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Genetics	Animal husbandry
Sheeps	Goats
Hair sheep	Ranges
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SMALL RUMINANT

COLLABORATIVE RESEARCH
SUPPORT PROGRAM
(SR-CRSP)

ANNUAL REPORT

PROGRAM YEAR ONE

1980

INDIVIDUAL ANNUAL REPORTS

PART II A

Prepared by the Management Entity 1980

PART II A

INDIVIDUAL ANNUAL REPORTS

931-1328

TITLE XII

SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM

Individual Annual Reports

The Annual Reports that the ME requested the individual PI's submit have been appended to this document. They are unedited and remain in the form in which they were received. Also attached, for additional information is a copy of the guidelines the ME sent the PI's to aid them in the preparation of these reports. It was intended that each Annual Report be closely tied with each project's Phase III work plan which can be found in Parts II, III, IV and V of the Integrated Program Plan (37,38,39,40,).

GUIDELINES

1. Use the AID format for your outline.

2. Keep your narrative to a minimum. Never use a sentence when a phrase will suffice.

3. Include only currently relevant information. Repeat only those portions of your Phase III Work Plan required to illustrate your past and/or proposed activities.

   a. Focus your Annual Report on those aspects of each category in the format which your project has specifically addressed or which have changed since the final version of your Phase III Plans were written.

   b. Focus your Subgrant Request specifically on those project needs for which you are currently requesting funds and those project activities you are about to initiate or are continuing from the previous year. Always refer back to the original Phase III statements of your problems, objectives, approaches, etc. to demonstrate that your proposed expenditures are in accordance with the pursuit of your stated goals.

4. Background information that was not included in your Phase III Plan, but has influenced the direction and conduct of your research, ie. revised estimates of animal numbers or distributions, should be inserted within the appropriate AID category. If this is awkward, present it in a separate section and we will include

the information in the introduction to the final document. This applies to both the Annual Reports and the Subgrant Requests.

5. If there are no changes or new information to add to a category, a simple statement indicating that this is the case is all that is necessary.

To summarise, maintain continuity between your Phase III Work Plan and all subsequent project reports whenever possible. It will be assumed that the final version of your Work Plan which was approved by the country in which you are working, is an accurate description of your project. As your research progresses and your project changes, we will alter your Phase III Plan to include the revisions in order to most accurately reflect the status of your project.

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Animal Breeding and Genetics

Report Title: Annual Report
October 1, 1978 - May 31, 1980

Sub-Grantee: University of California, Davis
Davis, California 95616

Funds: $206,786

Principal Investigator: Eric Bradford

Annual Report
4/18/80

Small Ruminants CRSP

Project Report for 6/1/79-5/31/80

Title: Genetic Improvement of Sheep and Goats for Smallholder Production Systems.

Personnel: G. E. Bradford (PI), E. J. Pollak, R. C. Laben, D. T. Torell and J. M. Levine. Department of Animal Science, University of California, Davis.

Objectives:

The first year objectives, briefly stated, were to:

1. identify specific locations and institutions where work is to be carried out

2. identify collaborators

3. develop facilities

4. establish flocks

5. initiate research, with special emphasis on dairy goats because of the lack of scientific information on this species in either the U.S. or in developing countries.

Achievements:

1. Indonesia

The Assistant Research Geneticist position was filled by Dr. J. M. Levine in late 1979, and Dr. Levine began work on the project in Indonesia in January 1980 after a few weeks of intensive training in the Indonesian language.

The Principal Investigator visited Indonesia in January/February 1980

and participated in development of detailed work plans for the SR Program there, in collaboration with host country and other U.S. scientists.

The trip involved visits to LPP stations, to IBP, Pajajaran and Gaja Mada Universities, and to several Regional Breeding Centers and villages, all of which provided information of great value in formulating research plans.

Locations identified for work on the breeding project included LPP Stations near Bogor at Cilebut (goats) and Cicadas (sheep). Collaborative data collection will probably be possible at the Margawati Station (sheep, West Java), Jember Station (sheep, East Java) and possibly later at Pangarasan (sheep, Central Java). A needed resource not yet identified is a station where breeding work with goats can be carried out on an adequate scale.

Collaborators identified include Sitorus, Subandryo and Triwulanningsih of the LPP, Borgor staff, and Dr. Astuti of Gaja Mada University.

Ear tags provided by this project were used to identify the animals at Cicadas and Cilebut, and data collection initiated on the animals there. However, the plan to bring fat-tailed sheep to Cicadas to compare with the thin-tailed sheep there has been delayed until a more adequate forage source has been established and some apparent toxicity problems have been solved.

Dr. Levine has participated actively with LPP scientists in planning the village survey, which will provide data on local sheep and goat production systems for all of the projects. Data related to the breeding project to be obtained from the survey include:

1. characterization of performance of local breeds or types under small holder husbandry conditions

2. comparisons of different types where more than one species or breed are kept in the same village

3. evaluation of the effect of degree of wool covering on performance of sheep under Indonesian village conditions

Planning for short term training in sheep and goat husbandry and research station management, for LPP and Regional Center staff, has been initiated. D. Torell, in charge of sheep research at the University of California's Hopland Field Station, is scheduled to participate in a training session in Indonesia in summer of 1980, and at least one LPP staff member may come to the U.S. for 6-8 weeks of training later.

A detailed second year work plan and budget have been developed (copy attached).

2. Kenya

The major accomplishment in Kenya was a planning trip by the Principal Investigator to Kenya (February 1980). This was an intensive tour of Sheep and Goat Development Project (SGDP) facilities, visits to villages where sheep and goats are raised in Coastal, Western and Nyanza Provinces, and research planning with SGDP personnel.

Collaborating scientists identified include:

Z. Gathuka and W. Odenya, Ministry of Livestock Development (SGDP

D. Kimenyi, University of Nairobi

E. Allonby and M. Sharafeldin, FAO/UNDP (SGDP)

One of the Kenya collaborators, Mr. William Odenya, has been admitted to the M.S. Program in Animal Science at the University of California, Davis and began his studies in March 1880, under the sponsorship of FAO and the CRSP. In addition, plans for use of data from the SGDP flock of Dorper sheep at Ol Magogo in Kenya for his M.S. thesis were developed in Kenya in February 1980, and Mr. Odenya was able to collect additional data towards this objective before coming to UCD.

A plan for the first two phases of a long term breeding project to develop a dual purpose goat for intensive crop/livestock farming systems in the tropics has been outlined, and a detailed plan and budget for this project for 1980-81 has been developed (copy attached).

3. U.S.

Analysis of U.S. dairy goat DHIA records was undertaken during 1979 with the objective of genetic evaluation to identify superior sires, for use in both the U.S. and overseas locations. (Imported sires or semen will be essential to achieving objectives of the Kenya project).

Since goat records have previously been used very little for this purpose, much preliminary work on editing the records and estimating the effects of various environmental factors on production has been necessary. This work has established a number of facts which will be useful in future work with goats, including, for example, a large effect of parity (lactation sequence) on milk production independent of age, and an age-parity-season interaction. Neither of these appears to occur in dairy cattle records, the model used until now for analysis of dairy goat records. The work to date has also suggested a number of experiments which need to be done to permit more precise definition of breeding goals, for any country. One graduate student from a developing country is already working on the goat records, and another may begin soon.

Plans for construction of a Grade A dairy goat research and training facility on the Davis campus have gone forward, though more slowly than anticipated. Approximately $80,000 has been contributed by U.S. dairy goat owners and organizations toward this facility, to augment the $50,000 budgeted from each of the breeding and animal health SR-CRSP projects at UCD for this purpose. However, the total is still short of the amount needed to implement the plan, and at this time it is not known whether construction of the facility will be possible. If it is not, the CRSP funds budgeted from this project for the grade A dairy will be divided among (1) a smaller facility, (2) increased use of DHIA records, and (3) the project in Kenya. It should be noted, however, that a dairy goat research and teaching facility, located where there is broad support in the Animal and Veterinary Sciences, remains an important need for the SR-CRSP.

In summary, staffing of the project and planning of overseas activities have proceeded on schedule during the first year. Remaining on schedule during the next year will depend substantially on host country decisions needed in the near future, specifically, on prompt allocation of a station for the breeding project in Kenya, and development of a more adequate forage supply for the LPP Stations in Indonesia.

Analysis of U.S. dairy goat records has taken a somewhat different direction than expected, since it is becoming evident that dairy goats are biologically much more different from dairy cows than was originally assumed. These analyses are providing valuable new information about factors affecting milk production in dairy goats.

The one component of the first year plan which has not been implemented is construction of a dairy goat research and training facility at UCD. Furthermore, it appears that rising costs and limited funds may preclude the development of this phase of the project at the level planned. Dropping plans for a grade A dairy would free some funds for other project activities, but means that important needs in the areas of both research and training would not be met by the SR-CRSP project, now or later.

Publication:

C. M. Finley, E. J. Pollak, B. W. Kennedy and G. E. Bradford. Influences of parity and seasonal breeding pattern on age adjustment factors for dairy goats. Paper to be presented at Annual Meeting, American Dairy Science Association, June 1980.

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Animal Breeding and Genetics

Report Title: Annual Report
October 1, 1979 - May 31, 1980

Sub-Grantee: Montana State University
Bozeman, Montana 59717

Funds: $200,000

Principal Investigator: Robert L. Blackwell

ANNUAL REPORT - 1979-80

I. Scientific Program in Peru

The breeding project has been confined to Peru as the foreign work site up to this time. Morocco may come in later. A visit was made to Peru (2 weeks) in July 1979 to make the initial contacts, identify and become acquainted with counterpart scientists, travel briefly to potential research locations in the Central and Southern Sierra, and learn about production methods and problems related to genetic improvement of both sheep and alpaca. Based on this experience, the Phase III work Plan was developed for the breeding project in Peru. A second visit was made in January-February 1980 (4 weeks) to further develop understanding and working relationships with research and administrative personnel, prepare more specific research plans for the second year (1980-81), and to outline with counterparts and cooperators long range programs in animal breeding research.

Good research resources will be available in our association with Universidad Nacional Agraria (UNA) through their cooperative research and extension agreements with SAIS Tupac Amaru and the Central de Cooperativas at Cerro de Pasco. Research projects in animal breeding at these two locations in the Central Sierra are going forward. Other large SAIS may become cooperators later. Resources available to the project will include animals, land, labor and management. Prospects for benefit to the small farmer through the Cooperative, SAIS and the associated communities for

genetic improvement appears to be good. Research in alpaca breeding will be done through the Instituto Veterinario de Investigaciones Torpicales y de Altura (IVITA) at the La Raya Experiment Station in the Southern Sierra. Our participation here will be primarily in support of the program of Dr. Jorge Velasco.

Initial steps have been taken to give support to the graduate training programs in animal production at UNA by providing funds to employ graduate students and advanced undergraduates to work on the project. This phase of the program will insure that a representative of UNA will be at each location during key times so that the recording of data will be done in accordance with the needs of the projects. An important responsibility of these student employees will be to tabulate the existing data so that it can be computerized for analysis. This will give the students field experience, provide the graduate students support while they are completing their thesis research, and hopefully provide a strong incentive to undergraduates to further their education and enter the field as professional animal scientists.

In contacts with Dr. Carlos Valverde of INIA we have been encouraged to emphasize as much as possible the training aspect of the project to assist in providing a corps of trained professionals for research and extension programs that are emerging. Strengthening their human resource is given high priority.

II. Cross Collaboration with other Title XII Small Ruminant CRSP P.I.

Discussions with Utah and Cal Poly (Physiology of reproduction projects) were held at Utah State University (Foote, Nelson, Burfening,

Kress, Blackwell) to determine how cooperation between the two research areas can be achieved. The two projects (breeding and physiology) need to be integrated, and we see no problem here. Clearly the low reproductive rate in sheep and alpacas require intensive study that incorporates not only physiology of reproduction and genetics, but nutrition and animal health.

During the July trip to Peru, Burzlaff and Blackwell traveled together and have discussed in considerable detail the areas where our projects can interface. As our projects develop, there will be numerous common elements including the fact that portions of our research will be accomplished at the same locations in the Sierra.

Contacts were made with the Systems Project through a visit to TAMU in May 1979 to learn more about this area of research and the data requirements for both projects. Cartwright and Nelson (TAMU) traveled to Peru with the Montana personnel in January. A close working relationship is developing between our projects, both in Peru and the U.S. Dr. Jorge Velasco will be counterpart scientist in Peru on both projects. We have made arrangements to supply growth data on sheep from the Montana Agricultural Experiment Station to a Ph.D. student at TAMU for his thesis research.

III. Regional Applicability

We visited a sheep breeding and management project in Columbia being conducted by a British team. It is a cross-breeding project located at 10,000-12,000 feet elevation. The results clearly indicate the need for basic studies in reproduction, and several

points of caution were evident as regards the introduction of exogeneous stock into high elevation environments. This aspect of genetic improvement needs further study to identify basic problem areas in the reproductive cycle (ovulation, fertilization, embryonic mortality, neonatal survival, male fertility, mating behavior, etc.) to insure that practical solutions to low fertility problems can be found. This and the adaptability problem exist which plague genetic improvement either through the introduction of genetic stocks or the improvement of indigenous stocks.

IV. Project Description

A. Problem

A high animal population per unit of land area in the Sierra is a basic problem in production. Overstocking compounds nutritional and disease related production problems, and creates a very serious environmental problem for the breeding project. Reproductive failures are limiting factors in production and limit the opportunity for genetic improvement. Two needs are evident in this area: (1) Environmental constraints to reproduction must be alleviated to permit a higher reproductive rate so that selection program can be more effective; (2) Improvement in the heredity for reproductive performance, as well as other production traits, need to proceed together. Selection to improve reproduction is a sound but slow route to follow. Introduction of a breed, or breeds from outside (such as the Finn) has real potential so far as the heredity for reproduction is concerned, but this approach presents adaptability problems. This multi-faceted problem requires a strong emphasis on

the breeding and genetic component, but also requires the integrated effort of other disciplines.

B. Objectives

Existing production records of sheep available in the SAIS are being tabulated for analysis (Objective 1). Extensive discussions with management of the SAIS and the Central de Cooperativas and with counterpart personnel at UNA have provided us with some understanding of their breeding programs and procedures and of the potential for genetic improvement of sheep in the Sierra. Research plans have been made and a research project is being initiated at the Central de Cooperativas. Breeding research at the SAIS will be initiated later in preparation for the 1981 breeding season. Arrangements have been made for some initial funding to support students and travel for counterpart scientists through the service organization, SACI. This will permit better supervision of data recording, the tabulation of existing data in the files of the SAIS, and provide the resources for Dr. Velasco to pursue the analysis of production and coat color data on alpaca at the La Raya Station, (Objective 2). Objective 3 will be held in abeyance until such time as activity on any new station development becomes clearer. Consideration will be given to a revision of the objectives for the breeding project in Peru as need, experience and expanded research opportunity dictates. At this time objectives 1 and 2 appear adequate for our initial effort.

C. Approach

Production records from SAIS Tupac Amaru are being tabulated and will be sent to MSU for analysis and study. A fairly sophisticated breeding program is in operation at this SAIS. We are studying that program in as much detail as possible from the records and the historical information available to us. A twin selection project has been going for about 5 years and several elete breeding groups exist on the SAIS. We plan experimental comparisons of their genetic merits starting with the 1981 breeding season. Control groups to monitor selection progress will also be started. The number of ewes that will be in the research projects will be in excess of 3000.

At the Central de Cooperativas matings for a breed comparison (Corriedale vs. Junin) will be made in 1980. This project will probably be expanded to include additional breeds in the following years. The breeding flock of approximately 3500 ewes will be available for research, and will accommodate a selection project to be initiated in 1981. Eartags are being provided to identify the ewes individually, an essential element in the breeding research efforts.

We will provide technical advise to these programs, assist with data collection and other work required to insure that accurate and meaningful records are produced for research. It will be necessary to incorporate the experimental projects into the existing programs. Opportunity exists to improve the breeding management of these large breeding herds and to accelerate the transfer of improved genetic material to the herds and flocks of the communities.

Management has enthusiastically invited this type of participation by our project. A very substantial resource will be provided the CRSP through this cooperation.

The alpaca breeding research of IVITA will be continued by Dr. Velasco. Our involvement at first will be in providing financial support and consultation. This should make it possible for him to do necessary "catch-up" work in analysis of data and to bring the main alpaca herd at La Raya into a broader research environment and permit greater participation of the geneticist in the total research effort at that location.

D. Indicators that objectives have been achieved:

Progress is evident in items 1, 2, 3, and 5. Of course, it is too early to give much consideration to having met any of the objectives.

E. Assumptions that objectives can be met:

These assumptions appear to be valid and we see positive evidence that an effective, productive research program in breeding and genetics can be carried out. The delay in signing the MOU does not appear to be the fault of INIA or either University. The AID Mission in Peru continues to be cooperative. Their policy on limited travel by P.I.'s and U.S. scientists on the project until the MOU is signed makes CRSP start-up difficult, but, we must understand that the CRSP is just one of numerous projects that AID is concerned with.

F. Assumptions that meeting the objectives will solve the problem:

Flexibility must be permitted in the project to modify objectives if necessary after experience is gained, perhaps in one or two years.

There are factors external to this project or the CRSP that will affect these assumptions. The project, if allowed to proceed to its logical conclusions will provide information and techniques for genetic improvement of animals in high elevation environments.

Montana Agricultural Experiment Station Project

The MAES sheep breeding project has proceeded normally with the basic breeding program, but some modifications have been made in the procedures. The project has been broadened to investigate male mating behavior and a nutritional study of ewe lambs for reproduction as yearlings under range conditions. Twenty years of data have been extracted from files for computer manipulation so accessiblity for research will be possible. Computer programs for data management have been developed for our own project and in anticipation of a large data volume from the Peru project. A large data set on growth in range ewes is nearly complete for a study at Texas A&M University by a Ph.D. student. This study will be done both from the genetic aspect as well as contribute to the Systems project.

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)
TITLE XII

I. Face Sheet

Research Area: Animal Breeding and Genetics

Report Title: Annual Report
October 1, 1978 - May 31, 1980

Sub-Grantee: Texas A & M University
San Angelo, Texas 76901

Funds: $160,000

Principal Investigator: J. Maurice Shelton

TITLE XII SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM

Annual Report (October 1, 1978-May 31, 1980)

I. TITLE: Evaluation of Meat Goats and Hair Sheep

II. SUB-GRANTEE: Texas A&M University
Texas Agricultural Experiment Station

III. PRINCIPAL INVESTIGATOR: Maurice Shelton

CO-INVESTIGATORS OR COLLABORATORS (U.S.): Dr. Charles Long
Dr. Darrell Ueckert
Dr. James Sanders
Dr. Gary Smith
Dr. C. W. Livingston

(BRAZIL): Elsio Antonio P. de Figueiredo
EMBRAPA-CNPC-Sobral
Francisco Helio Ferreira Machado
EPACE-Quixada
Francisco Antonio Rocha Macedo
EPACE-Quixada
Severino Gonzaga de Albuquerque
CPATSA-Petrolina

IV. PROJECT DESCRIPTION:

A. Problem

The problem remains essentially as stated in the first year work plan, but a brief restatement is being presented. A large portion of the world's sheep and goat population is located in the arid or semi-arid tropics and this also coincides with the location of many LDC countries. The sheep and goats in these areas often make unique contributions to the welfare of resident populations. The types of sheep and goats found in these areas tend to be different from those of developed areas and which have received emphasis in research. For instance with sheep the most developed types are finewool producing strains or meat producing breeds adapted to temperate regions. By contrast in LDC areas the hair sheep or fat-tail types tend to predominate. With goats well developed types exist for fiber production (Angora) or milk production (many breeds), but they have been less developed as meat producers. However, the majority of the goats of the world are not regularly milked or sheared, and this especially applies to Central and Latin America. This project is directed toward expanding out level of knowledge concerning these meat goat, hair sheep and fat-tail sheep. In the case of each type adaptation to prevalent environmental conditions (including disease and forage types) are a necessity, and genetic studies must take these factors into account. The arid region of Northeast Brazil provides an excellent area to study these problems as related to meat goats and hair sheep. In addition there exists local government interest in the problem and the information obtained would be transferable to many other areas. The potential for working with fat-tail sheep exist in Brazil, but it is not a major resource there and their work with this type may also require development at an alternative location. The genetic studies being proposed in Brazil will include observations on forage types and disease and parasite resistance as well as productive traits.

Brazil there is a need or interest in developing work with this type at an alternative site to be identified.

U. S.

Genetic studies are underway with meat type goats in the U. S. to provide initial estimates of genetic perimeters for these type of goats. Production perimeters, including milk production, are also being obtained for contribution to systems analysis project. One of the coworkers on the project is also involved in efforts to develop a diagnostic test for caseous lymphadenitis which is a serious problem in both the U. S. and Brazil. The availability of such a test would facilitate the work of both genetic and veterinary components of the project.

Objective No. 3
BRAZIL

This is a long term effort and extensive consultations have been carried out with Brazilian counterparts. This will be a continuing effort throughout the life of the project.

U. S.

Work on the development of genetic perimeters with sheep and goats in this country is underway and will be relied upon in decision making until comparable data from LDC sites is available. Thereafter these data will be supportive in nature to that collected at one or more LDC sites.

Objective No. 4

Plans are underway to bring the principal collaborator from Brazil to Texas A&M University in May for one month's training and a period of coordination and document preparation during the first year of the project. In addition two U. S. scientists from Texas A&M University have spent one month each in Brazil during the first year. Budget provisions have been and will be made for one or more graduate fellowships. These will be awarded to Brazil or LDC students as appropriate individuals are identified.

Objective No. 5
BRAZIL

Production or management systems are underway in Brazil at one or more locations. The major center for this type of work is at Petrolina. Project personnel have conferred with Brazilian workers in planning and conduct of these studies based on experience in this country and in other LDC areas. Specific cooperative projects are envisioned, but detailed plans have not been worked out. Studies in this area should benefit directly Brazilian producers, but may be expected to provide data for systems analysis.

U. S.

Experimental flocks of meat goats, hair sheep and fat-tail sheep are being maintained in the U. S. Experiences with these will be used to assist in planning production system alternatives in Brazil. A study of factors contributing to abortion has been completed during the year. This is a problem which is common to both areas.

B. Project Objectives

The project objectives remain the same as stated in the first year work plan with some increase in emphasis in the genetics of adaptation to Brazilian conditions and collaboration with range science and veterinary medicine in relation to problems of adaptation. The stated objectives represent long-term objectives with the first year to serve as a planning effort or lead into the ultimate goals.

C. Research Approach and Accomplishments

Objective No. 1
BRAZIL

A manuscript providing a brief description of the sheep and goat resources of Northeast Brazil has been prepared. This will be published providing a satisfactory outlet or publication medium can be identified. Workers in Brazil are conducting a more detailed study to characterize the productive traits of genetic types found in this region. This work was already underway and the contribution of workers from the Texas A&M Project is largely one of providing advice, assistance and council in this effort. A project outline is now being developed to provide a basis for selection between the various genotypes as to those showing promise for future exploitation.

U. S.

The Texas Animal Breeding component to the overall project is located in an area approximately 30°N. latitude with temperature and moisture resources not unlike many LDC areas and including as well that of Northeast Brazil. With the difficulty or administrative delays of initiating work at LDC sites some efforts have been directed at developing information and capability at this site to respond to international needs as outlined in discussing the problem. In this connection flocks of meat type goats, hair sheep and fat-tail sheep have been established in Texas for basic observations on these types of animals. Observations and data collection is currently underway. A Technician has been trained and is currently making observations on the diet selection of each of these types to determine the degree to which they are competitive or complimentary in forage selectivity and the potential to change this through genetic means. Fecal collections have been made and partially analysed for the winter season in this state. Slaughter studies have been initiated to evaluate the meat qualities of the various types of sheep and goats. A total of 81 animals of three types of sheep and two types of goats have been slaughtered to date and more will be included before the first year's efforts are completed. Evaluations will include not only the dressed carcass, but other edible parts as well. Eating qualities (taste panel) studies will be conducted with three types of sheep and two types of goats. These taste panels will include representatives (students) from LDC countries.

Objective No. 2
BRAZIL

The Project leader and one coworker (J. O. Sanders) spent approximately one month in Brazil. A general work plan was agreed upon with workers in Brazil. By the end of the term for the first year (May 31) a detailed subproject is expected to have been prepared to cover the proposed work in Brazil and for clearance and coordination between groups in Brazil. Actual initiation of collaborative efforts have not been initiated and could not have been expected to be initiated in the absence of a signed MOU between the two countries. Since fat-tail sheep is perhaps the single most important type on a world basis, but are not widespread in

D. Assumptions That Objectives Can Be Met

Assuming that administrative, financial and personnel commitments are made and carried out by all parties involved the likelihood of accomplishing the stated objectives are good. However, as in any animal breeding efforts, time is a factor and rapid changes in animal populations are not likely to be accomplished.

E. Assumptions That Meeting Objectives Will Solve the Problem

Animal improvements alone will not solve the economic and sociological problems of Northeast Brazil or similar areas. However, work in animal breeding is a necessary part of an overall improvement program to insure that it is not a limiting factor. The temptation is great to introduce exotic or "so called" improved types of animals because this may be easier than alteration of other forces. However, it is necessary to maintain expectation from these in the proper perspective. The use of exotics should not be ruled out nor should they be given high marks in terms of expectations from them in LDC environments.

F. Project Outputs

Project outputs will consist of manuscripts conveying research results, improved animal genotypes and eventually improved production systems with animal improvement as one component of the overall system. To date two manuscripts have been prepared, but have not been accepted or scheduled for publication. In addition to the above it is expected that training experience will be provided for one or more LDC scientists to carry on over the longtime period necessary successfully accomplish Animal Breeding Programs.

G. Technical Feasibility

The feasibility of accomplishing the objectives are good over the long term. Only modest results should be expected over the short time.

H. Inputs

The project leader and one animal breeder coworker (Dr. J. O. Sanders) have spent approximately one month in Brazil within the time period covered in this report. In the period from this writing to May 31 the Brazilian counterpart is scheduled to spend one month in this country in training, planning and coordination. Within the time frame involved funds were budgeted to be spent on developmental aspects in Brazil. Due to delays in administrative linkings (absence of a signed MOU) this was not accomplished and these funds will be carried over to subsequent years.

EXPENDITURES BY BUDGET CATEGORIES

	AS OF FEB. 29	ANTICIPATED FEB. 29-MAY 31	ESTIMATED TOTAL
Salaries, wages and fringe benefits	$25,128.29	$15,900.00	$41,028.29
Domestic travel	1,928.09	1,302.00	3,240.09
International travel	1,973.39	2,000.00	3,973.39
Supplies and expenses	2,325.30	7,500.00	9,825.30
Equipment	889.95	4,536.00	5,425.95
Other	1,140.10	2,250.00	3,390.10
Total direct	33,395.12	33,488.00	66,883.12
Indirect	11,571.59	8,268.00	19,839.59
Total	$44,966.71	$41,756.00	$86,722.10

These expenditures do not equal the budgeted amount due to absence of MOU which effectively prevented spending funds in LDC countries, the entire project has not been active for the full 12 month budgeted and some unavoidable delays have been encountered in recruiting personnel and acquiring desired equipment and animals. It is expected that these funds will be carried forward to subsequent years.

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Range Management

Report Title: Annual Report
October 1, 1978 - May 31, 1980

Sub-Grantee: Utah State University
Logan, Utah 84322

Funds: $196,081

Principal Investigator: John C. Malechek

Annual Report
(October 1, 1978 - May 31, 1980)
Rangeland Research for Increasing Small Ruminant Production
in Less Developed Countries

Department of Range Science
Utah State University, Logan

John C. Malechek, Principal Investigator

A. The Problem:

Improvement of animal production in less developed countries (LDC's) rests strongly on improvement of the forage base upon which these animals depend. In many LDC's, this implies native plants (browse, grass, forbs) obtained by grazing on rangelands. Rangelands of most LDC's have been historically overgrazed and are 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 of insufficient knowledge of biological and ecological limitations of the system. Thus, research is needed to elucidate these relationships.

An additional need for increasing range productivity in LDC's is a cadre of trained scientists and professional resource managers who can relate to local cultures and problems, and who are likely to have personal interests in the continuation of range and animal improvement programs after U.S. technical experts have withdrawn. This project attempts to address these two general needs.

B. Objectives:

Objectives outlined in the original proposal and in subsequent documents still apply. However, those addressed specific scientific questions. Essentially all work during the 19-month period covered by this report has been focused on getting the project located in an LDC. Therefore, for the immediate purposes at hand, the following specific objectives were attended:

1. Visit appropriate LDC's, review their rangeland resources, animal production systems and on-going research programs, and establish contacts with scientists interested in possible collaborative research and training.

2. Select an appropriate LDC for the project-location and identify a specific collaborating institution and scientific personnel to engage in the range management project. In collaboration with identified LDC scientists, develop a work plan for the initial year of research.

3. Identify and secure worksites within the selected LDC and within Utah for U.S.-component of research.

4. Recruit necessary project personnel, both for in-U.S. and in-LDC components.

5. Develop facilities and logistical support systems in LDC and in U.S.

6. Begin assembling pertinent background information on the LDC selected for work.

C. Project Approach:

1. Morocco

Site visits were made in March, 1979, to Turkey and Morocco (SR-CRSP Phase I). Morocco was selected as the best potential project location in the Mid-East/North Africa area. Hassan II Institute of Agronomy and Veterinary Medicine was identified as the collaborating institution.

In-Morocco worksites identified were:

a. Tinahdite - upland range
b. Talsinnt or Oujda - desert range
c. Sidi Aissa - oak woodland mid-elevation range

In-U.S. worksites identified were:

a. Tintic Pastures research facility, Eureka, Utah. This 1400-ka fieldsite is administered jointly by the Utah Agr. Exp. Sta. and the USDI-Bureau of Land Management.
b. Green Canyon Ecological Research Area, Logan, Utah. This site is administered by the Utah State Univ. College of Natural Resources. It will be the site of stall and laboratory experiments.

Moroccan scientists identified as collaborators were:

Hamid Narjisse - National Agricultural School, Meknes
Omar Berkat - Hassan II Institute, Rabat

A site visit was scheduled to Morocco (SR-CRSP Phase II) by CRSP scientists for September, 1979. However, due to several institutional and bureaucratic problems, permission for this visit was denied by the USAID Mission and the task was not completed. Subsequent efforts to re-schedule the visit materialized and three CRSP principal investigators will visit Morocco in June, 1981.

Personnel positions and job descriptions were drafted for the following positions:

a. Secretary, 50%-time
b. Project Administrator - Morocco
c. Graduate Research Assistants (SRA); three positions
d. Technician (U.S.)

The following people were recruited and hired:

a. Robin Scherting - secretary (50%-time)
b. Fred Provenza - U.S. Technician (30% time)
c. James Pfister - GRA; Ph.D.
d. Hamid Narjisse, - GRA; Ph. D. Supported by joint USAID-Univ. Minnesota training project
e. Robert Kirmse - GRA; M.S. Possible candidate for Project Administrator position listed above

Facilities development entailed renovation of an existing barn at the Green Canyon area mentioned above. This included installation of a heating and ventilating system for year-round metabolism and balance trials, and the construction of an adjoining shed for storage of hay and equipment. Part of the funds for this project was furnished by the Utah Agr. Exp. Sta.

Background data and information assembled on Morocco included "third-cycle" student theses from Hassan II, maps, "area hand-books," and assorted library information. No systematic attempt was made to compile this information.

2. Brazil

The Phase II site visit to Brazil was accomplished in March, 1980, by U.S. Range Management Project personnel, Malechek and Norton. The following institutional and scientific linkages were tenatively established.

a. Collaborating institution - EMBRAPA
b. Project worksite - CPATSA Station, Petrolina

Coordination and consultation will also be tied to the CNPC Station at Sobral. Work at both sites will focus on problems of the important caatinga vegetation-type.

c. Collaborating scientists

Severino Albuquerque - CPATSA
Martiniano Oliveira - CPATSA
Augmar Ramos - CNPC
Celia Silva - CPATSA
Jorge Ribaski - CPATSA
Luiz Vale - CNPC
Orlando M. de Carvalho Filho - CPATSA
Ederlon Oliveira - CNPC
Luiz Mauricio Salviano - CPATSA
Roberto Mesquita - CNPC
Ian Beale - IICA - Consultant (Australian) at Petrolina
Max Murray - IICA Consultant (Australian) at Sobral

d. CRSP personnel recruited and hired or transferred from Moroccan Project

Robin Scherting - Secretary (half-time)
Robert Kirmse, Project Administrator-Brazil (full-time)
James Pfister - GRA, Ph.D. (American)
Joao Queiroz - GRA, Ph.D. (Brazilian)
Fred Provenza - Technician (40%-time)

e. Background information

Efforts have recently begun to assemble, procure, and catalog information on the caatinga of Brazil. Initially, this will include information readily available in the U.S. Later, material from Brazil will be added.

D. Assumptions that Objectives can be met:

In the case of Morocco, we were unable to locate a project there because two basic assumptions could not be met:

1. A mutually agreeable collaborative agreement between the SR-CRSP and Hassan II Institute could not be resolved in the near term.

2. Approval of CRSP plans and procedures by the Moroccan AID Mission was delayed to the point that we felt it expedient to move the range management project to Brazil where other CRSP program components were already in place. The decision to make this move was reached in early February, 1980.

E. Outputs:

1. Project components in place in Brazil

2. P.I. site visit has been completed and outline of Phase III workplan has been agreed upon by collaborating Brazilian scientists.

3. Personnel necessary for implementation of work in Brazil have been recruited and hired.

4. Preliminary background data on both Brazil and Morocco has been assembled.

5. Completed M.S. thesis by Robert Kirmse under project funding. Acacia albida, a fodder tree used in West Africa and the subject of Kirmse's thesis, will be tested for forage potential in the caatinga of Brazil.

6. Agreement of AID (both at Washington- and Mission-levels) and Hassan II Institute has been secured for a site visit in June, 1980. This will be conducted with the long-range plan of implementing at least a partial program in Morocco within the next two years.

7. Contracts or commitments have been established for potential Latin American graduate students, including:

   a. 2 Brazilians (in addition to Queiroz who is already in the program)
   b. 1 Peruvian, sponsored by the Latin American Scholarship Program of American Universities (LASPAU)
   c. 1 Mexican, sponsored by Rancho Experimental La Campana, in Chihuahua

8. On-campus facilities have been renovated and are ready for use in experiments.

9. Research design, experimental animals, and equipment are in place for in-U.S. component of project by Hamid Narjisse, Moroccan student originally recruited when project was destined for Morocco. This project will investigate comparative feeding behavior and nutrition of sheep and goats consuming shrubs (Artemisia spp.) containing high concentrations of volatile oils.

10. Contacts have been established with the following U.S. scientists who will serve as consultants to project in Brazil:

    a. E. Lamar Smith, Department of Watershed Science, University of Arizona, Tucson. Smith spent four years teaching and researching range management problems in the Brazilian caatinga.
    b. Roger McCoy, Dept. of Geography, University of Utah, Salt Lake City. McCoy will provide assistance in use of LANDSAT satellite imagery for resource inventory in the caatinga.

11. Experimental design and pasture lay-outs are completed for a U.S. study (partially funded by CRSP funds) on the use of sheep and goats to manipulate (control) undesirable shrubs (sagebrush) on Utah ranges.

F. Time-Phased Scope of Work:

October 1978 - March 1979:	Initial site visits, site selection, initial contacts with potential collaborators (Malechek)
April 1979 - September 1979:	Organization of P.I.'s site visit (Phase II) to Morocco. Scheduling of visits, trip itineraries. Search and review of pertinent background literature. Formulation of job descriptions, preparation of budgets recruitment and hiring of personnel. Initiation of work on facilities renovation on-campus (Malechek, Norton, Dwyer).
September 1979 - January 1980:	Attempts to revive and re-schedule scrubbed visit to Morocco. Purchase experimental animals, lay-out experimental pastures and formulate experimental designs for Utah work. Investigate potentials for re-location of project in Brazil (Malechek, Norton, O'Rourke, Dwyer).
January 1980 - April 1980:	Administrative details of moving project to Brazil. Made initial site visit and contacted collaborating Brazilians. Hired

personnel and graduate students for Brazil work. Continued with scaled-down efforts to re-plan visit to Morocco in June, 1980. Continued work on facilities renovation (Malechek, Norton, O'Rourke, Dwyer).

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Range Management and Nutrition

Report Title: Annual Report
October 1, 1978 - May 31, 1980

Sub-Grantee: Texas Tech University
Lubbock, Texas 79409

Funds: $200,000

Principal Investigator: Donald F. Burzlaff

1979 - 1980 Annual Report

Texas Tech University component of the
Title XII Small Ruminant CRSP

Project Title: Improving Small Ruminant Nutrition Management and Production in Peru

Prepared by:

Donald F. Burzlaff - Principal Investigator
Robert Albin - Co-Investigator
Fred Bryant - Co-Investigator
Frank Hudson - Co-Investigator

Project Objectives (1979-1980)

1. To standardize analytical and technical procedures with the range management team for Morocco and the forages development team for Peru.

2. To insure a cooperative effort amont institutions conducting research in Peru under the Small Ruminant CRSP.

3. To establish lines of communication and identify collaborators in Peruvian institutions and government agencies.

4. To begin inventories of (a) rangeland vegetation, (b) existing strategies of herd management and husbandry practices, and (c) potential supplemental feed sources.

5. Assure continuation of the research effort.

B. Indicators and Outputs (June 1979 - February 29, 1980)

This portion of the report is directed at completed activities that assure that objectives of the 1979-1980 portion of Phase III outline have or are being met.

Objective 1.

Principal investigators have been in communication by phone, mail and at meetings to assure that vegetation and nutritional parameters were to be inventoried and analyzed under common techniques and reported with a standard nomenclature. Those involved in such investigations included Texas Tech University, Utah State University, Ohio State University and North Carolina State University.

Objective 2.

Principal Investigators of the Peru project from Texas Tech met with persons from Texas A & M who are responsible for the systems modelling. We were given the kind of inputs needed to assure appropriate data for the model(s). All principal investigators met at College Station to coordinate travel plans and discuss activities common to all projects. A third joint meeting has been planned for April 7, 8, and 9 at which a decision will be made relative to a Peru Site Coordinator.

We attended a 3 day symposium sponsored by the Small Ruminant CRSP investigators of the University of Missouri. This symposium was a sharing of some of the existing research and information relative to socio-economic circumstances of the high-Andean Pastorilist.

Objective 3.

The principal investigator visited Peru on two occasions (see Appendix A and B). Once in July with Dr. Blackwell of Montana and once with the three co-investigators from Texas Tech and the principal investigator from Winrock International in October.

Collaborating institutions and personnel were identified as follows:

INIA - As coordinator of activities among Peruvian institutions.
IVITA - San Marcos University
Universidad Nacional Agraria - LaMolina

Dr. Ricardo Valdivia of IVITA is counterpart to the nutrition studies.

Dr. Arturo Florez of the UNA is counterpart to the range management studies.

Both will advise graduate students within their respective institutions that are a part of this project. One Peruvian student will be at Texas Tech beginning in September 1980 under partial funding of the CRSP. This student is currently in Georgetown University in an English language program.

Adequate office space has been provided to the Range Management Project at the Universidad Nacional Agraria, LaMolina within the Forage and Range Section.

Research facilities have been identified at two locations (Appendix B). One site for small ruminant range research will be at Ayaraca (a division of the Central Cooperative of Cerro de Pasco). At this location there is a residence provided for project personnel. Adequate land, animal, labor and physical resources have been pledged to facilitate our range research activities with sheep. The agreement to conduct research at this site will be arranged by administration of the Universidad Nacional Agraria and the Officers of the Cooperative.

A second facility was designated at LaRaya. This is an experiment station operated jointly by IVITA and by the Ministry of Agriculture. It presents an excellent opportunity to support and expand ongoing research activities of San Marcos University. Research associated with the alpaca industry is planned for this activity. Development of the laboratory for forage analysis is underway. A list of equipment needs was submitted by Dr. Valdivia. This equipment is being ordered. Upon delivery it will be readied for shipment to Lima. It will be transported to LaRaya and installed by project personnel.

Adequate facilities for analysis of plant and soil samples were found in Lima. Both the Universidad Nacional Agraria and IVITA have excellent laboratories. Some equipment needs refurbishing and repair.

An additional forage laboratory is available at the Montaro Valley Station of IVITA. Dr. Aduna is director of this laboratory. He has been assigned to supervise also the laboratory at LaRaya. Dr. Aduna will be considered as a project counterpart.

Mr. Ramiro Farfan has been identified as a Peruvian student who will initiate graduate study in the United States. He is to be supported in part by the Small Ruminant CRSP program.

The initiation of a detailed literature search was not possible until permanent personnel can be assigned in Peru. This was delayed because of the failure of the Memorandum of Understanding to be in place precluded country clearance for personnel.

Objective 4.

Dr. Al Schlundt was employed as the Research Scientist to oversee the Texas Tech project in Peru. Dr. Schlundt will be on site in Lima in early June. He will office at LaMolina with Dr. Florez. He will coordinate activities at both research locations and will provide direction for graduate students on site. He will conduct research in collaboration with principal investigators from the U.S. and their counterparts in Peru.

Objective 5.

One American graduate student has been employed on the project to complete range soil and vegetation descriptions at Ayaraca. He has been

involved in the Academic program at Texas Tech University for one semester. He is currently enrolled in a Spanish language institute in Washington, D.C. while waiting for country clearance and the signing of the Memorandum of Understanding. His research outline has been developed and he will begin Peru residence in June. Dr. B. L. Allen will be a consultant on the soils phase of this project.

Two additional candidates are being considered for the nutrition work. They will begin academic work in September 1980 and be resident in Peru in May 1981.

Objective 6.

One Peruvian graduate student has been identified to be in the program at the M.S. level. A third nation individual is under consideration to work at the Ph.D. level in the nutrition aspects of the program. Plans have been made for two M.S. level Peruvians to begin work as soon as the MOU is in place and money is transmitted to Peru for CRSP use.

Indicators that project goals have been achieved or initiated

1. Communication and verbal agreements have been exchanged by principal investigators to assure standardization of procedures for inventory and analysis of vegetation and nutrition parameters.

2. Data taken will be suited to the systems modelling of the Texas A & M project.

3. Principal investigators from Texas Tech attended a 3 day symposium relative to the socio-economic circumstances of the Andean pastorilist.

4. Two visits were made by Texas Tech personnel to Peru for purposes of identifying collaborative institutions and personnel.

5. Collaborating institutions include INIA, IVITA, and the Universidad Nacional Agraria.

6. Dr. Ricardo Valdivia of IVITA was selected as the counterpart to the Nutrition Studies.

7. Dr. Arturo Florez of UNA is counterpart to the range management studies.

8. A Peruvian student has been given permission to attend Texas Tech. Mr. Farfan will be funded in part by the Small Ruminant CRSP.

9. Offices for the Range Management portion will be located at Universidad Nacional Agraria at LaMolina.

10. A detailed long-range study plan was developed and approved by our Peruvian counterparts (Appendix C).

11. A research site was identified at Ayaraca - A division of the Central Cooperative of Cerro de Pasco (Appendix C).

12. A residence, land, animals, equipment and labor have been pledged to the project by the cooperative (Appendix C).

13. Universidad Nacional Agraria is to obtain the agreement for Cooperation.

14. A second research site was selected at LaRaya, an experiment station operated jointly, by IVITA and the Ministry of Agriculture (Appendix C).

15. The research at LaRaya will be concerned primarily with Alpaca (Appendix C).

16. Laboratory equipment to develop a forage lab has been ordered and will be transported to LaRaya for installation.

17. Analysis of samples will be accomplished at laboratories in Lima and LaRaya. Facilities for forage analyses are also available at Huancayo.

18. Dr. Aduna of the Montaro Valley station has been assigned to work part time at LaRaya.

19. Dr. Al F. Schlundt has been employed as the Research Scientist to oversee the Texas Tech project in Peru.

20. Dr. Schlundt is scheduled to be in Lima in early June.

21. One American graduate student has been identified to work on the project. Brad Wilcox has completed one semester at Texas Tech and a program at the Foreign Language Institute at Washington, D. C.

22. Field work is to begin as soon as the MOU is in place.

23. The continuation proposal has been initiated. This includes plans for identification of additional students.

Appendix A

Peru Trip - July 10-25, 1979

Report: Peruvian Trip - July 10-25, 1979

Purpose of Trip: Site selection for Texas Tech participation in the Small Ruminant CRSP in Peru

Prepared by: Donald F. Burzlaff

Participants: Dr. Michael Nolan - University of Missouri

Dr. John DeBoer - Winrock International

Dr. Burk Dehority - Ohio State University

Dr. Robert Blackwell - Montana State University

Dr. Donald F. Burzlaff - Texas Tech University

Itinerary: July 10: Travel from Lubbock to Lima

July 11: Briefing with AID, Preparation for field trip.

July 12: Travel to Huancayo with an intermediate stop at the IVITA Station in the Montaro valley

July 13: Travel to Huancavelica, Lachoc and return to Huancayo

July 14: Travel from Huancayo to Seis Ramon Castillo, to Tarma and return to Lima

July 15: Sunday - rest

July 16: Met with the LaMolina representatives. Met with INIA

July 17: Meeting with IVITA representatives. Lunch and meeting with the North Carolina State Baseline Study group

July 18: Report Writing

July 19: Tour of facilities at LaMolina. Develop counterpart relationships

July 20: Early flight to Cuzco. Tour Cuzco - Drive to LaRaya Station

July 21: Tour of LaRaya station and facilities. Drive to Experiment Station operated by the University of Agriculture, Puno near Santa Rosa. Return to Cuzco

July 22: Sunday. Return flight to Lima

July 23: Tour IVITA facilities. Developed appropriate counterpart relationships. Meeting with representatives of INIA, IVITA and LaMolina

July 24: Visit to AID. Lunch and meeting with the N.C. State Baseline study group. Contact with SACI and a brief meeting with representatives.

July 25: Return trip - Lima to Lubbock

Contacts in Peru:

INIA (National Institute for Agricultural Investigations)

Javier Gazzo - Director

Jose del C. Murro

Julio Fozano M.

LAMOLINA (National Agricultural University)

Guillermo Parodi - Administrator

Dr. Arturo Florez - Range management

Dr. Arturo Carrasco - Supplement feeding , physiology

Dr. Manuel Carpio - Production and breeding

Arturo Pumayalla - Wool technology

IVITA (San Marcos University - Veterinary Institute)

Dr. Alberto Sato Sato - Administrator

Dr. Cesar Novoa - Reproductive physiology

Dr. Richardo Valdivia - Nutrition

Dr. Jorge Velasco - Genetics and breeding

Dr. Julio Sumar - Reproductive physiology

Dr. Horatio Acũna - Nutrition - (Montaro Valley)

Dr. Custodio Bojorques - Agronomist (Montaro Valley)

Dr. Antonio Ramirez - Veterinarian (LaRaya)

Ramiro Farfan - Agronomist (LaRaya)

Diomedes Holgado - Agronomist (LaRaya)

Dr. Franco - Anatomy and breeding (LaRaya)

MINISTRY OF AGRICULTURE - (HUANCAVELICA DISTRICT)

Ing. Maximo Ramirez M. - Director

Indalecio Pino P.

BASELINE STUDY GROUP - (NORTH CAROLINA STATE)

Dr. Art Coutu

Dr. Gene Mathia

Dr. Tim Scofield

Dr. Pedro Sanchez

Dale Bundy

U.S. AID

Loren Schultze - Agr. Officer

Al Henkins - Washington D.C.

Hugo Osario - Finance

David Chiriboga - Assistant program officer

Narrative Report

The U.S. AID Mission represented by Loren Schultze restated its strong support of the Small Ruminant CRSP. It complements the Mission objectives. They urged that we work on Alpaca as well as sheep since national objectives are to increase alpaca production because of wool from this animal representing a strong international demand.

U.S. AID will offer certain amounts of logistical support for the CRSP participants. It was recommended that we may want to contact SACI (Administra-

tive Services for Contracting Institutions) for complete logistical support.

It became obvious that the most meaningful research program would involve two locations within the country. The first would be at Lachoc Grandj near Huancavelica, the other would be at LaRaya Grandj near Sicuani in the Cuzco District.

The Huancavelica site was toured by the group representing the CRSP with two persons from IVITA (Sumar and Valdavis) and one person from LaMolina (Pumayalla).

Excellent facilities were observed at the IVITA station in the Montaro Valley. The laboratories for forage and soil analysis were particularly well equipped and operated by qualified persons. The forage lab had capability to do nitrogen analysis and complete "proximate" analysis. Fistulated animals and an artificial rumen have been utilized here.

Congestion may become a problem if the number of samples are generated by work of the CRSP that appear to be necessary. Some equipment and a technician or two may alleviate this problem.

It is envisioned that the Montaro Valley would be the site of initial sample preparation and analysis for the work at Huancavelica. Workers at this site would reside in Huancayo about 28 km from the station. Office space and working arrangements can be made.

Lachoc Grandj is a 45 minute drive from Huancavelica. The elevation at this site is in the vicinity of 4600 meters. Precipitation totals approximately 800 mm. Some of it comes as snow but grazing lands are covered with snow for only 2 or 3 days before melting. Lower elevations of the ranch receive no snow. The rainy season is late November through March.

The Lachoc unit is operated by the Ministry of Agriculture. There is certainty that if our work plans included this unit, its operation would transfer to LaMolina. Personnel at LaMolina consider acquisition of the land important to their High Sierra research effort.

Although the unit has 4800 ha of land, only about half is useable rangeland because of rock and steep terrain. There are currently 1200 alpaca and 500 sheep on the ranch. Government officials consider the unit understocked. There is no basis for increasing or even delaying stocking rates except years of experience. It would be useful to determine production of plant biomass over a period of years and to base stocking rates on intake rates of animals and this annual or seasonal production. Storage of forage for later consumption is not practical except within mixed farming enterprises.

There is no research being conducted at the station. Records of females bred, number of lambs, post-natal survival and annual wool yield are kept and compiled. No range or vegetation analysis has been attempted. Maps of the useable land are available.

Facilities at Lachoc include good corrals, a dipping vat and houses for workers. A shearing shed is under construction. There is no electricity or improved water. A small waterfall and stream provide water source for animals and workers. This water is very high in mineral content.

The logistics of working at this staion would be difficult but not impossible. If it is important to the national research effort to acquire and develop this station it should be accomplished. A diesel generator or a small hydroelectric plant might be possible from the waterfall area. Mineral deposits may present a problem. A unit similar to that seen at LaRaya may be possible.

Research personnel would have to reside in Huancavelica and drive the 25-30 km distance twice each day. Acceptable accomodations are available at the State-owned Hotel in that city.

Problems that should be approached include forage production, vegetation soil inventories, grazing system and stocking rates are to be determined. The seasonal nutritional value of forage is unknown as is the nutritional status of the animals at various seasons of the year. Efforts at supple-

menting the diet in the dry season through storage of feed or providing concentrates must be considered. The alpaca may present a special problem because of eating habits which are different. They do not consume supplements without specific training. Hay may be a possibility since it is eaten when the animal is in confinement.

A statistic that may be of interest is that the mature alpaca will weigh approximately 60 kg. Dry matter consumption has been calculated at about 2% of body weight per day. Current stocking rates are 1.8 ha/alpaca. The ministry claims 1 ha/alpaca is possible.

Fencing perimeters might be possible. Interior fences would be an expensive luxury since herders can keep animals confined to predetermined area with landmark boundaries. Water development may be an essential ingredient of successful grazing systems.

The LaRaya Station is a relatively complete station. It exists at elevations of 14,000 feet and would be an appropriate duplicate of the Lachoc Station. IVITA has control of 4,000 ha of the 28,000 ha ranch. The Ministry of Agriculture operates the balance of the site. There are currently 40 ha of irrigated land with improved forages seeded. Grasses need nitrogen. Legumes seem not to do well even with phosphorus.

The laboratories for physiology of reproduction are well equipped. The forage lab is very inadequate. Dry matter determination is about all they are equipped to do. It should be equipped to do proximate analysis, nitrogen determination and basic nutrition work. Electricity is available (220 volt) from a small hydroelectric plant at the site. There is a standby diesel generator.

The station is at an elevation over 14,000 feet. The coldest winter temperatures are at -5 to -8^{o}C and rise to a 14^{o}C high. In the summer temperatures vary from 5^{o}C to 17^{o}C. Rain patterns are similar to Lachoc November through March. Amounts average near 600 - 650 ml/year.

Rangelands have been classified according to carrying capacity. Class II, Improved forages, some migration; Class III, Foot hills, steep slopes, Class IV, Highest elevation, rocky and generally unuseable.

Facilities of the station include storage sheds, drying sheds for air drying, reasonably good handling facilities. There is a set of 12 metabolism stalls. Library facilities are at zero although a library is planned and space is available. There were a number of vehicles at the station in need of service. Budgets seem limited in providing appropriate maintenance for vehicles. Vehicles would have to go to Puno or to Cuzco for such maintenance.

This appears to be an ideal location to work even if logistics will be difficult. The station maintains a hotel at the site. Room and board and a bathroom with warm (not hot) water available at $25/month. I would not recommend extended stay at this site for graduate students or technicians. Its remoteness and lack of diversion would create a problem in personnel retention. However, personnel at the station have pride in their work and a good attitude. A bit of imagination, equipment and leadership could get athletic events underway among the workers and their families. Bicycle races were underway while we were at the station - a bit strenuous for flat landers until you get acclimated.

Lima Institutions

LaMolina -

This is a group of well-trained scientists who need working budgets to get research accomplished. They are appropriately motivated and capable of doing appropriate kinds of research but have had no budget for this over the years.

The laboratories and facilities at this institution are quite sophisticated and there are scientists qualified to do the work. They are anxious to be counterparts in this endeavor. Office facilities were offered to

the CRSP scientists. Dr. Auturo Florez would be an appropriate counterpart to the Texas Tech project. He is a range-trained scientist who received his Ph.D. from Utah State University. He has had considerable field experience and a good knowledge of the ecology of the high Sierra of central Peru.

Needs of personnel at this University seems to be funding to update library facilities, publication of reports and research results, membership in professional societies, and the means of or proper maintenance of research equipment. The latter is especially true for some of the more sophisticated analytical equipment needed in nutrition work. Service is slow to lacking even though sales offices are located in Lima. Much equipment, yet unpacked, was provided by the Hungarian government. The contents of this shipment should be examined prior to ordering equipment. I suspect service would be as great a problem with this as it is with U.S. equipment.

Computer facilities seem to be adequate for the scope of experimental activities planned. Provision of programmable calculators for use of counterparts and associates would be a major contribution. Much calculation could be done by technicians and scientists in the lab without waiting for access to the computer.

IVITA

IVITA is the National Veterinary Institute. It was built by the Rockefellar Foundation about twenty years ago. Inadequate budgets are reflected in the lack of maintenance at the facility. This is probably the sign of what will happen to any development done by the CRSP. The counterparts in animal breeding, animal health and nutrition will find functional labs. Again, some of the equipment is antiquated.

Some of the more sophisticated lab equipment is idle for the lack of service. The atomic absorption spectrophotometer is functional but it needs new elements to assure continuing precision in mineral analysis.

The nutrition lab is capable of complete forage analysis. Four full-time technicians do all the analytic procedures. I am positive the samples generated by the CRSP would tax the capability of the lab. Additional technicians may have to be employed as well as provision of additional or updated equipment especially Kjeldahl apparatus with exhaust system.

Dr. Ricardo Valdavia appears to be the appropriate counterpart for the Texas Tech project at this institution. He has a Ph.D. in nutrition from the University of Florida. He is interested in blood analysis to detect mineral and vitamin deficiencies.

Programmable calculators are needed to facilitate calculations at the institutional level.

INIA

INIA is headed by Javier Gazzo. It is an embryonic agency created to coordinate agricultural research in Peru. To date it exists in name only but is the appropriate agency through which to negotiate the CRSP agreement. The project workers will have to be constantly aware of the need to keep balance in relationship with agencies since certain sensitivities were detected in inter-institutional relationships. The role of INIA is hard to assess, except as it will function in a coordinating role.

Recommendations

It is my recommendation that Texas Tech University initiate a range management - range animal nutrition program in Peru as part of the Small Ruminant CRSP.

The program will be collaborative with research scientists of both LaMolina and San Marcos Universities. Counterparts will be Dr. Arturo Florez of LaMolina and Dr. Ricardo Valdivia of IVITA.

Office space for principal investigators will be located at LaMolina with the range and pasture agronomists. Laboratory analysis of forage and

diet samples will be done at both institutions depending on sample loads in a specific laboratory and the nature of analysis required. Some initial analytic work can be completed in field laboratories at Montaro Valley Station and at the LaRaya station.

Field locations for research should be developed at Lachoc Granja near Huancavelica and at LaRaya in the Puno - Cuzco districts. The agreement should read that lands and facilities at these two locations be made available for such a research program. Grazing animals should be provided by the government of Peru. Both sheep and alpaca will be required for the study.

Sheep will probably not be introduced at the LaRaya station although we do not want to rule out the possibility of dual use as an alternative. Laboratory facilities will be upgraded by the CRSP at this location to facilitate preliminary processing of forage and diet samples.

At Lachoc Granja activity will be delayed until the Ministry of Agriculture transfers use privileges to LaMolina for research activities. There will need to be some development at this station. One of the major disadvantages is the absence of electricity. Generators can probably be installed but fuel prices will make continuous service impractical. Samples will have to be frozen and transported to Montaro Valley or to Lima for processing.

One of the ways to assist a research program in Peru will be to help them update library facilities. Inadequate support and low salaries have taken their toll on maintenance of facilities and equipment and membership in professional organizations. Although purchase of equipment is possible in Peru, maintenance of sophisticated instruments is lacking. Service calls are either impossible or require a year or more to complete.

It is apparent that governmental regulations and red tape will be an omnipresent problem. Particularly in relation to procurement, employment of laborers, technicians, secretaries etc. An organization by acronym

known as SACI, provides administrative support on a contract basis. A copy of their services and a sample contract are appended. I recommend that Texas Tech and other institutions involved in the CRSP might be well-advised to avail themselves of the services of this group as they initiate program activity.

Language training will be essential for on-site participants in the program.

Distribution:

To: Burk Dehority - Ohio State University
Robert Blackwell - Montana State University
John DeBoer - Winrock International
Michael Nolan - University of Missouri
Tom Carpenter - Texas A & M University
Warren Foote - Utah State University
Cleone Kimberling - Colorado State University
Dr. Sam Curl - Dean - Texas Tech University
Dr. Max Lennon - Texas Tech University
Dr. J. Knox Jones - V.P. Research - Texas Tech University
Dr. Bill Johnson - North Carolina
Dr. Dave Robinson - University of California
Dr. Fred Bryant - Texas Tech University
Dr. Frank Hudson - Texas Tech University
Dr. Bob Albin - Texas Tech University

Appendix B

Peru Trip - Oct. 21 - Nov. 3, 1979

Report: Peruvian Trip - October 21 - November 3, 1979

Prepared by: Donald F. Burzlaff

Participants: Dr. Donald F. Burzlaff

Dr. Fred C. Bryant

Dr. Frank Hudson

Dr. Robert Albin

Itinerary:

Oct. 21: Arrival in Lima

Oct. 22: Meeting with INIA personnel

Meeting with Loren Schultz (AID)

Oct. 23: Meeting with Administrative groups of Collaborative institutions and counterparts at INIA office.

Oct. 24: Travel to Sicuani - enroute to LaRaya.

Oct. 25: Visit LaRaya Station. Travel on to Puno.

Oct. 26: Meeting with officers of Central de Empressa, Campesinos Empressa Regional

Oct. 27: Arrive in Aeriquipa

Oct. 28: Return to Lima.

Oct. 29: Depart Lima for Cerro de Pasco enroute to La Quinua.

Oct. 30: Travel to Ayaracra

Oct. 31: Tour cooperative - Return to Lima

Nov. 1: Prepare Report.

Nov. 2: Meet with counterparts to prepare research approaches.

Nov. 3: Return trip to Lubbock.

Meeting at INIA 10/22/79

The Texas Tech group met briefly with Xavier Gazzo and Carlos Valverde at the INIA office. The purpose of this meeting was to meet Valverde and to discuss the tentative itinerary and the procedure for initiation of activities. INIA had delegated responsibility of the trip to IVITA and to the Univ. National - Agraria. Per diem was to be paid to counterparts at a rate to be determined the following day. INIA was to advance money for tickets and per diem. Texas Tech would reimburse INIA.

Meeting with Loren Schulze on Monday afternoon to acquaint him with the Texas Tech group and to let him brief us on AID agricultural activities.

Tuesday 10/23/79

Meeting with total administrative group and counterparts at INIA office.

In attendance:

INIA - Xavier Gazzo
Julio
Jose
Dr. Federico Anauitdete - President of the Board

National Agrarian University
Manuel Carpio
Arturo Flores
Domingo Martinez
Julio Verasco
Victor Fernandez
Guillerimo Parodi

IVITA -
Ricardo Valdivia
Jorge Velasco

Xavier Gazzo made preliminary remarks. John DeBoer outlined the procedure for the economic study. Donald Burzlaff presented objectives of a range management - animal nutrition and animal management program.

Goals of range management and range nutrition research:

I. Strengthen existing research capabilities.

II. Conduct collaborative research to improve the management nutrition and production of sheep and alpaca in the Andes of Central and Southern Peru.

III. Train students and technicians at appropriate levels - (workshops - to Ph.D. programs) to assure personnel for continued research efforts.

IV. Information transfer projects will be developed to assure that persons with small land or livestock holdings will benefit.

Researchable areas to achieve goals:

1. Characterization of native soils and vegetation of the high Sierra. Evaluate production of specific range sites.

2. Determine area to animal ratios (stocking rates of major range sites).

3. Determine the diets and species preference of sheep and alpaca at the various seasons.

4. Determine seasonal nutritional value of various forages.

5. Study "in vivo" and "in vitro" digestibility of various diets.

6. Determine nutritional requirements of sheep and alpaca at various stages in their life cycle.

7. Determine the effects of the nutritional level before the breeding season on reproductive performance of sheep and alpaca.

8. Develop procedures for supplementing small ruminants when deficiencies in the diet occur.

9. Study endemic and exotic forages for purposes of harvesting, storage and feeding in the dry season.

10. Study forage production systems.

11. Determine appropriate mating season under regional conditions.

12. Determine ideal weaning ages and castration systems.

13. Determine ideal ages and weights for first mating.

14. Apply grazing management, animal sanitation, animal breeding and herd management in actual production systems.

15. Develop grazing systems for improving (regenerating) rangelands and animal production.

Comments of other researchers added the following additional areas of research:

1. Study of nutritional physiology of alpaca
2. Seasonal limitations in productivity
3. Fertility - nutritional relationships
4. Introduction of legumes
5. Use of complimentary pastures and forage

This discussion was followed by a procedural statement from Xavier Gazzo indicating that Peruvian counterparts would be reimbursed at a rate of $6000 soles per day while travelling in the field on this project. INIA was to advance the funds until the MOU is signed. Reimbursement to INIA to be made by the individual principal investigators involved. This procedure was approved prior to the meeting by Gazzo, DeBoer and Burzlaff.

Meeting was adjourned by 5:30 p.m.

October 24, 1979. Travel to LaRaya by plane and automobile. IVITA furnished a vehicle and Texas Tech provided gasoline. Spent the day traveling with overnight at Sicuani.

October 25, 1979. Drove to LaRaya. Met with personnel as follows:

Walter Bravo - Physiology and Reproduction
Dr. Nicanor Condorena - Animal Production
Dr. Mario Varela - Coordinator of Station
Dr. Enrique Franco - Animal Production
Antonio Ramirez - Veterinarian
Ramierio Farfan - Pastures
Diomedes Helgado - Pastures

The total station is 12,139 ha. There are 6000 alpaca. Of this stoal IVITA controls 800 ha and 1000 alpaca.

Stocking rate - 1 ha per alpaca - natural pastures
1 ha per 25 alpaca - improved pastures

Animals are in lower region for shearing and "lambing" reasons. The higher pastures are grazed during the rainy season each year and the lower areas through the dry season. There are currently 37 ha of improved pasture. There are approximately 50 ha of land that could be improved.

Administration indicates that there is a need for systemetizing the use of IVITA's grazing land. There is currently no program except as defined above. They indicated that additional area and animals would be available. This was confirmed by the minister of agriculture representatives at LaRaya and again by the Secretary General of the Ministry of Agriculture at Puno.

Activities to begin immediately are:

1. Development of the Forage laboratory facilities.
2. Establishment of exclosures in natural pastures of Class II, III and IV.
3. Collect vegetation samples at bi-monthly intervals - January, March, May, July, September, and November
   for 1. Proximate analysis
   2. Van Soest analysis
   3. Invitro digestibility
   4. Mineral analysis
   5. Invivo digestion
4. Plan grazing systems for the station

October 26, 1979. Meeting in Puno with Dr. Jose Caminada Hermosa. He is Secretary General of the Central De Empressa Campesinas, Empressa Regional. Puno Ltda No. 37.

Hermosa outlined and the nature of the Central De Empressa Campesinas. It consists of 36 cooperatives of which 23 are SAIS. It was formed through Agrarian Reform laws. Each cooperative appoints delegates to the Central Program. The governing body is a congress of delegates and an administration council which is responsible for execution of the plans. The council has a representative at each cooperative.

The Central was formed to help marketing of wool, meat and fiber and to provide assistance through reduced costs of veterinary products.

Some cooperative project proposals have been submitted to AID. These include:

1. Improvement of refrigerated meat storage
2. Marketing of wool and fiber after initial washing
3. Project on fiber treatment prior to yarn
4. Commercial fertilizers

Two locations were suggested for off-site possibilities for demonstration of procedures developed at LaRaya. These were Pyamana and Quichua.

The Central controls 35% of the sheep production of the Puno district and 25% of the alpaca. The District has 4.5 million sheep, 1.5 million alpaca and .45 million sheep.

Herd composition of sheep is about 50% female. There is a relatively high mortality of young animals.

At LaRaya, precipitation comes in November, December, January, February, March and April with the peak in January, February and March. Maximum forage production is reached by May. Beyond this there is no accumulation of forage.

October 27, 1979. Arrived in Aeriquipa. Returned to Lima October 28.

October 28, 1979. Departed Lima by automobile for Cerro de Pasco - La Quinua.

At La Quinua we met with the officials of the Central De Cooperativas Agrarias comunales y Servicos Pasco, LLDA 161.

Those attending were:

Victor Sota Atencio - President
Manuel Cristobal Ponca - Finance Officer
Deonicio Monaga Florez
Venancio Cornelio Mauticio
Caesar Rodriquez Bravo - Assistant Manager
Percy Hermosa Jeri - General Manager

They explained the structure of the Central Cooperative which included 22 cooperative societies. These included:

12 communities
9 Agricultural production units
1 cooperative services unit

The area controlled by the Central was 228,000 ha. The Central itself owned 10,522 ha. This land plus any other was offered to us as a research site. The land is at the LaQuinia and at Ayaracra production Centers.

We were assured that the Central Cooperative would make land, animals, equipment, housing and labor available to the project. The land would be available for both research and demonstration purposes to other cooperatives in the Central.

Problems of the cooperative related to small ruminant program included:

1. Inbreeding
2. Overgrazing
3. Disease and Parasite Control
4. Adequate Nutrition
5. Herd Management
6. Introduced grass and legume production

October 30, 1979. Drove from La Quinaua to Ayaracra to view facilities. This proved to be a productive visit. All the requisites for completing range research will be able to be met at this location.

This should provide adequate facilities for the breeding, range management and range animal nutrition studies. Suitable housing will be available at the site.

Roads are difficult but not impassible at any season. This increases logistical problems but will be an improved site over Huancavelica.

We were able to observe a trout production enterprise at a cooperative production unit named "Ucrucancha". This was an interesting enterprise worthy of pursuit by some funding agency.

Octavio Carhuamaca was the chief technician at the Ayaracra station. At this location there was also a Social worker named Dosrita Rosa Cunchapoma Espinoza.

November 2, 1979. Met with representatives of the Institutions with whom we will be working. Dr. Bryant outlined the following complete program for the project. This was well accepted by the Peruvians. Minor comments were made which can become a part of the program without question. Major of these concerns were for improved pastures including legumes and forage production and some additional emphasis on the physiology of nutrition. We suggested that Ohio State will be urged to participate to cover these aspects of a complete program.

Appendix C

RESEARCH ON STOCKING RATES AND CONVENTIONAL GRAZING SYSTEMS

Project	Date of Accomplishment	Location	Type of data collected	Dates of data collection	Supervisor or personnel
I. Establish fences for: 1. Cont. grazing at 3 stocking rates 2. One conventional system at 2 stocking rates 3. Exclosures	Feb-Nov. 31, 1980	La Raya Ayaracra	-------	--------	Arturo Florez and Ricardo Valdivea
II. Develop Nutr. Lab.	Feb-Nov. 31, 1980	La Raya	------		Ricardo Valdivea
III. Develop Facilities	Feb-Nov. 31, 1980	Ayaracra	------		Arturo Florez
IV. Ecological relationship of plants, soils and grazing	April-Aug 1980	Ayaracra	1. Soils Map (type, depth, classification 2. Plant com. (% comp., species)	April-Aug. 1980	Brad Wilcox Florez, Bryant
	Sept-Nov, 1980	La Raya Ayaraca Puno	1. Veg. comp. on relict areas vs. grazing areas of similar sites	Sept-Nov, 1980	Brad Wilcox, Florez, Bryant
V. Nitrogen requirements of Alpaca	Dec. 1, 1980-Nov. 31, 1981 (82)	La Raya	1. Metabolism studies for growth, location, gestation	1 Dec 1980 31 Nov 1981	# Ph.D. student Valdivea, Albin
VI. Energy requirements of Alpaca	1 Dec. 1981-31 Nov. 1982(83)	La Raya	2. Metabolism studies for growth lactation, gestation		# Ph.D. student Valdivea, Albin

Project	Date of Accomplishment	Location	Type of data collected	Dates of data collection	Supervisor or personnel
VII. Vegetation responses to continuous yearlong grazing (3 rates) conventional system (3 rates) exclosures	1 Dec. 1980-31 Nov. 1985		1. Yield by species 2. Yield at end of growing season and end of dry season	At initiation covariable May each year Sept. each year	Range Research Scientist, Florez, Bryant, Burzlaff
VIII. Animal responses to continuous grazing (at 3 rates) and 1 conventional system at 2 rates of stocking * (Include supplements, and herd management)	1 Dec. 1980-31 Nov. 1985(88)	La Raya Ayaracra	1. % lamb crops 2. Weaning wts 3. Fleece wts and score & etc.	?	Range Research Scientist, Hudson, Jorge, Manuel
XI. Botanical (Nutritional from and production later) composition of sheep and alpaca diets from light vs. heavy continuous stocking	1 May 1981-30 April 1982	La Raya Ayaracra	1. Monthly fistula samples 2. Montly forage availability	1 May 1981-30 April 1982	2 Peruvian M.S. students, Florez, Valdivea, Bryant, Burzlaff, Albin
X. Nutrient Content of 5 major forage species of sheep and alpaca	1 May 1982-30 April 1983	La Raya Ayaracra	1. Monthly samples 2. CP, DE, PO_4, Se ?	1 May 1982-30 April 1983	2 Peruvian M.S. students, Valdivea, Florez, Burzlaff, Albin, Bryant
XI. Forage intake of sheep and alpaca from light vs. heavy continuous stocking	1 May 1982-30 April 1983		1. % Digestibility 2. Fecal output 3. Inert, External markers 4. Forage availability	1 May 1982-20 April 1983	2 American Ph.D. students, Florez, Valdivea, Bryant, Burzlaff, Albin

RESEARCH ON 1-HERD, MULTI-PASTURE SYSTEMS

Project	Date or Duration	Location	Type of data Collected	Dates of collection	Supervisor or Personnel
I. Optimum interval of rest based on patterns of net primary production from 5 major forage species	15 Jan. 1980-15 May 1980	La Raya Ayaracra	1. Biweekly biomass samples from plants clipped Jan. 15, Feb. 15, Mar. 15 2. CHO's in roots (Lima)	15 Jan.-15 May 1980	Range Research Scientist, Florez, Bryant, Burzlaff
II. Establish fences for 2 reps of: 3 days graze-x days rest 7 " " " " " 12 " " " " " 16 " " " " " 24 " " " " " Cont. (already established)	1 Jan. 1981-31 Aug. 1981	La Raya Ayaracra	----------	--------	Range Res. Sci. Florez, Bryant
III. Forage responses during growing season as affected by length of grazing period (Set stocking)	31 Nov. 1981-31 May 1982	La Raya Ayaracra	1. Yield of initiation 2. Utilization: Yield before and after grazing period 3. Separate live and dead to see if grasses are at pt. of Inflection 4. Yield 'x' days after last grazing period to see "how much forage we made available as standing veg." 5. Yield at monthly intervals during dry season	1. Initiation 2. Before and after each period 3. End of growing season	2 Peruvian M.S. students, Florez, Burzlaff, Bryant
IV. Nutrient content of sheep and alpaca diets from 5 grazing treatments and cont. grazing	1 Dec. 1981-31 Nov. 1982	La Raya Ayaracra	Fistula samples 1. Growsing season a. Selected intervals during each grazing period	Depends on G.P. 3 day. All 7 day 2,4,7,12day-2,6,9, 12, 16 day,-2,5,8, 13, 16, 24 day,-3, 9, 15, 20, 24	Range Research Scientist, Florez, Bryant

Project	Date or Duration	Location	Type of Data Collected	Dates of Collection	Supervisor or Personnel
V. Establish fences for 1-herd multi-pasture system	1 Aug.-Nov. 31 1984	La Raya Ayaracra	-------	-------	Range Research Scientist, Florez, Valdivea
VI. Initiate 1-herd system Animal production from a 1-herd multi-pasture system	1 Dec. 1984 1988	La Raya Ayaracra	1. % lamb crops 2. Weaning wts 3. Fleece wts and score & etc.	?	Hudson, Jorge Manuel

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)
TITLE XII

I. Face Sheet

Research Area: Nutrition (By-products)

Report Title: Annual Report
October 1, 1978 - May 31, 1980

Sub-Grantee: North Carolina State University
Raleigh, North Carolina 27650

Funds: $109,435

Principal Investigator: William L. Johnson

NORTH CAROLINA STATE UNIVERSITY | AT RALEIGH

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

DEPARTMENT OF ANIMAL SCIENCE
P. O. Box 5127 ZIP 27650

Small Ruminants Collaborative Research Support Program

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

First Annual Report

April 4, 1980

Period Covered: October 1, 1978 to May 31, 1980

Principal Investigator: William L. Johnson

Abstract

The "nutrition and by-products" project has now established its research team at three sites: at the National Goat and Hair Sheep Research Center in Northeast Brazil, at the Livestock Research Institute in Bogor, West Java, Indonesia, and at our home campus in Raleigh. Research objectives and workplans have been agreed upon at these sites. The Principal Investigator has scheduled trips to both overseas sites early in the next program period, to make detailed plans for the initiation of the research program. At Raleigh, experiments have been completed on crop residue storage methods, the performance of growing or finishing lambs or goats when fed balanced rations with varying levels of crop residues, and the comparative effect of dietary fiber sources and levels on ration intake and digestibility in sheep, goats, or cattle. These data are presently in various stages of being processed and published. A trial comparing utilization of NPN by sheep and goats is now in progress. All of this work is contributing to the overall project objectives, and is designed to complement the overseas-based research.

The Problem

Small ruminants in the lesser-developed countries are generally not well-fed. They are managed in systems which have been adapted over time to the locally available resource base. Only now is thought being given to a systematic evaluation of the resource base, toward the goal of better understanding both the animals' requirements for optimum productivity, and the nutritional value of local feed resources.

Nutritional standards which have been developed for the breeds and management systems common to the United States and Europe can serve as broad guidelines for tropical regions. However, specific knowledge about how best to feed the sheep and goats of the tropics must be generated *in situ*, with the locally predominant breeds and involving a complete study of the locally important feeds.

In Northeast Brazil, the "Caatinga" native brush-predominant vegetation serves as the feed base for millions of small ruminants. It is adequate for animal needs only during a few months of the year. A prolonged yearly dry season (at least six months) is associated with declines in animal condition, reproductive rates, and survivability and growth rates of young animals. A different system of feeding is needed, probably involving energy and protein supplementation during the dry season.

In Indonesia, sheep and goats are raised in very small groups in almost total confinement. A wide variety of plant materials are used to feed these animals, including native and cultivated forage grasses and legumes, foliage from actively growing food-producing vines and trees, and post-harvest residues from food crops. The fact that combinations of these materials are usually offered over any short or medium time period is probably helping to prevent major nutritional deficiencies. However, objective data about most of the commonly used feeds are lacking, thus making it impossible to confidently prescribe an optimum feeding regime.

In both locations the kinds of sheep and goats that predominate have not been sufficiently evaluated in terms of their productivity response to improved feeding. The native goats and hair sheep of Northeast Brazil have undergone natural selection for survival at nutrient intake levels near or often below the maintenance requirement. Their response and relative efficiency at more challenging levels of energy and protein intake are unknown. Similarly in Indonesia, neither the native "cachin" goat, the "improved" etawah goat, the West Java thin-tailed ("Garut" or "priangan") sheep or the East Java fat-tailed sheep have been adequately studied, either to determine optimum nutritent intake levels or relative efficiencies.

The immediate problems to be solved for Brazilian or Indonesian conditions (and for similar areas throughout the tropics) are very much applied and practical in nature. The priorities for research at those sites must therefore be for immediate application. However, many basic questions about sheep and goat nutrition also merit research attention to help our general understanding of how these small ruminants function, and how they may be unique from each other or in comparison with cattle or buffalos. Issues such as selective eating habits, tolerance to toxic principles, relative rates of digestion and rates of passage of particulate fiber in or through the rumen, relative intake and utilization advantages, and relative requirements for utilizable protein--these and other basic questions need to be investigated more intensively in order to be able to generalize from site-specific applied research results. A better basic understanding of rumen function will also help in the planning of appropriate adaptive experimentation for specific climates and ecosystems.

Objectives

To summarize the long-term objectives of this project, they are: (1) to characterize the nutritional value of common roughage and by-product feedstuffs

in the target countries; (2) to develop guidelines for optimum feeding of small ruminants; (3) to adapt storage and treatment methods as needed to maintain and enhance the nutritive value of crop residues; (4) to increase the reliability of prediction of nutritive value from simple analysis procedures; and (5) to contribute to knowledge about nutritional requirements and relative efficiencies of small ruminants.

Specific objectives for Brazil and Indonesia have been elaborated, taking into account the local problems and priorities. The Integrated Program Plan for each country can be referred to for a detailed outline of country-specific objectives.

Approach

The Principal Investigator visited Brazil in October, 1979, for the purpose of finalizing project objectives and approach with collaborating scientists at EMBRAPA's national research centers in Sobral, Ceará, and Petrolina, Pernambuco. The main center of activity will be at the National Goat and Hair Sheep Research Center, Sobral, where Claudio Bellaver and Ederlon Oliveira will provide local leadership to the nutrition research. The first activity was scheduled for the dry season of 1980, which would normally be expected to start in June. Subsequent correspondence has confirmed the feasibility of starting systematic sampling of crop residue and by-product feeds in several extension districts of Ceará (and perhaps neighboring states) during the 1980 dry season. Corn, beans, and cotton are the main crops to be considered. However, napier grass must also be considered as a potential dry-season supplemental feed, as well as certain weeds and native grasses, which are common to dryland or irrigated cropping areas where small ruminants are allowed to graze post-harvest. The possibility of involving graduate students from the Federal University of Ceará (Fortaleza) and N. C. State University in research activities was agreed upon.

During a visit to Java, Indonesia, by the Principal Investigator in January-February, 1980, arrangements were finalized for principle research collaboration to be with the Livestock Research Institute (Lembaga Penelitian Peternakan) in Bogor. The entire nutrition and forages staff of LPP will participate in one or another phase of the project. Three Indonesian universities were visited, and preliminary discussions held with respect to their collaborative participation. Early emphasis will be focused on a survey of village feed resources and feeding practices, laboratory facility upgrading at LPP, and establishing protocols for feedstuff evaluation, ration development, and animal performance trials. North Carolina State University has requested an expanded budget sufficient to place a full-time post-doctoral ruminant nutritionist in Indonesia, early in the next program year, to provide co-leadership for these activities.

At Raleigh, the following activities were undertaken:

1. Evaluation of corn stover ensiled with broiler litter or soybean meal, fed with or without supplemental energy (227 g/day of ground maize) to growing-finishing lambs. The broiler litter silage was found to be unsatisfactory for lambs, due to low intake. A better storage method with more satisfactory fermentation characteristics is now being sought.
2. Evaluation of wheat straw and ensiled screened manure solids from dairy cattle, as fiber sources in complete mixed rations for growing lambs and kids. The data from this experiment are now being summarized as part of the M.S. thesis of Lynn Brown, a graduate research assistant in the project.
3. Comparative study of the utilization of urea or soybean meal as protein supplements with wheat straw, in rations for growing wether lambs and kids. This work is under the leadership of Dr. Antonio Ordoveza, visiting scientist from the University of the Philippines at Los Baños.
4. Reviews of literature have been initiated in each of the above topics. This information will be summarized and published in appropriate form as time permits.

Publications

Brown, Lynn E. 1979. "Export: a developing market " Dairy Goat Journal.

Goode, L., and R. W. Harvey. 1979. "Performance of steers and lambs fed corn stover ensiled with broiler litter or soybean meal " (abstract) Journal of Animal Science 49(Supplement I):73.

Johnson, W. L. 1979. "The technical Committee of the Small Ruminants CRSP; Issues and perspectives " Chairman's report to Technical Committee, Nov., 19/9 (mimeographed).

Johnson, W. L. 1980. "Los residuos de cosecha como estrategia para la alimentación de rumiantes menores"(Crop residues as an alternative for feeding small ruminants) Workshop on "Strategies for the use of crop residues in livestock feeding " CATIE, Turrialba, Costa Rica, March 1980.

Seminars and Meetings

Brown, Lynn E. "Nutrition of goats, sheep, cattle: a contrast." Animal Science Dept. Seminar. NCSU. March 21, 1980.

Johnson, W. L. "Title XII research with goats." North Carolina Dairy Goat Breeders Association. March 9, 1980.

Johnson, W. L. "Small ruminants for small farmers: the Title XII CRSP for sheep and goats." Animal Science Dept. Seminar. NCSU. March 14, 1980.

Johnson, W. L. "Animal research in lesser developed countries." International Seminar, School of Agriculture and Life Sciences. NCSU. March 24, 1980.

Domestic and International Travel

Lynn E. Brown

Dominican Republic, May 1979. Accompanied shipment of dairy goat breeding animals purchased in North Carolina by the Dominican Livestock Development Service; served as consultant on dairy goat housing and management.

W. L. Johnson

Washington, D. C., October 12, 1978, and January 2, 1979. Consultation with AID on overseas site selection.

Denver, Colorado, November 16-17, 1978. Technical Committee meeting.

Colombia, Brazil, Peru and Bolivia. January - February, 1979. Leader of South America site selection team.

Davis, California, February 26 - March 2, 1979. Technical Committee meeting.

Washington, D.C., March 14 and April 11, 1979. Report to Joint Research Committee of BIFAD.

Denver, Colorado, April 2-4, 1979. Technical Committee meeting.

Davis, California, May 3-4, 1979. Meeting of the Executive Committee of the Technical Committee.

Brazil, May 21-31, 1979. Consultations with EMBRAPA on program and administrative arrangements for the Small Ruminants CRSP.

Washington, D. C., June 6, 1979. Consultation with AID on the world-wide integrated program plan.

Logan, Utah, June 24-27, 1979. American Dairy Science Association; International Seminar on Dairy Goat Production and Milk Processing.

Tucson, Arizona, July 30 - August 1, 1979. American Society of Animal Science; Informational luncheon discussion on Small Ruminants CRSP.

Washington, D. C., September 10, 1979. Meeting of Peru sub-group of the Technical Committee.

Lima, Peru, October 2-7, 1979. Consultation with Peruvian collaborating institutions on integrated program plan for Peru.

Sobral, Ceará, Brazil, October 8-21, 1979. Development of nutrition and by-products collaborative research plan for Brazil; consultation with EMBRAPA on integrated program plan for Brazil.

College Station and San Angelo, Texas, November 11-16, 1979. Meeting of Technical Committee; visits to TAMU goat and sheep research sites in West Texas.

Davis, California, January 17-21, 1980. Consultation with Management Entity on integrated program plan for Brazil.

Indonesia, January - February, 1980. Orientation visit; development of nutrition and by-products collaborative research plan for Indonesia.

Kuala Lumpur, Malaysia, February 9-12, 1980. Liaison visits to MARDI and Malaysian Agricultural University on behalf of Small Ruminants CRSP. Consultation with prospective graduate student participants from Malaysia.

Rome, Italy, February 13-15, 1980. Consultation with Small Ruminants and Animal Nutrition officers at FAO.

Turrialba, Costa Rica, March 18-22, 1980. Presented invited paper at workshop on crop residue utilization in animal feeding; consulted with prospective graduate student participants and site coordinator candidate.

Estes Park, Colorado, April 6-9, 1980. Technical Committee meeting.

Project Personnel (Raleigh)

Dr. C. A. Lassiter, Head, Department of Animal Science;
Institutional Representative to SR-CRSP Board; Member, Executive Committee, Board of Institutional Representatives, 1979.

Dr. W. L. Johnson, Principal Investigator; Member, Executive Committee of the Technical Committee, 1978-1980; Chairman, Technical Committee, 1979.

Dr. Lemuel Goode, Professor of Animal Science; Co-investigator.

Dr. W. J. Croom, Asst. Professor of Animal Science; Co-investigaror.

Lynn E. Brown, Graduate Assistant

Debra Mann, Animal Research Technician

J. D. Pettyjohn, Senior Laboratory Technician

Lori Treble, Laboratory Technician

John Brasfield, Animal Research Technician

Ed H. Taylor, Animal Research Technician

Paula Foster, Secretary

Student Assistants: Bill Cooper, Judy Smith, Ronnie Gentry, Rex Gaskins, Maury Todd, Denise Robertson, Jerry Phelps, Meriella Jeantet, Mary Leuchtenberger, Mitch Jordan, Kirby Jones, Mike Buckley, Don Shuping.

Appendix I. Budget for First Program Period (10/1/78 - 5/30/80)

		AID/Title XII					
		Planning Grant	Program Grant 6/1/79 - 5/30/80		TOTAL BUDGET	Expected Carryover	NCSU Matching
		Oct. 1, 78-May 31, 79 (Actual spent)	U.S. Program	Overseas Program	[a]		
A.	Salaries						
	1. 0.8 SMY Johnson 0.5, Goode 0.15	1,000	2,285	3,600	6,885	-0-	14,225
	2. (Res. Assoc., Indonesia)1.0						
	3. Research Tech. Mann 1.0		10,000		10,000	1,000[b]	
	Treble 1.0		7,725		7,725	700[b]	
	Brasfield 0.25, Taylor 0.25 Pettyjohn 0.4						6,660
	4. Graduate Asst. Brown 1.0 (New) 1.0		4,400		4,400	-0-	
	5. Parttime labor	1,286	8,000		9,286	-0-	
	6. Benefits (18%, items 1-3)	245	3,602	648	4,495	319	3,759
	SUBTOTAL	2,531	36,012	4,248	42,791	2,089	24,644
B.	Supplies & Exp.	52	8,816	4,815	13,683	5,000[c]	
C.	Equipment		8,500		8,500	-0-	
D.	Domestic Travel		750		750	77	
E.	Internl. Travel			10,800	10,800	4,461[d]	
F.	Other dir. costs	31	4,714	8,300	13,045	8,500[e]	
G.	Indirect costs	1,212	17,826	828	19,866	974	11,487
	TOTAL	3,826	76,618	28,991	109,435[a]	21,101	36,131

[a] Sum of: Planning grant ($20,000)
First program award ($76,858)
Supplemental award ($12,577)

[b] Budget was based on 10 months; technicians actually worked 9 months.

[c] Carryover due to late start-up overseas

[d] Allocated for travel for Brazil, May-June, 1980

[e] Site administration fund

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Nutrition (Forages)

Report Title: Annual Report
October 1, 1978 - May 31, 1980

Sub-Grantee: Ohio State University
Wooster, Ohio 44691

Funds: $166,016

Principal Investigator: Robert W. Van Keuren

Small Ruminant Collaborative Research Support Program
Ohio/Peru Project
Annual Report
October 1, 1978 through May 31, 1980

Title: Cultivated Forage Production Systems for Small Ruminants in the Andean Highland

Problem: No change

Objectives: No change

Approach: No change

Indicators:

Because the memorandum of understanding has not been signed, we have not had an opportunity to visit the project sites selected, nor to establish working relations with Peruvian researchers.

B. A. Dehority visited Peru from July 10-19, 1979 and met with a number of individuals who might be potential collaborators. All sites visited on that trip have since been excluded; however, a general appreciation for the terrain, climate, agricultural practices, etc. was obtained.

Our on-site support person has been hired and is being trained in research techniques that we expect to use in Peru. He is currently working on the review of pertinent literature and on the gastrointestinal parasite resistance objective being conducted as part of our Ohio contribution to the project.

Small Ruminant Collaborative Research Support Program
Ohio/Kenya Project
Annual Report
October 1, 1978 through May 31, 1980

Note: Slight changes in title, problem statement, and in objectives from original proposal.

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

Problem:

Improved forage and feed production systems for smallholder mixed crop/livestock production are needed to increase animal productivity in the humid tropics. Forages, fodders, and crop by-products are the major sources 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 and feed 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 with serious gastrointestinal parasitism, resulting from intensive grazing. Confinement rearing and the development of genetic resistance can reduce the parasite constraint on production.

Objectives:

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

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

3. To evaluate the nutritional and microbiological factors of humid tropic forage and feed production systems for small ruminants, with emphasis on goats for meat and milk.

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

Approach:

No change from plans.

Indicators:

1. R. W. Van Keuren was in Kenya Feb. 7-29, 1980 as part of U.S. group discussing project with Kenyan officials and researchers, and touring research centers, training centers, and farms to get familiar with present forage, feed, and livestock programs.

2. Literature review is not completed because of lack of references in U.S. On-site support personnel from U.S. (T. C. Quick) is currently obtaining references and information from Kenyan libraries and other local sources.

3. Currently the field and laboratory sites are being determined, pending decisions by Kenyan Ministry of Agriculture.

4. On-site U.S. support personnel (T. C. Quick) is currently in Kenya as of February, 1980. Prior to going to Kenya, he was being trained in a number of laboratory and field procedures pertinent to the project.

Assumptions:

1. It is assumed that research locations will be approved by the Kenyan Ministry of Agriculture and that some of the Kenyan research personnel with whom we discussed the project will be approved as project collaborators.

   A. Potential collaborators:

      (1) Dr. D. N. Ngugi, Chairman, Department of Crop Science, Faculty of Agriculture, U. of Nairobi and/or staff members.

      (2) Dr. A. M. Said, Chairman, Department of Animal Production, and/or staff members.

      (3) Staff members of National Agricultural Research Station, Kitale.

Outputs:

None to date.

Approach:

No change from plans.

Indicators:

1. R. W. Van Keuren was in Kenya Feb. 7-29, 1980 as part of U.S. group discussing project with Kenyan officials and researchers, and touring research centers, training centers, and farms to get familiar with present forage, feed, and livestock programs.

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Outputs:

None to date.

Approach:

No change from plans.

Indicators:

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      (3) Staff members of National Agricultural Research Station, Kitale.

Outputs:

None to date.