benefits @ 13.5%	15,557		12,194		3,363	
LDCs						
Ministry of Agric. Officials and Officers, Consultation (@ $500/LDC)	2,000					$ 2,000
Livestock Technicians, Data Collection and Summary (@ $1,000/LDC)	4,000					4,000
Livestock Technicians, U.S. Training in Systems Analysis (@ $250/LDC)	2,000					2,000
Subtotal	$136,598		$136,523		$ 26,075	$ 8,000
B. Equipment/Facilities/Animals						
U.S.						
Offices, Conference Rooms, calculators etc. for 3.53 professionals, 2-4 Graduate students and .65 Sec.-Steno.	29,437				29,437	
Support for collaborative research by PI's on sheep, goat and systems analysis applied to ruminant production systems	48,142				48,142	
LDC - none						
Subtotal	$ 77,579				$ 77,579	
C. Travel and Per Diem						
U.S.	1,400		1,400			
U.S./LDC	7,800		7,800			
LDC	4,600		3,600			1,000
Subtotal	$ 13,800		$ 12,800			$ 1,000
D. Other Direct Costs						
Data Processing Center, Texas A&M Model Development, CPU time	2,400		2,400			
Simulation, CPU, time	6,500		6,500			
Paper and printing	400		400			
Data Summary and Analysis	500		500			
Key Punching	300		300			
Consultants, fees and expenses	700		700			
Communications	800		800			
Publication and Library Materials	382		382			
Office Supplies, Copying etc.	1,200		1,200			
Project Accounting And FInancial Reporting	6,675		6,675			
Site Coordination and Program Support	13,125		13,125			
Subtotal	$ 32,982		$ 32,982			
E. Overhead @ 18% of total	26,695		26,695			
Project Total	$287,654		$175,000		$103,654	$ 9,000

* The figures in parentheses are percent time allocation estimates for each person to be spent in LDCs.

** The TAES (Texas Agricultural Experiment Station) annual budget for collaborative sheep and goat research was in excess of $700,000 for 1977 and for 1978 is expected to increase during the next five years.

Budget FY 1982	$ Total	AID Percent Time*	AID $ Amount	TAES Cost Share** Percent Time	TAES Cost Share** $ Amount	LDC Institution $ Cost Share
A. Personnel (S&W)						
U.S. (Texas Agric. Exp. Sta.)						
T. C. Cartwright, Prof.	$ 13,892	15(5)	$ 6,946	15	$ 6,946	
J. W. Bassett, Prof.	24,079	40(20)	14,818	25	9,261	
T. C. Nelsen, Res. Sci.	17,640	100(25)	17,640			
J. O. Sanders, Asst. Prof.	7,946	15	3,973	25	3,973	
Sheep and Goat Specialist	16,800	100(35)	16,800			
C. R. Long, Assoc. Prof.	8,334	15	4,167		4,167	
Graduate Students, 1-1/2	23,153	50 each	23,153			
Secretary	3,334	40	3,334			
Steno., Data Recorder	992	15	992			
Programmer, Data Processor	2,084	15	2,084			
Fringe benefits @ 13.5%	16,209		12,677		3,532	
LDCs						
Ministry of Agric. Officials and Offices, Consultation (@ $500/LDC)	2,000					$ 2,000
Livestock Technicians, Data Collection and Summary (@ $1,000/LDC)	4,000					4,000
Livestock Technicians, U.S. Training in Systems Analysis (@ $250/LDC)	2,000					2,000
Subtotal	$142,463		$106,589		$ 27,879	$ 8,000
B. Equipment/Facilities/Animals						
U.S.						
Offices, Conference Rooms, calculators etc. for 3.53 Orifessionals, 2-4 Graduate Students and .65 Sec-Steno.	30,909				30,909	
Support for collaborative research by PI's on sheep, goats and systems analysis applied to ruminant production systems	50,549				50,549	
LDC - none						
Subtotal	$ 81,458				$ 81,458	
C. Travel and Per Diem						
U.S.	800		800			
U.S./LDC	7,000		7,000			
LDC	3,000		2,000			1,000
Subtotal	$ 10,800		$ 9,800			$ 1,000
D. Other Direct Costs						
Data Processing Center, Texas A&M Model Development, CPU time	800		800			
Simulation, CPU, time	5,000		5,000			
Paper and printing	400		400			
Data Summary and Analysis	300		300			
Key Punching	200		200			
Communications	300		300			
Publication and Library Materials	321		321			
Office Supplies, Copying etc.	1,200		1,200			
Project Accounting and Financial Reporting	6,675		6,675			
Site Coordination and Program Support	16,725		16,725			
Subtotal	$ 31,921		$ 31,921			
E. Overhead @ 18% of total	26,625		26,695			
Project Total	$293,337		$175,000		$109,337	$ 9,000

* The figures in parentheses are percent time allocation estimates for each person to be spent in LDCs.

** The TAES (Texas Agricultural Experiment Station) annual budget for collaborative sheep and goat research was in excess of $700,000 for 1977 and for 1978 and is expected to increase during the next five years.

Budget FY 1983	$ Total	AID Percent Time*	AID $ Amount	TAES Cost Share** Percent Time	TAES Cost Share** $ Amount	LDC Institution $ Cost Share
A. Personnel (S&W)						
U.S. (Texas Agric. Exp. Sta.)						
T. C. Cartwright, Prof	$ 14,585	15(5)	$ 7,294	15	$ 7,293	
J. W. Bassett, Prof.	25,282	40(20)	15,558	25	9,724	
T. C. Nelsen, Res. Sci.	18,522	100(25)	18,522			
J. O. Sanders, Asst. Prof.	9,294	15	3,647	15	3,647	
Sheep and Goat Specialist	17,640	100(35)	17,640			
C. R. Long, Assoc. Prof.	8,752	15	4,376	15	4,376	
Graduate Students, 1-1/2	18,232	50 each	18,232			
Secretary	3,500	40	3,500			
Steno., Data Recorder	1,094	15	1,094			
Programmer, Data Processor	2,188	15	2,188			
Fringe benefits @ 13.5%	15,806		12,426		3,380	
LDCs						
Ministry of Agric. Officials and Offices, Consultation (@ $500/LDC)	2,000					$ 2,000
Livestock Technicians, Data Collection and Summary (@ $1,000/LDC)	4,000					4,000
Livestock Technicians, U.S. Training in Systems Analysis (@ $250/LDC)	2,000					2,000
Subtotal	$140,896		$104,476		$ 24,420	$ 8,000
B. Equipment.Facilities/Animals						
U.S.						
Offices, Conference Rooms, calculators etc. for 3.53 professionals, 2-4 Graduate Students and .65 Sec.-Steno.					32,454	
Support for collaborative research by PI's on sheep, goats and systems analysis applied to ruminant production systems					53,076	
LDC - none						
Subtotal	$ 85,530				$ 85,530	
C. Travel and Per Diem						
U.S.			800			
U.S./LDC			7,400			
LDC			3,600			1,000
Subtotal	$ 12,800		$ 11,800			$ 1,000
D. Other Direct Costs						
Data Processing Center, Texas A&M Model Development, CPU time			800			
Simulation, CPU, time			8,000			
Paper and printing			400			
Key Punching			200			
Communications			800			
Publication and Library Materials			829			
Office Supplies, Copying etc.			1,200			
Project Accounting And Financial Reporting			6,675			
Site Coordination and Program Support			13,125			
Subtotal	$ 32,029		$ 32,029			
E. Overhead @ 18% of total	26,695		26,695			
Project Total	$297,950		$175,000		$113,950	$ 9,000

* The figures in parentheses are percent time allocation estimates for each person to be spent in LDCs.

** The TAES (Texas Agricultural Experiment Station) annual budget for collaborative sheep and goat research was in excess of $700,000 for 1977 and for 1978 and is expected to increase during the next five years.

5. Implementation Plan

a. The implementation of this project occurs in two phases

1. Model development and validation and refinement

2. Applications of systems analysis to LDC small ruminant production systems

The first phase will actually continue throughout the project and require input from the other collaborating Consortium institutions as well as data and information collected on the project in the LDCs.

The second phase is the application phase and depends more heavily on LDC cooperation as well as cooperation (actually coordination) with the colloborating Consortium institutions. The simulations will be the basis for examining alternative production practices and synthesizing production systems to most efficiently meet objective functions. These simulation outputs are very useful for examination of biological aspects but are most useful when subjected to economic analysis. Therefore this project is closely coordinated with the Economic Analysis project. Also determining objective functions and implementation of new technologies in sheep and goat production, will be closely coordinated with the Sociology project.

Livestock officers will be involved in the first two years in collecting data and characterizing production systems. They will be involved after that time in critiquing and making suggestions for modifying or altering production practices. Ministry of Agriculture Officers and/or planning officers will be involved in developing improved technologies and methods (order etc.) of implementation.

A time schedule of activities is given below.

Time Schedul

Activity	FY 79	FY 80	FY 81	FY 82	FY 83
Model Development	Initiate	Complete basic form	Fine tune, fit to locales	Adapt to Locales	Adapt to Locales
Model Validation	--------	Institute, tentative validation	Complete major validation	Minor validation	Minor validation
Characterize Present production Systems in LDCs	Initiate	Complete major categories	Extend	Extend	--------
Collection of Animal and Production Data in LDCs	Initiate	Complete major portion of data bank	Extend	Extend	--------
Baseline Simulations	--------	Initiate, tentative simulation	Major activity	Extend baseline simulations	--------
Examining alternative Recommended Practices for LDC's	--------	--------	Initiate	Major activity	Extend
Production of Biotechnical Data For Economic Analysis	--------	Initiate,	Major activity	Major activity	Extend
Re-examination of Altered Production Practices with Sociologist And LDC Livestock Officers and Ministry Of Agriculture Officials	--------	Tentative	Re-examine all simulations	Continue	Continue
Synthesis Of New Technologies for LDC Officers And Officials	--------	--------	Initiate	Major activity	Major activity
Advancement of Integral Model Capabilities					
Interacting Forage Component	--------	--------	Initiate preliminary study	Develop model concepts	Initiate base model component
Multiple Species Grazing	--------	--------	Initiate preliminary study	Develop procedure	Initiate interfacing models
Economic Analysis	--------	--------	Initiate preliminary study	Develop procedure	Initiate interfacing models

6. Annual Review And Planning Processes

This project is somewhat unique in that progress or status is clearly indicated by stage of model development, degree or closeness of validation of between actual LDC production and simulated production, and of the production systems synthesized. Also this systems analysis project assumes the role of coordinating the biotechnical aspects of all of the collaborating projects in the Title XII Small Ruminants Program. An annual report will be written for review. The annual report will be reviewed by the Head of the Animal Science Department, the Committee of Professors of the Animal Science Department, the office of the Director of the Texas Agricultural Experiment Station and the Committee of PI's of the Title XII Small Ruminant Program.

A model of production systems is an organization of knowledge and provides a logical basis for planning each step in systems analysis and synthesis. The review feedback is the primary basis for planning.

Planning with respect to linkages with LDCs will be coordinated with the Management Entity of the Program and the Committee of PIs.

Personnel and Expertise

Thomas C. Cartwright, Ph.D., Professor in charge of the Animal Breeding and Genetics Section, Animal Science Dept., Texas A&M Univ. His research has concentrated on cattle breeding, including adaptation to tropical conditions and systems analysis. He is leader or coworker on 5 research projects, was leader of an AID 211d grant on tropical livestock production systems and has consulted widely in LDCs. His publications (6 during past 4 years) and invited papers at national scientific meetings (3 during past 3 years) on synthesis of ruminant livestock production systems are his most significant recent contributions.

James O. Sanders, Ph.D., Assistant Professor, Animal Breeding Section, Animal Science Dept., Texas A&M Univ. His research has consisted of modelling beef cattle production systems and the application of genetic selection theory to increase the productive efficiency of beef cattle production systems. He teaches undergraduate animal breeding and breeds of livestock and is considered an authority on world breeds of livestock. He is a consultant for ILCA on analysis of beef cattle production systems for Botswana.

Terry C. Nelsen, M.S., Research Associate, Animal Breeding Section, Animal Science Dept., Texas A&M Univ. His research at Texas A&M has emphasized modelling and simulation of beef cattle production systems. He has taught animal breeding and presently devotes full time to systems analysis applied to livestock production. He is a consultant to ILCA for analysis and synthesis of beef cattle production systems for Botswana.

Organizational Qualifications

Texas is the leading state in the U. S. in numbers of sheep and goats, with over 2.5 million sheep and 1.3 million goats in 1977. These represent approximately 20% of the sheep and 90% of the goats in the U. S. The Texas Agricultural Experiment Station has had an active sheep and goat research program for many years. TAES funding for sheep and goat programs has exceeded $700,000/annum since 1975.

The TAMU Agricultural Research and Extension Center at San Angelo is in the heart of the sheep and goat production area and is largely devoted to sheep and goat research. There are six scientists along with support personnel, over 3,000 sheep and 1,900 goats and physical facilities at San Angelo, Brandy and Sonora for conducting research. The Research Station at Sonora is primarily used for grazing studies and development of pasture rotation systems using cattle, sheep and goats.

A significant portion of the state is located within the tropical or subtropical region as defined by being within 30^{0} of the equator. Within the state, rainfall conditions vary from arid to semi-humid.

Personnel on the main campus at College Station also participate and cooperate in sheep and goat research. The Animal Science Dept. has 67 professional staff located at the main campus with sections in Nutrition, Meats, Reproductive Physiology, Animal Breeding, Beef Cattle, Dairy, Swine, Horses, and Sheep and Goats. A Meats Laboratory, Wool and Mohair Laboratory, Veterinary Diagnostic Laboratory, Institute of Tropical Veterinary Medicine, Agricultural Analytical Service, Statistics Institute, Data Processing Center, and other similar research and service facilities are available for use on this project.

The TAMU International Programs Office has had programs in countries of Asia, Africa, South America, Latin America, and the Caribbean. Currently this office administers projects in Colombia, Guatemala, Mali, Tanzania and Uruguay. In addition, this office supervises training programs of from 55 to 75 degree candidate and 80 to 100 shorter term trainees from 12 LDCs.

Thomas C. Cartwright

SONAL DATA AND EDUCATION:

[redacted]

B.S., Animal Husbandry, Clemson University, 1948
M.S., Genetics, Texas A&M University, 1950
Ph.D., Animal Breeding, Texas A&M University, 1954

ERIENCE:

Leader, Beef Cattle Breeding at the McGregor Station, 1942-1948
Professor, Genetics Department 1958-1962
Professor, Animal Science Department, 1962 - present
Consultant, University of Texas Health Science Center, Genetics of Atherosclerosis in the baboon, 1972 - present
Member of Board and Executive Committee, Winrock International Livestock Research And Training Center, 1976 - present
Leader, FAO Team to Evaluate Cattle Production Programs in Uganda, 1975.
Leader, AID 211d grant in ruminant livestock production systems in tropics, 1972-1977.
Travel to observe, lecture, consult and/or advise on beef cattle breeding in Mexico, Guatemala, Costa Rica, Argentina, Venezuela, Australia, Germany, Italy, France, Austria, Switzerland, Denmark, Sweden, Great Britain, Ireland, Wales, South Africa, Rhodesia, Guyana, Ethiopia, Mali, Chad, Cameroons, Upper Volta, Botswana, Uganda, Tanzania.

ORS AND AWARDS:

TAMU Distinguished Faculty Achievement Award in Teaching, 1962
Fellow American Association for the Advancement of Science, 1965
Guest Professor, Animal Breeding Inst. Univ. of Gottingen, Germany, 1970
American Society of Animal Science Rockefeller Prentice Award for Research in Animal Breeding and Genetics, 1973

OR RESEARCH AREAS:

Heat tolerance and adaptability of cattle
Hybrid vigor, combining ability and complementarity in beef cattle
Genetics of growth in beef cattle
Analysis and Synthesis of Beef Cattle Production Systems

SENT POSITION AND DUTIES:

In charge, Texas A&M University Research Center at McGregor
Leader, Animal Breeding and Genetics Section, Animal Science Department
Member, Faculty of Institute of Comparative Medicine and Genetics Faculty
Project Leader, animal breeding and systems analysis research
Teaching of Animal Breeding, and Quantitative Genetics
Chairman, TAMU Mini-Grant Committee

BERSHIP IN ORGANIZATIONS:

American Association for the Advancement of Science
American Genetics Association
American Society of Animal Science
Asociacion Latinoamericana Production Animal
Sigma Xi
Alpha Zeta
Gamma Sigma Delta
Phi Kappa Phi

LICATIONS:

34 Scientific articles, 84 abstracts, 68 progress reports, 30 popular articles, 13 books and bulletins (chapters).

A. PROJECT TITLE: EVALUATION OF MEAT GOATS AND HAIR SHEEP

B New

C. Grantee: Management Entity/Texas Agricultural Experiment Station (TAES)

D. Principal Investigators:

	Percent of Time on Project
Dr. Maurice Shelton, Leader	0.50
Geneticist - to be employed	0.75

E. Duration: Minimum of 5 years with renewal options (estimated time required - 8 years)

F. Total Estimated Costs by Years:

	1979	1980	1981	1982	1983
A.I.D.	150,000	150,000	150,000	150,000	150,000
TAES*	194,644	195,212	195,779	196,347	196,914
LDC Institutions (4)	10,000	10,000	10,000	10,000	10,000
TOTAL	354,644	355,212	355,779	356,347	356,914

G. Funding by years - See above

H. Prior Funding - None

I. A.I.D. Project Manager:

*At the present time TAES has an annual research budget of over $700,000 committed to sheep and goats. The various areas of research are interrelated to the extent that it is not possible to designate exactly that which might be matching to the proposed Small Ruminant CRSP. In this proposal approximately $200,000 annually has been indentified as related to the specific objectives of this project, whereas, the total amount would be related to the overall objectives of the Small Ruminants CRSP.

2. Detailed Project Description

a. Description of Problem

Long term changes which have occurred relating to many animal industries have been through alteration of the species to produce products and services of greater value to man. Such changes tend to be permanent and do not require repetition on a seasonal or annual basis. By contrast, other components of the production system such as range forage quality or disease and parasite load have often deteriorated over time. Thus, if the past may be taken as a prologue to the future, the possibilities for continued improvement by selection between and within species and genotypes of both sheep and goats should receive high priority. This is particularly true in light of recent developments in animal breeding suggesting that good response can be realized in selection for such important traits as fertility (a major component of efficient meat production) and parasite and disease resistance. The genetic approach appears to hold as much interest as therapeutic treatment in the control or prevention of infections or parasitic diseases in many LDCs.

With both of the species involved in this proposal, there are a large number of genetic types (possibly as many as one thousand) many of which have not been properly identified and their potential fully utilized. Many of these would now be considered as exotic to selected sites in LDCs, but it should be pointed out that most domestic animals were exotic at some point in time to the areas in which they are presently found. A large portion of the world's sheep population is found in the group known as the Fat-Tail Carpet Wool sheep, and these, plus the non-wool producing type (hair sheep) constitute the primary types found in the LDC countries. These animals may or may not be milked, but a significant portion of the Fat-Tail sheep are milked for at least a short period during the year. These two types of sheep have

received relatively little emphasis in scientific literature, and the U.S. scientific community has little familarity with these types. There is a real need to devote some attention to these types of sheep in both the U.S. and in LDC countries. By contrast the alternative type of sheep, such as the Merino and Medium-wool breeds of European origin have been the subject of numerous investigations.

Some specific research needs relating to the Fat-Tail sheep might be concerned with the interrelationship of the Fat-Tail to performance and adaptation to adverse conditions. There is widespread belief that the meat of the Fat-Tail is preferred to other types of sheep, and this should be explored in light of the potential market in Middle Eastern countries. It is generally recognized that the fat in the tail is a significant impediment to reproduction. In this light is appears to be important to clarify the relationship of the Fat-Tail to eating qualities of the meat and survival in times of stress. Answers to these questions are basic to consideration of future selection practices with this type of sheep or the possibilities of introducing non-Fat-Tail types into the areas involved.

A high proportion of the world's sheep population and over two-thirds of the world's goat population is found within 30° of the equator. These tend to be concentrated in the arid regions, but significant numbers are also found in humid regions. Generally, it is only the Hair-type (non-wool producing) sheep that can persist or flourish in the humid regions. The LDC countries also tend to be concentrated in a belt around the equator. Thus, the goat and the Hair sheep are of considerable significance in the development of many LDCs. For the most part, these two animals have evolved under natural selection favoring those traits which contribute to survival and penalizing those traits of value to man, such as growth rate and milk

production. These animals have benefited little from selective breeding and management. In this proposal, the two species or types are being tied together because they serve a common function in this state as in many LDC's. One of the points of research interest is to clarify the contribution or need for both types and data on comparative efficiency as well as the overlap in grazing habits should be investigated. Little selective breeding is evident or even possible under conditions of many LDCs where these animals are raised. In general, the animals have slow growth rates, low dressing percent and small carcass weights. The latter may be an advantage or a disadvantage depending on the end use such as a home meat supply or commercial exploitation. The type of animal described above represents a good potential for a dam line. However, to utilize them efficiently or exploit their potential as a dam line, good sire lines as well as the potential for controlled breeding and management schemes would be required. Unfortunately good sire lines are not readily available with either goats or hair sheep. Those which might possibly qualify for this purpose (i.e. Boer or Jamunapari goat or Dorper or Blackhead Persian sheep) are not generally available. At present, the dairy types of goats of Alpine origin or the Down breeds of sheep of European origin are often introduced into the LDCs, and a number have been exported from the U.S. for this purpose. These types have generally proved unsatisfactory for use outside the temperate regions. There is also a need to clarify the relationship between adaptability to nutritional or climatic stress and such components of production as fertility, growth rate and milk production. These type of data are required in the design of the most efficient breeding systems, i.e. should efforts be directed at developing a single animal with overall merit or should specialized breeds or sire lines be developed to serve specific functions. There is a significant and growing interest in Texas in utilizing goats for meat and fiber production and in range management. There is also a

limited population of Hair sheep. Within the state a majority of these animals are found within 30° of the equator and thus any data generated or genotypes developed would be expected to hold interest both in this state and in many LDCs.

In this project it is proposed to survey existing genetic types with special reference to Meat type goats and Hair sheep. A total world survey is an unrealistic goal and these efforts will be concentrated in tropical regions including research sites involved in the total SRCRSP effort. In addition, breeding programs and data collection for genetic parameter estimates will be initiated in Texas and in one or more LDCs if suitable location can be identified and appropriate linkages arranged. Long term selection experiments will be initiated in this state with Meat type goats and Hair sheep, but not Fat-Tail sheep. A small flock of the latter will be established for use in specific studies and to insure the preservation of this gene pool in the United States. More conventional breeds and crosses of sheep, primarily Finewool, will also be maintained for comparative purposes. Attempts will be made to introduce and evaluate high fertility types for use in both the U.S. and LDC countries.

b. Objectives of project

The overall objective will be to improve the contribution of sheep and goats to meeting the needs of man for food and fiber with special reference to areas of greater need. More specific objectives are outlined below:

1. To survey existing populations and genotypes of tropically adapted (Hair type) sheep and Meat type goats and available data on their performance with a view to maximizing their contribution in the U.S. and LDC countries.

2. Introduce to the U.S., or designated sites in LDCs, selected genetic

types which appear to hold potential and mutual interest to the areas involved. These types would be evaluated in comparisons with existing genotypes in the U.S. and LDC locations. These studies would be designed to have application to larger ecozones. Any superior genotypes which are identified would be made available to research and development programs through live animals a frozen semen to the extent that resources, technological progress and disease control regulations permit.

3. To establish and maintain a small flock of Fat-Tail (Karakul) type sheep to insure that this genotype is not lost in the United States and to utilize this flock for educational and research purposes with emphasis on exploring the relationship of the Fat-Tail to carcass traits, (yield and eating quality), reproductive performance and adaptability to nutritional climatic stress. Attempts will be made to extend these studies to field evaluation of useful findings under LDC conditions.

4. Initiate and conduct long-term breeding programs with Meat type goats and Hair sheep with a view of collecting needed information on productive efficiency, genetic parameters and appropriate selection procedures. New genetic types would be compared with existing breeds. Answers will be sought to such basic questions as the relationship of productivity and adaptability to nutritional and climatic stress.

5. Compare grazing habits of goats and the three genotypes to determine to what extent they compete or compliment in forage utilization, and to explore the possibilities of altering grazing patterns through selection.

6. Assist cooperating institutions in LDCs to initiate selection programs for indigenous or introduced populations with special reference to adaptation and disease and parasite resistance.

7. In the process of accomplishing the above objectives, it is anticipated that needed new information will be developed relating to

management procedures, product evaluation, disease control, etc. Personnel in a number of departments or disciplines of Texas and LDC Institutions should make contributions in these areas.

8. Graduate training programs will be offered by Texas A&M University with the opportunity to concentrate on various aspects of sheep and goat production.

c. Project approach

The approach to objective number one and two will consist of a literature survey of current information on breeds of goats and Hair sheep. The information will be obtained not only from traditional literature sources, but from other groups or agencies having an interest in questions under study. This will be supplemented by on site visits to major areas of interest in Africa, Asia and Latin America by personnel involved in this specific project or others associated with the Small Ruminants Collaborative Research Support Program (SRCRSP). The results will be circulated to members of the consortium with recommendations on genotypes of interest. This should be accomplished to a significant degree within the first year of the project, but will be a continuing effort as additional information becomes available. A list will b prepared on animals having potential interest for relocation. Those considered for importation and use in the Texas contributing project will emphasize the components which contribute to meat production such as fertility, growth rate and adaptability. Those considered for relocation to sites in LDC would include milk production as well if this is a component of the use pattern of that particular area. It is suggested that selection of both sheep and goats for milk production can best be done outside the U.S. In the case of sheep, there is no U.S. market outlet for sheep milk, and it seems unrealistic to propose to establish breeding flocks directed toward this end in this country. There could well be a market for goat milk, but good dairy

breeds exist for temperate climates and selection efforts should concentrate on selection under conditions more typical of the LDCs. These might be simulated only in a few locations in the United States, but would generally require establishing a unit specifically for this purpose. Fiber production is not anticipated as having major interest, but this will not be ruled out for areas where fiber is an economic enterprise or where it is important for home use. Data on the use of both goats and sheep for fiber production will be available from control groups in the Texas project.

Potential relocation sites outside the U.S. may be at institutions contributing specifically to this (Germ Plasm) project or those involved in the overall effort of the SRCRSP. Insofar as possible, U.S. as well as LDC sites will be chosen in a manner that results would be applicable to larger ecozones.

In respect to objective No. 3 a flock of up to 100 head of Fat-Tail (Karakul) sheep will be established or produced and maintained for the period covered by this project. The animals will be obtained from a wide genetic base and sufficient males will be maintained to insure that inbreeding does not become a problem during the time span of this project. These animals will be selected to conform to the Karakul genotype insofar as possible to provide the potential for a possible revival of interest in Persian lamb skins. The basic breeding flock or their offspring will be utilized for various investigations of basic interest to Fat-Tail sheep in general. The male lambs will initially be utilized to compare Fat-Tail, Finewool and Finewool X Medium Wool crossbreeds as to carcass cutout, fat distribution, taste panel evaluations and for chemical characterization of the fatty tissue. Later comparisons will look at docked versus undocked market lambs as to fat distribution and eating qualities. It is realized that some of this type of work has been done, but a minimal amount of repetition may be desirable to provide a base point for this

project. A portion of the female offspring will be docked and evaluated throughout their productive lifetime with respect to reproductive performance as compared to undocked Fat-Tail ewes and other genotypes (Finewool). Comparable groups of docked and undocked Fat-Tail types along with thin tail types such as Merinos will be evaluated in respect to resistance to high temperature and nutritional stress. Temperature stress will be evaluated by measuring body temperatures under a variety of environmental conditions. Evaluation of resistance to nutritional stress will consist of exposing various types (i.e. Fat-Tail, docked Fat-Tail and thin tail) to submaintenance diets and measure weight loss and rate and site of fat disappearance. Comparative slaughter techniques and ultrasonics will be used for the latter purpose. It is determined that the Fat-Tail adversely affects reproduction, but is not necessary or beneficial to meat quality or survival, attempts will be made to initiate long term selection experiments in LDCs to explore the desirability and feasibility of altering this trait through selection.

The research approach for objective 4 will consist of establishing flocks of Hair sheep and Meat type goats on which data may be collected. The Texas Agricultural Experiment Station currently owns approximately 700 head of Meat type goats which will contribute to the effort. A small flock of Hair type sheep are available and will be expanded and maintained for study. Initially these will consist of Black-bellied Barbados, but other types will be integrated into the program as they become available and appear to be useful. It is anticipated that it will be possible to enlist several private breeders in a cooperative breeding scheme designed to improve the meat and leather production potential of these species. This work will be conducted in semi-arid conditions at sites near or within 30° of the equator. It

is anticipated that genotypes which are developed will have wide adaptation to many of the LDC countries.

The type of data collected will consist of that required to calculate phenotypic and genetic parameters, design efficient selection systems, compare productive efficiencies of genotypes involved and to carry on actual selection programs. Some basic questions which require answers relate to the interrelationship of fertility, growth rate and adaptability to nutritional of climatic stress or disease resistance. At this point it is not clear if selection programs will or should emphasize overall merit or the development of special lines or breeds to be utilized in stratified breeding schemes. The approach taken in this country and that at the LDC institutions would not necessarily be the same.

The research approach to objective number 5 will consist of establishing a diet analysis laboratory utilizing microscopic analysis of fecal material. This procedure can be utilized to identify constituents in the diet and to approximate their relative proportion. In the past this type of work has been done by use of esophageal fistulas or by observing the grazing habits. Both procedures place restrictions on the number of animals which can be utilized and possibly interfers with grazing behavior. The approach to be taken in this project will permit the study of relatively large numbers of animals and permit comparisons by species, breeds or genetic types within species and possible genetic variation within the breed. It seems important to determine to what extent Hair sheep and goats compete in grazing habits since they are very similar in adaptation and in the nature of the products produced. It also seems important to determine to what extent the Fat-Tail sheep differs from others in grazing habits as this might be related to their adaptation to arid regions. It is also planned to look into inheritance of diet preference with a view to proposing selecting animals which

preferentially consume prevalent or problem plant species. This may become of particular importance as restrictions are placed on mechanical or chemical control of problem plant species due to energy costs or environmental concerns. This work will initially be conducted in the U.S., but can also be carried out in LDCs by on-site studies by U.S. personnel or through training of graduate students or technicians.

The efforts relating to objective number 6 will be largely limited to performing advisory services in terms of recommending genotypes of interest and long term selection procedures. Priority effort would be to those LDC institutions which are cooperating with the SRCRSP, but would be extended beyond this as needs are expressed and time and travel funds permit.

In connection with objective number 7, the Texas A&M University and the Agricultural Experiment Station has professional staff competence in a number of disciplines (Range Science, Meats, Fiber Technology, Veterinary Science, etc.) who have a professional interest in the species involved. It is anticipated that individuals within these disciplines will become involved in the project directly or in an advisory capacity as their input is required in respect to management of the species involved or in collection of the data as proposed. Within the level of funding proposed, the involvement of supporting staff members in work in LDCs would be of a limited nature.

Objective number 8 involves a committment to the training component of the overall project. The normal graduate training program offered by Texas A&M University will provide the primary mechanism for this training. However, the animals involved in the project will provide resource material for graduate students from U.S. or LDCs who wish to utilize these in graduate training programs. Also personnel from the project will assist and participate in other training efforts as may be worked out be parties involved. It is anticipated that the Program Director for the overall SRCRSP will be primarily

responsible for initiatives in this area.

d. Conditions that will indicate objectives have been achieved

The overall objectives of improving the contribution of sheep and goats to meeting the food and fiber needs of mankind, and even of producing superior genetic material, are long term goals which obviously cannot be completed in the projected lifetime of this project. However, if programs and practices can be initiated which will be carried forward over a longer period of time some real progress can be expected. The more limited objectives outlined under 2(b) above lend themselves to more definitive accomplishments. The progress in these more limited areas would be documented by breed description information, by the presence of flocks and herds in experimental programs in this country and in LDCs and by publication of experimental data. Also the presence of personnel in LDC locations who have received advanced training as a result of this project would be considered as tangible evidence of progress.

e. Assumptions on achievement of objectives (externalities outside control of PI)

Some very significant factors outside the complete control of project personnel will have an affect on the success of the project. Primary among these is the ability to locate and finalize stable institutional linkages in LDCs. The funding budgeted to this project is certainly not adequate to establish and to finance research facilities outside the U.S., and it is simply not possible to determine to what extend funding in LDC locations will be adequate. The second major factor contributing to success of the project will be the ability to move breeds or genotypes of interest between countries. At present it is known that significant difficulties exist in this area, but it is expected that over the life of this project and as a result of activities associated with this project some progress can be made in this area. The ability to freeze and store sheep semen can

also be a limiting factor. No work of this nature is proposed under this specific project, but will perhaps be a part of the overall plan of SRCRSP. The likelihood of progress on this point appears to be good.

(b) Assumption that achieving objectives will solve problem

A stated precondition of the SRCRSP is that it will be contributing or conducted in countries designated as LDC which implies a need. Also the overall objective of its project is stated to "improve the contribution of sheep and goats to meeting the food and fiber needs of people." Thus by definition any progress in accomplishing this objective would contribute to the solution of a problem.

g. Outputs of project

The primary outputs would be:

1. Needed new information (publications),
2. Superior types of animals,
3. Facilities developed and programs placed in motion,
4. Better trained people.

3. Technical Feasibility

From a technological standpoint all the activities projected under this project are feasible, and some progress is assured based on work which will be done in this country. However, the objectives may not be fully realizeable under the time frame or level of funding proposed. Many of the more serious impediments to accomplishing the objectives are of human origin and may more likely classified as political or sociological constraints. Primary among these are regulations on animal transfer and the ability of project personnel to implement changes.

Budget FY 1979

	Total	AID Percent Time*	AID $ Amount	TAES Percent Time	TAES $ Amount	LDC Institution $ Cost Share
Personnel						
U.S.						
J.M. Shelton, Proj. Leader	$ 17,000	25(10)	$ 8,500	25	$ 8,500	
Geneticist	24,000	75(20)	18,000	25	6,000	
P. V. Thompson, Manager	8,000	25	4,000	25	4,000	
G. Snowden, Technician	6,000			67	6,000	
Technician, Diet Analyses	12,000	100	12,000			
Technician, Breeding	12,000	100	12,000			
Graduate Student	6,000	50	6,000			
Other Professional	15,000	25(10)	7,500	25	7,500	
Other Subprofessional	32,409			450	32,409	
Secretary	7,000	33	3,000	50	4,000	
Fringe @ 13.5%	18,820		9,585		9,235	
LDC						
Livestock Technicians and Professionals	8,000					$ 8,000
Subtotal	$166,229		$ 80,585		$ 77,644	$ 8,000
Equipment/Facilities/Animals						
U.S.						
Materials and Supplies	16,334		16,334			
Buildings, Facilities and Utilities	15,000				15,000	
Animals	25,000				25,000	
Support from Collaborative TAES sheep and goat res. proj. (H1745, H1942 and H6243)	77,000				77,000	
LDC						
Animals	500					500
Buildings and Facilities	500					500
Subtotal	$134,334		$ 16,334		$117,000	$ 1,000
Travel						
U.S.	1,400		1,400			
US/LDC	9,000		9,000			
LDC	1,800		800			1,000
Subtotal	$ 12,200		$ 11,200			$ 1,000
Other Direct Costs						
Publications	1,000		1,000			
Site Coordination And Program Support	11,250		11,250			
Fiscal Accounting And Reporting	6,750		6,750			
Subtotal	$ 19,000		$ 19,000			
Total Overhead @ 18%	22,881		22,881			
Project Total	$354,644		$150,000		$194.644	$10,000

figures in parentheses are percent time allocation estimates for each person to be spent LDCs.

TAES (Texas Agricultural Experiment Station) has an annual budget for collaborative ep and goat research of over $700,000.

Budget FY 1980

	Total	AID Percent Time*	AID $ Amount	TAES Percent Time	TAES $ Amount	LDC Institution $ Cost Share
Personnel						
U.S.						
J. M. Shelton, Project Leader	$ 17,200	35(10)	$ 8,000	25	$ 8,000	
Geneticist	24,100	75(20)	18,000	25	6,100	
P. V. Thompson, Manager	8,200	25	4,100	25	4,100	
G. Snowden, Technician	6,100			67	6,100	
Technician, Diet Analyses	12,400	100	12,400			
Technician, Breeding	12,400	100	12,400			
Graduate Student	6,000	50	6,000			
Other Professional	15,000	25(10)	7,500	25	7,500	
Other Subprofessional	32,409				32,409	
Secretary	7,200	33	3,.00	50	9,303	
Fringe @ 13.5%	19,037		9,734			
LDC						
Livestock Technicians and Professionals						$ 8,000
Subtotal	$168,046		$ 81,834		$78,212	$ 8,000
Equipment/Facilities/Animals						
U.S.						
Materials and Supplies	31,885		16,885		15,000	
Buildings, Facilities and Util.	25,000				25,000	
Animals						
Support from collaborative TAES sheep and goat res. projects (H1745, H1942 and H6243)	77,000				77,000	
LDC						
Animals	500					500
Buildings and Facilities	500					500
Subtotal	$134,885		$16,845		$117,000	$ 1,000
Travel						
U.S.	600		600			
US/LDC	8,000		8,000			
LDC	1,800		800			1,000
Subtotal	$ 10,400		$ 9,400			$ 1,000
Other Direct Costs						
Publications	1,000		1,000			
Site Coordin. & Program Support	11,250		11,250			
Fiscal Accounting & Reporting	6,750		6,750			
Subtotal	$19,000		$19,000			
Total Overhead @ 18%	22,881		22,881			
Project Total	$355,212		$150,000		$195,212	$10,000

The figures in parentheses are ppercent time allocation estimates for each person to be spent in LDCs.

The TAES (Texas Agricultural Experiment Station) has an annual budget for collaborative sheep and goat research of over $700,000.

Budget FY 1981

	Total	AID Percent Time*	AID $ Amount	TAES Percent Time	TAES $ Amount	LDC Institution $ Cost Share
Personnel						
U.S.						
J. M. Shelton, Proj. Leader	$ 17,400	25(10)	$ 8,700	25	$ 8,700	
Geneticist	24,200	75(20)	18,000	25	6,200	
P. V. Thompson, Manager	8,400	25	4,200	25	4,200	
G. Snowden, Technician	6,200			67	6,200	
Technician, Diet Analyses	12,800	100	12,800			
Technician, Breeding	12,800	100	12,800			
Graduate Student	6,000	50	6.000			
Other Professional	15,000	25(10)	7,500	25	7,500	
Other Subprofessional	32,409			450	32,409	
Secretary	7,400	33	3,200	50	4,200	
Fringe @ 13.5%	19,252		9,882		9,370	
LDC						
Livestock Technicians and Professionals	8,000					$ 8,000
Subtotal	$169,861		$ 83,082		$ 78,779	$ 8,000
Equipment/Facilities/Animals						
U.S.						
Materials and Supplies	17,037		17,037			
Buildings, Facilities and Utilities	15,000				15,000	
Animals	25,000				25,000	
Support from Collaborative TAES sheep and goat res. project (H1945, H1942 and H6243)	77,000				77,000	
LDC						
Animals	500					500
Buildings and Facilities	500					500
Subtotal	$135,037		$ 17,037		$117,000	$ 1,000
Travel						
U.S.	1,000		1,000			
US/LDC	7,000		7,000			
LDC	1,000					1,000
Subtotal	$ 9,000		$ 8,000			$ 1,000
Other Direct Costs						
Publications	1,000		1,000			
Site Coordination and Program Support	11,250		11,250			
Fiscal Accounting and Reporting	6,750		6,750			
Subtotal	$ 19,000		$ 19,000			
Total Overhead @ 18%	22,881		22,881			
Project Total	$355,779		$150,000		$195,779	$10,000

The figures in parentheses are percent time allocation estimates for each person to be spent in LDCs.

The TAES (Texas Agricultural Experiment Station) has an annual budget for collaborative sheep and goat research of over $700,000.

Budget FY 1982

	Total	AID Percent Time*	AID $ Amount	TAES Percent Time	TAES $ Amount	LDC Institution $ Cost Share
Personnel						
U.S.						
J.M. Shelton, Proj. Leader	$ 17,600	25(10)	$ 8,800	25	$ 8,800	
Geneticist	24,300	75(20)	18,000	25	6,300	
P.V. Thompson, Manager	8,600	25	4,300	25	4,300	
G. Snowden, Technician	6,300			67	6,300	
Technician, Diet Analyses	13,200	100	13,200			
Technician, Breeding	13,200	100	13,200			
Graduate Student	5,000	50	6,000			
Other Professional	15,000	25(10)	7,500	25	7,500	
Other Subprofessional	32,409				32,409	
Secretary	7,600	33	3,300	50	4,300	
Fringe @ 13.5%	19,468		10,030		9,438	
LDC						
Livestock Technicians and Professionals	8,000					8,000
Subtotal	$171,677		$ 84,330		$ 79,347	$ 8,000
Equipment/Facilities/Animals						
U.S.						
Materials and Supplies	16,389		16,389			
Buildings, Facilities and Utilities	15,000				15,000	
Animals	25,000				25,000	
Support from Collaborative TAES sheep and goat res. project (H1745, H1942 and H6243)	77,000				77,000	
LDC						
Animals	500					500
Buildings and Facilities	500					500
Subtotal	$134,389		$ 16,389		$117,000	$ 1,000
Travel						
U.S.	1,000		1,000			
US/LDC	7,000		7,000			
LDC	1,000					1,000
Subtotal	$ 9,000		$ 8,000		$	$ 1,000
Other Direct Costs						
Publications	400		400			
Site Coordination & Program Support	12,250		11,250			
Fiscal Accounting & Reporting	6,750		6,750			
Subtotal	$ 18,400		$ 18,400			
Total Overhead @ 18%	22,881		22,881			
Project Total	$356,347		$150,000		$196,347	$10,000

he figures in parentheses are percent time allocation estimates for each person to be spent n LDCs.

he TAES (Texas Agricultural Experiment Station) has an annual budget for collaborative heep and goat research of over $700,000.

Budget FY 1983

	Total	AID Percent Time*	AID $ Amount	TAES Percent Time	TAES $ Amount	LDC Institution $ Cost Share
Personnel						
U.S.						
J.M. Shelton, Proj. Leader	$ 17,800	25(10)	$ 8,900	25	$ 8,900	
Geneticist	24,400	25(20)	28,000	25	6,400	
P.V. Thompson, Manager	8,800	25	4,400	25	4,400	
G. Snowden, Technician	6,400			67	6,400	
Technician, Diet Analyses	13,600	100	13,600			
Technician, Breeding	13,600	100	13,600			
Graduate Student	6,000		6,000			
Other Professional	15,000	25(10)	7,500	25	7,500	
Other Subprofessional	32,409				32,409	
Secretary	7,800	33	3,400	50	4,400	
Fringe @ 13.5%	19,684		10,179		9,505	
LDC						
Livestock Technicians and Professionals	2,000					$ 8,000
Subtotal	$173,493		$ 85,579		$ 79,917	$ 8,000
Equipment/Facilities/Animals						
U.S.						
Materials and supplies	16,000		16,000			
Buildings, facilities and Utilities	15,000				15,000	
Animals	25,000				25,000	
Support from Collaborative TAES sheep and goat res. project (H1745, H-1942 and H6243)	77,000				77,000	
LDC						
Animals	500					500
Buildings and Facilities	500					500
Subtotal	$134,000		$ 16,000		$117,000	$ 1,000
Travel						
U.S.	500		500			
US/LDC	6,500		6,500			
LDC	1,000					1,000
Subtotal	$ 8,000		$ 7,000			$ 1,000
Other Direct Costs						
Publications	540		540			
Site Coordination And Program Support	11,250		11,250			
Fiscal Accounting And Reporting	6,750		6,750			
Subtotal	$ 18,540		$ 18,540			
Total Overhead @ 18%	22,881		22,881			
Project Total	$356,914		$150,000		$196,914	$10,000

he figures in parentheses are percent time allocation estimates for each person to be spent n LDCs.

he TAES (Texas Agricultural Experiment Station) has an annual budget for collaborative heep and goat research of over $700,000.

5. Implementation Plan

a. Time-phased scope of work, including relationships with LDC Institutions

The early phase of the project will consist of development of facilities for accumulating breeding flocks and recruitment of additional personnel at U.S. locations. This work will be continued in FY 1980 along with initiation of breeding programs and data collection on all phases or work to be conducted in Texas. This work will continue each year for the duration of the project. Early in FY 1979 and 1980 on site visits will be made to LDCs to survey existing breeding stocks and establish linkages with LDC Institutions. On site visits will also be made to areas other than potential cooperating LDC locations to survey genetic types of potential interest. Early in FY 1980 and 1981 attempt will be made to relocate genotypes having been identified to hold potential interest. To the extent this is successful these animals will be integrated into data collection schemes and this will be continued throughout the study. Also in FY 1980 selection programs with indigenous and exotic genetic types will be initiated with cooperating LDC Institutions. This would be expected to continue throughout the project. Activities in FY 1981 will consist of continuation of phases already initiated and a period of catch up for phases which have fallen behind schedule. The same will be true of FY 1982, and 1983 with the additional expectation of some data analyses and manuscript preparation. Plans should also call for an implentation phase of significant findings to date. Preparation of final reports and/or plans for extension of the project beyond 1983 should be scheduled for this year.

b. Project monitoring

The project leader would be expected to continuously monitor the activities of the project by being involved in many of these activities. It would be expected that the Program Director would be significantly involved in

monitoring these activities. Also officials of the Texas Agricultural Experiment Station would no doubt take on active interest in monitoring any activities involving local funds.

6. Annual Review and Planning Process

It is expected that two parallel procedures would be involved in the review and planning process. In the first of these the Texas Agricultural Experiment Station conducts an annual review of projects with a projection of plans for the future years activities. This would be expected to continue and to include activities conducted as a part of SRCRSP.

The second pathway would be that through the principal investigators of the SRCRSP. It is anticipated that there would be an annual meeting of this group at which time the past years activities and the future years plans would be reviewed. It is anticipated that this process would serve both a coordinating and a review process. The program director would be involved in and perhaps a convenor of this group and provide a repository of annual reports.

Project Title & Number: Germ Plasm Resource Development for Sheep and Goats

Total U.S. Funding $750,000.00
Date Prepared: May 19, 1978

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To improve the contribution of sheep and goats to meeting mankinds needs for food and fiber in LDCs.	**Measures of Goal Achievement:** Increased production from sheep and goats in LDC countries would be the final or end point. Short of this the presence of more productive and better adapted strains of animals at LDC or U.S. institutions and on going improvement programs.	Statistical data on animal production in Target LDC Publications. Project reports of studies in U.S.	**Assumptions for achieving goal targets:** That desirable genetic types of animals exist for exploitation. That arrangements can be made for relocation of some of these. That sufficient continuity of support exists for animal breeding projects to yield results. Development of satisfactory semen freezing technique will be important to maximize deployment of genetic resources.
Project Purpose: To identify, evaluate and improve genetic resources of sheep and goats to meet the needs of target areas. To establish a mechanism to interchange information and genetic materials between areas of interest. Develop an informational base relating to Fat-Tailed and Hair type of sheep and Meat and Fiber goats which will improve the ability of U.S. and LDC institutions to respond to needs.	**Conditions that will indicate purpose has been achieved:** End of project status.		**Assumptions for achieving purpose:** Complete or reasonable success will be dependent on satisfactory linkages with LDC institutions.
Outputs: 1. Description of breeds or types of sheep and goats in tropical and sub-tropical regions. 2. Relocation of selected genotypes to centers from which they can be more efficiently utilized in improvement programs. 3. Established flocks of Fat-Tail and Hair types of sheep and Meat type goats from which information and superior genetic material may be obtained. ~~4. Trained workers in LDC institutions.~~	**Magnitude of Outputs:** Publications of description and characterization of types of sheep and goats. Genetic parameters of sheep and goats, Suggested selection indexes, improved strains or breeds of sheep and goats.		**Assumptions for achieving outputs:** That needed new personnel can be recruited and integrated into overall programs.
Inputs: 1. Personnel and resource support from Texas Agricultural Experiment Station. 2. Personnel and resource support of cooperating institutions in LDC. 3. AID funding and guidance.	**Implementation Target (Type and Quantity)** 1. At least one long term selection program in LDC including presence of improved strains. 2. Texas Agricultural Experiment Station established flocks of Fat-Tail sheep and Hair sheep and Meat type goats. 3. AID: (a) budget $150,000 annually	Annual reviews and regular reporting requirements.	**Assumptions for providing inputs:** That a continued source of funding exists from all of the three sources indicated.

Name: J. Maurice Shelton
Date and Place of Birth: [redacted]
Family: Married, 4 children

EDUCATION:

PhD., Animal Breeding - Texas A&M University - 1957
M.S., Animal Production - Texas A&M University - 1953
B.S., Animal Science - University of Tennessee - 1948

EXPERIENCE:

Instructor - University of Tennessee, West Tennessee Branch - 1948-1950
Instructor - Texas A&M University - 1950-1953
Associate Professor - American University of Beirut; Beirut, Lebanese Republic - 1954-1955
Assistant Animal Husbandman to Professor - Texas Agricultural Experiment Station - 1956-Present

SIGNIFICANT PUBLICATIONS:

Shelton, Maurice. 1977. Breeding for improvement of fiber producing animals. In Animal Agriculture. W. H. Freeman & Co. (in press).
Shelton, Maurice. 1977. Management of reproduction in the goat. Proceedings symposium on "Management of Reproduction in Sheep and Goats" sponsored by American Society of Animal Science and Sheep Industry Development Program, Madison, Wisconsin, July, 1977.
Shelton, Maurice. 1977. Reproduction and genetics of the goat. Presented at the annual meeting of American Dairy Science Association, June, 1977. Submitted to Journal of Dairy Science.
Shelton, Maurice. 1977. Studies on tail length of domestic sheep and Mouflon crasses. J. Hered. 68:128.
Shelton, Maurice, G. C. Smith and Frank Orts. 1977. Predicting carcass cutability of Rambouillet rams using live animal traits. J. Anim. Sci. 44:333-337.

MEMBERSHIPS IN SOCIETIES

American Society of Animal Science
American Genetic Association
Society for Range Management
Sigma Xi
Registry of Professional Animal Scientists
Texas Sheep and Goat Raisers Assn.
National Wool Growers
National Lamb Feeders

SPECIAL ACTIVITIES

Have extensive research experience with both sheep and goats. Have traveled or worked in 15 different foreign countries including serving as a member of a sheep and goat breeding team which visited the Soviet Union as a part of Scientific Exchange Agreement. Member of Task Force on Nutrient Requirements of goats of the National Academy of Science.

HONORS AND AWARDS

Achievement Award - Block and Bridle Club - University of Tenn.
Honorary State Farmer - Future Farmers of America
Silver Ram Award - American Sheep Producers Council, Denver, Colorado

Project Title: Improving female reproductive performance of small ruminants in LDC countries. A new proposal.

Grantee: Utah State University

Principle Investigator: Warren C. Foote

Duration: 5 years (5-8 years)

Total Estimated Costs[1]:

FY	Total project costs	LDC contribution	USU contribution	(%) cost sharing
1979	147,300	90,000	57,300	39
1980	147,300	90,000	57,300	39
1981	147,300	90,000	57,300	39
1982	147,300	90,000	57,300	39
1983	147,300	90,000	57,300	39

1) These increases do not include merit, cost of living or inflation.

Abstract of a Research Proposal Submitted to US/AID Title XII-
Collobarative Research Support Program on Small Ruminants

Title: Improving Female Reproductive Performance of Small Ruminants in LDC Countries

Leader: Dr. Warren C. Foote, Utah State University

Rationale: Reproductive performance is a major contributor to the level and efficiency of meat and milk production from sheep and goats. The rate of reproduction also directly influences the rate of genetic improvement that can be accomplished in all phases of production.

Measurement of reproductive potential in selected genotypes of sheep and goats under different climatic environments and management programs will provide essential information in selection of genotypes for conditions in LDC's.

Progress in small ruminant production in LDC's would be facilitated if selected additional genotypes could be brought into the United States for basic research and for personnel training.

Approach: This project will be conducted in cooperation with California State Polytechnic University, Pomona and other members of the Small Ruminant CRSP. W. C. Foote will coordinate the cooperative projects between Utah State University and Cal Poly, Pomona.

Female reproductive potential (as indicated by measureable reproductive processes) will be estimated in selected genotypes of small ruminants in different climatic environments and under limited and optimum management conditions considered pertinent to LDC locations.

Research will be conducted in the United States initially and extended to selected LDC sites when feasible.

Contracts with USDA/APHIS will be strengtheded and continued in an effort to develop procedures for importing small ruminants. If approval is given by USDA selected genotypes will be imported and pure breeding groups will be established for research and training purposes.

Appropriate information will be obtained from valid sources throughout the world on reproduction and adaptation of small ruminants. The data will be computerized for use in small ruminant production.

USAID Budget: $90,000.

Detailed Description of Project

A. Description of problem

Reproductive performance is a major contributor to the level and efficiency of meat and milk production from small ruminants. The rate of reproduction also directly influences the rate of genetic improvement that can be realized in meat and milk production as well as fiber production.

Reproductive processes which bear directly on meat production include age at puberty, lambing or kidding rate, lambing or kidding interval, and longevity. Each of these are influenced genetically and also by environment including climatic factors, and nutrition, animal health and other management components involved in either intensive or extensive production systems.

Sheep and goats are adapted to practically every environment where man lives and are used by him for production of food and/or fiber. There are an estimated 1100 genotypes (850 sheep and 250 goats) which form a vast gene pool from which existing genotypes can be selected or new genotypes developed. This genetic variation can provide alternatives to increase level and efficiency of reproduction under existing or improved environmental conditions in LDC's.

Only a relatively small number of existing genotypes has been evaluated under conditions of their native environment and only a small proportion of these has also been studied under improved conditions to provide an estimate of their reproduction potential. Many genotypes of sheep and goats reproduce at relatively low levels as an apparent adaptive measure. Some of these might have a much higher genetic reproduction potential which would be realized under improved environmental conditions. This information would be essential in determining the feasibility of introducing new genes to increase level and/or efficiency of reproduction in LDC's. More information

concerning reproduction potential on an expanded number of genotypes of small ruminants in both the United States and LDC's and other available sources is necessary to provide an adequate genetic base for improved production under required management systems.

B. Objectives of project

1. To measure the reproductive potential of females of selected genotypes of small ruminants in the United States and at selected LDC locations.
2. To determine the influence of environment including climatic factors, and nutrition and other management components on female reproduction.
3. To establish a computerized data bank containing valid available information on reproductive performance and adaptation from genotypes of small ruminants under varying environments world wide for use in selecting genotypes with specific reproductive traits for particular environmental conditions.
4. To import selected genotypes of small ruminants into the United States when and if such is allowed and to establish small, pure breeding blocks for pertinent research in the United States in support of LDC programs.

C. Project approach

General considerations

This project will be conducted in cooperation with California State Polytechnic University, Pomona and other members of the Small Ruminant CRSP. W. C. Foote will coordinate the cooperative projects between Utah State University and Cal Poly, Pomona.

Research on reproductive physiology, particularly measuring reproductive performance in the female, will be conducted initially in the United States in Utah, California and at other locations representing the most appropriate environments available.

Similar research will be conducted under both intensive and extensive production systems in LDC locations as facilities are established, animals obtained, and management programs stabilized. Research in LDC's will depend on establishment of necessary on-site programs by the genetic, nutrition and related small ruminant projects.

The required research procedures and techniques to be used in LDC locations will be developed or refined and required levels of control determined primarily in the United States. Hormone and other physiological analyses will be conducted at the physiology and endocrinology laboratories at Utah State University or under their direction at points of entry into the United States (i.e. Plum Island) as required by animal health regulations.

An essential part of the research on reproductive physiology will be to identify and attempt to correct processes or conditions that limit increases in level and efficiency of overall reproduction. Because limiting factors may involve either the male of female or both this research will be closely coordinated between Utah State University and Cal Poly, Pomona. Combined efforts to analyse both male and female aspects of reproduction will be undertaken and continued as required.

Results of all research will be collected at Utah State University for storage, processing, analyses and publication.

Specific considerations

Objective 1.

There are over 25 breeds of sheep and at least 8 breeds of goats in the United States representing a wide divergence in reproductive physiology. Approximately four breeds of sheep and goats will be selected for study in

consultation with Cal Poly and other memebers of the Small Ruminant CRSP. Selections will be based on their potential usefulness in LDC locations. Examples of breeds which might be studied are the Rambouillet, Targhee, St. Croix, Suffolk, Romney, Border Leicester, Dorset, Spanish goat, Nubian, and Saanen. Levels of reproduction and physiological and endocrinological measurements will be determined under optimal management conditions to indicate their reproductive potential and as far as possible to determine factors limiting reproduction. Measurements will include age at puberty, length of estrous cycle, length and occurrence of breeding season, fertility, postpartum interval (interval from parturition to estrus and ovulation), lambing or kidding interval, ovulation rate, lambing or kidding rate, birth weight, growth rate to 60 days of age, mothering ability, and endocrine profiles during selected reproductive periods. Special attention will be given to influences of season of year. Research measuring reproductive performance would need to be conducted for a minimum of 2 years for each genotype. This research will begin at Utah State University in FY 1979.

Similar research will be conducted on selected genotypes of small ruminants at one or more LDC locations (a) using animals maintained specifically for physiology of reproduction research and (b) cooperatively using herds or flocks established for genetic and related research.

This research will be conducted in cooperation with genetic research projects and the genotypes measured would be those selected by or in cooperation with them. It is recommended that reproductive phenomena measured in the genetic research flocks include age at puberty, fertility, lambing or kidding rate, birth weight, growth rate to 60 days of age, and general mothering ability. Reproductive phenomena measured in groups established especially for physiology of reproduction research will study in more detail aspects of physiology and endocrinology of reproduction relating to reproduction potential. These will include, where possible,

length and occurrence of breeding season, estrous cycle length, ovualtion rate throughout the year, and endocrine profiles during selective reproductive periods such as the estrous cycle and the early postpartum period.

Preliminarily it is assumed that blood from studies in LDC's will be processed in the LDC and at Plum Island as required before introduction to the endocrine laboratory at Utah State University for hormone analysis.

Research in LDC's will be initiated after genetic and other research projects have been set up and controlled environments including standardized management components established.

The purpose of these studies is to provide estimates of reproductive potential of different genotypes and to identify, if possible, physiological and endocrinological constraints to reproduction.

Objective 2.

The research conducted to achieve this objective will be similar in some respects to those of objective 1. Appropriate measurements from those listed for Objective 1 will be taken. The major effort in this objective will be to measure the influence of different management components such as level of nutrition on level and efficiency of reproduction. This research will be cooperative with other research projects. It is considered to be of high priority among the objectives because it can provide essential inputs for the development of management components to optimize level and effiency of production.

Some aspects of the research in this objective will be initiated at Utah State University in FY 1979 but will be undertaken in LDC locations after genetic, nutrition and related small ruminant research programs have become stablized and adequate control is available.

Objective 3.

This objective will be accomplished by identifying reliable personnel working with small ruminants and obtaining valid information from them concerning reproductive physiology and adaptation for the genotypes with which they are involved. Information describing the environment will also be obtained.

Standard data recording forms will be used and all entries will be identified by person and institution providing the information. When information is obtained on a sufficient number of genotypes it will be computerized and be made available for use by other PI's in the Small Ruminant CRSP and others involved in small ruminant research and development.

Research on this objective will be initiated in FY 1979 and will proceed as reliable information becomes available.

Objective 4.

An effort will be made to encourage APHIS and other government agencies to develop required procedures and facilities to allow importation of heep and goats into the United States. Where appropriate, industry and government support for importation will also be encouraged.

If and when importation becomes possible the importation of small ruminant will be given prime consideration and effort. Genotypes of sheep and goats will be selected, based on the results and best judgement of persons at Utah State University and Cal Poly, Pomona and also those involved in genetic research in the Small Ruminant CRSP, and imported. Small, pure breeding flock will be developed and maintained for research and developmental purposes. These flocks will be established initially at Utah and California and other selected locations in the Unites States based primarily on climatic environmer Work on this objective will be carried on in cooperation with Cal Poly, Pomona

The accomplishment of this objective is beyond the control of the principa investigators and therefore no time schedule can be developed.

D. Conditions that indicate objectives have been achieved

1. Estimates of female reproductive potential of selected genotypes of small ruminatns established and available for use in U.S. and LDC locations.
2. Estimates of influences of environment on female reproductive performance of selected genotypes of small ruminants established and available for use in U.S. and LDC locations.

3. A computerized data bank containing available information on reproductive performance of small ruminants world wide available for use in the U.S. and LDC locations.
4. When and if USDA, APHIS permits selected genotypes of small ruminants imported into U.S. and small breeding flock established.

E. Assumptions on achievement of objectives (externalities outside control of P.I.)

1. That selected genotypes of small ruminants, adequate facilities and management control for research are available in LDC locations.
2. That capable LDC personnel are available to carry out research.
3. That persons throughout the world working with small ruminants will provide information for data bank.
4. That approval will be granted to import selected genotypes of sheep and goats into the United States.

F. Assumptions that achieving objectives will solve problem

1. Achieving objectives 1 and 2 will provide information on reproductive physiology of the female that will make possible selection of genotypes of small ruminants and development of management components for increased reproductive rate. This will contribute in a major way to level and efficiency of production in LDC's.
2. The establishment of a computerized data bank (Objective 3) will provide information on reproductive performance and adaptation for additional genotypes of small ruminants and environments which would provide a broader base for selection of genotype for use in LDC's.
3. When importation of small ruminants into the U.S. is permitted the establishment of small, pure breeding flocks would provide for more

detailed research on genetics, physiology, and nutrition and experience working on genotypes expected to be useful in LDC locations (Objective 4).

G. Outputs of project

1. Provide estimates of female reproduction potential of selected small ruminant genotypes.
2. Provide information on influence of environment including constraints to increased female reproductive performance.
3. Establish a data bank of information on reproductive and related performance for small ruminants worldwide.
4. Attempt to import small ruminants into the U.S.

Technicial Feasibility

Working within the limits of recognized constraints the probability of success of research and technological aspects of this project are very good. This is concluded because (1) much of the basic and procedural work will be accomplished in the U.S. (2) Working in LDC locations will be conducted in cooperation with projects with stabilized management programs, (3) the researchers involved have experience and expertise in conducting this type of research, (4) particularly the objectives dealing with physiology of reproduction information are well defined and achievable.

Financial Plan

A. Budget

	FY 1979			FY 1980			FY 1981			FY 1982			FY 1983		
	AID	USU	LDC[2]	AID	USU	LDC	AID	USU	LDC	AID	USU	LDC	AID	USU	LDC
1. Personnel[1]															
U.S. salaries	24,950	21,000		24,950	21,000		24,950	21,000		24,950	21,000		24,950	21,000	
Benefits	5,988	5,040		5,988	5,040		5,988	5,040		5,988	5,040		5,988	5,040	
LDC			4,000			9,000			11,000			11,000			11,000
2. Major facilities, equipment, animals, etc.[3]															
U.S.	10,000	6,000		9,000	6,000		9,000	6,000		9,000	6,000		9,000	6,000	
LDC			3,000	1,000		9,000	1,000		9,000	1,000		9,000	1,000		9,000
3. Travel and per diem															
U.S.	5,000	1,000		4,000	1,000		4,000	1,000		4,000	1,000		4,000	1,000	
LDC	5,000		300	8,000		500	8,000		500	8,000		500	8,000		500
4. Site maintenance share (7.5%)															
U.S.															
LDC	6,750			6,750			6,750			6,750			6,750		
5. Other direct costs															
U.S.	17,342	11,660		12,342	11,660		12,342	11,660		12,342	11,660		12,342	11,660	
LDC			2,500	3,000		4,000	3,000		4,000	3,000		4,000	3,000		4,000
Total direct costs															
U.S.	63,280	44,700		56,280	44,700		56,280	44,700		56,280	44,700		56,280	44,700	
LDC	11,750		9,800	18,750		22,500	18,750		24,500	18,750		24,500	18,750		24,500
6. Indirect costs															
U.S.	14,970	12,600		14,970	12,660		14,970	12,600		14,970	12,600		14,970	12,600	
LDC															
Total costs															
U.S.	78,250	57,300		71,250	57,300		71,250	57,300		71,250	57,300		71,250	57,300	
LDC	11,750		9,800	18,750		22,500	18,750		24,500	18,750		24,500	18,750		24,500
TOTAL	90,000	57,300	9,800	90,000	57,300	22,500	90,000	57,300	24,500	90,000	57,300	24,500	90,000	57,300	24,500

1) Total SY (scientists) 2.4 and technician and graduate student 5.0; .75 and 1.5 paid by AID, respectively.

2) Indicates amount for each LDC location; all of facilities and part of service resources are expected to be in-kind.

3) Some facilities related in-kind resources are provided by USU in addition to those included in overhead or otherwise specified in the budget.

B. Personnel and assigned SY's

Personnel	SY's Total	SY's AID	
Scientists			
Warren C. Foote	.5	.15	
Darrell H. Matthews	.6	.1	
Jay W. Call	.2	.0	
Rex L. Hurst	.1	.0	(statistician)
New member	1.0	.5	
Technicians	3.0	.5	
Graduate students[1)]	2.0	1.0	

[1)] Two graduate students each working one-half time for project and one-half time in course work and related endeavors.

Implementation Plan

A. Time-phased scope of work, including relationships with LDC institutions

Objective 1. Research will begin at Utah State University and other U.S. locations in FY 1979 and continue through remainder of project period. Procedures of research and levels of control required for work in LDC's will also be undertaken during this period.

Planning for cooeprative research in LDC locations will be initiated in FY 1979 with genetic, nutrition, animal health and related project personnel. Research on measuring reproductive potential will be initiated as soon as animals have been obtained and necessary facilities developed, and management control established. This is not expected earlier than FY 1981. Research will continue throughout the remainder of the project. Research in LDC locations will be carried out by trained technical LDC personnel.

Objective 2. Procedural development at Utah State University and planning for cooperative research in LDC locations will begin in FY 1979. Research in LDC's will be undertaken at the same estimated dates and under the same conditions as indicated for objective 1.

Objective 3. This work will be undertaken in FY 1979 by developing standard data recording forms and sending them along with explanations and requests to reputable persons working with sheep and goats throughout the world. Data forms and a list of persons is already partially completed. The information will be computerized and stored in a retrievable form as it is received. This will be a continuing project requiring updating and requests for new information.

Objective 4. Work on this objective will begin in FY 1979 and will continue by appropriate contact with APHIS personnel concerning importation of small ruminatns. Imports will be made if and when approval is granted and genotypes to be imported will be based on Small Ruminant CRSP needs and scope of approval by APHIS.

B. Project Monitoring

Programs in the United States will be initiated by or under the direct supervision of the principle investigator or other scientists and will be monitored continuously through research participation, supervision, research data and summaries, planning meetings, seminars and annual reports.

Programs in LDC locations will be initiated by or under the direct supervision of the principle investigator or other scientists and will be monitored continuously through research participation, supervision, research data and summaries, planning meetings, seminars and annual reports.

Programs in LDC locations will be initiated under the on-site direction of the principle investigator or other scientists and in cooperation with other Small Rum-nant CRSP scientists. The research would be conducted by trained LDC personnel with necessary supervision by scientists from Utah State University or otherPI's working in small ruminants. Monitoring would be accomplished through (1) review of detailed data records and daily logs, (2) periodic data summaries and accomplishment analyses, (3) periodic visits and checks by PI and other U.S. based or field project personnel, (4) continuous review of fund and other resource transactions. In addition at lease annual reviews of quantity and quality of data obtained will be made and compared to time schedule expectations.

Annual Review and Planning Processes

Annual evaluations of projects and personnel will be held at appropriate levels and locations.

Annual data summaries and progress reports will be prepared and compared to time schedule expectations.

Results will be analyzed for project strengths and weaknesses and procedures developed and additional resources requrested to maintain or achieve planned level of achievement.

In all reviews and planning programs both quantity and quality of results will be considered.

Project Title & Number: Improving female reproductive performance of small ruminants in LDC countries.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: To measure reproductive potential of females of selected genotypes of small ruminants in U.S. and LDC's; to determine environmental influences on reproductive physiology of female small ruminants for use in LDC's; to develop a computerized data bank on reproductive performance and adaptation of small ruminants worldwide; to investigate and when and if possible import small ruminants into U.S. and establish small flocks.	Conditions that will indicate purpose has been achieved: End of project status. Information on reproductive performance and influences of environment will be available and used to select genotypes of small ruminants and develop management programs in LDC's; available information on reproductive performance and adaptation of small ruminants worldwide will be computerized and available for use; all reasonable efforts to import selected genotypes of small ruminants into the U.S. will be made, if successful small breeding flock established.	Results of research on objectives as per time schedule. Same as indicated in "Conditions that will indicate purpose has been achieved"	Assumptions for achieving purpose: Specified outputs are accomplished; required resources are available in LDC's; small ruminant researchers throughout world will cooperate in contributing information to data bank.
Outputs: Provide estimates of female reproductive potential of selected small ruminant genotypes; provide information on environmental influences including constraints to increased female reproductive performance; establish a data bank of information on reproductive and related performance for small ruminants worldwide; attempt to import small ruminants into the U.S.; trained project personnel.	Magnitude of Outputs: Publications on female reproductive performance of selected genotypes of small ruminants, environmental influences on reproduction, and recommended management programs; data bank information on reproductive performance and adaptation computerized and available for use; seminars, workshops and short courses held in the U.S. and LDC's on reproductive physiology of small ruminants and its role in increasing production	Review of publications Review of computerized data bank information Review of recommendations	Assumptions for achieving outputs: Selected genotypes of small ruminants, adequate facilities and management control for research are available in LDC locations; adequate leadership available for reproductive physiology research in LDC's; persons throughout the world working with small ruminants will provide information for data bank; approval will be granted to import genotypes of small ruminants into the U.S.
Inputs: Funding from AID, USU and LDC's; USU analytical laboratories and computer center; experience and expertise of personnel; small ruminant CRSP management; LDC facilities; established LDC research resources and management control; data from small ruminant researchers worldwide; cooperation of other P.I.'s in small ruminant CRSP; APHIS approval to import small ruminants in U.S.	Implementation Target (Type and Quantity) LDC's: Initial genotypes of small ruminants to be studied identified June 1979; Reproduction research initiated Fall 1981. USU: Genotypes identified and reproduction research initiated November 1978; data bank program initiated Jan. 1979; review of status on importation of small ruminants into U.S. Jan. 1979.	Same as indicated in "Implementation Target".	Assumptions for providing inputs: Program funding and other resources will be provided by all agencies; proper management of Small Ruminant CRSP will be established; adequate LDC research resources and management control provided cooperation of small ruminant workers worldwide obtained; cooperation of USDA/APHIS.

RESUME

Name: Warren C. Foote

Professor, Departments of Animal, Dairy and Veterinary Sciences and Biology: Director, International Sheep and Goat Institute, Utah State University, Logan, Utah 84322

Date and place of birth: [redacted]

Education: B.S. Animal Science, Utah State University, 1954
M.S. Reproductive Physiology, University of Wisconsin, 1955
Ph.D. Reproductive Physiology, University of Wisconsin, 1958

Areas of specialization:

Total effort with sheep and goats in following areas: Endocrinology and physiology of reproduction; hormonal and environmental control of reproduction; genetic improvement of food and fiber production; development and application of breeding and management programs to increase food and fiber production. (More than 80 articles have been published in scientific and popular journals and magazines on the above areas.)

Consulted for US/AID Bolivia; Rockefeller Foundation; University of San Marcos, Peru; Syntex Corporation; and the Mexican Association of Animal Production.

Have served or are serving on editorial board of the Journal of Animal Science and Iranian Journal of Agricultural Research.

Served as a member of a research team to evaluate the sheep industry in Russia under the USA-USSR Agricultural Scientific exchange program.

International experience:

Have visited or worked in 23 foreign countries with specific purpose of studying sheep and goats and directed graduate students from 7 different foreign countries.

Instrumental in organizing International Sheep and Goat Institute and have directed program since its inception in 1973.

Relevant publications:

Ahmed, Shafeeq, D. A. Phelps, W. D. Foote and W. C. Foote. 1977. Out of season breeding in dairy goats. Proceedings, Western Section, American Society of Animal Science. 28:199-200.

Foote, W. C. 1977. Combined genetic and physiological approaches to increasing efficiency of goat production. Management of Reproduction in Sheep and Goats Symposium. p 140-149. Univ. of Wisconsin, July 24-25.

Foote, W. C. 1977. Extensive and intensive sheep production programs in Iran and their use in increasing sheep production. 1st Annual Iranian Sheep Production Conference (in press).

Matthews, D. H., M. A. Madsen, J. A. Bennett and W. C. Foote. 1977. Lamb production of Targhee and Suffolk-Targhee range ewes. Journal of Animal Science. 44(2):172-180.

Call, J. W., W. C. Foote, C. D. Eckre and C. V. Hulet. 1976. Postpartum uterine and ovarian changes, and estrous behavior from lactation effects in normal and hormone treated ewes. Theriogenology. 6(5):395-501.

Foote, W. C. 1975. Types of sheep for various environments. 1st International Reunion on Sheep Production. International Society for Range Management. Mexico. November 21-22.

Title XII Cooperative Project Submitted by

California State Polytechnic University, Pomona

a - Improving reproductive capability of small ruminants in L.D.C.'s with emphasis on male reproductive physiology.

b - New project

c - Grantee: California State Polytechnic University, Pomona

d - Principal Investigator: E. A. Nelson

Other key personnel - M. J. Burrill, California State Polytechnic University, W. C. Foote, Utah State University, will be the coordinator of reproductive physiology studies at both Utah State and Cal Poly.

e - Duration - 5 years with possible extension

f - Funding by years - (no cost of living or inflationary factors included):

	Total Project Costs	US/AID Contribution	Cal Poly University Contribution	Percentage Cost Share
FY 1979	121,700	60,000	61,700	50.7%
FY 1980	120,500	60,000	60,500	50.2%
FY 1981	120,500	60,000	60,500	50.2%
FY 1982	120,500	60,000	60,500	50.2%
FY 1983	120,500	60,000	60,500	50.2%

Detailed Description of Project

Description of Problem

Traditionally sheep and goats have supplied meat, milk and fiber to peoples of the developing countries (L.D.C.). Reproductive performance is a major factor in determining the efficiency and usefulness of these animals. Low reproductive rates coupled with excessive inferior males in proportion to producing females have limited the supply of animal products available to L.D.C. families. The use of acclimatized genetically adapted, progeny tested males would significantly increase animal production in the L.D.C.'s.

Reproductive performance in the male as measured by libido, female to male ratios, fertilizing capacity of semen and length of time males can be effectively used, are influenced by genetic and environmental factors. Environmental factors include climatic conditions, nutritional adequacy, available feedstuffs, disease, and management under either intensive or extensive production systems.

Improving the reproductive potential of selected breeds under conditions similar to those found in L.D.C.'s would facilitate the identification of germ plasm resources for improving the L.D.C. indigenous small ruminants. The reproductive performance of indigenous breeds should be evaluated under improved management, nutritional and health conditions and when necessary superior germ plasm introduced to increase their productivity. The most efficient method of introducing new germ plasm is through the use of semen. Females of indigenous breeds would be bred by artificial insemination to take advantage of their inherent adaptive qualities. These crossbred animals would then be tested for improved production of meat, milk and fiber under L.D.C. conditions.

Objective of Project

1. To develop methods to improve the capability of collecting, processing, storing and transporting sheep and goat semen to selected L.D.C. locations.
2. To measure the reproductive potential of selected small ruminant male genotypes in the United States and L.D.C.'s. To coordinate the relative importance of males as compared to females in solving reproductive problems in L.D.C.'s. These studies will be conducted in cooperation with Utah State University and other members of the consortium.
3. To measure and examine seasonality and other related responses to the environment as they affect the reproductive ability of male sheep and goats.
4. Cooperate with Utah State to establish a computerized data bank of valid reproductive information on sheep and goats from varied genetic sources and environmental locations world wide. This data bank would serve as a source of readily obtainable information for those desiring sires or germ plasm to fit specific needs.

Project Approach

In cooperation with Utah State University and members of the consortium in both the intensive and extensive management systems, coordinated reproduction and breeding programs will be developed. The emphases of this project will be on male reproductive physiology and possible germ plasm transfer through stored semen. Initially studies will be conducted at California State Polytechnic University, Pomona, California and at Utah State University, Logan, Utah. Genetic studies will be coordinated with breeding components of both intensive and extensive systems in the consortium. Cooperative arrangements have been established with Laurelwood Acres, Ripon, California where some goat reproductive work including semen studies are now in progress. (Utah State and Cal Poly have an on-going

research agreement with Laurelwood Acres, Ripon, California. This is the largest goat dairy in the United States. They milk from 600 to 1200 does daily. They have a large number of superior does and over 50 bucks on DHIA test, with considerable variation in productivity within the herd. Mr. W. Nordfelt, the owner of Laurelwood Acres, has agreed to the use of their records for the purpose of developing a progeny testing program for sire selection in dairy goats. This herd will be very helpful in obtaining research data and semen for use in achieving the above objectives).

Reproductive physiology studies will be conducted at selected sites involving both intensive and extensive management systems in cooperation with universities at the respective sites in L.D.C.'s. The management component in each system will have the responsibility to select sites and determine which indigenous breeds are to be studied.

Hormone analysis will be performed at Utah State University. Overall coordination of the physiology of reproduction projects will be under the direction of Dr. Warren C. Foote, Utah State University, Logan, Utah.

Procedures for achieving objective 1: Develop methods to improve the capability of collecting, processing, storing and transportating sheep and goat semen to selected L.D.C. locations.

a) Liaison will be established with Dr. J. Corteel of France and other scientific personnel to keep abreast of their developments and to make use of their knowledge on methods and procedures for the processing and storage of buck and ram semen when they can be helpful to our program.

b) Innovative methods of semen collection will be investigated. Some of these include the surgical by-pass of the accessory glands or tubular diversion of semen, because the presence of natural secretions from these glands is thought to reduce the viability of the spermatozoa for dilution and storage.

c) Emphasis will be placed on developing methods of storage and transportation of semen with emphasis on maintaining the viability of spermatozoa under conditions where conventional methods of storage may be limited.

d) The quality and viability of semen will be evaluated by: volume, concentration, motility, freezability and non-return rates of females or developing zygotes flushed from experimental does and ewes.

e) Semen will be collected from sires, as deemed desirable. This semen will be processed, frozen and stored for delivery on call to locations in the L.D.C.'s.

f) Samples will be cultured as appropriate from processed semen to assure freedom from disease producing organisms. These health control measures will be coordinated with health control personnel in both the intensive and extensive systems in the consortium.

g) The procedures for semen processing and storage will be initiated during FY 1979, the semen bank will be started in FY 1981.

The following procedures will be used in achieving objective 2: to measure the reproductive potential of selected genotypes of male small ruminants in the United States and L.D.C. locations.

a) In cooperation with Utah State, establish target breeds of sheep and goats to be measured for reproductive performance for possible use at L.D.C. locations. Initially, the St. Croix hair sheep, Rambouillet, Suffolks and Romney sheep breeds, Sannen, Alpine, LaMancha dairy goats and Mexican meat goats are being considered.

b) Locate outstanding males of selected breeds and where possible obtain permission to utilize breed and breeder records to assist in developing male performance, progeny testing records and testing procedures, (W. Nordfelt of Laurelwood Acres has already agreed to this approach with his dairy goat breeds).

c) Close cooperation between the male and female physiology of reproduction studies will be maintained to study the relative influence of each sex in contributing to fertility problems in L.D.C.'s.

d) Determine performance of sires for use in artificial insemination programs by obtaining data on: growth rate, size at 60 days of age, progeny performance, libido and freezability of semen. Estrus detection and cyclic reproductive patterns will be related to sire performance.

e) Similar research will be conducted at selected L.D.C. locations in cooperation with the genetic component leaders of the various management systems. Hormone relationship to male reproductive performance will be measured by periodic blood analysis. Hormone and blood studies will be coordinated by Dr. Foote.

The purpose of these studies is to provide estimates of reproductive potential of different genotypes and to identify possible physiological and endocrine constraints to reproduction. These studies will be initiated in the United States during FY 1979.

Procedures for acheiving objective 3: Measure and examine seasonality and other related responses to the environment as they affect the reproducing ability of male sheep and goats.

a) Representative individuals of target breeds of sheep and goats will be maintained under different environmental conditions.

b) Variations in plane of nutrition that approximate L.D.C. conditions will be studied to determine nutritional level and nutrient effect on reproduction in sheep and goats.

c) Male hormonal relationships with semen quality will be measured by taking periodic blood samples and correlating hormone levels with semen quality measurements. Occasionally samples of semen will be tested on females to

correlate other measurements with fertility in the female.

d) Seasonal differences in reproductive performance will be measured by blood and semen collections at intervals throughout the year. This semen will also be evaluated by standard quality measurements and checked for fertilizing ability.

e) Temperature and other environmental factors will be monitored and related to hormone and semen characteristics. These conditions will be modified to measure their effects on these characteristics.

f) Insemination procedures and techniques will be studied with emphasis on procedures useful to farm conditions where limited technical skills are available.

g) Representative individuals will be maintained for the duration of a 5-8 year study to measure age effect on semen quality and reproductive ability.

h) Representative males and females will be identified from indigenous sheep and goats at L.D.C. locations where consortium members have facilities. These animals will also be studied to correlate their breeding seasonality and reproductive performance to the test animals at the United States locations.

i) These studies will be initiated at United States locations in FY 1979 and at L.D.C. locations as sites become available and other research projects have been set up and include standardized management components.

Procedures for achieving objective 4: Cooperate with Utah State, to establish a computerized data bank of valid reproductive information on breeds of sheep and goats from varied genetic sources and environmental locations world wide. This data bank would serve as a source of readily available information for those wanting sires or germ plasm to fit specific needs.

a) Collect data from reliable breeders and other persons about breeds or types of sheep and goats. The data would include valid information concerning performance, reproductive physiology and adaptation of the genotypes with which the breeders are involved. Information on environmental conditions and seasonality as they affect reproduction would also be accumulated.

b) The data will be rechecked where necessary with sources and standardized for computer programming. Augmentation of this information will occur as pertinent information is accumulated.

c) The computerized data bank as it is prepared will be available to other principal investigators involved in the consortium and others involved in sheep and goat research and development.

d) Collection of data will begin in FY 1979 and data from the computer should be available by FY 1980.

Conditions that will indicate objectives have been achieved.

a) Estimates of reproductive potential will have been established for selected genotypes of sheep and goats. Data will have been collected and summarized on prospective sires of different genotypes as sources of germ plasm for use in the U.S. and L.D.C.'s.

b) Estimates of need and value of supplementing forage as related to small ruminant male reproductive performance will have been determined and correlated with L.D.C. conditions. Measurements of seasonal and age effects on reproduction of males of target breeds will have been made. These data will be compiled and available to other members of the small ruminant consortium and other persons interested in sheep and goat development and research.

c) A semen bank will have been established and be operable to supply germ plasm to U.S. and L.D.C.'s. Improved methods of semen processing, storage and transport will have been developed to maximize the potential use of semen for artificial insemination in L.D.C.'s.

d) A data bank would be available at Utah State for use in providing data for U.S. and L.D.C. breeders needing help in locating sheep and goat germ plasm to fit their specific needs.

These data will have been tested at L.D.C. locations and recommendations for their use will have been developed.

Assumptions on achievement of objectives (externalities outside control of PI)

a) The availability of L.D.C. locations with facilities and selected genotypes of sheep and goats.

b) The availability at L.D.C. locations of knowledgeable and reliable professional personnel to cooperate in reproductive physiological studies.

c) The availability at L.D.C. locations of sub-professional personnel to lend technical assistance.

d) The availability of breed associations, breeders and other competent persons to cooperate in gathering pertinent information for use in the data bank and in identifying outstanding genotypes from which germ plasm can be used.

e) Germ plasm from breeds exotic to the U.S. may require governmental clearance in order for it to be included in a semen bank at Cal Poly.

f) The willingness of producers in L.D.C.'s to accept and implement the results and recommendations made from research studies in this project.

Assumptions that achieving objectives will solve problem.

Increased availability of meat, milk, and fiber from small ruminants rests in part in increasing the genetic potential for production. Technology will have been developed and germ plasm identified that will allow the infusion of superior genetic material into L.D.C. indigenous sheep and goats. Environmental and seasonal constraints will have been identified and recommendations will have been made as to their modification to increase productivity of L.D.C. sheep and goats. Further, by correlating the performance of the various genotypes to environmental factors such as climate, feedstuff type and availability, disease and management systems, the likelihood of successful long term improvement by infusion of new germ plasm should be realized.

Outputs of Project

1. Estimates available on male reproductive performance under defined climate and nutritional conditions.
2. Germ plasm resources identified and procedures developed for identifying additional resources.
3. A semen bank available with identified germ plasm for use in the U.S. and L.D.C.'s.
4. A computerized source of information available with data on genotypes useful under varied environmental conditions and/or management systems.

Technical Feasibility

Working within the identified constraints and assumptions, the probability of success is excellent because of the following:

1. The technical capability to evaluate hormonal relationships, breeding, seasonality, nutritional influences on reproduction in two geographic areas is available by the cooperative and coordinated program involving Utah State University and California State Polytechnic University.
2. The scientists involved at both Universities have had considerable experience in research involving reproductive physiology in small ruminants.
3. Some techniques are available which can be modified and/or improved to permit the successful collection, processing, storage and distribution of small ruminant semen.
4. Both Universities are located in states where sheep and/or goats are important industries and where students need to be involved in undergraduate and graduate programs. Thus, both Universities are committed to long term programs of teaching, research and service in small ruminant, production.

BUDGET

COST ITEM[a]	1979/FY US/AID	1979/FY CAL POLY[b]	1979/FY L.D.C.	1980-1983/FY US/AID	1980-1983/FY CAL POLY	1980-1983/FY L.D.C.
A. Personnel - Salaries, wages and fringe benefits - (E. A. Nelson .6 SMY, M. J. Burrill .4 SMY, technician, graduate students, student labor, herdsman, nutritionist and other technical personnel)	34.3	30.1		34.3	30.1	--
B. Major facilities, equipment and animals (L.D.C.)	2.0 .2	6.7	--	2.2	6.7	5.0
C. Travel and Per Diem						
1. United States	3.0	0.3	--	3.0	0.3	--
2. L.D.C.	4.0	1.7	--	4.0	0.5	--
D. Site Maintenance (Share - 7½%)	4.5	--	--	4.5	--	--
E. Other Direct Costs (Feed, Glassware, Computer) U.S.	3.0	4.0		3.0	4.0	
L.D.C.	1.0		--	1.0		--
F. Indirect Costs - 49 percent of salaries[d]	8.0[c]	6.5[c] 12.4	-- --	8.0	6.5 12.4	-- --
TOTAL	60.0	61.7	--	60.0	60.5	5.0

[a]All figures in thousands of dollars.

[b]Includes only university's contribution to this project including part of the utilities.

[c]Indirect costs were divided with 8.0 thousand in AID budget and 6.5 thousand as university contribution.

[d]The university's experience in the first years operation will provide information to indicate how to better adjust the 49 percent indirect costs in future budgets.

Implementation Plan

Time-phased scope of work

1. The identifications of initial breeds of sheep and goats to be used in the project will occur early in FY 1979. Males will be selected and placed on controlled levels of nutrition by mid FY 1979. Blood and semen sampling will be intitiated as animals are placed on test.
2. Studies at L.D.C. locations will be initiated during FY 1980.
3. The computerized data bank will be initiated during the FY 1979 year.
4. Development of a semen bank capability will be underway in FY 1981.

Project monitoring

The following procedures will be followed to assure that the data collected by L.D.C. personnel is useful and accurate.

1. Persons selected to collect technical data in L.D.C. locations should be well trained and their technical performance monitored periodically by a peer group.
2. Detailed records of the project will be required. Periodic summaries of data collected will be sent to the collaborating PI in the United States.
3. Periodic on site visits and work periods will be scheduled in the L.D.C.'s by the PI.
4. Periodic audits of expenditures on the project will be made.

Monitoring the projects at U.S. locations will be as follows:

1. The project will be visited periodically by a peer or peer group.
2. Proper detailed records will be kept and periodic summaries of the data obtained will be distributed.
3. Periodic visits will be made by collaborating PI's, consortium members and others.
4. Periodic audits will be made of the expenditures involved in the project.

Annual Review and Planning Processes

The review and planning activities will occur in an annual review meeting with the Project Director of the small ruminant consortium and others involved in the program. The following procedures will be followed.

1. An annual report of the project will be prepared and will include a summary of the data obtained during the year.
2. The data obtained will be evaluated to determine how the project objectives are being met.
3. Possible modifications of the project might be made if the data obtained suggest such a course.
4. Expenditures will be available for audit.

Project Title & Number: _____

Date Prepared: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
rogram or Sector Goal: The broader objective to hich this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
roject Purpose: To increase meat, milk and iber production in LDC's. . Measure reproductive potential of small uminant male genotypes. . Study seasonality and other responses f environment on their reproductive bility. . Improve methods of germ plasm collec-ion and storage and develop a semen bank. . Provide computerized data bank on sheep nd goat genotypes.	Conditions that will indicate purpose has been achieved: End of project status. 1. Reproductive data collected, summarized and some in use by LDC's. 2. Seasonality and other environmental effects on reproduction measured, summarized and some in use by LDC's. 3. A semen bank and a computerized data bank established and operable and being made use of by LDC's.	1. Reproductive potential data available for distribution. 2. Data on seasonal and other environmental factors available for distribution. 3. Semen from selected sires in semen bank and available for distribution. 4. Data from computer is available for use.	Assumptions for achieving purpose: 1. Improving reproducing ability will increase meat, milk or fiber production LDC's. 2. Environmental and seasonal constraint identified and modified in LDC's. 3. Germ plasm can be imported into LDC's 4. Competent LDC personnel will assist i implementation of relevant data on impro small ruminants.
)utputs: . Provide estimates on male reproductive erformance under defined environmental onditions. . Identify germ plasm resources and pro-edures for locating additional ones. . Provide semen bank with identified erm plasm ready for LDC and US use. . Provide computerized data bank on breed enotypes for LDC and US use.	Magnitude of Outputs: 1. Publications on reproduction performance of small ruminant males under defined conditions. 2. Seminars, workshops and symposiums held in LDC's to help implement use of germ plasm bank, computerized data bank and other research data.	1. Review of publications issued. 2. Examination of stored semen. 3. Review of computerized data. 4. Review of sire selection recommendations.	Assumptions for achieving outputs: 1. Professional and sub-professional personnel will provide leadership in the of available germ plasm and reproduction information in LDC's. 2. Information on breed reproductivity w be supplied by breeders and others to Ut State and Cal Poly. 3. LDC technical assistance will help carry out objectives of the project.
nputs: . US/AID contract with Cal Poly. . Financial and facility commitment of al Poly. . Endocrine studies and analysis by tah State and Cal Poly. . Records and animals from sheep and oat breeders. . Experience and expertise required to onduct physiology of reproduction studies 5. Data from collaborating LDC's.	Implementation Target (Type and Quantity) 1. Target breeds identified Oct. 1978. 2. Selected males on test by March 1, 1979. 3. Hormone and semen evaluation started by March 1979. 4. Information for data bank starts to accumulate by January 1979. 5. Reproductive test in LDC's by August 198[illegible].	1. Annual review of project procedures, results, and recommendations.	Assumptions for providing inputs: 1. Project will be approved and funds pr vided by US/AID for project. 2. Breeders will continue to cooperate i the use of their animals and records. 3. LDC countries will continue cooperati and assist in collecting data and its implementation.

V. Appendices

Appendix I:

Resumes of principle investigator and other key personnel

a. Edward A. Nelson, B.S. (1951), M.S. (1952) Utah State University, Ph.D. (1958) Kansas State University.

Date and place of birth: [redacted]

Professional Experience

Farm and ranch management, Branch Agriculture College 1949-51; private 600 head sheep ranch since 1953; Professor in charge of sheep and goat research, management, and instruction, California State Polytechnic University, Pomona, since 1958; Visiting Professor, Massey University, New Zealand 1958; Breeding Committee, California Wool Growers Association.

International Travel

New Zealand, Australia, Phillipines, Hong Kong, Mexico, New Guinea, and Japan.

Publications

Nelson, E.A. 1958. Factors influencing semen quality and reproductive efficiency in rams. Dissertation Abstract. Kansas State Univ.

Nelson, E.A., W.H. Smith and C.S. Menzies. 1958. The use of management techniques and hormones to control the time, date and regularity of lambing. 45th Annual Livestock Feeder's Day, Kansas Agricultural Experimental Station, Manhattan, Kansas.

Peterson, P., E.A. Nelson, A.C. Christensen. 1978. Working in Animal Science. McGraw-Hill Book Company, New York, N.Y. (Book).

Nelson, E.A., L.E. Harris and M.A. Madsen. 1952. Wool growth of weanling lambs on various levels of methionine urea and sulphur. Proceedings Western Section Society of Animal Science.

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Intensive Systems

1. Face Sheet Data

a. Project Title: Intensive Dairy Goat Production Systems for Smallholder Agriculturalists

b. Project Status: New

c. Grantee: Management Entity/Tuskegee Institute

d. Principal Investigator: Doris M. Olivera

e. Duration: 5 Years

f. Total Estimated Costs: (See Financial Plan)

	AID	TI	Total	TI % Sharing
Year One	$100,000	$ 61,666	$161,666	38
Year Two	100,000	57,665	157,665	37
Year Three	100,000	65,537	165,537	40
Year Four	100,000	65,537	165,537	40
Year Five	100,000	65,537	165,537	40
Totals	$500,000	$315,942	$815,942	

ABSTRACT

2. Intensive Systems Project Components

Title:	Intensive Dairy Goat Production Systems for Smallholder Farmers and Landless Peasants
Leaders:	Dr. Doris M. Olivera, Tuskegee Institute Dr. George Cooper, Winrock International
Locations:	1. Asia 2. Latin America
Rationale:	A major portion of the goats in the humid tropics is owned by the target smallholder/landless peasant population in herds of less than five heads. Current production systems could probably be defined as "scavenger" systems, with little understood about the components of production. There is an acute need for the development of "total package" confinement/semiconfinement management systems for these producers aimed at improving milk production, principally for home consumption.
Over-all Objective:	To develop and test prototypes of systems of dairy goat production for smallholders.
Specific Sub-objectives:	1. To study the effects of confinement on goat production. 2. To compare confinement versus semiconfinement conditions. 3. To do a comprehensive review and analysis of current data on nutrition as applied to dairy goat production. 4. To determine crop-goat interaction.
Approach:	The basic approach will be to develop a total management package for three to five heads dairy goat production systems, applying to field conditions the best current technology. Training and extension education will be a part of the package. The project will be closely coordinated with other components of the Intensive Production Systems Research program (breeding, health, sociology, etc.).
USAID Budget:	$100,000 each location ($200,000 total)

3. Detailed Description of Project

a. Description of Problem: It has been estimated that the goat population in the tropics has reached the level of about 268 million. This, in itself, is a reflection of the relative significance of the goat to the people living there.

A major portion of the goats in the humid tropics is owned by limited resource people in herds of 3 to 5 heads. Although these goats constitute a significant source of meat and/or milk for the family, there is little evidence that the components of production are understood and no evidence of intensification in practice. There is an acute need for the development of "a total package management system" consisting of the essential components of production. In view of the limited resources available to the target population, there is need to develop and/or improve a management system for confinement and semi-confinement conditions for small farmers aimed at improving meat and milk production, mainly for home consumption.

In response to the need described above, Tuskegee Institute is proposing to develop and test intensive management systems for goat production under confined and semi-confined conditions. Initially, special attention will be given to nutrition, health care and sanitation, reproduction, breeding and selection, and to crop/animal interaction.

b. Objectives of Project: The general objective of this project is to develop and test an intensive management system of goat production which shows promise of improving the lot of farmers who are producers of 3 to 5 goats. More specific objectives include the following:

(1) To study the effects of confinement on goat production.
(2) To compare confinement versus semi-confinement conditions.
(3) To evaluate existing literature related to nutritional standards for goats.
(4) To determine crop/goat interaction.

c. Project Approach: The basic approach will be to set up prototypes of confined and semi-confined experimental lots of goats with sufficient treatments and replications such that significant treatment differences and interactions can be identified. Once the experimental lots are established, the several components of the package will be interacted using the "split plot" experimental design technique where applicable. By using this approach, the Tuskegee Institute scientists will be able to observe a variety of parameters on each experimental lot of animals.

In conducting the experimental approaches outlieed here, every effort will be made--to the extent feasible--to duplicate field conditions as they will exist in developing countries.

During the course of this experimental work, United States and Less Developing Country trainees (practical, extension, and degree) will be involved as soon as, and to the extent, possible so that they may become change agents in the transfer of technology to the target population. Following the development and testing of an intensive system for goat production at Tuskegee Institute, models will be set up and demonstrated in Latin America and in Asia. Associated with these will be adult education or extension education programs especially designed to facilitate the transfer of technology, to the extent feasible, throughout the rural communities.

d. Conditions that will Indicate Objectives have been Achieved:

(1) The development of the Intensive Management Package applicable and transferable to the needs and conditions of the target population.

(2) The successful demonstration of the creative models in LDC's.

(3) The socio-economic consumer acceptance of the intensive management models.

(4) The documentation of the successful transfer of appropriate technology.

e. Assumptions on Achievement of Objectives:

(1) That upon arrival in the LDC, there will be national and international political conditions favorable for work.

(2) That the local citizens will be receptive and cooperative.

(3) That local governments will be supportive and interested.

(4) That essential resources (land, labor, and facilities) will be made available.

(5) That major constraints to intensive management (feeds, pest control, manpower, etc.) will be resolved.

f. Assumption that Achieving Objectives will Solve Problem:

(1) That 3 to 5 goats can provide a significant amount of meat, milk, and income under an intensive management system.

(2) That the proper input of genetics, nutrition, health care, and manpower will significantly improve goat and milk production.

(3) That appropriate integration of the factors of production will maximize the value of goats to limited resource people.

g. Outputs of Project:

(1) An Intensive Management Manual thatmay serve as a guide to goat production around the world.

(2) A cadre of professional and sub-professional personnel capable of the transfer of appropriate goat production technology to target populations wherever they exist.

4. Technical Feasibility

Tuskegee Institute is fortunate in having a cadre of scientific personnel with international backgrounds extending from Latin America through the United States, Africa, the Middle East, and Asia. Their knowledge of the existing situation relative to goat production, coupled with their knowledge of what science and technology can do when properly applied, give assurance that the activities proposed herein are technically feasible.

Tuskegee's historical involvement has already demonstrated the value of the goat to its major constituency, "Limited Resource People." The multi-disciplinary faculty from Agriculture, Food Science, the Social Sciences, and Veterinary Medicine now committed to this project firmly establishes practical feasibility and support the enthusiastic optimism which is clearly evident.

5. Financial Plan

	Source of Funds--Year One						Source of Funds--Year Two						Source of Funds--Years Three, Four, and Five					
	AID		TI		LDC		AID		TI		LDC		AID		TI		LDC	
	US*	LDC*	US	LDC	US	LDC	US	LDC	US	LDC	US	LDC	US	LDC	US	LDC	US	LDC
PERSONNEL																		
Salaries	$ 37,000	$ 5,000	$10,000	$ -0-	$-0-	$ 5,000	$ 37,000	$ 5,000	$ 5,000	$ -0-	$-0-	$ 5,000	$ 25,000	$25,000	$10,000	$ -0-	$-0-	$ 5,000
Wages	10,000	-0-	6,000	-0-	-0-	10,000	10,000	-0-	11,000	-0-	-0-	10,000	10,000	-0-	10,000	-0-	-0-	10,000
Fringe Benefits	7,050	750	2,400	-0-	-0-	-0-	7,050	750	2,400	-0-	-0-	-0-	5,250	3,750	3,000	-0-	-0-	-0-
Sub-Total	$ 54,050	$ 5,750	$18,400	$ -0-	$-0-	$15,000	$ 54,050	$ 5,750	$18,400	$ -0-	$-0-	$15,000	$ 40,250	$28,750	$23,000	$ -0-	$-0-	$ 15,000
% Time		9.61						9.61					58	42				
MAJOR FACILITIES, EQUIPMENT, AND ANIMALS	$ 10,000	$ -0-	$ 5,000	$ -0-	$-0-	$15,000	$ 5,000	$ 3,000	$ 2,000	$ -0-	$-0-	$ 5,000	$ 1,000	$ 1,000	$ 1,000	$ -0-	$-0-	$ 2,000
TRAVEL & PER DIEM	$ 1,000	$ 5,000	$ 3,000	$ -0-	$-0-	$ 2,000	$ 1,000	$10,000	$ 2,000	$ -0-	$-0-	$ 2,000	$ 1,000	$10,000	$ 1,000	$ -0-	$-0-	$ 2,000
SITE MAINTENANCE	$ -0-	$15,000	$ -0-	$ -0-	$-0-	$ 1,000	$ -0-	$15,000	$ -0-	$ -0-	$-0-	$ 1,000	$ -0-	$15,000	$ -0-	$ -0-	$-0-	$ 1,000
OTHER DIRECT COSTS*	$ 8,700	$ 500	$ 1,000	$ -0-	$-0-	$ 2,000	$ 5,700	$ 500	$ 1,000	$ -0-	$-0-	$ 1,000	$ 2,500	$ 500	$ 1,000	$ -0-	$-0-	$ 1,000
INDIRECT COST	$ -0-	$ -0-	$30,971	$ 3,295	$-0-	$ -0-	$ -0-	$ -0-	$30,970	$ 3,295	$-0-	$ 1,000	$ -0-	$ -0-	$23,063	$16,474	$-0-	$ -0-
TOTALS	$ 73,750	$26,250	$58,371	$ 3,295	$-0-	$35,000	$ 65,750	$34,250	$54,370	$ 3,295	$-0-	$25,000	$ 44,750	$55,250	$49,063	$16,474	$-0-	$21,000

*Site of Expenditures

US = United States

TI = Tuskegee Institute

LDC = Less Developed Countries

6. Implementation Plans

a. Year 1: During the first year of this project, an extensive amount of time and effort will be devoted to planning and preparation. The major activities will include:

(1) The identification of specific countries in which we will establish models.

(2) A socio-economic analysis of the countries identified.

(3) The development of framework and initiating the operations of the newly designed experimental models.

(4) An analysis of technical and scientific constraints to goat production in the countries identified.

(5) The development of linkages with institutions in LDC's and collaborating with member institutions in the intensive goat production consortium.

(6) Initiating training activities for change agents.

b. Year 2: The second year will be devoted mainly to continued refinement of the intensive models developed at Tuskegee Institute. Staffing and other matters related to setting up models in target countries will take place.

c. Year 3: As the third year begins, graduate students will be ready to devote time and effort to both social and technical research. Evaluation of consumer acceptance and a study of utilization of the newly acquired technology will constitute major research activity. The maximum feasible expansion of extension and demonstration efforts will be achieved during this third year.

d. Year 4: A complete review of technology transfer system will be made and the results used to revise the system to take advantage of positive features and overcome any negative features that may have surfaced. Extensive evaluation and documentation will take place during this period.

e. Year 5: The fifth year of this project will be devoted to continued evaluation and refinement of the intensive models in the LDC's. In

addition, considerable attention will be focused on refinement and expansion of extension techniques for technology transfer and on the development of training aids in the form of bulletins, charts, and in some cases soft ware for use with electronic training aids.

At the close of the fifth year, there will be a complete set of publications to document the findings in all components studied in the process of developing and implementing this project.

7. Annual Review and Planning Process

This project consists of a team effort at Tuskegee Institute. Although each project leader will develop an annual report and budget plan, the teams will constitute the review and evaluation authority. The administrators for international programs will transmit external reports to the appropriate offices as required by the contract.

Project Title & Number: Small Holder, Intensive Management Systems Tuskegee/Winrock

Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving purpose: That LCD will cooperate fully; that r information will be made available to researchers; that small goat holders be amenable to change; that the small ers are capable of implementing appro procedures.
Project Purpose: To establish strategies required to improve small holder goat enterprises in selected communities, thus improving their standard of living. Research activities will include the following: a) the effects of confinement and semi-confinement. b) the efficiency of feed utilization c) determination of goat-crop interaction d) Most effective methods to maximize yeaning e) analysis of crop-goat interaction.	Conditions that will indicate purpose has been achieved: End of project status. Viable and Functioning small holding goat farms in LDC, of which 15-20 will be active by end of second year. By end of year four evaluation information will indicate replicability on national basis. By end of year eight, National small farmer goat management program will be self-iniated and operative.	By end of year one, process tasks will have been achieved; research activities in selected community designed by end of second year. Pilot project implemented during third year, and evaluation of such completed by end of 4th year. By end of eighth year, National policy, procedures and regulations to facilitate on-going self functioning farms will be successful in improving standard of living of small goat-holder farmers.	Assumptions for achieving outputs: An Institution of Higher Learning wil accessible and amenable to cooperativ efforts. Appropriate meeting arrangements can initiated. Decemination of materials can be loca accomplished in a timely manner.
Outputs: Seminars and meetings with National and community leaders to provide information, assess processes and outcomes. Training of samll farmers in requirements to achieve goals. Publication of appropriate bulletins when applicable. Analysis of research findings and sharing with persons needing information. Improved competence of small farmers in goat management processes, community and national leaders responsible for follow-up.	Magnitude of Outputs: In cooperation with CSRS Members The health improvements of goats will be documented as will the increased numbers of kids per farm. The production of milk will be increased. Such information will be publicized locally, regionally and nationally at appropriate times, thus providing a basis for expansion throughout the country. Finally, each farmer will have an improved diet due to increased productivity.	Each individual activity and component will be reviewed and appropriate changes made to increase probability of continued success. Documents, training, research and communication processes will be included in an on-going evaluation.	Assumptions for providing inputs: a) Program will be approved and funds provided by AID b) Winrock will work cooperatively with Tuskegee Institute c) principal researcher will continue to be employed at Tuskegee Institute d) no radical change in LDC political or climatic conditions. e) All components of CRSP will cooper to the maximum needed.
Inputs: Research facilities available at Tuskegee Institute. Goat breeding herd available at Tuskegee Institute for experimental purposes. Expertise of researchers is available.	Implementation Target (Type and Quantity) Annual seminar at Tuskegee Institute to get feedback on project. Publication of reports on annual basis highlighting accomplishments and future goals.	Semi-annual program review and production of annual report.	Assumptions for achieving goal target

OLIVERA, Doris M., Research Associate, School of Applied Sciences, Tuskegee Institute.

Education: B.A., 1956, Boston University; D.V.M., 1961, Tuskegee Institute.

Area of Research Activity: Swine Disease Research

Professional Societies:

American Association of Equine Practitioners
Association for the Advancement of Agriculture Sciences in Africa
New York Association of Comparative Pathology
New York Association of Laboratory Animal Veterinarians
United Nations Association
International Association of Electronic and Electrical Engineering

Previous Positions:

1975-76 Research Associate, Swine Disease Research, School of Veterinary Medicine, Tuskegee Institute.

1970-73 Director, Institute of Comparative Surgery, Harlem Hospital Center, New York, NY.

1969-73 Associate in Pathology, College of Physicians and Surgeons, Columbia University.

1968-73 Airector, Children's Council for Bio-Medical Careers Program, Columbia University, College of Physicians and Surgeons.

1967-69 Instructor, Department of Pathology, College of Physicians and Surgeons, Columbia University.

1966-67 Treatment Room Veterinarian, A.S.P.C.A. Hospital, NYC.

1964-65 Research Associate, Department of Surgery, VA Hospital, Tuskegee, AL.

1963-64 Veterinary Poultry Inspection Trainee, U.S.D.A., Philadelphia, PA.

1962-63 Research Associate, Department of Neuropathology, Ohio State University, Columbus, OH.

1961-62 Instructor, Department of Animal Pathology and Virology Research Diagnostic Laboratory Work, University of Rhode Island, Kingston, RI.

1956-57 Bio-Chemical Research Technician, Argonne Cancer Research Hospital, University of Chicago.

Project Title & Number: Small Holder, Intensive Management Systems - Tuskegee/Winrock

Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving purpose: That LCD will cooperate fully; that re information will be made available to researchers; that small goat holders w be amenable to change; that the small f ers are capable of implementing approp procedures.
Project Purpose: To establish strategies required to improve small holder goat enterprises in selected communities, thus improving their standard of living. Research activities will include the following: a) the effects of confinement and semi-confinement. b) the efficiency of feed utilization c) Characteristics of health problems d) Most effective methods to maximize yeaning e) analysis of crop-goat interaction.	Conditions that will indicate purpose has been achieved: End of project status. Viable and Functioning small holding goat farms in LDC, of which 15-20 will be active by end of second year. By end of year four evaluation information will indicate replicability on national basis. By end of year eight, National small farmer goat management program will be self-iniated and operative.	By end of year one, process tasks will have been achieved; research activities in selected community designed by end of second year. Pilot project implemented during third year, and evaluation of such completed by end of 4th year. By end of eighth year, National policy, procedures and regulations to facilitate on-going self functioning farms will be successful in improving standard of living of small goat-holder farmers.	Assumptions for achieving outputs: An Institution of Higher Learning will accessible and amenable to cooperative efforts. Appropriate meeting arrangements can b initiated. Decemination of materials can be local accomplished in a timely manner.
Outputs: Seminars and meetings with National and community leaders to provide information, assess processes and outcomes. Training of samll farmers in requirements to achieve goals. Publication of appropriate bulletins when applicable. Analysis of research findings and sharing with persons needing information. Improved competence of small farmers in goat management processes, community and national leaders responsible for follow-up.	Magnitude of Outputs: The health improvements of goats will be documented as will the increased numbers of kids per farm. The production of milk will be increased. Such information will be publicized locally, regionally and nationally at appropriate times, thus providing a basis for expansion throughout the country. Finally, each farmer will have an improved diet due to increased productivity.	Each individual activity and component will be reviewed and appropriate changes made to increase probability of continued success. Documents, training, research and communication processes will be included in an on-going evaluation.	Assumptions for providing inputs: a) Program will be approved and funds provided by AID b) Winrock will work cooperatively with Tuskegee Institute c) principal researcher will continue to be employed at Tuskegee Institute d) no radical change in LDC political or climatic conditions. e) All components of CRSP will coopera to the maximum needed.
Inputs: Research facilities available at Tuskegee Institute. Goat breeding herd available at Tuskegee Institute for experimental purposes. Expertise of researchers is available.	Implementation Target (Type and Quantity) Annual seminar at Tuskegee Institute to get feedback on project. Publication of reports on annual basis highlighting accomplishments and future goals.	Semi-annual program review and production of annual report.	Assumptions for achieving goal targets

1. Face Sheet Data

a. Project title: Intensive Dairy Goat Production Systems for Smallholder Agriculturalist

b. Project status: New

c. Grantee: Management entity/Winrock International

d. Principal Investigator: George E. Cooper

e. Duration: 5 years with anticipation of extension

f. Total Estimated Costs:

	U.S. $000				
	Year 1	Year 2	Year 3	Year 4	Year 5
A.I.D.	100.0	100.0	100.0	100.0	100.0
Winrock International	115.5	117.8	118.2	118.2	118.2
LDC Institution	24.0	25.0	22.0	25.0	34.0

g. Prior funding: None

h. AID project manager:

2. Detailed Description of Project:

a. Description of problem:

Dietary protein deficiency is widespread among the poorer nations of the world. Development planners have long overlooked the importance of the dairy goat to traditional smallholder producers in the developing regions of the world. Goat production systems are affected by social and economic factors, tradition and most importantly, by available resources. Livestock, especially goats, are an important source of income and sustenance to pastoral societies. There is important potential for smallholder agriculturalist under intensive conditions to realise the benefits from dairy goats kept in small 3-5 goat units. These animals can become the major source of protein (meat and milk) for the farmer and his family. In addition the problem of limited income can be overcome due to sales of surplus products associated with dairy goat production.

The four developing regions of the world have 78 percent of the goats. A major portion of these are expected to produce where other livestock species are not expected to survive. In such environments, the restricted opportunities have favored the evolution and development of low producing animals. Currently meat production is often of major concern with milk production given lower priority. Goat production levels are conditioned primarily by the nutritional plane on which the animals live and under extensive conditions, are frequently jeopardized by the shortage or unreliability of rainfall. Intensive production environments will have adequate precipitation and will often have forage available for "cut and carry", tethering and other intensive and semi-intensive feeding-management systems. Although precipitation is variable and occasionally results in alternating periods of subsistence and productivity during the dry and wet seasons respectively, improvements in feeding and management will enhance meat and milk production resulting in greater offtake for the smallholder family and increase in earnings. Progress depends on the extent to which these constraints can be reduced. Milk is an important source of protein in supplementing root, tuber and cereal diets. Protein levels are important for a viable segment of the population in developing countries, especially for young children and pregnant and nursing mothers. It is also important to note that goat milk is often consumed by those persons with allergies to cow's milk.

b. Objectives of project:

1) Develop integrated and comprehensive management packages for use by smallholder dairy goat producers through research that defines, biological, technical, production and economic constraints.

2) Develop nutritional standards for dairy goats, especially kids.

3) Validate and develop under controlled conditions computer simulations of intensive dairy goat production systems.

4) Develop collaborative research plans with other consortium and LDC institutions.

5) Develop prototype dairy goat production systems at U.S. and LDC sites.

c. Project approach:

1) Summarize published information related to dairy goat feeding and management and initiate contact with other investigators with interest in these areas.

2) Site selection: based on the current importance of dairy goats to small producers and opportunities for expansion; availability of adequate research supporting infrastructure or interest in developing.

3) Initiate kid nutrition and production data accumulation at Winrock facilities - emphasis will be placed on testing results from the Tuskegee studies on doe nutrition, collaboration with veterinary and breeding specialists.

4) Development of prototype dairy goat systems to test the feasibility of 3-5 goat management systems; initiate work at Winrock with primary efforts in LDC sites; coordinate inputs by other members of the consortium; and develop management training materials.

5) Documentation of dairy goat production statistics.

d. Conditions that will indicate objectives have been achieved:

1) Development of management and technology packages suitable to the needs of intensive dairy goat systems for smallholders.

2) Establishment of prototype models of appropriate dairy goats systems for LDC's.

3) Development of feeding standards for dairy goats.

4) Validation of computer simulations of individual animal and flock performance under intensive management situations.

5) Accumulation and publication of bio-technical and economic coefficients and production constraints.

6) Develop instructional training materials for smallholder dairy goat producers.

e. Assumptions on achievement of objectives:

1) Suitable sites in LDC will be located with interest by LDC collaborators and producers.

2) LDC interest does exist for research in dairy goat production and management.

3) Land, facilities and animals are available for supporting proposed programs in LDC.

4) Major constraints -nutrition, health, etc. - to intensive dairy goat production in the humid tropics will be resolved.

f. Assumptions that achieving objectives will solve problems:

1) Dairy goats under intensive production systems can improve offtake and increase income of smallholders.

2) Knowledge of nutrient requirments, herd health and genetic improvement methods will allow improvement of dairy goat production.

3) Net improvements of systems productivity requires integrated, collaborative, multi-disciplinary approach.

g. Outputs of project:

Same as 2-d above

3. Technical Feasibility:

Based on two years of actual involvement in a continuing dairy goat management program in Arkansas; an awareness of production constraints for U.S. and LDC environments; having a multi-disciplinary staff with interests and involvement with dairy goats; and an institutional interest and commitment to continue efforts in dairy goat production, research and management, the probability of developing research programs and management systems that will significantly improve dairy goat production for smallholders in LDC's is extremely high.

4. Financial Plan:

Year 1

	Title XII U.S.	Title XII LDC	Total AID	Winrock	Total AID + Winrock	LDC Estimate
A. Salaries (1 SMY)[1]	30,000		30,000		30,000	
G. E. Cooper (.40)						
H. A. Fitzhugh (.15)						
T. D. Nguyen (.25)						
R. Newton (.20)						
Site Coordinator		15,000	15,000		15,000	
Other Scientist				15,000	15,000	6,000
Technicians	8,000		8,000	4,000	12,000	4,000
Labor and clerical						4,000
Total Salaries	38,000	15,000	43,000	19,000	43,000	14,000
B. Equipment Facilities[2] and Animals:	12,500	5,500	18,000		18,000	6,000
C. Travel and Per Diem:[3]	4,000	18,000	22,000		22,000	2,000
D. Other Direct Costs:[4]	5,000	2,000	7,000		7,000	2,000
Total Salaries & Direct Costs:	59,500	40,500	100,000	19,000	119,000	24,000
E. Overhead on Title XII Funds:[5]						
1. Indirect costs (35% of salaries)				18,550	18,550	
2. Administrative costs (10% of A+B+C+D+ indirect costs)				11,855	11,855	
F. Winrock Contribution from Projects Related to Title XII CRSP						
Objectives						
1. Petit Jean Goat Dairy				57,200	57,200	
2. HPI Dairy Goat Management Training				8,800	8,800	
G. PROJECT TOTAL	59,500	40,500	100,000	115,405	215,405	24,000

Year 2

	Title XII U.S.	Title XII LDC	Total AID	Winrock	Total AID + Winrock	LDC Estimate
A. Salaries: (1 SMY)[1]	36,900		36,900		36,900	
G. E. Cooper(.40)						
H. A. Fitzhugh(.15)						
T. D. Nguyen (.25)						
R. Newton (.20)						
J. Thompson (.23)						
Site Coordinator		15,000	15,000		15,000	
Other Scientist				15,000	15,000	6,000
Technicians	8,000		8,000	4,000	12,000	4,000
Labor and clerical						4,000
Total Salaries	44,900	15,000	59,900	19,000	59,900	14,000
B. Equipment Facilities and Animals:[2]	13,100	5,000	18,100		18,100	7,000
C. Travel and Per Diem;[3]	5,000	10,000	15,000		15,000	2,000
D. Other Direct Costs:[4]	6,000	1,000	7,000		7,000	2,000
Total Salaries & Direct Costs:	69,000	31,000	100,000	19,000	119,000	25,000
E. Overhead on Title XII Funds.[5]						
1. Indirect costs (35% of salaries)				20,965	20,965	
2. Administrative costs (10% of A+B+C+D+ indirect costs)				12,097	12,097	
F. Winrock Contribution from Projects Related to Title XII CRSP Objectives:						
1. Petit Jean Goat Dairy				57,200	57,200	
2. HPI Dairy Goat management training				8,600	8,600	
G. PROJECT TOTAL:	69,000	31,000	100,000	117,862	217,862	25,000

Year 3

	Title XII U.S.	Title XII LDC	Total AID	Winrock	Total AID + Winrock	LDC Estimate
A. Salaries: (1 SMY)[1]	30,000		30,000		30,000	
G. E. Cooper (.40)						
H. A. Fitzhugh (.15)						
T. D. Nguyen (.25)						
J. Thompson (.20)						
Site Coordinator		15,000	15,000		15,000	
Other scientist				15,000	15,000	5,000
Technicians	16,000		16,000	4,000	20,000	5,000
Labor and clerical						5,000
Total Salaries	46,000	15,000	61,000	19,000	80,000	15,000
B. Equipment FAcilities and Animals:[2]	13,000	4,000	17,000		17,000	5,000
C. Travel and Per Diem:[3]	5,000	10,000	15,000		15,000	1,000
D. Other Direct Costs:[4]	6,000	1,000	7,000		7,000	1,000
Total Salaries & Direct Costs	70,000	30,000	100,000	19,000	119,000	22,000
E. Overhead on Title XII Funds:[5]						
1. Indirect costs (35% of salaries)				21,350	21,350	
2. Administrative costs (10% of A+B+C+D+ indirect costs)				12,135	12,135	
F. Winrock Contribution from Projects Related to Title XII CRSP						
Objectives						
1. Petit Jean Goat Dairy				57,200	57,200	
2. HPI Dairy Goat management training				8,600	8,600	
G. PROJECT TOTAL:	70,000	30,000	100,000	118,285	218,285	22,000

Year 4

	Title XII U.S.	Title XII LDC	Total AID	Winrock	Total AID + Winrock	LDC Estimate
A. Salaries: (1 SMY)[1]	30,000		30,000		30,000	
G. E. Cooper (.40)						
H. A. Fitzhugh(.15)						
T. D. Nguyen (.25)						
J. Thompson (.20)						
Site Coordinator		15,000	15,000		15,000	
Other scientist				15,000	15,000	5,000
Technicians	16,000		16,000	4,000	20,000	5,000
Labor and clerical						5,000
Total Salaries	46,000	15,000	61,000	19,000	80,000	15,000
B. Equipment Facilities and Animals:[2]	13,000	2,000	15,000		15,000	7,000
C. Travel and Per Diem:[3]	5,000	10,000	15,000		15,000	2,000
D. Other Direct Costs:[4]	6,000	3,000	9,000		9,000	1,000
Total Salaries & Direct Costs	70,000	30,000	100,000	19,000	119,000	25,000
E. Overhead on Title XII Funds:[5]						
1. Indirect costs (35% of salaries)				21,350	21,350	
2. Administrative costs (10% of A+B+C+D+ Indirect costs)						
F. Winrock Contribution from Projects Related to Title XII CRSP						
Objectives						
1. Petit Jean Goat Dairy				57,200		
2. HPI Dairy Goat management training				8,600		
G. PROJECT TOTAL:	70,000	30,000	100,000	118,285	218,285	25,000

Year 5

	Title XII U.S.	Title XII LDC	Total AID	Winrock	Total AID + Winrock	LDC Estimate
A. Salaries: (1 SMY)[1]	30,000		30,000		30,000	
G. E. Cooper (.40)						
H. A. Ftizhugh (.15)						
T. D. Nguyen (.25)						
J. Thompson (.20)						
Site Corrdinator		15,000	15,000		15,000	
Other scientist				15,000	15,000	8,000
Technicians	16,000		16,000	4,000	20,000	6,000
Labor & clerical						5,000
Total Salaries	46,000	15,000	61,000	19,000	80,000	19,000
B. Equipment Facilities and Animals:[2]	3,000	1,000	4,000		4,000	8,000
C. Travel and Per Diem:[3]	3,000	23,000	26,000		26,000	2,000
D. Other Direct Costs:[4]	7,000	2,000	9,000		9,000	5,000
Total Salaries & Direct Costs	59,000	41,000	100,000	19,000	119,000	34,000
E. Overhead on Title XII Funds:[5]						
1. Indirect costs (35% of salaries)				21,350	21,350	
2. Administrative costs (10% of A+B+C+D+ indirect costs)				12,135	12,135	
F. Winrock Contribution from Projects Related to Title XII CRSP						
Objectives						
1. Petit Jean Goat Dairy				57,200	57,200	
2. HPI Dairy Goat management training				8,600	8,600	
G. PROJECT TOTAL:	59,000	41,000	100,000	118,285	218,285	34,000

[1]Personnel (salaries & wages plus fringe)

a. All labor on project including direct hire labor, consultants, technicians and support.
b. Include student assistantships, stipends, etc.

[2]Equipment/facilities/animals

Permanent equipment and facilities used in carrying out project, not already counted in computing overhead rate (if any): office and laboratory space, furniture, non-expendable equipment, research animals, vehicles, etc.

[3]Travel and Per Diem

Air fares, per diem, automobile rental, local mileage. LDC travel includes travel from the U.S. to LDC sites as well as travel within LDC's.

[4]Report preparation, reproduction, publication, minor equipment (expendable), office supplies, supplies for animal maintenance, insurance for overseas travel, visas, immunizations, postage, telephone, allowances for US personnel relocated overseas (housing, education, salary post differential, temporary quarters), language training, translation services, books, maps, computer services, etc.

[5]Facilities, offices, office equipment, technical equipment, library and administrative overhead.

5. Implementation Plan:

a. Year 1: During this project period a significant portion of time will be required to travel to foreign locations for the purpose of identifying an appropriate research site. This travel will be planned in coordination with other intensive group principal investigators in order to establish professional and institutional linkages at the foreign location for research collaboration. The basic research program, as presented to JRC, will be presented for discussions once the site has been selected. Literature will be reviewed and contact will be established with institutions and investigators involved in dairy goat management research.

It is important during this phase of the study to characterize all components of traditional dairy goat production systems, expecially in the host LDC. This would include producer attitudes (sociologist); income and marketing (economist); production coefficient; feed resources (animal scientist); parasites and diseases (veterinarians). Such basic information is important in developing computer simulations (systems scientist) for traditional producers. These coordinated activities help to produce an information base, and identify production constraints. These are important in establishing dairy goat research priorities.

During this phase of activities, it is anticipated that other research activities will be initiated to study the nutritional requirements of does (pre and post-partum); with primary effort at Tuskegee; the nutritional requirements of kids (pre and post-weaning) with primary effort at Winrock; and an evaluation of intensive and semi-confinement systems for the production and management of dairy goats. These efforts will initiate and define basic nutrient requirements, especially energy and protein. Other nutrient parameters will be considered as the program expands.

Prototype facilities and control devices (fences, tethering) appropriate for intensive and semi-confinement production of dairy goats will be designed and tested at Winrock in the first year with primary efforts to be started subsequently at LDC sites.

Research activities will be planned for both U.S. and LDC locations to develop dairy goat management systems appropriate for traditional smallholder dairy goat producers. Activities will include nutrition, health, breeding, reproduction, economics, sociology and production systems research. In addition to these areas of basic research, applied research activities will be planned to test inputs of improved management technology and to validate basic reasearch results.

Year 2: Continue development of intensive and semi-confinement systems at the LDC location. This will include research efforts to compare traditional and improved management systems for dairy goats. It is anticipated that graduate students will be involved in both academic and research activities. Research plans to be

implemented at LDC location will be developed in collaboration with LDC scientist. A full time staff scientist located at LDC site will be necessary to coordinate efforts by Tuskegee/ Winrock and other consortium members and to collaborate with LDC institutional scientists. Model development of traditional dairy goat production systems will begin with production coefficients available from the year 1 activities, appropriate production alternatives will be developed for maximum productivity and offtake. Investigations on doe and kid nutrition will continue. Breeding and health problems will be characterized and responses to treatment will be recorded.in collaboration with other Title XII institutions conducting health research.

Year 3: During this phase of the program it is important that research results be evaluated from U.S. and LDC locations to begin establishment of applied research projects. These projects should provide results which demonstrate benefits to producers of dairy goats. It is important to develop marketing options for the use of milk, meat, skins and other products, as appropriate from dairy goats. Results from nutritional studies will be combined with inputs from other collaborators at U.S. and LDC locations. Both U.S. and LDC graduate students will be involved in research programs at LDC locations under the supervision of U.S. and LDC scientists. Principal investigators will be involved in the design and evaluation of student research activities.

Year 4: During this phase of the research program all project sites will be visited to plan research activities for year 5.

Results from dairy goat nutritional investigations should be ready for publication and distribution. It is anticipated that nutritional guidelines will be established for both energy and protein with some contributions to standards for minerals and vitamins.

It is important that cropping patterns be documented with the relative nutritional value of crop residues and by-products determined so that these results can be included in the applied management research for validation at U.S. and LDC locations.

Year 5: Research activities should be tested at the producer level to validate product offtake under different managment alternatives for dairy goats. These results will be based on the strategies developed by computer simulation, based on knowledge of traditional production and results from research results.

Training materials specific to the needs of smallholder dairy goat producers will be developed. These materials will be specifically coordinated to reach the majority of the producers who are often illiterate. Videotape programs which show how various management techniques are performed are anticipated.

Support materials (e.g. "picture books" with captions in local dialects) will also be developed. In that many developing areas have radio stations, it may also be appropriate to provide broadcasts of information specific to dairy goat production, management and marketing. Receptivity of this information and its affect on productivity are important areas to be considered beyond the scope of this initial five year program.

b. Project monitoring:

Projects established at LDC locations will be led by the Winrock staff member stationed on site. Progress reports will be submitted to the P.I. On site project monitoring will also be the responsibility of the P.I. to comply with the terms of the contract.

6. Annual Review and Planning Process:

Each project leader will be responsible for writing a progress report annually with program plans and budgets for the following year. Copies will be available to other P.I.'s and will be submitted for review as required under terms of the contract.

GEORGE E. COOPER, Animal Nutritionist. [redacted]

Education:	B. S.	Animal Science, Florida A & M University,	1967
	M. S.	Animal Science, Tuskegee Institute,	1969
	Ph.D.	Animal Science, University of Illinois,	1972

Employment History:

1977-Date — Animal Nutritionist, Winrock International Livestock Research and Training Center, Route 3, Morrilton, Arkansas 72110.

1972-77 — Assistant Professor, Animal Nutrition; Coordinator of International Programs; Coordinator of Tuskegee Institute 211-D grant activities on tropical livestock development; Tuskegee Institute, Tuskegee, Ala.

1976-77 — Chairman, USAID 211-d Livestock Consortium on Tropical Livestock Production involving the following four U.S. Universities: Tuskegee Institute; Texas A & M University; Purdue University; and University of Florida.

Selected Professional Experiences:

1972-77 — In addition to academic program involvement, Dr. Cooper has been involved in implementing practical training programs for participants from Guyana and South America. Also organized programs for evaluating technical constraints in livestock production for developing countries, and served as Chairman of a four university consortium interested in multi-disciplinary problem identification in livestock production systems.

1977 — Dr. Cooper has been involved in evaluating the role of sheep and goats in agricultural development and has been the scientist in charge of the cooperatively sponsored dairy goat project which is supported by Winrock and Southern Agriculture Corporation.

Publications:

Cooper, G. E., F. C. Hinds and J. M. Lewis. The Nutritive Value of Sheep Feces. J. Anim. Sci. 34:358 (1972).

Cooper, George E., and Glenn R. Howze. A Survey of Livestock Producers in Guyana (1975). Conducted in cooperation with the Guyana Ministry of Agriculture and the United States Agency for International Development (USAID).

Cooper, George E., Livestock Breeding Herds for Small Producers. 1976. Presented at the Workshop on Livestock Smallholders and Small Pastoralist. June 14-17, 1976. Winrock International.

Glimp, H. A., H. A. Fitzhugh, R. O. Wheeler, T. D. Nguyen, A. Martinez, G. E. Cooper and R. D. Child. 1977. The Role of Sheep and Goats in Agricultural Development - A state-of-the-arts study. Report of a study conducted by Winrock International and Co-sponsored by USAID/TAB Livestock.

Foreign Experience:

Africa: Senegal, Mali, Chad, Cameroon, Nigeria, Upper Volta, Botswana, Swaziland, Tanzania, Kenya.

South America: Guyana. Mexico: Mexico City.

AID 1020-28 (1-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

Project Title & Number: Intensive Dairy Goat Production Systems for Smallholder Agriculturalists.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: To develop integrated and comprehensive management packages for use by smallholder dairy goat producers through research that defines biological, technical, production and economic constraints.	Conditions that will indicate purpose has been achieved: End of project status. a) development of management and technology packages suitable to the needs of intensive dairy goat systems for smallholders; b) establishment of prototype models of appropriate dairy goat systems for LDC's; c) development of feeding standards for dairy goats; d) validation of computer simulations of individual animal & flock performance under intensive management situations; e) accumulation and publication of bio-technical and economic coefficients and production constraints.	a) Established dairy goat research projects in the U.S. and LDC's b) Publication of research results; c) Development of management packages on dairy goat production suitable to smallholders; d) Validation of computer simulations of intensive dairy goat management systems.	Assumptions for achieving purpose: a) Suitable sites in LDC will be located; b) LDC interest does exist for research in dairy goat production and management; c) Land, facilities and animals are available for proposed programs in LDC's; d) Major constraints to intensive dairy goat production in the humid tropics will be resolved.
Outputs: a) Publication of bio-technical and economic coefficients and production constraints of smallholder dairy goat production; b) Development of small (3-5 goat) dairy goat units applicable for use in LDC's; c) Development and publication of nutritional standards; technicial training.	Magnitude of Outputs: a) Collaborative research network established between U.S. & LDC universities; b) Establishment of research sites on dairy goats at LDC sites; c) Publication of research results.	Same as indicated in "Magnitude of Outputs"	Assumptions for achieving outputs: a) Collaborating scientist in LDC's will provide research data; b) Collaborative research network will be established
Inputs: a) Data from collaborating U.S. and LDC institutions; b) Data from ongoing Winrock dairy goat project; c) Professional experience in dairy goat production and management.	Implementation Target (Type and Quantity) 1. LDC's: a) Research site at LDC location b) LDC dairy goat producers. 2. Winrock: Petit Jean goat dairy (operated and managed by Winrock International in Arkansas).	a) Program review as described under terms of the contract.	Assumptions for providing inputs: a) Program will be approved and funds provided under Title XII; b) Winrock professional staff will continue; c) Data will be provided from U.S. and LDC research collaborators.

Revised June 9, 1978

SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM

PROJECT PROPOSAL

Project Title: Intensive Forage Production Systems for Small Holder Sheep and Goat Producers.

Institution: The Ohio State University and the Ohio Agricultural Research and Development Center.

Principal Investigators:

Robert W. VanKeuren, Agronomist-Forage, Project Leader.
Charles F. Parker, Animal Scientist-Genetics & Nutrition.
Burk A. Dehority, Animal Scientist-Rumen Microbiologist.

Duration: Five years or more beginning 1978.

Total Estimated Costs: (Inflation factor not included)

Institution	1978-79	1979-80	1980-81	1981-82	1982-83
AID	175,000	175,000	175,000	175,000	175,000
Ohio State Univ. & OARDC	68,480	68,480	68,480	68,480	68,480
LDC Institutions	70,000	70,000	70,000	70,000	70,000
TOTAL	$313,480	$313,480	$313,480	$313,480	$313,480

Prior Funding: None

Project Administration: Mervin G. Smith, Assistant Dean
International Agricultural Affairs
College of Agriculture & Home Economics
The Ohio State University
2120 Fyffe Road
Columbus, Ohio 43210

SMALL RUMINANTS COLLABORATIVE RESEARCH SUPPORT PROGRAM

OHIO PROJECT

Title: Intensive Forage Production Systems for Smallholder Sheep and Goat Producers

Description of Problem:

Improved forage production systems for smallholder mixed crop/livestock production are needed to increase animal productivity in the humid tropics. Forages are the only or major source of nutrients for small ruminants in this region and involve the utilization of marginal land, crop interstices and crop rotation programs. Frequently smallholders have only three to five animals and control a limited amount of land, but the availability of year-round forage could supply adequate feed if properly developed and utilized. Compounding the problem of forages in the humid tropics is the lack of information on the quality, intake and digestibility of the tropical forages and serious gastrointestinal parasitism, resulting from intensive grazing. Gastrointestinal parasite infestation is recognized as a major production constraint to most grazing sheep populations in the temperate and tropical zones throughout the world. Utilization of genetic variation for parasite resistance provides a basic approach for establishing genotypes with permanent inherent protection against parasitic infestation. Genetic resistance to gastrointestinal parasites is of paramount importance for intensifying forage animal systems in the developing countries of the world.

Objectives:

1. To identify and characterize the forages available in the humid tropics.

2. To develop forage/animal production systems and evaluate plant/animal response.

3. To evaluate the nutritional and microbiological factors of humid tropic forage production systems for small ruminants.

4. To determine the importance of animal genetic variation for resistance to gastrointestinal parasites under intensive grazing systems.

Project Approach:

1. Identify and characterize the forages available in the humid tropics.

   a. Identify the forages available including grasses, legumes, forbs and browse.

b. Survey current information to determine the best known management for optimizing yield, quality and persistence.

c. Determine the utilization methods adaptable to the humid tropics

(1) grazing, soilage, hay, deferred grazing and silage

d. Determine other nutrient sources available

(1) crop residues, by-product feeds, plant refuse, etc.

(2) coordinate with project on crop residues

e. Characterize the forages

(1) yield and persistence

(2) mineral composition

(3) nutrient composition

(a) CP, DP, ADF, NDF

(4) seasonality of production

(5) storability

f. It is anticipated that part of this objective will involve a review of pertinent literature. Other data will be obtained from on-site survey and evaluation of the forages available or adaptable, together with laboratory and field studies. Much of the laboratory analysis will be done at OARDC on samples collected on site. Field studies and some laboratory analysis will be done on site.

2. To develop forage/animal production systems and evaluate plant/animal response.

a. Based on best information available, estimate protein, energy and mineral requirements for animal production, including breeding, gestation, lactation, growth and maintenance.

b. Use knowledge from 1, 2a and 3 to develop forage/animal production systems and evaluate plant/animal response.

(1) conduct grazing and feeding studies such as soilage feeding

(a) determine animal response in terms of weight gain, milk production and reproductive performance.

(b) determine plant response in terms of yield, persistence and carrying capacity.

c. Redesign and improve forage/animal production systems on the basis of information from 2b and re-evaluate.

d. Forages will be produced as pasture and/or harvested feed and actual grazing and/or feeding studies will be conducted with small ruminants. It is anticipated that the cooperating overseas institutions will provide land, animals, and other facilities needed to conduct the needed research.

3. To evaluate the nutritional and microbiological factors of humid tropic forage production systems for small ruminants.

a. General approach:

(1) Estimate the intake and dry matter digestibility of available forages as pasture, soilage, hay and possibly silage.

(2) Using the above data, along with *in vitro* dry matter digestibility values on these same forages, generate prediction equations which can be used to evaluate both native forages as well as possible new introductions.

(3) Estimate total bacterial and protozoal numbers supported by different native forages.

(4) Measure rumen volumes, fluid turnover rates and total quantity of rumen contents on these same forages. Possible interrelationships of these criteria with gastrointestinal parasite infestation will also be studied.

(5) Compare the above parameters between different species and genetic types of small ruminants.

b. On site:

(1) Intake and digestibility trials will be conducted for sheep and goats with the available forages. All utilization methods will be considered, i.e., grazing; soilage, hay and silage.

(2) *In vitro* dry matter digestibility will be estimated on these same forages. Prediction equations will be calculated for the different forms and types of forages, and subsequently tested as to their reliability for forages grown in that particular locale.

(3) Samples of rumen contents will be collected from sheep and goats feeding on different forages with different utilization methods. Rumen pH and total viable rumen bacterial numbers will be estimated immediately, and samples will also be preserved for counting numbers of rumen protozoa. In subsequent years, it may be desirable to use the selective medium developed in our laboratory to estimate the distribution of various

functional groups of rumen bacteria, i.e., starch digestors, xylan digestors, etc.

(4) If fistulated animals can be prepared, then simultaneously with determination of microbial counts, rumen volume, fluid turnover rate and percent dry matter will be measured.

d. OARDC, Wooster:

(1) After appropriate sub-sampling, etc., samples from the digestibility trials can be returned to the laboratory in Wooster for analyses.

(2) Preserved samples of rumen contents will be returned for total protozoal counts as well as generic distribution of protozoa.

(3) The possible effects of gastrointestinal parasites on rumen microbial numbers, rumen volume, fluid turnover rate and percentage dry matter will be studied in detail.

(4) Since several different genetic types of sheep, including hair types, are available at Wooster, a comparison can be made between in vitro dry matter digestibility values with rumen contents from these animals and those animals on site.

4. To determine the importance of animal genetic variation for resistance to gastrointestinal parasites under intensive grazing systems.

a. OARDC:

(1) Genetic types of indigenous and hair sheep will be characterized by physiological and immunological measurements relating to haemonchosis.

(2) Studies will be conducted to elucidate the primary factors associated with the net genetic effect of gastrointestinal parasite resistance.

(3) High disease resistant types will be mated with low resistant types to determine the kinds of gene action controlling the genetic resistant factors.

(4) Cooperative studies will be conducted with research personnel under Objective 3 to investigate possible interrelationships between genetic types, degree of gastrointestinal parasitism and nutrient availability.

(5) Within group selection will be evaluated as a method for intensifying the degree of genetic resistance for haemonchosis.

b. On site:

Hair types from OARDC with known inherent characteristics for resistance to internal parasites will be involved in test matings under intensive grazing systems in LDC locations. On site hematological examinations will be made to determine the degree of haemonchosis among indigenous and introduced groups and their crosses.

RY

Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
omparison with previous and con-urrent forage and animal roductivity at LDC.	**Assumptions for achieving goal targets:** 1. Acceptance of recommendations by LDC's and adoption by smallholders
e forage/animal systems oped for LDC.	**Assumptions for achieving purpose:** 1. Outputs as specified are achieved. 2. Acceptance of recommendations by LDC's and promoted among small-holders by LDC's.
iew of publications. iew of work in progress. bers of LDC personnel actively olved in project. bers of personnel trained.	**Assumptions for achieving outputs:** 1. LDC's will collaborate in establishment of forage plots, provide suitable experimental animals, collect forage samples as requested and cooperate in carrying out project plans.
ual program review and luation in LDC and at OARDC.	**Assumptions for providing inputs:** 1. That program will be approved and funded by AID. 2. That LDC's will provide adequate laboratory, animal and field facilities, and personnel.

AID 1020-28 (1-72)

PROJECT DESIGN
LOGICAL FRA

Project Title & Number: Intensive Forage Production Systems for Smallholder Sheep and Goat Producers

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS
Program or Sector Goal: The broader objective to which this project contributes: Identify major constraints and develop forage production systems for smallholder mixed crop/livestock enterprises for intensification of animal productivity in the humid tropics.	**Measures of Goal Achievement:** Increased animal production through improved forage/animal systems and possible increased resistance to internal parasites.
Project Purpose: 1. Identify and characterize forages available in humid tropics. 2. Develop forage/animal production systems and evaluate plant/animal response. 3. Evaluate nutritional and microbiological factors of humid tropic forage production systems for small ruminants. 4. Determine importance of animal genetic variation for resistance to gastro-intestinal parasites under intensive grazing systems.	**Conditions that will indicate purpose has been achieved: End of project status.** Adoption of proposed changes in forage/animal systems by LDC.
Outputs: 1. Publications. 2. Identify optimal forage/animal systems. 3. Determination of forage nutr. quality. 4. Compare nutrient efficiency of small ruminants between and within species for LDC locales. 5. Establish importance of parasitism and animal genetic variation. 6. Training of LDC project personnel.	**Magnitude of Outputs:** 1. Data collected in 2 LDC's and at OARDC. 2. Periodic publications prepared. 3. Trained personnel in LDC.
Inputs: 1. LDC analytical laboratories; pastures, animals; lab and field personnel. 2. OARDC analytical laboratories, pastures animals; lab and field personnel; adm. support, staff experience and expertise 3. AID funding.	**Implementation Target (Type and Quantity)** 1. LDC: a. est. analytical laboratories. b. est. forage plots. c. obtain experimental animals. d. obtain field personnel to collect forage and animal data 2. OARDC: a. analytical laboratories, animal facilities and personnel. b. staff personnel.

Financial Plan:

This Collaborative Research Support project is an extension of a domestic research program presently being conducted in Ohio. The Agronomists and Animal Scientists have teamed up for many years to solve problems of forage production and utilization systems and have a creditable record. The same team will need to be kept together for the work in less developed countries. They would not be enthusiastic about the international aspect unless they can work together on all aspects of the project area.

In order to add this project to the present research program in Ohio, some time of the principal investigators need to be shifted from present research projects or teaching to this new research project. Likewise, additional faculty and other staff need to be added so that both on-going research projects are not disrupted and the new project is initiated.

The work with forages in the tropics will be of less benefit to Ohio since the forages are different. The work with the animals themselves may be of more benefit to Ohio and, therefore, Ohio can provide more cost sharing for the animal part of the project than the agronomic part.

The costs assumed by the foreign institutions are impossible to determine until the selection of the LDC sites. Likewise, expenditures abroad are very difficult to determine. It is assumed that only a small amount of AID funds would need to be spent in the LDC's for animals, forage production, equipment, or for staff doing the work. Flexibility will be needed in the budget between line items in order to adjust to the needs at the LDC sites.

This project would be administered through the regular channels of The Ohio State University and the Ohio Agricultural Research and Development Center. The principal investigators will be responsible through their respective departments of Agronomy and Animal Science. The project will be operated through the International Agricultural Affairs Office of the College of Agriculture and Home Economics, and the Ohio Agricultural Research and Development Center.

A budget is presented in detail for the first year of the project. The costs are based on present salaries and prices. These are expected to be higher in 1979 - 5 to 10%. Likewise, an inflation factor will need to be considered for each year in the future.

It is expected that the expenditures each year for the next 5 years will be about the same without consideration for inflation.

Cost sharing by Ohio is based on best estimates of the benefits received.

Revised June 9, 1978

PROPOSED BUDGET - 1978--1979

Intensive Forage Production Systems
for Small Holder Sheep and Goat Producers

ITEM		AID	OHIO STATE UNIV. & OARDC	LDC
A. PERSONNEL				
I. Salaries - Principal Investigators				
1. Robert W. VanKeuren	25% - 7949			
2. Charles L. Parker	20% - 5904			
3. Burk A. Dehority	20% - 6024			
II. Salaries - Staff & Other				
1. Animal Scientist - Post Doctoral	100% - 18,000			
2. Agronomist - Sr. Technician	100% - 12,000			
3. Animal Scientist Technician	100% - 10,000			
4. Two Graduate Students or Technicians	(LDC)	16,000		
5. Other - Secretarial & Lab Technician			23,500	
III. Fringe Benefits @ 20%		15,175	4,700	
TOTAL SALARY & FRINGES		91,052	28,200	
B. MAJOR EQUIPMENT, FACILITIES PASTURE, FORAGE AND ANIMALS		3,000	28,000	
C. TRAVEL & PER DIEM, U. S.		1,000		
INTERNATIONAL	(LDC)	14,000		
D. LDC SITE MAINTENANCE SHARE	(LDC)	22,500		
E. OTHER DIRECT COSTS: Supplies, Lab, Computer, Tuition, Communications, etc.		12,703	1,000	
Housing & overseas allowances for grad. students & rechnicians	(LDC)			8,000
F. INDIRECT COSTS Operation & Adm. 10% of salaries		30,745	11,280	
1978-1979 TOTAL		$175,000	$68,480	$70,000

2nd year - 1979-80 - Same as 1978-79 plus inflationary factor
3rd year - 1980-81 - " " " " " "
4th year - 1981-82 - " " " " " "
5th year - 1982-83 - " " " " " "

Implementation Plan:

1. Time track.

   a. General:

      (1) Establish at each LDC location working relations with the personnel.

      (2) Become familiar with local forage and animal production systems and genetic types of animals available.

      (3) Locate laboratory and field facilities.

      (4) Obtain personnel for project.

   b. Objective 1 (forage agronomic evaluation):

      (1) Year 1

         (a) review literature on humid tropic forages.

         (b) collect forage samples on-site periodically through the year for laboratory analysis on-site and at OARDC for determining mineral and nutrient composition.

         (c) evaluate forages in terms of yield, utilization, and storability.

      (2) Year 2

         (a) continue forage agronomic evaluation as in year 1, adding effect of seasons, evaluation of persistence and including additional forages. A wide range of forages are available and the amount of material evaluated each year must be geared to laboratory facilities, time and budget of the investigators. Emphasis in first years must be given to forages with most promise.

      (3) Year 3

         (a) continuation of forage agronomic evaluation, again adding new material of interest, as well as evaluating seasonal effects and persistence of major species.

      (4) Year 4

         (a) continuation of forage agronomic evaluation.

      (5) Year 5

         (a) continuation of forage agronomic evaluation. Evaluation will be necessarily a long-term effort because of the

large number of species and cultivars available, seasonal effects, and number of analysis to be made on each sample.

c. Objective 2 (forage/animal production systems, all on-site):

(1) Year 1

(a) evaluate forages and animals at each location in terms of availability, adaptation, and animal nutritional needs as currently known.

(b) plan production systems.

(c) establish pastures and/or other forages for use in production systems.

(2) Year 2

(a) conduct grazing and/or feeding studies to evaluate system in terms of plant and animal response.

(b) evaluate results.

(3) Year 3

(a) continuation of year 2 and evaluate in terms of redesigning and improving production systems.

(b) establish new forage programs and/or production systems.

(4) Year 4

(a) continue grazing and/or feeding studies.

(b) continue evaluation and implement any needed change.

(5) Year 5

(a) continue grazing and/or feeding studies and evaluate as previously.

d. Objective 3 (nutritional and microbiological factors):

(1) Year 1

(a) LDC:

1. Run intake and digestibility trials with sheep and goats on available forages. Several utilization methods will be employed.

2. Surgically prepare fistulated sheep and goats.

3. Set up *in vitro* fermentation system to estimate dry matter digestibility (DMD) of native forages.

(b) OARDC:

1. Chemical analysis of samples from LDC digestibility trials.

2. Begin studies on association between gastrointestinal parasitism and nutrient availability.

3. Using the same forages, compare *in vitro* (DMD) obtained with rumen contents from OARDC and LDC.

(2) Year 2

(a) LDC:

1. Continue with studies under 1 and 3 (year 1).

2. Evaluate DMD prediction equations generated from previous years data.

3. Begin to set up laboratory facilities and procedures for measuring rumen volume, fluid turnover and bacterial numbers.

(b) OARDC:

1. Continue with studies under 1 and 2 (year 1).

(3) Year 3

(a) LDC:

1. Using data from years 1 and 2, evaluate a fairly large number of available forages.

2. Estimate rumen volume, fluid turnover rate and total bacterial and protozoa numbers on several different forages and systems, using both sheep and goats.

(b) OARDC:

1. Counting of protozoa samples from LDC.

2. Continue studies under 1 and 2 (year 1).

(4) Year 4

(a) LDC:

1. Continue with studies from year 3, increasing the number of forages and feeding systems examined under 2.

2. Possibly begin on-site studies of association between nutrient availability and parasitism.

(b) OARDC:

1. Continue as in year 3.

(5) Year 5

(a) LDC:

1. Continue with studies under 2 (year 3), with emphasis on possible within species differences.

(b) OARDC

1. Continue as in year 3.

e. Objective 4 (Utilizing genetic variation for resistance to haemonchosis)

(1) Year 1

(a) LDC:

1. Establish a cooperative plan with other PIs and on site personnel for determining the degree of gastro-intestinal parasitism among genetic types across season and type of husbandry.

(b) OARDC:

1. Complete an in depth literature review on the genetic resistance to internal parasites.

2. Consult with knowledgeable persons in the areas of physiological and immunological components of parasite resistance.

3. Initiate experimental methods and strategy for collecting parameter measurements.

4. Introduce two populations of sheep with inherent ability to resist gastrointestinal parasitism.

5. Continue matings for the expansion of existing hair sheep populations and their crosses with indigenous groups.

(2) Year 2

(a) LDC:

1. Intensify efforts to monitor the degree of haemonchosis among and within genetic types across seasons and types of husbandry.

(b) OARDC:

1. Conduct laboratory studies across genetic types to identify primary resistance components against gastrointestinal parasites.

2. Initiate planned matings for introducing genetic resistant material into two indigenous populations.

3. Continue expansion of experimental flocks.

(3) Year 3

(a) LDC:

1. Begin sampling of genetic types to determine the amount of existing variation for the physiological and immunological parameters related to genetic resistance components.

(b) OARDC:

1. Continue to elucidate the primary components of genetic resistance and study their relative importance and interrelationships.

2. Initiate matings among groups with identified primary components for resistance to determine the type of genetic action for parasite resistance.

(4) Year 4

(a) LDC:

1. Establish genetic resistant groups of indigenous sheep by employing the established selection criteria for the resistant characteristics. These selected animals will be used for planned matings with unselected groups.

(b) OARDC:

1. Continue studies for establishing practical selection criteria for the net genetic effect of gastrointestinal parasite resistance.

2. Initiate studies for determining the importance of parasite resistant types on the nutrient value of the diet.

3. Begin within group selection for net genetic resistance to haemochosis.

(5) Year 5

(a) LDC:

1. Collect hematological and body weight data on offspring from the test matings to determine the amount of selection response against parasitism.

2. Study the genetic type - flock management interrelationship for further management system improvement.

(b) OARDC:

1. Evaluate selection response and continue within group selection to intensify the degree of genetic resistance.

2. Continue studies for determining the effect of genetic resistant types on diet nutrient availability.

2. Project monitoring.

It is assumed that the on-site program will be constantly monitored by the LDC staff cooperators, by the location project leader, and by annual visitations by one or more of the principal investigators. In addition, the project has an on-site technician at each LDC location under direct supervision of and responsible to the principal investigators.

Project monitoring will be done by the principal investigators and by the OSU and OARDC administration.

It is assumed that major responsibility for contracting arrangements with the LDC's will be made by the project manager hired by the total program.

PRINCIPLE INVESTIGATOR

THE OHIO STATE UNIVERSITY

BIOGRAPHICAL DATA SHEET

Name Robert W. VanKeuren 2. Address 209 Williams Hall

Birth Date January 2, 1922 OARDC, Wooster, Ohio 44691

Present Position Professor, Agronomy, OARDC & The Ohio State University

Education (highest degree) Ph.D.

Institution Univ. of Wisconsin Major Agronomy-Botany Date 1954

Experience Relevant to Proposed Assignment (Domestic and International)

Research for Graduate Education in Forage Production Consultant, Sao Paulo, Brazil, February/April, 1978.

Paper presented, International Grassland Congresses at Moscow, June 1974: Queensland, Australia, April, 1970; and Sao Paulo, Brazil, January 1965.

Scientist Exchange, US/USSR, Soviet Agricultural Research Centers, USSR, June/July, 1974

Research Related to Proposed Assignment (list most recent first)

Forage Research, OARDC and OSU, 1962-present

Forage Research, 1954-1962, Washington State University

Refereed Publications Related to Proposed Assignment (list the most recent first)

Van Keuren, R. W., and C. F. Parker. 1975. Controlling forage quality for optimum production. Proc. Sheep Industry Development Program Symposium: 54-58. Sioux Falls, S. Dakota. July 31-Aug. 2, 1975.

Van Keuren, R. W. 1974. Systems analysis in forage crop production and utilization. Editor, CSSA Special Publication.

Van Keuren, R. W., and C. E. Parker. 1971. Forage systems for sheep. Ohio Agr. Res. and Dev. Center Res. Summary 53:8-15.

Van Keuren, R. W. 1970. Grasses and legumes for sheep production. Ohio Agr. Res. and Dev. Center. Res. Summary 42:4-9.

Van Keuren, R. W. 1958. Lambs gain 900 pounds per acre on irrigated pastures in Washington. Crops and Soils.

Over 200 papers, bulletins and other publications.

Chapters in two books on Forage Production and Utilization.

Language Proficiency

Language	Speaking			Reading			Writing			Understanding		
	Poor	Good	Excl.	Poor	Good	Excl.	Poor	Good	Excl.	Poor	Good	Excl.

SMALL RUMINANTS COLLABORATIVE RESEARCH SUPPORT PROGRAM

AGENCY FOR INTERNATIONAL DEVELOPMENT - TITLE XII

Project Title Byproduct and Crop Residue Utilization in Intensive Sheep and Goat Production Systems for Limited-Resource Farmers

Grantee North Carolina State University
Agricultural Research Service
P. O. Box 5847, Raleigh, N. C. 27650
Through: Management Entity, Small Ruminants CRSP

Personnel William L. Johnson, Principle Investigator
Lemuel Goode, Co-Leader
Warren J. Croom, Co-Leader
Latin American Site Leader (to be named)
Asian Site Leader (to be named)

Duration 5 years (with intention to revise and/or renew)

Project Status New **Prior Funding** None

AID Project Manager (to be named)

Total Estimated Costs (shown in constant 1979 dollars)

		Source		
Fiscal Year	Total	AID	NCSU	Overseas Institutions (Estimated)
1979	139,922	96,858	38,384	4,680 (½ year)
1980	168,029	100,000	39,475	28,554
1981	167,581	10[illegible],000	38,027	28,554
1982	180,118	113,537	38,027	28,554
1983	161,036	88,605	38,027	34,404
Total	816,686	500,000	191,940	124,746
Avg. per year	163,337	100,000[a]	38,388[b]	24,949

Cost-sharing: b/(a + b) = 27.74%

For North Carolina State University

Charles A. Lassiter
Head, Department of Animal Science

J. Lawrence Apple
Associate Director,
Agricultural Research Service
Title XII Officer

Earl G. Droessler
Vice Provost and Dean for Research

BYPRODUCT AND CROP RESIDUE UTILIZATION IN INTENSIVE SHEEP AND GOAT PRODUCTION SYSTEMS FOR LIMITED-RESOURCE FARMERS

Principle Investigator: Dr. William L. Johnson, North Carolina State University

Objectives

1. To characterize the nutritional value of byproduct and crop residue feedstuffs that are available for small ruminants in the target countries, and to determine the relative importance of factors which contribute to variability in nutritive value of such materials.

2. To develop guidelines for the formulation of balanced, maximum-profit rations for various types and classes of sheep and goats, utilizing byproduct materials to the maximum degree possible, and to determine the expected productivity of animals that would consume these rations.

3. To study methods of storage which will maintain the nutritional value of residue and byproduct feedstuffs, and methods of treatment which may enhance their intake and digestibility.

4. To test the reliability of simple feedstuff evaluation parameters for prediction of animal performance.

5. Insofar as permitted by the studies implied above, to generate information on the nutritional requirements and comparative efficiencies of sheep and goats of various types, breeds, and productive life stages.

General Approach

The materials to be studied most intensively will be those that have major potential in the target regions. Byproducts and field residues from maize, rice, wheat, edible legumes, yams, sweet potatoes, and sugarcane are among the feedstuffs to be considered. The nutrient composition (protein, minerals, carotene, fiber and other carbohydrates) of these and other materials will be determined by standard chemical procedures.

Animal evaluation will be carried out at two levels: intensive, relatively short-term experiments in metabolism stalls where feces and urine can be collected for digestibility and nitrogen balance estimates; and longer-term trials in which appropriate productivity parameters such as growth rate, lactation yield, and reproductive performance can be determined. For both levels of evaluation, the emphasis will be on complete rations which are nutritionally balanced for a particular production class (breeding or lactating animals, growing kids or lambs, finishing intact males or castrates).

Recognizing the synergistic advantages of combining research with graduate training, the participation of post-graduate degree candidates from the target countries as well as the U. S. will be encouraged to the maximum possible. When appropriate, thesis research will be conducted at overseas cooperating sites.

Necessary laboratory and animal research facilities will be developed at the overseas cooperating sites, and research personnel will be trained so that studies of this kind can continue beyond the expected project lifetime.

Description of the Project

The Problem

Without adequate nutrition, animals cannot grow, produce or reproduce efficiently. Yet, recent reports on goat and sheep production in developing countries have repeatedly emphasized that inadequate nutrition is one of the major constraints for increased productivity (e.g., Winrock, 1977). For sheep, energy intake is cited as the most usual limiting factor (Louca, 1976). Nutrient requirements for goats are not well known but there is a consensus that dietary protein, as well as energy levels, may often be limiting for both meat and milk production (McDowell and Bove, 1977; Sands and McDowell, 1978). Clearly, close attention to these and other nutritional problems is necessary.

Crop residues and byproducts such as legume vines, waste bananas, stovers, straws, husks and hulls are available in large quantities in developing countries. Some of these byproducts already have a recognized place in ruminant rations--for example, dairy farmers in the Coastal region of Peru utilize sweet potato vines as a stimulant to milk yields during harvest season. Other byproducts are presently used by large or small ruminants in an almost subsistence dietary regime, often in a scavanger-type system. Still others are used for mulch, fuel, or building materials. Some are burned in the field or otherwise wasted. More efficient utilization of crop residues and byproducts as part of balanced, complete diets for small ruminants is a recognized desirable goal (Winrock, 1977).

The feeding value of crop byproducts varies widely. Straws from edible beans (Phaseolus spp.), for example, are relatively high in crude protein value and dry matter digestibility, as are sweet potato leaves and vines. Maize cobs and cottonseed hulls, on the other hand, appear to have very low nutritional value. Maize stover and cereal straws were intermediate to the above items in

one study (Johnson and Pezo, 1975).

The efficiency of byproduct utilization may vary among sheep, goats, and cattle (Sands and McDowell, 1978) or among breeds within species as evidenced by recent data comparing the Barbados Blackbelly to sheep of English origin (Brasfield and Goode, North Carolina State University, unpublished data). Therefore, it not always possible to transfer nutritional information obtained with one species (e.g., cattle) to another (e.g., goats).

The problem of byproduct utilization can be summarized by mentioning three closely interrelated aspects: (1) characterizing the nutritional value of specific byproducts; (2) defining the nutritional requirements of sheep and goats (of specific types) for specific productive functions and productivity levels; and (3) developing guidelines for formulation of balanced, maximum-profit rations, with inclusion of inexpensive and readily available byproducts and crop residues to the maximum degree. The project described below is designed to obtain better information about each of the major problem areas.

Benefits from Collaborative Research

It is planned that research under this project will be conducted at three major sites--the North Carolina State University campus at Raleigh and the two overseas sites for the Intensive Production Systems components of the Small Ruminants Collaborative Research Support Program. At Raleigh, an active program already exists for research on problems related to residue and byproduct utilization by cattle. This effort will continue, and, with support through Title XII, will be expanded to include work directed toward sheep and goat production in Asia and Latin America. The expanded effort will result in a more rapid rate of output of information applicable to United States conditions. The strong on-campus program will also benefit the overseas research efforts, directly through transfer of information, technical backstopping, and access to sophisticated

equipment and procedures, and indirectly through an improved capacity to provide relevant training for students from the overseas collaborating sites.

Research to be Conducted at North Carolina State University

The research program at Raleigh will center on intensive intake and digestibility trials with sheep and goats. Experimental rations will be formulated with cereal straws, maize residues, soybean and peanut straws and hulls, and other medium to high fiber byproducts common to the Southeastern United States. Warm season grass species and conventional forages such as corn silage or alfalfa hay will be included for comparative purposes.

Secondary emphasis at Raleigh will be given to productivity trials, wherein growth and reproduction are observed as criteria for evaluating nutritive efficacy. Lactation trials, although not ruled out, are expected to have a minor emphasis. Intake and rates of gain on given rations will be measured in both summer and winter in an attempt to evaluate the influence of climate on animal response, thus improving the transferability of results to tropical areas.

Laboratory analyses will include protein, minerals, caloric density, cellulose, hemicellulose, and lignin. *In vitro* digestibility of dry matter and the total cell-wall fraction (ligno-cellulose plus hemicellulose) will be measured. It is desired, if possible, to detect relationships which may exist between animal performance and the concentration of specific chemical fractions (e.g., holocellulose, or indigestible neutral-detergent fiber). Scanning electron microscopy may be used to help identify qualitative factors at the plant tissue level. It is hoped that high correlations between some aspect of animal productivity and some easily analyzable chemical component

may be detected, with the result that performance levels will be more readily predicted from laboratory analysis of specific feedstuffs.

The research described above will complement on-going projects with sheep and cattle, in which byproduct materials are being used to enhance the economic return above feed cost for ruminant animals in various stages of the lifetime reproduction cycle.

Research to be Conducted Overseas

Experiments contemplated to be conducted at overseas collaborating institution sites will parallel the work in Raleigh, in terms of methodology. However, emphasis will be on the residues and byproducts that are important for the target region. Intake, digestibility, and performance trials will be conducted. The performance criteria will be those that are important to local limited-resource goat or sheep raisers and may include milk yield and quality, growth rate, reproductive performance and wool or hair yields.

Experimental facilities (including laboratories) will be developed as needed at each overseas site. Close coordination with the Forage project (Ohio State) and the Goat Management project (Tuskegee and Winrock) will be expected as this phase of the program is implemented. Some interchange of samples for certain specialized analyses is expected, resulting in greater information with obvious economics.

By the third year of the project lifetime it is hoped to place graduate students at one or both overseas sites, where they will conduct research for their thesis. The use of graduate students in this manner has had demonstrated success in similar programs in the past, both in terms of information generated and the transmission of research skills to overseas cooperating personnel.

General Considerations

Throughout the project, close attention will be given to the evaluation of complete, balanced rations. Many residues and byproducts require supplementation with minerals, protein or NPN, and a more concentrated energy source. Economically viable approaches to satisfying total nutrient requirements for a given production situation will be studied.

Attention will also be given to factors which may negatively influence the utilization of byproducts as feedstuffs. Presence of aflatoxins is a case in point. Herbicide and pesticide residues could also limit the usefulness of a potential feedstuff, if there is possibility of their buildup in milk or muscle tissue. The anticipated resources of the current project will not permit in-depth coverage of toxic residue issues. However, the research teams will stay alert to potential toxicity and tissue buildup problems, especially when byproduct feedstuffs are obtained from fields in which toxic chemicals have been applied.

Coordination with the herd health, breeding, socio-economic and systems modeling phases of the program will be necessary in order to correctly evaluate the importance of nutrition-related concerns and to precisely orient the research toward viable solutions to production problems in the target areas.

Project Outputs and End-of-Project Status

If project objectives are achieved as stated, significant new knowledge will be generated about the feeding value of specific crop residues; ways by which the feeding value can (or cannot) be improved; the specific chemical fractions associated with poor or high feeding value in residues and byproducts; and the expected productivity of sheep and goats (specific production classes) when fed rations of given feedstuffs or chemical composition. These advances

in knowledge will be documented in scientific articles, bulletins, and popular publications as appropriate for communication with the scientific and production communities.

If the language of the target area(s) is other than English, suitable publications in the native language will be produced.

Much of the information to be generated will be equally applicable to large ruminants (cattle, water buffaloes) as to small ruminants. Within North Carolina and the United States, utilization of byproducts for beef and dairy cattle is of considerable interest. This aspect will be specifically dealt with in parallel studies, financed directly by the North Carolina State University Agricultural Research Service and other supporting entities. At overseas sites, it is anticipated that interest will exist for applications to cattle feeding (Asia and Latin America) and possibly for alpacas (Andean region) and water buffaloes (Asia).

The project includes a minimal provision for graduate level traineeships. Within five years approximately 2-4 Ph.D. students may be trained, with partial or complete support through this project (including NCSU or overseas government matching funds). Approximately 6-8 M.S. students may likewise be trained. Graduate students may be citizens of the United States, the collaborating countries, or in some instances other foreign countries. Some of them will have the opportunity to conduct a portion of their thesis research at an overseas collaborating institution, a dimension of training which will be of great value for the student who will return to his home country after completing his degree, as well as help train a cadre of American students with first-hand knowledge of conditions in developing agricultural economies.

It is hoped that the graduate training program can be expanded with additional support, over and above that anticipated under the present project budget.

One of the most important end-of-project conditions will be an enhanced capability for nutrition and applied feeding research at the overseas collaborating institutions. Animal facilities, a metabolism unit, a laboratory for routine feed evaluation, and technicians who are familiar with the day-to-day details of experimental work, will be part of the minimal capacity that will be strived for. Also, research leaders will have gained experience in research planning, design, implementation and interpretation.

Assumptions About External Conditions

In order for the project to achieve its goals, it is assumed (1) that sufficient funding will be available for the lifetime of the project; (2) that adequate overseas collaborators can be located; (3) that local support will be forthcoming for the overseas collaborating institutions; and (4) that political events or natural disasters will not interfere.

Certain additional factors will influence whether or not significant progress in sheep or goat productivity can occur from improved byproduct utilization, even of all project objectives are achieved. For example, it is assumed that (1) the byproducts studied will be of sufficient nutritive value and cost to enter least-cost rations; (2) a total "package of practices" can be developed which will deal with non-nutritional production constraints such as health, reproduction, and genetic merit; (3) a "technology delivery system" can be developed which will ensure that the small farmer is informed and instructed about the changed technology options available to him; and (4) there is sufficient economic incentive for the limited-resource farmer to risk investment in new technology, including expanded market opportunities and stability of product prices.

Technical Feasibility

The scientific literature on residue and byproduct utilization by ruminants is vast. The prospect of using the ruminant as a converter of highly cellulosic

materials to meat and milk for humans is highly appealing, since there is no other so direct a method available for incorporating these materials into food production systems for humans. For United States conditions, the relative economics of using feeds of high versus medium or low nutritional value has usually favored high energy-value forages and concentrates. In developing countries, however, the economicsof feedstuff acquisition are quite different. Limited supplies of cereal grains and other high-energy concentrates are required first for humans and secondarily for poultry and swine, with ruminant livestock not often a competitive bidder. Furthermore, land that is suitable for high quality, cultivated forages (grasses or legumes) often has a higher priority use for crops which will be consumed directly by man. Under such circumstances the use of residues and byproducts is an economically attractive alternative for ruminant livestock producers.

From various literature reports it can be deduced that the lowest value byproducts can be included in ruminant rations at levels up to 10-25% of total dry matter (for example, see reports by Fonseca, 1976; Johnson et al., 1975; and the University of Florida, 1974). This level is feasible even when moderate yields of milk are expected from dairy cattle, or feedlot gains of 1.0 kg per day or higher are expected from steers. For a breeding herd, or growing replacement animals, even higher levels can be used.

It is equally apparent, however, that a very wide degree of variation exists in the nutrient composition and digestibility of these kinds of feeds. If simple methods can be developed to reliably predict the energy value and even to improve it, the levels at which fibrous byproducts can be economically used will likely go much higher. Mertens and Van Soest (1973) and Johnson and Rodriguez (1977) have indicated that simplified laboratory techniques may be available for predicting voluntary intake and digestibility of high fiber

materials. As yet, these new methods have not been tested with tropical materials, nor have they been tested with goats.

Another possible means of improving utilization of high fiber materials is to increase their rate of passage through the rumen. The main benefit would be an increased intake capacity, in view of the suggestions by Conrad et al. (1961) and Rodriguez and Johnson (1976) that the indigestible fiber fraction occupies rumen space and thus imposes a ceiling on intake. It has been suggested that increasing the fluid dilution rate with special feed additives might have a beneficial effect on intake capacity (Owens and Isaacson, 1977).

It is also well known that the digestibility of high-fiber residues can be improved by treatment with alkalis such as sodium hydroxide. This and other promising treatment procedures will be evaluated under present project conditions

In dry climates, the storage of plant materials presents little problem as they can be sun-dried and stored with minimal protection from weathering influences. In humid climates, however, the problem is more complicated. A possible solution is ensiling. However, many residue materials are too low in soluble carbohydrates to support a rapid lactate-producing anaerobic fermentation. Proper and judicious use of additives such as molasses may be necessary in some cases. Water may have to be added for proper compaction. At the same time, addition of nitrogen supplements such as urea or poultry litter, or even a possible recycling of sheep or goat manure, could be considered. Adding a protein or concentrated energy source at time of ensiling may enable the producer to avail himself of a complete, nutritionally balanced ensiled ration.

For sheep or goats, particularly in small numbers, some type of microsilo may be desirable. Two of the investigators of this project (Goode and Johnson) have repeatedly used 55-gallon drums as microsilos, with total success.

Implementation Plan

Project Personnel

Biographical resumes of the Principal Investigator, Dr. W. L. Johnson, and Project Co-Leaders, Drs. W. J. Croom and Lemuel Goode, are annexed to this document (Appendix II). The combined experience of these persons brings to the project the necessary combination of applied and basic expertise in ruminant nutrition, experience with tropical feedstuffs including crop residues, practical knowledge of small ruminant production systems, firsthand experience with small-holder, limited-resource livestock production units in Latin America and Asia, experience in administration of agricultural research programs in developing countries, and experience in planning graduate training programs for students from developing country research institutions.

A project leader will be identified at each overseas site. These individuals should ideally be experienced research leaders with the equivalent of a Master of Science degree (or better) in ruminant nutrition. The planning of research at overseas sites will be conducted jointly by the Principal Investigator and the Leader for that site. Day-to-day supervision will be the responsibility of the Site Leader with consultation as necessary with the Principal Investigator. At least two visits per year by the Principal Investigator to each collaborating site are foreseen during the early years of the project. International travel by other project personnel, including the Site Leaders, is also provided for.

Overseas project leaders and other major contributors will receive equal recognition for results achieved, in project reports and scientific publications.

At North Carolina State University, several faculty members will be available to the project as consultants, advisors, thesis supervisors, or active research participants as needed and appropriate. Some of these persons

and their specialty areas are listed below.

Animal Science Department

Dr. R. G. Crickenberger, Ruminant Nutrition, Byproduct Utilization

Dr. R. W. Harvey, Ruminant Nutrition, Protein Utilization

Dr. J. M. Leatherwood, Ruminant Nutrition, Cellulose Utilization

Dr. J. J. McNeill, Rumen Microbiology

Dr. H. A. Ramsey, Nutrition of the Young Ruminant

Crop Science Department

Dr. J. C. Burns (USDA), Forage Utilization

Economics and Business Department

Dr. R. K. Perrin, Production Economics

Statistics Department

Dr. A. C. Linnerud, Statistics and Design of Animal Experiments

Calendar of Work

Assuming a project initiation date of October 1, 1978, it is anticipated that the period of October-December 1978 will be occupied with procurement and minor remodeling activities, and that animal experiments at Raleigh will be underway by January 1979. Feedstuffs for first-year trials will be procured and stored during the 1978 growing season.

Simultaneously it is expected that overseas collaborators will be identified and that sufficient planning can be completed so that animal experiments will begin at one of these sites by April 1979 and at the second site soon thereafter.

Animal experiments at all sites during the first year will probably be limited to digestibility and intake trials, with productivity trials getting underway by Fall 1979. Gearing up of overseas laboratories should be accomplished during the first year, to the point of full operation by October 1979.

Students recruited during the first year will be ready for thesis projects by early 1980, at which time the research program will be fully underway at

all sites. It is expected that several Ph.D. thesis projects for North Carolina State University degrees will be conducted in part at overseas collaborating sites.

Preliminary publications will be forthcoming by the end of the second year. By that time some definitive ration-formulating recommendations should be possible. It is hoped that the overseas cooperators can arrange for on-farm demonstration tests of economically promising diet formulations by the third year of the project.

An objective for the third year would be the publication of nutrient composition tables for most of the byproducts likely to be used in the target countries.

During the first two to three years the emphasis will be on survey of local problems, the cataloguing and characterization of byproduct and residue feedstuffs, and how to use them in balanced rations. Storage procedures will also be given early consideration. By years four and five it is expected that more emphasis will be placed on methods for improving nutritive value. Some input toward defining animal nutrient requirements may also be possible by that time, as well as some insights toward the prediction of animal performance from laboratory data.

The chronology of work by project objective (see page 1) is summarized below:

	Year				
Objective	1	2	3	4	5
1. Characterize nutritional value	X	X	X	X	X
2. Ration guidelines and animal productivity		X	X	X	X
3. Storage and treatment methods		X	X	X	X
4. Prediction methodology			X	X	X
5. Nutrient requirements and comparative efficiencies			X	X	X

Experimental Procedures

The experimental procedures to be used in animal trials and laboratory analyses are for the most part widely known and appropriate for application in the context of research institutions of developing countries. Many of the procedures are summarized in the publications of Bateman (1970), Goering and Van Soest (1970), and Schneider and Flatt (1975).

Productivity trials will be designed in a manner that will allow detection of non-linear responses and definition of economically optimum input-output ratios.

Data observations will include animal age and productive state, health information, animal weight and condition, feed intake, product yield and quality, input costs, and any other items that can reasonably be obtained and which are needed for nutritional, economic, and production systems analysis. A standardized record-keeping system that lends itself to computerized data storage and retrieval will be utilized.

Maintenance level rations will be avoided in intake and digestibility trials except as reference points by which to estimate animal nutrient requirements. Major emphasis will be on ration formulations and intake levels which are realistic from the standpoint of meeting full productivity requirements.

Coordination with Other Projects of the Small Ruminants Program

At all stages during the execution of this project, close communications will be maintained with other projects of the Small Ruminants Collaborative Research Support Program. Three levels of coordination are seen as necessary: (1) at the total program level; (2) with other project components for the intensive production systems; and (3) with nutrition-related components of both intensive and extensive production systems. By means of these coordinated

efforts, the applicability of project results within the total systems framework will be assured. Also, total information will be maximized by pooling data from several projects: for example, across-project estimates of animal nutrient requirements should add to the precision of such estimates. Finally, any unnecessary duplication of effort will be avoided, and wherever profitable to do so, standardization of procedures will be accomplished.

Extension of Research to Additional Overseas Sites

Recognizing the general interest and applicability of the expected results of this project, opportunities will be exploited, if they arise, to extend its scope to additional overseas sites. This may be accomplished within the framework of the present and future Title XII programs if appropriate, or otherwise with supplementary sources of funding. The objective of such endeavors will be to expand the applicability and impact of results achieved, while being careful not to dilute the principal efforts which will be concentrated at the two initial collaborating sites.

Project Budget

The projected five-year budget is summarized on the face sheet of this document, and detailed in five tables of Appendix I. Budget contributions are shown from three sources: AID/Title XII, North Carolina State University matching contribution, and estimated matching contributions from overseas collaborating institutions. The latter figures are quite hypothetical at this point and are to be taken as examples only.

Twenty-five percent of the Principal Investigator's salary is charged to the AID/Title XII contribution; the released State funds are shown to reenter the project as a half-time assistantship for a M.S. candidate; however, if an appropriate Ph.D. candidate is available the stipend will be increased accordingly.

Two new technician positions will be created on the Raleigh campus in support of this project, one for overseeing animal experiments and one for laboratory work. Other existing technician positions will be supporting the project, although they are not listed. The possible necessity of new technician-level support for work to be conducted overseas is foreseen and budgeted for.

Other budget items include graduate student assistantships, travel funds for scientists and students, and funds for part-time labor, supplies, reagents, animals, and publications.

It should be emphasized that the budget inputs listed in the table as matching contributions from North Carolina State University represent only a portion of the total matching contribution. The collaborative projects which will be strengthened and which will assume an international dimension and a small ruminant orientation with the help of AID/Title XII funding, are already being supported through Agricultural Research Service budgets. Laboratory equipment and supplies, animals, animal housing facilities, feed production and handling capability, computing facilities, graduate assistantships, and other project support items, if enumerated with dollar values, could easily bring the matching component to a one-to-one basis. The items that are shown total to about 28% of the total U.S. portion of the budget (AID plus NCSU) and thus exceed the guideline of 75% AID funds, 25% grantee matching funds.

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Appendix I. Detailed Budgets

A. PROPOSED BUDGET - FISCAL YEAR 1979

Item	Total	Source: AID	Source: NCSU	Source: Overseas Institutions* (estimated)
				*½ year
Personnel				
1. U.S.				
Scientists - Johnson 50%	11,608	5,804	5,804	
Goode 15%	4,716		4,716	
Croom 15%	2,942		2,942	
Technicians - Ag Res Tech I, new, 100%	11,232	11,232		
Res Tech I, new, 100%	8,662	8,662		
Assistantships - M.S. level	8,800	4,400	4,400	
Part-time Labor	8,640	8,640		
Fringe Benefits - 17%	6,657	4,369	2,288	
2. Overseas - Co-Leader 25%	2,000			2,000
Co-Leader 25%	2,000			2,000
Technician - Site 1	2,500	2,500		
Technician - Site 2	2,500	2,500		
Fringe Benefits - 17%	680			680
Facilities and Animals				
1. U.S.				
Remodel and expand sheep facility	4,000	4,000		
Purchase animals	1,500	1,500		
2. Overseas				
Purchase animals	1,000	1,000		
Travel				
1. U.S.	2,000	2,000		
2. Overseas - Site 1	2,000	2,000		
Site 2	2,000	2,000		
LDC Site Maintenance - 15%	14,531	14,531		
Other Direct Costs				
1. U.S.				
Out-of-state tuition	2,272	2,272		
Materials and supplies	6,345	6,345		
2. Overseas				
Materials and supplies	4,000	4,000		
Indirect Costs - U.S. - 48.3% (Personnel)	27,337	9,103[a]	9,607[b] 8,627	
TOTALS U.S.	106,711	68,327	38,384	
Overseas	33,211	28,531		4,680
GRAND TOTAL	139,922	96,858	38,384	4,680

[a] 23.5%, and [b] 24.8% of AID-supported personnel

B. PROPOSED BUDGET - FISCAL YEAR 1980

(Shown in Constant 1979 Dollars)

Item	Total	Source: AID	Source: NCSU	Source: Overseas Institution (estimated)
Personnel				
1. U.S.				
Scientists - Johnson 50%	11,608	5,804	5,804	
Goode 15%	4,716		4,716	
Croom 15%	2,942		2,942	
Technicians - Ag Res Tech I, new, 100%	11,232	11,232		
Res Tech I, new, 100%	8,662	8,662		
Assistantships - M.S. level	22,000	8,800	4,400	8,800
Part-time Labor	8,640	8,640		
Fringe Benefits - 17%	6,657	4,369	2,288	
2. Overseas - Co-Leader 25%	4,000			4,000
Co-Leader 25%	4,000			4,000
Technician - Site 1	5,000	2,500		2,500
Technician - Site 2	5,000	2,500		2,500
Fringe Benefits - 17%	2,210			2,210
Facilities and Animals				
U.S.				
Purchase animals	1,500	1,500		
Travel				
1. U.S.	2,000	2,000		
2. Overseas - Site 1	3,000	3,000		
Site 2	4,500	4,500		
LDC Site Maintenance - 15%	15,000	15,000		
Other Direct Costs				
1. U.S.				
Out-of-state tuition	9,088	4,544		4,544
Materials and supplies	4,012	4,012		
Publications	800	800		
2. Overseas				
Materials and supplies	2,000	2,000		
Indirect Costs - U.S. - 48.3% (Personnel)	29,462	10,137[a]	10,698[b]	
			8,627	
TOTALS U.S.	109,975	70,500	39,475	
Overseas	58,054	29,500		28,554
GRAND TOTAL	168,029	100,000	39,475	28,554

[a] 23.5%, and [b] 24.8% of AID-supported personnel cost

C. PROPOSED BUDGET - FISCAL YEAR 1981

(Shown in Constant 1979 Dollars)

Item	Total	Source: AID	Source: NCSU	Source: Overseas Institutions (estimated)
Personnel				
1. U.S.				
Scientists - Johnson 50%	11,608	5,804	5,804	
Goode 15%	4,716		4,716	
Croom 15%	2,942		2,942	
Technicians - Ag Res Tech I, new, 100%	11,232	11,232		
Res Tech I, new, 100%	8,662	8,662		
Assistantships - M.S. level	17,600	4,400	4,400	8,800
Fringe Benefits - 17%	6,657	4,369	2,288	
Parttime Labor	7,200	7,200		
2. Overseas - Co-Leader 25%	4,000			4,000
Co-Leader 25%	4,000			4,000
Technician - Site 1	5,000	2,500		2,500
Technician - Site 2	5,000	2,500		2,500
Assistantship - Ph.D. level	8,400	8,400		
Part-time labor	1,000	1,000		
Fringe Benefits - 17%	2,210			2,210
Facilities and Animals				
Travel				
1. U.S.	2,000	2,000		
2. Overseas - Site 1	4,500	4,500		
Site 2	4,500	4,500		
LDC Site Maintenance - 15%	15,150	15,150		
Other Direct Costs				
1. U.S.				
Out-of-state tuition	6,816	2,272		4,544
Materials and supplies	3,246	3,246		
Publications	1,000	1,000		
2. Overseas				
Materials and supplies	3,000	3,000		
Publications	500	500		
Indirect Costs - U.S. - 48.3% (Personnel)	26,642	8,765[a]	9,250[b]	
			8,627	
TOTALS U.S.	96,977	58,950	38,027	
Overseas	70,604	42,050		28,554
GRAND TOTAL	167,581	101,000	38,027	28,554

D. PROPOSED BUDGET - FISCAL YEAR 1982

(Shown in Constant 1979 Dollars)

Item	Total	Source: AID	Source: NCSU	Source: Overseas Institution (estimated)
Personnel				
1. U.S.				
Scientists - Johnson 50%	11,608	5,804	5,804	
Goode 15%	4,716		4,716	
Croom 15%	2,942		2,942	
Technicians - Ag Res Tech I, new, 100%	11,232	11,232		
Res Tech I, new, 100%	8,662	8,662		
Assistantships - M.S. level	17,600	4,400	4,400	8,800
Part-time Labor	7,200	7,200		
Fringe Benefits - 17%	6,657	4,369	2,288	
2. Overseas - Co-Leader 25%	4,000			4,000
Co-Leader 25%	4,000			4,000
Technician - Site 1	5,000	2,500		2,500
Site 2	5,000	2,500		2,500
Assistantship - Ph.D.	16,800	16,800		
Part-time Labor	2,000	2,000		
Fringe Benefits - 17%	2,210			2,210
Facilities and Animals				
Travel				
1. U.S.	2,000	2,000		
2. Overseas - Site 1	4,500	4,500		
Site 2	6,000	6,000		
LDC Site Maintenance - 15%	17,033	17,033		
Other Direct Costs				
1. U.S.				
Out-of-state tuition	6,816	2,272		4,544
Materials and supplies	3,000	3,000		
Publications	1,000	1,000		
2. Overseas				
Materials and supplies	3,000	3,000		
Publications	500	500		
Indirect Costs - U.S. - 23.5% (Personnel)	26,642	8,765[a]	9,250[b]	
			8,627	
TOTALS U.S.	96,731	58,704	38,027	
Overseas	83,387	54,833		28,554
GRAND TOTAL	180,118	113,537	38,027	28,554

E. PROPOSED BUDGET - FISCAL YEAR 1983

(Shown in Constant 1979 Dollars)

Item	Total	Source: AID	Source: NCSU	Source: Overseas Institutions (estimated)
Personnel				
1. U.S.				
Scientists - Johnson 50%	11,608	5,804	5,804	
Goode 15%	4,716		4,716	
Croom 15%	2,942		2,942	
Technicians - Ag Res Tech I, new, 100%	11,232	11,232		
Res Tech I, new, 100%	8,662	8,662		
Assistantships - M.S.	17,600	4,400	4,400	8,800
Part-time Labor	5,760	5,760		
Fringe Benefits - 17%	6,657	4,369	2,288	
2. Overseas - Co-Leader 25%	4,000			4,000
Co-Leader 25%	4,000			4,000
Technician - Site 1	5,000			5,000
Site 2	5,000			5,000
Assistantship - Ph.D.	8,400	8,400		
Part-time Labor	1,000	1,000		
Fringe Benefits - 17%	3,060			3,060
Facilities and Animals				
Travel				
1. U.S.	2,000	2,000		
2. Overseas - Site 1	3,000	3,000		
Site 2	6,000	6,000		
LDC Site Maintenance - 15%	13,291	13,291		
Other Direct Costs				
1. U.S.				
Out-of-state tuition	6,816	2,272		4,544
Materials and supplies	1,000	1,000		
Publications	600	600		
2. Overseas				
Materials and supplies	1,650	1,650		
Publications	400	400		
Indirect Costs - U.S. - 23.5% (Personnel)	26,642	8,765[a]	9,250[b] 8,627	
TOTALS U.S.	92,891	54,864	38,027	
Overseas		33,741		
GRAND TOTAL	161,036	88,605	38,027	34,404

RESUME OF PRINCIPAL INVESTIGATOR

William L. Johnson

Associate Professor of Animal Science, North Carolina State University

Born August 23, 1936, Keene, New Hampshire

Education: B.S. in Dairy Husbandry, University of New Hampshire, 1958
M.S. in Dairy Science and International Agric. Development, Cornell University, 1964
Ph.D. in Dairy Nutrition and International Agric. Development, Cornell University, 1966

Employment: 1958-61, International Voluntary Services, Animal Husbandry volunteer in Laos
1964-66, Graduate Assistant, University of the Philippines, Los Banos
1966-69, Dairy Production Specialist, N. C. State University AID contract in Peru
1970-72, Co-leader, Forages and Animal Nutrition Program, N. C. State University AID contract in Peru
1973-present, Department of Animal Science, Raleigh

Languages: Fluent in Spanish; working knowledge of French and Portuguese; passive knowledge of Thai and Laotian

Teaching: Graduate level course in Tropical Livestock Production
Special Topic problems in advanced ruminant nutrition
Visiting Professor, Agrarian University, La Molina, Peru, 1966-72
Visiting Lecturer, Graduate course in Ruminant Nutrition, CATIE, Turrialba, Costa Rica, 1977

Research: Tropical forage utilization by beef and dairy cattle, sheep, and water buffaloes. Management systems for dairy cattle in the tropics. Pasture grazing studies by sheep, cattle, and alpacas in the Altiplano of Peru. Refeeding value of plant fiber residue recovered from bovine feces. Factors influencing intake and digestibility of plant cell-wall components by ruminants. Administration of cooperative research projects between N. C. State University, the Peruvian Ministry of Agriculture, the Agrarian University at La Molina, and other Peruvian universities, 1966-72.

Selected Publications

Johnson, W. L., Ederlon Oliveira, A. H. Rakes, and L. E. Armentano. 1978. Recovery and re-utilization of plant fiber from bovine feces. Joint Session of ASAS, ADSA and ASA (Southern Sections), Houston.

Johnson, W. L., and Danilo Pezo. 1975. Cell-wall fractions and *in vitro* digestibility of Peruvian feedstuffs. J. Animal Science 41:185-197.

Johnson, W. L., Hector Li Pun, Javier Sifuentes and Renato Zeppilli. 1973. Fiber levels in dairy cattle rations. Memoria, Latin American Association of Animal Production (ALPA) 8:27-38.

AID 1020-28 (1-72)

PROJECT DESIG
LOGICAL FR.

Project Title & Number: Byproduct and Crop Residue Utilization in Intensive Sheep & Goat Production Systems for Limited-Resource Farmers.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:
Project Purpose. Determine feeding value of byproducts and crop residues. Determine producitvity of sheep and goats on byproduct-based rations. Study methods for improving byproduct nutritive value. Develop practical feeding systems for limited-resource production units, with definition of criteria for optimizing economic returns from byproduct feeding.	Conditions that will indicate purpose has been achieved: End of project status. Specific information on how best to utilize local byproducts and residues as feedstuffs will be available. Laboratories will be equipped and personnel trained to continue applied nutrition research at overseas collaborating institutions. Accumulated experience of grantee institution will be available for more effective attention to research and training needs in ~~developing countries.~~
Outputs: Publications in English and target country language. Recommendations for practical feeding systems. Enhanced capability for grantee institution to effectively contribute to livestock production problems in developing countries. Enhanced capability for applied livestock research at overseas collaborating institutions. Increased knowledge for application to livestock production in U.S. as well as developing countries.	Magnitude of Outputs: Specific information for production systems in one Latin American and one Asian country. Functioning small ruminant nutrition research facilities at each collaborating institution. Generally applicable information on crop residue utilization by ruminants. Trained personnel.
Inputs: AID/Title XII budget through Small Ruminants Program Management Entity. Faculty time, research facilities, student participation at grantee university. Scientist time, research facilities at overseas collaborating institution.	Implementation Target (Type and Quantity) Five-year AID budget $562,280. Matching contribution about 35% of above figure from grantee institution. Matching contributions according to means from overseas collaborators.

UMMARY
:WORK

Life of Project.
From FY 1979 to FY 1983
Total U.S. Funding $792,276
Date Prepared: May 22, 1978

MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	Assumptions for achieving goal targets:
Project reviews by Technical Board and External Review and Advisory Committee of Small Ruminants CRSP. Periodic program reports.	Assumptions for achieving purpose: Funding levels available as planned. Suitable overseas collaborators identified. Continued collaboration for project lifetime. Successful implementation of complementary projects within Intensive Systems Sub-program of Small Ruminants CRSP.
Articles and abstracts in scientific journals. Bulletins and project reports.	Assumptions for achieving outputs: Successful implementation of research plan at grantee and overseas institutions. Establishment of appropriate research facilities at each collaborating site. Identification of suitable candidates for participant training and satisfactory completion of their planned training programs.
Appropriate program documents and reports.	Assumptions for providing inputs: Project approval within Title XII CRSP. Creation of program Management Entity and implementation of its coordinating role. Continued funding levels by AID/Title XII. Approval of matching contribution levels from grantee university and overseas collaborating institutions.

Face Data Sheet - Small Ruminants Project

a. Title: Improving genetic potential of dairy goats and sheep for small holder systems

b. New

c. Grantee: Department of Animal Science, University of California, Davis, CA 95616

d. Scientific personnel: G. E. Bradford, Principal Investigator (.35); E. J. Pollak (.15); D. T. Torell (.20); J. F. Medrano (tentative), (1.00)

e. Duration: Phase I, 5 years; Phase II, 5 years.

f. Total estimated costs

	Year 1	Year 2	Years 3-4 (each)	Total
AID Direct costs	141,603	130,687	125,202	817,896
Indirect costs	28,397	34,313	39,798	182,104
LDC facility devel.	30,000	30,000	30,000	150,000
Total AID	200,000	200,000	200,000	1,000,000
Univ. of Calif.	117,396	121,228	127,325	620,599
LDC (estimated)	10,000	37,000	37,000	158,000
	327,396	358,228	364,325	1,778,599

g. Prior funding: None

Approvals:

Principal Investigator — G. E. Bradford — Date 6/7/78

Department Chairman — G. E. Bradford — Date 6/7/78

The Regents of the University of California — Fredric W. Hill, Associate Dean for Research — Date 6/7/78

Improving Genetic Potential of Dairy Goats and Sheep for Small Holder Systems (Contributing Project to Title XII Small Ruminants Collaborative Research Support Program)

G. E. Bradford, Animal Science Department, University of California, Davis

Abstract

Use of animals with improved genetic potential offers an inexpensive and often very effective means of increasing efficiency of human food production from livestock. The increases may be achieved by use of improved breeds, by crossbreeding, or by selection within existing breeds. In a situation where there has been little or no previous research, controlled experiments are necessary to determine which of these tools, or what combination of two or all three will be most effective. This situation is in effect the case for dairy goats in the U.S., and for the majority of sheep and goat populations in the tropics.

The major focus in the proposed project is on dairy goats, although the approach would apply similarly to other classes of small ruminants where there has been limited genetics research. The proposal is to conduct research, in California and in one or two developing countries where sheep and goats are important, with the following objectives:

1. Summarize published information on breed differences and genetic parameters, and analyze any suitable data which can be found to provide additional information in these areas.

2. Initiate an experimental program in both California and the LDC(s) to provide information on breed differences, and heterosis. In addition to the standard traits of milk production and composition, litter size and growth, emphasis will be placed on genetics of disease and parasite resistance (in collaboration with veterinarians in the Small Ruminants Program), and on the inheritance of length of breeding season.

3. Compare indigenous and exotic-indigenous cross genotypes under typical local feeding and management conditions and under improved conditions determined to be feasible as a result of research (nutrition, health) in this program. Comparisons within producer flocks will be conducted if possible.

4. Based on results of the above research, set up intra-population improvement programs suitable to the LDC, and collaborate with other members of the Small Ruminants Program team to develop practical methods of disseminating superior germ plasm.

The program will involve a substantial training component. Emphasis will be on training of students from the participating countries or other developing countries, but the program will also provide expanded training opportunities for U.S. students interested in small ruminant research and production in an international context.

2. Detailed description of project

a) Description of problem

Dairy goats and sheep contribute significantly to the quantity and particularly the quality of the food supply of people in the densely populated humid tropics, yet little is known about the genetic material available or about the potential for increasing genetic merit for productivity of these stocks.

Two facts suggest that use of genetic tools, along with improvements in nutrition, management and disease control, may lead to large increases in production. First, selection for performance in stocks not previously subjected to systematic selection is usually highly effective in the early generations. Secondly, the disease and parasite resistance and other components of adaptability of indigenous stocks subjected to many generations of natural selection, combined in the proper proportion with the productive potential of stocks selected for high performance from other areas, often results in a very large one-step increase in productivity. The lack of livestock performance recording and information exchange generally true of the humid tropics may also mean that genetic variation among indigenous stocks is not being utilized; identification and distribution of more productive local breeds or types may lead to marked improvements in production, even without initiation of a selection program or crossing with improved breeds from temperate areas.

A particular problem exists with regard to dairy goats, in that information on breed differences or on genetic parameters within breeds is very limited, even in advanced agricultural countries, compared to that available on sheep, swine or cattle.

In sheep, one important performance characteristic on which genetic information is relatively limited is seasonality of breeding; seasonality is also a major problem in goats, at least in temperate climate breeds and possibly in

breeds in the tropics as well, although effects of nutrition need to be more clearly identified.

b) Objectives

1. To summarize published information on inheritance of production traits in dairy goats.

2. To utilize existing California and U.S. dairy goat production records to help characterize U.S. breeds and to estimate potential rates of genetic improvement.

Steps 1 and 2 are to aid in designing genetic improvement programs for both the U.S. and participating LDC's and to indicate which breed(s) may be best to use in LDC crossbreeding trials.

3. To establish a dairy goat research and teaching facility at Davis, jointly with the animal health participants in the intensive systems program. This facility is to provide for research on genetic and disease problems needed in the U.S. and as back-up for research in the LDC's, and for training of both U.S. and foreign students in management and research with this species.

4. To evaluate the 2 or 3 major breed types available in the target LDC(s) with regard to production and reproduction at optimum and sub-optimum levels of nutrition and management. (To be done in collaboration with nutrition, management and animal health members of the team.)

5. To compare the best indigenous breed type(s) with the F_1 cross between that stock and the best temperate zone stock identified under objectives 1 and 2.

Data under objectives 4 and 5 are to be collected not only to meet the primary objectives, but also with a view to their use in a comprehensive systems analysis of the LDC production system.

6. To utilize the information obtained under objectives 1, 2, 4 and 5 to

initiate an intra-population selection program (Phase II), and to provide animals with superior genetic potential performance for distribution to livestock owners. Investigation of alternative methods of disseminating superior germ plasm to small holders will become a specific objective if a need for this is indicated.

7. To utilize results of the research carried out under objectives 1 to 5 above and from ongoing sheep research in the California Agricultural Experiment Stations to develop methods of reducing or eliminating seasonality of breeding in sheep and goats.

Note: The above objectives relate primarily to goats kept for milk production, the expected primary emphasis. The same objectives would apply, with only minor modifications, to hair sheep, if that is the primary target species. For wool sheep, objectives 1 to 3 could be bypassed because of work already done; nos. 4 to 7 would be the main goals.

c) Project approach

As indicated in the statement of objectives, the approach proposed is a sequential one, using:

1) published information

2) information obtained from analyses of existing production data

3) information obtained from experiments designed to fill gaps in our present knowledge base, and carried out under this project in the U.S. (general questions) and in the target LDC(s) (area specific questions).

Examples of research to be done in the U.S. would be comparison of F_1 crosses and parental breeds to determine if traits not previously studied from a genetic standpoint, e.g. date of onset and duration of estrus season, resistance to parasite infestations, are inherited additively or whether there is a useful level of heterosis. These same questions will be investigated in the LDC's to the extent feasible. In addition, LDC research will emphasize specific questions such

as: what (if any) is the optimum level of temperate zone breed inheritance in production stocks, at management levels normal for the area, and with management improvements as indicated by results of the forage, nutrition and animal health research at that location.

d) The objectives will have been achieved when scientifically based recommendations can be made on optimum small ruminant genotype(s) and genetic improvement methods for specific production objectives in the target country, when the best genotypes are being distributed and utilized generally, and an improvement program is being carried out effectively by local people (many of whom may have been trained through this project).

e) It is assumed that facilities for the experimental work described below can be developed and that these will be available for the project as described for a minimum of 5 and preferably for 10 years. It is further assumed that participating country personnel, both scientific and support, will be available at the outset, or can be trained, who are interested in and committed to the project on a continuing basis.

It is assumed that it will be possible to test other than local genotypes, i.e. that breeding animals or semen can be imported into the participating country to be included in the genetic evaluation. Any importation of semen and use of A.I. will be done in collaboration with the team members from Cal Poly Pomona.

Collaboration of several other members of the Small Ruminants Program team will be essential to full achievement of objectives.

f) Identification of genotypes superior in performance under local conditions, and the dissemination of these genotypes can increase animal production by 10 to 30% or more. Two well documented examples of this are provided by the performance of Romanov or Finnsheep crosses in temperate climates, and the performance of Zebu/European or Zebu/Criollo cattle crosses in tropical environments.

The potential for improving production of dairy goats, largely neglected by animal scientists of all disciplines to date, seems particularly high.

g) Outputs expected are indicated in (d) above.

3. Technical feasibility

If the assumptions stated under (e) above are fulfilled, with regard to availability of facilities, reliable personnel and adequate budgetary support on a continuing basis, there is a very good probability of developing recommendations which if implemented would lead to large increases in productivity (see 2, f). The more difficult step is likely to be to achieve adoption of the practices indicated, e.g. replacement of one breed by another, use of a specific cross, or use of a systematic recording and selection scheme. However, the recommendations need not be compex, and given success in understanding the social and economic environment in which the producers operate, implementation should be effected.

4. Financial plan

See Detailed Budget at end of proposal.

5. Implementation plan

Phase I, evaluation of breeds and crosses and development of an intra-population improvement plan based on the results obtained, will require all of the initial 5-year period for which this proposal is written. In fact, assessment of lifetime production of samples of the groups involved will continue through most of the second 5-year period. However, initiation of Phase II, implementation of a selection plan and plans for germ plasm distribution, can begin late during the first 5-year period or at the start of the second.

Personnel on the project will include G. E. Bradford (P.I.), E. J. Pollak, and a person to be hired, tentatively planned as J. F. Medrano, animal geneticist currently in Guatemala. Their respective contributions to various phases of the project are identified below. In addition, it is expected that several graduate

students will participate.

Objective 1, summarization of published information on inheritance of production traits in dairy goats, should be completed and readied for publication in year 1. A recent publication (Sands and McDowell, Cornell Int. Agr. Mimeo. 60, 1978) summarizes a substantial amount of information in this area and will be very useful. We plan an in-depth analysis and summary of all of the genetic parameter information which can be found. This will be done by Pollak and Medrano. They and a graduate student will also be working on objective 2, analyses of goat DHIA records. That study is estimated to require at least 2 years, and should accomplish the following:

1) identify breeds to be used in working on objective 3, and part of objective 5.

2) provide estimates of parameters needed to design an efficient selection program (Phase II).

Planning of a dairy goat research and training facility (objective 3) will be initiated in year 1, with construction (or renovation) to begin late year 1 and to be completed in year 2. This facility will be supported and used jointly by the UCD Animal Science and Veterinary Medicine Small Ruminants projects, and might also contribute to the objectives of the Utah/Cal Poly Pomona reproduction projects. The funds requested in the two Davis Title XII projects represent 55% of the total estimated cost of establishment of this facility, and will be sufficient, with existing facilities, to establish research capability with this species. Additional funds will be sought for completion of the project. The facility is envisioned as a 200-goat dairy, constructed and equipped to permit its use for both research and instruction, and to permit sale of grade A milk (to offset a portion of operating costs). Research uses planned include major emphasis on genetics, including breed and breed cross evaluation with regard to production, growth, and

susceptibility to disease and parasite problems. The facility may also be used for research in nutrition and other areas as space and support permit.

As soon as the target country(ies) and collaborating institution(s) are identified, planning will be initiated for provision of facilities there, for evaluation of local breeds and types and their crosses (objectives 4 and 5). This may require construction of facilities where none now exist, or may involve modifications and augmentation of existing facilities. Facilities should be jointly planned, developed and supported to meet the needs of other components (nutrition, health, management) of the Small Ruminants Program.

Facilities should be no more elaborate than necessary to achieve the various experimental objectives. For example, if labor is inexpensive and a sufficient number of reliable people are available, hand milking could be an acceptable alternative to machine milking. Facilities must be sufficient to permit dependable separation of breeding groups (for parentage identification) and to permit recording of performance on all animals. Development and testing of facilities for small holders will no doubt also be an emphasis of the Small Ruminants project; to some extent this will need to be done separately from the research phase, since research in genetics (and in nutrition, animal health, etc.) will require more extensive facilities than appropriate to small holders.

For the genetic evaluation component of the project, a minimum of 300 breeding does will be needed to compare 2 local breed types (A and B) pure, crossed with each other and with an imported breed (C), as follows:

Mating Plan, Years 2 and 3

	Females	
Males	A	B
A	50	50
B	50	50
C	50	50

Mating Plan, Years 4 and 5 (Young does)

	Females				
Males	A	B	AB/BA	CA	CB
A	50				25
B		50		25	
AB/BA			50		
C			50	25	25

Groups A and B might be general types with subtypes within each included in a systematic way. C would be the U.S. (or other exotic) breed which in the collective judgment of the geneticists on the Small Ruminants Program team has the highest potential for improving productivity of the local stocks. The AB/BA cross is included to provide an estimate of the importance of heterosis; it may be neither desirable nor economically feasible to introduce females of breed C. (Note: If numbers permit, it may be desirable to extend the project to include crosses with two different exotics.)

The proposal calls for assessment of these genotypes under two sets of environmental conditions. The traits of interest would be milk production; growth and mature size; age at puberty, fertility, prolificacy and livability; seasonality; and relative incidence of diseases and parasites. The precise treatments will be determined by constraints of facilities and degree of experimental control; ideally, the two conditions would be (1) optimum nutrition, management and disease control, insofar as these are known, and (2) as nearly as possible the conditions normal for the area. The possibility of carrying out this phase in producer herds will be investigated. For example, one could place 1 doe kid of each of 3 genotypes (A, B, AxB) in privately owned flocks of size 3 or more, and measure their performance there. Alternatively, in any flock of 2 or more, one could inseminate with semen from 2 or more breeds, and measure the performance of the progeny in that herd. "Yield" rates of data from such a set-up might be no more than 50%, but given enough herds, such a plan could provide results more relevant to local conditions than a single experiment station herd however large. The number of traits measured would undoubtedly be less than feasible in an experiment station flock, but if the most important ones such as conception, survival, milk production and growth could be measured, the advantage of relevance of results to local conditions would outweigh disadvantages of less information. Furthermore, such a

plan would (a) provide researchers with much more contact with producers and (b) if successful, would undoubtedly contribute to development of locally effective methods of distributing superior germ plasm.

Costs and net returns should be recorded for all genotype-management combinations.

The mating plan outlined would provide animals of two "pure" local types, their F_1 and F_2, and crosses with 0, 25, 50 and 75% inheritance from an exotic breed. This should provide an indication of the optimum proportion (possibly 0) of the exotic breed, and also a variety of choices of genetic material from which to develop a new "synthetic" if that is the indicated approach for Phase II (objective 6). Phase II experimental plan details are not developed in detail here, since they will depend on results of Phase I. The facilities and personnel required for Phase I would be equally useful in Phase II, and the suggested numbers would be minimally adequate for a selection project.

Bradford and Medrano will be the principal U.S. participants in the experimental phases described above. One or both will visit the host country and participate in the work several times annually. In addition, the participation of one or more scientists from the host country throughout the project will be invited and encouraged.

It should be noted that a project of the scope and duration of that described above, for evaluation and improvement of genotypes in the target country, should be undertaken only when adequate facilities and trained labor are clearly available for the project, and prospects are good that they will remain available for a period of several years.

Objective 7, the study of inheritance of length of breeding season in sheep and goats, will be primarily Bradford's responsibility. The sheep portion will be done at Davis (supported primarily by other than Title XII funds) and the goat

portion will be a part of the projects outlined for both Davis and the participating country. Results of this phase of the study, and those from all phases of the goat work, should be valuable in the U.S. as well as in other countries, because of the present dearth of scientific information in these areas.

Training of graduate students in research and management techniques with small ruminants is an integral part of this project. Both U.S. and foreign students will be included, with emphasis on students from the participating countries in the hope that over time these people will take progressively greater responsibility for small ruminants research and development work in their countries. Opportunities exist for training at both the M.S. and Ph.D. levels. It is anticipated that emphasis will be on M.S. level training at least for the first few years.

Budget - AID Funds

	Year 1		Year 2		Years 3-5		Total	
	US	LDC	US	LDC	US	LDC	US	LDC
Salaries & wages								
a) Academic	19,200	-	20,500		21,700			
b) Staff	24,780		26,020		31,743			
c) Trainees	6,740		6,740	8,740	6,740	17,480		
Fringe @ 23% on a, b	10,115		10,700		12,230			
	60,835		63,960	8,740	72,413	17,480	342,034	61,180
Eqip't, facil., animals								
Facil. devel.	50,000	-	20,000	5,000	-	-	70,000	5,000
Facil. support	-	-	5,000	-	5,000	5,000	20,000	15,000
Travel & per diem	3,000	15,000	2,000	15,000	2,000	13,800	11,000	71,400
Other direct costs	12,768		15,987		14,509		72,282	-
tal direct costs	141,603		130,687	5,000	125,202	5,000	647,896	20,000
tal indirect costs*	28,397		34,313		38,813	985	179,149	2,955
nds for LDC facil. velop. (15% of tal)		30,000		30,000		30,000		150,000
	155,000	45,000	141,260	58,740	132,735	67,265	694,465	305,535
tal AID funds quested	200,000		200,000		200,000		1,000,000	

1% of U. S. exp., including all trainee and travel costs; 19.7% of LDC exp.; no ndirect costs on facilities.

Explanations of budget calculations

1. All calculations based on 1978-79 dollars.
2. Estimated salaries include 23% employee benefits, except trainee stipends. Merit increases for continuing employees included.
3. A.I.D. funded salaries include:

   1 Academic FTE (Assistant Research Geneticist)

   1 SRA I (technician), years 1,2; 0.5 years 3-5

   1 Animal technician years 1,2; 2.0 years 3-5 (for UCD sheep and goat research facility operation).
4. Trainee stipends and fees based on 1 A.I.D. supported Research Assistant first year, 2 second year, and 3 per year thereafter. Non resident fees of $2000 per year included for 1 trainee, year 2 and 2 per year, years 3-5.
5. Travel in U.S. first year includes trips to collect data from commerical goat herds in California.
6. Other direct costs includes animal feed and supplies, computing and publication costs (A.I.D. portion); office support and telephone also included in U.C. portion.

Curriculum Vitae

G. Eric Bradford

Title and address: Professor of Animal Science, University of California, Davis

Birth date: [redacted]

Education: B.Sc.Agr., Macdonald College of McGill University, 1951
M.S. (1952), Ph.D. (1956), Genetics and Animal Husbandry, University of Wisconsin

Positions: Assistant Professor, Animal Husbandry and Genetics, McGill University, 1955-57
Assistant (1957-65), Associate (1965-69) and Professor (1969 -), University of California, Davis. Department Chairman, 1973-78
Associate Dean, College of Agricultural and Environmental Sciences, 1969-70

Research interests: Genetics of mammalian growth and reproduction; sheep improvement.

Foreign language: Some French

Selected publications 1972-77:

1. Bradford, G. E. 1972. Genetic control of litter size in sheep. J. Reprod. Fert. Suppl., 15:23-41.

2. Bradford, G. E. and G. M. Spurlock. 1972. Selection for meat production in sheep - Results of a progeny test. J. Anim. Sci. 34(5):737-745.

3. Bradford, G. E. 1972. The role of maternal effects in animal breeding: VII. Maternal effects in sheep. J. Anim. Sci 35(6):1324-1334.

4. Bradford, G. E. 1973. Increasing the lambing percentage. Proc., Sheep Industry Development Program Symposium, "Profitable Range Sheep Production", Denver, Colo., pp. 10-17.

5. Meyer, H. H. and G. E. Bradford. 1973. Reproduction in Targhee and Finnish Landrace X Targhee ewes. J. Anim. Sci. 36(5):847-853.

6. Bradford, G. E., St.C. S. Taylor, J. F. Quirke and R. Hart. 1974. An egg-transfer study of litter size, birth weight and lamb survival. Anim. Prod. 18:249-263.

7. Bradford, G. E. 1974. Breeding plans for the improvement of meat production and carcass merit of the meat breeds of sheep. Proc., 1st World Congress of Genetics Applied to Livestock Production, Vol. I:725-738.

8. Bradford, G. E. 1977. Replacement ewes for California sheep flocks. Calif. Livestock Symposium, Fresno, May 26, 1977, 6 pp.

9. Bradford, G. E. 1977. Combined genetic and physiological approaches to increasing efficiency of sheep production. SID Symposium on Control of Reproduction in Sheep, Madison, Wisconsin, 20 pp.

a. PROJECT TITLE

"Herd/Flock Health Program"

b. NEW OR EXTENSION

New.

c. GRANTEE

The Regents of the University of California
School of Veterinary Medicine
University of California
Davis, California 95616

d.

		% EFFORT
PRINCIPLE INVESTIGATOR:	Blaine McGowan, Jr.	40%
OTHER FACULTY:	Norman F. Baker	25%
	John S. Glenn	25%
	Robert BonDurant	25%
PRIMARY CONSULTANTS:	D. Bailey	33%
	S. Guss	33%
PROFESSIONAL TRAINEE:	N. East	100%

e. DURATION

Five years, with option for renewal.

f. TOTAL ESTIMATED COSTS BY YEARS

	1978-79	1979-80	1980-81	1981-82	1982-83	TOTALS
AID: Total Direct Cost[a]	$139,744	$136,244	$138,744	$136,244	$134,226	$ 685,242
Total Indirect Costs[b]	26,401	31,032	36,456	35,908	35,001	164,798
Funds for Facility Dev.	30,000	30,000	30,000	30,000	30,000	150,000
Total AID Funds Req.	196,145	197,276	205,200	202,152	199,227	1,000,000
UCD Contribution[c]	84,701	84,701	84,701	84,701	84,701	423,505
LDC Est. Contribution	45,000	80,000	80,000	80,000	80,000	365,000
TOTAL PROJECT	$325,846	$361,977	$369,901	$366,853	$363,928	$1,788,505

[a]See detailed AID budget.

[b]Indirect costs charged at 31% for on-campus expenditures (except renovation) and 19.5% for overseas expenditures.

[c]See attached for details.

g., h., and i. None

APPROVALS:

Blaine McGowan, Jr., Principal Investigator

B. T. Osburn, Associate Dean-Research

M. E. Fowler, Department Chairman

Frederick W. Hill, Associate Dean

SMALL RUMINANT FLOCK/HERD HEALTH PROGRAMS IN SMALL HOLDER SYSTEMS

Detailed Description of Project

Description of Problem

Sheep and goats constitute an important source of animal products for small holder consumption and use in the densly populated tropics. Presumably, these consumers would benefit from increased production of milk, meat, fiber and hides from these species. However, there is scant knowledge of why these products are not produced in greater abundance.

Fundamental to increasing production from the existing small ruminant population and to increasing the total numbers of these animals is to define limiting factors and through research devise means to overcome them. The solution will be many faceted, involving research input generated particularly by the fields of genetics, nutrition, management and animal health. These fields are so interrelated and interdependent that it is neither possible nor desirable to separate them. The herd/flock health component has two major responsibilities: 1) to define the health constraints to increased production associated with infectious and contagious agents as well as those related to nutrition, genetics and management, and 2) through research devise strategies to control or prevent these health problems that are effective, inexpensive and acceptable to the small holder. Until the target country is identified and preliminary investigations are accomplished, it is not possible to define the problem in terms of existing specific diseases. However, following these two events the animal health problems can be attacked by the development of experimental flock/herd health programs

and by generating research both in the U.S. and the L.D.C., directed at developing new control and prevention strategies for high priority health problems which are currently inadequately controlled.

Objectives

1. To increase for human use the off-take of meat, milk, fiber and hides from sheep and goats reared by small holders in humid/semi-humid regions of LDC's by:

   a. decreasing the health related loss of these products in existing animal populations through the development of flock/herd health programs, and by

   b. experimentally developing control and prevention techniques against health problems identifiable as major constraints to expanded rearing of sheep and goats in these regions.

2. To develop an US-LDC animal health research axis aimed at generating knowledge which will:

   a. augment and strengthen flock/herd health programs in both countries and

   b. result in improved techniques to control or prevent individual diseases currently unmanageable in both countries.

3. To train professionals and paraprofessionals of the target LDC in improved methods of diagnosis, control and prevention of small ruminant diseases.

4. To utilize the herd/flock health project for graduate training of US professionals.

4a) To assist the germ plasm bank researchers by examining semen samples for common contagious and/or infectious agents.

5. To adapt and integrate flock/herd health programs so that they constitute a positive supporting and additive role to the overall small ruminant CRSP (particular collaboration with the projects on nutrition, management, genetic modification and dairy goat production systems).

6. To develop simple, inexpensive, effective diagnostic techniques for animal diseases.

7. To study disease resistance related to genetics.

8. To develop "model" systems approach for assessing health problems in a flock or herd.

Project Approach

Herd health programs for beef and dairy cattle, swine and poultry are effectively and economically increasing production of food animal products in the United States and other developed countries. Similar programs for sheep and goats in these same countries are currently embryonic. However, pilot programs with sheep conducted by this institution indicate a 20-50% production increase in 2-4 years. Basically these programs constitute a continuous animal health surveillance program combined with application of the most appropriate treatmemt, control and prevention strategies.

Fundamental to the development of flock/herd health programs in the target LDC will be a definition of the health problems which most commonly and continuously limit production. Some data will be available from the target country professionals and knowledgeable small holders. However, much will need to be developed by project personnel in a "hands on" situation.

To accomplish the latter a limited number of areas (villages, barrios, etc.) which represent small holder/sheep/goat rearing most typical of the country will be selected for intensive identification and characterization of animal health problems. Within the selected areas five major approaches will be initiated to accumulate sufficient disease data to begin formulating flock/herd health programs.

1) Regularly scheduled ambulatory "mini-clinics" held in strategic locations. These will function as a means of acquainting the project personnel with the prevalent health and rearing problems and expose them to the sociological, religious and/or husbandry customs which may impact on projected flock/herd health programs. An additional function will be the development of confidence among the small holders that improved animal health is both possible and advantageous.

2) Establish (in collaboration with the projects on nutrition, management, genetics and dairy goat production) a target area headquarters facility which will supply:

a) housing for animals referred from the ambulatory "mini-clinic" and walk-in patients which require a more detailed diagnostic workup, b) more sophisticated diagnostic capacity and c) space for experimental animals.

3) Develop a communication rapport with knolwedgeable small holders to elicit from them information about small ruminant health and rearing problems in their area. This exercise will require much patience and skill but the payoff should be significant.

4) Systematic ante and post mortem examination of animals being processed in abbatoirs or whatever killing facilities exist.

5) Observation of animals at points of accumulation such as markets.

In 3-6 months after the above on site investigations begin sufficient animal health data will have been gathered to initiate rudimentary flock/herd health programs. While simplistic at first, they will become more comprehensive as additional animal health problems are identified and characterized in the target country.

Initially disease control and prevention strategies known to be successful in other parts of the world will be applied. Experimental modification and adaptation of some of these strategies will be necessary to be effective under the conditions existing in the target LDC.

During the second year and beyond, animal health problems unmanageable by known control and prevention strategies will be identifiable. As these emerge, individual disease research projects will be initiated with components in both the LDC and the U.S. The thrust of the research will be to generate knowledge which will control or prevent these unmanageable animal health problems.

As each F/HHP matures additional disease control and prevention strategies will be incorporated so that these two functions (disease control and prevention) will predominate over individual animal treatment. Husbandry, management, nutrition and genetic modification will play an increasingly important role in disease prevention as the F/HHP's develop and progress.

To most effectively implement all of the objectives of this project, it has been cooperatively worked out with the UCD Department of Animal Science to establish a dairy goat research facility. The following discussion of this facility is the same as that presented in the UCD genetics project (Bradford).

"Planning of a dairy goat research and training facility will be initiated in year 1, with construction (or renovation) to begin late year 1 and to be completed in year 2. This facility will be supported and used jointly by the UCD Animal Science and Veterinary Medicine Small Ruminants projects and may also contribute to the objectives of the Utah/Cal Poly Pomona projects (for animal health the Washington, Colorado and Tuskegee projects). It is envisioned as a 200-goat dairy, constructed and equipped to permit its use for both research and instruction, and to permit sale of grade A milk (to offset a portion of operating costs). Research uses planned include work in the areas of genetics, disease, and genetic-disease interactions. The facility may also be used for research in nutrition and other areas as space and support permit."

A major small ruminant health research responsibility for the intensive system project will be to determine what disease(s), if any, peculiar to the humid-semi-humid ecozones significantly limit the expanded rearing of sheep and goats. Specifics must wait for on site investigation, however, it is reasonable to assume external and internal parasites will be a major deterrent. Identification of parasite species, assessment of cyclic burdens, relationship to environment andimpact on production will be an initial effort. Experimental strategic treatment with the newer parasiticides will be an ongoing event and could provide information currently quite scant in the United States.

In addition to internal parasites, we may assume that other health problems will be identified. The following diseases are currently on project, in abeyance waiting funding, or there exists expertise to conduct research, given support:

Enzootic pneumonia - Dungworth, Moulton, McGowan

Chlamydial and viral infections - Brooks, McKercher, Adler, McGowan

Blue tongue - Osburn, McGowan, Ardans, Bushnell

Caseous lymphadenitis - Knight, McGowan

Ram/buck epididymitis - Biberstein, Bushnell, McGowan

Contagious ovine foot rot - McGowan

Hemoprotozoan diseases - Howarth

Mastitis - Jasper, Carroll

Animal health systems - Glenn

Diseases of the newborn - BonDurant, East, McGowan

Plant toxicities - Cordy, Fowler

The majority of the people listed above are not included in the F/HHP project personnel at this time, but at a recent meeting of the S.V.M. Livestock Disease Research Laboratory participants, they and others expressed a desire to become involved in individual disease research as the project matures and the need for that type of input develops.

Other Broad Research Considerations

1. Prior to the "hands on" stage of the project, a uniform disease recording system will be established by collaboration with the systems analysis people and the Flock/Herd Health personnel of the Extensive

project. Data to be systematized would include occurrence and incidence of diseases, morbidity and mortality, regional, seasonal and age incidence, husbandry/management/nutritional/genetic relationships and economic impact. This will allow for identification of problems and establishing priorities for research.

2. There is mutual agreement among the Flock/Herd Health Principal Investigators of both the Intensive and Extensive Systems to:

a. maintain continuous communication with each other regarding development of information and knowledge on animal health problems.

b. maintain sufficient research flexibility to be able to mount cooperative research efforts and to allow research emphasis to flow to the institutions with an ongoing project on any particular health problem.

3. Training component

It is anticipated that two categories of LDC animal health paraprofessionals would be trained and utilized extensively:

(1) Animal health technicians with modest on site training by project personnel and functioning at village, county or area levels could be very effective in handling the more common disease problems. They could also function as a disease reporting network.

(2) Laboratory diagnostic technicians.

A cadre of skilled diagnostic technicians is critical to the longterm success of a nation-wide Flock/Herd Health Program. Much of their training could be accomplished on site by U.S. instructors, however, there

should be opportunity through this project to bring selected individuals to the U.S. for advanced training. Both of the above paraprofessionals would be supervised by LDC professionals.

In addition to the animal health and diagnostic technicians selected, LCD and U.S. professionals would receive advanced or graduate training through this project. The two traditional degrees, M.S. and Ph.D. could be available as well as the M.P.V.M. (Masters in Preventive Veterinary Medicine).

The Objectives Will Have Been Acheived When:

1) Scientifically sound, clinically feasible and societally acceptable Flock/Herd Health Programs have been developed;

2) These programs are being effectively applied by local professionals and paraprofessionals (many trained through this project), and when

3) improved animal health results in an economically acceptable increase in human-useable animal products from small ruminants.

Assumptions on Achievement of Objectives

The cooperating LDC should:

a) be strongly motivated to work towards the project objectives

b) provide all sheep and goat disease data available

c) make available diagnostic and research facilities, services and personnel

d) provide interpreters if needed

e) provide professional, technical and nontechnical personnel

f) assist in disseminating experimentally developed useful disease control and prevention strategies to the small holders.

Assumptions That Achieving Objectives Will Solve Problems

Curtailing and preventing animal diseases will result in an increased production offtake for human use from the existing small ruminant populations and assist in the expansion of small ruminant rearing by small holders in the target LDC.

Outputs of Project

1. Increased production of human-useable animal products from small ruminants in the target LDC.

2. Generation of new knowledge on ways of devising and implementing Flock/Herd Health programs both in the US and the target LDC.

3. Generation of new technology to curtail or prevent sheep and goat diseases currently unmanageable in both the US and the target LDC.

4. Advanced training for professionals and paraprofessionals of the LDC and professionals of the US.

5. Disease information generated in the target LDC will be useful in other LDC's of similar ecozones.

Technical Feasibility

Disease-induced production losses in sheep and goats stem from (1) sporadic sweeps of epizootics, and (2) continuous attrition by diseases common to sheep and goats worldwide. Data from pilot trials in the US clearly incriminate the latter as the major cause of loss on a longterm basis. Pilot Flock/Herd Health programs on selected sheep and goat operations in the US have increased offtake of human-useable animal products

by 20 to 50% in 2 to 4 years. These disease control and prevention programs are developed by modifying, adapting and utilizing known basic technical information on all disease causing factors, including pathogenic agents, nutrition, husbandry, management and genetics. When all these are correlated and brought into focus, the end result is a marked production increase. Similar programs with sheep and goats in LDC's could result in a quick and significant increase in human-useable animal products and would provide invaluable information for the sheep and goat industries in the US. The key personnel selected for this project are all involved in initiating and developing Flock/Herd Health programs with sheep and goats in the US and are highly qualified in this field. The expertise level would allow early application of disease control and prevention strategies against the more manageable diseases and the ability to develop experimental strategies against the less manageable diseases.

AID DETAILED BUDGET

	YEAR I		YEAR II		YEARS III-V	
LARIES	U.S.	LDC	U.S.	LDC	U.S.	LDC
ofessional and araprof. trainees	$ 15,000	$	$15,000	$ 5,000	$ 90,000	$ 42,000
0 Animal tech.	12,000		12,000		36,000	
Fringe @ 23%	2,760		2,760		8,280	
5 Animal caretaker	4,458		4,458		13,374	
Fringe @ 23%	1,026		1,026		3,078	
A						
at dairy renovation[1]	35,000		15,000			
eep/goat barn renov.	5,000					
imal care	5,000	5,000	5,000	5,000	22,500	15,482
AVEL	3,000	15,000	3,000	15,000	8,500	39,000
NSULTANTS				18,000		36,000
HER						
Systems Model	6,000	10,000	5,000	5,000	55,000	40,000
Research Support	10,500	10,000	15,000	10,000		
TAL DIRECT COSTS	99,744	40,000	78,244	58,000	236,732	172,482
TAL INDIRECT COSTS	18,521	7,880	19,606	11,426	73,386	33,979
Subtotal	118,265	47,880	97,850	69,426	310,118	206,461
NDS FOR FACIL. DEV.		30,000		30,000		90,000
Subtotal		77,880		99,426		296,461
TAL AID FUNDS REQ.	$196,145		$197,276		$606,579	

hese funds requested in the two U.C. Davis Title XII projects represent 55% of the total stimated cost of establishment of this facility and will be sufficient with existing acilities to establish research capability with these species. Additional funds will e sought for completion of the project.

c) UCD Contribution to Title XII Small Ruminants CRSP

Faculty Salaries	% Salaries	Salary
Blaine McGowan, Jr., Principal Investigator	50%	$20,633
Robert BonDurant	15%	3,638
John Glenn	10%	2,688
Bennie Osburn	22%	8,455
Fringe Benefits		8,145
Total Faculty Salaries		$43,559

Research Support - AES Component (Livestock Diseases Research Laboratory)	
Alex Ardans	$ 3,382
John Glenn	596
Blaine McGowan, Jr.	9,956
Bennie Osburn	13,221
Robert BonDurant	1,787
California Department of Food and Agriculture	12,200
Total Research Support	$41,142

Total UCD Yearly Contribution: $ 84,701

Total UCD Five-Year Contribution: $423,505

AID 1020-25 (1-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1978 to FY 1982
Total U.S. Funding $1,382,780
Date Prepared: 5/19/78

Project Title & Number: Small Ruminant Flock/Herd Health Programs in Small Holder Systems

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: To identify, characterize, & systematize animal health constraints in target LDC's; experimentally modify & adapt known disease control & prevention strategies; develop new strategies where needed; establish research to advance knowledge of prevention of diseases unmanageable in LDC's & U.S.: integrate animal health with other disciplines; train LCD paraprofessionals & professionsls; train U.S. professionals.	Conditions that will indicate purpose has been achieved: End of project status. Viable & functioning flock/herd health programs which can control/prevent animal products loss from disease; cadre of LDC professionals & paraprofessionals capable of sustaining & augmenting F/HHP's; acceptance & utilization by small holders of animal health strategies. Published information; knowledge developed transportable to other LDC's.	Flock/herd health programs functioning in LDC with primary responsibility under LDC professional guidance; acceptance by LDC small holders of health improvement strategies; increased off-takes for human consumption of small ruminant animal products; increased capability by LDC & U.S. professionals to implement F/HHP's.	Assumptions for achieving purpose: AID & LDC professionals recognize need to increase production of small ruminant animal products for LDC small holder consumption. U.S. & LDC professionals, combining improved animal health, nutrition, genetics & management, will be able to devise workable & acceptable strategies to raise S/R production levels.
Outputs: Profile of animal health problems in target LDC's. Development of scientifically sound, clinically applicable & societally acceptable disease control & prevention strategies; research generated new knowledge of animal disease mechanisms; economic impact of animal diseases; increase in number & quality of trained personnel; published knowledge useable in other LDC's.	Magnitude of Outputs: Published data on: 1) ways of devising & implementing flock/herd health programs useful to both the U.S. & LDC's; 2) research generated new knowledge re: mechanisms of control & prevention of diseases unmanageable in U.S. & LDC. Preparation of guidelines on subject matter for LDC professionals. In LDC a disease surveillance, reporting & control network.	Same as indicated in magnitude of outputs.	Assumptions for achieving outputs: Target LDC's will collaborate in supplying facilities, personnel, equipment & animals. UCD can successfully link clinical & basic research into the development of F/HHP's which will be useable in both the LDC & U.S. Professional & support staff are identified by UCD capable of achieving stated outputs.
Inputs: AID contract with University of California, Davis; LDC personnel, facilities, equipment & experimental animals; experience, expertise & project supervision by UCD-SVM professionals & U.S. consultants; world-wide data on project objectives.	Implementation Target (Type and Quantity) Implementation of UCD & AID contract October 1, 1978. AID - $1,000,000 over 5 years UCD - $382,780 (38%) over 5 years LDC - $284,000 (est.) personnel, facilities, animals, supplies.	Regular AID reporting requirements.	Assumptions for providing inputs: Project is approved. Cooperative agreement between AID & UCD is reached. Target LDC government, AID professionals & UCD project personnel agree on cooperative nature & support of project.

Extensive Systems

PROJECT INFORMATION AND PLAN

1. Face Sheet Data

A. Project Title: IMPROVING SMALL RUMINANT NUTRITION, MANAGEMENT PRODUCTION.

B. New or extension: NEW

C. Grantee: U.S. AID

D. Principal Investigator

Donald F. Burzlaff (25%)

Co-Investigators

Robert Albin (25%)

Fred C. Bryant (25%)

Frank Hudson (25%)

E. Duration: FIVE YEAR MINIMUM WITH PLANNED EXTENSION OF 3 YEARS.

F. Budget Estimate (Tentative)

	U.S. AID*	Texas Tech	LDC institution
FY 1979	$200,000.00	$80,463.00	$58,000.00
FY 1980	$200,000.00	$89,180.00	$78,000.00
FY 1981	$200,000.00	$98,800.00	$78,000.00
FY 1982	$200,000.00	$90,000.00	$80,000.00
FY 1983	$200,000.00	$90,000.00	$80,000.00
TOTAL	$1,000,000.00	$448,443.00	$344,000.00

Total Project Cost: $1,448,443.00

% Cost Sharing by Texas Tech: 30.96%

* Includes indirect cost

G. Prior Funding: None

H. AID Project Manager: _____

Abstract of Project Proposal

Title: Improving Small Ruminant Nutrition, Management and Production

Rapidly growing populations have resulted in increased dependence of many African people on the small ruminant as a source of food and fiber. The result has been widespread deterioration of vegetation resources and declining productivity from the small ruminants.

This proposal is developed to research alternatives in management of both grazing lands and grazing animals to an end of optimizing resource use and improve the living conditions for a major segment of the developing world. The proposed research calls for an inventory of rangeland and small ruminant resources in the target areas. Grazing lands are to be classified according to soils, climate, topographic features and their capability to produce forage. Grazing systems with stocking rate based on productive potential will allow improvement in range resources.

The nutritive value of individual plant species and the contribution of each species to the diet of small ruminants will be studied. Methods of supplementing diets when feed or nutrients are deficient will be developed. Consideration will be given to reseeding rangelands and production of fodder crops.

Management of grazing animals will be considered in cooperation with segments of the program dealing with animal health and genetic improvement.

Graduate training opportunities will be developed for limited numbers of qualified African students in disciplines of Animal Science and Range Management. Graduate students and research personnel will provide faculty for short courses and workshops for existing agency personnel in the host country.

D. F. Burzlaff

Texas Tech University

2. Detailed Description of Project

A. Description of problem

Rapidly increasing populations have resulted in increased dependence of many people of Africa on the small ruminant as a source of food and fiber. Well over 50% of the caloric intake of the people in arid lands may come from meat, milk and other by-products of sheep and goats. This increased dependence has resulted in build up of their numbers. The ultimate result has been wide-spread deterioration of vegetation resources and a reduced productivity from a major source of subsistence, the small ruminant.

Management alternatives exist which, when developed through research, will permit the rangelands to become more productive and the vast sheep and goat herds to attain a higher level of output as they graze an improved resource. Constraints posed by social, economic and political custom will have to be adjusted to correct the present resource management problem. Tenure systems which allow individual or tribal use of specific lands for grazing under specified rates of stocking must be developed. This will allow a system of delineating property boundaries and encourage users to improve their range resource without concern for trespass from livestock not within their jurisdiction. It will permit incorporation of research results dealing with grazing management, animal nutrition and management, superior germ plasm, flock health, and product marketing.

Any improvement to be expected in production from small ruminants will be accomplished only through improved range management and a simultaneous improvement in animal nutrition and management. Grazing systems and intensities based on the potential of a site to produce forage, together with systems of stockpiling or otherwise developing feed

reserves for the dry season will result in improvement of resources. Castration and early marketing of males, controlled reproduction, and synchronized production of young in sheep and goat herds will be a major factor in improving production and marketing efficiency. The result would be improved food production from a lesser number of more productive animals. More importantly, the rangeland resource will increase in productivity in spite of recurrent drouth which intensifies the effects of improper grazing. Achievement of these goals will translate directly into improving the welfare of those whose survival depends on small ruminant production.

Acceptance of these practices requires development of host-country personnel with the philosophy and capability to initiate effective research and extension programs in target areas.

B. Objectives of project

The goal of this research activity would be to improve production of small ruminant animals in the host country. This will be accomplished by meeting the following objectives:

1. To inventory the natural resources applicable to small ruminant production.
2. To determine appropriate length of grazing and intervals of rest that result in the most rapid improvement of the native vegetation and sustain this improvement over an indefinite time.
3. To determine the nutritive value of forages grazed throughout the year and the contribution of specific plants to seasonal diets of sheep and goats.

4. To investigate the use of ungrazed and/or harvested forage and other feeds as a supplement to the diet of sheep and goats in critical periods and to investigate range reseeding potential of deteriorated grazing lands.
5. To improve animal performance through proper management of small ruminants concurrently with improvements in grazing management and alternatives developed from cooperating projects relative to herd health and improved breeding.
6. To provide long-term graduate training in Range Management and/or Animal Science with an emphasis on small ruminant husbandry for limited numbers of personnel from arid/semi-arid countries in Africa.
7. To provide "in-service" short courses and workshops in the host country for existing agency personnel.

C. Project approach

Abjective 1:

a. Soil - a complete edaphic inventory and classification is necessary and appropriate for delineating range sites on target areas. All existing information relative to soil and vegetation will be used to compliment data collection.
b. Vegetation - range sites will be identified for and stratified by existing rainfall-area patterns. These then may be projected to the entire area applicable to small ruminant production through the use of remote sensing procedures. These range sites will be evaluated in terms of frequency and composition of existing vegetation. Condition classes will be assigned to a range site as to how it deviates from the potential, using relic areas and grazing exclosures as

a guide to assess this potential. An estimate of standing crop biomass will be made for range sites once each during the wet and dry seasons. These will function to provide an estimate of carrying capacity.

c. Water - former hydrologic surveys will be reviewed to determine the extent of water distribution and relate these to use patterns by nomadic graziers. Future water developments at strategic locations may temporarily relieve grazing pressure until stocking rates and management regimes can be controlled.

d. Animal - an inventory of the existing grazing pressure by small ruminants (i.e. animal numbers) is imperative to define potential disaster areas based on how much forage is actually needed to sustain grazing at the present rate. Grazing paterns of nomadic, transhumant, and sedentary graziers must be documented for future planning of land tenure and management systems.

e. Potential feed reserves - an inventory of potential supplemental feedstuffs and feed reserves (i.e. crop residues, hay aftermath, ungrazed forage) must be developed to assess their contribution as supplemental feed to increase and/or evaluate the potential carrying capacity for small ruminants.

The general approach for objectives 2-5 will be to establish at least two experimental research centers (ERC) to conduct research on grazing-animal management. Each ERC should be at least 500 ha in size and adequately supplied with necessary facilities (e.g. fencing materials, handling pens and chutes, electricity, water, sheds, feed storage dwellings, metabolism stalls, experimental animals, and living quarters for graduate assistants, laborers, and on-site personnel, etc.).

For nomadic and transhumant graziers, an ERC will be strategically located to offer the widest possible applicability to territories used by these producers. Ultimately, a planned system of nomadism and grazing rotation will be developed through research that will embrace principles of range management and reclaim denuded grazing lands.

The other ERC will be located near a suitable population center where sedentary grazing commonly is practiced. The size and facilities of the ERC should be similar to that under nomadic grazing. Planned systems developed for these areas through research must be strictly controlled.

Objective 2:

Paddocks will be established to apply replicates of the greatest number of grazing treatments with varied stocking rates that may be of potential benefit to these producers. As most livestock are under one-herd ownerwhip, several one-herd, many-pasture systems will be evaluated. These include any of the short duration, rotational grazing systems. Research will focus on the length of grazing and interval of rest that promotes greatest yield and improvement in the native vegetation. Thus, these treatments will be evaluated in terms of the vegetation produced as contrasted with the control, or, the use normally applied by nomadic graziers. After 5 years of research, specific systems should clearly be designated that will improve the rangeland and sustain maximum productivity.

Objective 3:

In addition to evaluating the vegetational response of the grazing treatments (as outlined in Objective 2), nutritional quality and forage composition of diets will be determined for each grazing

system and the 'control'. Sheep and goats fitted with esophageal cannulae will be used to collect representative diets as influenced by the grazing treatments. Nutritionally, these diets will be evaluated in terms of in vitro digestible organic matter, crude protein, and selected minerals and vitamins. The contribution of plant species, their plant parts and major forage classes also will be determined for diets sampled. In this way, seasonal nutrient deficiencies and important plants may be assessed under a variety of grazing conditions. Prior to termination of the project, seasonal intake will be estimated using inert markers to monitor fecal output and In Vitro analysis to predict digestibility. The quantity of forage consumed will provide a more realistic determination of carrying capacity. The optimum mix of sheep and goats also will be evaluated based on forage availability and forage preferences.

Objective 4:

Research dealing with ungrazed and/or harvested forage and other feeds as a dietary supplement will depend upon the reliability of existing nutritional composition data. During the first year, all available information on nutrient content of the feedstuffs will be compiled. During succeeding years of the project, research will be conducted to determine missing values and to quantify the unknown nutritional value of alternative forages, feedstuffs, and by-products. Initial studies will include various chemical analyses such as proximate analysis, acid detergent fiber, calcium, phosphorous, sodium, chlorine, and carotene. In Vitro digestibility determinations will be made on forages, feedstuffs and by-products found in greatest quantity. The above information

will provide a basis for determining the nutritional status of sheep and goats if potential feed reserves were used as supplements. Subsequent research will include animal feeding studies to determine digestibility and utilization of nutrients from the most promising forages, feedstuffs and by-products. In addition, digestion-balance, metabolism trials, and growth and lactation feeding experiments will be conducted to develop new information and to refine estimates for estimated nutritional values.

It is anticipated that after the first two years, additional research will likely be needed to elucidate causes of and possible solutions for other nutritional deficiencies. Primary concerns at this time are ability to use nonprotein-nitrogen supplements, salt intake and utilization, water balance, and specific mineral and vitamin deficiencies. Rangeland reseeding will be considered as a source of improved forage.

During the third and fourth years of the project, adaptation of more advanced technology will be explored for improving by-products in the host country. Initially, physical and chemical treatments of crop residues and by-products will be investigated. Economic and technical deficiencies in the target area will be primary limiting factors for this phase of the project.

Objective 5:

An inventory of herd composition by age and sex classification and variances that prevail between nomadic, transhumant, and sedentary graziers must be documented prior to development of proper herd management practices within the limits available. In preparation of managerial practices, increased production with

possibly fewer animals will incorporate recommendations that include controlled breeding season and duration coinciding with periods of high nutrient quality of forages; assurance of high lamb or kid survivability; castration and early market development of surplus males; optimum initial breeding age of ewes and does to maximize longevity of reproduction and total lamb/kid production; identification and removal of poor-producing females and superannuated males; accessory management feasibility of practicing strategic supplemental feeding, drenching and improved herding practices, use of improved genetic stock, and reduction of stress associated with excessive travel and infrequent watering. By incorporating alternatives developed from the other research teams, programs will be developed to disseminate (1) management recommendations by a qualified extension program, (2) flock health and veterinary supplies, (3) improved genetic stock, (4) and a supplemental feeds stockpiling and supply system. If vegetative resources indicate a potential, it may be valid to propose specialized programs such as a stocker project in which castrates could be developed for slaughter thereby relieving the grazier of otherwise unproductive animals. Pooling of animals in similar physiological or productive stages by many graziers may also eliminate complications developed from maintaining small, private herds containing diverse sex and age composition.

Objective 6:

Graduate training directed at 4 distinct phases will include 6 U.S. and 6 LDC personnel. Coursework and planning for the thesis problem of M.S. degree candidates will be conducted at Texas Tech University. International students will spend 2-3 years at Texas Tech University depending upon previous academic experience. In

the second phase, all participating students will be involved in techniques that are used in grazing management, fistulation, and nutritional and botanical laboratories. This phase will be accomplished at facilities developed near campus. Thus we will insure their exposure to data collection and analysis before they arrive in the host country to begin phase 3, their thesis research. The fourth phase corresponds to their return to Texas Tech for degree completion.

Objective 7:

Texas Tech University staff or other qualified personnel will be engaged to conduct short courses and workshops for high-level employees of the ministries entrusted with management of land for small ruminant activities. These 3- to 6-week courses will provide arid/semi-arid countries with qualified persons to train their respective employees and will provide a broadening experience for Texas Tech faculty.

D. Conditions that will indicate objectives have been achieved.

Data generated from the natural resource inventory will provide baseline information for future management.

Appropriate statistical tests will be used to determine if vegetation, animal diet, and animal production data (kg meat and milk/ha) from the ERC's are indeed an improvement over the 'control' grazing treatments. In addition, tests among different short duration grazing treatments will indicate the most suitable treatment for implementation in the host country.

Production levels that included various animal husbandry practices will be compared with those levels achieved under the 'control' production scheme to indicate if efficiency has been improved.

Research projects by graduate assistants will be completed and M.S. degrees in Range Management and/or Animal Science awarded.

Agency personnel are trained through short courses and workshops.

E. Assumptions on achievement of objectives (externalities outside direct control of PI)

1. This research project can affiliate with a host country and a collaborative institution is identified and totally cooperative.
2. Qualified students are available for selection to graduate programs.
3. The host country will provide land, housing, facilities, transportation and a counterpart project leader to work closely with the on-site project leader from America.
4. The research timetable will allow fulfillment of certain objectives related to significant vegetation changes. Arid ecosystems are delicately balanced and plant succession is extremely slow. Once an ecosystem has been disturbed it may not heal itself within one man's lifetime. However, trends should be evident to properly evaluate grazing management objectives.
5. The host country must be in full support of the project or implementation of the results will be futile. Development of range improvements or supplement feed without grazing control is a short-sighted exercise. Since political power is concentrated in the cities where there is little concern or priority for improvement of arid grazing lands, public attitudes will play an important role in final implementation of results.
6. Inequitable government policies are discouraged. These policies include crop price supports with livestock prices controlled, export markets developed only for cattle, lack of credit and delivery

systems for nomadic producers, and inadequate marketing and land tenure systems.

F. Assumptions that achieving objectives will solve the problem

1. The host government will exercise control of or implement grazing management for nomadic, transhumant, or sedentary producers.
2. The government will provide credit and market incentives, avenues for external marketing of products, delivery systems for supplemental feed and veterinary supplies, and far-reaching extension and education programs. The government must develop strategic depots for transportation and marketable products within easy access to all producers.
3. The host government will accept the overall plan of self improvement and will initiate programs to insure its survival for future generations.
4. Socio-economic problems are reduced so that nomadic and sedentary graziers accept management alternatives.

G. Outputs of project

1. Delineation of range sites and their productive potential plus a data bank of soil, water, animal, and feed resources.
2. An effective system of managing small ruminants which will result in sustained range improvement and will incorporate results developed from those working in the areas of breeding, flock health, socio-economics, and marketing.
3. Seasonal nutrient deficiencies along with solutions and the contribution of palatable plants to the diets of sheep and goats.

4. A husbandry plan of optimizing sheep and goat production per unit area of the land base in terms of both meat and milk.
5. A workable system of providing supplemental feed for sheep and goats during critical periods of the year.
6. At least 12 M.S. graduates (6 LDC and 6 American) trained in Range Management and/or Animal Science, emphasing small ruminant husbandry.
7. Annual workshops, short courses, and demonstrations.
8. Publications on the many facets of research generated through the overall program.
9. Data output for incorporation into systems analysis programs.

3. Technical Feasibility

A. Technical capabilities of range management and animal husbandry will not be a limiting factor in the program. Adequate long-term financing and logistical support from U.S. AID and the host country will be the most critical factors. The goals cannot be met in less than 5 years. Extension from requested funding of 5-years to an 8-year program is fully anticipated by the Principal Investigator.

B. Implementation of activities and achievement of goals of the proposed project will be dependent upon identifying and entering into contract with a suitable host country. It is recommended that this be an English speaking African nation. The language constraint imposed by working in a French-speaking nation would cause delays, inefficiencies, and technical difficulties. Generally, technical expertise in the management of natural grazing lands is not as common in Francophone Africa. There are more U.S. trained personnel that possess range and small ruminant expertise in such nations as Sudan.

C. Implementation will be dependent upon identification of a collaborative institution or agency within the host country. Willingness of the institution to assume a collaborative role and provision of laboratory space facilities and faculty time will be important.

D. Availability of qualified host country personnel will be of significant importance. Prior training in range management would be advantegeous.

E. The host country will have administrative capabilities to synthesize, implement, and maintain the data banks and technology developed by the research effort. The information compiled should be applicable to most arid and semi-arid countries where small ruminants are a necessary entity of day-to-day living.

5. Implementation Plan

Fiscal Year	Objective	Responsibility
1979	Collaboration with extensive team for South America	Texas Tech Research Team (TTRT)
	Host country selection	AID and TTRT
	Retain on-site project leader (OPL)	Extensive team for Africa
	Collaboration with and travel to host country	TTRT
	Begin natural resource inventory	TTRT
	Employ personnel	TTRT and Host Country (HC)
	Interview and select first group of graduate students	TTRT, HC
1980	Establish experimental research centers	HC
	Begin long-term research objectives (1st group of graduate students arrive in host country)	TTRT, HC
	Complete natural resource inventory	TTRT, HC
	Short course for agency personnel	TTRT, OPL, HC
	Annual report from on-site project leader	OPL, TTRT, HC
1981	Report natural resource inventory	TTRT, HC
	Continue long-term research objectives	TTRT, HC
	Interview and select 2nd group of graduate students	TTRT, HC
	Short course for agency personnel	TTRT, OPL, HC
	Mid-project report published	TTRT, OPL, HC
1982	2nd group of graduate students arrive in HC; continue long-term objectives	TTRT, HC
	Complete theses from 1st group of graduate students	TTRT

Fiscal Year	Objective	Responsibility
1982	3rd group of graduate students interviewed and selected	TTRT, HC
	Short course for agency personnel	TTRT, OPL, HC
	Annual report from on-site project leader	TTRT, OPL, HC
1983	3rd group of graduate students arrive in HC to complete long-term research objectives	TTRT, HC
	Complete theses of 2nd group of graduate students	TTRT
	Short course and workshop for agency personnel	TTRT, OPL, HC
	Annual report from OPL	TTRT, OPL, HC
	Publish results from theses of 1st group of graduate students	TTRT, HC
	Project termination in HC	TTRT, HC, AID
1984	Complete theses from 3rd group of graduate students	TTRT
	Final report of project	TTRT, OPL, HC
	Publish results from 2nd group of graduate students	TTRT, HC
1985	Publish results from 3rd group of graduate students	TTRT, HC

6. Annual review and planning processes

The ultimate success or failure of the project will be determined by the adequacy of planning during the first year. Initially, the extensive range management team for Africa will meet with the counterpart extensive team for South America. This conference is designed to standardize procedures and parallel research efforts so that objectives, techniques and results will be comparable. This unification approach will insure the funding agency of having a consolidated program with wide ranging applicability at termination of the projects. Secondly, the extensive range management team for Africa will meet with its collaborative extensive project leaders to determine facilities, equipment, labor, and space they will require in the host country to fulfill all research objectives. The extensive range management team along with the OPL will then visit the host country to discuss overall project goals, technical requirements, and availability of facilities. Economic constraints will pose as the major limiting factor to successful operations. Upon returning from the host country, a conference will be held among the extensive team for Africa to report project feasibility based on resources available and to adjust the research goals and objectives accordingly.

In succeeding years, annual reviews of the project should include avenues for maximum flexibility and coordination. Incorporated in these reviews will be an on-sight, host country evaluation involving at least two members of the research team. Review processes will be hierarchial beginning with evaluation of reports from the OPL and his host country counterpart. These reports should be directed (1) to each principal investigator operating in the host country who will review accomplishments of individual projects goals and (2) to an external review committee. This will allow evaluation of technical and economic feasibility with the possible

alterations in project design. Progress and changes resulting from these individual reviews should be channeled back to the extensive project leader and the external review committee for overall assessment and future planning. The mid-project report (see Implementation Plan) should include an overall review of the present status of the project and possible changes requiring implementation for future years.

A.I.D. 1020-24 (10-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1979 to FY 1983
Total U.S. Funding $1,453,250.00
Date Prepared: 5-17-78

Project Title & Number: Improving Small Ruminant Nutrition, Management and Production

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: To help arid and semi-arid Africa improve the welfare of those dependent upon small ruminants and decrease the burden of their day to day living through proper management of native vegetation and small ruminants.	Measures of Goal Achievement: 1. Increased herbage yield and advancement in plant succession on native rangeland. Improvement in overall vegetative response and capability to sustain the improvement. 2. Improved nutrition of small ruminants. 3. Increased number of animals as marketable products. 4. Increased quality of animals reaching markets. 5. Increased meat and milk production per unit area.		Assumptions for achieving goal targets: 1. Cooperation of government in host country. 2. Collaborative institution in host country. 3. Avenues for effective extension programs will be made available to local and remote graziers.
Project Purpose: To inventory all natural resources applicable to small ruminant production. 2. To provide an understanding of proper management both of rangeland vegetation for sustained yield and of the vast sheep and goat herds for increased production. 3. To provide workshops to train individuals in range management and small ruminant husbandry so they can effectively utilize the technology made available. 4. To educate individuals from the arid countries at the graduate level.	Conditions that will indicate purpose has been achieved: End of project status. 1. Natural resources are identified and quantified. 2. Documented evidence that vegetation improvements are feasible. 3. Small ruminant husbandry practices can be enhanced. 4. Host country will have quantitative information to establish future tenure and management policies with regard to small ruminant production, grazing management, and supplemental feed programs. 4. Trained personnel in arid, semi-arid countries.		Assumptions for achieving purpose: 1. Vegetation in arid and semi-arid lands will respond to grazing treatments. 2. Water developments are feasible. 3. Potential feed reserves are available to be included in the overall scheme. 4. Host government will develop legislation for implementation of the overall management plan. 5. Local graziers will accept government intervention and recommendations.
Outputs: 1. Data bank of soil, water, vegetation, animal, and feed resources available to the host country. 2. Publications on proper grazing management for improving and maintaining native vegetation, nutritive deficiencies and probable solutions, effective solutions to herd management problems, quantity and value of potential feed supplements. 3. Workshops to train arid country personnel. 4. M.S. graduates trained in Range Management and Small Ruminant Husbandry.	Magnitude of Outputs: 1. Records of existing and potential carrying capacity of small ruminants based on soil, water, vegetation, animal, and feed resources. 2. Major publication bulletin at mid-term and termination of project ("Small Ruminants and Management in Arid and Semi-Arid Africa"). 3. Annual seminars and workshops. 4. At least 6, arid country M.S. graduates. 5. At least 12 M.S. thesis and 20 corresponding publications.		Assumptions for achieving outputs: 1. Host country has the organizational structure and leadership to insure outputs are realized. 2. Texas Tech will collaborate and support the project in total.
Inputs: 1. Host country; analytical laboratories, field stations and personnel from collaborative institutions. 2. Texas Tech; laboratories, expertise, guidance, and administration. 3. AID contract with Texas Tech University.	Implementation Target (Type and Quantity) 1. Host and/or arid country: analytical laboratory; Co-project leader; develop research center (i.e. labor, land, facilities); qualified B.S. candidates seeking M.S. degree. 2. Texas Tech University: Analytical laboratory, field laboratory, project personnel, on-sight project leader (collaborative dollars from other American institutions available). 3. AID: Budget - at least $200,000/year; selection of host country.		Assumptions for providing inputs: 1. Host country will agree to inputs as designated. 2. Texas Tech University will retain qualified staff and facilities. 3. AID will approve project and provide funding.

FY - 1979

SOURCE OF FUNDS	US AID		Texas Tech University	LDC
Funds Expended in	US	LDC	US	LDC
Budget Category				
I. Personnel				
P.I. Salary (Burzlaff 25%)	9,000			
Co-Investigators Salary				
Albin 25%	8,250			
Hudson 25%	6,500			
Bryant 25%	5,250			
African counterpart (on site leader)				8,000
Clerical and Technical	2,000		12,700	15,000
Labor		7,230		3,000
Contributed Faculty Time			22,244	
Fringe Benefits (12% of 31,000)	3,720	-		
Total for Category	34,720	7,230	34,944	28,000
II. Major Equipment-Facilities-Etc.				
Site development	5,000	45,000		
Equipment		18,000		
Animals			15,600	10,000
Total for Category	5,000	63,000	15,600	30,000
III. Travel				
Professional Staff		25,000	2,000	
Total for Category		25,000	2,000	
IV. Site Coordination and Support		30,000		
V. Other Direct Costs				
Laboratory Supplies		10,000	8,700	
Fuel, Oil, Utilities		8,000		
Total for Category		18,000	8,700	
VI. Indirect Costs (55% of 31,000)	17,050		19,219 (55% of 34,944)	
Total Fiscal Year 1979	56,770	143,230	80,463	58,000
Total	200,000		83,463	
% Texas Tech Cost Sharing			42.5%	

FY - 1980

SOURCE OF FUNDS	US AID		Texas Tech University	LDC
Funds Expended in	US	LDC	US	LDC
Budget Category				
I. Personnel				
P.I. Salary (Burzlaff 25%)	9,000			
Co-Investigators Salary				
Albin 25%	8,500			
Hudson 25%	6,750			
Bryant 25%	5,750			
African Counter-part (on-site leader)				8,000
Clerical and Technical	2,000	5,000	12,700	15,000
Labor		6,560		5,000
Countributed Faculty Time			22,900	
Fringe Benefits (12% of 32,000)	3,840			
Total for Category	35,840	11,560	35,600	28,000
II. Major Equipment, Facilities, Etc.				
Site Development	2,000	38,000		25,000
Equipment		10,000	2,000	
Animals			15,000	15,000
Total for Category	2,000	48,000	17,000	35,000
III. Travel				
Professional Staff		20,600	2,000	
Students		9,400		
Total for Category		30,000	2,000	
IV. Site Coordination and Support		30,000		
V. Other Direct Costs				
Laboratory Costs		9,000		10,000
Educational Support	3,000	5,000	15,000	5,000
Fuel, Oil, Utilities		8,000		
Total for Category	3,000	22,000	15,000	15,000
VI. Indirect Costs (55% of 32,000)	17,600		19,580 (55% of 35,600)	
Total Fiscal Year 1980	58,440	141,560	89,180	78,000
Total	200,000		89,180	
% Texas Tech Cost Sharing			44.5%	

FY - 1981

SOURCE OF FUNDS	US AID		Texas Tech University	LDC
Funds Expended in	US	LDC		LDC
Budget Category				
I. Personnel				
P.I. Salary (Burzlaff 25%)	9,500			
Co-Investigators Salary				
Albin 25%	9,000			
Hudson 25%	7,000			
Bryant 25%	6,000			
African Counterpart (on-site Leader)				8,000
Clerical and Technical	2,000	5,000	13,500	15,000
Labor		5,000		5,000
Contributed Faculty Time			23,500	
Fringe Benefits (12% of 33,000)	4,020			
Total For Category	37,520	10,000	37,000	28,000
II. Major Equipment, Facilities, Etc.				
Site Development	2,000	14,256		25,000
Equipment		5,000	10,000	
Animals			16,500	10,000
Total for Category	2,000	19,256	26,500	35,000
III. Travel				
Professional Staff		30,000		
Students		25,800		
Total for Category		55,800		
IV. Site Coordination and Support		30,000		
V. Other Direct Costs				
Laboratory Supplies		1,000	10,000	
Educational Support	6,000	10,000	5,000	15,000
Fuel, Oil, Utilities		10,000		
Total for Category	6,000	21,000	15,000	15,000
VI. Indirect Costs (55% of 33,500)	18,424		20,350 (55% of 37,000)	
Total for Fiscal Year 1980	63,944	136,056	98,850	78,000
Total	200,000		98,850	
% Texas Tech Cost Sharing			49.4%	

Name: Donald F. Burzlaff [redacted]

Present Position: Chairman and Professor, Department of Range and Wildlife Management, 1973

Previous Positions:

Professor and Vice Chairman, Department of Agronomy, University of Nebraska (2 years)
Professor of Agronomy, University of Nebraska (4 years)
Associate Professor of Agronomy, University of Nebraska (6 years)

Education:

Degrees	Institution	Year	Major
B.S.	University of Wyoming	1950	Range Management
M.S.	University of Wyoming	1952	Botany
Ph.D.	Utah State University	1960	Range Management

Honorary and Professional Societies:

Society for Range Management
American Society of Agronomy
Soil Conservation Society of America
American Forage and Grassland Council
Sigma XI
Gamma Sigma Delta
Alpha Zeta

African Experience:

Niger, Mauritania, Senegal

Publications:

Burzlaff, D.F. 1971. Seasonal variations of the in vitro digestibility of three sandhill grasses. J. Range Manage. 24:60-63.

Burzlaff, D.F. and D. C. Clanton. 1971. Production of upland hay in the sandhills of Nebraska. Univ. of Nebraska. SB 517.

Daigger, L. A. and D. F. Burzlaff. 1972. Fertilization of sub-irrigated meadows in western Nebraska. Univ. of Nebraska. SB 521.

Burzlaff, D. F. and L. A. Daigger. 1974. The impact of commercial fertilizers on semi-arid grassland ecosystems. Proc. XII International Grassland Congress. Vol. 11: 40-50.

Burzlaff, D.F., J. L. Launchbaugh, and J. Stubbendieck. 1975. The growth and development of blue grama, Bouteloua gracilis. Texas Tech University, Range and Wildlife Management Series #1.

Proposal for Research

submitted by

Utah State University

TITLE: Rangeland Research for Increasing Small Ruminant Production in Latin American Highlands

STATUS: New Project

GRANTEE: Small Ruminant CRSP Management Entity

PRINCIPAL INVESTIGATORS: John C. Malechek, Philip J. Urness, Brien E. Norton and Don D. Dwyer

DURATION: Five years with anticipated extension to 10 years

TOTAL ESTIMATED COSTS: (first 5 yrs; thousands of 1979 dollars)

	1979	1980	1981	1982	1983	Total
AID	169.4	171.8	211.1	217.8	229.9	1000.0
USU	94.3	102.0	110.7	117.6	124.6	549.2
LDC	18.5	18.5	21.5	26.0	26.0	110.5
TOTAL	282.2	292.3	343.3	361.4	380.5	1659.7

PRIOR FUNDING: None

AID PROJECT MANAGER: _____

APPROVAL:

John C. Malechek 6-7-78
Principal Investigator Date

6-7-78
Department Head, Range Sci. Date

Director, Utah Agricultural Experiment Station Date

F. H. Stager June 78
Dean, College of Natural Resources Date

M K Jeppesen 6/7/78
Director of Contracts and Grants Date

Proposal Abstract

Rangeland Research for Increasing Small Ruminant Production in Latin American Highlands

John C. Malechek, Philip J. Urness, Brien E. Norton, and Don D. Dwyer, Utah State University

Rangelands provide the major or sole source of forage for sheep and goats in many least developed countries (LDC's). However, these lands are typically overgrazed and are producing at levels far below their potential. For any animal improvement program to succeed, equal attention must, therefore, be given to the forage resource. Research outlined in the four major objectives below will seek to fill existing gaps in information and technology peculiar to Latin American LDC's with highland range areas. Additionally, and probably of greater long-term significance, will be provisions for training LDC nationals in rangeland management and science, and for training Ph.D.-level U.S. citizens in international resarch, education, and development.

Specific objectives to accomplishment of these goals follow:

1. Ecological assessment of the existing range forage resource in relation to prevailing environmental and resource-use constraints.

2. Determination of specific plant:animal relationships (including animal diets, forage preferences, forage quality, and intake) as a basis for designing grazing management programs and supplementary feeding practices.

3. Design ecologically sound grazing management practices to insure improvement and sustained use of the range forage resource, and assess the potential for manipulative range improvement practices.

4. Conduct long-term controlled grazing trials designed to compare improved range and animal materials and management techniques to traditional animals and grazing practices. These trials will provide a demonstration and research basis for continued work by LDC nationals after the Title XII Program is phased-out.

The over-all philosophy of this research is one of integration of range management into the overall production system, including the physical and biological environment, domestic animals, and people.

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A. Description of Problem

Increasing production of domesticated small ruminants has been recognized as a logical and viable alternative for improving the economic and social welfare of least developed countries (LDC's). However, no animal improvement program can proceed without primary attention to the forage resource. In many LDC's, the only source of forage is from rangelands, most of which have been historically overgrazed and are presently producing at levels far below their potential.

Attempts to directly transfer U.S. range management technology to LDC's has met only limited success, partly because of social and cultural barriers, and partly because the basic biology and ecology of the systems differ. Research is greatly needed to ascertain the specific ecological limitations to range improvement and increased production that are operating in the particular LDC's. The additional, and probably greater, need is for training and education of a cadre of native scientists and resource managers who are likely to have personal interests in the continuation of range and animal improvement programs after the U.S. technical experts have withdrawn. The objectives and activities described in this proposal form a component part of a larger research program aimed at providing technical information and training to LDC's of the Latin American highlands.

B. Objectives

1. Ecological assessment of the range forage resource.

   a. Determine present condition (successional status) and productivity of important plant communities, including the following variables.

      1. seasonal trends and fluctuations in primary productivity.

      2. botanical composition of important plant communities.

      3. effects of climatic variations on vegetational response emphasizing drought impacts.

   b. Determine the ecological potential (including both kinds and amounts of vegetation) for important range inventory units (range sites).

   c. Monitor plant community succession/retrogression in relation to climate and grazing management.

   d. Describe and delineate important soil taxonomic units and define edaphic limitations to range improvement and forage production.

2. Plant:animal relationships.

   a. Determine diets and feeding behavior of sheep and goats, as affected by season, species of animal, and influence of other competing large and small herbivores.

   b. Describe the annual forage quality cycle by season, range site, and management practices and in relation to established animal requirements for maintenance, weight gain/loss, gestation, lactation, and hair or wool production.

   c. Ascertain forage intake by the grazing animal in relation to nutritive requirements and environmental constraints.

d. Design and test practical supplementary feeding programs, based on information derived from activities a, b, and c above.

3. Range improvement

a. Based on information derived from Objectives 2 and 3, devise systems of grazing management aimed at improving productivity and quality of range forage.

b. Investigate potentials for use of controlled burning and hand-removal where appropriate, and for use of sheep and goats as biological control agents for undesirable woody plant species.

c. Assess potential for planting native and introduced forage species (as potential sources for supplemental feed in 2d above).

4. Establish controlled grazing trials designed to test applicability of improved range and flock management techniques and practices, including the following factorial components:

a. traditional range management x traditional animal genotypes and herd management

b. traditional range management x improved animals and herd management

c. improved range management x traditional animals and herd management

d. improved range management x improved animals and herd management

C. Project Approach

Rangeland production systems are, by their nature, extensive, often involving large tracts of land with great variation in soils, vegetation, and even climate. Such systems fit poorly into a highly-controlled, traditional research context. Hence, the rangeland scientist must ultimately develop his major activities on a parcel of land small enough that treatment effects, when present, are not obscured by site variation. Yet, the area must be sufficiently large to represent fairly the extensive system he is attempting to study.

Considering these necessary trade-offs, our approach will be to first ascertain (i.e. from existing publications, vegetation maps and reconnaissance) the location and extent of economically and ecologically important forage plant community types in the geographic region of interest, probably the Altiplano region of Bolivia and Peru. Within the community type deemed most important and representative of the region, a specific study site will be located. This site, perhaps comprising 200-500 ha of land, will then become the common location of much of the research outlined under the Latin American "Extensive System" (RTI, 1978). Additional to range management investigations, much of the animal breeding and animal health research will be performed on this site. Integration of these forage:animal components on a common area is essential, as they exist as a unified system in the natural environment. Data from these components will form the nucleus for much of the systems analysis and modelling work on the forage: animal subsystem. Local cultural constraints, particularly those that relate to animal management, must be evaluated early in the site selection process so as to include those factors in the investigations under Objective 4.

Although this primary site approach tends to optimize experimental control for the kinds of activities generally contained in Objectives 2, 3, and 4 of this proposal, additional locations in other important range community types will likely need to be considered. The need for this broader view is especially acute in relation to the ecological assessment activities outlined under Objective 1. If necessary, one or more satellite locations will be selected where investigations of a lower resolution are appropriate. Also, some questions (e.g. determination of range and forage conditions and animal production under extant local management) may be amenable to study under cooperative efforts with local pastoralists. This over-all approach has worked well in an ecosystem-modelling study now in progress in southern Tunisia (Wagner, 1974-1977).

Specific research will be conducted by project scientists and graduate students who will spend varying periods of time at the primary study site. Their residency periods will probably range from 1 month to 2 years and will depend on the demands of the specific experiments performed.

Critical to the success of the entire project will be an individual who might be called the resident site coordinator. This person will be a facilitator and will be responsible for the day-to-day operation of the project. He will hire and supervise resident technicians, coordinate transportation, lodging, and activities of various project graduate students and scientists, oversee facilities and animals, and will generally serve as the in-country representative for the project. He will be directly responsible to the principal investigators or their elected representative. He must have an understanding of the needs and procedures of research, but would not necessarily be engaged in project research. He must reside in-country and should be familiar with local customs, language(s),

and politics. Financial responsibility for his salary and operating budget, and for development and maintenance of facilities and animal herds will be shared by all projects. This expenditure, termed "LDC Site Maintenance Share" in the project budget, will be shared as follows: range management, animal breeding, and animal health @ 15% of each respective project's total financial allotment; systems analysis, economics, and sociology each @ 7.5% of their respective annual allotment.

Great potential exists for integration of research efforts by the Latin American extensive and intensive programs. Tentative agreement has already been established with the nutritionists in the intensive program (P.I. Johnson) to cooperate and correlate experiments where possible. Should satellite studies be located in Mexico, a great potential exists there for studying intensive and extensive systems side-by-side.

D. Externalities Outside Direct Control of the P.I.

Only a few circumstances might arise that would totally negate some level of success in the proposed work. The obvious ones are listed below:

1. Political upheaval, necessitating exit from the LDC.
2. Lack of cooperation by LDC's government.
3. Inability to maintain long-term control of the experimental site.
4. Substantial reduction in funding by AID.
5. Withdrawal of support by Utah State University's administration.

Those possibilities that might lead to a premature exit from the primary LDC could be mitigated by early establishment of linkages and even a restricted level of research in another country (or countries) having comparable small ruminant production systems.

Additionally, some of the fundamental work on animal nutrition, feeding behavior, and plant-animal relations applicable to the LDC outlined under Objective 2 can and will be conducted in the U.S. In the eventuality of a premature exit from the primary LDC, this work could be emphasized.

E. Assumptions That Achieving Objectives Will Solve Problem

Rangelands supply the major part of the feedstuffs consumed by small ruminants in many LDC's. Thus, it is generally assumed that efforts directed toward increasing sustained production and utilization of range forage will eventually be translated into improved animal production. Specifically, we assume:

1. Ecological information on soils, plant communities and environmental relationships will form the basis for scientific range management in the LDC.
2. Improved range condition and environmental stability will result through proper grazing management.
3. Increased grazing capacity can be achieved through improved range condition.
4. Improved animal genotypes (products of the animal breeding component) will require improved range forage for expression of genetic potential.
5. Animal nutrition and production can be improved through stabilization of seasonal variation in forage quality and quantity.
6. Grazing trials demonstrating improved range and animal management will promote application of scientific principles by LDC producers.
7. A cadre of LDC professionals trained by this program will implement grazing management and range improvement programs and will continue research on range management problems.
8. U.S. graduate students trained through this program will be better equipped to respond to range-related problems in LDC countries.
9. Utah State University will attain experience, contacts, and stature that will improve its capabilities for responding to research, educational and developmental needs of LDC's.

F. Outputs of Project

1. Range management principles and practices specifically applicable to Latin American highlands.
2. Animal grazing management practices specifically applicable to indigenous and improved animal genotypes in Latin American highlands and other world highland areas.
3. Field demonstration areas for illustrating scientific range and animal management practices.
4. Publications on range plant ecology, range animal management and nutrition, range improvement procedures, and animal production under various input levels of range technology. Guidelines on education of students from LDC's in range science.
5. Four ~~Six~~ trained M.S. and Ph.D. students at the end of the initial five years, and ten ~~eight~~ additional M.S. and Ph.D. students by the end of the tenth ~~eighth~~ year, assuming project time is extended.
6. Linkages with various National LDC institutions concerned with range management, resource conservation, and animal production.
7. Linkages and cooperative research projects with other Latin American institutions outside the primary LDC.

G. Technical Feasibility

We judge the proposed program of research to be both technically feasible and accomplishable within the time limitations specified. The ecological inventory and assessment described under Objective 1 can all be accomplished with time-proven methodologies that are not limited by primitive conditions or equipment. The primary need is for trained people and a limited amount of fencing material for establishment of grazing exclosures. A meteorological station network capable of measuring temperature, humidity, and precipitation will also be required.

Work under Objective 2 is considerably more dependent on technology and access to well-equipped laboratory facilities. However, most of the lab work will likely be done in the U.S. The major needs at the research site will be for research animals that can be fistulated (to provide representative dietary samples for botanical and chemical analysis) and trained to wear equipment needed in forage intake determinations (Objective 2-c). These animals will be integrated into native herds or else maintained as an experimental herd simulating native practices. No major technical difficulties are anticipated. All of these approaches have been successfully applied in other LDC studies (Greigo and Malechek, 1975). Detailed work on fundamental nutrition and behavioral aspects is planned for comparison studies in Utah (under Utah Agr. Exp. Sta. Projs. 755 and 771).

Work under Objectives 3 and 4 necessitates fencing and control over a herd of experimental animals. Although establishment of fenced pastures is expensive, it is not a major technical limitation. However, maintenance of fences and prevention of trespass by local flocks may present a

significant administrative and sociological problem. The range management and animal breeding projects will share animals and pasture facilities.

Grazing studies outlined under Objective 4 are viewed as the "capstone" or critical evaluation of the entire range research project. This segment is also designed for providing much of the focus of graduate student training and instruction. Once such studies are applied on the ground, they can also serve as a practical demonstration of "old" vs. "new" technology. Hence, Objective 4 is a key element in our long-range plan of research and development for Latin American highlands. However, our objectives are so designed (in terms of subject matter and scheduling) that essential components of the overall systems model will be derived from work under Objectives 1 and 2.

Allied work relating to Objective 4 will also be conducted in Utah (under Agr. Exp. Sta. 771). Although this U.S. research will not have the inputs of indigenous LDC animals or traditional management practices, it will offer perspective on the relation of range management to animal production. It will also offer a fall-back contingency in the event of difficulties of operating Objective 4 in the LDC.

H. Time-Phased Scope of Work

The active data collection phase of this project is planned for ten years, realizing that work will be subjected to major review and evaluation after five years. The rationale for planning based on the longer time is that most plant community responses (e.g. recovery from overgrazing, variation in primary production in relation to climate, responses to prescribed grazing treatments) are slow, and can be reliably evaluated only over relatively long (>5 yrs.) periods.

The schedule of research activities is phased generally in the order that objectives have been presented (Fig. 1). The first step, essential not only to the range management project, but also to the breeding and genetics and animal health projects, will be the location and establishment of a suitable study site (hereafter termed the primary site) where the major part of the integrated research will be done. Contacts with and assistance from LDC institutions and the AID Missions are prerequisite to this effort. Early assistance from program sociologists will be required in obtaining a cursory evaluation of the socio-cultural environment of the prospective study area and how this will relate to the physical and biological conditions of the research.

Once a mutually suitable primary site has been established, detailed ecological assessment of the area will proceed. At this point, work will be sufficiently research-oriented that graduate student training may begin (Fig. 2). Also during this time, secondary (low research resolution) study sites will be located, as appropriate, in outlying but ecologically important areas. The major purpose of the secondary sites will be to give an ecological perspective to the detailed findings derived from studies on the primary site.

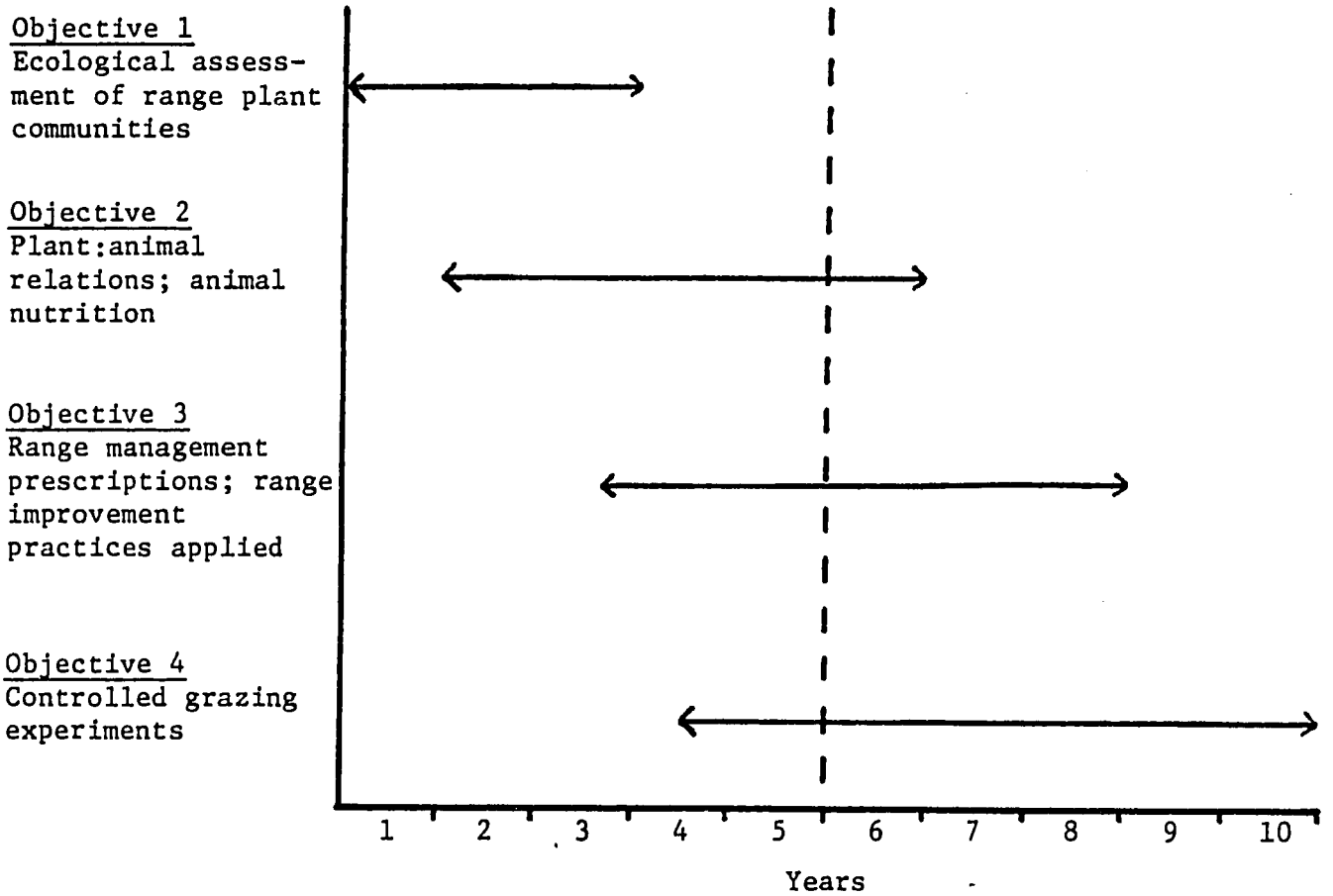
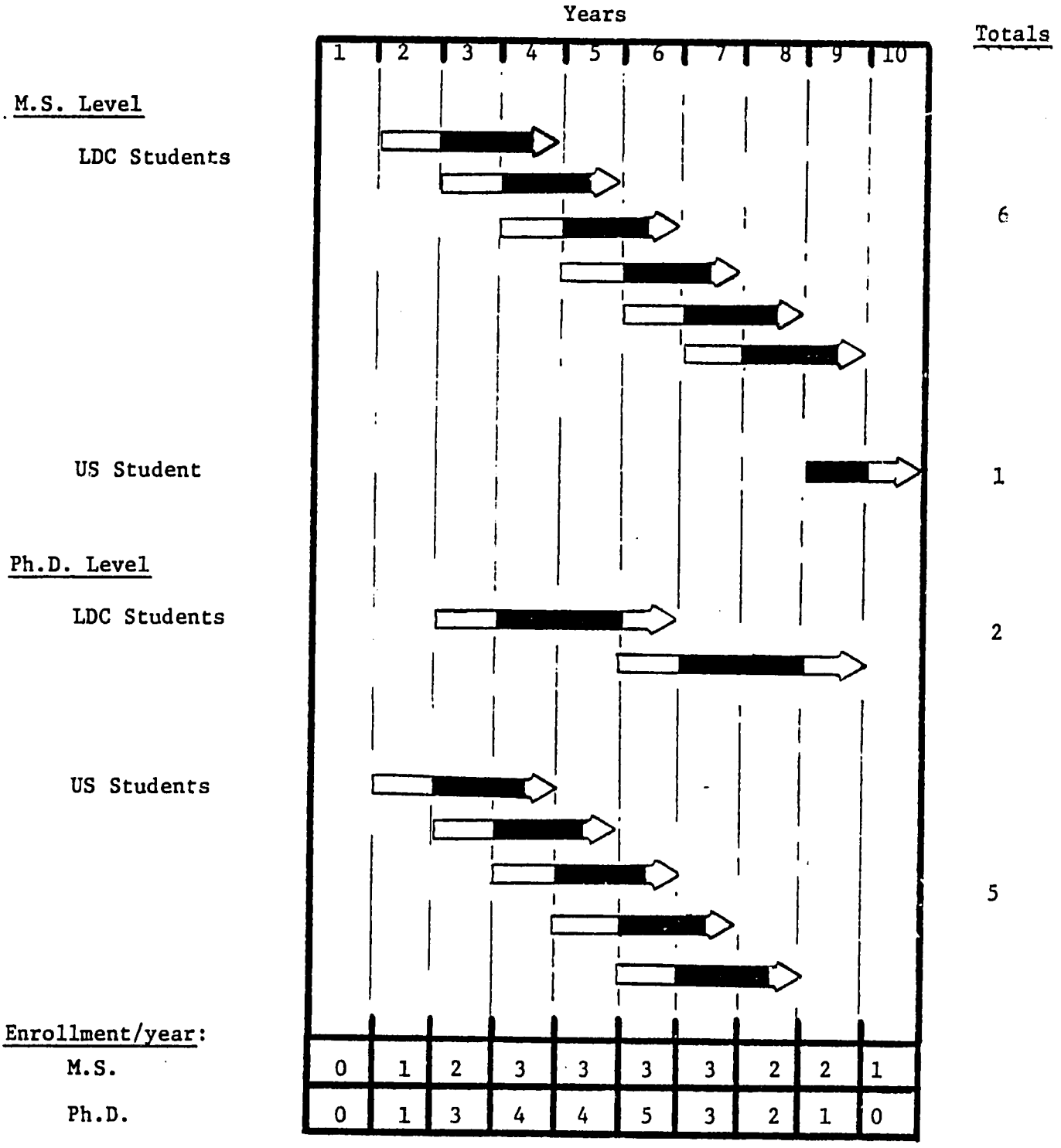


Fig. 1. Schedule of research activities, by objective. Each arrow represents the approximate time-course for work under a particular objective. Internal synthesis and review will occur after 3, 5, 8 and 10 years of research. Vertical broken line indicates point of major review by AID.



Grand total students trained: 14

Fig. 2. Graduate student training schedule. Each arrow represents the time course for a particular student. Shaded portions of arrows indicate time student is in LDC performing research; unshaded portion represents time in residence at USU for coursework, data analysis, and writing.

Work on Objective 2 (plant:animal relationships and animal nutrition) will begin in the second year. This will provide time for the animal breeding project to assemble a nucleus for its experimental flock, which will also provide essential subjects for range plant:animal studies. Graduate student training will intensify during this time, involving the first LDC students (Fig. 2).

Implementation of Objectives 3 and 4 in the LDC is possibly only after a suitable amount of baseline ecological data has accumulated from Objectives 1 and 2. We have projected approximately 3 to 3.5 years as necessary for this baseline work (Fig. 1). However, work on complemental studies related to Objectives 2, 3, and 4 will already be underway in Utah in the initial year of the project. These allied studies (see Appendix for abstracts of these studies) will be supported in part by the Utah Agricultural Experiment Station, but deal with principles and hypotheses as related to the proposed project. They will be utilized when and where they directly relate and will be especially valuable for LDC graduate student training and research while these students are in residence in the U.S. Appropriate parts of these Utah projects will receive funding support from this proposed small ruminant project.

Additionally, linkages will be established with other Latin American countries during the initial year to ascertain where other related work is being done or is anticipated. The Range Science Department at Utah State University presently maintains a viable connection (largely through former graduate students) with the Rancho Experimental La Campana in Mexico. This group is presently expanding studies on range goat systems (Fierro et al., 1977). We will promptly attempt to foster cooperative studies with them, and will investigate other alternatives

in additional Latin American countries represented in the highland ecozone. John Malechek (P.I.) tentatively plans to spend part of a pending sabbatical leave (Sept. 1978-Aug. 1979) investigating and establishing such linkages. Cooperative development of these related projects will be pursued. Where appropriate, they will be supported by partial funding from this project.

Assuming approval for continuation of field research for the entire ten years (Fig. 1), the final two years would be devoted to collection of final field data on the grazing experiments (Objective 4) and to synthesis and writing. Particularly close collaboration with the systems analysis project and the African range management project would be necessary during that period. Several major book volumes are anticipated on range management for small ruminants in LDC's. These volumes will synthesize and integrate detailed studies that are published during the course of the project, and they will attempt to integrate findings from the African extensive project for cross-continent perspective. Additionally, practical, application-oriented extension bulletins and other materials will be prepared for use by LDC nationals. This will require close collaboration with the AID Missions and national institutions.

I. Project Monitoring

The key to efficient day-to-day operation of the project in the LDC will be a highly-qualified site coordinator. Supervision of this person will be maintained directly by project principals who will spend an aggregate of about 3.5 scientist months per year in the LDC, actively engaged in research activities.

Scheduling of graduate student programs (Fig. 2) will provide for a minimum of at least two U.S. students in the LDC at a time for mutual support and low-level supervision. Also, schedules are arranged for in-LDC overlap of exiting and entering graduate students to provide an orientation period.

J. Annual Review and Planning Process

Additional to standard review procedures prescribed by AID, we plan periodic review of the range management project by four categories of external authorities.

1. Institutional experts from the host-LDC, but not people directly associated with the project. Appropriate designates from the AID Missions will also be included in this group.
2. International experts on rangeland ecosystems and small ruminant production.
3. Scientists associated with other projects of the small ruminant CRSP. For example, regular review by and exchange of information with Don Burzlaff (P.I.) of the African Extensive CRSP would be mutually beneficial.
4. Administrators and designated representatives of Utah Agricultural Experiment Station. These people will evaluate relationships of the small ruminant CRSP to state-supported comparison projects, and will specifically evaluate research conducted under allied projects (through existing format of written annual reports).

Review by the panel of international experts would logically best correspond to the major 5-year review planned by AID. At that point, accumulated data will be summarized by interim publications. Final publications from work under Objective 1 will be possible at that time. Major objectives will be critically analyzed and possible new research directions could be explored.

Review by in-LDC experts, as well as other CRSP scientists will occur on a more frequent basis, probably biannually. A second major

project review would logically fall at the end of the eighth year when decisions would be reached on continuation of field research beyond the proposed ten years.

K. LITERATURE CITED

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Griego, R. R. and J. C. Malechek. 1975. Sheep and goat grazing responses in the Tunisian pre-Sahara. Proc. West. Sec. Am. Soc. Anim. Sci. 26:151-154.

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L. BUDGET
1979

	Total	Source: AID	Source: University Cost Share	Source: LDC/Institution Cost Share
A. Personnel (s & w plus fringe)[1/]	($000)			
US	75.4	53.1	22.3	0.0
LDC[2/]	19.3	13.3	0.0	6.0
Total	94.7	66.4	22.3	6.0
B. Equipment/Facilities/Animals[3/]				
US	89.2	20.0	69.2	0.0
LDC	20.0	7.5	0.0	12.5
Total	109.2	27.5	69.2	12.5
C. Travel and Per Diem[4/]				
US	2.0	2.0		
US/LDC	9.0	9.0		
LDC	1.0	1.0		
Total	12.0	12.0		
D. LDC Site Maintenance Share	30.0	30.0		
E. Other Direct Costs[5/]				
US	3.9	1.1	2.8	
LDC	0.0	0.0	0.0	
Total	3.9	1.1	2.8	
F. Indirect Costs[6/]				
(60% of $54.0)	32.4	32.4	0.0	
G. Annual Total	282.2	169.4	94.3	18.5
H. University Cost Share as a Percentage of AID Funds =	55.7%			

(Footnotes on p. 26)

L. BUDGET
1980

	Total	Source: AID	Source: University Cost Share	Source: LDC/Institution Cost Share
A. Personnel (s & w plus fringe)[1/]	($000)			
US	84.9	59.3	25.6	0.0
LDC[2/]	27.6	21.6	0.0	6.0
Total	112.5	80.9	25.6	6.0
B. Equipment/Facilities/Animals[3/]				
US	73.4	0.0	73.4	0.0
LDC	15.5	3.0	0.0	12.5
Total	88.9	3.0	73.4	12.5
C. Travel and Per Diem[4/]				
US	2.0	2.0		
US/LDC	12.0	12.0		
LDC	2.0	2.0		
Total	16.0	16.0		
D. LDC Site Maintenance Share	30.0	30.0		
E. Other Direct Costs[5/]				
US	4.1	1.1	3.0	
LDC	0.0	0.0	0.0	
Total	4.1	1.1	3.0	
F. Indirect Costs[6/]				
(60% of $68.0)	40.8	40.8	0.0	
G. Annual Total	292.3	171.8	102.0	18.5
H. University Cost Share as a Percentage of AID Funds =	59.4%			

(Footnotes on p. 26)

L. BUDGET
1981

	Total	Source: AID	Source: University Cost Share	Source: LDC/Institution Cost Share
A. Personnel (s & w plus fringe)[1/]	($000)			
US	92.0	62.3	29.7	0.0
LDC[2/]	46.1	37.1	0.0	9.0
Total	138.1	99.4	29.7	9.0
B. Equipment/Facilities/Animals[3/]				
US	77.8	0.0	77.8	0.0
LDC	22.5	10.0	0.0	12.5
Total	100.3	10.0	77.8	12.5
C. Travel and Per Diem[4/]				
US	2.0	2.0		
US/LDC	16.0	16.0		
LDC	2.0	2.0		
Total	20.0	20.0		
D. LDC Site Maintenance Share	30.0	30.0		
E. Other Direct Costs[5/]				
US	4.9	1.7	3.2	
LDC	0.0	0.0	0.0	
Total	4.9	1.7	3.2	
F. Indirect Costs[6/]				
(60% of 79.3 + 23% of 6.0)	50.0	50.0	0.0	
G. Annual Total	343.3	211.1	110.7	21.5
H. University Cost Share as a Percentage of AID funds =	52.4%			

(Footnotes on p. 26)

L. BUDGET
1982

	Total	Source: AID	University Cost Share	LDC/Institution Cost Share
A. Personnel (s & w plus fringe)[1/]	- - - - - - - - -	($000)	- - - - - - - - - - - - -	
US	82.0	50.5	31.5	0.0
LDC	69.6	56.1	0.0	13.5
Total	151.6	106.6	31.5	13.5
B. Equipment/Facilities/Animals[3/]				
US	82.5	0.0	82.5	0.0
LDC	15.5	3.0	0.0	12.5
Total	98.0	3.0	82.5	12.5
C. Travel and Per Diem[4/]				
US	3.0	3.0		
US/LDC	18.5	18.5		
LDC	2.0	2.0		
Total	23.5	23.5		
D. Site Maintenance Share	30.0	30.0		
E. Other Direct Costs[5/]				
US	7.3	3.7	3.6	
LDC	0.0	0.0	0.0	
Total	7.3	3.7	3.6	
F. Indirect Costs[6/]				
(60% of 82.7 + 23% of 6.0)	51.0	51.0	0.0	
G. Annual Total	361.4	217.8	11[illegible].6	26.0

H. University Cost Share as a Percentage of AID Funds = 54%

(Footnotes on p. 26)

L. BUDGET
1983

		Source		
	Total	AID	University Cost Share	LDC/Institution Cost Share
A. Personnel (s & w plus fringe)[1/]	- - - - - - - - -	($000)	- - - - - - - - - - - - -	
US	83.1	49.8	33.3	0.0
LDC[2/]	77.2	63.7	0.0	13.5
Total	160.3	113.5	33.3	13.5
B. Equipment/Facilities/Animals[3/]				
US	87.5	0.0	87.5	0.0
LDC	16.0	3.5	0.0	12.5
Total	103.5	3.5	87.5	12.5
C. Travel and Per Diem[4/]				
US	2.0	2.0		
US/LDC	19.0	19.0		
LDC	2.0	2.0		
Total	23.0	23.0		
D. LDC Site Maintenance Share	30.0	30.0		
E. Other Direct Costs[5/]				
US	8.6	4.8	3.8	
LDC	0.0	0.0	0.0	
Total	8.6	4.8	3.8	
F. Indirect Costs[6/]				
(60% of 88.3 + 23% of 9.0)	55.1	55.1		
G. Annual Total	380.5	229.9	124.6	26.0
H. University Cost Share as a Percentage of AID Funds =	54.2%			

(Footnotes on p. 26)

Footnotes to Budget Entries

1/ Personnel salaries, graduate student stipends, and salaries for a half-time technician and a half-time secretary. Includes a 23% fringe benefit package for all salaries and wages except graduate student stipends. Salary data derived from Appendix Table 1.

2/ Allocation of AID funds based on proportion of project scientists time spend in LDC, plus all graduate student stipends paid to students while in LDC. Example: 1981 budget,

$$(1 \text{ Grad Stipend @ } 6.0 + \left[\frac{(99.4 \times 0.5 \text{ SY spent in LDC})}{(1.6 \text{ SY allocated to project})}\right] = 37.1$$

3/ Permanent equipment and facilities not already counted in indirect costs. Includes animals, vehicles, and research sites. In case of USU cost-share component, portions of on-going US research directly related to Small Ruminant CRSP are included.

4/ Travel and Per Diem
Air fares, per diem, automobile rental, local mileage for project principles and graduate students.

5/ Report preparation, reproduction, publication, minor equipment (expendable), office supplies, supplies for animal maintenance, insurance for overseas travel, visas, immunizations, postage, telephone, translation services, books, maps, computer services.

6/ Indirect costs calculated as 60% of salaries and wages for project principals, technicians, and secretaries, and graduate students while in residence in U.S. Calculated as 23% of graduate student's stipends while they reside in LDC.

M. APPENDICES

Page		Title
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29	Table 2.	Project scientists' assignments, time allocations and time to be spent in LDC.
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Table 1. Allocation of AID funds to personnel salaries and wages (budget category A): Detailed cost summary, annual basis.

Year	Professional		Grad Student		Technician		Secretarial		Total	
	SY1/	$000	SY2/	$000	SY	$000	SY	$000	SY	$000
1979	1.5	42.0	0.00	0	0.5	6.0	0.5	6.0	2.50	54.0
1980	1.5	43.6	1.00	12	0.5	6.2	0.5	6.2	3.50	68.0
1981	1.6	48.5	2.00	24	0.5	6.4	0.5	6.4	4.50	85.3
1982	1.7	51.5	2.25	27	0.5	6.6	0.5	6.6	4.95	91.7
1983	1.8	56.7	2.25	27	0.5	6.8	0.5	6.8	5.05	97.3

1/ Scientist Year (SY) equivalent based on $28,000 in 1979 and increased 4% annually.

2/ 1.0 Grad Student = 0.5 SY @ $6,000 per year stipend.

Does not include professional scientists' time contributed by USU.

Table 2. Project scientists' assignments, time allocations, and time to be spent in LDC.

Name and Expertise	Assignment	Time Allocation (SY per year)[1/] 1979	1980	1981	1982	1983
John C. Malechek Range Mgt.; Range animal nutrn.	Principal Investigator; research leader on Objs. 2 and 4	0.60	0.60	0.50	0.50	0.50
Brien E. Norton Ecosystems anal. range ecology	Research leader on Obj. 1	0.40	0.30	0.40	0.40	0.40
Philip J. Urness Range animal relations; range mgt.	Research leader Obj. 3	0.40	0.30	0.30	0.30	0.30
Don D. Dwyer Research administr. range animal prod.	Proj. administr.	0.20	0.20	0.20	0.20	0.20
Unfilled Scientist Range ecol.; systems anal.; biostatistics	Data aquisition, analysis, exp. design, synthesis	0.20	0.40	0.50	0.65	0.75
	Annual total:	1.80	1.80	1.90	2.05	2.15
Time spent in LDC (SY's)		0.30	0.40	0.50	0.60	0.70

1/ Includes time budgeted for salaries on AID funds plus time contributed by Utah State University.

Table 3. International travel: Detailed cost summary, annual average basis.

Traveler(s)	Average number round trips per year	Per-Trip[1/] rate	Total
Project principals	4	$1,700	$ 6,800
Graduate students + 1 dependent each[2/]	1.5	3,000	5,250
Total			$12,050

1/ Basic per-trip costs calculated as:

Round-trip fare	$1,100
10-day in-transit per diem	450
Excess baggage-freight	150
Total:	$1,700

2/ Only fares paid for dependents.

Table 4. Graduate student training: Detailed cost summary.

U.S. Students	
Ph.D. (per-student basis)	
Stipend (6,000/yr. x 3 yrs)	$18,000
International travel and per diem (student + 1 dependent for 1.0 trip each)	3,000
Total:	$21,000
M.S. (per-student basis)	
Stipend (6,000/yr. x 2 yrs)	$12,000
International travel and per diem (student + 1 dependent for 1 trip each)	3,500
Total:	$15,500
LDC Students	
Ph.D. (per-student basis)	
Stipend (6,000/yr. x 2 yrs; only while in U.S.)	$12,000
International travel and per diem (student + 1 dependent, 2 trips each)	6,500
Total:	$18,500
M.S. (per-student basis)	
Stipend (6,000/yr. x 1.50 yrs; only while in U.S.)	$ 9,000
International travel and per diem (student + 1 dependent, 2 trips each)	6,500
Total:	$15,500

RESUME

Name: John C. Malechek

Associate Professor, Department of Range Science, Utah State University, Logan, Utah 84322

Date and place of birth: [redacted]

Education: B.S. Range Management, Texas Technological College, 1964
M.S. Range Science, Colorado State University, 1966
Ph.D Range Science (animal nutrition), Texas A & M University, 1970

Areas of specialization:

Range management: Design of grazing management systems; range inventory and analysis; forage production and utilization

Range animal nutrition: Analysis of animal diets, forage quality, forage consumption and digestibility (includes both domestic and wild ungulates).

Grazing animal behavior: Analysis of animal food preferences; behavior in response to weather, animal use of time and space.

Experience in following geographical areas in the United States: Western Texas, central Colorado, and throughout Utah.

International experience:

Work with small ruminants in Tunisia and directed graduate students from three foreign countries.

Relevant publications:

Malechek, J. C., K. J. Kotter and C. H. Jensen. 1978. Nutrition and production of sheep in response to intensity and duration of spring grazing. Journal of Range Management. 31 (in press).

Malechek, J. C. and B. M. Smith. 1976. Behavior of range cows in response to weather. Journal of Range Management. 29:9-12.

Griego, R. R. and J. C. Malechek. 1975. Sheep and goat grazing responses in the Tunisian pre-Sahara. Proceedings, Western Section, American Society of Animal Science. 26:151-154.

Smith, A. D. and J. C. Malechek. 1974. Nutritional status of prong-horn antelope (Antilocapra americana) in Utah. Journal of Wildlife Management. 38.

Malechek, J. C. and C. L. Leinweber. 1972. Forage selectivity by goats on lightly and heavily grazed ranges. Journal of Range Management. 25:105-111.

Malechek, J. C. and C. L. Leinweber. 1972. Chemical composition in in vitro digestibility of forages selected by goats on lightly and heavily stocked ranges. Journal of Animal Science. 35:1014-1019.

SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM

Title: Evaluation and genetic improvement of sheep and goats in extensive management systems.

New

Grantee: Montana State University, Department of Animal and Range Sciences through University of California, Davis - Management Entity

Principle Investigators: R. L. Blackwell
P. J. Burfening
D. D. Kress

Duration: 10 years with review after 5 years

Annual estimated cost*:

	1978-79	1979/80 - 1982/83
AID	$200,000	$200,000
U. S. Institution	61,882	61,982
LDC Institutions	40,000	80,000

*Estimated costs based on 1978-79 data.

Prior funding: None

AID Project Manager:

2. DETAILED DESCRIPTION OF PROJECT.

A. DESCRIPTION OF THE PROBLEM

In many arid/semi-arid regions where sheep and goats are produced under extensive conditions, animal numbers are often excessive. Hence the capability of the feed resource is inadequate to properly nourish these animals for optimum production. This over grazing has resulted in low animal productivity and accentuated poverty conditions among the people. Since grazing by food producing animals is the best practical method for harvesting most of the natural vegetation in these regions of the world, it is essential that balance between the feed resource and numbers of animals be achieved to insure productive livestock industries. In the process of attaining this balance, it is particularly important that animal productivity be improved genetically to the greatest extent possible. Opportunity to improve the productivity of animals by genetic means is usually substantial in most populations. There is reason to believe this opportunity pertains in many sheep and goat populations of the lesser developed countries. Therefore, a strong genetic/animal breeding component in the Small Ruminants Collaborative Research Support Program is necessary in achieving the program goals.

The introduction of an effective, systematic breeding program into extensive production systems in the LDC's may be difficult. This is due, in part, to lack of specific knowledge of the culture, the animals and the environmental constraints. Examples are numerous where attempts to transfer genetic stocks from favorable to unfavorable environments have been unsuccessful. It has been shown rather clearly from basic research[1] that progress from selection under "unfavorable" environmental conditions is more successful than similar selection

[1] Falconer, D. S. and M. Latyszewski. 1952. Environment in Relation to Selection for Size in Mice. Journal of Genetics. 51:67.

practice under "favorable" environmental conditions when the breeds are expected to perform under "unfavorable" conditions. Breeds or genetic types that have evolved in the harsh environments undoubtedly are relatively highly adapted to the environment and have developed varying degrees of genetic resistance to local disease and parasites and tolerance for marginal feed conditions. Therefore, breeding research with indigeneous breeds in their native habitats appears to be the most logical approach to the development of information and methodology for changing genetic potential for improved food and fiber production from these animals. The information derived from the proposed research should have a high degree of transferability to similar areas. Also, acceptance and implementation of the research results by the people of the region where the work is done should be relatively good.

The two major tools available to the animal breeder for changing the heredity of animals are selection and the mating system. Although crossbreeding has proven to be valuable in producing phenotypically productive animals, it is difficult to use systematically in practice. Selection is a powerful tool for improvement where there is adequate genetic variation, both interbreed and intrabreed, and is relatively inexpensive to apply. The potential gain from selection should always be compared with that of crossbreeding before a choice is made between two breeding systems[1]. A comprehensive research project that embodies breed evaluation, interbreed and intrabreed selection, and the possibility of developing synthetic stocks from several indigeneous breeds is needed to provide basic information for the development of

[1]Turner, H. N. 1976. Genetic Resources for Meat, Milk and Fiber Production. Extensive Production Systems. In "Proceedings of a Workshop on the Role of Sheep and Goats in Agricultural Development". Winrock Report.

sound animal breeding procedures under the environmental conditions encountered. A direct added benefit would be the production of breeding stock that should be acceptable to local sheep and goat raisers and which would produce genetic improvement in their animals.

Little is known about the basic biological characteristics of animals regarding adaptability to, and tolerance of, harsh environments. It will, therefore, be essential to incorporate experimental procedures to provide data that will assist in the understanding of the phenomenon of adaptability. It is important to understand these basic biological principles to insure that the processes of improving animals genetically for the characteristics directly related to food and fiber production do not run counter to the mechanisms of adaptability and survival. Information on the interrelationship among these characteristics should have value for many areas of the world.

The need for animal breeding investigations in the total research effort of the Small Ruminant CRSP to enhance the production of food and fiber from sheep and goats arises from (1) a paucity of research information on genetics and breeding that is directly applicable to the animal populations and the environmental constraints likely to be encountered in the LDC's, (2) a limited understanding of the relative importance of characteristics that contribute to adaptation to environmental stress and the interrelationships among these traits and those that affect production directly, and (3) a lack of trained personnel and well tested methodology applicable to the LDC's for improving animal productivity.

To be effective in improving the food needs of the people in the LDC's, the results of research must be accepted and applied by the livestock producers. Action programs resulting from animal breeding

research must have the support of government and local agricultural leaders. Local personnel must be trained in the scientific method, in animal breeding theory and practice, and in improved animal husbandry. They need to become an integral part of the research team in the LDC, and be given responsibility for making application of the results in their own country. Procedures for implementing animal breeding technology needs further development. Therefore, a training component is an essential part of the project to insure that competent personnel will be available to continue the program of research and implement the improvement program in the region.

B. OBJECTIVES

1. Determine the production norms for important biological and production characteristics of indigeneous and/or introduced breeds of sheep and goats, and identify those breeds that have the highest genetic potential for increasing food and fiber production under extensive systems of management in the LDC's.
2. Develop superior breeding stocks by:
   a. selection within existing breeds that exhibit superior productivity, and
   b. combining characteristics of several breeds into synthetic stock(s) and subsequen selection.
3. Provide training at the Mater's level in animal breeding and livestock management for students (both foreign and domestic) who will work in the LDC's.
4. Utilize superior breeding stocks to improve the productivity of indigeneous herds and flocks.

C. PROJECT APPROACH

Land, animals, facilities and certain personnel required for the research program will need to be provided in the LDC's for a longterm project (at least 10 years). The land resource will need to be adequate to maintain the experimental animals required for the breeding research. It is expected that the land, facilities, animals, labor and some technical personnel will be provided by the participating LDC's. Many of these resources will also serve the mutual needs of the grazing management and herd health improvement research projects in the Small Ruminant CRSP. Some personnel should be used cooperatively, in particular a position of "project manager" at each location which would be jointly funded by several of the program components. Managerial control of the experimental animals will be essential.

Objective 1

The first step in the breeding project will be the evaluation of breeds of sheep and goats to estimate population parameters and establish norms for important biological and production characteristics. The evaluation of several breeds to identify those that give promise of improving the productivity of sheep and goats in the region would be conducted in collaboration with the Germ Plasm Resource Development Program. Depending on the resources available, up to 8 or 10 distinctive breeds or genetic types of each species should be evaluated in the first four years of the project in each location. A basic and highly useful body of data from which guidelines for subsequent research will be developed would be collected during this period.

Animals assembled for the first phase of the research will be representative of the various breeds. Initial selection will be based on availability and importance in the region, apparent adaptability

and disease resistance, anticipated performance for production characteristics (milk, meat and fiber) and reproductive capacity. Productivity levels and genetic variation in the breeds will be assessed by selecting males from each breed and mating them in single sire pens to 15-20 females and evaluating the resulting progeny for as many characteristics as is considered necessary.

Traits to be considered in evaluation of the breeds will be:

1. Disease resistance and adaptability
2. Reproduction
    a. Age at puberty
    b. Length of estrus and estrus cycle
    c. Litter size
    d. Gestation length
    e. Breeding season
    f. Regularity of reproduction
3. Maternal ability
4. Meat quantity and quality
    a. Growth rate
    b. Typical age and weight at slaughter
    c. Mature size
    d. Quality
5. Milk production
    a. Quantity - length of lactation and level of production
    b. Quality - fat and protein content
6. Fiber
    a. Quantity
    b. Quality

Extensive analysis of the data generated in the first phase of the project will be required to estimate adjustment factors, make accurate

breed comparisons and estimate genetic parameters. Data analyses will be accomplished at Montana State Univeristy. Graduate students will be actively involved in collection and analysis of the data.

Objective 2

The second phase of the project will be result-directed to a large degree. The goal will be to further improve groups of animals that are considered to have above average production potential. If one or more breeds among those evaluated are clearly outstanding in many of the important production characteristics, additional experimental animals from these breeds will be assembled and intrabreed selection experiments will be initiated. The methods of selection will depend upon information obtained from analysis of the data generated in the first phase of the project.

It is anticipated that one or more breeds may be identified in each species that should be included in selection studies. The specific goals in selection practiced within each breed may vary depending on their expected role as sources of breeding stock and their degree of excellence in the various production and adaptation characteristics. At this point in the project a thorough review will be made to clarify procedures and identify selection goals.

In addition, the second phase of the project will include selection in "synthetic" stocks. Synthetic stocks will be produced by crossbreeding two or more of the superior breeds (as determined in phase one) to bring together complimentary traits from several breeds. These populations will be mated inter se and selection procedures will be initiated similar to that for the intrabreed selection study. Thus there will be several individual breeding groups established (breeds and synthetic stocks) and they will be subjected to similar selection procedures. Suitable control populations will be maintained to insure

that the effects of selection can be determined clearly, free from the effects of environmental trends. The critical test of the genetic value of these experimental breeding stocks will be the performance of their progeny in the general population.

It may be desirable to introduce genes from wild populations into the synthetic stocks or to introduce breeding stock from outside the general region if there is good evidence from the Germ Plasm Resource Development Program that such addition might be beneficial. This option will be kept open and the decision to exercise it will be determined in consultation with PI's from other breeding/genetics projects, the systems modeling, and animal health groups and from the Advisory Committee.

It is proposed to study the genetic basis of adaptation and disease resistance. Jointly conducted subprojects with the animal health scientists will be developed to study these facets of the problem of improving productivity and adaptability and to clarify, if possible, the underlying genetic basis of adaptation and disease resistance.

Objective 3

People will be trained in the areas of animal breeding and livestock management. This will be done by (1) conducting shortcourses, (2) training students from the LDC's at the master's level and (3) training students from the U.S. at the master's level. In addition to training of the individuals directly involved in the research, this will provide technically trained personnel to carry out Objective four.

Shortcourses will be conducted in the LDC's at the research locations. They would be of an approximate one month duration. Shortcourses will be designed for lay people and will teach the basics in

management practices and animal breeding. The experimental animals will be used to demonstrate the application of the research.

Students from the LDC's will be trained at the master's level in the following manner. They will have close contact with the research in the LDC at all times and will spend the first year of their training at the research site. This will give the students opportunity to become familiar with the project, to see how records are collected and how selections are made, and to start making contacts with agricultural leaders in the LDC. The last part of the training will be at Montana State University. Appropriate courses and training in genetics, animal breeding, statistics and support courses in computer science, animal physiology, nutrition, meats and biology will be taken. Data from the research in the LDC with which they are familiar will be analyzed and interpreted in a master's level thesis.

Students from the U.S. would be trained in a similar manner except that they will receive the coursework and training at Montana State University before spending time at the research site in the LDC. This will provide additional highly trained personnel on site to aid in the research. These students will then return to Montana State University to analyze their data and write the thesis.

Objective 4

The final phase of the project will involve methods of utilizing the breeding stocks developed in the project under objectives 1 and 2, to improve the animals of the country. Obviously, this would require an extension effort by the participating LDC's which would incorporate this effort in a general livestock management and improvement program.

This could be accomplished by supplying males from the project directly to sheep and goat producers with sufficient monitoring to

determine the improvement produced. A second method of utilizing the animals produced in the project to improve the sheep and goats of the country would be to establish multiplier flocks. Males from the project would be used to improve the multiplier flocks. Selected breeding animals from these multiplier flocks would then be made available to farmers throughout the country.

This phase of the program is a necessary and logical step in animal improvement in an LDC. It would incorporate the products of research and training. Our participation in this phase of the project would be data collection and analysis to evaluate the breeding values of selected animals and advisory to insure that principles and practices in animal breeding were carried through to their logical conclusions.

Montana State University Supporting Projects and Facilities

Research at the Montana Agricultural Experiment Station on sheep breeding methods addresses certain questions that are relevant to this proposed project in the Small Ruminant CRSP. A long term selection experiment to improve fertility in Rambouillet sheep is generating basic information concerning genetic effects on ovulation rates, fertilization rates, embryonic mortality and lamb survival. In a complimentary project methods are being studied for increasing reproductive performance in range sheep by introducing genetic material from a highly prolific breed. These research projects will be considered supportive of the project proposed herein. They will provide guides for experimental techniques needed to evaluate sheep (and goats) for reproductive performance and opportunity for graduate students to study sheep husbandry under extensive management conditions. A relatively large range area, approximately 10,000 acres, is used in part for this research. In addition to sheep involved in the breeding project others

others are utilized in management studies. A total of approximately 800 mature ewes, plus replacements, are involved in this research.

The Montana Agricultural Experiment Station also has good working relationships with the U. S. Sheep Experiment Station. This can be further developed to incorporate training and additional research opportunity for graduate students. The Montana Wool Laboratory can provide training in wool technology.

D. CONDITIONS THAT INDICATE OBJECTIVES HAVE BEEN ACHIEVED

The development of genetically superior breeding stock as measured by their own productivity and the productivity of their progeny produced in breeding tests in multiplier flocks would be one measure of the achievement of objectives 1 and 2. The rate of improvement in the breeding value of the experimentally developed stocks would be a more critical measure of the effectiveness of the project and this will be accomplished by experimental herd - control herd comparison.

Publications in media suitable for local use, such as bulletins prepared by LDC personnel trained in the project, with pictorial characterization of the research results and simply phrased statements of methodology for utilizing the information, would be added indication that objectives 1, 2, and 3 had been achieved. Publication of results in international scientific journals that required critical editorial review would indicate that the project had been productive of scientifically sound information.

The training of technical and scientific personnel who demonstrate capability of conducting independent research and of convincingly transmitting the results of research to livestock producers will be a further measure of success. The acceptance and use of the products

of research (information and breeding stock) by individual local breeders to improve the productivity of their animals will clearly be the ultimate measure of success of the project.

E. ASSUMPTIONS ON ACHIEVEMENTS OF OBJECTIVES

Certain conditions are required for successful achievement of objectives. These include (a) availability of resources (land, animals, facilities, and support personnel) on a continuing long term basis (at least 10 years) in the LDC's and (b) control of the resources by the Principle Investigator so that experimental procedures can be imposed on the animals and relevant data collected. Conditions that would prevent or severely curtail the orderly execution of the experimental plans and achievement of objectives would include (a) failure of LDC to support the project in terms of needed resources on a continuing basis; (b) lack of commitment to the program by failure to authorize the Principle Investigator or his representative to control the research and to make decisions that affect the integrity of the project; (c) severe and protracted drought or other natural phenomena that would require abandonment of the experimental effort; (d) political unrest that would adversely affect continuity of the research. The achievement of objective 4 depends in a large part on the modification of husbandry practices that will permit the effective use of selected breeding stock from the project to improve production potential, and to establish animal selection as an integral part of local animal husbandry practices. This will require a change in management of male animals to insure that selected males do in fact sire the next generation of progeny. If this concept cannot be achieved through education, the ultimate success of the project ot improve production could be hampered.

F. ASSUMPTIONS THAT ACHIEVING OBJECTIVES WILL SOLVE THE PROBLEMS

Improving animals genetically is but one facet of the solution of the problem of increasing the production of animal products per unit of land area. Closely associated with this effort are improving the feed resource through range management and improving the health status of the livestock. If these three components (breeding, nutrition and health) of the Small Ruminant CRSP and the systems modeling group achieve their respective objectives to a major degree, the basic information and necessary methodology for improving animal productivity will result. The research and training portions of the project are closely interrelated with regard to success.

G. OUTPUTS OF THE PROJECT

The basic outputs of this project will be increased number of trained personnel, a substantial body of factual data that describes the potential for increased food and fiber from sheep and goats, methodology for effecting genetic improvement within the environment(s) that exist in the LDC's, and the production of experimental animals that will improve the production potential of indigeneous animals.

In addition, this project will provide experimental animals to other projects in the Program to meet their needs in many instances, particularly the range management and animal health projects. This project can supply certain relevant data to the systems modeling projects. Coordination of research activity among these four components of the CRSP will be mutually beneficial.

3. TECHNICAL FEASIBILITY

The project as outlined, relies heavily on existing animal breeding

knowledge. The underlying principles of animal genetics, biometrical relationships among animals in natural populations, and application of the principles of selection to animal improvement are well established. What is lacking in the LDC's are the essential statistics concerning the indigeneous animal populations to guide the breeder in developing animal breeding plans appropriate to the conditions. Effective animal breeding plans can be developed if suitable numbers of experimental animals are available from which to generate the necessary statistics. It is less clear whether substantial impact on our understanding of the biology of animal adaptation can be achieved. However, the opportunity exists to study certain basic principles of animal biology that relates directly to production problems.

FINANCIAL PLAN*

1978-79

Item	Fund Source: AID-Title XII U.S.	AID-Title XII LDC's	MSU/ MAES	Each LDC
Salary-Principle Investigators (1.25	36,520			
Salary - Other Faculty			9,600	3,000
Salary - Clerical and labor		4,000	5,000	3,000
Salary - Technicians		15,000		
Salary - Graduate Research Assistants	20,000		5,000	
Salary - Project Managers		20,000		
Support - Project Managers		20,000		
Personnel Benefits	5,313	5,460	2,094	
Indirect Costs - Campus (52%)	32,153		11,281	
Indirect Costs - Off-campus (35%)			15,561	
Domestic Travel (U.S.)	3,000		500	
Domestic Travel (LDC's)		8,000		
International Travel	15,000			
Computer			1,000	
Supplies, Fees, Feed & Pasture	2,000	3,000	10,000	2,000
Communications		2,400		
Experimental Animals		6,000		6,000
Office/Lab Rental		4,000		2,000
Equipment				4,000
Publications				
Less indirect costs as cost sharing	(1,846)		1,846	
Totals	$112,140	$87,860	$61,882	$20,000

Total AID-Title XII $200,000

*See: Comments and assumptions regarding budget on the last page in this section.

FINANCIAL PLAN

1979/80 - 1982/83

Item	Fund Source: AID-Title Xii U.S.	AID-Title Xii Overseas	MSU/ MAES	Each LDC
a. Personnel (salaries and benefits)				
R. L. Blackwell - 0.80 SY				
P. J. Burfening - 0.27 SY	41,633			
D. D. Kress - 0.20 SY				
Graduate Research Assistants (4)	20,200		5,050	
Other faculty			10,944	5,000
Technicians		17,100		
Support staff		6,840	5,700	12,000
b. Major equipment, facilities and livestock		17,000		13,000
c. Travel and per diem	2,000	18,000	500	
d. LDC site maintenance share		30,000		
e. Other direct costs	2,300	12,774	12,800	10,000
f. Indirect costs	32,153		11,281	
(indirect costs as cost sharing)	(15,707)		15,707	
g. Totals	$98,286	$101,714	$61,982	$40,000
TOTAL AID-Title XII	$200,000			

FINANCIAL PLAN

1978-79

Item	Fund Source: AID-Title XII U.S.	AID-Title XII Overseas	MSU/ MAES	Each LDC
a. Personnel (salaries and benefits)				
R. L. Blackwell - 0.80 SY				
P. J. Burfening - 0.25 SY	41,633			
D. D. Kress - 0.20 SY				
Graduate Research Assistants (4)	20,200		5,050	
Other faculty			10,944	3,000
Technicians		17,100		
Support Staff		5,700	5,700	3,000
b. Major equipment, facilities and livestock		10,000		12,000
c. Travel and per diem	3,000	23,000	500	
d. LDC site maintenance share		30,000		
e. Other direct costs	2,000	7,234	11,000	2,000
f. Indirect costs	32,153	7,980	11,281	
(Indirect costs as cost sharing)	(17,407)		17,407	
g. Totals	$98,986	$101,014	$61,882	$20,000
TOTAL AID-Total XII	$200,000			

LOGICAL FRAMEWORK

Total U.S. Funding $2,633,000
Date Prepared: May, 1978

Project Title & Number: Evaluation and Genetic Improvement of Sheep and Goats in Extensive Management

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: To evaluate indigenous breeds of sheep and goats, identify those with genetic potential for increasing productivity of animals in the regions. To increase the number and competence of animal breeding specialists in the LDC's. Develop programs for producing and utilizing improved animals.	Conditions that will indicate purpose has been achieved: End of project status. Experimental breeding herds develop that will improve the genetic capability for food and fiber productio of sheep and goats in the region. Published results of research and formulated breeding plans useful under local conditions. Published research results that have broad scientific interest and application to other areas. Increased number of trained scientific and technical personnel.	Results of well designed breeding tests; publication of experimental data and statistical information that describes levels of production, population characteristics, and opportunity for improvement. Success of training program evaluated by increase in number and level of competence of scientific and technical personnel and their participation in the project.	Assumptions for achieving purpose: That a stable political and social environment will prevail, that necessary cooperation and resources for the research from LDC's will emerge, that potentially competent personnel will be available to participate in the program, that continued funding of sufficient magnitude will be provided to carry out the work.
Outputs: Publications in forms suitable for use in LDC's and by scientific personnel throughout the world. Increased level of competent, technical personnel in animal breeding. Production of breeding animals that will transmit superior production potential to their progeny.	Magnitude of Outputs: Publications include relevant information to develop programs for genetic improvement. Train at the M.S. level three to five students annually, provide inservice training for technicians and leaders in animal production. Animals produced in the project with documented superiority made available to the producers.	Peer review of scientific publications at MSU and editorial review by publishing journal. Applied publications reviewed by MSU, Technical Committee and personnel in LDC's. Training evaluated according to policies and standards at MSU. Animal evaluation based on accepted procedures in animal breeding.	Assumptions for achieving outputs: That the projects are sufficiently large (numbers of experimental animals and training component) to insure biologically and statistically meaningful data will be derived, that a sufficient number of breeding animals will be produced and utilized to have an impact on the charact of the animal populations locally. That enough trained personnel will result to carry out meaningful research and teaching programs in the LDC's.
Inputs: AID-Title XII funds, Support from Montana State University in a closely related sheep breeding research project, experienced personnel to guide the project, support from LDC institutions in terms of scientific and technical personnel, labor, facilities, animals and land.	Implementation Target (Type and Quantity) Establish LDC contacts, planning and initiation of research 1978-79, breeds evaluation, initial selection and specific matings made during 1979-83, selection experiments and evaluation of selected stocks in multiplier herds 1983-88.	Annual review of project execution on site by PI's, evaluation of progress reports, publications by Technical and Advisory Committees and JRC and AID. Training component evaluated by MSU, PI's and representatives of LDC's.	Assumptions for providing inputs: That project will be approved by JRC and AID, that project will be funded by AID and acceptance by MSU administration, that LDC's will collaborate in the work as indicated, that the necessary additional scientific and technical personnel can be empl to assist with the research.

RESUME'

Robert L. Blackwell

Education:

New Mexico State University - B. S. (Agriculture)	1949
Oregon State University - M. S. (Animal Genetics)	1951
Cornell University - PhD. (Animal Breeding)	1953

Experience:

Assistant Professor, Department of Animal Husbandry
New Mexico State University (1953-57)

Associate Professor, Department of Animal Husbandry
New Mexico State University (1957-December 1958)

Director, U. S. Sheep Experiment Station, Agricultural
Research Service, U.S.D.A. (January 1959-February 1966)

Professor of Animal Science and Head, Department of Animal and Range
Sciences, Montana State University (March 1966-present)

Additional Applicable Experience

Member of Consultant team on Agricultural Experiment Station Development in Saudi Arabia. November, 1975.

Geneticist in Cooperative State Research Service, USDA, under Intergovernmental Personnel Act, November, 1976 - June, 1977.

Served on Western Regional Task Force on Regional Research Planning.

Publications

Hulet, C. V., S. K. Ercanbrack, D. A. Price, R. L. Blackwell and L. O. Wilson. 1962. Mating behavior of the ram in the one-sire pen.

Hulet, C. V., S. K. Ercanbrack, R. L. Blackwell, D. A. Price and L. O. Wilson. 1962. Mating behavior of the ram in the multi-sire pen. Journal of Animal Science. 21:865.

Hulet, C. V., R. L. Blackwell, S. K. Ercanbrack, D. A. Price and L. O. Wilson. 1962. Mating behavior of the ewe. Journal of Animal Science. 21:870.

Hulet, C. V., R. L. Blackwell, and others. 1962. Effects of feed and length of flushing period on lamb production in range ewes. Journal of Animal Science. 21:505.

Burfening, P. J., J. L. Van Horn, and R. L. Blackwell. 1971. Genetic and Phenotypic parameters in Rambouillet ewe lambs with special reference to estrus as ewe lambs. Journal of Animal Science. 33:919.

ROJECT TITLE: A Program to Improve Sheep and Goat Production by Reduction of Disease Losses (Herd/Flock Health Program)

EW OR EXTENSION: New Project

RANTEE: Washington State University, Pullman, Washington

RINCIPAL INVESTIGATOR: William G. Huber

URATION: Five years with renewal option

OTAL ESTIMATED COSTS, BY YEARS:[1]

	Agency for International Development	Institution Cost Sharing	Total	Cost Sharing as Percentage of Total	LDC
Year 1	$149,999	$105,365	$255,364	41.26%	$48,907
Year 2	$149,999	$105,365	$255,364	41.26%	$48,907
Year 3	$149,999	$105,365	$255,364	41.26%	$48,907
Year 4	$149,999	$105,365	$255,364	41.26%	$48,907
Year 5	$149,999	$105,365	$255,364	41.26%	$48,907
Total	$749,995	$526,825	$1,276,820	41.26%	$244,535

RIOR FUNDING: None

ID MANAGER:

The budget required for Years 6-10 are estimated in the narrative section.

ABSTRACT

Diseases, acute and chronic, especially internal and ecto-parasitic diseases, reduce production efficiency of sheep and goats throughout the world. Thus, there is unnecessary wastage of nutrient resources. The objective of this proposal is to implement effective preventive, therapeutic, and control measures to reduce mortality and disease prevalence in LDC's. This program will increase the production of food and fiber in the LDC's and will provide additional valuable information for the sheep and goat growers in the United States. In order to meet this objective, the following approach will be taken: (1) Assessment of the prevalence and economic significance of small ruminant diseases and ecto-parasites; (2) adaptation and modification of known successful control and prevention programs, development of new research and development approaches to small ruminant diseases, and initiation of a program of improved animal health management, chemoprophylaxis, and therapeusis; (3) coordination of information regarding small ruminant diseases with nutrition, genetics, and land management in the establishment and implementation of herd and flock health programs; (4) expansion of the technologies within the LDC through interaction with their scientists and providing graduate education for selected students from LDC's; (5) assist the LDC in training existing personnel as animal health technicians (paraprofessionals) in disease control programs, diagnostic, extension, and research techniques important to HHP's; and (6) assist the LDC in developing a health care delivery system incorporating the application of new technologies to small ruminant resources.

The establishment of a small ruminant health project will result in the harvesting of a necessary and critical body of knowledge to address disease problems of small ruminants. Expanded and improved communications programs will develop, bridging the gap of information from research to practical application under field conditions. The improved disease prevention and control methods will eventually dominate disease treatment, a less efficient approach. This program will result in more food and fiber becoming available in the LDC and an improvement in production efficiency.

2(a) DESCRIPTION OF PROBLEM

Diseases, acute and chronic, especially internal and ectoparasitic diseases, reduce production efficiency of sheep and goats throughout the world. Thus, there is unnecessary wastage of nutrient resources. Effective preventive, therapeutic, and control measures to reduce mortality and disease prevalence can facilitate significant production of increased food and fiber in areas of LDC's as well as providing valuable information for the sheep and goat growers in the United States. Data from current research projects and ongoing Herd Health Programs (HHP's) at our institutions relating to the following disease and parasitic conditions would be directly applied to LDC's: reproductive diseases such as vibriosis, enzootic abortion, and brucellosis; parasitic diseases such as liver flukes, coccidiosis, and hemonchiasis; and viral and bacterial diseases of the neonate. This research data, in coordination with input from the fields of nutrition, genetics, land management, and animal husbandry will be used to develop effective HHP's in the target LDC. Disease prevention and control should eventually dominate disease treatment, a less efficient approach. There are several diseases of small ruminants in LDC's that can be controlled by present technologies and animal health management utilized in U.S. flocks having Herd Health Programs.

2(b) OBJECTIVES OF PROJECT

1. To assess the prevalence and economic significance of major small ruminant diseases and ectoparasites.

2. To adapt and modify known successful contol and prevention programs, to develop new research and development approaches to small ruminant diseases, and to initiate a program of improved animal health management, chemoprophylaxis, and therapeusis.

3. To coordinate information regarding small ruminant diseases, nutrition, genetics, animal husbandry, and land management in the establishment and implementation of HHP's.

4. To expand the technologies within the LDC through interaction with their scientists and provide graduate education for selected students from LDC's.

5. To assist the LDC in training existing personnel as animal health technicians (paraprofessionals) in disease control programs, diagnostic, extension, and research techniques important to HHP's.

6. To assist the LDC in developing a health care delivery system incorporating the application of new technologies to small ruminant resources.

(c) PROJECT APPROACH

The initial phase will include establishment of a working relationship with the collaborating institution. During this period, sheep and goat disease prevalence data will be gathered with the assistance of LDC professionals and cooperative growers. On-site surveys of sheep and goat operations will also be conducted. The following are examples of items which will be included

in the survey: regional or location effect, seasonal variation, morbidity, mortality, management practices, existing control methods, and regulatory disease control practices.

The disease assessment survey data will be used as a basis for the facilitation and the expansion of ongoing sheep and goat disease research programs to the needs of the LDC. Initiation of control and prevention programs will include implementation of programs of chemoprophylaxis and therapeusis as well as including input and coordination with nutrition, genetics, animal husbandry, and land management projects.

The assistance of LDC animal health technicians and local professionals will be interdigitated with U.S. personnel to provide an effective information team to help establish good acceptance of suggested herd health programs.

After initial contacts have been made with LDC scientists, collaborating research projects will be selected by both institutions. Washington project scientists will develop a collaborative effort with LDC scientists for a plan of action for adaptation of their research talents and activities to the needs of the LDC. The multidisciplinary team of scientists will plan the approach to utilize the initial assessment data in developing short and long term research projects applicable to the LDC. The entire team will coordinate the protocol via the project's executive committee thereby establishing the plan of action

for the disease research and control program. If necessary, research projects will be modified and/or expanded according to the needs of the LDC.

In conjunction with research efforts, U.S. scientists will also assist training LDC personnel in procedures of diagnoses, disease control, and research techniques.

Students from the LDC institution will be selected for graduate study. The collaborating LDC researcher will be a member of the student's graduate committee. In most instances, the student will receive academic instruction and training in research in Idaho and Washington, but thesis research will be conducted at the LDC institution bringing available technology to the LDC. Cooperating U.S. scientists will travel to the foreign institution as required to initiate and supervise the research and otherwise assist the graduate student and the collaborating scientist.

Once the collaborative research program is underway and initial herd health plans have been implemented, policy recommendations will be made for the establishment of a health care delivery system which would include a continuing education program for LDC veterinarians, animal health technicians, and animal growers. This delivery system will include new technologies established in the U.S. and will be applied to existing LDC programs. In addition, proper implementation and effectiveness of existing HHP's will be monitored and evaluations made accordingly. Results from these evaluation surveys will then be used to make policy changes relating to the delivery systems.

2(d) CONDITIONS THAT WILL INDICATE OBJECTIVES HAVE BEEN ACHIEVED

Significant Ruminant Diseases

The data obtained from the disease survey will indicate those small ruminant diseases of economic importance to the LDC. Approximately one complete case study for each 1,000 animals will indicate the objective has been achieved.

Initiation of Control and Prevention Programs

This objective will be achieved when a minimum of 20 herd health programs have been initiated and are operable.

Initiation of Collaborative Research Program

This objective will be achieved when small ruminant research projects in the LDC and U.S. have been jointly conceived and initiated as indicated by the collection and assessment of survey data, the preparation and publication of reports for growers and small ruminant research workers, the preparation of information to assist the improvement of animal management, and the generation of cooperative research proposals to reduce small ruminant diseases that will qualify for funding from other extramural sources.

Graduate and Animal Health Technical Training

This objective will be achieved when students have received the M.S. degree each year, starting with Year 2, and when individuals have been trained as animal health

technicians or paraprofessionals each year starting with Year 2. Greater numbers of students can be trained if additional financial support can be obtained or if graduate students are available who do not require financial assistance.

Applications of New Techniques and Methods

This objective will be achieved when each new technique or method has been suitably tested and applied under field conditions and a document prepared for publication in lay or professional journals.

2(e) ASSUMPTIONS ON ACHIEVEMENT OF OBJECTIVES (EXTERNALITIES OUTSIDE CONTROL OF PI)

The assumptions are as follows: (1) that the LDC has the capability to improve the level of scientific sophistication to incorporate new methodologies and techniques; (2) that an effective system of extension and communication can be developed in the LDC to maximize the transition of developing disease control systems to routine applied use; (3) that the LDC institution provide support for obtaining the disease surveillance information; (4) that maximal cooperation of LDC animal disease research stations and centers results in support of exchange of disease prevalance information and the willingness to enforce or enact mutually beneficial

disease control practices and regulations; and (5) that environmental conditions will not adversely affect the efficacy of drugs and biologics used successfully in other climatic conditions.

2(f) ASSUMPTIONS THAT ACHIEVING OBJECTIVES WILL SOLVE PROBLEM

The assumptions are as follows: (1) that establishment of a disease surveillance system will identify those entities of greatest economic importance; (2) that disease entities established in assumption #1 will be successfully researched to facilitate preventive and control programs; (3) that the LDC will contribute "extension-type" individuals capable of effectively communicating new and different animal health procedures; and (4) that a collaborative education program can be organized to encourage graduate students at both the LDC site and U.S. site and encourage training of animal health technicians at the LDC site.

2(g) OUTPUTS OF PROJECT

The following conditions are expected to be achieved at the end of the flock health project: (1) Effective small ruminant disease control and prevention programs will reduce mortality, morbidity and "nutrient wastage" and thereby improve the availability of food and fiber to the people of

the LDC. (2) The animal disease status of the LDC will be better defined by the initiation and operation of the disease surveillance and control system. (3) An improved level of scientific sophistication of diagnostic techniques will be achieved. (4) Additional personnel at the graduate level and the animal health technician level will be trained, thus expanding the research and control base to address disease problems of small ruminants and to control disease outbreaks. (5) New methods of disease prevention and control will be developed. (6) Expanded communications programs will develop, bridging the gap of improvements through research to practical application under field conditions, e.g., extension-type programs and publications. (7) A necessary and critical body of knowledge dealing with research information of small ruminants will be published in lay and science journals.

3. TECHNICAL FEASIBILITY

Experienced researchers of small ruminant diseases have demonstrated that establishment of herd health programs for selected sheep and goat units have improved production efficiency from 20 to 50% within a period of 4 years. This improved production will be achieved by reduction of diseases of a sporadic epizootic and continuous attrition nature, effective animal disease control programs, and training of

paraprofessionals needed in the sheep and goat production units. It is our judgement that the host country has the ability to utilize and maintain techniques and features of proposed herd health programs.

The University of Idaho and Washington State University have a cooperative program in teaching, research, and service in veterinary medicine which includes a program of research on food animal diseases, including sheep and goats. A cooperative graduate program, leading to either the M.S. or Ph.D. degree, places substantial emphasis on research on diseases of sheep and goats. An extension program in the field of sheep diseases is in operation.

The U.S. Sheep Experiment Station located at Dubois, Idaho, is a unique resource for sheep diseases. The station has a population of approximately 5,000 head of sheep on which it maintains individual computer records. In this flock, it is possible to conduct epidemiologic studies and large-scale research aimed at prevention and control of sheep diseases not possible anywhere else in the United States.

WASHINGTON STATE UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

Budget Proposal
Improvement of Sheep and Goat Production
by Reduction of Disease Loss

	FTE	Agency for International Development	Institution Cost Sharing	LDC Estimate
NEL				
es:[1]	FTE			
William G.	0.20			
		$ 1,760	$ 2,640	---
		1,760	2,640	---
ubtotal, W. G. Huber		$ 3,520	$ 5,280	---
Norman[2] (see Other Costs Section)				
Floyd W. (see tant Section)				
, William	0.35			
		$ 1,590	$ 2,120	---
		1,590	2,120	---
btotal, W. Foreyt		$ 3,180	$ 4,240	---
James	0.15			
			$ 7,000	
d, Timothy	0.20			
		$ 2,400	$ 2,400	---
		600	600	---
btotal, T. Crawford		$ 3,000	$ 3,000	---
, Richard	0.25			
		$ 2,800	$ 4,200	---
		700	1,050	---
btotal, R. Wescott		$ 3,500	$ 5,250	---
ive V.M. Clinician and miologist	0.50			
		$ 1,500	---	---
		13,500	---	---
btotal, Preventive V.M. Clinician and Epidemiologist		$15,000	---	---

alary increases and other inflationary costs are not in the budget. All calculations ed on FY 79 dollars. Upon final negotiation it is understood that AID will provide for osts or the personnel effort and the scope of the project will require reduction. The is submitted in this manner as requested for the ease of comparing to other budget ls of the "Small Ruminant Program."

he salary for the .250 FTE of Norman Gates is included in the Other Direct Costs y as a subcontract with the USDA.

		Agency for International Development	Institution Cost Sharing	LDC Estimate
nnel (continued)				
ogy, Bacteriology, Protozoology, itology, Hemoprotozoology, ology, Microbiology, Pharmacology, oxicology[3]				
		---	$15,000	---
ate Trainees				
		$11,533	11,533	---
national Graduate Trainees oned at LDC		---	---	$17,300
icians	2.00			$19,104
ical Support, Preventive Clinician and Epidemiologist				$ 2,634
cal Assistant	0.50			
		$ 1,817	$ 2,725	---
cal Support, Preventive Clinician and nologist	0.25	---	---	$ 2,271
, Salaries				
		$23,400	$47,618	---
		18,150	6,410	$41,309
, Salaries		$41,550	$54,028	$41,309
tant Fees				
, Floyd W.				
		$ 990	---	---
		1,485	---	---
Consultant Fees		$ 2,475	---	---
ee Benefits				
faculty and staff salaries				
		$ 2,729	$ 8,300	---
		4,175	1,474	$ 5,522
ubtotal, Faculty and Staff Benefits		$ 6,904	$ 9,774	$ 5,522
graduate assistant salaries				
		$ 1,384	$ 1,384	---
		---	---	$ 2,076
ubtotal, Graduate Assistant Benefits		$ 1,384	$ 1,384	$ 2,076

Personnel involved less than 0.15 FTE: Several faculty will be working on diseases of ruminants in the disciplines of virology, bacteriology, protozoology, parasitology, otozoology, immunology, microbiology, pharmacology, and toxicology, i.e., bluetongue, is lymphadenitis, chlamydial and viral infectious, trypanosomiasis, coccidiosis, mastitis, al diseases, foot rot, goat arthritis, enzootic pneumonia, plant toxicities. Involvement ious personnel time committment for each year will vary with the prevalence of economically ant diseases in the LDC to be assigned and the research talent at WSU.

	Agency for International Development	Institution Cost Sharing	LDC Estimate
l, Employee Benefits			
	$ 4,113	$ 9,684	---
	4,175	1,474	$ 7,598
l, Employee Benefits	$ 8,288	$11,158	$ 7,598
l, PERSONNEL COSTS			
	$28,508	$57,302	---
	23,810	7,884	$48,907
l, PERSONNEL COSTS	$52,313	$65,186	$48,907
R EQUIPMENT, FACILITIES, AND ANIMALS			
	$ 9,600	---	---
	3,200	---	---
l, MAJOR EQUIPMENT, FACILITIES AND ANIMALS	$12,800	---	---
EL			
Fare			
	$ 1,000	---	---
	4,036	---	---
Subtotal, Air Fare	$ 5,036	---	---
Diem, 135 days @ $50/day			
	$ 1,350	---	---
	5,400	---	---
Subtotal, Per Diem	$ 6,750	---	---
., TRAVEL			
	$ 2,350	---	---
	9,436	---	---
., TRAVEL	$11,786	---	---
MAINTENANCE AT LDC			
	$22,500	---	---
DIRECT COSTS (includes USDA ntract)			
	$16,240	---	---
	24,360	---	---
, OTHER DIRECT COSTS	$40,600	---	---
DIRECT COSTS			
	$56,693	$57,302	---
	83,306	7,884	$48,907
, DIRECT COSTS	$139,999	$65,186	$48,907

	Agency for International Development	Institution Cost Sharing	LDC Estimate
RECT COSTS			
% of Salaries			
	$10,000	$40,179	---
L OPERATING COSTS			
	$ 66,693	$ 97,481	---
	83,306	7,884	$ 48,907
I, OPERATING COSTS	$149,999	$105,365	$ 48,907

Sharing as Percentage of Proposal 41.26%

The following budgets, Years 2-5, are presented as requested taking into consideration:

1) Personnel changes may occur based on the results of the disease survey of the first year, i.e., the identification of those diseases of major economic importance and involving the appropriate scientists at the U.S. and LDC institutions.

2) The matter of salary increases and inflationary costs are not included in the budget. All calculations are based on FY 79 dollars. Upon final negotiation it is understood that AID will provide for these costs or the personnel effort and the scope of the project will require reduction. The budget is submitted in this manner as requested, for the ease of comparing to other budget proposals of the "Small Ruminant Program."

WASHINGTON STATE UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

Budget Proposal
Improvement of Sheep and Goat Production
by Reduction of Disease Loss

	FTE	Agency for International Development	Institution Cost Sharing	LDC Estimate
2				
NEL				
es:[1]				
William G.	0.20			
		$ 1,760	$ 2,640	---
		1,760	2,640	---
ubtotal, W. G. Huber		$ 3,520	$ 5,280	---
Norman[2] (see Other Costs Section)				
Floyd W. (see tant Section)				
William	0.35			
		$ 1,590	$ 2,120	---
		1,590	2,120	---
ibtotal, W. Foreyt		$ 3,180	$ 4,240	---
James	0.15			
			$ 7,000	
d, Timothy	0.20			
		$ 2,400	$ 2,400	---
		600	600	---
btotal, T. Crawford		$ 3,000	$ 3,000	---
, Richard	0.25			
		$ 2,800	$ 4,200	---
		700	1,050	---
btotal, R. Wescott		$ 3,500	$ 5,250	---
ive V.M. Clinician and niologist	0.50			
		$ 1,500	---	---
		13,500	---	---
btotal, Preventive V.M. Clinician and Epidemologist		$15,000	---	---

alary increases and other inflationary costs are not in the budget. All calculations ed on FY 79 dollars. Upon final negotiation it is understood that AID will provide for osts or the personnel effort and the scope of the project will require reduction. The is submitted in this manner as requested for the ease of comparing to other budget ls of the "Small Ruminant Program."

e salary for the .250 FTE of Norman Gates is included in the Other Direct Costs as a subcontract with the USDA.

		Agency for International Development	Institution Cost Sharing	LDC Estimate
nnel (continued)				
ogy, Bacteriology, Protozoology, itology, Hemoprotozoology, ology, Microbiology, Pharmacology, oxicology[3]				
		---	$15,000	---
ate Trainees				
		$11,533	11,533	---
ational Graduate Trainees oned at LDC		---	---	$17,300
icians	2.00			$19,104
ical Support, Preventive linician and Epidemiologist				$ 2,634
al Assistant	0.50			
		$ 1,817	$ 2,725	---
al Support, Preventive linician and ologist	0.25	---	---	$ 2,271
Salaries				
		$23,400	$47,618	---
		18,150	6,410	$41,309
Salaries		$41,550	$54,028	$41,309
tant Fees				
Floyd W.				
		$ 990	---	---
		1,485	---	---
Consultant Fees		$ 2,475	---	---
ee Benefits				
faculty and staff salaries				
		$ 2,729	$ 8,300	---
		4,175	1,474	$ 5,522
ubtotal, Faculty and Staff Benefits		$ 6,904	$ 9,774	$ 5,522
graduate assistant salaries				
		$ 1,384	$ 1,384	---
		---	---	$ 2,076
ubtotal, Graduate Assistant Benefits		$ 1,384	$ 1,384	$ 2,076

[3]ersonnel involved less than 0.15 FTE: Several faculty will be working on diseases of uminants in the disciplines of virology, bacteriology, protozoology, parasitology, otozoology, immunology, microbiology, pharamcology, and toxicology, i.e., bluetongue, lymphadenitis, chlamydial and viral infectious, trypanosomiasis, coccidiosis, mastitis, l diseases, foot rot, goat arthritis, enzootic pneumonia, plant toxicities. Involvement ious personnel time committment for each year will vary with the prevalence of economically nt diseases in the LDC to be assigned and the research talent at USU

	Agency for International Development	Institution Cost Sharing	LDC Estimate
ıl, Employee Benefits			
	$ 4,113	$ 9,684	---
	4,175	1,474	$ 7,598
ıl, Employee Benefits	$ 8,288	$11,158	$ 7,598
ıl, PERSONNEL COSTS			
	$28,508	$57,302	---
	23,810	7,884	$48,907
ıl, PERSONNEL COSTS	$52,313	$65,186	$48,907
R EQUIPMENT, FACILITIES, AND ANIMALS			
	$ 9,600	---	---
	3,200	---	---
l, MAJOR EQUIPMENT, FACILITIES AND ANIMALS	$12,800	---	---
EL			
Fare			
	$ 1,000	---	---
	4,036	---	---
Subtotal, Air Fare	$ 5,036	---	---
Diem, 135 days @ $50/day			
	$ 1,350	---	---
	5,400	---	---
Subtotal, Per Diem	$ 6,750	---	---
L, TRAVEL			
	$ 2,350	---	---
	9,436	---	---
L, TRAVEL	$11,786	---	---
MAINTENANCE AT LDC			
	$22,500	---	---
R DIRECT COSTS (includes USDA ontract)			
	$16,240	---	---
	24,360	---	---
L, OTHER DIRECT COSTS	$40,600	---	---
L DIRECT COSTS			
	$56,693	$57,302	---
	83,306	7,884	$48,907
l, DIRECT COSTS	$139,999	$65,186	$48,907

	Agency for International Development	Institution Cost Sharing	LDC Estimate
IRECT COSTS			
5% of Salaries			
•	$10,000	$40,179	---
AL OPERATING COSTS			
•	$ 66,693	$ 97,481	---
	83,306	7,884	$ 48,907
l, OPERATING COSTS	$149,999	$105,365	$ 48,907

t Sharing as Percentage of Proposal 41.26%

WASHINGTON STATE UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

Budget Proposal
Improvement of Sheep and Goat Production
by Reduction of Disease Loss

	FTE	Agency for International Development	Institution Cost Sharing	LDC Estimate
3				
IEL				
es:[1]	FTE			
William G.	0.20			
		$ 1,760	$ 2,640	---
		1,760	2,640	---
btotal, W. G. Huber		$ 3,520	$ 5,280	---
Norman[2] (see Other Costs Section)				
Floyd W. (see ant Section)				
William	0.35			
		$ 1,590	$ 2,120	---
		1,590	2,120	---
btotal, W. Foreyt		$ 3,180	$ 4,240	---
James	0.15			
			$ 7,000	
l, Timothy	0.20			
		$ 2,400	$ 2,400	---
		600	600	---
btotal, T. Crawford		$ 3,000	$ 3,000	---
Richard	0.25			
		$ 2,800	$ 4,200	---
		700	1,050	---
total, R. Wescott		$ 3,500	$ 5,250	---
ve V.M. Clinician and iologist	0.50			
		$ 1,500	---	---
		13,500	---	---
total, Preventive V.M. Clinician and Epidemologist		$15,000	---	---

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e salary for the .250 FTE of Norman Gates is included in the Other Direct Costs as a subcontract with the USDA.

		Agency for International Development	Institution Cost Sharing	LDC Estimate
onnel (continued)				
logy, Bacteriology, Protozoology, sitology, Hemoprotozoology, nology, Microbiology, Pharmacology, Toxicology[3]				
		---	$15,000	---
ate Trainees				
		$11,533	11,533	---
national Graduate Trainees oned at LDC		---	---	$17,300
icians	2.00			$19,104
ical Support, Preventive Clinician and Epidemiologist				$ 2,634
cal Assistant	0.50			
		$ 1,817	$ 2,725	---
cal Support, Preventive Clinician and nologist	0.25	---	---	$ 2,271
Salaries				
		$23,400	$47,618	---
		18,150	6,410	$41,309
Salaries		$41,550	$54,028	$41,309
tant Fees				
Floyd W.				
		$ 990	---	---
		1,485	---	---
Consultant Fees		$ 2,475	---	---
ee Benefits				
faculty and staff salaries				
		$ 2,729	$ 8,300	---
		4,175	1,474	$ 5,522
ubtotal, Faculty and Staff Benefits		$ 6,904	$ 9,774	$ 5,522
graduate assistant salaries				
		$ 1,384	$ 1,384	---
		---	---	$ 2,076
ubtotal, Graduate Assistant Benefits		$ 1,384	$ 1,384	$ 2,076

Personnel involved less than 0.15 FTE: Several faculty will be working on diseases of ruminants in the disciplines of virology, bacteriology, protozoology, parasitology, otozoology, immunology, microbiology, pharamcology, and toxicology, i.e., bluetongue, s lymphadenitis, chlamydial and viral infectious, trypanosomiasis, coccidiosis, mastitis, al diseases, foot rot, goat arthritis, enzootic pneumonia, plant toxicities. Involvement ious personnel time committment for each year will vary with the prevalence of economically ant diseases in the LDC to be assigned and the research talent at WSU.

	Agency for International Development	Institution Cost Sharing	LDC Estimate
1, Employee Benefits			
	$ 4,113	$ 9,684	---
	4,175	1,474	$ 7,598
1, Employee Benefits	$ 8,288	$11,158	$ 7,598
1, PERSONNEL COSTS			
	$28,508	$57,302	---
	23,810	7,884	$48,907
1, PERSONNEL COSTS	$52,313	$65,186	$48,907
R EQUIPMENT, FACILITIES, AND ANIMALS			
	$ 9,600	---	---
	3,200	---	---
1, MAJOR EQUIPMENT, FACILITIES AND ANIMALS	$12,800	---	---
EL			
are			
	$ 1,000	---	---
	4,036	---	---
Subtotal, Air Fare	$ 5,036	---	---
iem, 135 days @ $50/day			
	$ 1,350	---	---
	5,400	---	---
Subtotal, Per Diem	$ 6,750	---	---
, TRAVEL			
	$ 2,350	---	---
	9,436	---	---
, TRAVEL	$11,786	---	---
MAINTENANCE AT LDC			
	$22,500	---	---
DIRECT COSTS (includes USDA ntract)			
	$16,240	---	---
	24,360	---	---
, OTHER DIRECT COSTS	$40,600	---	---
DIRECT COSTS			
	$56,693	$57,302	---
	83,306	7,884	$48,907
, DIRECT COSTS	$139,999	$65,186	$48,907

	Agency for International Development	Institution Cost Sharing	LDC Estimate
RECT COSTS			
% of Salaries			
	$10,000	$40,179	---
L OPERATING COSTS			
	$ 66,693	$ 97,481	---
	83,306	7,884	$ 48,907
1, OPERATING COSTS	$149,999	$105,365	$ 48,907

Sharing as Percentage of Proposal 41.26%

WASHINGTON STATE UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

Budget Proposal
Improvement of Sheep and Goat Production
- by Reduction of Disease Loss

	FTE	Agency for International Development	Institution Cost Sharing	LDC Estimate
4				
NNEL				
ies:[1]	FTE			
. William G.	0.20			
		$ 1,760	$ 2,640	---
		1,760	2,640	---
Subtotal, W. G. Huber		$ 3,520	$ 5,280	---
, Norman[2] (see Other t Costs Section)				
, Floyd W. (see tant Section)				
, William	0.35			
		$ 1,590	$ 2,120	---
		1,590	2,120	---
ubtotal, W. Foreyt		$ 3,180	$ 4,240	---
, James	0.15			
			$ 7,000	
rd, Timothy	0.20			
		$ 2,400	$ 2,400	---
		600	600	---
ubtotal, T. Crawford		$ 3,000	$ 3,000	---
t, Richard	0.25			
		$ 2,800	$ 4,200	---
		700	1,050	---
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tive V.M. Clinician and emiologist	0.50			
		$ 1,500	---	---
		13,500	---	---
ubtotal, Preventive V.M. Clinician and Epidemologist		$15,000	---	---

Salary increases and other inflationary costs are not in the budget. All calculations sed on FY 79 dollars. Upon final negotiation it is understood that AID will provide for costs or the personnel effort and the scope of the project will require reduction. The is submitted in this manner as requested for the ease of comparing to other budget ls of the "Small Ruminant Program."

The salary for the .250 FTE of Norman Gates is included in the Other Direct Costs y as a subcontract with the USDA.

		Agency for International Development	Institution Cost Sharing	LDC Estimate
nnel (continued)				
ogy, Bacteriology, Protozoology, itology, Hemoprotozoology, ology, Microbiology, Pharmacology, oxicology[3]				
		---	$15,000	---
ate Trainees				
		$11,533	11,533	---
national Graduate Trainees oned at LDC		---	---	$17,300
icians	2.00			$19,104
ical Support, Preventive Clinician and Epidemiologist				$ 2,634
cal Assistant	0.50			
		$ 1,817	$ 2,725	---
cal Support, Preventive Clinician and nologist	0.25	---	---	$ 2,271
Salaries				
		$23,400	$47,618	---
		18,150	6,410	$41,309
Salaries		$41,550	$54,028	$41,309
tant Fees				
Floyd W.				
		$ 990	---	---
		1,485	---	---
Consultant Fees		$ 2,475	---	---
ee Benefits				
faculty and staff salaries				
		$ 2,729	$ 8,300	---
		4,175	1,474	$ 5,522
ubtotal, Faculty and Staff Benefits		$ 6,904	$ 9,774	$ 5,522
graduate assistant salaries				
		$ 1,384	$ 1,384	---
		---	---	$ 2,076
ubtotal, Graduate Assistant Benefits		$ 1,384	$ 1,384	$ 2,076

Personnel involved less than 0.15 FTE: Several faculty will be working on diseases of ruminants in the disciplines of virology, bacteriology, protozoology, parasitology, otozoology, immunology, microbiology, pharamcology, and toxicology, i.e., bluetongue, s lymphadenitis, chlamydial and viral infectious, trypanosomiasis, coccidiosis, mastitis, al diseases, foot rot, goat arthritis, enzootic pneumonia, plant toxicities. Involvement ious personnel time committment for each year will vary with the prevalence of economically ant diseases in the LDC to be assigned and the research talent at WSU.

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	$28,508	$57,302	---
	23,810	7,884	$48,907
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R EQUIPMENT, FACILITIES, AND ANIMALS			
	$ 9,600	---	---
	3,200	---	---
l, MAJOR EQUIPMENT, FACILITIES AND ANIMALS	$12,800	---	---
EL			
are			
	$ 1,000	---	---
	4,036	---	---
Subtotal, Air Fare	$ 5,036	---	---
Diem, 135 days @ $50/day			
	$ 1,350	---	---
	5,400	---	---
Subtotal, Per Diem	$ 6,750	---	---
L, TRAVEL			
	$ 2,350	---	---
	9,436	---	---
L, TRAVEL	$11,786	---	---
MAINTENANCE AT LDC			
	$22,500	---	---
R DIRECT COSTS (includes USDA ontract)			
	$16,240	---	---
	24,360	---	---
L, OTHER DIRECT COSTS	$40,600	---	---
L DIRECT COSTS			
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	Agency for International Development	Institution Cost Sharing	LDC Estimate
IRECT COSTS			
5% of Salaries	$10,000	$40,179	---
AL OPERATING COSTS			
	$ 66,693	$ 97,481	---
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Sharing as Percentage of Proposal 41.26%

WASHINGTON STATE UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

Budget Proposal
Improvement of Sheep and Goat Production
by Reduction of Disease Loss

	FTE	Agency for International Development	Institution Cost Sharing	LDC Estimate
5				
NNEL				
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, William G.	0.20			
		$ 1,760	$ 2,640	---
		1,760	2,640	---
Subtotal, W. G. Huber		$ 3,520	$ 5,280	---
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tive V.M. Clinician and emiologist	0.50			
		$ 1,500	---	---
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Salaries		$23,400	$47,618	---
		18,150	6,410	$41,309
Salaries		$41,550	$54,028	$41,309
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Floyd W.		$ 990	---	---
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Consultant Fees		$ 2,475	---	---
ee Benefits				
faculty and staff salaries		$ 2,729	$ 8,300	---
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		---	---	$ 2,076
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, PERSONNEL COSTS			
	$28,508	$57,302	---
	23,810	7,884	$48,907
, PERSONNEL COSTS	$52,313	$65,186	$48,907
EQUIPMENT, FACILITIES, AND ANIMALS			
	$ 9,600	---	---
	3,200	---	---
MAJOR EQUIPMENT, FACILITIES AND ANIMALS	$12,800	---	---
ire			
	$ 1,000	---	---
	4,036	---	---
ubtotal, Air Fare	$ 5,036	---	---
iem, 135 days @ $50/day			
	$ 1,350	---	---
	5,400	---	---
ubtotal, Per Diem	$ 6,750	---	---
, TRAVEL			
	$ 2,350	---	---
	9,436	---	---
TRAVEL	$11,786	---	---
IAINTENANCE AT LDC			
	$22,500	---	---
DIRECT COSTS (includes USDA tract)			
	$16,240	---	---
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OTHER DIRECT COSTS	$40,600	---	---
DIRECT COSTS			
	$56,693	$57,302	---
	83,306	7,884	$48,907
DIRECT COSTS	$139,999	$65,186	$48,907

	Agency for International Development	Institution Cost Sharing	LDC Estimate
ECT COSTS			
of Salaries	$10,000	$40,179	---
OPERATING COSTS			
	$ 66,693	$ 97,481	---
	83,306	7,884	$ 48,907
, OPERATING COSTS	$149,999	$105,365	$ 48,907

Sharing as Percentage of Proposal 41.26%

5(a) IMPLEMENTATION PLAN

Time-phased scope, including relationship with LDC institution.

YEAR 1: Months 1-6

1. Establish working relations with collaborating institution.
   a. Establish executive committee to oversee project.
   b. Select LDC graduate students for U.S. study.
      1) Select committees for the graduate students.
      2) Design programs.
   c. Assess research and extension capabilities of LDC institution.
2. Collect data on sheep and goat diseases.
   a. Collaborate with LDC professionals and knowledgable growers.
   b. Coordinate efforts with other flock health researchers involved in the herd health program (University of California-Davis, Colorado State University, Tuskeegee Institute, University of Idaho, and Washington State University) for designing survey instrument and collating data.

YEAR 1: Months 7-12

1. Conduct on-site surveys of production systems.
   a. Collect data e.g., reproductive performance, weak and dead neonates, types of parasites and disease conditions, diseases of young, growing animals, management practices, nutritional-disease profile.
2. Prepare to enroll graduate students at UI/WSU for Year 2.
3. Prepare for on-site paraprofessional training sessions.
4. Annual review of project: modifications as contingencies are assessed.

YEAR 2: Months 1-6

1. Evaluate data on disease conditions.
   a. Determine prevalence and economic importance of major diseases.
   b. Select disease conditions to be studied.
   c. Formulate prevention and control systems for selected disease and parasitic conditions (including chemoprophylaxis, therapeusis, and animal health management techniques).
   d. Initiate program of diagnostic technique development and modification.

2. Initiate training program for animal health technicians (paraprofessionals) plus informational programs for herdsmen and veterinarians.
3. Initiate Herd Health Programs at a minimum of 5 locations.
4. Initiate collaborative research projects at the LDC institution and UI/WSU (annual).
5. Conduct annual seminar at LDC to report on overall progress of project.

YEAR 2: Months 7-12

1. M.S. graduate students will return to LDC to initiate research programs.
2. Initiate Herd Health Programs at a minimum of 5 or more additional locations.
3. Determine format for publication of extension-type informational bulletins.
4. Biannual reports on progress of collaborative research due.
5. Annual review of project (results to be given at seminar at LDC).
   a. Progress of Herd Health Programs, research projects, graduate programs, informational programs, etc.

YEAR 3: Months 1-6

1. Continuation of research projects
   a. Annual reports on collaborative research due.
2. Annual evaluation of Herd Health Programs initiated during Year 1.
   a. Evaluate effect of recommended changes, e.g., reduced mortality and morbidity, increased productivity, increased feed and energy conversion, etc.
   b. Evaluate informational program for herdsmen and veterinarians.
3. Publish informational bulletins on disease control and prevention.
4. Continuation of training program for animal health technicians.
5. Graduation of M.S. students.
   a. Publication of research findings.
   b. Presentation of results at biannual or annual seminar.
6. Select additional graduate students (M.S. or Ph.D) and enroll.
7. Initiation of additional Herd Health Programs.
8. Biannual seminar on progress of Herd Health Programs, research projects, etc.

YEAR 3: Months 7-12

1. Preparation of document based on evaluation of Herd Health Programs conducted during Years 1 and 2.
2. Initiation of 5 or more additional Herd Health Programs.
3. Publication of additional informational bulletins.
4. Annual review of project and presentation of results in annual seminar.

YEAR 4: Months 1-6

1. Continuation of research projects.
   a. Preparation of progress reports and publication of research findings.
2. Continued supervision of:
   a. Herd Health Programs;
   b. Informational program for herdsmen and veterinarians;
   c. Animal health technician programs;
   d. Collaborative research.
3. Biannual seminar to be conducted.

YEAR 4: Months 7-12

1. Graduate students (M.S.) will return to LDC to initiate research program.
2. Preparation of document based on evaluation of Herd Health Programs conducted during Years 1, 2, and 3.

3. Continued publication of informational bulletins.
4. Annual seminar to be conducted.

YEAR 5: Months 1-6

1. Graduation of M.S. students (June, Year 5).
   a. Publication of research findings.
   b. Presentation of program at biannual or annual seminar.
2. Selection of additional graduate students and enrollment.
3. Continuation of research projects.
   a. Preparation of progress reports and/or publication of research findings.
4. Continued supervision of:
   a. Herd Health Programs;
   b. Informational programs;
   c. Animal health technician programs;
   d. Collaborative research.
5. Biannual seminar to be conducted.

YEAR 5: Month 7-12

1. Preparation of document based on evaluation of Herd Health Programs conducted during Years 1, 2, 3, and 4.
2. Annual seminar to be conducted.

YEARS 6-10

Established Herd Health Programs will continue to be monitored with new technologies and disease control prevention programs implemented as needed. Policy changes relating to the health care delivery system will be made according to the results of annual evaluation surveys of established Herd Health Programs and informational programs. Collaborative research projects will continue and new projects initiated according to the needs and capabilities of the collaborating institution. Research results will be published in lay and scientific journals. Informational and training programs will be expanded as demands increase. As funds allow, additional graduate students will be selected for study in the U.S.

5(b) PROJECT MONITORING

A project executive committee, composed of the principal investigator as chairman (Huber), the primary consultant (Frank) the clinical epidemiologist, the microbiologist, the parasitologist, and representation from the collaborating LDC institution, will provide the coordination of planning and evaluation of progress. The committee will meet regularly to advise the administrators concerning (1) criteria for research and extension programs and their review, selection and assignment of graduate students and technical support, evaluation of

progress and allocation of funds; (2) progress reports; (3) professional and lay publications; (4) coordination of disciplines and services; and (5) serve as a focal point for constant program assessment and direction or re-direction to suit the needs of the collaborating and possibly other LDC's. In addition, arrangements have been made to coordinate the animal health technical development activities, the research planning, and educational activities with the other flock health A.I.D. units (Dr. Kimberling of Colorado State University, Dr. McGowan of the University of California-Davis, and Dr. Oliveira of Tuskeegee Institute), and with other disciplines such as nutrition, genetics, and land management involved in the "Small Ruminant Program". The utilization of educational and research resources at the five universities will be coordinated to avoid duplication effort and to provide maximal educational opportunities for graduate and animal health technician training.

The project will be monitored in the LDC by the clinical veterinary epidemiologist and preventive medical clinician for a significant period of time each year (approximately three months per year). In the absence of all U.S. personnel from the LDC site, arrangements will be made with the collaborating LDC unit since these scientists will also have had the opportunity to develop the overall plan of action and they will be familiar with the time frame and the assignments of responsibilites.

6. ANNUAL REVIEW AND PLANNING PROCESSES

The annual review and the planning process will involve the personnel of this A.I.D. flock health team and those of the other three institutions. Firstly, the executive committee of this project will have bimonthly meetings to assess progress and consider possible protocol modifications. The information from the bimonthly executive committee meetings will be very useful for planning the animal disease research program. The project leader, Dr. W.G. Huber of WSU, will be in routine contact with Drs. Oliveira of Tuskeegee Institute, McGowan of the University of California-Davis, and Kimberling of Colorado State University to coordinate all flock health activities to avoid redundancy and maximize efficiency. The budgetary constraints require complete coordination of all flock health efforts regardless of location.

AID 1020-28 (1-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 79 to FY 84
Total U.S. Funding $750,000
Date Prepared: 5-17-78

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Project Purpose: Assess prevalence of disease conditions; to establish a program of improved management, chemoprophylaxis, and therapeusis; to develop collaborative research; to provide graduate study in the U.S. for LDC students; to assist in training of animal health technicians; to establish a health care delivery system for applying current and new disease control technologies.	Conditions that will indicate purpose has been achieved: End of project status. 1)Increased production of food & fiber through disease control and prevention 2)Operation of disease surveillance and control systems (HHP's). 3)Advanced training for graduate students & animal health technicians. 4)Expanded communications program through: a)Research projects; b)Graduate programs; c) Extension-type programs.	1)One complete disease prevalence & economic impact case study for each 1,000 animals. a)Data verifying reduced morbidity, mortality & "nutrient wastage." 2)Operation of 20 HHP's. 3)Graduation of graduate students(M.S. level) at end of Year 2. 4.Establishment of collaborative research projects(verified through progress reports and publications). 5)Establishment of extension-type programs verified through publications of extension bulletins, progress reports, etc.	Assumptions for achieving purpose: 1)That LDC has capabilities to porate new methodologies and te ques. 2)That LDC provide support for ing disease surveillance infor 3)That an effective communicati tem can be developed for transi of disease control systems to r use. 4)That environmental conditions not adversely affect the effica drugs & biologics used successf in other climatic conditions.
Outputs: 1)Special reports on disease prevalence and economic importance of major disease conditions. 2)Research publications-including progress reports on a)Graduate research. b)Collaborative research. 3)Extension-type publications(information from research projects, HHP's, and on new diagnostic techniques). 4)Biannual seminars. 5)Increased competence of personnel.	Magnitude of Outputs: 1)Projected publication of disease prevalence at end of Year 1. 2)Annual reports of collaborative research. 3)Projected publication of biannual extension bulletins, beginning Year 2. 4)Publication of results from survey of HHP's. 5)Biannual seminars planned. 6)Trained personnel(animal health technicians, laboratory technicians, graduate students.)	1)Biannual program review and evaluation techniques by executive committee.	Assumptions for achieving outputs: 1)That collaborating country wi assist in collection of disease surveillance data. 2) That LDC will assist in esta ing training programs. 3)That LDC will assist as an in tion team to help establish acc ance of HHP's. 4)That LDC will forward researc to UI/WSU for evaluation.
Inputs: 1)AID contract to UI/WSU for $150,000/year for 5-10 years. 2)Data from collaborating country. 3)Expertise hired to: a) collect data; b)disseminate information; c)assist in research projects.	Implementation Target (Type and Quantity) 1)At least one diagnostic-research laboratory at LDC institution. 2)Trained LDC animal health technicians. 3)Graduated LDC students with M.S. or Ph.D. degrees. 4)Analytical laboratory and personnel at UI/WSU.	1)Biannual program review and evaluation by executive committee.	Assumptions for providing inputs: 1)Program will be approved and by AID. 2)That UI/WSU staff will contin that institution. 3)That LDC will collaborate in lecting data, in disseminating mation and in assisting in rese projects.

(a)

We have a candidate in mind for the open position of preventive veterinary medicine clinician and epidemiologist. The individual is a professor at a leading college of veterinary medicine, has served as a Fulbright Lecturer at the University of Cairo, a veterinary professor at the National University, Bogota, Columbia, and a department head at the Ahmadu Bello University, Nigeria, an AID project.

CURRICULUM VITA

William G. Huber

EXPERTISE: Veterinary Pharmacology and Toxicology and Administration. Fifteen years teaching, research, and administration in academic veterinary medicine. Five years industrial research including three years as Director of Research for a major drug firm. Consultant to several drug firms and government agencies.

ROLE IN PROJECT: Project Administrator

EDUCATION

College	Dates	Degrees
University of Illinois	1950	B.S.
University of Illinois	1952	D.V.M.
University of Illinois	1958	Ph.D.
Harvard University, Graduate School of Business Administration	1974	

EXPERIENCE:

1952-1958: Food Animal Practicioner.
1958-1960: Industrial Research and Development, Chas. Pfizer & Co., Inc., in charge of veterinary research.
1960-1973: Assistant, Associate Professor, Professor, Associate Department Head, Assistant Dean, Physiology and Pharmacology, College of Veterinary Medicine, University of Illinois. Presented approximately 140 scientific presentations since 1960.
1973-1976: Director of Research, Hoffman-La Roche
1976: Head, Department of Veterinary and Comparative Anatomy, Pharmacology and Physiology; Associate Dean, Research and Graduate Education, College of Veterinary Medicine, Washington State University; Head, Department of Veterinary Science, Agricultural Research Center, Washington State University.
1978: Associate Director, Agricultural Research Center, Washington State University.

PUBLICATIONS: 32 Research Publications on Pharmacology and Toxicology. Selected publications listed under publications.
BOOKS: Author of several chapters in standard text on veterinary pharmacology.

APPOINTMENTS AND CONSULTANTSHIPS:

Member of Advisory Committee to Bureau of Veterinary Medicine, FDA, Department of HEW, 1965-1972.
Appointed Senior Staff Member, Center of Zoonoses Research, University of Illinois, 1966-1973.
National Academy of Sciences Master Committee for Veterinary Drug Efficacy Review. Chairman, Panel on Antibacterial Drugs, 1966-1969.
Member of Editorial Board, American Journal of Veterinary Research, 1967-1973.
Consultant, Toxicology Center, National Academy of Sciences, 1976.
NAS-NRC Committee to Review the Scientific Program of the National Center for Toxicological Research, 1977.

FACE SHEET DATA

A. Project Title:

RESEARCH ON THE HERD HEALTH PROBLEMS OF SHEEP AND GOATS AFFECTING THEIR PRODUCTIVE EFFICIENCY

B. Type of Project: NEW

C. Institution: COLORADO STATE UNIVERSITY

D. Principal Investigators:

Cleon V. Kimberling, D.V.M.

Lloyd H. Lauerman, D.V.M.

E. Duration: 5 years with plans for continuation

F. Total Estimated Costs by Year:

Year	Total	A.I.D.	C.S.U.	L.D.C.	CSU Cost Sharing %
1979	263,122	150,000	75,622	37,500	29%
1980	263,122	150,000	75,622	37,500	29%
1981	263,122	150,000	75,622	37,500	29%
1982	263,122	150,000	75,622	37,500	29%
1983	263,122	150,000	75,622	37,500	29%
	1,315,610	750,000	378,110	187,500	

2. DETAILED DESCRIPTION OF THE PROJECT

a. Description of problem

The productive efficiency of any livestock operation is directly dependent upon the health of the individuals constituting that unit. Sheep and goats are a vital segment of the economy, to the survival and well being of many small holders throughout the less developed countries of the world. The productive efficiency of these small units is limited primarily by 3 factors: health, nutrition, and genetics with health and nutrition being inseparable. In most less developed countries the small holder is unaware of the health and nutritional factors which limit production. For the most part, the agricultural officials in the L.D.C.'s are not fully aware of the problems within the livestock industry due to the limits of diagnostic and disease surveillance capabilities within their country.

Until initial surveys are conducted in the locality to be studied it is not possible to determine the exact constraints on production. In many areas of the world, including our own Indian reservations, improvement in range and livestock production are limited by social custom. The team of investigators must necessarily be extremely conscious of these social problems. Production in certain areas may well be satisfactory but expansion and utilization of the milk, meat, hides and fiber may be restricted by inadequate marketing channels. The research team will therefore need to be sensitive to the social implications as well as the nutritional, marketing, genetic and herd/flock health constraints. Solutions will be generated by a collaborative effort in all of these areas. The herd/flock health component must identify those diseases and agents which restrict

productive efficiency and coordinate a prevention program with the programs in nutrition and genetics.

b. Objectives of project

1) To improve the standards of living of the small sheep and goat holders in the less developed countries through the increased production and utilization of their animals and animal products by:

a) Improving the health of the animals in existing populations through herd health programs as production constraints are identified and programs tailored to alleviate these constraints and by

b) working with the local and other collaborative researchers in expanding the utilization of the products through marketing and distribution.

2) To develop an U.S./L.D.C. animal health collaborative research team which will:

a) Assess the major disease, parasite and nutritional problems which decrease the productive efficiency of the small ruminant population in the L.D.C.;

b) increase the diagnostic capabilities within the livestock industry of the L D.C.; and

c) establish a diagnostic and herd health delivery system to the small holders within the L.D.C.

3) To train professionals and paraprofessionals of the L.D.C. in diagnostic techniques feasible and applicable to local situations.

4) To train professionals and paraprofessionals of the L.D.C. in in herd health management in order to implement disease prevention and control in the sheep and goat population.

5) To develop simple, feasible diagnostic tests and procedures which can be utilized, not only by diagnosticians in the L.D.C. but also in the U.S.

6) To study nutritionally related diseases.

7) To develop model system for disease surveillance and an educational delivery system to the small holder.

c. Project approach

As the specific L.D.C. in the extensive production area of Latin America has not been identified, a generalized plan is all that can be outlined at the present. The areas of genetic improvement, range management and nutrition, herd/flock health have been assigned to principal investigators from Montana State University (MSU), Utah State University (USU), and Colorado State University (CSU) respectively. When the specific L.D.C. has been identified it will be necessary for these principal investigators to meet and coordinate their efforts as one and an in-country researcher will act as Coordinator for the entire group. It will therefore be necessary for the P.I.'s to select an individual who can effectively represent all facets of the investigation, research and educational efforts.

In the U.S. disease prevention on a herd/flock basis has proven the most efficient and economical approach to combating losses from contagious, infectious and nutritional diseases. It will therefore be the major thrust of the herd/flock health component to develop herd health management programs. A systematic approach to establishing such a herd health program will be necessary. Some of the components of this outline will be:

1) To draft a comprehensive plan of work which will encompass the objectives set forth by the principal investigators in the areas

of genetic improvement, range management and nutrition, herd/flock health, marketing and systems analysis.

2) To identify within the L.D.C. the institutional research capabilities.

3) To identify within the L.D.C. the individual professionals and paraprofessionals interested in and willing to establish a collaborative research program on the health constraints of small ruminants.

4) To establish an investigator, selected by the U.S. collaborative universities at the research site in the L.D.C.

5) To review the disease reporting system in the L.D.C. to thereby determine and outline the most efficient procedure for collecting data relevant to loss by disease and nutrition.

6) To collect data relevant to the major disease and production. Losses will require herd/flock inspections, contact and feedback from the owners, ante and post mortem inspections of home and local slaughter, being especially watchful for those conditions with human health significance, having a thorough knowledge of current management practices.

7) To identify researchers in the L.D.C. for training at U.S. universities in diagnostic techniques, epidemiology and public health.

8) To identify graduate researchers at the U.S. University and outline their research activities both in the U.S. and the L.D.C.

9) To develop simple efficient diagnostic procedures suitable for field use in the L.D.C. and the U.S.

10) To develop an educational delivery system in the L.D.C. to assist the small holder in fully utilizing the results of the research.

11) To establish herd health management programs tailored for the needs of the small holder in the L.D.C.

These last two items will require a team of workers from the L.D.C. and the U.S. to conduct workshops and demonstrations at the local community and individual flock level.

The work plan developed by the U.S. Universities must be flexible and extremely sensitive to the social customs of the people and it is therefore necessary to speak only in generalities.

As data is being collected herd health management procedures of proven value can be initiated. As the research progresses, refinement and adjustments in the herd health programs will be introduced. See Project Approach Timetable (Attachment A)

d. Conditions that will indicate objectives have been achieved:

1) When a herd/flock health program has been established which is is efficient, economical and meets the needs and approval of the small holder in the L.D.C.

2) When the herd/flock health program is being conducted, maintained and improved by the local scientists of the L.D.C.

3) When the productive efficiency of the small ruminants has increased, thus providing an improved standard of living for the small holder in the L.D.C.

e. Assumptions on achievement of objectives

The Cooperating L.D.C. should:

1) have a group of scientists motivated to improving the productive efficiency of the small ruminants of that country;

2) have the basic disease reporting and data collecting system upon which to initiate further investigations;

3) be willing to provide facilities and animals for collaborative research; and

4) assist U.S. scientists with interpretation, transportation, and establishment of herd/flock health programs.

f. Assumptions that achieving objectives will solve problems

By increasing the productive efficiency of the small ruminant through preventive medicine, improved nutrition, and improved genetic potential, the small holder will have increased production to serve his own needs and the potential for sale of products beyond his need.

g. Outputs of project

1) Increase of animal products from small ruminants in the L.D.C.

2) Generation of new diagnostic techniques suitable for field use in the L.D.C. and the U.S.

3) Generation of new preventive medicine programs applicable to small ruminants in the L.D.C. and the U.S.

4) Advanced training in small ruminants for professionals and paraprofessionals of the L.D.C. and professionals of the U.S.

5) The extension of knowledge gained on research in the L.D.C. to other similar areas throughout the world and to other small ruminants.

3. TECHNICAL FEASIBILITY

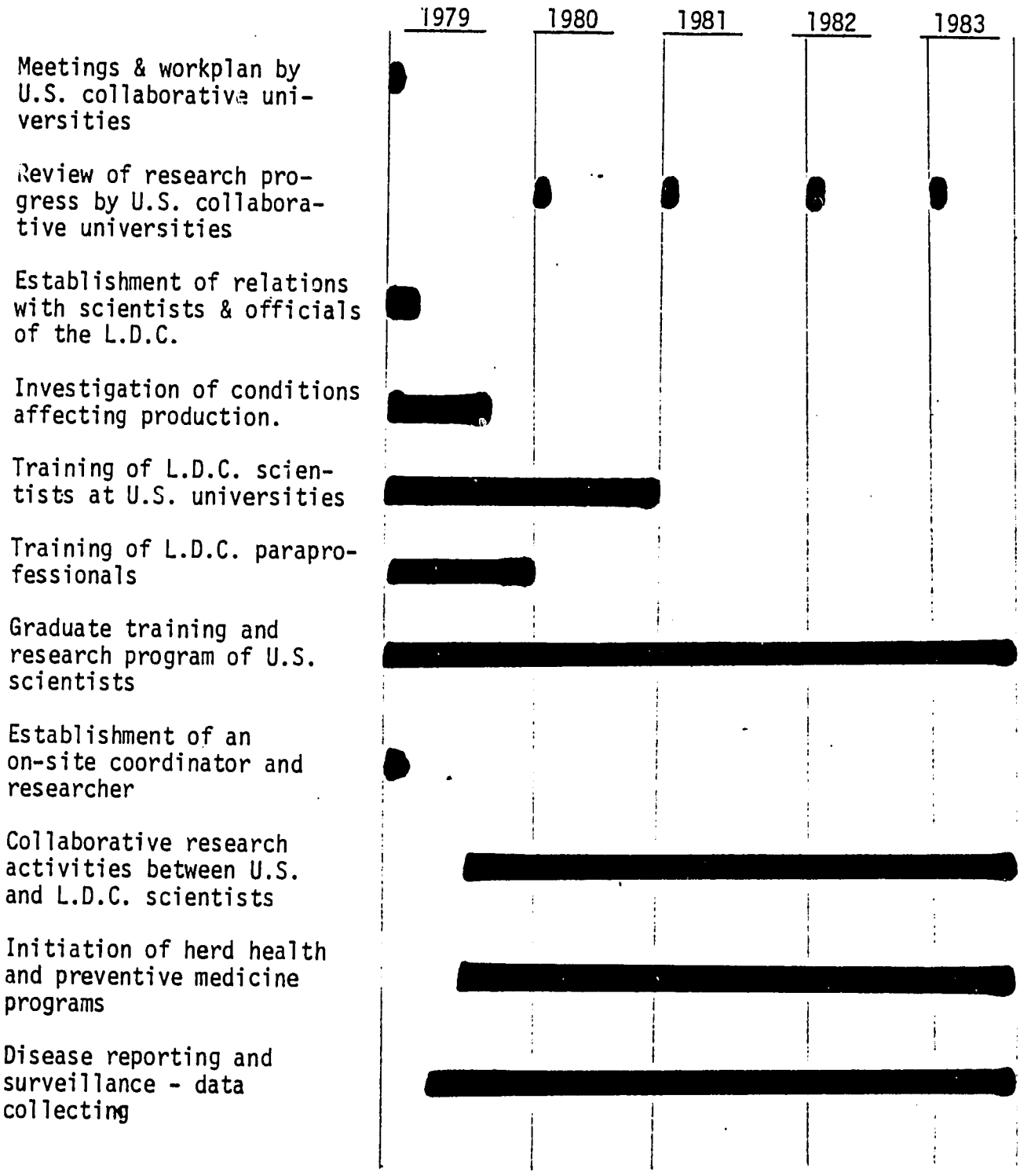
Throughout history and modern day, man and beast have been plagued with the scourge of epidemics which have decimated entire populations. With the advent of vaccines and technical knowledge most diseases capable of destroying large segments of the population have been brought under control.

Today, the most serious losses due to disease are those of an

insidious nature causing sporadic deaths but, more important, a loss in productive efficiency. In various segments of the livestock and poultry industry, rather refined and sophisticated preventive medicine programs have eliminated these production losses. By utilizing and modifying the principles of preventive medicine programs of proven efficacy, immediate advancements will be possible in the L.D.C. A thorough study by the investigators of the problems limiting productive efficiency in small ruminants will provide the necessary information to modify or initiate new preventive medicine programs. These modified and new preventive medicine programs will be the foundation for increased productivity.

ATTACHMENT A

PROJECT APPROACH TIMETABLE



4. FINANCIAL PLAN

Source of Funding

A.I.D.	C.S.U.	L.D.C.	Total
150,000	50,000	37,500	237,000

Expenditure of Funding

	U.S.A.	L.D.C.	Total
Personnel:			
L. Lauerman, 25%	7,500		
S. DeMartini, 25%	8,000		
Fringe Benefits, 10.64%	1,650		
2 Graduate Veterinary Research Assistants	30,000		47,150
Overhead @ 76.8%			36,211
Location Program[1] Support		22,500	22,500
Equipment/Facilities/ Animals[2]	15,000	20,000	35,000
Travel[3]	1,139	8,000	9,139
			150,000

1) The location program support is to provide for salary and support of site coordinators and for a basic experimental facility and necessary supporting facilities (including vehicle(s), dormitory, etc).

2) As sheep and goat research facilities already exist at C.S.U., the U.S.A. expenditure will be used primarily for purchase and maintenance of experimental animals with a portion of the funding being utilized for expendable research materials. The funds allocated for use in the L.D.C. will be used to support facility development during the initial phase of the program. As the three universities (C.S.U., M.S.U. and U.S.U.) develop specific areas of research the funds will be allocated to equipment, supplies and animals necessary to conduct on site research.

3) U.S.A. travel is to provide C.S.U. scientists with local travel necessary to conducting research activities and attending scientific meetings and seminars. The L.D.C. travel is to provide site visits for the C.S.U. investigators as well as travel of the L.D.C. researchers to the U.S.A. for educational and training purposes.

C.S.U. CONTRIBUTION TO TITLE XII SMALL RUMINANTS C.R.S.P.

Faculty Salaries	% Salary	Salary
Cleon V. Kimberling, Prin. Investigator	30%	10,000
J. Cheney	20%	6,000
R. E. Pierson	20%	7,000
R. Rubin	20%	7,000
Secretarial Support	50%	7,500
Fringe Benefits @ 10.64%		4,522
		42,022
Research Support - (Reproductive performance of cattle and sheep)		
L. Pearson (Immunology)		2,700
R. Phillips (Neonatal Enteritis)		2,900
J. DeMartini (Immunology)		3,000
J. Cheney (Parasitology)		5,000
R. Rubin (Parasitology		5,000
Diagnostic Lab Support		15,000
		33,600
		75,622

TOTAL C.S.U. YEARLY CONTRIBUTION -------- 75,622

TOTAL C.S.U. FIVE-YEAR CONTRIBUTION -----378,110

LOGICAL FRAMEWORK

From FY 1979 to FY 1983
Total U.S. Funding AID -150,000; CSU-37,7
Date Prepared: 26 May 1978 LDC-37,5

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
gram or Sector Goal: The broader objective to ch this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
ject Purpose: To improve the productive ciency of small ruminants in less de-ped countries. To identify the major disease nutritional problems restricting the uctive efficiency of small ruminants. ssist scientists of the L.D.C. in pro-ng answers to these problems. To estab-an educational delivery system. To st the small holder with his sheep and production problems.	Conditions that will indicate purpose has been achieved: End of project status. System exists for disseminating information and guidance to the small holder in the L.D.C. A network of field diagnosticians to answer disease and nutritional problems. A reporting system to analyze production and disease conditions.	The network of field diagnosticians supplying information to the small holder and duplicate reports to the national disease control system within the L.D.C. The dissemination of monthly production and disease reports to the Mission and Government offices in L.D.C.	Assumptions for achieving purpose: A.I.D., U.S. scientists and L.D.C. scientists and L.D.C. scientists recognize the need for a network system of diagnosi disease and production problems reducing the efficiency of sheep & goat production and the need for an educational delivery system to the small holder.
tputs: Identification of major disease, ·itional and genetic problems in small nants of the L.D.C. Training of L.D.C. ·ntists in research techniques to study problems. Training of a corps of nosticians. To conduct practical field nostic services. ·rmation dissemination.	Magnitude of Outputs: - Report of disease conditions in the small ruminant population - Assessment of production - Training seminars for diagnosticians - A plan for educational delivery - Development of diagnostic techniques	- Disease and production reports available at the Mission and Governmental agencies on the sheep & goat populations. - Verification of training programs and reports on participation - Existence of diagnostic facilities in the field service program	Assumptions for achieving outputs: The combined expertise from the U.S. universities can strengthn the L.D.C. research efforts and provide technical assistance in establishing reporting systems and educational delivery systems.
uts: Collaborative research and efforts olorado State University, Montana State ersity and Utah State University. nical assistance and guidance in report-systems. ning of L.D.C. research diagnostic and ension personnel.	Implementation Target (Type and Quantity) A.I.D. 750,000 over 5 years C.S.U. 188,500 over 5 years L.D.C. 187,500 over 5 years	Regular A.I.D. audits	Assumptions for providing inputs: Project is approved, collaborative research greements can be reached with MSU and USU. Agreements can be reached with Missions and host Government to facilitate and cooperate in research and training activities.

CURRICULUM VITAE

NAME: Cleon V. Kimberling

RANK: Associate Professor

SOCIAL SECURITY NO: [redacted]

DATE & PLACE OF BIRTH: [redacted]

BUSINESS PHONE: 303-491-5770

BUSINESS ADDRESS: Veterinary Teaching Hosp.
Colorado State University
Fort Collins, Colo. 80523

HOME PHONE & ADDRESS: [redacted]

MARITAL STATUS: Married, 2 children:
Kirk Leon - 17
Beth Ann -- 14

MILITARY SERVICE:
U.S. Army - Engineers 1951-53

COLLEGE AND UNIVERSITY EDUCATION:

Institution	Dates	Specialties	Degree
Colorado State University Fort Collins, Colorado	1947-1951	Animal Science	B.S.
Colorado State University	1955-1959	Veterinary Med.	D.V.M.
University of Minnesota	1961-1963	Public Health	M.P.H.

TEACHING, RESEARCH & RELATED APPOINTMENTS:

Institution	Dates	Specialties	Title
U.S.D.A. ARS APHIS	1959-1965	Field Service & Research	Brucellosis Epidemiologist
Colorado State University	1965-1969	Teaching	Assistant Prof.
University of Nairobi Kenya, East Africa	1969-1972	Teaching and research	Associate Prof.
Colorado State University	1972- present	Teaching, research & administration	Associate Prof.

CURRENT ADMINISTRATIVE DUTIES: Campus Coordinator of the Kenya Project, Kenya
Project Leader of the Navajo Project, Arizona
State Board of Examiners for Animal Technicians
Admissions Committee, College of Vet Med, CSU

MAJOR RESEARCH/PROFESSIONAL INTERESTS:

International programs, applied immunology, epidemiology of domestic animals

PROFESSIONAL SOCIETIES: American Veterinary Medical Association
Colorado Veterinary Medicine Association

HONORARY SOCIETIES: Phi Zeta
Sigma Xi

RESEARCH: 1 patent
publications