

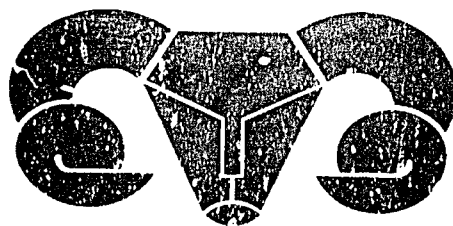
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**Small Ruminant  
Collaborative Research  
Support Program**

**Annual Report for**

**Peru**

**Program Year Nine  
1987-1988**



**Small Ruminant CRSP  
University of California  
Davis, California 95616**

## COLLABORATING ORGANIZATIONS

### Federal (U.S.):

United States Agency for International Development  
Science and Technology Bureau

Board for International Food and Agricultural Development  
Joint Committee on Agricultural Development

### Overseas Collaborators:

INDONESIA--Agency for Agricultural Research and Development (AARD)

KENYA--Kenya Agricultural Research Institute

MOROCCO--Institut Agronomique et Veterinaire--Hassan II University  
(IAV)

PERU--Instituto Nacional de Investigacion Agraria y  
Agroindustrial (INIPA)

### Participating Institutions:

University of California, Davis

Colorado State University, Fort Collins

Montana State University, Bozeman

University of Missouri, Columbia

North Carolina State University, Raleigh

Texas A&M University, College Station

Texas Tech University, Lubbock

Utah State University, Logan

Washington State University, Pullman

Winrock International Institute for Agricultural Development,  
Merrilten, Arkansas

**This publication is dedicated to  
the memory of**

**Constantine Gregory  
and  
Gustavo Rojas**

**SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM**

**ANNUAL REPORT FOR PERU**

**1987-1988**

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If more information is desired, the Principal Investigator of the specific project may be contacted at his U.S. institution, or by enquiry from the Management Entity, Small Ruminant Collaborative Research Support Program, University of California, Davis, CA 95616. In addition to this series of annual reports by host country, the Management Entity has compiled a complete roster of trainees and a full listing of over 2400 theses, book chapters, scientific journal articles, abstracts of papers presented at meetings, and written and verbal technical presentations that reflect the activity of the SR-CRSP prior to 1989.

## 1987-1988 ANNUAL REPORT

### Introduction

During the past year, 1987-88, the Small Ruminant Collaborative Research Support Program has had a landmark year in the tremendous progress made in all interdisciplinary ventures. These include (1) SR-CRSP sponsored workshops in LaPaz, Bolivia (150 participants), arequipa (60 participants), and Lima, Peru (88 participants); (2) the Integrated Research in Peasant Communities; and (3) the initial development of the Peru Technological Package (Peru Tech Pack). These unique and highly visible team-oriented efforts will make lasting impressions on the peoples of the Andes, both in Peru and Bolivia. Peruvian and U.S. scientists were the first in the CRSP to begin building information bridges to neighboring countries that have not received direct benefits from having a CRSP project. We believe strongly that this was the ultimate goal of the USAID designers of the CRSP's.

Another major step forward was the Management Entity's decision to fund "Special Projects" research. These short-term projects produced valuable results relative to "Embryo Transfer in South American Camelids," "Standardizing Methods for Determining Passive Immunity in Small Ruminants," "Early Maturation of Female Alpacas," and "Development of a Complete List of Poisonous Plants Which Affect Animal Production in the High Andes." Significant findings include (1) the preliminary indication that ovulatory hormones (LH, GnRH) have promise for superovulation in camelids, (2) female alpacas may be bred at one year of age rather than the customary three years of age by strategic use of cultivated forages, and (3) losses from poisonous plants center on photosensitization and Astragalus poisoning. (Only nine genera were identified as serious floral agents in small ruminant losses: Astragalus, Trifolium, Utica, Polylepis, Elodea, Lupinus, Pennisetum, Ephedra, and Conium.)

Under the umbrella of team-oriented research and outreach, each discipline effectively produced results that are significant. For example, the health project at Colorado State University purified a Clostridium perfringens Type A enterotoxin, a serious agent in the neonatal mortality of small ruminants. In addition, several native plants were examined for the efficacy in treating parasites such as the sheep ked (Melophagus ovinas), liver flukes, and gastrointestinal nematodes. Respectively, these effective plants were "utashayli," artichoke, and "paico."

The University of Missouri Sociology project had the primary coordination role in the Integrated Research in Peasant Communities and the development of the Peru Technology Package. Their study of the genealogy of knowledge transfer and their monograph on ethnoveterinary developments will be landmark works.

The Economics Project at Winrock International Institute for Agricultural Development has been heavily involved in studies on the micro- and macro-economics affecting peasants and peasant communities. Interesting contributory findings include the fact that animal and crop production are so closely linked that they cannot be considered independent economic enterprises of the smallholder. Moreover, the time invested in small ruminant production is twice that of crop production, even though livestock are normally considered ancillary to crops.

Montana State University's Breeding Project has had many accomplishments aside from the normal flow of prestigious publications in world-renowned outlets. Scientists have learned why peasants refuse to castrate males and how they select rams for breeding purposes. Furthermore, they are developing an understanding as to the contribution of males and females into production traits of Andean sheep. Such knowledge will enable extension specialists to alter decisions made by producers.

Because native forage (rangelands) and introduced plants are the nutritional base for animal production, Texas Tech University and their Peruvian co-investigators are delving into topics like mixed-species (complementary) grazing, proper stocking rates, and the nutrient status of free-grazing small ruminants. Stocking rate has had the primary influence on animal performance traits, such as fleece weights, staple lengths, and lamb crops. Furthermore, stocking rates that exceed four to five sheep units per hectare will have severely deleterious effects on sustainable animal production and the health of native vegetation. Sheep were successfully flushed with cultivated pastures and raised production levels by as much as 25%.

Collectively, the SR-CRSP in Peru has been one of the most productive projects of all the CRSP worksites. Indeed, this is a tribute to our Peruvian colleagues who have worked tirelessly and courageously in the face of extreme hardships and terrorism.

## 1987-1988 Annual Report

Project Title: **Evaluation and Improvement of Small Ruminants in Extensive Management Systems**

Host Country: Peru

U.S. Institution: Montana State University (MSU)

Host Country Institutions: INIAA  
Universidad Nacional Agraria, La Molina (UNA)  
Universidad Nacional de Altiplano, Puno (UNA-P)

Personnel: Principal Investigator:  
P.J. Burfening

Collaborating Personnel:  
Dr. Juan Chavez, Animal Genetics and Breeding UNA

Ing. Manual Carpio, Animal Scientist, UNA

Ing. Rolandro Alancastre, Animal Scientist, UNA-P

Ing. Victor Bustinza, Animal Breeder, UNA-P

Dr. J. Berardinelli, Associate Professor of Animal Science, MSU  
Dr. D. Kress, Professor of Animal Breeding, MSU

### RESEARCH RESULTS

Communities have their own production system which varies among them according to location. This determines the natural resources community peasants utilize. Because communities have their own sheep raising technologies, it is difficult to force them into sudden changes. Introduction of new technologies produced under different environmental conditions could harm rather than benefit the production system, due to the unknown animal response and social impact.

The Animal Breeding Project "Response to mass selection and

improved environment in Criollo sheep at the Central Andes of Peru" was established at three Mantaro Valley communities of Aramachay, Quicha Chico and Miraflores, located at Sinchos District near Huancayo. Twenty-three family Criollo flocks with a total of 466 sheep were included in the study.

According to proposal specifications, family flocks were chosen within each community. Some flocks were designated as Control and the remaining considered as Selected groups. After they were ear-tagged, recording of periodic data collection began.

Analysis of technologies used in the communities indicates the peasants' selection criteria for rams is mostly based on animal strength (body size) and fleece quality. Males not used for reproduction are kept uncastrated in the flock. Peasants refuse to castrate them because they claim castrated animals do not grow as fast as the uncastrated, and they also get too fat.

Shearing is made with a sharp piece of glass or metal (lid of a can) and knives. Peasants avoid shearing too close to the skin in order to reduce the potential risk of pneumonia. Shearing begins early in the morning with family participation, and is done directly on the field, keeping the sheep tied. Only 50% of flock animals are shorn every year.

Flock structure is peculiar. Ewes of various ages are found, but males are only represented by lambs and mature rams. No intermediate ages are observed.

Ram to ewe proportion is near 8% and the estimated lambing rate was 110%. Growth is reached earlier than other breeds of sheep, but weights are light at maturity. Ewes average 30 kg, and rams 34 kg at the communities of Aramachay and Miraflores. At Quicha Chico, ewes are even lighter, approximately 24 kg, and rams 34 kg. Fleece weights of one year growth are approximately 2 kg with staple lengths of 9 cm.

Criolla flocks that has been established at Chiquibambilla from 2 sources has been compared. Ewes and rams from the Puno and Cusco areas were purchased and moved to Chiquibambilla and were crossed in a 2 x 2 factorial design to determine if there was a difference in progeny performance due to origin of the male or female germ plasm. The results show that there was no difference in fertility, birth weight, weaning weight, fleece weight or fleece quality (Lencinas et. al., 1987). The progeny will now go into a selection program as one group independent of origin similar to the Corriedale flock.

Scrotal circumference was measured on 370 Corriedale rams sired by 5 rams at approximately 16 mo. of age. The mean scrotal circumference was 27.4±2.5 cm. there were low correlation with the



other traits associated with growth rate and fleece production. The heritability of scrotal circumference was  $.4 \pm .08$  which compares very favorably with other estimates in the literature for this trait (Quevedo et al., 1987).

#### **Work at MSU:**

A mixed model program has been developed for the evaluation of genetic change in the populations of sheep that have been under selection for reproductive rate for 20 years. The results indicate that the regression of breeding value of the ewes in the selected populations increased in the high line ( $b=.013 \pm .002$  lambs per year) while in the low line reproductive rate decreased at the rate of ( $b=-.004 \pm .001$  lambs per year). Laporscopy of the ewe for the last three years indicates that the ovulation rate was 1.23, 1.75 and 1.48 CL per ewe for the low high and random bred control line, respectively (Schoenian, 1988). These results clearly show that the change in reproductive rate is mostly accounted for by the correlated change in ovulation rate. Another experiment was conducted to determine if differences existed between lines in LH levels in response to a standard dose of gonadotropin releasing hormone. No effect of line was detected in this experiment, thus responses to GnRH does not appear to be a method by which animals with different reproductive potentials could be screened.

### **PUBLICATIONS**

#### **Journal Articles, Refereed**

- Stobart, R.H., R.L. Blackwell, T.C. Cartwright and J. W. Bassett. 1987. Relationship between growth and productivity of range ewes. *J. Anim. Sci.* 65:929-935.
- Bustinza, V. A., P.J. Burfening and R.L. Blackwell. 1988. Factors affecting survival in young alpaca. *J. Anim. Sci.* 66:1139-1143.
- Burfening, P.J., M. Carpio, K. Hanford P. Cabrera and R. L. Blackwell. 1988. Genetic and environmental factors affecting growth rate and survival of Junin sheep in the central highlands of Peru. *J. Anim. Sci.* (submitted for publication).
- Burfening, P.J., R.W. Kott and K.L. Coleman. 1987. Selection of ram lambs versus yearling rams in Targhee sheep. *SID Research Digest.* Spring 6-9.
- Lewis, R.D. and P.J. Burfening. 1987. Comparison of Finnish Landrace crossbred ewes with Columbia, Rambouillet and Targhee ewes on western range. *J. Anim. Sci.* 66:1059-1066.
- Burfening, P.J., M. Carpio and R. Alencastre. 1988. Effect of ram

stimulation on estrous activity and lambing rate in two sheep breeds in the Sierra of Peru. Small Ruminant Research (accepted for publication).

Lewis R. D. and P.J. Burfening. 1988 Finish Landrace crossbred ewes compared to Columbia, Rambouillet and Targhee ewes. Mont. Ag. Res. 5:6-10.

Bradford. G.E., P.J. Burfening and T.C. Cartwright. 1988. Evaluation of production and reproduction traits of sheep, goats and alpaca genotypes in the small ruminant CRSP. J. Anim. Sci. (submitted for publication).

#### Papers presented at scientific meetings

Lencinas, M. R. Alencastre, B. Quijandria and P.J. Burfening. 1987. Pruebas de performance y progenie en ovinos corriedale. Xth Reunion Cientifica Anual de la Association Peruana de Production Animal. Puno Nov. 8-12.

Lopez, M. and M. Carpio. 1987. Evaluation Productiva de pesos vivo y vellion de ovinos Targhee x Junin y Targhee-Finish x Junin nacidos en los anos 1981 a 1984. Xth Reunion Cientifica Anual de la Association Peruana de Production Animal. Puno Nov. 8-12.

Nelson, R.M., M. Gammarra, P. Cabrera and Salas, W. 1987. Cruzamiento de carneros Targhee-Finish-Junin, Targhee-Junin, Junin y Criollos con borregas criollas. Xth Reunion Cientifica Anual de la Association Peruana de Production Animal. Puno Nov.8-12.

Lencinas. M., R. Alencastre, B. Quijandria and P.J. Burfening. 1987. Seleccion de ovinos corriedale por performance y progente en hacienda San Antonia Puno. Xth Reunion Cientifica Anual de la Association Peruana de Production Animal. Puno Nov.8-12.

Quevedo, P. M. Lopez and M. Carpio. 1987. Avances sobre del efecto de la Circunferencia escrotal en ovinos. Xth Reunion Cientifica Anual de la Association Peruana de Production Animal. Puno Nov.8-12.

Lencinas, M., R. Alencastre, B. Quijandria and P. J. Burfening. 1987. Parametros productivos de ovinos criollos, procedents de Puno y Cosco. Xth Reunion Cientifica Anual de la Association Peruana de Production Animal. Puno Nov.8-12.

Olatre, U., G. Mamani V. Bustinzia and G. Medina. 1987. Efecto del tiempo de crecimiento de 12, 18 y 24 meses sobre longitud de macha y de fibra en Alpacas Wacaya. Xth Reunion Cientifica

Anual de la Association Peruana de Production Animal. Puno  
Nov.8-12.

Bradford. G.E., P.J. Burfening and T.C. Cartwright. 1988.  
Evaluation of production and reproduction traits of sheep,  
goats and alpaca genotypes in the small ruminant CRSP.  
Presented at the American Society of Animal Science Meetings.  
Rutgers NJ.

### Theses

#### **M.S. degree:**

Schoenian, S.G. 1988. Direct and correlated responses to selection  
for reproductive rate in Rambouillet sheep. M.S. thesis,  
Montana State University, Bozeman, MT.

#### **Ingeniero Degree:**

Contreras, W. 1988. Efectos del cruce de carneros Junin, Targhee  
x Junin, Targhee-Finish x Junin y Criollos con borregas  
criollas, sobre la performance productiva de corderos hasta  
el destete. Universidad Nacional del Centro (Huancayo).

### Technical reports

Bustinza, V. 1988. Avances de mejoramiento genetico en Alpaca.  
Presented at Taller de Trabajo sobre Transfencia de tecnologia  
"Proyeccion hacia Bolivia de los Resultados del Programa  
Rumiantes Menores." La Paz, Bolivia May, 1988.

Carpio, M. and P.J. Burfening. 1988. Resultados de las  
Investigaciones sobre Mejoramiento Genetico de Ovinos en  
Sistemas Extensivo en la Sierre Central del Peru. 1980-1987.  
Presented at Taller de Taabajo sobre Transfencia de tecnologia  
"Proyeccion hacia Bolivia de los Resultados del Programa  
Rumiantes Menores." La Paz, Bolivia May, 1988.

### Training

#### **Degree oriented:**

Schoenian, S. U.S., M.S., MSU. Animal and Range Sciences, April  
1988.

Choo, Jun. U.S., M.S. Animal and Range Sciences, June 1989.

Lopez, Manual. Peru, M.S. Universidad Nacional Agraria La Molina,

Dec. 1988.

Layva, Carlos. Peru, M.S. Universidad Nacional Agraria La Molina, Dec 1989.

Villaverde, Nora. Peru, M.S. Universidad Nacional Agraria La Molina, Sept. 1989.

Contreras, William. Peru. Ingeniero Zootecnista. Universidad Nacional del Centro (Huancayo), Aug. 1988.

#### Workshops

Micro computers and data management; For SR-CRSP and other university and INIPA personnel held in Lima and Puno Peru.

Program on Alpaca Management for Bolivian extension specialists held from June 27 to July 2 at La Raya Puno by Victor Bustinza.

## 1987-1988 Annual Report

Title: **Economic Analysis of Small Ruminant Production and Marketing Systems**

Host Country: Peru

U.S. Institution: Winrock International Institute for Agricultural Development

Host Country Institution: Universidad Nacional Agraria "La Molina," Grupo Yanapai, INIAA

Personnel: Principal Investigator:  
Henk Knipscheer

U.S.: Domingo Martinez (Co-P.I.-UNA)  
Corinne Valdivia (UNA)

Peru: Norma Canales (Resid., Winrock/Yanapai)  
Constantine Gregory (Research Assistant, Winrock/Yanapai)  
Dolores Fernandez (Yanapai)  
Maria Fernandez (UMC/Yanapai)  
Mercedes Barrera (UNA)

### IN MEMORIAM

With shock, unbelief, and great sadness the SR-CRSP learned of the tragic loss of Mr. Constantine Gregory and Mr. Gustavo Rojas. Both men were killed in an ambush on Monday, June 13. They assisted the project in the data collection and processing of on-farm trials. Constantine is survived by his wife Dolores, and Gustavo by his parents Mr. and Mrs. Cavamutti. Gregory's body was flown to California where funeral services were held on June 20.

### RESEARCH RESULTS

During this period, the economics component has allocated most of its resources to support the multidisciplinary Project of Validation of Campesino Technologies (PVTC, formerly called Community Project) in the communities of Aramachay, Quicha Chico, and also Miraflores and Llacuaripampa, in the lands surrounding the Mantaro Valley in central Peru. This effort has involved data collection, data analysis, and an important amount of support for the PVTC as a whole.

The field work had to be indefinitely suspended after the slaying of C. Gregory (along with G. Rojas, a veterinarian working for Colorado) while doing fieldwork. The data organization and analysis effort, on which Gregory had the main responsibility, is currently being restructured.

What follows is a brief listing of the tasks carried out by the economics component of the Peruvian SR-CRSP:

1. Design of formats for collection of biological and socioeconomic data, according to the needs of each of the participating CRSP components, initially every 2 weeks and then weekly (Canales and Gregory).
2. Training in use of microcomputers, offered to residents and research assistants of the other components. Specifically, a five class course was given on the use of WordStar (Gregory) and Panacea (Canales).
3. Advise on data organization for data on pastures and animal production.
4. Development of methodologies and experiences for on-farm research (Canales).
5. Study on risk-sharing as a sound technique to carry out on-farm trials (Gregory, with final cooperation of Canales, Fernandez, Martinez).
6. Topical studies based on the dynamic survey (Martinez, Canales).
7. Dynamic survey data base organization (Gregory, Martinez, Canales).
8. Economic evaluation of research results on pastures (Gregory).
9. Support in the design of the PVTC (Canales).
10. Studies on labor (Martinez and Barrera) and land (Canales, Gregory, and Martinez) use in the communities of Aramachay and Quicha Chico. Other daily activities were field data collection (until June 13), and support for the coordination of the PVTC during the absence of M. Fernandez.

For these activities, the economic component has loaned a microcomputer, which has been enhanced (memory, hard-disk, modem), and which is being used by most research assistants and residents. In the near future, this computer will be used to maintain modem communications with the United States and the site coordinator office in Lima.

Specific results have shown that animal husbandry and crop production are activities so closely linked that it may be difficult to think of any of them as a "main" activity. The labor use study indicates that time invested in tending the livestock is almost twice as much that allocated to crops, in spite of the general perception that livestock was a subsidiary production. Also, the study on risk sharing presents strong evidence favoring the use of this kind of approach to carry out meaningful on-farm trials, especially taking into account the prevalence of traditional forms of reciprocal exchange in the Andean milieu.

The ongoing studies on land use and herd composition are shedding light on the complexities of the production system, and constitute a type of constraint not easily measurable but that is necessary to take into account.

Corinne Valdivia is working on a model to analyze the effect of macroeconomic and sectorial policies on the Peruvian livestock sector, as part of her dissertation research.

Domingo Martinez is using data of the PVTC to study the microeconomics of decision-making at the community level, and the implications of that on farming systems research, also as part of his dissertation requirements.

Domingo Martinez has also participated as a speaker in the workshop carried out at La Paz, Bolivia, in which the experiences of the Peruvian SR-CRSP were presented to Bolivian professionals.

Norma Charles has participated in similar workshops in Lima and Arequipa, Peru.

#### PUBLICATIONS

Several of the listed publications have been published with the cooperation of other institutions (IDRC). Invited papers have also been presented at international meetings.

Martinez, Castilla, Domingo. 1985. Microeconomia de las unidades ganaderas extensivas del Peru. Una revision. Centro de Investigacion del Departamento de Economia y Planificacion (CIDEP), UNA. La Molina, Peru. (mimeo)

Martinez, Castilla, Domingo. 1986. La ganaderia en el Peru. Informacion basica sobre aspectos economicos y productivos. (CIDEP-UNA, IDRC. La Molina, Peru (book, 78 pp.).

Martinez, Castilla, Domingo. 1987. Un modelo computacional para investigacion en sistemas de produccion en ganaderia. CIDEP-UNA, IDRC. La Molina, Peru. (mimeo)

Martinez-Castilla, Domingo and Mercedes Barrera. 1988. Labor use in two Andean communities. University of Missouri (in edition).

Gregory, Constantine. 1988. FSR/L Al partir. Sharing Risk with Farmers. (in edition). Accepted by the FSR/E Symposium, Fayetteville, Arkansas.

Canales, Norma. 1988. Looking to Our Methodological Experiences in High-Altitude Communities in the Central Sierra of Peru. International Workshop on Women, Households, and Development: Building a Data Base. University of Illinois, Urbana-Champaign.

Canales, Norma. 1988. La experiencia de Yanapai - Peru. Seminario-Taller: Produccion de semilla a nivel campesino. Buga, Colombia.

### Training

#### Degree Oriented

Two Fellows are being supported by the Peruvian economics component of the SR-CRSP. Domingo Martinez and Corinne Valdivia are enrolled in the Ph.D. program of the Department of Agricultural Economics at the University of Missouri-Columbia. They have completed all coursework and passed their comprehensive examinations, and are expected to complete their respective researches during 1989.

#### Nondegree Oriented

The project has also supported their attendance to professional events in the United States, as follows:

1. Farming System Symposium, at Fayetteville, Arkansas, in October 1987 (Martinez, Gregory).
2. Meeting of the Peruvian Association of Agricultural Economics, at Lima, 1987 (Canales, Gregory).
3. Seminar on Agrarian Systems, at UNA La Molina, October 1987 (Canales).
4. Workshop on Participative-Action Research, Huancayo, May 1988 (Canales, Gregory).
5. Animal Agriculture Research Towards the Year 2000. Symposium at Washington, D.C., June 1988 (Martinez).



6. Workshop on Women, Households and Development, at Urbana-Champaign, July 1988 (Canales).

## 1987-1988 Annual Report

Title: **An Investigation of Small Ruminant Health Problems**

Host Country: Peru

U.S. Institution: Colorado State University

Host Country Institution: IVITA/San Marcos University

Personnel: Principal Investigator:  
James C. DeMartini, Pathology

### US/CSU

R. Ellis, Inv., Microbiology  
O. Kajikawa, Res. Assoc., Path.  
C. Kimberling, Inv., Clin. Sci.  
M. Salman, Inv., Epidemiology

### Peru/IVITA

Co-Investigator  
E. Ameghino, Microbiology  
H. Bazalar, Inv., Parasitology  
L. Coronado, Inv., Huancayo  
D. Huaman, Inv., Microbiology  
A. Hung, Inv., Clin. Sci.  
G. Leguia, Inv., Parasitology  
C. Novoa, Inv., Reproduction  
B. Pizarro, Inv., Pathology  
A. Ramirez, Inv., Microbiology  
H. Rivera, Inv., Microbiology  
R. Rosadio, Inv., Pathology

## RESEARCH RESULTS

### Subprojects 1 and 2. Perinatal Mortality in Alpaca

The high prevalence of neonatal mortality in alpaca has been related to Clostridium perfringens type A (CPA), and enteropathogenic E. coli (EEC) in association with the failure of passive transfer (FPT) of maternal antibody. We have recently purified a CPA enterotoxin which is a virulence factor in alpaca and llama enterotoxemia, and may be of importance in lambs as well (Ramirez et al, 1988). Our goal is to develop a field diagnostic test and to analyze serum antibody-mediated neutralization of CPA enterotoxin in animal models. Using monoclonal antibodies to enterotoxin, we have been standardizing a latex agglutination test, sandwich ELISA, and a rapid dot-immunobinding assay for its detection. Over 350 serum samples from alpaca, llama, and sheep are on hand for detection of antibodies to CPA enterotoxin. The immunoaffinity purified CPA enterotoxin failed to cause membrane damage or cytotoxic effects on Vero cells. However, we confirmed

the enteropathogenic response of the sporulated CPA cells in susceptible alpaca and llama by ligated intestinal loop assay. Further studies of these newly standardized diagnostic assays and pathogenic mechanisms for CPA enterotoxemia are in progress. To study the role of E. coli in neonatal diarrhea, rabbits were hyperimmunized with pili from three different strains of E. coli isolated from diarrheic alpacas. All three strains were grown in media that enhances pilus production, and the pili were harvested for use in the vaccine. Sera were collected from all the rabbits (3 per strain) and stored for future use. We plan to determine whether these sera can be used to identify pili present on alpaca E. coli and use different pilus types in a vaccine to prevent colibacillosis in neonatal alpacas.

Perinatal mortality of alpacas was studied at two enterprises near Puno. Whereas bacterial diarrhea was the most important cause of mortality at the enterprise with a 26% mortality rate, the other, which had a lower mortality rate, had pneumonia as the most important mortality factor. The lesions and bacteria associated with these losses were characterized and will be correlated with immunoglobulin levels when the studies are complete. Management factors appear to be important in determining the incidence and cause of mortality in newborn alpacas.

### **Subproject 3. Parasite and Disease Control in Community Flocks**

The general goal of the animal health component of the "community project", an interdisciplinary project of the SR-CRSP in Peru, is to evaluate the efficacy of changes in management as means of parasite and disease control in community flocks. As a result of the security situation in this part of Peru, research was largely limited to studies on the usefulness of particular indigenous plants in control of certain parasitic diseases.

The efficacy of dipping sheep in baths containing leaves of "utashayli" (Nicotiana sp.) against the sheep ked (Melophagus ovinus) was evaluated. Seven days after the treatment, immersion baths of 7 liters of water containing 500 g of the plant per sheep were over 90% effective in controlling this parasite. Furthermore, no toxic effects of the treatment were noted and the mean weight gain in the treated group after 60 days was 2 kg compared with 1.2 kg in the untreated group. Although there are problems associated with the seasonal occurrence of the plant, its usefulness in control of keds in community flocks has been demonstrated.

Another experiment was conducted to evaluate feeding artichoke leaves (Cynara sp.) and shipita as a means of controlling liver flukes in sheep. At doses of 280 mg/kg or 150 mg/kg, over 80% control of adult flukes was achieved. Reduction in fecal egg output also was observed. Finally, "paico" was demonstrated to be useful in control of gastrointestinal nematodes, as assessed by removal of 70-80% of the adults from the GI tract of treated sheep.

Other such studies are planned.

#### **Subprojects 4 and 5. Field and Laboratory Research on Retrovirus-induced Respiratory Diseases of Sheep in Peru.**

In Peru, chronic respiratory diseases (ovine pulmonary carcinoma, OPC, and ovine progressive pneumonia, OPP) caused by two retroviruses have been shown to be important causes of mortality of adult sheep. Attempts are being made to assess the feasibility of controlling these diseases using management strategies in an isolated sheep flock at the Cochabamba unit of SAIS Tupac Amaru. The overall death rate in this flock was reduced by approximately 70% relative to other flocks at the enterprise, and the incidence of OPC/OPP was reduced by over 50%. The seroprevalence of ovine lentivirus infection was only slightly reduced in the experimental flock. Lung tissue samples of 20 animals clinically diagnosed as OPC were studied histopathologically and used in other tests for presence of viruses and viral antigens. Eleven of these had lesions of OPC. These results indicate that the prevalence of OPC/OPP can be reduced in sheep flocks by saving lambs only from primiparous ewes and by eliminating disease affected animals from the flocks. Complete control or eradication of these diseases, however, must await the development of sensitive diagnostic tests or vaccines.

At CSU, success has been achieved in developing a model for rapid, consistent induction of OPC in neonatal lambs (Rosadio et al, 1988). The causative virus of OPC has been serially passaged 4 times, inducing OPC in 24 of 35 lambs within 2 to 6 months of intratracheal inoculation with lung tumor homogenate or lung fluid (DeMartini et al, 1988). A radioimmunoassay (RIA) for detection of OPC retroviral antigen was developed and compared to the previously used Western blotting assay (Kajikawa et al, 1988). Furthermore, the Western blotting assay was modified to use a non-radioactive immunoenzyme detection technique, so that it could be more easily used in Peru. Both assays were able to detect OPC retroviral antigen in unconcentrated lung fluids of 11 sheep naturally or experimentally infected with OPC. In an effort to recover the etiologic agent of OPC, DNA extracted from tumors of two sheep was transfected into a canine fetal thymus cell line, but no evidence for replication of the virus in the cells was obtained. Similarly, efforts to clone proviral OPC viral fragments in phage vectors were unsuccessful. Antigenic and biochemical comparison of ovine lentivirus strains isolated from OPC cases with OvLV isolated from field OPP cases is nearing completion and should provide some insight as to their potential role in the etiology or pathogenesis of OPC.

#### **Subproject 6. Other Animal Health Research at IVITA.**

A small grants seed money program provided incentive and funds for several small ruminant disease studies at IVITA. Evidence was

obtained through serological surveys that Mycoplasma mycoides subsp. mycoides is likely to be an important cause of pneumonia in alpaca herds in Southern Peru. Studies of experimental infection of cats, dogs, and young alpacas with Sarcocystis aucheniae indicated that this protozoan parasite is highly pathogenic in alpaca and that dogs rather than cats are the definitive host for the parasite. An indirect ELISA test using sporozoite antigens of this parasite has been developed and will be used to determine whether serum antibody levels correlate with presence of muscle cysts in infected animals. Using an indirect hemagglutination test for Toxoplasma gondii, high prevalence of seroreactivity was found in alpacas and goats, indicating the likelihood that this parasite is associated with abortion in these species. Lastly, a study was undertaken to assess the species involved and frequency of plant poisoning in Peruvian livestock.

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Ramirez, A. 1988. Conference: Biotechnology in Animal Health. Special Conference. Agrotec. December 1987. Lima, Peru.

Ramirez, A. 1988. Conference: C. perfringens toxins. Selected topic in Microbiology. Peruvian Association of Microbiology. April 1988. Lima, Peru.

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Ramirez, A., R. P. Ellis, D. Huaman, and V. Leyva. 1987. 1st. Scientific Award in Animal Health, Peruvian Association for Animal Production. Nov. 1987. Puno, Peru.

## 1987-1988 Annual Report

Title: **Improving Small Ruminant Nutrition, Management, and Production through Proper Management of Native Range and Improved Pastures**

Host Country: Peru

U.S. Institution: Texas Tech University

Personnel: Principal Investigator:  
Fred C. Bryant

Co-Investigators:  
Dr. Arturo Florez, UNA - Central Sierra  
Dr. Felipe San Martin, IVITA - Lima  
Dr. Enrique Flores, UNA - Lima  
Ing. Ramiro Farfan, IVITA - La Raya  
Ing. Juan Astorga, UNTA - Puno  
Ing. Francis Villena, UNPRG - Lambayeque

Host Country Co-Workers:  
Ing. Godofredo Atamari, UNTA - Puno  
Ing. Jorge Gamarra, Huancayo

U.S. Co-Investigators:  
Dr. Ron Sosebee, Range Management  
Dr. Bill Dahl., Range Management  
Dr. C. M. Britton, Range Management  
Dr. Dave Wester, Range Management  
Dr. Gerry Matches, Improved Forages,  
Dept. of Plant and Soil Science  
Dr. B. L. Allen, Soils,  
Dept. of Plant and Soil Science

### RESEARCH RESULTS

The year 1987-88 marked a banner year for the Texas Tech Range and Forages Research Program of the Small Ruminant - Collaborative Research Support Program. By August 1988, at least 11 manuscripts were in print or accepted as "in press" during the past year. These publications covered subject matter such as animal production, wool quality, animal nutrition and forage intake, grazing systems and management, diet selectivity, range condition, and soils. Further, the articles have or will appear in 5 different prestigious

Journals such as the Journal of Animal Science, Journal of Range Management, Journal of Small Ruminant Research, Geoderma, and Agricultural Systems.

Also in 1988, we published Volume IV of our continuing series of research papers published in Spanish. This volume contains 10 research papers varying in topics such as legumes, improved pastures, native plant communities, climate, and comparative animal nutrition. We also published nine abstracts and made nine presentations at scientific meetings.

To date, 13 individuals, 9 M.S. and 4 Ph.D. students, have been trained in the United States. These include 6 Peruvians, 2 Mexicans, 1 Moroccan, and 4 Americans.

Significant results of our research effort have been brought to fruition. For specific results, please consult the publications list.

## PUBLICATIONS

### Journal Articles, Refereed

- Blackburn, H. D., F. C. Bryant, T. C. Cartwright, L. C. Fierro, and J. Astorga. 1988. Corriedale sheep production when supplemented with tame pasture in southern Peru. *Agric. Systems* (In Press).
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- Bryant, F. C., E. R. Flores, and J. A. Pfister. 1988. Diet selectivity of sheep under different grazing management schemes in the Andes of Peru. Abstr. No. 138. Abstracts of Papers, 41st Annual Meeting, Soc. for Range Manage., Corpus Christi, TX.
- Bryant, F. C., F. San Martin, R. Reiner, and L. C. Fierro. 1987. Comparison of selectivity between alpaca and sheep on a Festuca dolichophylla range site in Peru. Abstr. No. 236. Abstracts of Papers, 40th Annual Meeting, Soc. for Range Manage., Boise, ID.
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Bryant, F. C., E. R. Flores, and J. A. Pfister. 1988. Diet selectivity of sheep under different grazing management schemes in the Andes of Peru. 41st Annual Meeting, Soc. for Range Manage., Corpus Christi, TX. Feb. 21-24.

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El Aich, A., M. Harkousse, A. Chyra, F. C. Bryant, and L. Rittenhouse. 1987. Dry matter intake and stocking rate levels for Timahdit sheep in Morocco. 40th Annual Meeting, Soc. for Range Manage., Boise, ID. Feb. 8-13.

San Martin, F., F. C. Bryant, R. Farfan, and A. Rosales. 1987. Comparison of sheep, llama, and alpaca selectivity on two native range sites and an improved pasture in Peru. 40th Annual Meeting, Soc. for Range Manage., Boise, ID. Feb. 8-13.

San Martin, F., J. A. Pfister, F. C. Bryant, and T. Huisa. 1987. Comparative digestibilities of South American camelids (Pseudo ruminants) and true ruminants. 40th Annual Meeting, Soc. for Range Manage., Boise, ID. Feb. 8-13.

Soltero, S. and F. C. Bryant. 1988. Changes in vegetation under short duration and continuous grazing on an oak-bunchgrass range site in northern Mexico. 41st Annual Meeting, Soc. for Range Manage., Corpus Christi, TX. Feb. 21-24.

Soltero, S., F. C. Bryant, A. Melgoza, and L. C. Fierro. 1987. Grazing distribution under short duration and continuous grazing on an oak-bunchgrass range site in northern Mexico. 40th Annual Meeting, Soc. for Range Manage., Boise, ID. Feb. 8-13.



Villalobos, C., L. C. Fierro, S. Soltero, and F. C. Bryant. 1987. Nutritive quality of cattle diets under short duration and continuous grazing on a oak-bunchgrass range site in northern Mexico. 40th Annual Meeting, Soc. for Range Manage., Boise, ID. Feb. 8-13.

### Training

#### 1. Degrees in U.S.

Soltero, Sergio  
Citizenship: Mexican  
Degree Objectives: M.S. Range  
Host Institution: INIP-SARH  
Dates: Dec. 1984-May 1987 (graduated)

San Martin, Felipe  
Citizenship: Peruvian  
Degree Objectives: Ph.D.-Range Science  
Host Institution: IVITA/San Marcos  
Dates: Jan. 1984-Dec. 1987

Villena, Francis  
Citizenship: Peruvian  
Degree Objectives: M.S.-Range Science  
Host Institution: INIPA  
Dates: Jan. 1986-Dec. 1987

#### 2. Short-term

Villena, Corolla  
Citizenship: Peruvian  
Degree Objectives: Laboratory Technician  
Host Institution: INIPA  
Dates: Jan. 1986-Feb. 1987

#### 3. Degrees in Peru

Ccari, Estaban  
Citizenship: Peruvian  
Degree Objectives: ING-Range  
Host Institution: UNA-Puno  
Dates: Jaii. 1986-May 1987

Atamari, Godofredo  
Citizenship: Peruvian  
Degree Objectives: M.S.-Range  
Host Institution: UNA-Puno  
Dates: Jan. 1985-Dec. 1987

Condori, Hector  
Citizenship: Peruvian  
Degree Objectives: ING-Range  
Host Institution: UNA-Puno  
Dates: Jan. 1986-May 1987

Paricahura, Claudio  
Citizenship: Peruvian  
Degree Objectives: ING-Range  
Host Institution: UNA-Puno  
Dates: Jan. 1986-May 1987

Velande, Roberto  
Citizenship: Peruvian  
Degree Objectives: ING-Range  
Host Institution: UNA-Puilo  
Dates: Jan. 1986-May 1987

Silva, Angostine  
Citizenship: Peruvian  
Degree Objectives: ING-Range  
Host Institution: INIPA  
Dates: Jan. 1985-Dec. 1987

## 1987-1988 Annual Report

Title: **Sociological Analysis of Small Ruminant Production Systems**

Host Country: Peru

U.S. Institution: University of Missouri-Columbia

Host Country Institutions: PERU - INIAA  
Grupo Yanapai

Personnel: Principal Investigator:  
Michael F. Nolan

Resident Scientist:  
Maria Fernandez

Host Country Collaborators:  
Martha Abuhadba  
Manuel Estofanero  
Nilo Torres

Collaborating U.S. Scientists:  
Keith Jamtgaard  
Constance M. McCorkle

### RESEARCH RESULTS

Integrated Research in Peasant Communities. The SR-CRSP renewed its support for field research in communities of the Mantaro Valley in September 1987 after a one-year hiatus. Three Peruvian scientists were hired to support activities in the areas of breeding, range management, and agricultural economics. An office was organized in Huancayo, and field assistants were hired to gather field data. Sociology's resident scientist, Maria Fernandez, was assigned primary responsibility for coordinating these activities and for acting as intermediary between community representatives and the various project participants. Fernandez also played a central role in assisting with the design of technology validation experiments appropriate to conditions found in peasant communities.

In June 1988, all field work in the region had to be discontinued due to the tragic killing of two CRSP field workers, Constantine Gregory (agricultural economics) and Gustavo Rojas (animal health). Local and Embassy officials blamed the incident on guerrillas moving through the area, although no guerilla group has claimed responsibility for the attack.

Besides the tragic personal loss felt by everyone associated with the project, this incident triggered a shift in research emphasis -- from technology validation in the field to analysis of intermediate results. The Sociology Project accepted primary responsibility for coordinating the editing and production of 9 proposed publications based on the past several years of work in Mantaro communities. This move was in line with the larger Sociology Project thrust begun two years ago to synthesize and publish its research results to date across all SR-CRSP sites.

Technological Domains of Women in Mixed Peasant Farming Systems. In 1987-88, Oxfam America extended its support to the Grupo Yanapai for work with women's committees in the Mantaro Valley area. Women's committees had been formed there during 1986 to explore ways to address livestock management problems with those most directly responsible for herds -- the women. These groups also proved instrumental in achieving a better understanding of present husbandry practices.

In 1987-88, the focus of this research was expanded to include: not only production but also consumption, processing, and distribution of agropastoral products, as well as management of the natural resources need to produce them; in addition to women, the roles of community, interhousehold, and other biosocial groups (girls/boys, elder women/men) in crop/livestock systems; and with comparative field research directed by McCorkle in Cuzco Department in 1988, the southern as well as the central sierra.

This research seeks to determine which groups have decision-making authority, task responsibility, and technological knowledge in different crop and livestock domains, and the ways such knowledge is transmitted from one generation to the next. A related topic is the loss of knowledge regarding traditional production practices. Research in all the foregoing areas forms the basis for Abuhadba's thesis and Fernandez' dissertation, with continued analysis and reporting of data gathered prior to June 1988.

Ethnoveterinary R&D. With a Fulbright grant, McCorkle continued research on this subject in the community of Usi for five months in 1987. In 1988, a Spanish-language monograph on her earlier ethnoveterinary work appeared in Peru. Also in 1988, arrangements were made to prepare and publish an annotated bibliography of ethnoveterinary literature worldwide, with the collaboration of veterinarians at Iowa and Michigan State Universities. Plans are also underway for an edited anthology on this subject.

Analysis of Large-scale Statistical Data on Peasant Communities. During 1987-88, Jamtgaard continued to refine and publish his earlier analyses of a large-scale DCCN data base on agricultural production in Peruvian peasant communities.

Peru Technology Package. In 1988, the UMC Sociology Project assumed responsibility for coordinating, editing, and producing this document, working closely with the Range Management, Animal Health, Reproduction, and Economics Projects. As of the time of reporting, a draft of over 50% of the document is in hand and production and editing are underway.

Synthesis of a Decade of Research on the Sociology Project. Under this workplan, three ethnographies of Peruvian farming systems are underway; modest support was extended to a Peruvian scholar for preparation of an edited anthology on camelid pastoralism; and three new publications in the Spanish-language Serie Comunidades initiated by Sociology are planned. Also, Sociology/Peru research is well-represented in the forthcoming volume on the social sciences in international agricultural R&D, edited by the Sociology Project. One other synthetic effort completed in 1988 was an overview of all SR-CRSP communications and reporting strategies to date.

#### **PUBLICATIONS\***

\*Due to confusion arising from asystematic omissions of Sociology publications in last year's annual report, it is necessary to list both 1986-87 and 1987-88 communications in this report.

#### **Books and Chapters in Books**

Fernandez, M.E. 1988. Technological Domains of Women in Mixed Farming Systems of Andean Peasant Communities. In S.V. Poats, M. Schmink, and A. Spring (eds.), Gender Issues in Farming Systems Research and Extension. Westview Press, Boulder, CO. pp. 213-221.

Guillet, D.W. 1987. Contemporary Agricultural Terracing in Lari, Colca Valley, Peru: Implications for Theories of Terrace Abandonment and Programs of Terrace Restoration. In W.M. Denevan, K. Mathewson, and G. Knapp (eds.), Pre-Hispanic Agricultural Fields in the Andean Region. BAR International Series 359. Oxford U. Press. Pp. 193-206.

#### **Abstracts**

Fernandez, M.E. 1987. Desarrollo Comunal: Estrategia y Acciones. Anales del V Congreso Internacional de Sistemas Agropecuarios Andinos. Puno, Peru. P. 492-493.

### Journal Articles and Proceedings (Refereed)

- Esslinger, D.L. and C.M. McCorkle. 1986. Communications in FSR Team-Building: The Interdisciplinary Research Team. Proceedings of Kansas State University's 1985 Farming Systems Research and Extension Symposium: Management and Methodology. Kansas State University, Manhattan, KS. pp.158-175 (supporting).
- Esslinger, D.L. and C.M. McCorkle. 1986. Communications on Agricultural Research, Development, and Extension Teams. Agricultural Communications in Education Quarterly 69(4):7-17 (supporting).
- Guillet, D.W. 1987. Terracing and Irrigation in the Peruvian Highlands. Current Anthropology 28(4):409-430.
- McCorkle, C.M. 1986. An Introduction to Ethnoveterinary Research and Development. Journal of Ethnobiology 6(1):129-149.
- McCorkle, C.M. and J.L. Gilles. 1987. Stereotypes and Roles of Social Scientists in International Agricultural Development. The Rural Sociologist 7(3):216-224 (supporting).

### Manuscripts Submitted or in Press

- Guillet, D.W. In press. Irrigation and Power in Southern Peru. In S. Smith and E. Reeves (eds.), Human Systems Ecology: Studies in the Integration of Political Economy, Adaptation, and Socionatural Regions. Westview, Boulder.
- Jamtgaard, K. Forthcoming. Targeting Production Systems on the SR-CRSP: A Typology Using Cluster Analysis. In C.M. McCorkle, ed. The Social Sciences in International Agricultural Research: Lessons from the CRSPs. Lynne Rienner Publishers, Inc., Boulder.
- McCorkle, C.M. Forthcoming. Introduction. In C.M. McCorkle, ed. The Social Sciences in International Agricultural Research: Lessons from the CRSPs. Lynne Rienner Publishers, Inc., Boulder.
- McCorkle, C.M. In press. "Veterinary Anthropology". Human Organization, Fall 1988.
- McCorkle, C.M. Forthcoming. Veterinary Anthropology on the Small Ruminant CRSP/Peru. In C.M. McCorkle, ed. The Social Sciences in International Agricultural Research: Lessons from the CRSPs. Lynne Rienner Publishers, Inc., Boulder.
- McCorkle, C.M., M.F. Nolan, K. Jamtgaard, and J.L. Gilles. Social

Research in International Agricultural R&D: Lessons from the Small Ruminant CRSP. Submitted to Agriculture and Human Values (supporting).

### Technical Communications

- Bilinsky, P. 1986. Exchange Labor in a Highland Peruvian Community. International Sociological Association XI World Congress of Sociology, New Delhi, India.
- Bursten, J. and M. Abuhadba. 1987. Proposal for Overcoming Western Bias in a Land Grant University WID Program. Association for Women in Development Conference, Washington, DC.
- Fernandez, M.E. 1986. Technological Domains of Women in Mixed Farming Systems of Andean Peasant Communities. Conference on Gender Issues in Farming Systems Research and Extension, The Women in Agriculture Program (WIA), University of Florida, Gainesville.
- Fernandez, M.E. 1986. Participatory-Action-Research and the Farming Systems Approach with Highland Peasants. SR-CRSP Technical Report No. 75 (33 pp.) NTIS # PB87 196200/AS.
- Fernandez, M.E. 1988. Methodologies for Working with Community-based Farmers. ILEIA Workshop on Participative Methodologies for On-Farm Research. Lusden, Netherlands.
- Fernandez, M.E. 1988. Participative Research with Community-based Highland Farming Systems. XVI Congress of the Latin American Association of Animal Producers. Havana, Cuba.
- Guillet, D.W. 1986. Alfalfa Introduction, Animal Management, and Land Tenure in an Andean Village. The Annual Farming Systems Research & Extension Symposium: Food and Feed. Kansas State University, Manhattan, KS.
- McCorkle, C.M. 1986. Veterinary Anthropology on the Small Ruminant CRSP/Peru. The Cross-CRSP Conference, "Bringing People In: Social Research in International Agricultural Development." University of Missouri-Columbia.
- McCorkle, C.M. 1987. Principles into Practice. Anthropology Newsletter 28(5):2.
- McCorkle, C.M. 1988. Manejo de la Sanidad de Rumiantes Menores en una Comunidad Indigena Andina. Documento de Trabajo No. 1. Comision para la Coordinacion de la Tecnologia Andina, Lima (77 p.).

- McCorkle, C.M., D.L. Esslinger, and J.L. DeWeese. 1988. Communicating and Disseminating Project Results: A Model from the Small Ruminant CRSP. Farming Systems Research & Extension Symposium, University of Arkansas-Fayetteville (supporting).
- Perevolotsky, A. 1983. Herder-Farmer Relationships in the Tropical Desert of Piura, Peru. International Congress of Anthropological and Ethnological Sciences, Vancouver.
- Swindale, A.J. 1985. Diagnostico de las Comunidades Alto-andinas del Valle del Manataro. IVITA/SR-CRSP, Lima.

### Verbal Presentations

- Bilinsky, P. 1986. Fieldwork in Peru: Issues and Observations. The Noel P. Gist Luncheon Seminar on International Affairs. University of Missouri-Columbia.
- Fernandez, M.E. 1987. Farmer Participatory Research. Institute for Development Studies (IDS). University of Sussex, Brighton, U.K.
- Fernandez, M.E. 1988. Advances of the Community Technology Validation Project. USAID Seminar, Lima.
- Fernandez, M.E. 1988. Kellogg Fellow to the World Congress of Rural Sociology. Bologna, Italy.
- Fernandez, M.E. 1988. Organizer, Taller de Investigacion Participativa con Pequenos Productores Comuneros. (Workshop on Participative Research with Small Community Producers.) Huancayo, Peru.
- Fernandez, M.E. 1988. Research with Community-based Small Farmers in Peru. USAID Seminar, La Paz, Bolivia.
- McCorkle, C.M. 1987. Doing Development: Brazil, Indonesia, Kenya, Morocco, Peru. The Noel P. Gist Luncheon Seminar on International Affairs. University of Missouri-Columbia (supporting).

### Training

#### **Degree Oriented**

- o Martha Abuhadba, Peruvian, MS Rural Sociology, UMC, in progress.
- o Manuel Estofanero, Peruvian, MS Community Development, UMC, in progress.



- o Maria Fernandez, American/Peruvian, PhD, Rural Development, University of Reading, in progress.
- o Keith Jamtgaard, American, PhD Rural Sociology, UMC, in progress.

## MAJOR ACCOMPLISHMENTS

1. Three workshops in Spanish conducted primarily by Peruvian scientists were held in Bolivia and at two locations in Peru, with 300 participants in attendance. These efforts represented the first attempt to regionalize the program at any overseas location.
2. Field data collection in the peasant communities in the highlands progressed well until the tragic killing of two SR-CRSP fieldworkers in June, 1988. As a result, field activities were suspended, but analysis of the data continues, with the prospect of nine interdisciplinary publications emanating from the data.
3. Organization and initial development of the technology package got underway.
4. The enterotoxin, Clostridium perfringens Type A, which is involved in neonatal mortality of alpacas, llamas, and perhaps lambs, was purified by the veterinarian scientists. These developments could lead to field diagnostic tests and eventually to a vaccine.
5. The causative virus of ovine pulmonary carcinoma (OPC), a common and economically important contagious lung tumor of sheep in Peru, has been successfully transmitted to newborn lambs. Furthermore, sensitive assays have been developed to detect viral proteins. Research in the near future should lead to isolation of the OPC virus and development of a new diagnostic test and perhaps a vaccine for the disease.
6. Several native plants were examined for their efficacy in treating endo- and ecto-parasites. Varying degrees of effectiveness were demonstrated and some show considerable promise as "home remedies."
7. Crop and animal production are so closely linked in the highlands that they cannot be considered independent economic enterprises. Also, the time invested in small ruminant production is twice that of crop production even though livestock are normally considered ancillary to crops.
8. Research on breeding revealed the reasons peasants refuse to castrate males (quicker growth) and the selection criteria for rams used for breeding. In addition, research is elucidating the contribution of male and females to production traits, thereby providing guidelines useful to extension specialists as they work with producers.

9. Grazing land research has demonstrated that stocking rates are the primary influence on animal performance traits, such as fleece weights, staple length, and lamb crops. Stocking rates that exceed four to five sheep units per hectare negatively impact sustainable animal production and the health of native vegetation. Improving the plane of nutrition before and during breeding by using cultivated pasture improved production levels by as much as 25%.
10. Significant findings emanating from special short-term projects include the following:
  - a) The ovulatory hormones, LH and GNRH, show promise for inducing super ovulation in camelids.
  - b) Female alpacas may be bred at one year of age rather than the traditional three years of age by strategic use of cultivated forages.
  - c) Losses from poisonous plants can be attributed to photo sensitization and astragalus poisoning. Nine genera were pointed out as serious floral agents identified as causing losses in small ruminants.
11. The projects produced forty-one journal publications, thirty-three technical publications, thirty-three abstracts, and two chapters in books. Twenty-four presentations were made at scientific meetings, symposia, and workshops in Peru and in the U.S. Four workshops were given in Peru and one in Bolivia. Three Peruvians and one U.S. scientist received the first award given by Peruvian Association for Animal Production for their work on diseases in alpacas.
12. Two students completed their M.Sc. degree in the U.S., and one his ingeniero degree in Peru; three are continuing their studies for the M.Sc. in the U.S., two their Ph.D. in the U.S., and three their graduate degrees in Peru, all with full or partial support from the SR-CRSP.
13. Findings from sociological research on gender roles indicate that women are the principal actors in livestock production in Andean peasant communities. The SR-CRSP has developed methods to work directly with them.

| <u>COUNTRY</u> | <u>SR-CRSP<br/>DISCIPLINE</u>                                | <u>PRINCIPAL<br/>INVESTIGATOR</u>                    | <u>COLLABORATING<br/>SCIENTIST</u>        |
|----------------|--|--|---|
| Indonesia:     | Animal Nutrition   | K. Pond  | B. Maryanto                               |
|                | Economics  | H. Knipscheer  | T. Soadjana                               |
|                | Breeding   | E. Bradford  | B. Gunawan                                |
|                | Sociology  | M. Nolan<br>J. Gilles                                | K. Suradisastri                           |
| Kenya:         | Breeding/<br>Systems Analysis                                | T. Cartwright  | C. Ahyua<br>B. Mwandotto                  |
|                | Animal Health  | T. McGuire   | S. Chema<br>S. Waghela                    |
|                | Economics  | H. Knipscheer  | F. Nyaribo                                |
|                | Production Systems<br>Feed Resources<br>Nutrition Management | H. Fitzhugh  | K. Otieno<br>M. Mathuva<br>M. Simba       |
|                | Sociology  | M. Nolan<br>J. Gilles                                | A.N. Mbabu                                |
| Morocco:       | Genetics   | E. Bradford  | A. Lahlou-Kassi                           |
|                | Nutrition  | K. Pond  | F. Guessous                               |
|                | Range  | J. Malechek  | H. Narjisse                               |
|                | Sociology  | M. Nolan<br>J. Gilles                                | A. Hammoudi                               |
| Peru:          | Animal Health  | J. DeMartini   | E. Ameghino                               |
|                | Breeding   | P. Burfening   | J. Chavez                                 |
|                | Economics  | H. Knipscheer  | D. Martinez                               |
|                | Range Management<br>Sociology                                | F. Bryant<br>M. Nolan<br>K. Jantgaard<br>C. McCorkle | A. Florez<br>M. Abuhadba<br>M. Estafonero |

## SR-CRSP ADMINISTRATIVE COUNCIL

|                   |                             |
|-------------------|-----------------------------|
| Robert C. Albin*  | Texas Tech University       |
| Antonio Chavez#   | INIAA - Peru                |
| Samson Chema#*    | MALD - Kenya                |
| Elmer Clark       | Utah State University       |
| James Henson      | Washington State University |
| Larbi Firdawcy#   | AIV-Hassan II-Morocco       |
| Charles Lassiter* | N. Carolina State Univ.     |
| Arthur Linton*    | Montana State University    |
| Allen G. Marr*    | University of California    |
| Carl Menzies*     | Texas A&M University        |
| Jan Nari#         | CRIAS-Indonesia             |
| Gordon Niswender  | Colorado State University   |
| Ned S. Raun*      | Winrock International       |

\* Member of Board of Directors  
# Host Country Representative

## EXTERNAL EVALUATION PANEL

|                      |                             |
|----------------------|-----------------------------|
| S. Gordon Campbell   | Cornell University          |
| Saul Fernandez-Baca  | Peru                        |
| William Flinn        | Ohio State University       |
| Gerald Thomas, Chair | New Mexico State University |

## MANAGEMENT ENTITY STAFF

|                |                            |
|----------------|----------------------------|
| James Oxley    | Program Director           |
| James Scott    | Assistant Program Director |
| open           | Administrative Assistant   |
| Lucia Lojewski | Accounting Assistant       |

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