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SMALL RUMINANT

COLLABORATIVE RESEARCH
SUPPORT PROGRAM
(SR-CRSP)

ANNUAL REPORT

PROGRAM YEAR ONE

1980

INDIVIDUAL ANNUAL REPORTS

PART II C

Prepared by the Management Entity 1980

PART II C

INDIVIDUAL ANNUAL REPORTS

931-1328

TITLE XII

SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Animal Management

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

Sub-Grantee: Tuskegee Institute
Tuskeegee Institute, Alabama 36088

Funds: $100,000

Principal Investigator: Doris Oliveira

TUSKEGEE INSTITUTE

CARVER RESEARCH FOUNDATION
Office of International Programs
Tuskegee Institute, AL 36088

INTENSIVE MANAGEMENT OF GOATS

ANNUAL REPORT

TUSKEGEE INSTITUTE PROGRAM FOR EXPANSION AND INTENSIFICATION

of

GOAT PRODUCTION IN NORTHEAST BRAZIL

Date Due: April 1, 1980

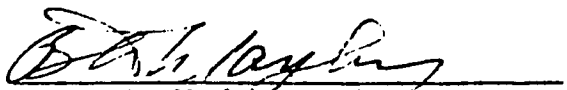
Date: April 1, 1980

USAID: TITLE XII, SMALL RUMINANT CRSP

Grantee: Tuskegee Institute, Alabama 36088

Grant Program Director: Doris M. Oliveira

Dr. Doris M. Oliveira
Principal Investigator



Dr. B. D. Mayberry, Director
International Programs

TUSKEGEE INSTITUTE PROGRAM FOR EXPANSION AND INTENSIFICATION OF GOAT PRODUCTION IN NORTHEAST BRAZIL

A. STATISTICAL SUMMARY

Period of Grant: October 1, 1978 through May 31, 1980

Amount of Grant: $133,333

Expenditures for October 1, 1978 - May 30, 1980:

Anticipated for June 1, 1980 - September 30, 1981:

B. NARRATIVE SUMMARY

1. Principal Accomplishments of the Grant for October 1, 1978 - May 31, 1980

During the first year of the grant, Tuskegee Institute made some progress toward the realization of the project objectives. There was one major administrative change that affected the project. In 1978 the small ruminant - CRSP was placed administratively under the International Programs Office. Therefore, Dr. Mayberry, the Tuskegee Institute representative to the CRSP-BIR, is able to offer guidance and counsel to the project staff. A major objective of this new office is the strengthening of international programs at Tuskegee Institute.

Further, an advisory board was established consisting of leading Tuskegee Institute researchers to assist with the planning and operation of this project. The members of the advisory board may change as the dynamics of the project indicate different needs.

The principal accomplishments during the first year of the grant can be summarized as outputs under the five principal objectives of the grant:

Objectives

a. Expanded Knowledge Base

1. General literature reviews and consultation with recognized experts on selected topics in Brazil, Indonesia and the United States.

2. Development and execution of selected research topics that were felt to be relevant to Brazil and Indonesia. Initial data has been collected from the following studies and is in the process of being analyzed:

   (a) The Effects of Castrating with "Kastrin" on Growth.

   (b) Synchronization and Super-ovulation of Does During Breeding Season.

3. Dr. Oliveira spent one month in Brazil at the National Goat Center in Sobral, reviewing research data and meeting research scientists.

4. Dr. Oliveira visited Brazilian experiment stations at Sobral, Quixada, Petrolina, Soledade and Cruzdas Almos. Conferences were held with scientists designated as possible collaborators of CRSP investigators by EMBRAPA-Sobral.

   The results of the Brazil planning trip are included as Appendix #1.

   The terms of collaboration, types of data and location of research were discussed.

b. Advisory and Consultation Services

Contacts were made in Brazil with extension personnel and several visits were made to local farms.

c. Education and Training

There are several activities associated with this component of the grant:

1. EMBRAPA was appraised of the possibility of training for Brazilian staff at Tuskegee Institute or other institutions.

2. Animal technician was hired full time.

3. Graduate and undergraduate students who had an interest in learning to manage goats were assigned to work for varying periods.

4. A seminar was held at Tuskegee dealing with "Diseases and Management of Goats in Small Farm Flocks." The program was designed to complement the research activities of the project and the programs focus on small farmers. It was attended by 80 goat farmers from Tennessee, Georgia, Florida and Alabama.

   The papers were delivered by staff members from Tuskegee Institute and Auburn University. A summary of the seminar is being prepared from tapes for distribution to goat owners and other interested people.

5. Dr. Oliveira had one month of language (Portuguese) training before trip to Brazil.

6. Dr. Oliveira participated in a seminar on goats at Auburn University presented a wet lab on "Preparation of Does and Bucks for Breeding.", March, 1979.

7. Dr. Oliviera presented two lectures and a laboratory to undergraduate animal science students: "Dairy Goat Management." January, 1980.

d. Information Capacity

The information capacity was increased by:

1. Purchase of a few relevant books and periodicals for the project and the libraries at EMBRAPA Stations.

2. The acquisition of computer based materials (bibliographies).

e. Linkages and Networks

Domestic linkages were fostered:

1. During year one in several ways:

   (a) Dr. B. D. Mayberry participated in BIR meetings.

   (b) Dr. Oliveira attended several CRSP meetings and visited research facilities of fellow scientists in CRSP.

(c) Contact was established with organizations involved in development in Brazil (Rockefeller, Presbyterian Club).

(d) Dr. Oliveira has attended meetings of dairy goat associations of Alabama and Georgia to give talks about diseases and management of goats.

2. International relations -

International linkages were fostered by:

(a) Visits with AID officials in Washington, DC.

(b) Participation on the Asia site-selection team.

(c) Development of contacts with EMBRAPA officials during the course of preparation of research plans in Brazil. See Appendix #1 for details.

(d) Drs. Warren Foote and Stanley Nelson met with EMEPA and EMBRAPA officials on our behalf in Sobral and Paraiba, Brazil to clarify research plans.

DETAILED REPORT

1. General Description of Problem

In Brazil mixed farming is the predominant production system for small farmers; few have access to mechanization or technical expertise. Even though the cropping is frequently well integrated with livestock, the animal of choice is not generally the goat.

The harshness of the Brazilian climate and the sparceness of vegetation increase the value of the resourceful, adaptable goat for this area; it should be an easily manageable and appropriate enterprise for the Northeast of Brazil. The present project was designed to examine the management constraints associated with the expansion and intensification of goat production in Northeast Brazil. Tuskegee Institute and other CRSP members

will conduct projects to alleviate the handicaps which inhibit the advancement of this enterprise.

Since the development of its first-year research plans, Tuskegee Institute has consulted with collaborating scientists in Brazil. This more thorough assessment of their needs has resulted in a slight alteration of the original plans.

The Brazilian priorities for goat production are as follows:

1. Decreasing neo-natal deaths of kids.
2. Decreasing the market age of kids.

2. General Purpose of the Grant

This grant is to assist seventeen U. S. Land Grant Institutions to strengthen their capacity to participate in international development. The grant has the overall goal of helping the world's poorest people most of whom are unable to communicate in written word, are rural, and female to better utilize available resources, and increase the amount of protein in their diets.

RESOURCES TO CARRY OUT OBJECTIVES

1. Goat Barn, corals, paddocks, sheds - 5 acres of land.
2. Veterinary services with diagnostic laboratories.
3. Tuskegee Institute is providing an office with spaces enough for small meetings and storage of reference materials collected.
4. The computer staff is available to assist in analysis of research.

PERSONNEL

Tuskegee Institute has a pool of consultants available from a number of disciplines, reproduction, physiology, entomology, animal science, pathology, microbiology, public health, etc. Budgetary constraints limit the amount of involvement of interested individuals.

The present members of the Advisory Committee are as follows:

Ronald Chung, Ph.D., Nutrition (Chairman)

James Allen, Ph.D., Plant Science

Edward T. Braye, DVM, M.S., Extension Veterinarian

Om Verma, DVM, Ph.D., Veterinary Physiology

C. Molouwku, DVM, Ph.D., Veterinary Physiology

Claude McGowan, Extension Husbandman.

PROJECT MONITORING

The project is under the direct supervision of the Principal Investigator, who is responsible for coordination of research, supervision of research and planning of scope of work with the Advisory Committee, collection of data and reporting research results.

The Principal Investigator reports to the Office of International Programs and Carver Foundation, who report all grant information to granting institutions.

The management entity and EEC review plans periodically.

PLANNING PROCESS

Planning is done constantly with the Advisory Committee in bi-monthly meetings. The directors of International Programs and Carver Foundation from time to time participate in these meetings.

Periodic meetings with CRSP members to plan research.

ANNUAL REVIEW

Like planning the Principal Investigator and the Advisory Committee prepare the annual report and review the year's accomplishments, revise objectives as necessary and prepare the grant needs for the coming year.

EXPERIMENT I

The Effect of Castrating with "Kastrin" on Growth Rate (Pilot Study). Duration: March 7, 1979 to February 1, 1980

Control of surplus males is an important part of any breeding and management program. Many forms of castration have a deleterious effect on the growth rate and carcass yield in domestic animals. The method used by Dr. Fahim, University of Missouri, of injecting "Kastrin". a heavy metal sclerossing agent intratesticularly, has been demonstrated by him to enhance growth in domestic animals.

This pilot study was designed with Dr. Bettye Collette of Howard University assisting in the pathology and radioimmune assays for testosterone. The purpose was to collect data for designing a study using kastrin on a large number of animals. The measurements have been obtained, and are being analyzed.

This study will not continue as a part of our management package for Brazil, because new information gathered in Brazil indicates that the forage system is too frazil to try to feed out castrated animals for food. Until the forage situation improves separation of males will be encouraged, without castration and selling by 5 months of age.

Materials and Methods

3 Nubian Bucks - 1 year of age

7 Nubian Bucks - 4 months of age

6 Alabama brush goats - 1 month of age

"Kastion" - Trade name, Merck, Sharpe Dome.

The above goats were weighed, measured and placed into two groups via random numbers, and a blood sample was taken.

Group I received an injection of kastrin into both testicles, asceptically.

Group II received an injection of sterile, distilled water into both testicles.

Thirty-four (34) (4/11/79) days later a second blood sample was withdrawn, animals were weighed and measured, the left testicle was removed.

Five and one-half months (5½) later (2/1/80) animals were weighed and measured and another blood sample was drawn.

Eleven months later (2/1/80) animals were weighed, measured, a blood sample withdrawn, the remaining right testicle was removed. Animals were slaughtered through Woodruff Food Processing Slaughter facilities, the carcasses were weighed and burned.

Data from this study is being analyzed.

In view of the priorities of the Brazilian research team, the following experiements were designed for implementation on the Tuskegee Institute caprine research farm. The results of these experiments will blend into the CRSP body f knowledge presented to the Brazilian scientists. Additional on-site assistance will be given to them along with local Brazilian farmers in the implementation of programs to overcome the constraints to the expansion and intensification of goat production in Northeast Brazil.

EXPERIMENT II

Supra-ovulation of Does During Breeding Season.
Beginning date: September 10, 1979 - Ending Date: March 1, 1980.

Reproductive efficiency is necessary in order to assure one of kids for naturation. The Brazilian scientists are examining one goat breeding season per year and correlating the results with food demands and availability; while the Tuskegee team utilized a year-round breeding program. A year-round breeding plan enables the team to look at the reproductive patterns of breeding herds and to assure an adequate kid supply for experiments which are important for other types of collaborative and correlative studies for the Brazilian team.

For this study, which involved the induction of ovulation by injecting pregnant mare serum, the selection of does with high reproductive capacities was most important. The selection of an ideal experimental test goat is hampered by the lack of literature on the capacities of goat uteri. However, there are numerous reports of does yeaning four kids. The goats with one of the highest kidding rates are the anglo-nubians (1). Therefore, they were suitable for this supra-ovulation study.

The data obtained as a result of supra-ovulating goats are being correlated with growth rates and carcass yield data from the male offspring in Experiment II. In addition economic analyses will be conducted for all phases of the project. This is of extreme importance in the efficient management of the project and for determinations and projections of the cost effectiveness of the program for small enterprises like those proposed for Brazil.

Materials* and Methods

Experimental Animals: Twenty-one anestrus does belonging to a herd of genetically nubian and nubian grade animals who have yeaned before were divided into two groups randomly. The weights varied widely. Group I received prostaglandin and pregnant mare serum; Group II received a progesterone implant and pregnant mare serum. Group II received no treatment and were controls.

Group I - This group received two prostaglandin injections at 10-day intervals. They cycled 24-48 hours after the second injection and were bred to the same bucks as Group II as they exhibited standing estus.

Group II - A progesterone impregnated pessary was inserted subcutaneously in the axillary area of each doe. It was removed in 14 days. Pregnant mare serum was administered on the 12th day intramuscularly (700 iu per animal). Animals were showing signs of estus within 24 hours and were bred to pure bred bucks. Bucks utilized were Tracey, Danny, T. Ancos, or T. Aznar.

Group III - Controls.

All does received a selenium/tocopherol injection and booster injections to protect against the clostridial infections; random fecals and deworming monthly, if necessary, with appropriate products, and dusting with corral monthly. Mineral supplements and hay were available constantly in addition to twice daily feedings of 16% dairy ration (Cargill), 1 pound/doe/day. (Assuming average weight gains). In super-ovulated does, since

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*See attached list.

weight gains are more than .5 kg/day, a greater food allowance was provided for the last two months as weight gains indicated.

All does were confined for kidding, and kid weights were recorded immediately after birth, before colostrum. There was attendants at all births except two. Does were weighed when confined for kidding and after kidding and passing of membranes.

Parameters measured were:

1. Length of estus cycle
2. Gestation length
3. Kidding rate
4. Birth weight
5. Neo-natal survival
6. Dam weight
7. Kidding interval
8. Length of anestrus

All does were semi-confined: sheds were bedding boxes at night and pasture (unimproved) during the day. Pregnancy was verified at 30 days (intravenous progesterone or estrus symptoms). Non-pregnant animals were re-exposed to bucks and new breeding date recorded.

APPENDIX # 1

TUSKEGEE INSTITUTE
THE CARVER RESEARCH FOUNDATION
Office of International Programs
Tuskegee Institute, AL 36088

November 9, 1979

PHASE III -- Work Plan Coordination Activities in Brazil in Relation to the Tuskegee Institute Intensive Dairy Goat Production Systems for Smallholder Agriculturalists

Supported by

TITLE XII -- Small Ruminant CRSP

Reported by

Doris M. Oliveira, D.V.M.
Research Associate, Carver Research Foundation

TABLE OF CONTENTS

PART I - ADMINISTRATIVE MATTERS

Preparation for Travel to Brazil

The International Programs Office is quite adept at preparing staff members for travel abroad. One needs the following:

1. Valid passport
2. Visa--obtained from Consulate in New Orleans
3. Preventive medicine--smallpox, yellow fever, gammaglobulin, typhus are suggested
4. A knowledge of Portuguese is essential

The ticketing and active scheduling was done through the International Programs Office once a schedule of cities to be visited and travel dates were presented. There are two ports-of-entry to Brazil--Rio and Minaus. Rio is suggested, although out of the way for the Northeast because Minaus is a free-port entry and very long custom lines frequently cause passengers to miss connecting flights. Tickets cannot be exchanged for credit in Brazil; they must be done in the United States. Changes in travel will have to require additional tickets which must be paid for in Brazil.

Trip to Brazil. I departed Montgomery at 11:30 am for Atlanta; from Atlanta I departed on time at 3:40 for Miami. In Miami, when I arrived at 5:00 I immediately contacted Pan Am for confirmation of a hotel reservation for Rio. They checked my ticket and confirmed the Leme Palace Hotel in Rio for a 6:00 am check on September 30.

Left Miami 11:30 pm and arrived at Rio Galeo Airport at 5:30 am. Cleared customs, cashed travelers cheques, and took taxi to hotel 6:15; Brazil is two hours ahead of Tuskegee. All Brazil has the same time.

Trip from Brazil. Left hotel at 4:00 pm in Salvador for airport which is a

40-minute drive. Checked into Varig at 4:95 pm, received seat assignment, paid airport tax and waited for a 6:00 pm departure which was only 3 minutes late. Didn't check baggage through.

Arrived Rio 8:00 pm; claimed baggage and went to Pan Am to check in for 11:40 pm flight. Received seat assignment and paid airport tax. Proceeded to customs and then to waiting room. Flight was 10 minutes late, but made up the time; we arrived Miami 5:20 pm; we were scheduled in at 5:40 pm.

After a long wait for luggage, had the U.S.D.A. personnel disinfect my shoes, since I had been on farms where Aftosa is common. Cleared customs; went to check in for flight to Montgomery. I took a Republic flight at 11:40 which goes to Orlando/Montgomery. Others might not want the long wait in Miami and would prefer going through Atlanta a little earlier.

The flight to Montgomery was one hour late and arrived at 1:30 pm.

Cost of Living and Per Diem

The cost of living for short-term assignments vary according to the city. Generally, for an air-conditioned room with a refrigerator, it will cost about the following:

Sobral	$22.50
Petrolina	28.00
Salvador	35.00
Paraiba	25.00
Rio	52.00

Meals are varied but can be obtained in most cities for about $5.00-6.00 for lunch and dinner. Shrimp or lobster will cost about $9.00 almost everywhere.

Bottled mineral water which is in necessity everywhere is from .25-.35 a pint.

Long-term people usually get filters and boil their water. Most cities

have chlorinated water supplies, but very few Brazilians drink it.

A figure of $40,000 was given for long-term personnel with no children for a year.

Currency Exchange Rates

When I arrived in Brazil, $1.00 was worth $?9.63 cruzeiros, by October 24 the rate was $30 cruzeiros, and by November 1 the rate was $31 cruzeiros for one dollar.

It is not possible to exchange any money in banks outside major cities; this includes travelers checks. Some hotels will accept them in payment of bills. Isobral, the station personnel, will exchange money in an emergency. It is advisable, however, to change money in Fortelza before going to Sobral.

The hotel in Petroliva exchanged and cashed travelers checks. In Salvador and João Pessoa Hotels and banks cash travelers checks.

Transportation Within Brazil

All EMBRAPA stations are equipped with vehicles and they are happy to fit us into their station schedule for the use of cars. This is all right for short visits, but if a project requires that a person be in the country a longer period, if a vehicle isn't brought perhaps compensation should be considered for the use of their vehicles.

Roads are generally excellent, the last few hectares before most stations are on good hard surfaced dirt roads; I have no idea how passable they are in rainy season since the soil seems to have a large amount of clay.

There is good bus transportation within and between cities. The drivers drive very fast, however.

Telephone service is available through offices in every city with good connections. They are open from 8:00 am until 9:00 pm. Within Brazil, calls are relatively inexpensive, less than $3.00/3 minutes.

Project Personnel

Tuskegee will only be able to make small contributions to facility development in Brazil; however, we will assume a fairly major responsibility for manpower development in the station where we work. Tuskegee will provide counterpart training in animal science and technology related to dairy goat production. Formal training is ultimately possible at Tuskegee and other CRIP institutions.

Salaries and compensation are to be arranged based on 1980 budget.

PART II - GENERAL BACKGROUND

Purpose of Visit

This report covers a month-long trip (September 29 - November 2, 1979) to examine the research facilities available through EMBRAPA and to consult with EMBRAPA personnel on the development of the Phase III work plan for SR-CRSP Dairy Goat Management project. The draft management plan will serve as a report of this activity; additional information is to be found in the daily itinerary. The trip was made, also, to meet with EMBRAPA-CRSP leaders and SR-CRSP Latin American Principal Investigators on the development of the over-all Phase III work plan.

During the month I visited four EMBRAPA research stations, the Veterinary School of Bahia, and the Bahia College of Agriculture at Cruz das Almos.

Places Visited and Persons Contacted

A. Centro National de Pesquina en Caprinose Ovinos-Sobral:

Elino Moraes, Chief
Claudio Bellaver, Adjunct, Technical Chief (Nutrition)
Ederlon de Oliveira, Nutrition
Carlos A. F. Costs, Health
Elsio Antono Figueiredo, Breeding
Aurino A. Simplicio, Reproduction
Francisco de Assisi Arruda, Bioclimatology
Agumar D. Ramos, Agronomy
Jose Ubiraci Alves, Extension Liaison

B. Empressa de Pesquisu Agropecua do Ceará, Quixadá

Helio Machado, Chief
Antonio R. Macedo, Technical Chief

C. Centro de Pesquisa Agropecuária do Tropico Semi-Árido-Petrolina

Manoel Abiliode Queiroz, Technical Chief
Célia M. M. Silva, Genetics
Clóvis G. Filho, Animal Science
Luiz Corsino Freire, Agricultural Economict
Mauricio B. Coelho, Animal Science (Irrigation)
Severion G. de Albuqueque, Breeding
Moacir Alves da Silva

D. EMEPA - Empessa de Entadual de Pesquisa Agropecuiaria

Paul M. Leite, Technical Chief
Aldomario Rodriquez, Veterinary Scientist

E. EPABA - Empressa de Pesquisa Agropecuária de Bahia

Abidas M. Silva, Professor, Laboratory Animal Medicine
Fuluio José Alice, Professor, Infectious Diseases
José de Silva, Microbiology

F. Biological Institute of Bahia

Gustaro M. Netto, Chief

G. University of Bahia College of Agriculture, Cruzdos Almas

Chancellor

General Background

Nutrition is the overriding problem of goat producers in Northeast Brazil with poor management practices coming second. The arid conditions of this area minimize the spread of infectious disease, especially when animals are extensively managed, which is the usual way they are cared for. The need for a year-round forage system is paramount, with the use of hay, silage, or cutfeeds to supplement during the dry season, which can vary from 6-8 months.

It was not our intention to conduct a survey of goat production, but we did go through published and unpublished records to get information we felt was important in decision-making.

Categories of Producers. EMBRAPA has classified producers according to the number of technical improvements they utilize in their production (See Categories of Producers, Appendix 1).

Class 1 Producers utilize a very empirical level of production. They may or may not own land; the land, however, will not be able to support any other agricultural enterprise. There are no fences, no shelters for animals; the family subsistence crops are usually fenced in. There is no consideration of grazing pressure, since these animals are virtually out of control; they take a heavy toll on everything when they graze. There is often no water or a long walk to some contaminated water source.

Class 2 Producers are medium level producers; they often own land, can utilize and receive technology, and can get credit. They often expect and get some financial return for their time. The grazing areas are frequently poorly defined with few fences. They have some crop residues to feed as supplement; they deworm and treat sick animals. Cash crops are fenced.

Class 3 Producers have access to technology, credit, are receptive to innovations, and are looking for economic gain from their goat enterprise. They feed crop residues, minerals, treat animals and vaceirate. Their pastures are fenced; they have corrals and shelter for animals.

Description of Animals.

Sex: There is no set sexual division in Class 1 herds. Generally, young males and old females are sold. If old female has no teeth, she is sold.

Breed: No Class 1 farms have any goats except the mixed SRD local goats with a few having some Anglo-Nebian and Buhj. (SRD = Sim Raça Difinida--no definite breed.) No farms have pure flocks of the Northeast breeds--Moxoto, Canidé, Repartido, Maroto; they are available only at research instillations and on government farms. These animals are not sold in any open market, and when sold are too expensive for most, e.g., 1 Repartido buck was $4,000 cruzeiros.

Sources: Because the females in markets are always very old, it is thought that the initial source of does for a farmer is usually another farm near by for money or trade. Middlemen often come to the farms to buy for market.

Basis for Flock Grouping and Flock Size. In Class 1 there are no controls other than the periodic sales of young males once they have reached market size around 23 kg. If they need money, of course they sell at any time.

The basic herd will be does (20), kids, about 2 bucks. Generally, the SRD animals, because they are free; they breed with neighbor's goats. In-breeding frequently occurs since they never change bucks and culling is not practiced.

Two percent breeding male, 9.6% males our 12 16% males under 12 both sheep and goat herds are about 30% male, which is totally unnecessary.

Characteristics of Population.

Percent males and females in flock	30-40% bucks
Death rate - less than 1 year	50%
Birth rate	60%
Birth weight	2 kg
Age at 1st Estus	7 mos
Age at 1st kidding	12-15 mos
Number of offspring--(caprine twinning)	25%
(ovine twinning)	20%
Number males in flock	10 or more often
Age at slaughter	2 years
Weight at slaughter	18-25 kg

(See Production Indices by Caudio Bellever, Appendix 2.)

Percent Removals. There is no basis for computing this figure; it is probably the same as the disfruit figure, i.e., % sold + % consumed - disfruit (Appendix 3).

The value of a goat removed, on the free market at market weight, 18-25 kg - $700 cz. Breeding animals from farms can be traded or often can cost around $1,500 cz. There is no theft between farms; people from towns steal from farmers.

Nutrition. Class 1 animals are fed totally on pastures plus maybe trash around the farm. None are fenced; they range freely. Sheep generally return at night; goats can range for days before returning home. Often even contaminated water is far away. There is no system of forage saving for future. No mineral or feed supplementation.

Production. None of this class has fencing or castrates their surplus males; they range freely. There is an occassional covering for animals. Prices for goat milk and cheese from Paraiba are as follows:

Cattle milk cheese cr $100/kilogram
Goat milk cheese cr $400/kilogram
Goat milk cheese cr $800/ kilogram in Mina Aerai State, where most is produced presently.

Herd Health. There are no cost figures available for the treatment of

goat diseases at this time. There is very little federal money that goes into producing vaccines for goats. The contagious erthyma and contagious lymphadentis vaccines at Bahia are the only ones known. There are autopsies and samples taken at many stations but they must be sent to veterinary labs at Recife or Salvador or Fortelezá for diagnosis. There are many quality medical products available and some are not too expensive, frequently made in Germany. The efforts at Sobral and Petrolina are the first economic studies of treatment versus no treatment and they have only information for one year so far.

Extension Service. There is high rural to urban migration and 65% of the population of Brazil is 0-16. There is an extension specialist for sheep and goats, who covers about 110 km, who has a car, college training, and some demonstration materials. They generally make 15-20 farm visits a month. The sheep farm extension effort near Sobral was visited. The goat extension effort in Soledade has not begun.

The Class 1 producer is the producer title 12-CRSP by definition is designing programs to help.

The CRSP will examine meat and milk production under current management, then with optimum levels of improved production technology: (1) The roll of goats in providing employment for non-adult family members through production or processing of their products for home or sale--current management by women and children, and optimum management by women and children; and (2) roll of goats in providing milk, meat, fiber, skins for family use or sale--optimum use of handicrafts technology.

APPENDIX 1

CATEGORIES OF PRODUCERS
(EMBRAPA Working Paper)

CLASS 1 - No Technology
CLASS 2 - Some Technology
CLASS 3 - Most Technology, Management Needs Improving

CLASS 1 PRODUCERS -- Small Producers

Land Use

No land; no credit; no source of information
If land, usually no water; no adequate feeding installations

Breeding--Usually from 15-30 Animals; can Own 2,000 and Still Beat this Level

Totally mixed animals SRD--Sim Raca Designata
Mixed bucks used throughout year; sexes not separated

Feeding

Native unimproved caatiga pastures
Water distant and not good
No mineral supplementation

Sanitation and Health

No health care or "good housekeeping"
Use of native cures
No deworming
No treatment of casseous lymphadenitis

Installations

No shelter, no perimeter fence ± chiqueiros

Management

Animals go days without observation
No definite breeding age
Natural breeding
No weaning age
No buck/doe ratio--high percentage of bucks

Commercialization-Marketing

None exists in subsistence economy; they often must eat themselves
Sell to neighbors
Sell skins of animals they eat

Production Figures

Kidding -- 50-56
Twinning - 25-30 goats
Mortality - Young Old
Slaughter Age --
Disfruit

RECOMMENDATION FOR CLASS 1

Land Use

Protect trees and shrubs that are good forage
Do not use areas with slope of more than 25% for crops, leave for goats
Use rock and shallow soils for range land
Use area with slope of 15-25% using alternate strips for grazing, other for reserve feed storage for dry season

Genetic Improvement

Change bucks every two-three years, get from distant places
Choose bucks carefully; look for defects
Recommend Nubian buck and Morda Nova rams to get more milk

Feeding

Range on native pasture during rainy season and crop residue in dry season
Iodized salt/bonemeal
Kids colostrum

Health Care

Deworming schedules recommended for three different rainfall areas 7,500 mm, dry; 500-700 mm; coast - 800 mm or more

Deworming Schedule:

a. 500 mm - Ceará, Paraiba, Pernembuco---End of November, 1st deworming before rains begin; May; August
b. 500-700 mm - Morada Novay Quixiada--End of November; March; June; August
c. Coast - Over 800 mm--November; March; April (young, May); June; August

Most farmers are willing to deworm; it is the first practice they do
Ecto Parasites - a factor in disease transfer; suggest dipping or spraying

Infectious Diseases
a. Vaccinate against aftosa lymphadenitis
b. Lymphadenitis, open absesses and clean with iodine (2) burn infected material; (3) animal infected three times, slaughter
c. Contagious Erthyma - Glycerine and iodine on lesions
d. Footrot - Clean areas frequently
e. Diarrhea in young

Installations

Small shelter in well drained area so can observe animals
1.5m^2 open chiqeiro, .8m^2 - covered
Clean monthly
Place Ahrigo - shade roof

Management

Observe once a week
Mark animals to identify
Confine kids first month of life
Use bells on animals to find them
Remove skins carefully
Buck/doe ration - 1/25
Separate bucks ± castrate surplus or sell by 5 or 6 months

Commercialization

Sell old unproductive females
Avoid middleman
Organize cooperatives

Disfruit (See Appendix 2)

Birth - 65%
Twinning - Goats, 30
Sheep, 25
Deaths - Young, 35%
Adult, 7%
Slaughter Age - 20 months
Disfruit - 14-16%

CLASS 2 PRODUCERS -- Medium Level Producers, Own Land; Utilize and Receive Technology; Can get Credit; Expect some Financial Return

Land Use

Own land
Generally no fences except to enclose cash crops

Overgrazing
Own cattle, sheep, and goats
Poor soil, but water generally available in dams

Genetic Improvement

Animals mixed
No culling, no castration, high percentage of male
Generally sell breeding animals at Feirá

Nutrition

Native pastures, unimproved, few improved
Crop residues and grass on dam margins
Concentrates before shows, minerals and bonemeal supplementation

Health Practices

Some deworm
Must "cure" disease that appear in flock

Installations

Fencing only for cash crops
Chiquerios-corrals, Acudes-dams, Abrigos-Shelters

Management

Have herdsmen
Year-round mating, no separation of sexes
No castrat
Natural weaning by dams, usually 4 months
No breeding control, give birth in fields, unattended
No ratio of males to females maintained

Commercialization

Sell breeding animals to other farms
Sell for slaughter to middleman
Sell hide to middleman

Disfruit -- The disfruit is low because of high mortality and high slaughter age. Production figures for Class 2 Producers - projections

Portuition	-	65-70%
Twinning	-	30-35 goats
		25-30 sheep
Mortality	-	30-35 young
		7-8 adult
Slaughter age	-	18-20
Disfruit	-	18-19

RECOMMENDATIONS FOR CLASS 2 PRODUCERS

Land Use

Protect forages that are potential food crops
Do not use areas with slope of more that 25% for crops, leave for use of goats
Defer pasture strips for dry season grazing
Cut and butn unwanted and uneaten forage; trim fodder trees and feed
Fence areas for cach crops

Genetic Improvement

Change bucks every two-three years; buy from distant sources
Castrate surplus bucks
Control birth; cull bad breeding does
Native goats bred to Anglo-Nubian buck, purebred buck or 15/16 pure
Breed standards must be considered
Breed animals showing best performance

Nutrition

Native pasture all year
Clear uneaten brush and trees; improve pasture
Grow pasture legumes; plant cactus
Graze on edges of dams
Supplement 1:1 salt:bonemeal
Get forage into kids as early as possible
Water supplementation in cactus enhances the digestibility of native pastures

Health

Same as Class 1

Installations

Build kidding pens, kid areas, weaning areas

Management

Same as Class 1
Separate bedded areas for kidding
Keep does confined near parturition
Wean at 120 days

Commercialization

Same as in Class 1
Sell bucks and rams through shows

Disfruit -- Expected Production Figures Improvement for Class 2

Parturition - 75-80
Twinning - goat 40-45
sheep 35-40
Mortality - 20-25 young
4-5 adult
Slaughter age - 14-16 mos
Disfruit - 35-40%

CLASS 3 PRODUCERS -- Good Level of Production Technology; Access to Credit; Receptive to Innovation; Looking for Economic Gain

Land Use

Good characteristics of breeds
Change bucks frequently.
Breeding season seldom controlled
Breed for exhibition

Nutrition

Give supplementation of grain and minerals
Feed crop residues, use native pastures

Health

Control of worms
Vaccinations whenever necessary, if advised
Treat naval cord on newborn animals
Dip or spray for external parasites
Open and clean abcesses

Installations

Well structured apriscos and corrals
Pastures divided for kidding does
May separate bucks

Management

A paddock
Control of age at first mating
Breeding season control
Castration of surplus males
Dip naval cords
Separate kidding pen

Commercialization

Actively engaged in the sale of breeding animals and animals for slaughter
Generally do not sell hides; sell animal on hoof

Disfruit -- Low because of high kid mortality.

Parturition	- 75-80	
Twinning	- 40-45	goats
	35-40	sheep
Mortality	- 20-25	young
	4-5	adult
Slaughter age	- 14-16	

RECOMMENDATIONS FOR CLASS 3 PRODUCERS

Land Use

Same as for System 2
Soil analyzed for pastures and grass supplements
Mix forage and subsistence crops
Do not farm areas with a slope greater than 15%
Control grazing pastures
Rotate crops

Genetic Improvement

Castrate surplus males
Eliminate all animals giving defective kids
Breed for body growth
Breed Santa Ines if feed available

Nutrition

Native pasture year-round plus improved pastures
Dry season feed supplements of napier grass or other
Feed before breeding:
15 days before, 150 g concentrate/day
400 g corn/day + cotton or sorghum
Density of mesquite 5 meters between trees
Cotton, corn, beans between trees for 1-3 years
3 Years after cultivate buffed grass
10 days before and after breeding, 3 kg
Common salt and bonemeal 1:1
Feed kids same as 2

Health - Same as # 2

Deworming based on mating season--before start of mating, December, after parturition, at weaning

Installations

Aprisco de piso suspenso, matemidade
Limpeza clean daily

Management - Same as # 2

Have 60-day breeding season
Male/female ratio of 1/40
Individual breeding pens and hand breeding
Keep records of age at parturition, weight of dam, breeding weight, typr of kidding, weight of kids, weaning weight
Select animals carefully
Select for body development, absence of defects,
Castrate surplus bucks - 6 days
Wean at 90 days and separate sexes
Breeding season when animal reaches 70% adult weight
3-Year-olds have 45-day breeding season
First year culling: (1) all does that are inbred, (2) all does that don't take care of kids, (3) all does that have chronic mastitis
Supplement bucks 5-6 days before mating

Commercialization

Slaughter at 10-12 months (about 20-25 kg)

Disfruit - (% Projection)

Parturition	-	80-85%
Twinning	-	40-45 goat
		35-40 sheep
Mortality	-	10-15 young
		4-5 adult
Slaughter are	-	10-12 mos
Disfruit	-	45%

APPENDIX 2

PRODUCTION INDICES - CLARDIO BELAVER

	Actual (1980)	Espeado (85)
Parturition (%)	55-60	75-80
Twinning -- Sheep (%)	20-25	35-40
Twinning -- Goats (%)	25-30	40-45
Mortality -- Ateumano (%)	40-45	20-25
Mortality -- Adult (%)	8-10	4-5
Idade abate - Slaughter (meses)	22-24	14-16
Disfruit - Economic Indices	8-12	35-40

	Valorabate 10%	Valorabate 37%	Difference
Caprine	366 milhoes	1,353 bilhoes	987 milhoes
Sheep	317 milhoes	117 bilhoes	857 milhoes

Population No. East

Goats	6,094,586
Sheep	5,289,935

Abates	Disfruit, 10%	Disfruit, 37%
Abates Goats	609.459	2,254,997
Abate Sheep	528,994	1,957,276

There is a market for 9 million skins/year, more than are produced presently.

APPENDIX 3

DISFRUIT ANALYSES

$$\text{Disfruit} = \frac{\%\ \text{slaughter number}}{\%\ \text{total number in herd}} / \text{age coefficient}$$

How derived:

$$\text{Disfruit} = \frac{(\%\ \text{births}) - (\%\ \text{mortality less than 1 yr) or (until slaughter)}}{(\%\ \text{females over 1 yr} - \%\ \text{mortality}) + (\%\ \text{males over 1 yr} - \%\ \text{mortality})} / \text{age coefficient}$$

Disfruit--A term used for measuring production. It is computed as in the above formulas. Presently, it is very low here (see chart of Dr. Bellows) 8-12%. In Argentina, it is 20-25%, U.S.A., 30%, and in France, 40%. If an animal is slaughtered before one year, the disfruit goes up; when they are slaughtered after one year, the disfruit does down, e.g., 18 mos, Age coef. = 1.5; 6 mos, age coef. = 0.5.

In goats it is possible to have a higher disfruit than in cattle because of the short generatior interval and the increased liter size.

To maintain the validity of this formula, the figure for mortality until slaughter must replace the mortality to one year in the equation for animals kept over one year. Generally, it takes more than one year for the Class 1 Producers to get an animal to market size.

APPENDIX 4

DETAILED ITINEAERY OF VISIT TO BRAZIL

September 29, 1979 - 9 a.m.

Left Tuskegee via auto for Montgomery, Ala and flight to Atlanta, flight 40 minutes late.

Arrived Atlanta 2 p.m. near Republic Airlines gate had extremely long walk to Eastern flight to Miami.

Left Atlanta 3:40 p.m. -- arrived Miami 5:40, in a storm. Proceeded to Pan Am to check on a hotel reservation, they had promised to confirm. Pan Am confirmed room in Rio at the Leme Palace.

I went to find ectachrome 400 film because I didn't have a flash attachment - none available. Proceeded to Pan Am International building for seat selection at 8 p.m.. Flight left at 9:50 p.m.

Arrived Rio 6:40 a.m. (1 hour earlier than estimated) Cleared customs. They all bags and looked through everything! Changed $50 to paid taxi, ticket agent went to hotel. Was given Room 508 at hotel which has a balcony that allows a view of the sea (rate $52/night.) Had a shower, brunch, and went to find some museums The only other activity available on Sunday is swimming.

October 1, 1979

Arrived via Vasp airlines in Forteloza at 12:40 p.m. met by Dr. Ederlon R. deOliveira and a driver from EMBRAPA. Dr. McGowan left a note saying he had to see some people at the Research Station in Salvador and at the Veterinary School in Recife and would return 10/5/79 to Sobral. I was informed there were no facilities in Sobral to exchange travelers checks so Dr. deOliveira took me to a bank.

We then had a quick lunch in a restaurant in Forteleza by the Sea and left for Sobral - a 3 1/2 to 4 hour drive.

Along the road there was an opportunity to see the vegetation of the northeast for the first 50 kilometers. There was still some growth of underbush and leaves on catinga (small trees) as we drove further inland over foothills. The trees became empty of leaves and no brush covered the ground. This is still the case around Sobral. Dr. Oliveira is a nutritionist.

Arrived at the Municipal Hotel de Sobral at 8:15 p.m. Checked in, put excess cruziers in hotel safe. Received Room 111. The room has little light but is clean with an airconditioner and refrigerator. I put my clothes away and practiced my Portuguese.

October 2, 1979

8:25 a.m. EMBRAPA driver arried to take me to Centro National de Pesquisa de Caprinos (CNPC) headquarters in Sobral.

8:40 a.m. greeted by Dr. Claudio Bellaver, acting director in the absence of Dr. Elino -- attending a meeting in Panama, with Mr. Augmor D. Ramos during the translating (with U.S. Mission)

They asked about Tuskegee, the types of programs and its interests. They were told of our interest in the small farmer and the programs designed to reach them.

I was told the overall CNPC plans for goat and sheep production. In terms of goat production there is a great interest in (1) increasing their carcass yield and (2) reducing kid mortality. They are doing some syncronization projects but have no fertility and progency data on these experiments yet.

There is a parasitology project that takes farm samples as well as research station samples in their survey of parasites of the northeast. There is an idea that Tuskegee might blend into this effort with does and kids.

There is a short course on goats here beginning October 8 that will have 25 farmers participating at least 15 are very poor with 4-5 goat herds. These are the farmers we have been asked to focus attention on as possible ollaborating farmes for our research efforts.

I met several other researchers briefly and talked to them about their work:

Aurino A. Simplico production

Francisco A. ~~Armda~~ Arruda bio climitology

Elsio A. Figueiredo - genitics

I will talk with them individually about their work during the week.

Because this area is arid and range so important to animal survival, I asked about range research and was given a document by Dr. Smith of Arizona. It will be in the Brazil folder circulated when I return.

Because of the severity of the 8 mo. dry season it is imperative that data be collected through the entire year and work must be designed accordingly.

I was told the unusal lunch break is from 12-2. I was picked up at 2 p.m. and spent 2 1/2 hours going through EMBRAPA reports prepared by Drs. Shelton, Smith, and their own general research program objectives.

At 4:30 we went to the EMBRAPA Research site to be finished by November 21, 1979. The soils lab staff is the only one in place, they moved in October 1

It is an impressive facility comprising several buildings and many acres of pasture. EMBRAPA Administration offices, research scientist of all disciplines, office and lab space. pathology, microbiology, parasitology and isolation areas. A conference room and cafeteria. An office for guest scientists is available.

Because the hide of goats in Brazil constitutes 30% of the value of the animal, methods of the protection of the skin must be included in the study.

See production indics of Clardio Bellivar - p. 5 & 6.

October 3, 1979

EMBRAPA Office - Reviewed their old literature on production systems for the northeast with emphasis on their #1 production systems which are for the poorest farmers --

Worked on Portuguese - one hour

Reviewed the final report on Dr. Ian Mason - F.A.O. a consultant who came to give some direction to their efforts to strengthen agricultural research.

Since this trip has to make an attempt to gather and identify published and unpublished data.

CNPC is presently completing another production scheme they feel more comfortable about - it will be ready by the 10th of October.

I will try to outline categories of Products etc., as well as possible given the paucity of data now available.

Most of the researchers are trying to finish annual reports and have little extra time. This may also have been their reason to try to delay our visits until October.

Production Indices - Clardio Belquior

	Actual(1980)	Esperado (85)
Partition (%)	55-60	75-80
Twinning (Sheep %	20-25	35-40
(Goats %	25-30	40-45
Mortality - at umaro (%)	40-50	20-25
Adult (%)	8-10	4-5
Idade abate - Slaughter _____	22-24	14-16
Desfoute - Economic indices	8-12	35-40

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Caprine	366 milhoes	1,353 bilhoes	987 mil hos
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Abate Sheep	528.994	1,957,276

There is a market for 9 million skins/year more than are produced presently.

$$\text{Disfruit} = \frac{\%\ \text{Slaughter number}}{\%\ \text{total number in herd/}} \quad \text{age coefficient}$$

How derived

$$\text{Disfruit} = \frac{(\%\ \text{births}) - (\%\ \text{mortality less than 1 year})}{(\%\ \text{females over 1 year} - \%\text{mortality}) + (\%\ \text{males over 1 year} - \%} \quad \text{(until slaughter) or}$$

Age coefficient

Disfruit - Is a term used for measuring production. It is computed as in the above formulas. Presently it is very low here (see chart of Dr. Bellaver 8-12%. In Argentina it is 20-25%; U.S. A. 30% and 40% in France.

If an animal is slaughtered before 1 year the disfruit goes up; when they are slaughtered after 1 year, the disfruit goes down. e.g. 18 mos Age coefficient = 1.5; 6 mos. age coefficient = 0.5

In goats it is possible to have a higher disfruit than in cattle because of the short generation interval and the increased liter size.

To maintain the validity of this formula the figure for mortality until slaughter must replace the mortality to 1 year in the equation for animals kept over 1 year. Generally it takes more than 1 year for the class 1 producers to get an animal to market size.

October 4, 1979

7:45 a.m. Ederlon arrived at the hotel with Arruda and driver to take me to see his experiment in nutrition at EMBRAPA.

The facilities are built of native catinga, some commercial wood slats and tiled roofs.

He has prepared four levels of treatment, most of which will be out of range for the poor farmer for slated floor could be made of catinga.

Group 1 - on dirt, receive normal salt, water not other than unimproved pasture.

Group 2 - Raised slatted home - unimproved pasture

Group 3 - Raised floor - Improved pasture

Group 4 - Raised floor - improved pasture, grass supplement.

He compares the animals by body weight.

He is summarizing his results now and will be available next week.

There is another site which has no chiqueiro, water and salt are given but closest to natural forms with only the catinga brush as a source of nutrition. Animals return to fenced area at night.

10:00 a.m. returned to EMBRAPA Office. Talked further with Claudio via Agumar D. Ramas about small farmers and programs for next week; met extension agent.

2 p.m. Returned to EMBRAPA to work on report and receive their literature.

4:00 p.m. went to farm to review the bork in Breeding and Reproduction

Mr. Aurino Alves Simplicio - Is studying the reproductive efficiency of sheep. Dr. Figueirdo is doing the similar program with goats. First Mr. Simplicio's project.

They are using 3 breeds of sheep--(1) Somali, (2) Sarta Ives; (3) morada Nova.

The animals are kept on improved catinga pastures (no large trees) and given mineral salt and bone meal supplement only. They are housed in groups at night. They control the breeding cycle to 45 days beginning September 15 They will breed only once this year. Some parameters they are studying are:

1. Age and weight at 1st estrus
2. Age at pubity
3. Influence of breeding season
4. Duration of estrus
5. Number of lams (kids)
6. Ratio of rams and ewes that is optimal.

Vasectomized rams are painted twice a day and they run with the ewes (does). Attendants are always with the animals.

When animals yean their young they are separated at 105 days.

To get ewe/ram ratio two groups are used - 42 ewes are divided as follows:

1 ram - 30 ewes; 1 ram - 12 ewes.

Slides - Role #1 (- 18-20) Roll #2 (1-5) (5=SRD Goat)

Kidding rate for ewes is as follows:

Somali - 1.3 /year

St. Ives - 1.2/year

Morada Nova - 1.6/year

Figueiredo - This project is examining reproductive parameters in goats using 6 breeds of goats to determine which is the most efficient in reproduction. Bucks are pure representatives of their types---whether all are actual breeds is yet to be determined. The does other than mineral and bone meal supplement grace improved catinga pasture in the evening they have open shelter on raised wooden floors. They expect to have examined all of the genetic parameters within the next 5 years. They are also looking at milk production via the weight of kids before and after nursing.

Slides: Roll #2 (5-14)

4 native breeds of the northeast of Brazil	(Moxoto (5)(6)(7) - mixed colors (Canindè (11)(12) (Rapartido (8)(10) (Marota (13)(? 11)
Imported	- Anglo nubian (9) - Bhuj (14)

There is a National Program using the SRD female and bucks of the four native types to examine their reproductive efficiency - will see Oct. 22-28)

Because the Title XII efforts are aimed only at the poorest portion of the population my remarks will be pertaining mostly to this group. I will bring information on all groups but my report will be containing remarks applicable ~~only~~ mostly to Class #1 producers.

8 - 10 p.m. - Studied Portuguese - with Arruda's.

October 5, 197

8 a.m. CNPC Office to work on report - Prepare 1st weeks notes for mailing.

10/5/79

2:00 p.m. returned to EMBRAPA Office

2:30 p.m. Mr. Arruda - bioclimatology discussed his work. His projeect involves the study of the tolerance of animals to heat stress, toward the development of animals with some resistance to heat stress. His work is using three types of goats, (1) anglo-nubian, (2) Bahj and (3) caniadé. The caniadé a native goat of Brazil was found to run fastest, achieve highest temperatures but had the ability to dissapate the heat faster than the other two.

The parameters studies were temperature, rectal, and respiration.

8-10 p.m. Studies Portuguese with Mrs. Arruda.

10/6/79 7:10 a.m. Dr. Claudio Bellavier arrived to take me to the "Free merket" to see the sheep and goats from local farms placed on sale.

While waiting for Dr. Bellavier, I saw a bus stop and two people get off; who then took two goats from the luggage section of the bus. They were tryping to sell them,when we left.

The price of goat and sheep that day was cr $850. There were only mailes for sale. One will find most herds are 30% male; 2.9% breeding males; 9.6% over 12 months; 16% under 12 months.

(Slide roll #2, 15-19 - farmers selling goats; #20 donkeys packed by market; Roll #3, 1-6 market; #4 - meat market; #5 & 6 - goat market; #7, milk salesman; #8 - Brahna at Abbatoir; #9 - skin salesman; #10 skin house.)

After the market we visited the Abbatoir, we were too early for the slaughter. They don't begin until 11:00 a.m. They kill 15-17 animals on week days and 9 on Saturday.

The next stop was the hide warehouse. This is a rather small dealer who sells 15,000/month. He was just beginning to refill the building. He pays cr $200, for regular size hides and 150 for smaller ones; whether

the skins are damaged or not. A few with Bexiga - a skin parasite - only brought the owner cr $100. For a hide from a dead carcass cr $105. For best results hides must be air dried on sticks, in the shade with hair side toward the sun.

10/7/79 - Sunday visited museum of Padre José. Studied Portuguese.

10/8/79 - Arrived CNPC for an 8 a.m. meeting with Drs. Elino, McGowan. The meeting actually began at 9:30 with Carlos Costa acting as interpreter.

Dr. McGowan gave a report of his trip to Salvador and the Veterinary School of Recife. The area's sheep and goats are slaughtered in ~~Piauí~~ Piauí State. Dr. McGowan outlined his work at Sobral.

1) He will monitor the health of all experimental animals via Dr. Nancy East. A veterinarian who will be in Sobral working for Dr. McGowan through January.

2) Monitor 2-3 farms where Carlos Costa is taking fecal samples for his parasite survey.

3) Accompany any animals from experimental farm herd to slaughter and perform post mortem inspections.

4) Necropsy all animals dying on experimental farm.

The money that is supporting the building and expansion efforts at CNPC. Sobral is coming from and International Development Bank loan. We were told a great amount of equipment has been ordered. but seems Brazilia EMBRAPA paper work is causing some delay.

Dr. Elino asked that Title XII institutions assist in

1) Training of CNPC personnel

2) Assist in equipment speed-up or purchase elsewhere

At 2 p.m. returned to CNPC to discuss carcass evaluation of animals on-the-hoof with Claudio. He has parameters for carcass and skin weights

from experimental animals but the data is still to be analyzed.

4:00 p.m. went to farm for the opening of the Short Course for Goat Producers. The first training course for CNPC was organized by their extension service liaison, Jose Ubiraci Alves.

There were 25 farmers. Fifteen were from farms classified as Class 1, the ramainder were from Class 2 farms.

The course lasted all weed and is paid for by the Federal Land Reform Organization. The federal government is interested in having farmers switch to goats as a principal livestock investment. They feel within two years the goats will pay off their loan.

Lodging, meals, educational materials were supplied to producers. One woman attended.

Dr. Elino explained the purpose and program of CNPC. Then questions were accepted from the floor.

A number of producers, of the Sobral area, were sheep farmers and didn't want to raise goats. "Sheep are more important and goats give too much trouble."

All of the producers paid close attention and entered the discussions readily. There are a lot of graphs and statistics to consider. I am not sure how much was understood.

10/9/79 - 7:30 p.m. CRSP, PI's met, Johnson, McGowan, Debâar & Oliveira -

1) To discuss Brazil with McGowan who was leaving .

2) Discuss a job description and qualifications for the site co-ordinator as we saw it.

It was felt he or she should have research and practical experience with more emphasis on management skills, willingness to learn Portuguese and live in Brazil. The job would be administration, procurement and

coordination. Assisting the local PI's in the local implementation of their projects. The counterpart person from CNPC is Ederton Oliveira.

2 p.m. Meeting with Dr. Louiz C. Freire, and economist from Petrolina.

Petrolina is planning to obtain demonstration farms in areas where they have research stations; the areas are:

1. Oariana - (PE) (CAPTSA)
2. IRECE (BA) (EPABA)
3. Serra Talhana (PE) (IPA)
4. Igatu-ce (EPACE)
5. Souza (PB) (JEPACEY)
6. Jaico - PI

The system of production will be: irrigation (Petrolina) dry season; farming (Petrolia, Caatinga management. Investigation of native Browza species of the northeast.

Petrolina Research -

1. The irrigation study has 1 year of data on traditional and modified plots. They are adding manure fertilizer this year.

2. There is a study building water shed area to manage run off water.

3. Management of Caatinga with livestock and improved varieties of native bushes.

   a. Methods of planting - i.e. manual versus tractor

   b. Number of animals a hectare can support

      1) Traditional management of goats
      2) Some management-input deworming
      3) Management increase plus supplemental feeding
      4) Control of breeding season.

All animals slaughtered after one year.

4:30 p.m. Visit to breeding Season projects with goats. There are two groups of goats; one being bred July 15 -November 15; the other bred January - March.

Animals born in the dry season are lighter in weight and some die. The survivors, however, recover their weight when it rains and develop better.

NB - Goats in NE Brazil have an 18-19 day estrus cycle.

(Slides - Roll 3 - (11-12)

10/10/79 - 8 a.m. arrived at CNPC office at farm. Discussed collaboration efforts with Drs. Johnson and DeBoer and Mr. Guitewez. Read the plan for economic analysis. Discussed plans for farm visits, November 12. Spent time in parasitology research laborator. Worked on report.

2 p.m. - CNPC office - worked on report.

4:30 pm Government Land Reform Officer, who is financing the course came to speak to us in our office.

The Northeast has bank supported homestead loans for small farmers that have come about because of the high social tension in some areas of re-settlement after the war. INCRA - Agrarian Land Reform Organization. The loan package is for 300 hectares. People will grow corn, beans, manioc, potatoes and will be given 50 head of goats as their livestock. It is thought that by the time the goat herd has increased to 200 head, the goats will be supporting the farm.

Thirty farms have been given out already in Pemambuco area. They are planning to give our 500 farms.

Some of the farmers attending the course may apply for these loans once they are available in Ceará.

5:30 - Demonstration of slaughtering a goat by Claudio Dellaver for people in the course.

(Slides - Roll 3 - 13-20; Roll 4 - 1-5, 1 opening carcass 2 wetting hands to remove skin)

Two economists arrived from Brasilia. Because they work generally with other commodities, they will talk primarily with the economic group.

October 12, 1979 - 8:15 a.m.

CNPC worked on report, prepared questions for extension service.

1. High or noderate rural urban migration
2. Youth dependence ratio? High 45% (0-15 yrs)
3. Lowest administrative level: County - 4 extension officers one each for different commodities.
    a. Area covered - fartherest city is 110 kilometers
    b. How adequate is mobility - have cars
    c. Educational level of extension contact people - college
    d. Must they carry messages beyond their capacity? No.
    e. Number of days a year, devoted to farm training - 15-20 days per month
    f. Logistic support - Have vehicles and some demonstration materials.

12 pm - Cabrito luncheon at Club Uruguay hosted by Dr. Elino and his wife. Given for INCRA officials who came for closing of short-course on sheep and goats.

3:15 pm Returned to CNPC office to go with Extension Agents to visit farms in Regiao de Pedro de Fogo.

Farm #1 Class 1 farm had enclosed chiquiero for sheep and goats. Farmer was a "farm leader" --owned 40 hectare, 30 sheep, no goats. Pigs and chickens around the yard. Their water source was an artificial lake. They grew corn, beans. Slide Roll #4 (13-15)

Farm #2 The farm of a man attending the course. This farmer did deworm animals and had a chiquiero and did try to improve production, dipped naval cords, and castrated males. The only water source is in barrels delivered every few days. The herd size has gone from 60 to 300 sheep. He owns 40 hectars of land.

Farm #3 Was an urban farm with sheep and goats. The chiquiero was small, crowded and highly contaminated with feces even from a donkey. His goat crop had been mostly male so his goat herd was smaller than his sheep herd since most farmers tend to sell male kids. Farmer feels he earns more from sheep since the ewe lambs tend to stay in herd.

Returned to Sobral 7:30 pm

October 11, 1979

Arrived CNPC 8 am. Met and talked with Sobral's two public health veterinarians from GESA-GRUPO executive de Saude Animal. They are in charge of prophylaxis against foot and mouth, rabies, brucellous and TB testing.

I will go out with them October 16 or 17 to possibly see some cases. Their work is preventative, going out will give me the opportunity to evaluate their efforts.

October 12, 1979

Arrived CNPC 8 am. Examined the CAB-Bibliography to shich EMBRAPA subscribes. It seems to be the most complete reference on goats I have seen. I have ordered a copy from EMBRAPA through 1979. We may have to find a way to get on this system.

October 13, 1979

Returned to market - goats - cr $850 to cr $1,000; hide prices same cr $200.

10 am - Social meeting with Sobral veterinary group. "Children's day" celebration. (Slide Roll #5 1-5)

7-10 wash day in Sobral in contaminated river. River is contaminated from Sobral to Forteleza.

October 14, 1979

EMBRAPA car came to pick up Dr. DeBoer, Mr. Guiture and me at 10 am to go to mountains. This is the farming area. There are produced cashews, mangos, coffee, black pepper, and pineapple. The day was spent visiting farm families and looking at plants.

Returned to Sobral - 4 pm

October 15, 1979

Met with Mr. Arruda with Carlos Costa translating. Discussed existing projects and whether a management component could be added to them.

There is only one project of Arruda's available and the animals must be worked on by December 15. Presently there is no one at EMBRAPA - Sobral, to carry on the project.

There is a dairy goat project in Paraiba that couls use some management assistance--found in research file at EMBRAPA. This project is due to begin 1980. We will explore Paraiba.

Talked with Elsio and Claudio about other attachments at EMBRAPA.

5 pm Went to Veterinary Extension Office (G.E.S.A.) The veterinary officer--4 months at station--works closely with the extension agents.

is vaccination controlled. Brucellosis program is test and slaughter after positive retest. High rabies incidence because of large bat population. Vaccinate animals and try to kill bats.

October 16, 1979

9 am meeting with CNPC staff to discuss categories of producers.

2 pm Discussed possibility of factoring on management component to Elsio's project with Dr. Daunders. In AM will discuss where management will best fit.

October 17, 1979

Arrived CNPC 8 am. Discussed breeding program plans and areas of possible imposition of management parameters. NB Concept of Index. Most animals that have adapted to stress, climate, poor nutrition are generally small.

October 18, 1979

Arrived CNPC 8 am. Discussed "on farm" research with Carlos Costa as interpreter. We sha-l try to cooperate with EMBRAPA's on-farm efforts if at all possible.

October 19, 1979

6 am - Extension workers arrived to visit farms we visited; three Class #1 producers and one probable #2. We had a discussion with the veterinarian at Coreau about health practices. There are presently several outbreaks of Aftosa on eleven farms. Pigs and cattle are the most severely affected sheep and goats get mostly foot

2 pm returned to CNPC to finalize plans for travel to Petrolina and Parabia. Station director Paulo Leite was called and told about my visit October 29. (Slide roll #6)

October 20, 1979

Went to market at 7:15 am. The severity of the drought is obvious for today desperate farmers have brought many more animals to market, about 40 animals. Many are young femals, cr $1,000, 2 does with 4 kids--cr $3,000

10 am went to office to work on report.

1-3 worked on report

October 22, 1979

Arrived 8 am - CNPC. Went to farm for "systems" lecture by Dr. Sanders - 9 am.

2 pm Exit discussions with Dr. Elino. Told him of our sincere efforts to assist EMBRAPA whenever a collaborating scientist is made available at Sobral, and that we are hoping to find a meaningful collaboration at Paraiba. He thanked us for our interest.

October 23, 1979 -

EMBRAPA car arrived at 5:15 for trip to Quixada. Car engine skipped badly and we had to stop for car repair at Canidaé 9-13:30 am. Arrived at Quixada at 11:45 am. EMBRAPA office was closed for lunch. We went to hotel to check in and have lunch. This city has very poor hotel facilities.

2 pm Returned to CRACE Station. This station is laid out into 9--3 hectar plots for range studies; 21-3.5 hectare plots and 25-9 hectare plots for goats, a total of 2,519 hectars.

Slide Roll #7 - 1-3 Canidaé and holiday of remembrance of St. Francis of Assisi
4 Quixada
5 Sheep pastures
6-7 Cassions - sheep
8 View of sheep pens
9 Goat research area
10-13 Bubj --and bucks
15-16 Goats in corral

Pastures - (1) 16 native pastures clear--25/25 sheep and goats

(2) 24 improved pastures--weaned female sheep and goats on 42 hectars--goats obviously doing better.

Breeding Season - 15 November--15 January possibly extended 10 days. 7 breeds of goats--nubian, Bubj, Canidadé, Moxoto, Moroto, SRD, Repartida.

Sheep mostly Morota Nova--200 males--300 young animals.

There is a large 25' deep silo filled with buffed grass and molasses and covered with earth for compaction.

Quixada is the most outstanding facility for research with goats in the Northeast; having excellent pastures, housing, etc. There are no animal scientists on Quixada staff for collaborating, however.

8 pm returned to office to discuss arrangements for Dr. Shelton's breeding project. There is a possibility of a project dealing with care of neo-natal kids during the rainy season. When temperatures drop to 75° many kids die because of the high wind velocity and excessive chilling. Pens are not bedded. We will stop in IGATU on the way to Petrolina to confer with Helio Machado--director of Quixada Station.

October 24, 1979

5 am - Left Quixada for Petrolina--car trouble, lost 1 hour.

Stopped briefly at Iguatu to inquire about space and animals at Quixada of Dr. Machado. There is space but no animal science counterpart scientist.

Ate lunch, continued to Petrolina

Arrived Petrolina 9 pm.

October 25, 1979

Petrolina has 300-400 mm rainfall/year and has been developing farming systems aver the last three years. They put animals into the system last year and they are continuing over the next 5 years. 2,800 hectares in experiment station. There is an experiment by Terezina Padhila looking at 4 levels of management.

9 am --visit to experiment.

1. Traditional

2. Health care

3. Roughage and mineral supplementation

4. Aparisco--raised shelter

The greatest difference was between groups 1 and 2.

The grazing capacity is also being studies

T_1 - 1 goat/hectare

T_2 - 2/2hectares

T_3 - 3/3 hectares .

They are examining continuous and deferred grazing. Each treatment get grazed then rested four months. There are no replications.

Recommendations: Areas of high precipitation--knock down trees, plant pastures, human food

Areas of low precipitation--mixed bushes and grasses.

2 pm -- visit to on farm experiments, feeding several forages to sheep and goats--cut and carry--all animals prefer guffel grass.

October 26, 1979

Meeting with all deciplines of station. Very strange gathering. No new information was exchanged. They are very anxious to have some aspects of the CRSP to locate at Petrolina. I told them I would consider it a good location if something can be worked out with Teresina Padhildo.

12:30 pm - left for Salvador

10/29/79

Left Salvador via air 11:40 to Joao Passoa and a meeting with EMEPA - Empressa de Pesquisa Agropecuiaria Paraiba EMBRAPA group.

Arrived Joao Passoa 12:40 pm, met at 2:30. Went to EMEPA office to discuss dairy goad project with Dr. Paulo Leite, animal scientist in breeding, Deputy Chief of Station.

The Experiment Station at Soledade is 700 hectares with 200 H set aside for goats and planted permanent buffel grass pastures. The project has only one technician, Dr. Aldomario Rodriques, a veterinary scientist from Receife. Because the rainfall is only 394 mm rain/year, the median in research area of Solidade is 220 mm. There are 4 rainy months and 8 dry months. The pastures are mixed with Algoroba trees, a leguminous fodder tree that sprouts from seed in feces of goats. Pastures of palma and algoroba vary in age from 3 to 10 years.

The area from Joao Passoa to Campinia Grande is green with many pastures of pangola grass. The Caatinga doesn't begin until one crosses the mountains after Campinia Grande. There are many living fences of Aveloz--a tree that only goats seem to eat.

Campinia Grande, a city of 250,000 people, has a good hotel, Rique Palace Hotel, which seems quite good. The experiment station has a guest house with 3 bedrooms and baths, which is very clean. There is a good cook and meals cost cr$75 for lunch/dinner, and cr$35 for breakfast. There is no charge for sleeping there because it is government owned. For periods exceeding a few weeks, arrangements probably would have to be made. The station is in Soledade, a tiny town with no facilities other than a few grocery stores. The station is one hour from Capinia Grande on a good road.

10/30/79

Left Joao Passoa 4:00 am to drive to experiment station with Dr. Paulo Leite and driver. Arrived in Soledade at 8:00 am. Met Mr. Aldomario Rodrigues and looked at goat facilities. In a meeting later in the morning, Mr. Rodrigues outlined his research plans and his plans for the Station. He is interested in evaluating local goats and the two milk breeds--Anglo-Nubian and Parde Alegmania. He is anxious to help the small farmers in their area become adept at caring for dairy goats on the sparce foods available. He desires to eventually be able to balance off production costs with the sale of goat cheese, skins and meat.

This is a very real possibility of production cost can be kept down.

1 kg cattle cheese - cr$100
1 kg goat cheese - cr$400-500 (in Salvador and Minya Garia, cr$800)

The government is assisting through bank loans to farmers. They would like help in this effort to reach the farmers. They would like for us to help with their first research effort in any way we think possible.

The farm has 9 pastures - 5 are 16 x 22 hectares, and 4 are 11 x 14 hectares. Some of the ways of helping, which were discussed, are:

1. Assistance in pasture divisions for rotation for all classes of animals.

2. Assistance in designing of milking area and pens.

3. Designing health surveillance regime for all classes of animals.

4. Planting plots of various legumes and dry fodder to cut and feed. Supplemental feed for farmers must be plants they can grow and feed. No concentrates will ever be available for small farmer dairy goats in this area.

If the forage group locates at Petrolina they may help with the evaluation of species.

Dr. Shelton has suggested that in selecting breeding animals, we should select animals that eat the widest variety of species of plants for the best growth. It is best to have animals that eat mostly waste vegetation.

The smallness of animals and poor nutrition and heat stress contribute to formulating an index for genetic selection--better teeth and better ability to graze.

EMEPA has to place some more technicians at this station. We can collaborate but cannot carry the total weight of the research necessary to evaluate the three breeds of goats in that environment.

They have asked that we include some physiological studies of adaptation to thermal stress and low nutrition.

The Parauba extension veterinarians for Soledade area arrived at 11:30 am and answered questions about producers. There are 42,000 goats in Soledade; the average herd size is 300 goats. There are more than 100 farms, and the average size of the farm is 100 hectares. I don't have any way of determining the classification of the producers within this area.

The average age of animals for sale is about 9 mos (28 kg), cr$50-60/kg.

SRD, cr$1,000/doe; cr$400/kid).

The extension agent handles sheep and goats and makes about 20-25 farm visits per month. He says people use goat milk for cheese and to feed children. There is probably more ability to deliver technology and improvement than the capability to absorb them on small farms.

I told the group in the meeting about the CRSP and that generally the attractiveness of a possible dairy goat project in the Caatinga area is very exciting for Tuskegee, and that their project would receive a great deal of consideration as a primary site in Brazil for Tuskegee.

1:30 pm, we left for Receife and a 7:00 pm flight back to Salvador.

10/31/79

9:30 pm, Dr. Maner came to pick me up to take me to the Veterinary College of Bahia in Salvador. He introduced me to the director and left me with Dr. Silva, Professor of Laboratory Animal Medicine, who is in charge of goat production.

A major purpose of the visit was to make personal contacts for future diagnostic and laboratory back-up. I met producers of vaccines for casseous lymphadenitis and contagious ecthyma, Dr. Silva and Dr. Alice, respectively. We will be able to order products from them, and we will be able to send them blood and tissues for analysis.

2:30 pm. The afternoon was spent talking to members of the pathology department and looking at their facilities. There is more of an emphasis on small animal medicine than large; however, there is a possibility of getting students over vacation (December to March) to do work on goats as a special project.

5:00 pm. Met the director of the Institute of Biology of Bahia, a graduate of Iowa State University.

7:00 pm. Dinner with Dr. Susan Almy to discuss the rural development efforts at Cruz das Almas and the people of that area.

There is a literacy program (MOBRAL) there, conducted mostly by young girls, so older women tend to drop out after one or two lessons. Students do not readily go out to work with farmers; they have very little in common, since most are from the city. There is a Catholic effort that attracts a few students to work on weekends with farmers. The only effort completed at Cruz was a Manioc Survey.

11/1/79

Breakfast was at 7:00 am., with Dr. Maner to discuss the possibility of Tuskegee taking over the dairy goat herd at Cruz das Almas and doing some evaluation of available forages and selection for milk production from Native goats (SRD) and Nubian bucks.

Facilities and herd were established by the Rockefeller Foundation some years ago to do feed evaluation, but has been abandoned by the principa investigator. The university is very anxious to have the additional animal science expertise on its campus. I told Dr. Maner that I would have to see Cruz in order to be able to evaluate it properly.

12:00 pm. Dr. Maner and I left for Cruz, and arrived at 2:00 pm. Dr. Maner had some business on campus; he showed me the herd and facilities. I met the director and a few scientists. Left for return trip to Salvador 4:00 pm; arrived in Salvador 6:00 pm.

APPENDIX 4

DETAILED ITINERARY OF VISIT TO PARAIBA

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TUSKEGEE INSTITUTE • Carver Research Foundation

Small Ruminant CRSP

Collaborative Research Support Program

1980 CONFERENCE ON DISEASES AND MANAGEMENT OF GOATS IN SMALL FARM FLOCKS

March 15, 1980 - 9 am to 4 pm
Learning Resource Center
School of Veterinary Medicine
Tuskegee Institute

PROGRAM

Morning Session - Dr. Doris M. Oliveira, Presiding

9:00 a.m.	Greetings	—Dr. M. Tolbert, Director Carver Research Foundation
		--Dr. Walter Bowie, Dean School of Veterinary Medicine
		—Mr. J. W. Hallman, Jr., President North Alabama Dairy Goat Association
9:20 a.m.	Public Health - Potential Disease Spread by Goats and Goat Products	—Dr. E. T. Braye, Extension Veterinarian
9:50 a.m.	Cheesemaking	--Dr. R. Cannon, Professor Animal and Dairy Science Auburn University
10:30 a.m.	Coffee Break	
10:45 a.m.	Dairy Goat Nutrition	—Dr. W. Barnes, Animal Scientist Extension Service, Auburn University
11:15 a.m.	Parasite Control	—Dr. T. Hoover, Associate Professor Large Animal Medicine Auburn University
11:35 a.m.	Poisonous Plants	--Dr. & Mrs. R. Judkins Tuskegee, Alabama
12:10 p.m.	Lunch (Large Animal Classroom, $1.00/person)	

Afternoon Session - Dr. Om Verma, Presiding

1:15 p.m.	Kid Diseases	--Dr. W. Dade, Professor-Pathology
1:40 p.m.	Herd Health Program for Goats	--Dr. M. Creel, Practitioner Boaz, Alabama
2:00 p.m.	Reproduction and Breeding of Do	Dr. Molowuku, Associate Professor, Tusk.
3:15 p.m.	Breeding Soundness Evaluation of Herd Sires	--Dr. R. Brown, Assistant Professor Anatomy Auburn University

QUESTIONS AND CONSULTATIONS.
Audio Visuals-Mr. John Phillips
P.O. Box 1181, Tuskegee Institute, AL 36088, (205)727-8160

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Management/Production Systems

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

Sub-Grantee: Winrock International Livestock Research
and Training Center
Morrilton, Arkansas 72110

Funds: $100,000

Principal Investigator: Henry A. Fitzhugh

Dairy Goat Production Systems for Smallholder Agriculturalists

PROGRESS REPORT

Period Covered

Planning Grant: October 1, 1978 to September 30, 1979

Year 1 Program: October 1, 1979 to March 31, 1980

Submitted by:

H. A. Fitzhugh
Principal Investigator

Small Ruminants Collaborative Research Support Program
Title XII/USAID

I. Background

Winrock International's interest in the concept of "Dairy Goat Production Systems for Smallholder Agriculturalists" preceded Title XII Small Ruminants-CRSP. Participants such as Devendra (Malaysia), Sengar (India) and Allonby (Kenya), attending the Winrock International conference on the Role of Small Ruminants in Agricultural Development (Novermber, 1976) cited the potential advantages for small dairy ruminants in intensive farming systems of the humid tropics.

The original proposal for a small ruminants CRSP was developed by representatives from Texas A&M University, University of Arizona, Oklahoma State University and Winrock International during a meeting at Winrock International in February, 1977. This proposal, which included an intensive dairy goat component, was reviewed by the Joint Research Committee in May, 1977. Their favorable response to the proposal led to the 1977-78 Planning Study by the Research Triangle Institute. This Study culminated in the organization in June, 1978 of the SR-CRSP, including 13 US institutions responsible for 17 projects. One of these projects was entitled "Dairy Goat Production Systems for Smallholder Agriculturalists". The SR-CRSP was funded by USAID in October, 1978. The 1976-77 Winrock/USAID state of the arts study on small ruminants in developing countries further identified such systems as deserving special emphasis for research and development.

This report describes the activities and accomplishments of the Dairy Goat Production Systems project during the period October, 1979 through March, 1980.

II. Goals

The goal of the dairy goat production systems project is essentially the same as the program goal and objectives for the SR-CRSP in Kenya; namely,

To Develop and adapt goat production systems to the needs of smallholder agriculturalists in the humid/sub-humid tropics, emphasizing dual purpose utilization of goats for milk and meat production.

This commonality of program and project is in recognition of the responsibility of this project to meet necessary research objectives not covered by the other collaborating projects and to synthesize a technically and economically feasible smallholder system utilizing the technology, animals and knowledge developed by all collaborating projects.

III. Objectives

The time period covered by this Report includes the Planning Phase (October, 1978 to October, 1979) during which time a foreign work site had not yet been identified. Project objectives during this period were limited in scope, they were:

1. Revise project statement, procedures and budget to meet specific requirements of U.S. and international work sites.

2. Initiate literature review, design of experimental facilities and protocol for dairy goat nutrition and managment experiments planned for 1979.

3. Coordinate planning for production system research with disciplinary specialists at other CRSP institutions.

Objective 1 was slightly revised in July, 1979 to reflect tentative identification of Kenya as the expected international work site.

Following tentative approval of Kenya as the foreign work site, more specific research objectives were formulated for the first years. These are:

A. Foreign site - Kenya

   1. Design experiments and develop facilities for research on management systems appropriate to dual purpose goats on small farms, including evaluation of nutrient requirements.

   2. Survey production systems in current use.

      a. Identify feed resources, health problems, animal resources, product utilization, markets, labor requirements and attitudes of small farmers to goats.

      b. Establish baseline data base of production and economic coefficients for use in systems simulation and assessment of the impact of future interventions.

      c. Determine major constraints on production systems and identify research priorities.

B. U.S. site - Petit Jean Goat Dairy/Winrock International

   1. Evaluate management systems and nutrient requirements for kids, replacement females and lactating does.

   2. Document amount and sources of phenotypic variation for growth, lactation, fertility and health traits for five dairy breeds (Saanen, Alpine, Toggenburg, Nubian and La Mancha).

3. Review and summarize published information on dairy goat produciton systems emphasizing those reports appropriate to humid/sub-humid tropical regions.

IV. Activities and Accomplishments

Activities and accomplishments have been organized into four principal categories:

A. Program Development - Coordination

B. Literature Review

C. Performance Record Documentation

D. Kid Nutrition - Management Experiment

Expenditures of AID funds (cf. section VI) have been similarly allocated.

A. Program Development and Coordination

1. Foreign program and site evaluation. G. E. Bradford (PI; University California, Davis) spent his sabbatical year with H. A. Fitzhugh conducting a survey of hair sheep resources in the Americas and West Africa. This project was jointly funded by AID and Winrock International. During the course of this survey, Bradford and Fitzhugh also evaluated potential foreign work sites for the SR-CRSP. Results of these inspections were reported to the SR-CRSP Technical Committee. Countries visited during this time period (11/78 to 5/79) included:

Fitzhugh	Bradford	Fitzhugh and Bradford
Brazil	Guatemala	Trinidad-Tobago
Dominican Republic	Venezuela	Barbados
Cameroons	Guyana	Virgin Islands
Liberia	Jamaica	Mexico
	Ivory Coast	Colombia
	Mali	Nigeria
	Senegal	

Other foreign visits during which discussions were held re dairy goat research in developing countries included:

H. A. Fitzhugh

17-23 October 1978. Conference on Integrated Crop and Animal Production on Small Farms in Developing Countries; Bellagio, Italy. Presented paper entitled "Small Ruminants for Small Farms". (expenses paid by Rockefeller Foundation)

24-28 October 1978. Discussions with FAO/Rome officials (Mussman, Rendel, Mahadevan and Riveros) re small ruminants projects, including SR-CRSP activities (expenses paid by Winrock International).

5-12 November 1978. FAO/UNEP Consultation on Evaluation and Conservation of Animal Genetic Resources in Latin America, Bogota, Colombia. Presented paper on SR-CRSP organization and objectives. (expenses paid by FAO/UNEP)

J. A. Yazman

24-27 September 1979. Attended symposium on Goat Production under Rigorous Conditions in Latin America, Asociacion Latinoamericana de Produccion Animal; Panama (expenses paid by SR-CRSP/AID and Winrock International).

2. Kenya program development. Fitzhugh traveled to Kenya in September, 1979 with Robinson (ME Program Director) and Nolan (PI, University of Missouri) to negotiate placement of dairy goat project in Kenya. Selection of Kenya was based on knowledge of the GOK/UNDP/FAO Sheep and Goat Development Project and on recommendations from the CRSP site survey team which visited Kenya in January, 1979.

Subsequently, Fitzhugh returned to Kenya for February and March, 1980 to establish the Production Systems project and also to serve as interim Program Coordinator for SR-CRSP/Kenya. Michael Sands (Ph.D. candidate, Cornell University) moved to Kenya in March, 1980 beginning a two-year assignment to the Production Systems project.

While program implementation in Kenya has been delayed by the recent partition of the Ministries of Agriculture and Livestock Development, two experiments have been designed for expected initiation in July, 1980. These are (detailed project statements are given in attachment 1 and 2):

a. Small Farm Production Systems Survey (in collaboration with other SR-CRSP/Kenya projects).

b. Comparison of Goats and Cattle for Milk and Meat Production on Small Scale Farms (in collaboration with Forage and Health Projects).

Extensive discussions were held with potential Kenyan ators re their research interests and the opportunities for involving Kenyan students in the Production Systems projects. Potential collaborators include members of the University of Nairobi faculty: Animal Production (Sand, Wanyoicke, Kayongo -Male); Agriculture Engineering (Muchiri) and the Ministry of Livestock Development staff (Kevelerge, Kitale Station; Ochunyo, Nyanza Prov.). Final decisions will be made in Summer, 1980.

Accomplishments during the period February-March, 1980 were primarily administrative rather than technical but were critical to successful initiation of the SR-CRSP in Kenya. These accomplishments included organization of initial field visits in Kenya by ten SR-CRSP scientists (including all seven PI's); signing of Memorandum of Understanding by Ministry of Livestock Development (MLD) and Finance representatives; negotiations for assignment of MLD staff and facilities to SR-CRSP in Kenya; arrangement of housing for SR-CRSP staff in Kenya; drafting Phase III integrated program plan for Kenya.

3. U.S. program development. A kid raising experiment was designed and implemented at the Petit Jean Goat Dairy (operated by Winrock International). Principal objectives are to evaluate biological and economic feasibility of pre and post weaning nutrition and management regimes. Pre-weaning treatments include whole goat milk fed ad lib; bottle feeding warm lamb milk replacer; suckling does for first 30-days of lactation; and stripping residual milk from does post machine milking. These pre-weaning treatment comparisons are relevant to developing countries due to the conflicting needs for goat milk for human consumption and for higher survivability of kids. Post-weaning treatments will compare three crude protein levels (12, 16 and 20 percent). Five breeds (Alpine, La Mancha, Nubian, Saanen and Toggenburg) are compared. Details of experimental design are given in attachment 3. Preliminary results will be available for analysis in August, 1980.

4. Integrated program planning. A proposal "Dairy Goat Production Systems for Smallholders", was prepared in March, 1979 and circulated to all PI's. This proposal (attachment 4) included a statement of need for systems research on dual purpose goats in humid tropics, a list of objectives for this research, a suggested approach and estimated budget for work at a foreign site. Nine projects from the SR-CRSP were suggested for collaboration at a site in humid ecozones in Africa (seven of these projects are involved in Kenya).

Kenya trip reports and proposals for an integrated research program on dual purpose goat systems were circulated to PI's in October, 1979. A meeting of seven PI's was convened in Denver, October 18-19, 1979 to develop an integrated program plan for Kenya. Individual project proposals and the overall program plan were submitted to Kenyan officials for review in December, 1979.

B. Literature Review

The June, 1979 publication, "A World Bibliography on Goats" by Sands and McDowell, Cornell University contains citations to 1033 references. An additional 275 citations have been added through searches by Production Systems staff which includes Sands. These and future citations will be stored on a computer data file to facilitate their utilization.

An annotated bibliography on kid rearing is in preparation. Emphasis is on foreign language publications; in some cases, abstracts must be translated to English. Preparation of this bibliography has been delayed by necessary reallocation of additional staff effort to conduct the kid rearing experiment. New target date for completion is September, 1980.

C. Production Record Documentation

Initial efforts were directed to review, correction and computerization of Petit Jean Goat Dairy data recorded from 1976 to 1979 (approximately 1000 animal-years.) A system of computer programs has been developed for maintaining these data (attachment 5). Work continues in the checking of these records for accuracy. Once checked and corrected, data will be analyzed to evaluate sources of phenotypic variation.

The computer programs are written in FORTRAN IV and are designed for ease of adaptation to other computer facilities. They will be available for use in Kenya.

Traits currently recorded include:

Lactation - biweekly milk weights; monthly analyses of milk composition; monthly samples to check indicators of mastitis, including plating for pathogen profile and somatic cell counts (microscopic, electronic Coulter counter).

Growth - birth weight; kid weights weekly through 4 months; does weights monthly.

Fertility - breeding and kidding dates (services to conception, gestation length); litter number and survival; estrous activity.

Health - diagnosis and treatments; blood samples sent to Washington State University in collaborative study on caprine arthritis-encephalitis; mortality records.

Data are now routinely recorded on computer data files. Preliminary analyses of kid growth and health data will be completed in August, 1980; other analyses will be completed in December, 1980. Results will be used to plan additional experiments on kid, replacement female and lactating does nutrition and management.

D. Kid Rearing/Management Experiment

This experiment (cf. attachment 3) started in February, 1980. As of April 1, 1980, fifty-three kids from the five breeds had been placed on experiment; approximately 160 additional kids will be started by July 1, 1980. Current and planned assignments of kids and does to treatments are shown in attachment 6.

Although no analyses have been performed as yet, kid survival on all treatments has been very good. Only three kids have died to date. Kids raised on lamb milk replacer have had a higher incidence of scouring and bloating than those on other treatments.

V. Status of Expected First Year Outputs

First year indicators and outputs identified in the Sub-Grant Request for First Program Year were subdivided into those for foreign and US based research. Those identified for foreign based research have been met, except that the proposed base for research in Kenya has been shifted from the Coast Province to the Western and Nyanza Provinces.

All outputs from US based research have not yet been realized. The summary of performance traits has been delayed by unexpected difficulties in checking and correcting previous data; however, this phase is nearing completion and preliminary analyses will begin before June, 1980. The annotated bibliography has not been completed because staff efforts have been diverted to the kid rearing experiment; this bibliography will be completed by August, 1980. A letter and questionnaire have been prepared to send to individuals and institutions interested in dairy goat research; responses will be used to develop a directory (one of the proposed outputs) part of which will be completed before May 31, 1980, the end of Program Year 1.

VI. Project Expenditures

	AID FUNDS						
	Program Development Coordination	Literature Review	Performance Record Documentation	Kid Nutrition Management Experiment	TOTAL	Winrock Matching Funds	TOTAL
Planning Grant							
A. Salaries	9496	1195	1385	2039	14115	-0-	14115
B. Supplies, Expenses	117	-0-	-0-	-0-	117	168	285
C. Equipment, Materials	-0-	-0-	-0-	-0-	-0-	-0-	-0-
D. Domestic Travel	373	-0-	-0-	90	463	-0-	463
E. International Travel	1134	-0-	-0-	302	1436	3357 1/	4793
F. Indirect Costs	-0-	-0-	-0-	-0-	-0-	7633	7633
Sub-total	11120	1195	1385	2431	16131	11158	27298
Year 1 (1/10/79 to 29/2/80)							
A. Salaries	9885	1964	1852	3660	17361	2942	20303
B. Supplies, Expenses	165	108	-0-	-0-	273	-0-	273
C. Equipment, Materials	159	-0-	-0-	1166	1325	-0-	1325
D. Domestic Travel	1625	-0-	-0-	-0-	1625	1045	2670
E. International Travel	3575	-0-	-0-	563	4138	-0-	4138
F. Indirect Costs	-0-	-0-	-0-	-0-	-0-	10628	10628
Sub-total	15409	2072	1852	5389	24722	14615	39337
TOTAL	26529	3267	3237	7820	40853	25773	66626

1/ Prorated share of travel expenses for Bradford and Fitzhugh paid by Winrock International

Budget Analysis

1. Sixty four percent of AID funds were expended in foreign site evaluation and project development; future expenditures are expected to exceed 75 percent in Kenya

2. Thirty nine percent of total project expenditures provided by matching funds from Winrock International.

VII. Project Personnel

U.S. (approximate Percent Time on Project) *

H. A. Fitzhugh, Principal Investigator (0.40)
J. A. Yazman, Nutritionist (0.20)
L. Turillo, Research Associate (1.00 Arkansas)
M. W. Sands, Research Associate (1.00 Kenya)
E. A. Henderson, Research Assistant (0.75 Arkansas)
J. Perkins, Computing Specialist (0.05 Arkansas)

Kenyans to be named **

Scientific collaborators
Nutritionist
Agricultural Engineer

Research Associates, two

* Time allocations at time progress report submitted. Research associates started on project after November 1, 1980.

** Kenyan collaborators will be funded for research and travel expenses only; research associates will be salaried.

Experiment: Production Systems Survey of Small Scale Farms in Kenya

Participants: Ministry of Livestock Development
Central Bureau of Statistics
Small Ruminants - CRSP

Production Systems	- Winrock International
Animal Breeding	- University of California, Davis
Animal Health	- Washington State University
Feed Resources	- Ohio State University
Sociology	- University of Missouri
Economics	- Winrock International
Systems Analysis	- Texas A&M University

Location:

Western Province	- Busia, Kakamega
Nyanza Province	- Siaya, Kisumu, South Nyanza Districts
Coast Province	- Kilifi, Kwale Districts
Central Province	
Eastern Province	

Time Period: June 1980 to July 1981 for initial production year characterization with monitoring to continue throughout life of SR-CRSP in Kenya.

Problem: Expanding human population and increasing demands for adequate nutrition for everyone place extraordinary pressures on the limited land resources available, especially in the medium to high potential agricultural areas. Food crops, especially roots and tubers, grown on small scale farms may provide adequate levels of food energy, but not the protein needed by the more vulnerable members of the family - children and women. Animal protein if available consistently at relatively low cost, can provide this needed nutrient balance. Dairy ruminants, such as cattle and goats, are especially suited to converting low cost forages and crop residues into milk and meat.

Unfortunately, the feed requirements to support a dairy cow (approximately 6.5 tons of dry matter per year) may exceed the productive capacity of small farms. Dairy goats, requiring less than 1.5 tons dry matter per year, may be more suitable. Three or four does mated to kid at different times could also ensure the consistent supply of milk needed for good human nutrition and, also, produce 6 to 10 progeny for sale each year. Thus, the potential of a dual purpose goat for small farms appears to be very good. On this basis, the SR-CRSP will establish a major research program to develop a viable dual purpose goat component for small scale farms in Kenya.

First, however, it is critical to thoroughly characterize existing small farm systems - identify, feed, land, economic and human resources; evaluate potential competition between goats and other livestock for feed, resources; anticipate major constraints requiring research to resolve health, nutrition, breeding and management problems. Failure to adequately characterize all aspects of existing systems may lead to inappropriate research goals, wasting science, time and financial resources.

Recognizing that few small farm systems in Kenya include dairy goats now, the principal purpose of the proposed production systems survey is to evaluate if and how this goat component may be introduced.

Objectives:

1. Characterize existing small scale farm systems in Kenya, including available biological, economic and human resources, and constraints throughout a production year.

2. Evaluate interaction between resources, especially potential competition between livestock and cropping activities for land, labor and capital resources.

3. Establish priorities for research to develop a viable dual purpose goat component to be introduced into small scale farm systems.

4. Provide baseline data for assessment of biological, economic and sociological impacts of changes in small farm systems based on research developments.

Procedures:

1. Four Integrated Rural Surveys (IRS) have been conducted by the Central Bureau of Statistics (CBS) since 1974-75. These surveys have documented monthly statistics on agricultural production, labor health and other characteristics of some 3500 small farm households in the higher potential agricultural regions of 22 districts of 6 provinces. The survey sample was further stratified according to eleven agro-ecological zones.

   Enumerators were hired to live in villages and report monthly on any changes in the status of approximately 20 households in the village. Enumerators were selected on the basis of aptitude and knowledge of local language and customs. They were supervised by District and Provincial Statistical Officers. Data were processed at a central computer facility in Nairobi.

   Results from IRS 1 have been published; however, difficulties in processing and analyzing data from IRS 2-4 have delayed publication. Data files have been checked for accuracy but at least some additional corrections will be required.

   Parheet Singh, Director of CBS, has approved use of data files from IRS 1-4 by SR-CRSP. In addition, CBS staff will assist CRSP in data analyses and in the conduct of addition field surveys.

To this end, CBS is constituting a new, expanded National Sample of Small Farm Households (approximately 9,600). Director Singh has agreed to the incorporation of a special "livestock module" developed by SR-CRSP/CBS staff in the new survey. This survey is scheduled to begin in March, 1981 and will provide a means for monitoring baseline data throughout the life of the SR-CRSP in Kenya.

2. In addition to the IRS sample households, other small farm units have been identified through the Integrated Agricultural Development Program and through the Provincial and District staff officers of the Ministry of Livestock Development. These farm units will be used to augment the IRS sample group.

3. Three related phases are envisaged for this research effort:

   a. In conjunction with the Winrock International Economics project staff, analyses of the IRS 1-4 files will be done to assess the productivity of livestock on small farms, constraints to production and, if possible, any time trends. These analyses will include evaluation of feed resources, marketing activities, family nutritional status, etc.

      It is anticipated that these analyses will contribute to design of new field surveys, establish research priorities and provide historical baseline reference data.

   b. Detailed survey instruments will be developed to characterize small farms with respect to resources, interesting activities and productivity. The focus will be on the livestock component with the objective of identifying if and how a dairy goat component will work. The initial draft of the questionnaire is attached. This draft will be reviewed by the MLD, CBS, and SR-CRSP staff prior to field testing.

      The questionnaire will be revised as necessary after field testing (using smaples other than those to be surveyed later). Surveys will be conducted among the old National Survey Sample in cooperations with IRS Officers and Enumerators. This cooperation is critical to the ready acceptance of SR-CRSP staff by the surveyed households. The IRS Sample group will be augmented with other households in the same region.

This field survey will be closely coordinated with the Animal Health project sample to assess health status of small farm stocks, especially ruminants. Collaboration among all SR-CRSP projects is anticipated with special survey efforts by the Feed Resources, Health, Sociology, Economics and Production Systems projects.

The survey will be conducted by SR-CRSP, CBS and MLD staff (all Requirements).

c. Based on analyses of IRS 1-4 files, preliminary results of field survey and SR-CRSP project for baseline data, a "livestock" module will be developed to be incorporated in the new National Survey Sample of small farm households. This module will monitor resource requirements (feed, labor, livestock, capital) farm demography and output by season.

4. The expected time frame for these three phases is:

IRS 1-4 analyses	June 1980 to January 1981
Field surveys	August 1980 to July 1981
Small Farm Monitoring	March 1981 to February 1985

Requirements:

1. Phase 1 - experienced data processor and analyst, including COBOL, file management and statistical analysis of survey data. CBS staff are fully occupied so these persons (2) must be provided by SR-CRSP.

2. Phase 2 - CBS and MLD field staff, especially District level officers to assist in interview of local small farm families (knowledge of language and being known and trusted are critical requirement for at least part of survey team).

   In the document "Requirements for Ministry of Livestock Development Personnel - SR-CRSP" (developed from Annex 1 of the Memorandum of Understanding) five 4-person teams are requested. Each team includes a Research Officer, Technical Assistant and two laborers and will require a 4-WD vehicle for transportation. This team would usually be supplemented by District level staff from CBS and by SR-CRSP staff.

3. Phase 3 - SR-CRSP staff from all projects will collaborate with CBS and MLD staff to develop and test an appropriate "livestock module" for the new National Survey. No special requirements are anticipated except staff time and the opportunity to test the module during the Field Survey under Phase 2.

Experiment: Comparison of Goats and Cattle for Milk and Meat Production on Small Scale Farms in Kenya

Participants: Ministry of Livestock Development, University of Nairobi
Small Ruminants Collaborative Research Support Program

Production Systems	- Winrock International
Feed Resources	- Ohio State University
Health	- Washington State University
Economics	- Winrock International
Systems Analysis	- Texas A&M University

Location: Research Stations at Maseno, Nyanza, Kenya with future replications at stations in other agro-ecological zones.

Time Period: June, 1980 - July, 1981 for initial experiment following which procedures will be revised, taking into account information from production survey. Experiment will be continued for 2 or 3 additional production years with revised procedures.

Problem: Improvement of the standard of living of small scale farm families is an expressed goal of the Government of Kenya. Attainment of this goal is constrained by the limited land, capital and other resources available to small scale farmers.

Animal agriculture, particularly that of utilizing ruminants which are not directly competitive with man for nutrients - offers an excellent means of improving the lot of small scale farmers. Dual purpose (milk, meat) animals supply high quality animal protein to improve family nutrition as well as sale of a highly desired market commodity.

Principal opportunities for developing dual purpose ruminants appropriate to Kenya are cattle and goats. Cattle are better established and accepted as milk producers; goats are primarily known for meat production under more extensive pasture conditions in Kenya. However, dairy goats, which are well established in other countries and not unknown in Kenya, have certain potential advantages over dairy cows for small scale farmers. These include:

1. Several goats can be maintained at productive levels on the nutrients required by a single cow (approximately 5 does to cow). This allows:

a. Year round production of milk by staggering matings (at equatorial latitudes) to ensure that at least one doe is lactating every day. In contrast the single cow will likely lactate for 6-7 months only.

b. Five month versus 9-month gestation intervals and litters of 2 or 3 kids versus one calf make it feasible for five does to produce 15 to 20 kids for sale in one year compared to one calf.

2. At least one indigenous type of goat (East African) exhibits a greater tolerance (or resistance) to diseases such as trypanosomiasis than do local cattle. This resistant-type provides a better base for developing a dual purpose, adapted genotype for local use.

3. Small size of goats simplify handling and control requirements on small farms, such as zero grazing and tethering. Goats can be dipped in a barrel; cows require a deep vat, which may not be readily accessible to the small scale farmer.

Despite these apparent advantages for goats, cattle predominate as producers of milk even on small scale farms. Furthermore, arguments have been advanced concerning the relative efficiencies of goats and cattle especially in the conversion of low opportunity feed resources, such as marginal land, forage, hop by-products and residues. Questions have also been raised about the efficiency of labor use, since five goats likely require more labor than a single cow; seasonal labor shortages might severely constrain the value of goat systems. Little is known about the feed preferences of goats and cattle, especially relative to the small farm feed resources; nor is there much known about the relative magnitude of health and management problems for cattle and goats.

Objectives:

1. Compare resource requirements (feed, labor), productivity (milk, meat) and efficiency of goats and cattle under conditions similar to small scale farms.

2. Evaluate health and management problems associated with holding cattle and goats in confinement or semi-confinement conditions.

3. Evaluate preferences of goats and cattle for different feedstuffs, including those typical to small farms and those which might be introduced in the future.

4. Evaluate techniques for processing and preserving feedstuffs to improve nutritive qualities and to ensure sufficient supplies in periods of shortage.

Procedures:

1. Comparisons will be made between goats and cattle on experiment stations in environments representative of small scale farming areas. The principal constraint applied to comparisons is that the feed resources will be those available on a typical small farm in the regions or those which are agronomically suitable and show special promise as feed resources.

   Choice of feed resources to be grown on land adjacent to feeding areas will be based on survey of small farms in regions and on recommendations by provincial and district staff. Feed resources may include forages, by-products and residues from food (maize stores, potato vines, etc.) or commercial crops (sugar cane).

   Feed will generally be cut and carried to animals or stored for later feeding. Zero grazing management will be necessary for comparisons and will be appropriate to the type of livestock management in intensively cropped areas. Several types of control management may be evaluated, including tethering, paddock or closed housing (suitable to tsetse fly areas).

   Different types of feed will be available in separate feeders in order to measure preferences. Nutrient values of feed as placed in feeders and of refusals will be assessed to evaluate effects of selective feeding.

2. Experimental animals will be of similar type - mature second or later parity dual purpose females. Goats will be sampled from first crosses or back crosses of European dairy breeds (Nubian, Toggenburg, etc.) on East African or Galla Goats. Cattle will be sampled from similar crosses or European dairy breeds on East African Zebu or from some existing populations of Kenya grade cattle.

   Experimental groups will be matched approximately on an equal metabolic weight ($W^{.75}$) basis. For example, five 50 kg does have approximately the same metabolic weight as one 400 kg cow. Total numbers will depend on land available for feed production, facilities, labor and availability of suitable genotypes from each species. However, a minumum number for each species will be 10 cattle and 25 goats. These minimum numbers will be sufficient only with replication across several years and will require extrapolation to units of similar metabolic weight (i.e., $25:10 \neq 5:1$).

   Experimental animals will be carefully screened for diseases and parasite problems prior to start of experiment. Herd health procedures will be applied to minimize health problems. Financial cost, labor requirements and effect on productivity of health treatments will be recorded.

Breeding males will be available to allow herd mating when females of either species exhibit estrus. Reproductive traits (including postparturient anestrus, litter number) will be recorded.

Lactating females will be kept separate from their progeny, who will be bucket fed whole milk from their respective species. Progeny will be switched from milk to other feeds as soon as physiologically feasible (primarily dependent on nutrient values of available feedstuffs).

3. Performance traits to be measured include:

   - amount, type and composition of selected diet from available feedstuffs
   - milk yield, persistancy of lactation, milk composition
   - weight changes of mature females and their progeny throughout one production year
   - disease and parasite problems, symptoms, treatments and responses.

4. At those locations where erratic rainfall pattern or lack of irrigation do not allow year-around harvest of fresh feed, feed preservation (hay, ensilage) techniques will be investigated. Also, processing methods, including chemical and mechanical treatments, of land quality crop residues and other feedstuffs will be evaluated for practicality and efficacy.

   Labor requirements, financial inputs and value of marketable products will be assessed. Observations will be made on the indirect benefits of such things as the fertilizer value of manure.

Requirements:

Animals: 25 to 50 dairy does
10 to 15 dairy cross or grade cows

Land: Assuming 15 kg dry matter requirement (50 to 55 percent digestibility) per unit (one cow/five does) per day plus 20 percent for progeny, each unit will require 6.5 MT per year. Assuming 3.25 MT dry matter yield per hectare, land requirements will be 30 ha for the minimum (25 does, 10 cows) to 50 hectares for the maximum (50 does, 15 cows). Additional land will be required for paddocks and/or housing area.

Land requirements will be less on land producing more than 3.5 MT of dry matter. Also these experimental requirements will be greater than those anticipated for small farms because of the need to evaluate several different feed production options simultaneously.

Labor: Assuming one half man-year per each animal unit, labor for feed production, harvesting, milking, care of progeny, data recording, pen cleaning, etc. will be 7 to 8 people at a minimum to 12 to 13 at a maximum for the proposed experiment.

Experiment: Management systems for rearing kids from birth to breeding.

Participants: Small Ruminants - Collaborative Research Support Program
Production Systems - Winrock International

Location: Petit Jean Goat Dairy, Winrock International, Morrilton, Arkansas.

Time Period: February, 1980 - September 1981

Problem: Low kid mortality and adequate rate of growth are essential to genetic improvement of dairy goats for increased production of milk, meat and hides. The period of birth to weaning (6-8 weeks) is the time of highest mortality and that of weaning to breeding the time when low rates of gain can seriously affect subsequent bodyweight at the time of kidding. For maximum kidding efficiency (live kids and age at first kidding) and yield over first lactation, adequate body size and weight is essential, especially if forage is to comprise a significant proportion of the diet.

The traditional system of rearing on commercial dairy operations is to remove kids at birth, feed colostrum for three days, and bottle feed warm goat's milk for 6-8 weeks. Such a system wastes valuable milk for human consumption, plus high mortality rates of kids are common. Post-weaning, either expensive commercial concentrate rations designed for calves or low-quality diets high in fiber are used. Little is known of the levels of protein and energy necessary to provide for an efficient and optimum rate of gain.

Specific milk replacer formulas have been developed for raising orphan lambs. Formulas have not been developed for dairy goats nor has the use of lamb milk replacer been compared to goat's milk as to growth rate and kid mortality. Use of milk replacer may become important under tropical conditions where improved breeds of bucks are bred to low milk-producing does and kid survival and growth rate is dependent upon an alternative to goat's milk. An alternative system under such circumstances is to use "nurse" goats who produce enough milk to raise a kid but due to problems such as mastitis or difficulty in milking, are not part of the milking herd.

Recently, systems of rearing orphan lambs have been developed utilizing cold milk replacer fed ad libitum. The ingestion of cold fluid causes the lamb to consume only small amounts at a single suckling. Frequent feedings of small amounts appear to lead to lower frequency of scours and higher rates of gain compared to feeding of warm milk or milk replacer by bottle 2 or 3 times daily.

In systems where kids are suckled on does, an effect on udder health and milk yield may be expected. Recent work with dairy cows has shown that primiparous cows which suckled calves during the early part of lactation showed an increased milk yield in the subsequent lactation period compared to controls which more than compensated for loss of the early milk. Such an effect would also be expected in dairy goats and may also be seen in does in which residual milk is suckled post-milking. Rearing systems involving suckling are common in parts of the tropics, especially where kid meat is a delicacy. Comparison of milk yield and udder health of suckled and non-suckled does is important in determining the total value of such systems.

Objectives:

1. Compare mortality and morbidity rates of dairy goat kids raised on lamb milk replacer, cold goat milk ad libitum and suckling of does.

2. Compare udder health and total milk yield of dairy goats which suckle kids for the first 30 days post-partum either completely (no milking) or post-milking to recover residual milk to those milked normally without suckling.

3. Compare three levels of crude protein (12, 16, 20) in diets of locally available ingredients (alfalfa hay, molasses, oats, cottonseed meal and corn) for kids post-weaning to breeding.

Procedures:

1. Kids will be randomly assigned by birth order and sex within breed to one of three treatments: Bottle feeding of commercial lamb milk replacer (30% fat, 24% crude protein) (T_1); ad libitum cold (40° F) dairy goat milk (T_2) and suckling of does post-milking or not milked (T_3). All kids will be weaned at 6 weeks of age to dry feed.

2. Weaned kids will be randomly assigned by sex and breed to one of three crude protein levels in the diet; 12%, 16%, 20%. The experimental period will be from weaning to 4 months of age.

3. Beginning January 15, 1980 all does kidding in the Petit Jean Goat Dairy herd will be randomly assigned by kidding order and parity (first lactation and second or greater) within breed to one of three treatments; normal milking (T_1); milking with stripping by kids post-milking (T_2); no milking with suckling by kids (T_3). Both treatments T_2 and T_3 will be for 30 days followed by normal milking.

4. Performance traits to be measured include:

   Kids: Rate of gain from birth to weaning, mortality, morbidity and feed consumption pre- and post-weaning.

   Does: Milk yield post-suckling, somatic cell levels and CMT scores of milk.

5. Labor requirements will be assessed for each system.

Requirements:

Animals: 125 cross and purebred does including Alpines, La Manchas, Nubians, Saanens and Toggenburgs. Approximately 215 kids will be available for assignment to treatment. Experimental design is illustrated in the following tables.

TABLE 1. Assignment of kids to preweaning treatments by breed and sex

Breed	Treatment 1 Milk replacer		Treatment 2 Cold Goat's milk		Treatment 3 Suckling	
	Male	Female	Male	Female	Male	Female
Alpine	10	10	10	10	9	9
La Mancha	8	8	8	8	8	8
Nubian	6	6	6	6	6	6
Saanen	5	5	5	5	5	5
Toggenburg	7	7	7	7	7	7
Total	36	36	36	36	35	35

TABLE 2. Assignment of does to early lactation treatments by breed and age.

Treatment 1 - normal milking

Breed	Adults	Yearlings
Alpine	7	3
La Mancha	6	3
Nubian	4	3
Saanen	5	1
Toggenburg	6	3
Total	28	13

Treatment 2 - post-milking suckling (30 day)

Breed	Adults	Yearlings
Alpine	8	4
La Mancha	7	3
Nubian	4	3
Saanen	5	1
Toggenburg	6	3
Total	30	14

Treatment 3 - complete suckling (30 day)

Breed	Adults	Yearlings
Alpine	8	4
La Mancha	6	3
Nubian	5	3
Saanen	4	2
Toggenburg	5	2
Total	28	14

DAIRY GOAT PRODUCTION SYSTEMS FOR SMALLHOLDERS

Justification:

The advantages of small ruminants for smallholders in developing countries are many. Small body size is a favorable characteristic where feed supplies are sparse and irregular in quantity and quality. Small product yield - undesirable when harvest labor is expensive - is desirable where product processing and preservation technology are primitive.

The dairy goat shares the general advantages of small ruminants, plus the special attribute of the much higher energetic efficiency of dairy systems relative to meat-only systems. Small supplies of milk on continuous serve as a valuable supplement to root, tuber and cereal diets - especially for the most vulnerable segments of the human population - children, pregnant and lactating women.

Generally, the financial investment required to start a small scale dairy goat herd is within the means of most smallholders. The high prolificacy and early maturity of goats contributes to rapid buildup of female numbers as well as yielding male kids for slaughter, often a good source of income. Smallscale operations suitable to meet the food needs of the subsistence family, if managed well, may be expanded to offer greater income earning potential. This potential offers hope to the subsistence family for improved economic status and a higher standard of living.

Dairy goats have many advantages for smallholders but certain constraints must be overcome. Feeding standards have not been adequately developed. These standards are needed to establish economical nutrition regimes, especially for growing kids, replacement females and lactating females. First priority should be given to identifying energy and protein requirements under tropical production conditions. Standards for minerals and vitamin requirement are also needed. Even though the substantial base of knowledge on the nutrient requirements of dairy cattle provides a useful foundation, simple extrapolation of these standards to dairy goats has not proven effective.

The majority of the nutrients for the goat herd will likely be from grass and browse; however, some concentrate feeds will be needed for early weaned kids and lactating females if their production potential is to be realized. Grain and oilseeds are the concentrates most often used in developed countries but they are likely to be too expensive for use as animal feed in developing countries. Therefore, it is important to evaluate the nutritional values of locally available, inexpensive feedstuffs - residues, by-products and other noncompetitive plant products - for use in dairy goat rations. Tropical forages appropriate to rotation with food crops offer special advantages in integrated crop-livestock systems.

Health problems of dairy goats also require special consideration. For example, the brucellosis organism which commonly affects goats is different than the one affecting cows. Goats are often thought of as hardy, vigorous animals. So they are in their more common arid environment under extensive management; however, health problems can be expected when dairy goats are required to produce in confinement and in hot, humid environments. The challenge will be to develop effective health management regimes for goats under humid tropical conditions.

Confinement schemes may protect goats from predation and theft. They also control movement and keep goats away from crops, trees and other plants which might be damaged. Such systems are labor intensive since feed is cut and carried to the goats and often must be preserved in major growth seasons to be used later. Confinement (stalls or small pens) or semi confinement (small pastures, tethering on raodsides or field interstices) regimes will require more investment in facilities than is needed for freely roaming goats. If these systems are to be financially feasible for smallholders, inexpensive easily constructed facilities must be designed.

Goats tend to be seasonal breeders. In some instances, this tendency reflects seasonal availability of nutrients; in others - especially at latitudes away from the equator - the tendency is apparently photoperiodic. Regardless of the reason for seasonal breeding, it will usually be advantageous to lengthen the breeding season and, probably, to increase litter size. Both improvements may require combined efforts of physiologists, nutritionists and geneticists.

Genetic improvement of dairy goats - productivity of meat and milk, fertility and adaptation to humid tropical environmental stresses - requires documentation of sources of phenotypic variation, estimation of genetic parameters evaluation of breed differences, estimation of heterosis, and formulation of selection indices and appropriate mating plans.

Genetic improvement goals will largely depend on economic values of various traits, development of desired products, organization of effective product harvesting, processing and marketing methodology. Sociological factors which must be evaluated include consumer taste and preference for goat milk and meat products, the social status of goat producers, willingness of producers to adapt to the special time and labor demands of dairy systems, and responsiveness of government and other agencies in providing credit and orienting policy to support improved goat production.

This opportunity for members of the CRSP to work together will demonstrate the feasibility of such comprehensive research efforts on the problems of the developing world. Success will pay off handsomely for both producers and consumers of milk and meat from dairy goat production systems.

Objectives:

The overall objective is to develop and adapt dairy goat production systems to the needs of smallholders in the humid/semi-humid tropics. Successful accomplishment of the comprehensive objective will require the coordinated accomplishment of the following specific objectives:

1. To identify and amend biological constraints to dairy goat production.

   a. Evaluation of nutrient requirements and development of general feeding standards with emphasis on use of locally available, low cost feed sources.

   b. Characterization of health problems of goats under intensive management and development of prophylactic and therapuetic treatments.

   c. Characterization of genetic resources, estimation of genetic parameters and development of improvement programs with emphasis on fertility, milk yield, growth rate and survivability.

2. To identify and amend social and economic constraints to production.

   a. Evaluation of social aspects of dairy goat production - taste and preference, social status, political attitudes and policies.

   b. Evaluation of financial costs and returns to all components of dairy goat production, including benefits and costs of new or adapted technology.

   c. Evaluation of current and potential markets for milk and meat from dairy goat systems including local and export markets for improved products.

3. To develop facilities and management techniques to improve productivity of dairy goats and the harvesting, processing and preservation of milk and meat products.

4. To develop and test appropriate materials and methodology for training scientists, extension personnel and producers in the techniques required for successful implementation of improved dairy goat production and marketing systems.

Project Approach

Coordinated multidisciplinary research efforts to improve production and marketing systems are the basis for the Small Ruminants CRSP. This approach is especially critical to research on dairy goat production systems, which are affected by a broad range of biological, social and economic factors.

Dairy goats in the humid tropics are likely to be combined with cropping activities on small holdings. Since most cropping research is beyond the scope and budget of the Small Ruminants CRSP, it will be useful to combine dairy goat research efforts with tropical cropping research already underway.

Relatively little research has been done with dairy goats and most of that done has been with improved European breeds in temperate environments. Therefore, experimentation with indigenous types (including crosses with European dairy breeds) in hot humid environments will be emphasized.

ILCA and IITA are currently collaborating in the Guinean zone of Nigeria on a research program to evaluate dairy goat-cropping systems for small producers. This program is still in the initial stages of planning and implementation.

The ILCA/IITA program is based in West Africa. Location of the CRSP effort in the humid area of East Africa should broaden application of results. Kenya is a logical country in which to base the CRSP project because of the well developed research infrastructure present there. There would also be opportunities for overhead cost-sharing and complementary research activities with CRSP projects based in Kenya.

A necessary element will be interest by the Kenyan government and/or other institutions with cropping research projects in Kenya. If this interest exists and appropriate research sites are available, the dairy goat research efforts could be incorporated with ongoing cropping research.

The marginal costs of the dairy goat research would be provided by the Small Ruminants CRSP. Crop residues, by-products, land for testing forage rotations, collaborating agronomists and, perhaps, some facilities, labor and other inputs would come from the cropping research program.

Research to accomplish the objectives of this project will include both fundamental and application oriented efforts. Further research will be required to develop and test appropriate means for extending improvements to smallholder producers. The following outline indicates the broad scope of research activities necessary for improvement of dairy goat production in humid tropical environments.

I. Fundamental research efforts.

   A. Nutrition - identification of nutrient requirements and development of feeding standards, especially for dairy females including herd replacements, primiparous, mature females (dry and lactating), and newborn, early weaned and slaughter kids.

B. Individual and herd health programs - characterization of health problems of goats under confinement, including live animal monitoring and autopsy; development of appropriate treatments.

C. Characterization of genetic resources for important production and fertility traits; development of physiological treatments and breeding plans to improve fertility and production traits.

D. Systems analysis of dairy goat production systems. Computer models of biological, technical and economic components of the systems will be developed and validated. These models will be used to evaluate biological, climatic, technical, social and economic interventions, including cost/benefit assessments.

II. Application research efforts

A. Management system development - development of handling and control facilities techniques (housing, fencing, tethering, etc.) appropriate for confinement and semi-confinement; protection from predation, theft, disease and climatic elements; product harvesting, processing and preservation - equipment, facilities and techniques.

B. Feed resource - livestock interactions. Combinations of nutrients from grass, browse and supplements will be compared locally available feedstuffs (by-products, residues and other feed sources) will be evaluated for nutrient content and suitability for dairy goats; feed, fertilizer and fuel values of manure will be evaluated; production of cultivated forage in rotation with other crops, including economic and ecological benefits and cost will be examined.

C. Documentation and analysis of biological, technical, social and economic coefficients and constraints. This research activity will provide data base essential to modeling dairy goat systems, assigning research priorities, establishing benchmark production and market levels and assessing the impacts of improvements.

D. Evaluation of prototype systems. The prototype systems will be designed to test the individual and integrated recommendations developed under other research objectives. They will utilize appropriate technology, available resources - land, feed, labor and conform to local production, processing and marketing constraints.

III. Training materials and methodology

A. University training of LDC scientists in dairy goat production, product processing and marketing.

B. Development and testing of training materials. Materials appropriate for producers, especially those who are poorly educated or illiterate, will be developed and tested.

C. Development and testing of extension methodology, including use of foreign site for demonstration of improved production technology and training of producers and paraprofessionals.

Budget Estimates:

Annual research costs specifically allocable to work at foreign site include:

1. Salary and travel expenses for U.S. based principal investigators and/or other research personnel from each project, while they are at foreign site.

Salary and benefits (3 months)	9000
International travel (2 round-trips)	4000
Per diem in country (90 days @ $50)	4500
	$17500

This average estimate per project does not include salary or other expenses in U.S. even when directly relevant to foreign site activity.

2. Salary and benefits (insurance, housing, educational allowance, home leave, etc.) for expatriate researchers based at foreign work site. At least two expatriate scientists will be needed full-time at the foreign site. Estimates of per scientist (and family) expenses include:

Salary	25000
Benefits (15% of salary)	3750
Special allowances	12000
	$40750

Salary and allowances will vary with training, experience and nationality. It is expected that expatriate scientists will have counterparts whose salary will be paid by local government; any additional expenses will be covered by the operational costs budgeted for the foreign site.

3. Experimental facilities, materials, labor, equipment, animals, vehicles and other operating costs at foreign site. Costs will vary between sites depending on available infrastructure and foreign government participation. However, it is anticipated that savings in one category will be balanced against extra costs in another. Annual experimental costs at the foreign site are estimated to be at least $200000.

Preliminary estimates of annual financial requirements for the foreign site activity are:

Activity	Amount
U.S. based researchers (9)	157500
Foreign based researchers (2)	81500
Foreign site operating expenses	200000
Total	$439000

Allocation of these expenses among specific projects must await definite assignment of research responsibilities at this and other foreign sites. However, the following example illustrates that the preliminary estimates of expenses for a dairy goat site in the humid tropics could be met within current CRSP budget allocations.

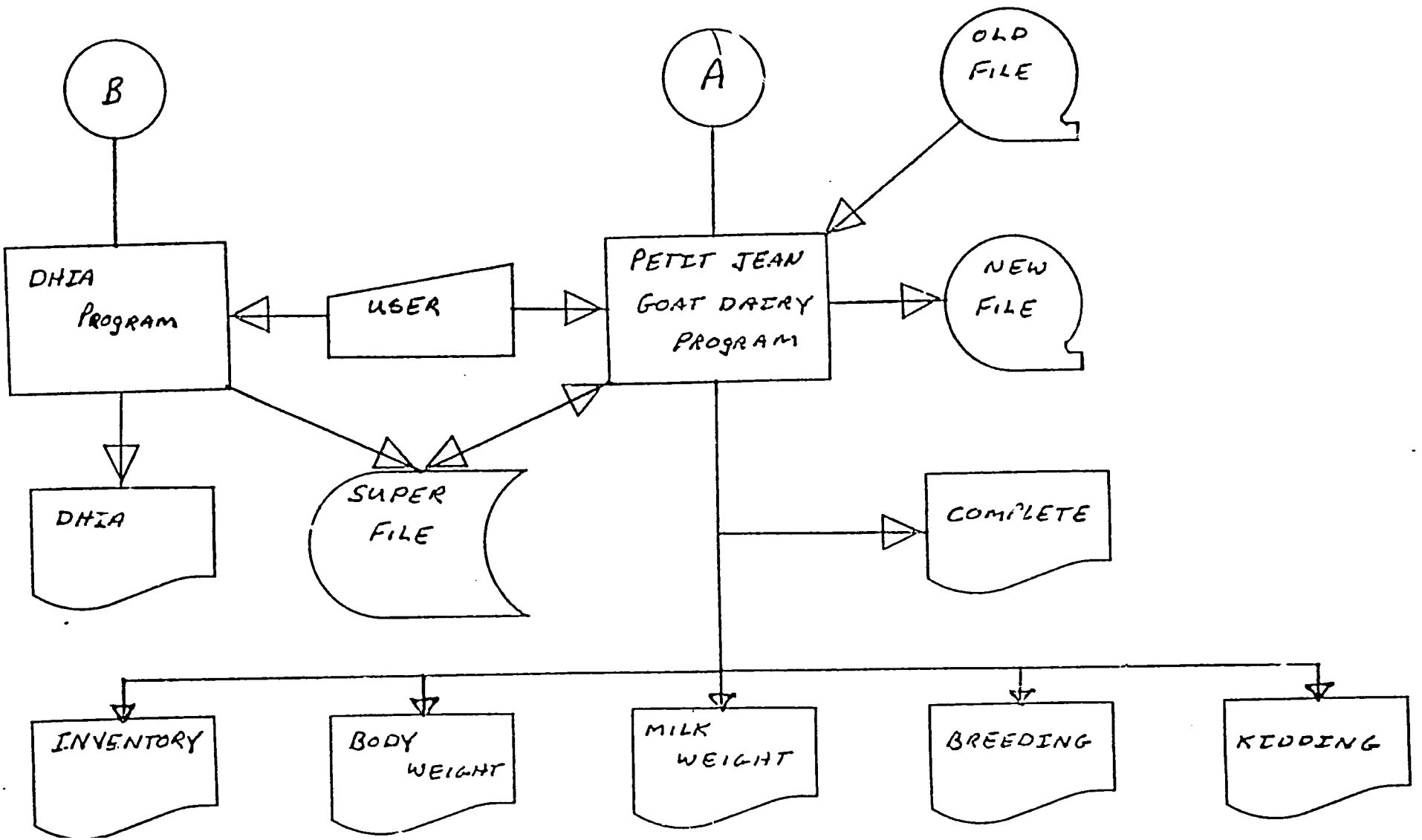
Activity	Amount
Dairy goat production systems	75000
Feed resources	
Forages	75000
Crop residues, byproducts	25000
Genetic improvement	75000
Health	75000
Reproduction	25000
Sociology	40000
Economics	40000
Systems research	20000
Total	$450000

Expenditures per project will likely vary from year to year so that the above estimates represent annual averages over a 5-year period. Some projects may primarily require researcher time to collect biological and technical data and to evaluate producer and consumer attitudes; others will be primarily concerned with the experimental operating costs. Foreign site based scientists will have multiple research responsiblilites under the supervision of specific project prinicpal investigators.

DAIRY GOAT PERFORMANCE RECORD SYSTEM

SMALL RUMINANTS - CRSP

G. PERKINS



ATTACHMENT 5

A:

1. LOAD TAPE ON TO DISK (SUPER FILE).
2. WRITE A NEW TAPE WHEN PROGRAM IS DONE.
3. PROGRAM OPTIONS:
   - A. DATA ENTRY FOR INVENTORY.
   - B. " " " BODY WEIGHT.
   - C. " " " MILK WEIGHT.
   - D. " " " BREEDING.
   - E. " " " KIDDING.
   - F. CHANGE ALL DATA SECTIONS.
   - G. LIST ALL DATA SECTIONS.
   - H. USE SUPER FILE AS A CHECK FOR VALID ID NUMBERS.
   - I. CREATE A NEW SUPER FILE AT END OF YEAR.

B:
1. ENTER BARN RECORDS.
2. AVERAGE MILK WEIGHTS.
3. WRITE MILK DATE & WEIGHTS INTO SUPER FILE.
4. USE SUPER FILE TO VALIDATE HERD ID NUMBERS.
5. LIST DHIA RECORDS IN SORTED FASHION TO HELP WITH MILK TEST PROCEDURE.

PROGRAM NAME

FLOWCHART NAME

DATA FILE NAME : INV1980.DAT

THE FOLLOWING CODES ARE USED IN THIS FILE

BREED	DIPOSITION	SOURCE	SEX	ORDER
1=ALPINE	0=UNKNOWN	0=UNKNOWN	1=FEMALE	1=WINROCK
2=LA MANCHA	1=SOLD AS CULL	1=BORN INTO HERD	2=MALE	2=SAC
3=NUBIAN	2=SOLD AS BREEDING STOCK	2=PURCHASED		
4=SAAN	3=DIED	3=DONATION		
5=TOG	4=EUTHANIZED			
6=CROSSBRED	5=ALIVE & WELL			

REC NO.	HERD ID NUMBER	BREED	TATOO	REGISTRY #	BIRTH DATE	SOURCE	SEX	DAM'S HERD ID	DAM'S REGISTRY #	SIRE'S HERD ID	SIRE'S REGISTRY #	OWNER	DISP.	DISP. DATE
1	391.	1.	EEP 24F	A192152	2-20-73	3.	1.	0.	A180171	0.	A168523	1.	5.	0- 0- 0
2	791.	1.	RNN L57	A325130	4-30-77	3.	1.	0.	A207950	15.	A216885	1.	5.	0- 0- 0
3	591.	1.	JPD J5	A218221	4-11-75	3.	1.	0.	A206148	0.	A196980	1.	5.	0- 0- 0
4	691.	1.	JJ K1	A234351	4-16-76	3.	1.	0.	A196979	0.	A196980	1.	5.	0- 0- 0
5	53.	1.	DPK K8	A229502	4- 4-76	2.	1.	0.	A175437	0.	A196462	2.	5.	0- 0- 0
6	59.	1.	GEI K5	A228084	2-13-76	2.	1.	0.	A183876	0.	A222792P	2.	5.	0- 0- 0
7	78.	1.	ADN K18	A267302	3-28-76	2.	1.	0.	A183319	0.	A237131	2.	5.	0- 0- 0
8	178.	1.	RNN K4	GA007440	1-25-76	3.	1.	0.	GA003164	0.	A196980	1.	5.	0- 0- 0
9	227.	1.	DPK K7	A229501	4- 4-76	2.	1.	0.	A175437	0.	A196462	2.	5.	0- 0- 0
10	232.	1.	YNT K2	AMA3575P	2-26-76	2.	1.	0.	AMA1891	0.	A200751P	2.	5.	0- 0- 0
11	249.	1.	YNT K5	A232680	4-21-76	2.	1.	0.	A192776	0.	A192125	2.	5.	0- 0- 0
12	705.	1.	SAG2 L40	A295711	4- 7-77	1.	1.	0.	A236197	0.	A219356	1.	5.	0- 0- 0
13	720.	1.	SAG2 L77	A295715	4-12-77	1.	1.	0.	A231682P	0.	A219356	1.	5.	0- 0- 0
14	803.	1.	WJP2M427	AA358220	6- 2-78	1.	1.	720.	A295715	10.	AA295716	1.	5.	0- 0- 0
15	830.	1.	SAG2M326		4- 7-78	1.	1.	78.	A267302	0.	A219356	1.	5.	0- 0- 0
16	831.	1.	SAG2M256	AA343199	3- 8-78	1.	1.	21.	A265986	10.	AA295716	1.	5.	0- 0- 0
17	834.	1.	SAG2M342	AA343203	4- 9-78	1.	1.	122.	AA003851	10.	AA295716	1.	5.	0- 0- 0
18	835.	1.	SAG2M243	AA343198	3- 3-78	1.	1.	130.	A265988	10.	AA295716	1.	5.	0- 0- 0
19	838.	1.	SAG2M341	AA343202	4- 9-78	1.	1.	122.	AA003851	10.	AA295716	1.	5.	0- 0- 0
20	853.	1.	SAG2M430	AA366066	6-19-78	1.	1.	82.	A234681	10.	AA295716	1.	5.	0- 0- 0
21	855.	1.	SAG2M384	AA345232	3-20-78	1.	1.	75.	AA003877	10.	AA295716	1.	5.	0- 0- 0
22	864.	1.	SAG2M294		3-21-78	1.	1.	53.	A229502	10.	AA295716	1.	5.	0- 0- 0
23	869.	1.	WJP2M307	AA358224	4- 2-78	1.	1.	89.	AA003767P	10.	AA295716	1.	5.	0- 0- 0
24	901.	1.	WJP2N237		4-30-79	1.	1.	838.	AA343202	10.	AA295716	1.	5.	0- 0- 0
25	902.	1.	WJP2 N6		1- 3-79	1.	1.	731.	A295708	10.	AA295716	1.	5.	0- 0- 0
26	903.	1.	WJP2 N27		1- 9-79	1.	1.	735.	AA295722	10.	AA295716	1.	5.	0- 0- 0
27	904.	1.	SAG2 N28		1-10-79	1.	1.	249.	A232680	10.	AA295716	1.	5.	0- 0- 0
28	905.	1.	SAG2 N35		1-15-79	1.	1.	74.	A265997	10.	AA295716	1.	5.	0- 0- 0
29	906.	1.	SAG2 N49		1-22-79	1.	1.	74.	A265996	15.	A216885	1.	5.	0- 0- 0
30	908.	1.	SAG2 N84		2-25-79	1.	1.	31.	A235145	15.	A216885	1.	5.	0- 0- 0
31	909.	1.	WJP2N113		2-27-79	1.	1.	705.	A295711	15.	A216885	1.	5.	0- 0- 0
32	911.	1.	SAG2N152		3- 6-79	1.	1.	703.	A23497	15.	A216885	1.	5.	0- 0- 0
33	913.	1.	WJP2N855		5- 3-79	1.	1.	855.	AA345232	30.	AA363845	1.	5.	0- 0- 0
34	915.	1.	SAG2N190		3-19-79	1.	1.	122.	AMA3851	15.	A216885	1.	5.	0- 0- 0
35	929.	1.	WJP2N252		5- 3-79	1.	1.	855.	AA345232	30.	AA363845	1.	5.	0- 0- 0
36	958.	1.	SAG2N178		3-17-79	1.	1.	53.	A229502	10.	AA295716	1.	5.	0- 0- 0
37	24.	2.	CT K5	AL265985	3- 8-76	2.	1.	0.	AL000808	0.	AL004142	2.	5.	0- 0- 0
38	29.	2.	CT K6	AL265990	4-24-76	2.	1.	0.	AL004046	0.	AL004142	2.	5.	0- 0- 0
39	121.	2.	CT K3	AL267300	5-12-76	2.	1.	0.	AL002262	0.	AL001326	2.	5.	0- 0- 0
40	238.	2.	CT K2	AL265992	5- 1-76	2.	1.	0.	AL001454	0.	AL004142	2.	5.	0- 0- 0
41	700.	2.	SAG2 L23	AL301931	4- 6-77	1.	1.	14.	AL265991	0.	AL004860	2.	5.	0- 0- 0
42	702.	2.	SAG2 L5	AL295705	3-27-77	1.	1.	0.	AL004742P	0.	AL004860	1.	5.	0- 0- 0
43	715.	2.	SAG2 L51	AL292879	4- 9-77	1.	1.	0.	AL265982	0.	AL004860	1.	5.	0- 0- 0
44	802.	2.	SAG2M349		4-11-78	1.	1.	45.	80	0.	L4560	1.	5.	0- 0- 0
45	828.	2.	WJP2M298	AL358222	3-26-78	1.	1.	0.	AL295709	0.	AL301929	1.	5.	0- 0- 0
46	847.	2.	SAG2M281	AL345233	3-19-78	1.	1.	9.	GL001101P	0.	AL301929	1.	5.	0- 0- 0
47	858.	2.	SAG2M364	AL357517	4-13-78	1.	1.	40.	GL285336	0.	AL004860	1.	5.	0- 0- 0
48	875.	2.	WJP2M359	AL358221	4-12-78	1.	1.	709.	AL295706	0.	AL301929	1.	5.	0- 0- 0
49	912.	2.	SAG2N160		3- 9-79	1.	1.	128.	AL265944	0.	AL301929	1.	5.	0- 0- 0

DATA FILE NAME : JAY1980.DAT
NUMBER OF RECORDS = 53.
DATA FILE YEAR : 1980.

REC #	BIRTH DATE	KID'S HERD ID	KID'S SEX	DAM'S BREED	DAM'S HERD ID	DAM'S REGISTRY #	SIRE'S REGISTRY #	AI	KID'S TATOO	LITTER SPECS	BIRTH COND.	BIRTH WT.	EXP. ASSET	DISP.	DAM'S NUMBER	ANIMAL'S COLOR
1	123.	9.	2.	1.	705.	A295711		1.	WJP2P 9	2. 2. 0.	1.	8.5	0.	3.	1.	COUCLAIR
2	123.	10.	2.	1.	705.	A295711		1.	WJP2P 10	2. 2. 0.	1.	8.5	0.	3.	1.	COUCLAIR
3	122.	7.	2.	3.	230.	N240925	N305435	1.	SAG2P 7	2. 2. 0.	1.	8.0	0.	3.	2.	DK BROWN
4	122.	8.	2.	3.	230.	N240925	N305435	1.	SAG2P 8	2. 2. 0.	1.	9.3	0.	3.	2.	DK BROWN
5	124.	11.	2.	3.	0.	N0770	N305435	1.	SAG2P 11	1. 1. 0.	1.	9.0	0.	3.	2.	GRAYSPOT
6	211.	12.	2.	2.	896.	AL325146	AL004449	1.	WJP2P 12	1. 1. 0.	1.	9.3	0.	0.	1.	WHITE
7	214.	13.	1.	2.	892.	AL312572	AL324643	1.	WJP2P 13	2. 1. 1.	1.	5.0	0.	0.	1.	BROWN
8	214.	14.	2.	2.	892.	AL312572	AL324643	1.	WJP2P 14	2. 1. 1.	1.	6.5	0.	0.	1.	TOGCOLR
9	216.	15.	2.	3.	82.	N228367	N305435	1.	SAG2P 15	2. 1. 1.	1.	8.3	0.	0.	2.	WHITE
10	218.	16.	1.	3.	82.	N228367	N305435	1.	SAG2P 16	2. 1. 1.	1.	8.5	0.	0.	2.	WHITE
11	219.	17.	2.	5.	914.		T324639	1.	WJP2P 17	2. 2. 0.	6.	4.3	0.	6.	1.	TOGCOLR
12	219.	18.	2.	5.	914.		T324639	1.	WJP2P 18	2. 2. 0.	6.	4.5	0.	6.	1.	TOGCOLR
13	219.	19.	2.	2.	891.	AL303597	AL324643	1.	WJP2P 19	2. 1. 1.	1.	6.5	0.	0.	1.	BRNWHITE
14	219.	20.	1.	2.	891.	AL303597	AL324643	1.	WJP2P 20	2. 1. 1.	1.	6.0	0.	0.	1.	BLKWHITE
15	219.	21.	1.	2.	893.	AL325144	AL004449	1.	WJP2P 21	1. 0. 1.	1.	7.3	0.	0.	1.	CHAMOISE
16	219.	22.	2.	2.	700.	AL301931	AL357516	1.	WJP2P 22	2. 2. 0.	1.	9.1	0.	0.	1.	CREAM
17	219.	23.	2.	2.	700.	AL301931	AL357516	1.	WJP2P 23	2. 2. 0.	1.	6.3	0.	0.	1.	DK BROWN
18	223.	24.	1.	2.	916.		AL357516	1.	WJP2P 24	1. 0. 1.	1.	7.8	0.	0.	1.	CREAM
19	223.	25.	1.	5.	936.			1.	WJP2P 25	1. 0. 1.	1.	8.1	0.	0.	1.	BLKWHITE
20	223.	25.	1.	2.	793.	AL266219	AL324643	1.	WJP2P 26	1. 0. 1.	1.	9.7	0.	0.	1.	TOGCOLR
21	224.	27.	1.	3.	96.	N230484	N305435	1.	SAG2P 27	2. 1. 1.	1.	7.0	0.	0.	2.	LT BROWN
22	224.	28.	2.	3.	96.	N230484	N305435	1.	SAG2P 28	2. 1. 1.	1.	7.7	0.	0.	2.	DK BROWN
23	224.	29.	2.	4.	932.		S324641	1.	WJP2P 29	2. 1. 1.	8.	3.9	0.	8.	1.	WHITE
24	224.	30.	1.	4.	932.		S324641	1.	WJP2P 30	2. 1. 1.	8.	3.2	0.	8.	1.	WHITE
25	225.	31.	2.	2.	917.		AL357516	1.	WJP2P 31	2. 1. 1.	1.	6.1	0.	0.	1.	CREAM
26	225.	32.	1.	2.	917.		AL357516	1.	WJP2P 32	2. 1. 1.	1.	9.0	0.	0.	1.	WHITE
27	229.	33.	2.	1.	831.	AA343199	A216885,	0.	WJP2P 33	3. 3. 0.	1.	5.0	0.	0.	1.	COUCLAIR
28	229.	34.	2.	1.	831.	AA343199	A216885	1.	WJP2P 34	3. 3. 0.	1.	6.5	0.	4.	1.	COUCLAIR
29	229.	35.	2.	1.	831.	AA343199	A216885	1.	WJP2P 35	3. 3. 0.	1.	8.3	0.	0.	1.	COUCLAIR
30	229.	36.	1.	1.	903.		A324635	1.	WJP2P 36	1. 1. 1.	1.	8.3	0.	0.	1.	CHAMOISE
31	229.	37.	2.	1.	905.		A324635	1.	WJP2P 37	2. 2. 0.	1.	7.5	0.	0.	1.	TAN&WHIT
32	229.	39.	2.	2.	792.	AL005670	AL004449	1.	WJP2P 39	3. 1. 2.	1.	6.5	0.	0.	1.	WHITE
33	229.	40.	1.	2.	792.	AL005670	AL004449	1.	WJP2P 40	3. 1. 2.	1.	5.5	0.	0.	1.	WHTBLKSP
34	229.	41.	1.	2.	792.	AL005670	AL004449	1.	WJP2P 41	3. 1. 2.	1.	5.3	0.	0.	1.	WHTBLKSP
35	301.	42.	1.	1.	906.		A324635	1.	WJP2P 42	1. 0. 1.	1.	6.8	0.	0.	1.	TAN
36	301.	43.	2.	1.	904.		A324635	1.	WJP2P 43	2. 2. 0.	1.	8.5	0.	0.	1.	COUCLAIR
37	301.	44.	2.	1.	904.		A324635	1.	WJP2P 44	2. 2. 0.	1.	7.3	0.	0.	1.	COUCLAIR
38	303.	45.	1.	4.	65.	AS002297	S324641	0.		0. 0. 0.	0.	0.0	0.	0.	0.	
39	303.	46.	1.	4.	65.	AS002297	S324641	1.	SAG2P 45	4. 0. 4.	1.	8.0	0.	0.	2.	WHITE
40	303.	47.	1.	4.	65.	AS002297	S324641	1.	SAG2P 46	3. 0. 3.	1.	4.8	0.	.	2	WHITE
41	306.	48.	2.	6.	815.		S324641	1.	WJP2P 48	2. 2. 0.	1.	10.3	0.	0.	1.	WHITE
42	306.	49.	2.	6.	815.		S324641	1.	WJP2P 49	2. 2. 0.	1.	12.9	0.	0.	1.	WHITE
43	306.	50.	1.	3.	95.	N230485	N305435	1.	SAG2P 50	3. 0. 3.	1.	6.0	0.	0.	2.	BROWN
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46	307.	53.	1.	5.	850.		T324639	1.	WJP2P 53	2. 1. 1.	1.	7.6	0.	0.	1.	CHOCTOG
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48	308.	55.	2.	6.	852.		T324639	1.	WJP2P 55	2. 1. 1.	1.	10.3	0.	0.	1.	CHOCTOG
							T324639	1.	WJP2P 56	2. 1. 1.	1.	7.1	0.	0.	1.	CHOCTOG

LISTING OF BREEDING FILE

DATE OF THIS LISTING 02-APR-80

THE FOLLOWING CODES ARE USED IN THIS FILE.

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1=ALPINE	101=STRAIGHT MILKOUT	1=YES (POSITIVE)	1=YES	1=YES
2=LA MANCHA	102=POST-MILKING SUCKLING	0=NO (NEGATIVE)	0=NO	0=NO
3=NUBIAN	103=COMPLETE SUCKLING			
4=SAANEN	104=RAISE ON GOAT MILK			
5=TOG	105=RAISE ON MILK REPLACER			
6=CROSSBRED	106=RAISE ON POST-MILKING SUCKLING			
	107=RAISE ON COMPLETE SUCKLING			

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   BREEDING DATE INFORMATION
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   BREEDING DATE INFORMATION
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                BUCK                          BUCK                          BUCK                          BUCK                          BUCK
   1ST DATE E M REGISTRY #:2ND DATE E M REGISTRY #:3RD DATE E M REGISTRY #:4TH DATE E M REGISTRY #:5TH DATE E M REGISTRY #:
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   SUBSEQUENT KIDDING DATE  0- 0- 0  GROW OUT BUCK KID      1
   -----------------------           GROW OUT DOE KID      1
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KIDS

	Treatments		
	1	2	3
Alpine			
Male	3 (7)	2 (8)	2 (7)
Female	1 (9)	0 (10)	1 (8)
La Mancha			
Male	1 (7)	1 (7)	0 (8)
Female	1 (7)	2 (6)	2 (6)
Nubian			
Male	0 (6)	0 (6)	1 (5)
Female	2 (4)	1 (5)	1 (5)
Saanen			
Male	1 (4)	1 (4)	1 (4)
Female	2 (3)	3 (2)	3 (2)
Toggenburg			
Male	4 (3)	4 (3)	4 (3)
Female	4 (3)	3 (4)	3 (4)

( ) = unborn

DOES

	Treatments		
	1	2	3
Alpine			
Young	1 (2)	2 (2)	1 (3)
Adult	1 (6)	1 (7)	1 (7)
La Mancha			
Young	1 (2)	1 (2)	1 (2)
Adult	2 (4)	0 (7)	1 (5)
Nubian			
Young	0 (3)	0 (3)	1 (2)
Adult	1 (3)	1 (3)	0 (5)
Saanen			
Young	0 (1)	1 (0)	1 (1)
Adult	1 (4)	1 (4)	1 (3)
Toggenburg			
Young	2 (1)	1 (2)	2 (0)
Adult	3 (3)	3 (3)	3 (2)

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Economics

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

Sub-Grantee: Winrock International Livestock Research
and Training Center
Morrilton, Arkansas 72110

Funds: $175,000

Principal Investigator: John DeBoer

ANNUAL REPORT

(October 1, 1978 - May 31, 1980)

Economic Analyses of Small Ruminant Production and Marketing Systems in Brazil, Indonesia, Kenya and Peru

Small Ruminant Collaborative Research
Support Program Sub-Grant Agreement No. 116-01

Submitted to: University of California, Davis (Management Entity)

Submitted by: Winrock International Livestock Research and Training Center, Morrilton, Arkansas. A. John De Boer, Principal Investigator

Date Submitted: April 1, 1980

Project Title: Economic Analyses of Small Ruminant Production and Marketing Systems in Brazil, Indonesia, Kenya and Peru

Status: Old Project

Sub-Grantee: Winrock International Livestock Research and Training Center
Petit Jean Mountain, Morrilton, Arkansas 72110

Principal Investigator: A. John De Boer

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

Budget Summary (Planning Grant and First Year Sub-Grant):
(October 1, 1978 - May 31, 1980)

	Title XII	Winrock	Total
Approved Budget	$175,000	$62,510	$237,510
Total Expenditures as of January 31, 1980	56,480	27,925	84,405
Anticipated Expenditures, Feb-May, 1980	62,800	14,715	77,515
Anticipated Total Project Expenditures	119,280	42,640	161,920
Anticipated Balance of Funds	55,720	19,870	75,590

Prior Funding: Planning Sub-grant Agreement No. 116-00.

I. Problem Description

Activities over the period October 1, 1978 - April 1, 1980 have concentrated on defining more specifically the types of problems faced by sheep and goat producers in collaborating countries and then defining the economic research program needed to effectively tackle these problems in collaboration with other Small Ruminant CRSP projects and host country researchers. This process also allowed the Principal Investigator to identify and recruit staff with interests in these specific areas and estimate resources required to do the job. These activities included the following aspects:

(i) December, 1978 - Visited Small Ruminant Rural Sociology CRSP to work out details of cross-country collaboration, staffing and funding.

(ii) January, 1979 - Leader of Asian site selection team. Visited FAO, Rome; Pakistan, Nepal, India and Indonesia to discuss and observe small ruminant production and marketing problems and the research efforts being undertaken to solve those problems.

(iii) July, 1978 - Visited Peru and worked on plans for Small Ruminant CRSP. Visited sheep and alpaca producers.

(iv) Visit to Winrock by John Dixon, Production Economist, FAO, Rome.

(v) October, 1978 - Visited Brazil and Peru. Held detailed discussions on economics inputs in project research at CNPC in Sobral and CPATSA in Petrolina, Brazil. Finalized and discussed Phase III work plan for Brazil. In Peru, visited Domingo Martinez and Julio Echevarria, La Molina, University and INIA to discuss research problems and the strategy for the economics and rural sociology projects.

(vi) January, 1980 - Visit to Winrock International by Domingo Martinez, Chief Collaborator in Economics, Peru. Further work on Phase III work plan, project design, and project staffing in Peru. De Boer and Martinez attended Symposium on Andean Pastoralism at University of Missouri-Columbia, sponsored by Rural Sociology CRSP.

(vii) February, 1980 - Visit to Winrock by Drs. McCorkle and West, Rural Sociology CRSP Research Associates for Peru. Worked out details of joint Economics-Rural Sociology research in Peru including work areas, questionnaire, use of data and joint logistical support.

(viii) March, 1980 - Field visits to Indonesia and Kenya to discuss Phase III work plans, current problems of small ruminants, and research activities.

These activities have led to certain changes in the First Year Work Plan and a somewhat broader scope of research than was initially anticipated. These are now discussed:

Overall Aspects - The visit to Rome in January, 1979 and subsequent visit by Mr. John Dixon in August, 1979 convinced us that the fieldwork aspects of farm management-production economics should be coordinated as closely as possible with FAO's current planning studies. Therefore, some problem descriptions were altered to more closely conform to the types of problems routinely handled by FAO's program. This will also allow our data to be quickly compared with that collected on other FAO projects, including several where small ruminants are important.

The visits to each of the collaborating institutions also identified several problem areas not originally included in Phase III work plans. These included problems associated with ex-ante evaluation of new experiment station technologies over different types of production systems, evaluation of goat milk production in human nutrition, resource allocation in peasant economies, international marketing of certain small ruminant projects, and planning agricultural research.

Country Specific Aspects -

(i) Brazil - A strong desire was expressed to consider the problem of how to evaluate new technological packages for various types of production systems in terms of their impact on expected income, assets, variance of returns, income distribution and composition of herd/flock outputs. More efforts will now be put into the economics of technological change. In addition, these desired estimates also require estimates of market behavior and two marketing studies are scheduled for 1980-81.

(ii) Peru - The inclusion of alpaca producers has necessitated immediate studies of the international pricing and marketing of alpaca fiber, long-term price prospects and the need to initiate studies oriented more towards economic - anthropological aspects of peasant behavior. More emphasis will also be placed on institutional economics and factors which put severe limitations on the small ruminant producers resource base. A specific request was also made for the Small Ruminant Economics CRSP to play a lead role in short-term training of Peruvian economists and planners in techniques of research project evaluation, ex-ante evaluation of technologies, and research planning.

(iii) Kenya - The expressed desire to simultaneously increase small farmer incomes and nutritional levels has shifted emphasis towards dual purpose goats and the efficacy of these animals to alleviate human nutrition problems in select areas of Kenya. Initial research will thus focus on the economics of human nutrition intervention through various maeans.

(iv) A strong desire was expressed for a substantial training program for collaborating agency scientists and some of the economics program will now shift from research to training. Thus, in addition to the previously identified problems facing small producers, an additional problem of a lack of adequately trained staff has to be tackled.

II. Project Objectives

In addition to the General Objectives submitted with the First Year Work Plan and each individual Phasee III Country Work Plan, the following objectives will now be included:

(i) Training of counterpart staff in economic research techniques in the host country.

(ii) Development of procedures for the ex ante evaluation of technologies.

(iii) Analysis of export marketing and pricing for sheep skins, goat hides and alpaca wool.

(iv) Training of selected counterpart staff and host country personnel in research project evaluation techniques.

III. Project Approach

A. U. S. Based Research

1. Literature survey of Animal Health Economics/Veterinary Epidemiology and Economics complete and draft being prepared.

2. Materials collected for literature reviews of allocative efficiency, economics of joint products, systems analysis related to small ruminant management and animal production economics, marketing, and genetic improvement economics.

3. Some shift in project approach has taken place with the partial adoption of FAO Farm Management Data Collection and Survey system. Using more common data collection format between countries.

4. The loading, testing and running of FAO package now receiving high priority.

B. Overseas Based Research

1. Identification of production and marketing constraints underway in Peru for Central Sierra and Southern Puna region in collaboration with University of Missouri. These projects will help identify later research topics of high priority.

2. Brazil - Research approach was changed slightly to allow more modelling work simulating experiment station technological packages under the three small ruminant systems already identified.

3. Peru - Emphasis will now be split between sheep production cooperatives in the Central Sierra and small campesina sheep/alpaca producers in the medium altitude regions of the Southern Puna. Responsibilities between the two Peruvian co-collaborators has been worked out. The project approach will use a Research Fellow on long-term assignment in Peru to help supervise graduate students and conduct research in both areas as well as work closely on training aspects.

4. Kenya - The project approach is to use two U.S. based graduate students to initiate two projects; one building on the established data base on animal health to conduct research on the economics of animal health, and the other working on optimal intervention policies for human nutrition improvement.

5. Indonesia - Economic research is being initiated by joint efforts of Dr. Joel Levine (25% support under Economics sub-grant) and Mr. Sabrani, Indonesia counterpart. Initial work will concentrate on multi-disciplinary survey teams with local student support plus a major training effort.

icators and Outputs that Indicate First Year Project Objectives
e Been Achieved

Site coordination activities

1. Phase III work plans in place and approved for Brazil, Indonesia, Kenya and Peru.
2. Two site visits made to Peru and Indonesia and one each to Brazil and Kenya.
3. Research protocols established in above four countries.
4. Principal collaborators or co-collaborators identified for above four countries.
5. One graduate research assistant on long-term assignment in Brazil.
6. Sub-contract entered into with Servicios Administrativos Contratos Institucionales, Lima, Peru to facilitate transfer of funds to co-collaborators in Peru to allow research program to commence in absence of Memorandum of Understanding and site coordinator.

B. U. S. Based Research Activities

1. Completed literature review and annotated bibliography of animal health economics.
2. Installed and debugged FAO Farm Management Data Collection and Survey tapes and made trial runs using Egyptian Feed Resource Survey data.

3. Developed field survey questionnaires for Brazil and a joint questionnaire for Economics and Rural Sociology in Peru.
4. Organized workshop on data collection coordination and procedures, August, 1979.
5. Gave seminars on Title XII Small Ruminants CRSP at Universities of Florida and Minnesota and visited these Universities for staff recruitment as well as Purdue and Cornell Universities.

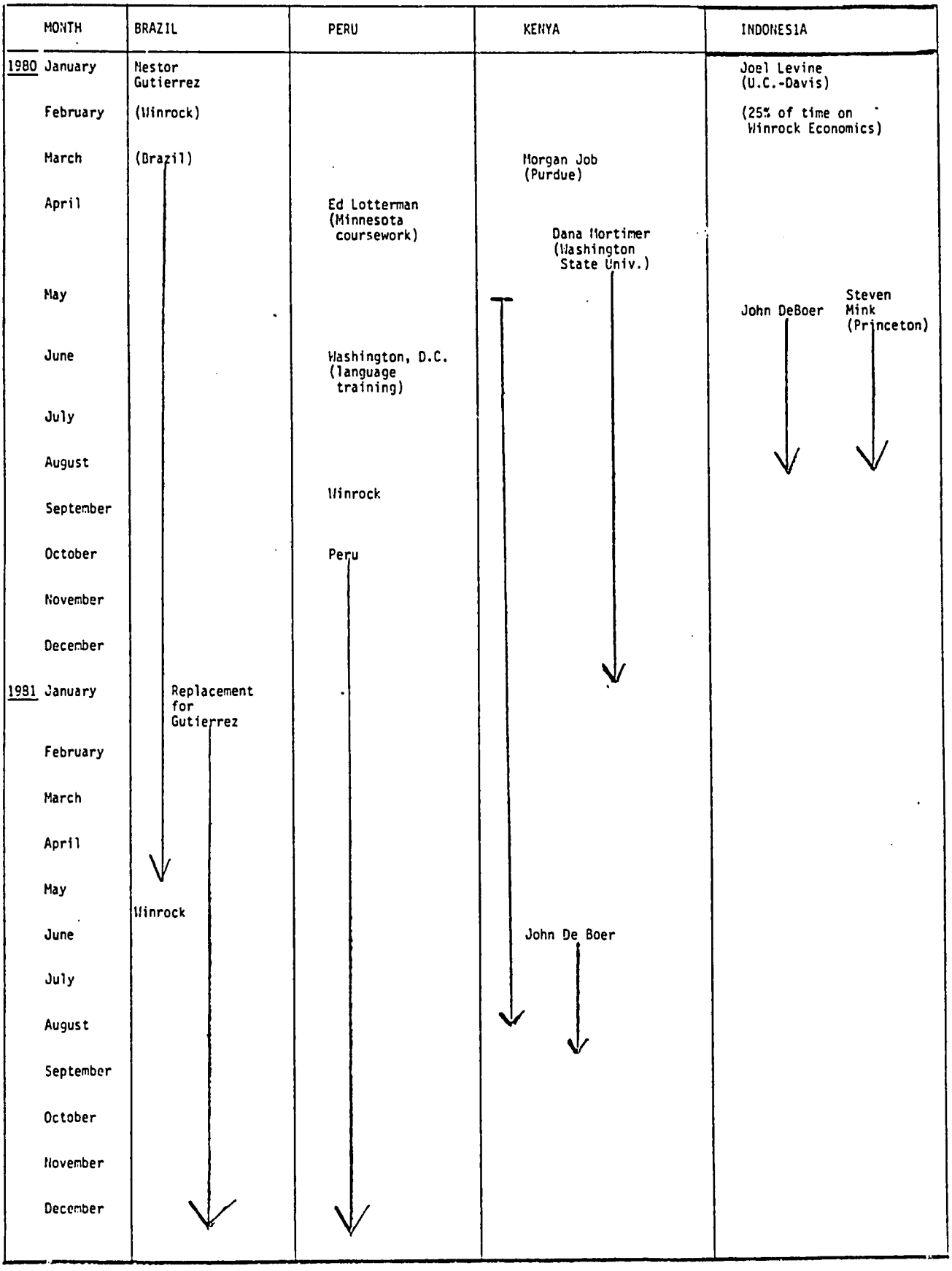
C. Overseas Based Research Activities

1. Initiated fieldwork in Brazil with Nestor Gutierrez.
2. Initiated field survey work in Peru in collaboration with Domingo Martinez and Dr. Julio Echevarria (co-collaborators) and with Drs. McCorkle and West (Rural Sociology, Missouri).
3. Sponsored three Peruvian M.S. students working on small ruminant related projects with Martinez and Echevarria.
4. Initiated two M.S. thesis research projects in Brazil on small ruminant marketing.
5. Established survey procedures to be used by multi-disciplinary survey teams in Kenya and Indonesia.

D. Staffing

1. Nestor Gutierrez, Graduate Research Assistant, Brazil, August, 1979.
2. Morgan Job, Graduate Research Assistant, Kenya, February, 1980.
3. Ed Lotterman, Research Associate, Peru, March, 1980.
4. Joel Levine, part-time (25%) Research Associate, Indonesia, January, 1980.
5. Dana Mortimer, Graduate Research Assistant, Kenya, June, 1980.
6. Steven Mink, Graduate Research Assistant, Indonesia, May, 1980.
7. Completed long-term staffing plan (attached).
8. Wikorn De Boer, Research Assistant, January, 1979.

TITLE XII - ECONOMICS PROJECT: Staffing and Field Site Activities, 1980-1981



E. Publications, Papers, Reports

1. Nestor F. Gutierrez and A. John De Boer. "An Econometric Model of the Colombian Beef Sector: 1950-1970", paper submitted to Canadian Journal of Agricultural Economics, January, 1980.

2. H. A. Fitzhugh and A. J. De Boer. "Physical and Economic Constraints to Intensive Animal Production in Developing Countries", paper presented to British Society of Animal Production Conference on Intensive Animal Production in Developing Countries, Harrogate, U.K. November, 1979.

3. A. J. De Boer. "Livestock in Farming Systems Research and Development", paper presented to Farming Systems Workshop, Caribbean Agricultural Research and Development Institute, Port of Spain, Trinidad, April, 1979.

V. Assumptions Needed for Objectives to be Completed

A. The initial data base needed to complete project objectives has been most deficient in the areas of marketing, prices of small ruminants and their products, and consumption. The entire marketing research program will suffer from this problem and the very limited resources of the Economics CRSP implies that these data collection needs will remain unfilled.

B. Lack of progress in signing the Memorandum of Understanding in Brazil has placed the program at Sobral well behind schedule. Fieldwork was scheduled to begin in early January to coincide with the start of cropping following the rains. The program will now start 3-4 months behind schedule.

C. Availability of suitably trained counterpart staff has been a problem only in Brazil where CNPC has yet to hire the staff Agricultural Economist so no counterpart yet exists for N. Gutierrez.

D. Access to and gaining confidence of small ruminant producers and will be a serious problem only in the Peruvian highlands where differences in language and customs as well as a mistrust of government officials will make field research a long and difficult process.

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Sociology

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

Sub-Grantee: University of Missouri
Columbia, Missouri 65211

Funds: $174,992

Principal Investigator: Michael F. Nolan

Sociological Analysis of Small Ruminant Production Systems

ANNUAL REPORT

(June 1, 1978 - May 31, 1980)

In order to keep the annual report brief and to the point, the project statement for the 1979-80 plan of work will be restated and then short summaries of procedures used to achieve these goals and objectives will be given.

Project Objectives

I. Establish project office, hire necessary personnel and make preliminary delegations of responsibility.

II. Initiate literature search for previous studies on the role of socio-cultural factors in agricultural production in LDCs.

III. Establish collaborative relationships in all three sites.

IV. Develop a tentative research plan of work in the three sites during the next three-four years.

V. Initiate first field study in Brazil (or one of the other sites if work in Brazil is delayed). Topic to be an analysis/description of the basic parameters of the farming system.

Project Approach

I. Objective I

A. Begin recruitment efforts for qualified LDC and U.S. students for research assistantship positions. Four U.S. graduate students have been working on the project helping develop the resource center. Two of the students have been continuous in this activity since the project was founded and another student worked for one semester and one for five months. Applications have been given to prospective LDC students and it is expected that at least two LDC students will be in training on this campus during the 1980-81 academic year.

B. Recruit advanced graduate students (ABDs) to assist with literature review. Begin efforts to locate a social scientist to be stationed at one of the

overseas sites. Two ABD students have been working on the project reviewing literature 3/4 time since the project was funded. These are both LDC students.

C. Staff U.S. project office and purchase essential office equipment (e.g., dictation equipment, filing cabinet, desk, typewriter, etc.). Suitable office equipment including files, tables, bookcases, chairs, etc., have been purchased for the project office and are in place. One senior secretary has been hired along with two one-fourth time equivalent clerical support staff.

II. Objective II

A. Make trips to major domestic resource centers such as Washington, D.C. (World Bank, AID, USDA, George Washington University, etc.); Cornell University; New York City (U.N., ADC, Rockefeller and Ford Foundations); University of Wisconsin (Land Tenure Center). These trips will also provide the opportunity for consultation with social scientists who have had experience conducting field research in LDCs. Four trips were made to various institutions to collect resource information. Two trips were to the Land Tenure Center at Wisconsin, one to Cornell University and one to Washington, D.C. Additional information has been obtained from other sources. The trips which included 40 days of travel time, were to consult with several U.S. scientists who have conducted research in the site countries and to collect unpublished reports from reference centers.

B. Utilize electronic bibliographic resources when possible (e.g., computer bibliographic data banks). Utilizing computer bibliographic sources, a series of computer searches was made through the University of Missouri library using a large number of word descriptors. The searches produced several thousand titles and summaries of publications. Each summary was examined and accepted or rejected based upon its utility for the project.

C. Copy and purchase reference materials as necessary. A large amount of reference materials have been collected. The Comparative Agriculture Reference Center, which is the label we have given to this portion of the Small Ruminant project, now has 400 publications and reports plus 50 hardback books. New acquisitions are adde daily.

c. Organize project reference center (i.e., purchase necessary equipment and delegate a portion of staff time). Organized project reference center. In consultationn with trained library personnel, the material has been cataloged, organized and cross-referenced so that persons wishing to use the material can find it readily.

III. Objective III

A. Two person team to make a two-four week visit to each site. Three trips of two or three week duration each have been made to Kenya. Two visits have been made to Peru. One for two weeks and one for three weeks. A three week trip has been made to Indonesia. Social scientists have been contacted in all the sites. In Peru they have been actively involved in project planning. In Indonesia and Kenya, which were visited later we are actively seeking their input and developing strategies to facilitate their involvement.

IV. Objective IV

A. Conduct a seminar in Spring 1980 with LDC collaborators in either a U.S. or an LDC site to assist in development of research agenda. A three day symposium was held on Andean Peasant Economics and Pastoralism at the University of Missouri-Columbia. This symposium consisted of presentations by three economic anthropologists who have done fieldwork in the Southern area of Peru: Benjamin Orlove, Univeristy of California at Davis; David Guillet, Univeristy of Missouri-Kansas City; and Gordon Appleby, California Institute of Technology. The topics covered were: "Risk Management Among Andean Peasants," "Pastoralism in the Southern Sierra," "Markets and the Marketing System in the Southern Sierra." The symposium was a means whereby personnel from the project could be exposed to the social constraints of small ruminant production in the Southern Andes. In addition, we had three Peruvian participants, two of whom are collaborators on the project: Dr. Jorge Flores-Ochoa, an anthropologist from the University of Cuzco, (the most noted Peruvian anthopologist working on pastoralism); Domingo Martinez (an economist from the Universidad Nacional Agraria-La Molina who will be participating in the project); and Felix Palacios-Rios, (a Peruvian anthropologist completing his Ph.D. at Cornell University). David Browman of Washington University, who has written on the ethnohistory of pastoralism, also

participated. Other participants came from Texas Tech, University of California at Davis and from A.I.D., Washington. The proceedings of the symposium will be published by May 1, 1980.

V. Objective V

A. Send one person to Brazil to collect data on farming systems. Duration of visit: 6-10 weeks. Because of changes in the selection of country sites, Brazil had not moved far enough along in the process in order for research to begin there during the first year. However, Peru has progressed more rapidly than expected and objective 5A was achieved in Peru. In February we sent two economic anthropologists to peru to do baseline research. These researchers were hired by us and are to do fieldwork for 90 days and then return to Columbia to write up their results. (Given the lack of a signed MOU, 90 days was as long as they could stay on a tourist visa.) Among the most important information to be gained is a general picture of the present animal population. We want to know the distribution of the animals by breed, location, altitude, as well as by size of herd. One economic anthropologist will be concentrating his efforts in the Department of Puno and the other in the Department of Cuzco. The information that we obtain will be used to develop future projects. The work at this stage is being done under the supervision and sponsorship of the Centro de Estudios Andinos, of which Dr. Jorge Flores-Ochoa is the Director.

Indicators and Outputs

I. Development of a reference center for socio-cultural materials relevant to the CRSP. This process is well underway as has been described under Objective II. Additional reference materials will be obtained as researchers return from the various countries. Considerable materials have been gained from Kenya and Indonesia as a result of recent trips there and it is expected that additional materials will be obtained with future trips which are currently planned.

II. Development of a tentative research plan for each site. Phase III work plans have been developed for each of three sites: Peru, Kenya, and Indonesia. Copies of these work plans were sent to UCD earlier this year.

III. Conducting a 1-2 week seminar in Spring 1980 for LDC collaborators. This has been accomplished. See Objective IV above.

IV. Provide collaborating animal production projects with summaries of relevant studies (i.e., develop a source book for each site. The entire book is not likely to be completed in 1980, but some material will be made available to other projects in the CRSP). The material on Peru which resulted from the symposium is in the final stages of editing and is expected to be published and presented to the other SR-CRSP projects by May 1980. A Sociology of Range Management Bibliography is well along in preparation and a preliminary draft will be circulated in late Summer of 1980. Compilations relevant for Indonesia and Kenya have been started.

Financial Report

The following report of actual and anticipated expenditures should be considered unofficial. An official report will be forthcoming from the University of Missouri Grant's Accounting Office. A few clarifications of the report are in order:

1. The Salary/wages (Payroll) item (actual) includes funds encumbered by contractual commitments through the end of the grant period (e.g., faculty, research assistants, etc.)

2. Site coordinator costs were allocated to various categories. These are listed as anticipated expenses as none have been billed to date.

3. The report includes only DIRECT COSTS. Indirect costs (53.99% of salary and wages) would be as follows:

Current and Encumbered (53.99% of $40566)	$21902
Anticipated (53.99% of $4700)	2338
Total Indirect	$24240
Balance ($26750 - 24240)	2510

4. Cost sharing for the 6/1/79 - 5/31/80 period is as follows:

Salaries (includes Nolan, Gilles, Campbell, Primov, Carroll)	$22080
Fringe benefits @ .18%	3974
Travel, Supplies, Equipment	18051
Total Direct	44105
Indirect (53.99% of salaries)	11920
TOTAL COST SHARING	$56025

The salaries are all either expended or encumbered and the supplies et al item will be spent or encumbered by May 31, 1980.

Total cost sharing for the entire first year period (including planning) is 56025 + 9158 = 65183. The total award was $174992. The total cost sharing percentage is 27% (65183 ÷ (174992 + 65183)).

University of California - May 1980

	International Travel (Trans.)	International Travel (Subsist.)	I.T. (Pre-Departure Expenses)	Domestic Travel (Trans.)	Domestic Travel (Subsist.)	Supplies	Equipment	Payroll	Staff Benefits	Other	Totals
Allocated	$20,000.00	$16,500.00	$1,000.00	$1,500.00	$2,000.00	$6,000.00	$6,000.00	$49,546.00	$5,041.00	$7,708.00	$115,295.00
Expended	(11,279.27)	(4,923.74)	(220.29)	(2,068.45)	(1,650.13)	(3,476.50)	(507.00)	(40,566.14)	(1,473.86)	0.00	(66,165.38)
Current Balance 3/01/80	8,720.73	11,576.26	779.71	(568.45)	349.87	2,523.50	5,493.00	8,979.86	3,567.14	7,708.00	49,129.62
Anticipated Expenses:											
Site Coord	1,200.00	1,200.00	400.00	0.00	0.00	1,000.00	4,500.00	4,200.00	672.00	0.00	13,172.00
Other	5,100.00	5,300.00	200.00	0.00	0.00	1,500.00	0.00	2,700.00	0.00	0.00	14,800.00
Total	(6,300.00)	(6,500.00)	(600.00)	0.00	0.00	(2,500.00)	(4,500.00)	(6,900.00)	(672.00)	0.00	(27,972.00)
Anticipated Balance	$ 2,420.73	5,076.26	$ 179.71	($ 568.45)	$ 349.87	$ 23,50	$ 993.00	$ 2,079.86	$2,895.14	$7,708.00	$21,157.62

SMALL RUMINANT COLLABORATIVE RESEARCH PROGRAM (SR-CRSP)

TITLE XII

I. Face Sheet

Research Area: Systems Analysis

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

Sub-Grantee: Texas A & M University
College Station, Texas 77843

Funds: $184,000

Principal Investigator: Thomas C. Cartwright

SYSTEMS ANALYSIS AND SYNTHESIS

SMALL RUMINANT PRODUCTION

A Title XII Collaboratove Research Support Program (CRSP) Project

Between the

Texas Agricultural Experiment Station

and the

Empresa Brasileira de Pesquisa Agropecuaria - Centro Nacional de Pesquisa de Caprinos (EMBRAPA - CNPC)
Centro de Pesquisa Agropecuaria do Tropico Semi-Arido (CPATSA)

and

Empresa de Pesquisa Agropecuaria do Ceara (EPACE)

Cooperative with CRSP Projects of:

California State Polytechnic University, Pomona
University of California, Davis
Winrock International Livestock Center
North Carolina State University
Tuskegee Institute
Utah State University

First Year Annual Report
March, 1980

I. Project Description

A. Description Of Problem
Appropriate as stated

B. Objectives Of Project

B1. Model Development

The SR-CRSP systems analysis group has met on a weekly basis except when SR-CRSP international travel prevented key persons from being available. This group has developed a detailed outline for the sheep production model and individual members are assigned specific segments for development. Present assignments are:

Growth and nutrition components - Sanders
Minerals - Brenni
Water - Blackburn
Wool and hair - Bassett
Reproduction - Smith
Health - Nelsen
Flock dynamics and management options - Smith

Data have been obtained from the Sonora Station (TAES) and are being analyzed for use in model verification and validation. Blackburn is responsible for this data analysis.

Smith has consulted with scientists conducting systems analysis research with sheep or related research, in Australia (Dr. N. Graham et al. at CSIRO, Div. of Animal Physiology, Prospect, NSW), in Israel (Dr. N. Seligman et al., Div. of Range and Forage Crops, Agric. Res. Organ., Volcani Center); and in Scotland (Mr. J. Eadie, et al. Animal Production and Nutrition Department, Hill Farming Research Organ., Edinburgh).

Most of the literature reviews have been completed and development of functions are in progress. Early versions of a sheep production systems model are expected to be operational for verification and validation tests in the summer of 1980. As previously planned, development of the goat production systems model will begin after the sheep model is functional.

After the first version of the model becomes operational, a continuing process of updating and verifying components of the model will be carried out. Each individual will continue to review specific components; all or part of the group will be available for assisting in solving problems as they arise. Data for further model development and verification will be obtained from a continuing search of literature and from other SR-CRSP projects, especially the forage, range and animal breeding projects.

B2. Characterization of production systems

Considerable effort has been made to communicate to the other CRSP collaborators (both U.S. and Brazilian) regarding the data required for successful production systems evaluations as well as the types of data extension and integration services we can provide to them. These efforts have included conferences in Utah (range), Colorado (health), Arkansas (economics and sociology) and Texas (all projects) as well as in Brazil with all collaborators. Also written materials describing our requirements for host-country collaborators, training objectives and cooperative inputs into other projects (copies attached) have been developed.

Elsio Figueiredo at CNPC will be a primary collaborator. He is scheduled to visit A&M this spring. Claudio Bellaver, also at CNPC, and Matiniano Oliveira at CPATSA have also been identified as collaborators. (see section IV Implementation).

B-3, B-4, B-5

Activities of these objectives will begin during the second year.

C. Project Approach

Conferences were held with all SR-CRSP project personnel including all PIs. These conferences were directed toward coordinating activities of other research projects to insure that appropriate input for the systems analysis project was available and that the systems analysis project was conducted to provide appropriate feedback or input for the other projects. Also, planning was done to assure coordination in selection of collaborators from the countries involved. (See attachments: (1) Cooperative Inputs, (2) Identification of In-Country Collaborators and (3) Training Objectives).

D. The Indicators

1. Development of sheep model in progress. Goat model to begin second year.
2. Validation with CNPC, EPACE, and CPATSA data to take place in second year.
3. To begin in second year.

E. Assumptions That Objectives Can Be Met

Model development is proceeding on schedule; i.e., there is evidence that a sufficient model can be developed.

F. Assumptions That Achieving Objectives Will Solve Problem

Identification of collaborators has taken place and their interest and willingness to participate in systems studies has been established.

G. Outputs Of Project

II. Technical Feasibility

Model development is on schedule (see statements above).

III. Project Budget

A. See accompanying Subgrant Request

B. Personnel

No change.

IV. Implementation

Model development is on schedule. Simulation of sheep production in the Sobral, Ceara, area will begin in the second year. Data from CNPC will be used for validation of these simulations. In the following year, sheep production in the Petrolina, Pernambuco area (low rainfall) and goat production in both areas will be simulated. Data from both CNPC and CPATSA will be used in validation. Data from EPACE will be used in breed characterization.

V. Annual Review And Planning Processes

Review by EEP and Texas A&M - TAES personnel.

VI. Literature cited

None

VII. Attachments

1. Identification of In-Country Collaborators for the Texas A&M University Systems Analysis Project.

2. Cooperation Inputs into the Title XII Systems Analysis Project.

3. Training Objectives of the Texas A&M University Systems Analysis Project.

SYSTEMS ANALYSIS AND SYNTHESIS
SMALL RUMINANT PRODUCTION

A Title XII Collaborative Research Support Program (CRSP)

Project

Between the

Texas Agricultural Experiment Station (TAES)
and the Peruvian Organizations:

Instituto Nacional de Investigacion Agraria (INIA),

Universidad Nacional Agraria (UNA) - La Molina, and

Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA), Universidad Nacional Mayor de San Marcos

Cooperative with CRSP Projects of:

California State Polytechnic University, Pomona
Colorado State University
Montana State University
Ohio State University
Texas Tech University
University of Missouri
Utah State University
Winrock International Livestock Center

First Year Annual Report
March, 1980

I. Project Description

A. Description Of Problem
Appropriate as stated

B. Objectives Of Project

B1. Model Development

The SR-CRSP systems analysis group has met on a weekly basis except when SR-CRSP international travel prevented key persons from being available. This group has developed a detailed outline for the sheep production model and individual members are assigned specific segments for development. Present assignments are:

Growth and nutrition components - Sanders
Minerals - Brenni
Water - Blackburn
Wool and hair - Bassett
Reproduction - Smith
Health - Nelsen
Flock dynamics and management options - Smith

Data have been obtained from the Sonora Station (TAES) and are being analyzed for use in model verification and validation. Blackburn is responsible for this data analysis.

Smith has consulted with scientists conducting systems analysis research with sheep or related research, in Australia (Dr. N. Graham et al. at CSIRO, Div. of Animal Physiology, Prospect, NSW), in Israel (Dr. N. Seligman et al., Div. of Range and Forage Crops, Agric. Res. Organ., Volcani Center); and in Scotland (Mr. J. Eadie, et al. Animal Production and Nutrition Department, Hill Farming Research Organ., Edinburgh).

Most of the literature reviews have been completed and development of functions are in progress. Early versions of a sheep production systems model are expected to be operational for verification and validation tests in the summer of 1980. As previously planned, development of the goat production systems model will begin after the sheep model is functional.

After the first version of the model becomes operational, a continuing process of updating and verifying components of the model will be carried out. Each individual will continue to review specific components; all or part of the group will be available for assisting in solving problems as they arise. Data for further model development and verification will be obtained from a continuing search of literature and from other SR-CRSP projects, especially the forage, range and animal breeding projects.

B-2 Data collection and characterization of production systems

1. Counterparts have been identified (L. Coronado and J. Velasco) who have collected data at the IVITA Experiment Station at Huancayo on intensive lamb growing and finishing and at a Cooperative (Coop) on extensive breeding flocks. Arrangements are being made for Coronado to come to Texas A&M for graduate training and as a co-worker on the systems analysis project. He will analyze data from Peru and consult and assist in model development and validation and in simulation of sheep production systems in the Huancayo area.

2. Counterparts and data sets have been identified. The counterparts for the first year are L. Coronado and J. Velasco of IVITA. The data are from the IVITA Experiment Station at Huancayo (including data collected at a Coop). The second year work will begin with A. Pulmayalla of UNA using data from the Central Cooperatives and the SAIA Tupac Amaru.

3. Counterparts in IVITA (Velasco) and UNA (Pulmayalla) and PI's in the breeding (Blackwell), economics (Martinez) and range (Bryant) have conferred on the needs of the systems analysis project. Also we have conferred on feedback from the systems projects to their research projects and the continuing interactions. Conferences were held in Utah (range), Colorado (with a participant from California, veterinary) Arkansas (Winrock and University of Missouri), and Texas (all institutions represented) concerning the integration of the systems analysis project with all other Projects.

   Two activities for the coming year are to collaborate with Dr. Coronado and Dr. Velasco to edit and analyze data from the IVITA Station at Huancayo and from the Cooperative in the Huancayo area. Data from the intensive sheep finishing research, a carefully collected set of data taken under controlled conditions, will be analyzed first for use in model validation. Coronado will receive training in procedures and techniques required for model development and use.

   Data collection planned by other SR-CRSP projects have been or will be reviewed in order to coordinate requirements of the systems analysis project for model development and validation and simulation. During the first year in Peru, close coordination is anticipated with the forage, range and breeding SR-CRSP projects. Later emphasis will be placed on producing output for these projects a well as the economics projects. Coordination will be accomplished during meetings of country PIs, meetings with individual PIs and time spent at the project sites in Peru; at least two separate site tours are planned.

B-3, B-4, B-5

Activities of these objectives will begin during the second year.

B-6 Activities of this objective may begin the second or third year.

C. Project Approach

Conferences were held with all SR-CRSP project personnel including all PIs. These conferences were directed toward coordinating activities of other research ppojects to insure that appropriate input for the systems analysis project was available and that the systems analysis project was conducted to provide appropriate feed back or input for the other projects. Also, planning was done to assure coordination in selection of collaborators from the countries involved. (See attachments: (1) Cooperative Inputs and (2) Identification of In-Country Collaborators.

D. The Indicators

1. In progress.
2. To take place in second year. Data sources identified at Huancayo, Coops and SAIS.
3. To begin in second year.

E. Assumptions That Objectives Can Be Met

Model development is proceding on schedule; i.e. there is evidence that a sufficient model can be developed.

F. Assumptions That Achieving Objectives Will Solve Problem

Identification of enthusiatic collaborators and of a wealth of data has taken place. Collaborating organizations (INIA, IVITA, UNA) also have welcomed the systems analysis project. These were the first assumptions which had to be met.

G. Outputs Of Project

The first outputs are expected in the second year.

II. Technical Feasibility

Model development is on schedule (see statements above). The application of simulation to the Huancayo area has been tentatively agreed upon: to test the feasibility (biological, economic, sociological) of finishing lambs, which are produced in extensive grazing flock of coops, on intensive pastures in the Montaro Valley. Data are available to conduct this study and the organization of Coops (and SAIS) is such that a structure for implementation of this practice, if feasible, is in place. At this point, the benefits to the small holder would be by example

III. Project Budget

A. See accompanying Subgrant Request

B. Personnel

No change.

IV. Implementation

Model development is on schedule and the Huancayo area has been chosen for the first application (second year) and the Cerro de Pasco area for the second application (third year).

V. Annual Review And Planning Processes

Reviewed by EEP and Texas A&M - TAES personnel.

VI. Literature cited

None

VII. Attachments

1. Identification of In-Country Collaborators for the Texas A&M University Systems Analysis Project.

2. Cooperation Inputs into the Title XII Systems Analysis Project.

SYSTEMS ANALYSIS AND SYNTHESIS

SMALL RUMINANT PRODUCTION

A Title XII Collaborative Research Support Program (CRSP) Project

between the

Texas Agricultural Experiment Station

and the

Indonesian Agency for

Agricultural Research and Development (AARD),

Lembaga Penelitian Peternakan (LPP)
(Animal Husbandry Research Institute)

Cooperative with CRSP Projects of:

University of California, Davis
University of Missouri
North Carolina State University
Winrock International Livestock Center

First Year Annual Report
March, 1980

I. Project Description

A. Description Of Problem
Appropriate as stated

B. Objectives Of Project

B1. Model Development

The SR-CRSP systems analysis group has met on a weekly basis except when SR-CRSP international travel prevented key persons from being available. This group has developed a detailed outline for the sheep production model and individual members are assigned specific segments for development. Present assignments are:

Growth and nutrition components - Sanders
Minerals - Brenni
Water - Blackburn
Wool and hair - Bassett
Reproduction - Smith
Health - Nelsen
Flock dynamics and management options - Smith

Data have been obtained from the Sonora Station (TAES) and are being analyzed for use in model verification and validation. Blackburn is responsible for this data analysis.

Smith has consulted with scientists conducting systems analysis research with sheep or related research, in Australia (Dr. N. Graham et al. at CSIRO, Div. of Animal Physiology, Prospect, NSW), in Israel (Dr. N. Seligman et al., Div. of Range and Forage Crops, Agric. Res. Organ., Volcani Center); and in Scotland (Mr. J. Eadie, et al. Animal Production and Nutrition Department, Hill Farming Research Organ., Edinburgh).

Most of the literature reviews have been completed and development of functions are in progress. Early versions of a sheep production systems model are expected to be operational for verification and validation tests in the summer of 1980. As previously planned, development of the goat production systems model will begin after the sheep model is functional.

After the first version of the model becomes operational, a continuing process of updating and verifying components of the model will be carried out. Each individual will continue to review specific components; all or part of the group will be available for assisting in solving problems as they arise. Data for further model development and verification will be obtained from a continuing search of literature and from other SR-CRSP projects, especially the forage, range and animal breeding projects.

B-2 Characterization of Production Systems

1. Based on recent visits to Java by Smith and PI's from other CRSP projects, there seems to be little data presently available to accurately characterize small ruminant production systems. Preliminary arrangements were made by LPP to organize an integrated village level monitoring program that would meet the requirements of all projects for production systems characterization data. Considerable effort has been made to communicate to other CRSP collaborators (both U.S. and Indonesian) regarding the data required for successful production systems evaluations as well as the types of data extension and integration services we can provide to them. These efforts have included conferences in Colorado (health), Arkansas (economics and sociology) and Texas (all projects) as well as in Indonesia with all collaborators. Also, written materials describing our requirements for host-country collaborators, training objectives and cooperative inputs into other projects (copies attached) have been developed.

2. Mr. M. Sabrani, an economist on LPP staff, will be our primary collaborator. He plans to be heavily involved in the village level monitoring program. Potential collaborators, who could become involved in characterization and simulation of traditional production systems, include junior LPP staff members who may be identified to come to A&M for graduate study under World Bank funding. Maria Astuti, an animal breeder at Gadjah Mada University, has simulation experience with poultry and is also a potential collaborator.

B-3, B-4, B-5

Activities of these objectives await collection of primary data by LPP and other CRSP projects and will begin during the third year.

C. Project Approach

Conferences were held with all SR-CRSP project personnel including all PIs. These conferences were directed toward coordinating activities of other research projects to insure that appropriate input for the systems analysis project were available and that the systems analysis project was conducted to provide appropriate feedback or input for the other projects. Also, planning was done to assure coordination in selection of collaborators from the countries involved. (See attachments: (1) Cooperative Inputs, (2) Identification of In-Country Collaborators and (3) Training Objectives).

D. The Indicators

1. Development of sheep model in progress. Goat model to begin second year.
2. Validation with TAES data and data from other LDCs.
3. To begin in third year.

E. Assumptions That Objectives Can Be Met

Model development is proceeding on schedule; i.e., there is evidence that a sufficient model can be developed.

F. Assumptions That Achieving Objectives Will Solve Problem

Identification of collaborators has taken place and their interest and willingness to participate in systems studies has been established.

G. Outputs Of Project

II. Technical Feasibility

Model development is on schedule (see statement above).

III. Project Budget

A. See accompanying Subgrant Request

B. Personnel

No change.

IV. Implementation

Model development is on schedule. Evaluation of production systems will follow collection of baseline data by LPP and other CRSP projects.

V. Annual Review And Planning Processes

Review by EEP and Texas A&M - TAES personnel.

VI. Literature cited

None

VII. Attachments

1. Identification of In-Country Collaborators for the Texas A&M University Systems Analysis Project.
2. Cooperation Inputs into the Title XII Systems Analysis Project.
3. Training Objectives of the Texas A&M University Systems Analysis Project.

SYSTEMS ANALYSIS AND SYNTHESIS

SMALL RUMINANT PRODUCTION

A Title XII Collaborative Research Support Program (CRSP) Project

Between the

Texas Agricultural Experiment Station

and the

Kenya Ministry of Livestock Development

Sheep and Goat Development Project

Cooperative with CRSP Projects of:

University of California, Davis
Ohio State University
University of Missouri
Washington State University
Winrock International Livestock Center

First Year Annual Report
March, 1980

I. Project Description

A. Description Of Problem
Appropriate as stated

B. Objectives Of Project

B1. Model Development

The SR-CRSP systems analysis group has met on a weekly basis except when SR-CRSP international travel prevented key persons from being available. This group has developed a detailed outline for the sheep production model and individual members are assigned specific segments for development. Present assignments are:

Growth and nutrition components - Sanders
Minerals - Brenni
Water - Blackburn
Wool and hair - Bassett
Reproduction - Smith
Health - Nelsen
Flock dynamics and management options - Smith

Data have been obtained from the Sonora Station (TAES) and are being analyzed for use in model verification and validation. Blackburn is responsible for this data analysis.

Smith has consulted with scientists conducting systems analysis research with sheep or related research, in Australia (Dr. N. Graham et al. at CSIRO, Div. of Animal Physiology, Prospect, NSW), in Israel (Dr. N. Seligman et al., Div. of Range and Forage Crops, Agric. Res. Organ., Volcani Center); and in Scotland (Mr. J. Eadie, et al. Animal Production and Nutrition Department, Hill Farming Research Organ., Edinburgh).

Most of the literature reviews have been completed and development of functions are in progress. Early versions of a sheep production systems model are expected to be operational for verification and validation tests in the summer of 1980. As previously planned, development of the goat production systems model will begin after the sheep model is functional.

After the first version of the model becomes operational, a continuing process of updating and verifying components of the model will be carried out. Each individual will continue to review specific components; all or part of the group will be available for assisting in solving problems as they arise. Data for further model development and verification will be obtained from a continuing search of literature and from other SR-CRSP projects, especially the forage, range and animal breeding projects.

B2. Characterization of production systems

1. Because there is currently little dairy goat production in Kenya, the data collected by the CRSP at a dairy goat research station and at the women's cooperatives near Busia will be the primary source of data to characterize these production systems and to refine and validate the goat model. Considerable effort has been made to communicate to the other CRSP collaborators (both U.S. and Kenyan) regarding the data required for successful production systems evaluations as well as the types of data extension and integration services we can provide to them. These efforts have included conferences in Utah (range) Colorado (health), Arkansas economics and sociology) and Texas (all projects) as well as in Kenya will all collaborators. Also written materials describing our requirements for host-country collaborators, training objectives and cooperative inputs into other projects (copies attached) have been developed.

2. Mr. Z. Gathuka who is the co-manager of the Sheep and Goat Development Project will be a primary collaborator. He is tentatively scheduled to begin work on a masters at A&M this fall on a FAO fellowship. Dr. A. B. Carles, University of Nairobi, Animal Production Department, has expressed strong interest in participating in systems analysis research and graduate student training. He will likely visit A&M in August or September to further discuss his participation in the project. Mr. James Mathenge, a Kenyan completing a B.S. in animal science at A&M this May, has been identified to begin a masters program. He and Mr. Gathuka will provide good knowledge and intuition about Kenya production systems. Their research will be directed toward the analysis of Kenyan small ruminant production systems.

3. Another excellent opportunity for the evaluation of small ruminant production systems has been explored. Two UNESCO projects in the North of Kenya (Drs. Chris Field, Dennis Herlocke and Jurgen Schwartz) have collected extensive data (weights, milk production, health status, reproduction performance, diet quality, forage intake, water intake and forage productivity) for sheep and goat production systems. Their data collection format was designed with advice from ILCA (Dr. John Trail) so as to be most suitable for simulation of production systems. In addition, they are most anxious to cooperate in the use and extension of their data. Even though this area of Kenya is outside the primary focus of the CRSP, we plan to collaborate with the UNESCO project for the following reasons: (a) this is the best data set of which we are aware for testing and validating our models; (b) these arid, semi-arid, high-browse-usage production systems are common in many LDCs including our target area in Northwest Brazil; (c) these production systems prevail in much of Kenya and are a major interest of the Sheep and Goat Development Project.

B-3, B-4, B-5

Activities of these objectives will begin during the second year.

C. Project Approach

Conferences were held with all SR-CRSP project personnel including all PIs. These conferences were directed toward coordinating activities of other research projects to insure that appropriate input for the systems analysis project was available and that the systems analysis project was conducted to provide appropriate feedback or input for the other projects. Also, planning was done to assure coordination in selection of collaborators from the countries involved. (See attachments: (1) Cooperative Inputs, (2) Identification of In-Country Collaborators and (3) Training Objectives).

D. The Indicators

1. Development of sheep model in progress. Goat model to begin second year.
2. Validation with UNESCO date to take place in second year. Dairy goat data not expected until third year.
3. To begin in second year.

E. Assumptions That Objectives Can Be Met

Model development is proceeding on schedule; i.e., there is evidence that a sufficient model can be developed.

F. Assumptions That Achieving Objectives Will Solve Problem

Identification of collaborators has taken place and their interest and willingness to participate in systems studies has been established.

G. Outputs Of Project

II. Technical Feasibility

Model development is on schedule (see statements above).

III. Project Budget

A. See accompanying Subgrant Request

B. Personnel

No change.

IV. Implementation

Model development is on schedule. The North of Kenya (UNESCO data) has been chosen for the first application (second year). Evaluation of dairy production systems will follow collection of baseline data by other CRSP projects.

V. Annual Review And Planning Processes

Review by EEP and Texas A&M - TAES personnel.

VI. Literature cited

None

VII. Attachments

1. Identification of In-Country Collaborators for the Texas A&M University Systems Analysis Project.

2. Cooperation Inputs into the Title XII Systems Analysis Project.

3. Training Objectives of the Texas A&M University Systems Analysis Project.

July 9, 1979
DRAFT

Cooperative Inputs into the Title XII Systems Analysis Project

I. Contributions to other Title XII Projects.

The production systems project will contribute to other projects primarily in two areas.

A. Extension and application of biological data. The application of experimental results to livestock production systems is often restricted because treatment effects are either not measured at the production unit (flock) level or are measured only for a limited set of management and environmental conditions. These restrictions can be greatly lessened by the use of simulation techniques to examine single and combined effects of production system alternatives such as supplemental feeding, breeding season, weaning age, health treatments or breed choice on net productivity at the flock level. Once the sheep and goat production systems models are completed, other Title XII research groups will be encouraged to request and utilize simulations that will allow them to better apply their experimental results to production systems.

B. Provide data for economic and sociological analyses. Data relative to input requirements and productivity of livestock enterprises are difficult to obtain, are often not well quantified and are usually limited to prevailing management practices. Simulation offers the opportunity to better quantify inputs and productivity of both prevailing and potentially improved production systems. These simulation data will enhance and simplify the economic evaluation of production alternatives and will help guide the assessment of social effects of the implementation of potentially favorable production interventions including social constraints to such implementation. The TAMU system group will cooperate with the economic and sociology research groups to provide simulations of interest.

II. Capability of Production Systems Models.

The TAMU production systems models are being designed to simulate sheep or goat flocks in a manner similar to that which would occur if an actual flock, of specified type, was placed in an actual specified production re-

source; i.e., the livestock respond to the environment in which placed. In order for simulation results to be useful, production systems of interest must be simulated with an acceptable degree of accuracy. Outlined below are the present plans relative to model structure and capability. These plans will be refined as feedback is obtained from other project groups and as the modelling efforts progress.

A. Model structure. Simulations will require the specification of an initial flock (genetic potential and current reproductive status and body weight and condition of each animal), available feed resources (by 15-day period), and management practices to be imposed. The performance (weight, finish, milk, etc.) of each animal will be simulated for each 15-day period and individually stored. Summaries of these individual records will provide flock productivity and inputs utilized.

B. Degree of resolution. The genetic potential of an individual, the feed available to it, and the management imposed upon it will determine its performance as contrasted to the calculation of feed required to meet some assumed level of performance. The feed available will be specified as the digestibility, crude protein percentage and maximum per head availability each 15-day period of the forage or ration and of any supplemental feed. The effects of both energy and protein deficiencies will be simulated. The reduced productivity and increased mortality related to major classes of diseases and parasites will be included. The nutritional and disease effects are related to each individual according to age, body condition, lactational and pregnancy status, etc.

C. Management practices. The models will have the capacity to simulate the following management practices.

1. Mating systems
   a. straightbreeding
   b. crossbreeding (specific and rotation)
   c. grading up

2. Reproduction
   a. out-of-season breeding
      -model is expected to accurately predict seasonality effects; however, hormone treatment effects would have to be emperically specified.
   b. accelerated production cycles
      -multiple flocks

c. pregnancy diagnosis
-degree of accuracy differences

3. Rearing young
   a. sibling competition
   b. foster dam
   c. milk replacer

4. Castration
   a. optional at any age
   b. castrates for fiber production

5. Weaning
   a. constant age
   b. constant date

6. Sales (specify separately by class)
   a. constant age
   b. constant weight
   c. constant condition
   d. constant date

7. Culling
   a. age
   b. reproductive performance
   c. weight/condition

8. Fiber
   a. specify shearing date(s)
   b. hair breeds (i.e., not shorn)

9. Milk
   a. nursing with partial milking
   b. dairies

10. Health care
    a. vaccination
    b. drenching
    c. dipping
    d. tolerant breeds

11. Supplemental feeding
    -any amount to any age or class

III. Data Necessary for Model Development and Application.

Most of the biological concepts and explanatory relationships to be included in the sheep model will be developed from previously published data. However, in some areas such as disease and parasite effects on productivity, model development will rely heavily upon data collected on Title XII projects or summarized and interpreted from existing records by Title XII personnel. The importance of disease and parasite effects on small ruminant production and the lack of data quantifying these effects make collection of these data critical to the development of a realistic model of small ruminant production. Also, much of the data necessary to convert the sheep

model to a goat model will likely come from Title XII projects.

The simulation of production systems for a given location requires that feed, environmental, management and animal performance data be available. These data are used to simulate actual conditions as a validation; after validation, this simulation is then set as a baseline for comparison of management alternatives. We anticipate that most of the required baseline data will already be available from LDC cooperators or can be obtained from the on-site projects with minimum additional effort. Some baseline data on traditional production systems may have to be obtained through survey or monitoring projects in cooperation with the economic and sociology projects.

Once baseline validations are complete, simulation of alternative systems can begin. These simulations are in many ways analogous to conducting an experiment and should be selected with the same care as are experimental treatments. In physical experimentation the number of treatments is usually limited by resources, whereas, the number of simulated treatments is usually limited by a person's ability to summarize, verify for reasonableness and interpret. Hence, objectives should be clearly defined and simulations selected to test pertinent hypotheses. The selection of alternative systems should be guided by biological potential, economic feasibility and social effects and/or constraints. In order to simulate alternative systems, one must be able to specify management policies (including supplemental feeding), forage qualities and availabilities and genetic potentials of the breed to be simulated. Originally, no within-breed genetic variation will be simulated; hence, the genetic potential of each animal will be its breed mean. Genetic potential is defined as the performance level that would be achieved by animals in good health and with good nutrition throughout their lives. The genetic parameters that will be required for each breed include:

A. Health Parameters

1. Quantitative effects of endemic and reduced levels of diseases and parasites on feed intake, growth rate, reproductive performance, fiber growth and milk production as well as mortality.
2. Effects of production management practices on disease and parasite incidence and severity.

3. Breed resistance or tolerance to endemic diseases and parasites.

B. Baseline Validation Data.

1. Forage quality and quantity for each 2-week period.
   a. digestibility
   b. crude protein
   c. maximum availability per head
   d. actual forage intake (amount and composition)
      -feed intake data are not essential but would be highly useful in strengthening what is expected to be one of the weakest areas in the model.

2. Supplemental feed
   a. amount by period
   b. digestibility
   c. crude protein percentage

3. Environment
   a. latitude
   b. altitude
   c. ambient temperature, monthly
   d. rainfall, monthly

4. Management
   a. breeding dates
   b. number of females/males
   c. age at first parturition
   d. care at birth
   e. castration age/date
   f. weaning ages/dates
   g. vaccination/drenching/dipping practices
   h. selection/culling practices
   i. shearing dates

5. Animal performance

   Growth size (weight, condition score, skeletal size)
   a. birth
   b. 60-70 day
   c. 120-140 day
   d. puberty
   e. breeding
   f. postpartum
   g. weaning

   Milk (females of all ages)
   h. lactation curve (amt./time)
   i. fat and protein composition

   Wool or hair production (yearly clip)
   j. grease weight
   k. fiber length
   l. fiber diameter
   m. clean weight (estimate)

Reproduction
n. puberty age and weight
o. breeding dates
p. parturition dates
q. numbers born

Disease and parasites
r. frequency and severity by age, class and season
s. mortality rates by cause, age, class and season

C. Genetic Potential

1. Mature weight
2. Maturing rate (growth curve for body weight)
3. Milk production
   a. lactation curve (amount over time)
   b. age effects
   c. fat and protein composition
4. Wool or hair production
   a. grease and clean weight (yearly)
   b. fiber length
   c. fiber diameter
5. Fertility
   a. puberty age and weight
   b. seasonality of estrus
   c. conception rate
   d. young born/females
   e. gestation length
6. Fat deposition pattern
7. Disease and parasite tolerance

IV. Experimental Designs

Most of the data for simulation of alternative production systems will come from Title XII projects. Any productivity data on pertinent breeds under traditional or improved management would be of some use, but the most useful data would be those which included growth, reproduction and other productivity data along with a detailed description of feed availability throughout the year. The inclusion of certain design components in the Title XII projects would enhance the usefullness of the data for simulation studies. Outlined below are the experimental design elements that would be most beneficial for systems analysis. These are offered as suggestions to be discussed, modified and incorporated into other experiments.

The basic approach would be to include the breeds of primary interest at each location in most experiments (e.g., range evaluations) and collect the data listed in III. B. above for use in baseline validations. These

data would also provide further data for use in characterization of breeds. These flocks would generally be subjected to an improved management regime that would be feasible to implement in that location. Data from flocks traditionally managed will also be needed; hence, on-site experimental data will likely be combined with data from LDC cooperators or from survey and monitoring projects.

In order to provide more detailed data, sub flocks of the breeds of major interest at each location should be used for more intensive experiments including the evaluation of genetic potential. About 150 females per breed would be required over a two-year period to fully evaluate genetic potential for use in simulations. These flocks should include females of all ages and be provided excellent care and nutrition. One approach would be to to divide these ewes into four groups with similar management and data collection procedures except for specific alterations in management.

1. Flocks
   a. productivity, 50-60 females managed to maximize performance
   b. seasonality, 25-30 females managed the same as (a) except exposed only to non-fertile males.
   c. disease/parasite tolerance, two groups of 25-30 females each managed the same as (a) except only minimal health care in one group and a moderate level of health care in the other.
2. Data required
   a. Mature weight and maturing rate
      -weight, condition score and measure of skeletal size on each animal in flock at birth and monthly.
   b. Milk production
      -estimate milk production (by direct milking or nursing-weight) and analyze milk sample for fat and protein content shortly after parturition and monthly for 5 months on a subsample of the ewes.
   c. Wool or hair production
      -measure grease weight and fiber length on a yearly basis, measure fiber diameter and estimate grease content
   d. Reproductive traits
      -record all mating dates (non-fertile males during nonbreeding season); record all births (number, sex, vigor, etc.)
   e. Disease/parasite tolerance
      -monthly disease and parasite levels
      -record all deaths and determine cause
   f. Fat deposition pattern
      -determine physical and chemical composition by body location of some mature females in different body conditions
   g. Feed intake
      - if possible, amount and composition by season

Identification of In-Country Collaborators for the Texas A&M University Systems Analysis Project

The successful application of sheep and goat production systems model in the formulation and analysis of alternative production systems is dependent upon the cooperation of in-country collaborators. During the early phases of the project, these collaborators will need to help TAMU scientists gain an overview of traditional production systems, major constraints to productivity, potentially beneficial interventions, social and technology restrictions to implementation of production alternatives, and the objectives of their country relative to small ruminant production systems. This overview will need to be gained during one or two visits by TAMU scientists during the first year or two of the project.

Once simulations are initiated to examine production alternatives in a country, the collaborators will need to help TAMU scientists examine simulation results to ascertain if traditional production is being accurately simulated as a baseline validation of the model. They will then need to make major contributions to the identification of production alternatives to be simulated and to the examination of these simulations for reasonableness, as well as for potential impact on production systems. These activities will require collaborators with an in-depth understanding of traditional production systems and intuition relative to the effects of interventions on these systems and will require a minimum of several weeks of concentrated effort during the second and succeeding years of the project. Finally, the successful adoption of favorable production alternatives will occur only through the efforts and influence of in-country collaborators.

The primary qualifications of collaborators for the systems analysis project are (1) first-hand knowledge of small ruminant production systems currentl practiced, (2) insights about country objectives and sociological constraints, (3) a willingness to assess and solve problems within the framework of the tota production system, and (4) the time to devote to working with TAMU scientists during their in-country stay. These qualities imply the willingness to work as part of a team, i.e. to utilize data and information provided by others (e.g. forage and animal scientists and veterinarians), on the one hand, and to supply appropriate data and information to others (e.g. economists and sociologists), on the other hand.

Of much lesser importance among qualifications would be the disciplinary training, quantitative abilities, or previous systems analysis experience of the individual collaborators. The identification of collaborators with strong quantitative abilities and interest in gaining expertise in systems analysis would enhance the development of an in-country systems analysis capability; however, this capability may be more effectively developed through training components of the project, and is a longer term objective.

Training Objectives of the Texas A&M University Systems Analysis Project

The use of the systems analysis to formulate and evaluate production alternatives requires three distinct capabilities.

1. The capability to cooperate in the application of production systems models. This capability will require an understanding of the systems approach, the willingness to assess and solve problems from a total systems viewpoint, and experience in evaluating and interpreting simulation results.

2. The capability to adapt and use previously developed production systems models to simulate production alternatives. This capability will require the abilities identified in (1) above plus strong quantitative and biological training as well as computer facilities.

3. The capability to develop comprehensive, mathematical models of production systems based on biological functions. This capability will require the coordinated efforts of a well-trained team of plant and animal scientists along with biological scientists with strong quantitative abilities and experience in model development.

The first of these capabilities will result from the experienced gained by in-country collaborators during the course of the systems analysis project. The development of the second capability would be the primary objective of the training component of the systems analysis project. This objective would most likely be accomplished through advanced degree studies by LDC students in which their course work would be taken in the U.S. and their research would be the application of production systems analysis in their own country. In some instances, shorter-term, post-degree programs for in-country collaborators with the interest and apptitude for systems analysis would be another useful approach to provide in-country capability to apply production systems models.

The capability of developing production systems models is not considered essential for most countries. Nevertheless, the advanced degree training necessary to establish the second capability combined with increased plant and animal research expertise gained through other avenues would eventually lead to an in-country capability of model development.