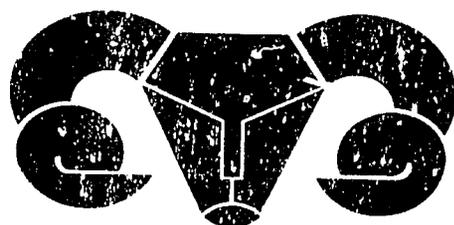


- PN-ABC-798

**Small Ruminant  
Collaborative Research  
Support Program**

**Annual Report for  
Indonesia**

**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,  
Morrilton, Arkansas

**SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM**

**ANNUAL REPORT FOR INDONESIA**

**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

The SR-CRSP program in Indonesia has followed the farming systems research approach. This is reflected in the development of the research activities over the last nine years, which can be divided into several stages: baseline data collection (descriptive/diagnostic), technology development (on-station research trials), and on-farm testing. A fourth, and complementary, final stage in a formal farming systems approach is the extension of the tech packs developed to the end users. Although extension is outside the mandate of the SR-CRSP and its host institution in Indonesia (the Research Institute for Animal Production), the program has developed sui generis methodologies that can be used by extension services, from its on-farm technology development research. These methodologies explore, among other aspects,

- new avenues to maximize the receptivity of the farmers to a given technology;
- the magnitude and direction of the interaction between a given technology and type of practical recommendations associated with that technology; and
- dynamic alternatives to improve the information exchange gap that often exists between researchers and the end user of new technologies.

At present, the program is operating its interdisciplinary testing phase, which has received an important boost during 1987-1988. A key element of this testing phase is the Outreach Pilot Project (OPP), where new tech packs are developed and focused on the production problems outlined by the farmers. The tech packs are produced by the disciplines of the different projects (i.e., nutrition, breeding, etc.) through their discussions and collaboration with the farmers. This methodology incorporates traditional knowledge with current information.

In this process, emphasis has been given to shortening the lambing interval, reducing lamb mortality, increasing weaning weights, improving marketing information for farmers, improving feeding management, and designing barns. In the Outreach Pilot Project, it was shown that a combination of shorter lambing intervals, lower lamb mortality rates, and higher proportions of ewes successfully being bred consistently raised the animal's reproductive performance, as reflected by the information contained in Table 1. A major part of this improvement is believed to be due to the application of feeding and management recommendations developed in the SR-CRSP, combined with the availability of ewes with high genetic potential for prolificacy.

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**Table 1**

Reproductive performance traits in small ruminants in the OPP compared to earlier West Java Studies.

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Traits <sup>1</sup>	West Java <sup>2</sup>		OPP <sup>3</sup>
	1982	1986-87	1987-88
% lambs/kids born	126	145	184
% lambs/kids weaned	113	116	166

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<sup>1</sup>On the basis of ewes available

<sup>2</sup>Knipscheer et al., 1983

<sup>3</sup>B. Setiadi, 1988

Correspondingly, a number of tech packs available for on-farm testing include (1) high prolificacy contributed by the Javanese Thin-tailed sheep; (2) hair-sheep cross; (3) improved housing for animals; (4) use of gliricidia, leucaena, and sesbania tree legumes as feed supplement; (5) use of ampas tahu (soybean waste); (6) cassava leaves as a feed supplement; (7) use of ensiled grasses during the dry season; (8) integrated sheep-rubber plantation management systems; (9) care of lambs at birth; (10) several animal health improvement measures; (11) composting system for feces and feed refusals; (12) marketing at optimum weight; and (13) various health care technologies. While high prolificacy and feed supplementation technologies have been developed for the confinement (cut-and-carry) system, the hair sheep and the sheep-under-rubber management practices are technologies geared for grazing systems.

The economics and sociology components are the principal organizers in the on-farm testing and farmer participatory research program. These efforts are conducted in collaboration with the biological components, generally under the umbrella of the OPP in West Java, or the ORP (Outreach Research Project) in Sei Putih, North Sumatra. With increasing emphasis in user-based technology development, assessing the economic and social acceptability of the various tech packs will be a critical area of on-farm research. In addition, the economics program has begun a large-scale pricing efficiency and marketing study on Java, where the vast majority of Indonesia's small ruminants are maintained. This study was designed to gather data concerning livestock markets, slaughter houses, middlemen, and small ruminant farmers' marketing strategies.

Additional on-station work on the above and other technologies

is continuing as an integral part of the disciplinary research of the participant. Continuation of this on-station work is necessary for the development of future technologies and the reshaping or adjustment of the existing technologies through farming systems research methodologies.

Research results obtained at the Citadas Station during the first year provide confirmation of segregation of a major gene for prolificacy in Javanese sheep. Based on this information, good progress is being made developing lines with high or moderate levels of prolificacy, permitting adjustment of genetic potential for prolificacy to different types of environments with regard to feeding constraints. For instance, prolific ewes (producing predominantly twins and occasionally triplets) could increase substantially the productivity of production systems in areas where forage and feed availability are not constrained.

In Sei Putih, North Sumatra, the evaluation of hair sheep in an integrated system of grazing under rubber plantations is in progress. Crosses of local and hair sheep, compared to local sheep stands, have shown higher growth rates and less proportion of wool. This research will continue to assess the comparative advantage of hair sheep in reproduction and in overall production performance. Hair sheep avoid the need for shearing and, since the wool is not sold, represent a significant saving in labor.

Nutritional studies are focusing on the use of agricultural by-products (especially from rubber and oil-palm trees), supplementation studies (the use of legumes, of different energy products, and of minters), and feeding strategy studies. The focus of the nutrition research is shifting slowly to Sei Putih, where rotational grazing studies under young and aged rubber trees are being conducted in conjunction with studies exploring alternatives for improving the quality of forage by introducing and testing new forages and shade-tolerant species.

During 1987-88 the SR-CRSP provided full sponsorship to five graduate students: 2 Ph.D. degrees (breeding and economics), and 3 M.Sc. degrees (breeding, nutrition, and sociology).

#### **Literature Cited**

Knipscheer, H.C., M. Sabrani, A. J. De Boer, and T. D. Soedjana. 1983. The economic role of sheep and goats in Indonesia: A case study of West Java. Bulletin of Indonesian Economic Studies XIX (3): 74-93.

Setiadi, Bambang. 1988. Reproduction Efficiency of Sheep and Goats from OPP Farmers (October 87-September 88), Mimeo, Balai Penelitian Ternak/SR-CRSP, Bogor/Ciawi, Indonesia.

## 1987-1988 Annual Report

Title: Genetic Improvement of Sheep and Goats

Host Country: Indonesia

U. S. Institution: University of California, Davis

Host Country Institution: Balai Penelitian Ternak (BPT)  
Bogor, Indonesia

Personnel: Principal Investigator:  
G. E. Bradford

Resident Scientist:  
Luis Iniguez, Ph.D

Collaborating Scientists:  
Benny Gunawan, Ph.D., Co-PI  
Bess Tiesnamurti, M.S.  
Ismeth Inounu  
Bambang Setiadi, M.S.  
Subandriyo, M.S. (on study leave)  
Muryanto  
Elianor  
Sirman Purba  
Djoko Pitono  
Manuel Sanchez, Ph.D. (NCSU)

### RESEARCH RESULTS

Recent data on ovulation rates in the experimental flock of Javanese sheep maintained at the Cicadas Station near Bogor provide confirmation for the hypothesis of a major gene for prolificacy in these sheep. Mean ovulation rates of yearling ewes from "High" and "Low" dams (with some similar selection on paternal grandams) were 2.10 and 1.50 respectively. This is a larger difference than produced by 10 generations of selection for multiple births in an experimental flock of sheep in California, and clearly indicates a genetic basis other than the usual quantitative model. The results indicate it will be possible to develop lines with a high frequency of the prolificacy gene ( $F^J$ ) and a resulting consistently high ovulation rate and litter size (predominantly 2's, 3's, and 4's), and without the gene, resulting in almost exclusively 1's and 2's. With this kind of predictability, genetic potential and nutrition/management can be appropriately matched, leading to more efficient use of resources for sheep production.

The evaluation of hair sheep and their crosses in a system of grazing under rubber is progressing well. Pure hair sheep are performing satisfactorily, with a higher growth rate than the local sheep (as expected based on their larger mature size). F<sub>1</sub> animals tend to have considerable wool, although there is much variation, and F<sub>1</sub> individuals free of wool are found. The growth rate of F<sub>1</sub>'s is also higher than that of the local North Sumatra sheep. Sufficient ewes are now available for a good evaluation of reproduction (including lambing interval) of the three breed-groups, and this will be carried out in 1988-89 and 1989-90.

Work in the U.S. is continuing on the evaluation of the lines of sheep selected for many generations for growth and multiple births, on their linecrosses, on out-of-season breeding, and on cryopreservation of embryos. This work is largely supported by non-CRSP funds, but complements the research in Morocco and Indonesia, and contributes to the training of Host Country, U.S., and third country graduate students.

## **PUBLICATIONS**

### **Technical Communications**

Gatenby, R. M., R.A.C. Jensen, Subandriyo and G. E. Bradford. 1988. Actual and potential levels of performance of Indonesian sheep and goats under traditional management systems. SR-CRSP Technical Report No. 97. 36 pp.

### **Theses**

Tiesnamurti, Bess. 1987. Inheritance of prolificacy in Javanese Thin Tail Sheep. M.S. Thesis, Univ. of Calif., Davis. (Studies supported by World Bank Fellowship; research supported by SR-CRSP).

### **Training**

#### **Degree Oriented:**

- o Bess Tiesnamurti. Completed M.S. at U.C. Davis, December 1987. (see comment under Theses).
- o Subandriyo. Ph.D. program at U. Mo; Columbia, funded by UCD Breeding Project. 1987-1990.

- o Ismeth Inounu. M.S. Program, Institute Pertanian, Bogor, funded by UCD Breeding Project 1987-1989.

## 1987-1988 Annual Report

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

Host Country: Indonesia

U.S. Institution: Winrock International

Host Country Institution: Balai Penelitian Ternak (BPT),  
Research Institute for Animal  
Production (RIAP)

Personnel: Principal Investigator:  
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Resident Scientist:  
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Sri Wahyuni  
Beriadjaja (veterinarian)  
A. Adjud (veterinarian)  
Kedi Suradisastra, Ph.D.  
Darwinsyah Lubis, M.Sc.  
Syahrir Mawi  
M. Sabrani (Ph.D. student)  
Setel Karo-Karo (M.Sc. student)  
Agus Muljadi N. (Ph.D. student)

### RESEARCH RESULTS

The major emphasis for this phase of the SR-CRSP is the implementation and economic evaluation of the research findings from the past several years of the project into forms, i.e., Technology Packages, that a selected group of small ruminant

Outreach Pilot Project (OPP) farmers, neighboring farmers, and livestock extension personnel can readily understand, adopt, and transfer. This research is directed toward improving the productivity of sheep and goats at the village level thereby improving the farm families' nutrition and income derived from raising small ruminants. The research staff has emphasized the need for research on innovative technologies that are economically feasible, socially acceptable, and capable of having a significant positive impact on the welfare of small farmers. Continued emphasis has been placed on sustainable technologies designed around the socioeconomic constraints of the small farmers.

### **Evaluation of Small Ruminant Technology Development and Transfer Methodologies**

During the early part of this year a strengthening component was added to the CPP's data collection and information dissemination network concerning increasing small ruminant productivity. This component was called "Progressive Farmers in Limited Extension" (PROFILE). It was begun due to an analysis of the animal performance data--i.e., lambing/kidding interval, lamb/kid mortality rates, and parturition percentages--over the first three and one-half years of the OPP that indicated that the participating farmers were performing well below Research Station Determined Potentials of the local animals. It was determined that there was an inadequate exchange of information concerning production problems, constraints on the farmers resources, recent technology improvements, and marketing alternatives.

Four concentration areas were identified among several major issues to direct the on-farm research work designed to close the communication/information gaps between the farmers, researchers, and livestock extension staff. The methodological issues raised with each area are being resolved with time. The four areas included to (1) develop on-farm tested small ruminant technologies (Tech Packs) and methods or strategies for transferring this information to the small farmers; (2) provide the opportunity for small farmers to meet regularly to discuss their sheep and goat production, and marketing constraints; (3) develop the communication and problem-solving abilities within and between various groups of small farmers; and (4) encourage participation and provide practical training for the extension agents who are participating in these research and extension activities.

The effectiveness of this farming systems approach is evaluated from two perspectives: a qualitative analysis of the information exchange methodologies being employed, and a quantitative analysis including animal performance criterion, and an economic analysis of changes in the market structure and price fluctuations.

Mr. Wilbur Scarborough and Mr. Amidjono Martosuwiryo joined

the research teams visits to the small ruminant farmers villages on several occasions to review the research and extension activities in progress.

#### **Characteristics of High and Low Performance Farmers in the OPP**

A survey was conducted during May 1988 to determine the difference in management practices between the 10 highest and 10 lowest performing farmers in the OPP, in terms of animal performance data. The questionnaire solicited data in the areas of animal management, education level, labor availability, land holding, and other socioeconomic variables. The results of the study have shown that the labor available to the farmers had a significant affect on the management practices of the small ruminant farmers. The study also indicated that education and land ownership also have a positive relationship toward management techniques used by the small ruminant farmers.

#### **West Java Pricing Efficiency and Marketing Margins for Small Ruminants**

A study on pricing efficiency and marketing margins for small ruminants was conducted in eight districts in West Java during September 1988. In addition to secondary data collected at these livestock data collection centers, questionnaires were used to gather data concerning livestock markets, slaughter houses, middlemen, and small ruminant farmers marketing strategies. The major purpose of this study was to provide information for analyzing the profitability of small ruminant enterprises. The specific objectives of the study were: (1) determine the existing marketing channels for small ruminants, (2) determine the small ruminant supply responses to various factors, (3) obtain data and analyze relationships between factors of production and supply potentials at specific periods throughout the year and (4) evaluate alternative marketing strategies for the farmers for increasing income generated from small ruminant enterprises.

A seminar for small ruminant farmers, entrepreneurs, market agents, and government livestock service officers is planned for December 1988 to discuss the research findings and recommendations derived from this research.

#### **Outreach Research Project (Sungei Putih Sumatera) Constraints to Smallholder of Sheep Under Rubber Trees Systems**

Forty-eight ewes were distributed among 12 farmers in two communities in order to test and demonstrate improved management and feeding practices.

Half of the ewes were bred to a local ram and half to a St. Croix (hair sheep) ram. The first nutrition study is the supplementation with Palm Kernel Cake (PKC) to half of the ewes

during later pregnancy and lactation. Each farmer supplements two ewes, one of each breeding treatment, and has two as a control. The birth and weaning weights, the survival percentage, and the second conception rates will be assessed in the two supplementation treatment groups.

### **Standards for Animal Performance in the Outreach Pilot Project**

Data from the breeding aspects of the Outreach Pilot Project (OPP) have been collected from individual OPP farmers during monthly farm visits throughout the previous 12 month period. A final analysis of the data will be tabulated in early October 1988. It is hoped that the reproduction parameters will indicate an improvement over last years performance data, perhaps reflecting the improved communication and information exchange efforts of the recently initiated extension research.

### **Group Dynamics in the Outreach Pilot Project**

The OPP was begun 4 years ago as a multidisciplinary research activity for on-farm technology testing. The CRSP provided 17 groups of farmers (2 farmers per group) with a small raised barn and 4 ewes and 1 ram. Subsequently, from the original 17 groups only 9 presently exist. This research addresses the issues concerning why some of the groups have separated and individual farmers who are now responsible for the animals. To obtain this information, all of the OPP farmers were interviewed concerning the problems and advantages of the group versus individual management techniques.

### **Manual**

During the last 2 years steady progress has been made in the development of a manual on the economic analysis of On-Farm Animal Research (OFAR). The goal of this manual is to give the reader skills in designing, testing, and evaluating livestock technologies that can be used by small farmers. Some specific objectives are:

- To explain the framework of on-farm animal research with special emphasis on its economic evaluation;
- To describe the economic, statistical, and animal-production concepts that apply to conducting on-farm animal research;
- To provide case studies and analytical tools that will help researchers and extension workers improve animal productivity at the farm; and
- To provide training materials that can be used in farming systems research, animal husbandry, farm management, and extension.

This manual is aimed at junior- and middle-level researchers and extension workers interested in the conduct and economic analysis of on-farm animal research. It also should be helpful to graduate students taking a course in animal husbandry that focuses on animal production systems research. This project is a result of the collaboration between the SR-CRSP, the Economic Analysis Support Program which is managed jointly by AID and the Office of International Cooperation and Development (OICD) at USDA. Co-sponsors are the International Development Research Center (IDRC) and Winrock.

## **PUBLICATIONS**

### **Technical Communications**

Priyanti, A., B. Setiadi, D. Lubis, A. Abjid, and M. Rangkuti. 1988. Report on the Third Annual Outreach Pilot Project (OPP) Farmers Meeting, Working Paper Series #93.

Priyanti, A., S. Mawi, and Kedi Suradisastra. 1988. Farmers Responses to the Outreach Pilot Project (OPP): First Socioeconomic Evaluation, Working Paper Series #94.

2 Outreach Pilot Project Farmers newspapers have been published.

### **Bulletins**

16 extension bulletins have been published in various small ruminant management areas.

### **Training**

#### **Degree Oriented**

Mr. Agus Muljadi N. is continuing his Ph.D. studies at the University of the Philippines at Los Baños with limited support from SR-CRSP funds.

Sri Wening Handayani has begun her M.Sc. studies in rural sociology at the University of Missouri at Columbia.

M. Sabrani is continuing his Ph.D. studies at Gadjah Mada University in Indonesia.

Setel Karo-Karo is continuing his M.Sc. studies at the University of Arkansas.

## **Nondegree Oriented**

A 5-month English conversation, presentation skills, and technical writing course is continuing for the research and technical support staff.

Course work for five students involved with village training are continuing in Semarang, C. Java, and Sumedang, West Java.

Five members of the technical support staff are continuing their computer application course work in Bogor.

## 1987-1988 Annual Report

Title: Nutrition and feeding Systems  
Research for Small Ruminants in  
Indonesia and Morocco

Host Country: Indonesia

U.S. Institution: North Carolina State University

Host Country Institution: Balai Penelitian Ternak  
(Animal Production Institute)  
  
Sub-station of BPT, Sungai-Putih  
North Sumatra

Other Institutions: Research Institute for Rubber  
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Bogor Agricultural Institute

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31, 1988)

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Dr. Asril Darussamin (Biochemistry)

North Carolina State University, Raleigh (USA)

Dr. Manuel D. Sanchez (Resident Scientist at Sungai Putih)  
Dr. Kevin R. Pond (Principal Investigator)  
Dr. William L. Johnson (Previous Principal Investigator)  
Dr. Jean-Marie Luginbuhl  
Dr. Jerry W. Spears  
Alice Reese (completed Ph.D. May 1988)  
Ms. Silvia Buntix (M.S. candidate)

RESEARCH RESULTS

**BOGOR**

1. Fiber Utilization by Indonesian Kacang Goats Fed Mixed Native Grass Forage Supplemented with Zinc and Nitrogen. Budi Haryanto.

A series of three experiments was conducted at the Research

Institute for Animal Production, Bogor, Indonesia.

The purpose was to investigate the utilization of forage cell wall constituents of native tropical grasses as affected by the supplementation of zinc, and/or nitrogen in the form of urea or legume tree foliage (*L. leucocephala* or *G. maculata*), and to provide more information toward an optimum strategy for utilizing mixed native grasses for goats.

Growing male Kacang (dwarf) goats, (8 months old), were used in the three experiments.

Results of experiment 1 indicate that intake and digestibility of neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose and hemicellulose were not significantly different among treatments ( $P > .05$ ). A faster weight gain and higher estimate of rumen microbial protein production were obtained in the group supplemented with both zinc and nitrogen ( $P < .01$ ).

Results of experiment 2 show a significant interactive effect between zinc and urea supplementation on the intake of NDF, ADF, cellulose and hemicellulose, in that adding either zinc or urea alone increased intake, but the two together decreased intake. Digestibility coefficients for NDF were not different among treatments. ADF and cellulose digestibility coefficients were reduced ( $P < .05$ ) by legume tree foliage supplementation. Digestibility of hemicellulose and liquid digesta passage rates were not different among treatments ( $P > .05$ ), but solids passage rates were reduced by zinc supplementation ( $P < .05$ ). A faster ( $P < .05$ ) weight gain in the group supplemented with legume tree foliage alone, compared to the control treatment, was observed. Rumen ammonia-N concentrations were increased by supplementation with urea ( $P < .01$ ) or legume tree foliage ( $P < .05$ ). Rumen concentrations of volatile fatty acids were not affected by zinc or urea supplementation, except isovaleric, which was increased ( $P < .01$ ) by urea. Acetic, propionic, isobutyric, and isovaleric acid concentrations were increased ( $P < .01$ ) by legume tree foliage ( $P < .01$ ). Molar percentage of propionic acid was increased ( $P < .05$ ) by zinc supplementation. Molar percentage of butyric acid was reduced by legume tree foliage supplementation ( $P < .05$ ). Rumen pH did not vary appreciably, with an overall mean of 7.1. Estimates of rumen microbial protein production were not different among treatments, ranging from 18.5 to 27.4 g microbial crude protein per day ( $P > .05$ ). Plasma concentration of copper was slightly reduced ( $P > .05$ ) in individuals supplemented with zinc.

In experiment 3, intake and digestibility of NDF and its constituents were significantly increased by supplemental zinc at the lowest level of legume supplementation (10%), but were decreased by supplemental zinc at 20 and 30% legume supplementation ( $P < .05$ ). Animal growth performance was lower than in experiments 1 and 2.

It is concluded that nitrogen, particularly in the form of legume tree foliage protein, is an advantageous supplement to a basal native grass diet for growing Kacang goats. Supplemental zinc may be advantageous, especially in the presence of adequate nitrogen and energy. Although data were inconclusive, these positive effects of zinc and nitrogen on animal weight gain may be due to a higher rumen microbial protein production, since no significant improvement of intake and digestibility of forage cell wall constituents was observed.

Further investigation is recommended on the rumen microbial protein production and the possible negative effect of the legume gliricidia on cellulose digestion, with native grass diets.

2. Detoxication of cassava leaves in sheep diets. I. Triiodothyronine concentrations in blood samples of sheep fed cassava leaves as basal diets. B. Sudaryanto, A. Djajanegara and S. Sitorus.

Cassava leaves, an important agricultural byproduct, is a protein rich material (18-35 percent crude protein content) found in abundance and readily obtainable. The cassava leaves used in this experiment is the bitter cassava variety (HCN content in leaves: 1253 ppm) and 22 percent crude protein content. Twenty-four Javanese Fattail rams (average live weight 15.4 kg) were divided into 4 groups of six rams and were given the following dietary treatments R-I: Basal Ration (RB); R-II: 70% RB + 30% Cassava leaves; R-III: 40% RB + 60% Cassava leaves and R-IV: 10% RB + 90% Cassava leaves. The Basal ration contained 13% crude protein and 70% Total Digestible Nutrients.

The results show no effect of dietary treatments on T3 concentration in blood serum taken either in the morning or in the afternoon. The T3 concentrations in the blood samples of rams fed R-I, R-II, R-III and R-IV were 139; 157; 153 and 126 n mol/l, and 118; 129; 115 and 105 n mol/l, for the morning and afternoon samples, respectively.

3. Native grass and legume digestion in situ. I. In Situ Potential Degradability of Cell Walls and Nitrogen in Several Native Grasses Special and Napiergrass. H. Pulungan.

In situ degradability of dry matter (DM), neutral detergent fiber (NDF), and nitrogen (N) of 12 native grass species (50% bloom) and mixed native grass from Ciburuy-Bogor as well as napiergrass (~6 weeks) obtained from Balitnak-Bogor have been investigated using 4 male mature, ruminally cannulated Ongole grade cattle as the media for incubation. Samples were incubated for 6 different durations: 0, 6, 12, 24, 48, and 72 h.

Significant ( $P < 0.01$ ) effects of time of incubation, grass

species and their interaction were observed for DM degradability of native grass (mixed), *I. timorense*, *E. indica* were not different ( $P>0.05$ ). The other species were lower except for *P. barbatum* which was higher ( $P<0.05$ ).

The degradability of DM, NDF and at 24 and 72 h incubation were significantly different among species. At 24 h, 3 species were lower and 4 species were higher in their N degradability ( $P<0.05$ ) compared to napiergrass; 3 sp. were lower and one sp. higher than napiergrass after 72 h incubation. For NDF, 2 sp. were lower and 2 sp. higher than napiergrass at 24 h incubation ( $P<0.05$ ) and 3 sp. were lower and 1 sp. higher at 72 h incubation ( $P<0.05$ ).

The average degradability for DM, NDF and N (across species) were  $55.3 \pm 8.2$ ;  $44.6 \pm 8.6$ ; and  $48.8 \pm 14.1\%$  for 24 h incubation and  $68.4 \pm 6.1$ ;  $61.4 \pm 8.2$ ; and  $63.6 \pm 9.5\%$  for the 72 incubation.

DM degradability was positively correlated with NDF degradability with  $r = 0.83$  and  $0.86$  for the 24 and 72 h incubation, respectively. Similar relationship was also observed between NDF and N degradability with  $r = 0.51$  and  $0.75$ , respectively.

It was concluded that degradability of DM, NDF, and N for several native grass species were not different from that of napiergrass, and NDF degradability was related to nitrogen degradability.

## **RESEARCH RESULTS**

### **SUNGAI PUTIH**

1. Effect of energy supplementation on reproduction and lifetime performance of North Sumatran ewes grazing under rubber plantations. A. Reese, S. Ginting, P. Kataren, S. Handayani, M. D. Sanchez and W. L. Johnson.

The effect of level of energy supplementation on ewes grazing under the rubber plantations was studied for 3 years. The ewes received either no supplementation, 0.6, 1.0, or 1.4% of their body weight (BW) per day of concentrate while maintaining the same level of total and by-pass protein. By March, 1988, when the study was terminated, the control ewes had lambed 4.5 times, the 0.6% 5, the 1.0% 5, and the 1.4% 5.2 times. The number of lambs born was increased only with the highest level of supplementation (1.8 vs. 1.4) but the number of lambs weaned increased progressively with the level of supplement (1.1, 1.3, 1.4, 1.6 lambs weaned per ewe per parturition). The lambs were also heavier at weaning from the ewes of the high level of supplement.

A feed intake measurement was conducted in January 1988 in a selected group of ewes using chromium oxide as fecal marker. Results indicated that in early pregnant or non-pregnant ewes the total feed intake increased with the level of supplement. This was also found in late pregnant ewes but the regression was not significant. There was a tendency for the feed intake to decrease with higher BW and with advanced pregnancy.

2. Supplementation of growing local and F<sub>1</sub> local x St. Croix lambs grazing under the rubber plantations. M. Sanchez, M. Boer and W. L. Johnson.

A beneficial effect of supplementation was obtained with adult ewes on the growth rate, feed intake and feed conversion in growing lambs. Twenty seven local males and 12 F<sub>1</sub> local x St. Croix males were divided in groups and assigned to 3 supplementation treatments: control, 0.6 and 1.2% of BW per day. The supplement contained palm kernel cake, rice bran, molasses, and fish meal. The sheep received the concentrate in the morning and then grazed for 8 h under the rubber plantations with a shepherd. At the end of the trial (4 months) some of the animals were slaughtered to determine carcass yield and quality. A taste test was conducted with meat from local and F<sub>1</sub> lambs. The supplemented lambs gain weight faster than the control (54 g/d), with no difference between the two levels (78 and 84 g/d for 0.6 and 1.2%, respectively). The supplement completely replaced the pasture intake but improved the conversion rates: 15.3 vs 21 kg feed per kg BW gain. The F<sub>1</sub> lambs gain weight faster than the locals (82 vs. 67 g/d), had lower intakes and consequently better conversion rates. This finding supports the hypothesis of better efficiency of hair type sheep in the humid tropics. There were no differences in the carcass yields and only the local lambs had more fat at the same weight when compared to the F<sub>1</sub>. The taste test showed better tenderness for the local meat, but no differences in odor or taste.

3. Rubber seed as feed for sheep.

The rubber seed is a resource available at the rubber plantations that could be used as feedstuff for small ruminants. A series of trials are being conducted to assess its value for sheep.

- I. Processing to reduce cyanide (CN<sup>-</sup>) content. A. Darussamin and M. Sanchez.

The fresh rubber seeds contain up to 1,600 ppm of CN<sup>-</sup>. The concentration is reduced with storage, with shelling and storage, soaking in water and boiling (best treatment).

- II. Processed rubber seed as feed supplement for growing lambs M. Sanchez and M. Boer.

Processed rubber used (boiled, dried and ground) was used in combination with rice bran (20%) and molasses (10%) as supplement for growing sheep at four levels 0, 0.3, 0.6, and 0.9% of BW per day. There was a linear increase in weight gain with increasing levels of rubber seed, but the high cost of collection and processing limit its economical use as a major ingredient in supplements for grazing animals.

### III. Digestibility of rubber seed and its effect of the digestibility of the forage. S. Purba and M. Sanchez.

A digestibility trial as just been completed using 20 male sheep and rubber seed in two forms, just dried and ground or processed (as above), as supplement to a grass ration at three levels 0, 0.3, and 0.6% of BW per day. The samples are being analyzed now.

4. Supplementation of growing sheep grazing under rubber plantations with palm kernel cake (PKC) with extra by-pass protein and energy. M. Sanchez and M. Boer.

An experiment is in progress trying to improve the response to PKC supplementation with extra by-pass protein (fish meal 10%), by-pass energy (broken rice 10%) or the combination of the two. Thirty-five male lambs were divided in five groups and assigned to five treatments: control, PKC, PKC + fish meal (FM), PKC + broken rice (BR), and PKC + FM + BR. All supplements were given at 0.6% of bw per day. Two months weight gains with supplementation are: control 69, PKC 104, PKC + FM 104, PKC + BR 106 and PKC + FM + BR 85 g/d. There is no advantage in adding extra by-pass nutrients to the PKC when used as only supplement to growing sheep grazing under rubber trees. But the use of PKC is economically feasible. Samples are being analyzed now to determine the effects of the concentrate on forage and total intake.

5. Strategic supplementation of ewes. M. Sanchez and W. L. Johnson.

In order to improve the economics of supplementation of adult ewes, an experiment is in progress in which concentrate is provided to ewes during the last 6 weeks of pregnancy (1% BW per day), and during lactation according with the number of lambs: 0.6% to ewes with singles, 1.0% with twins and 1.4% with triplets. The ewes of the previous energy supplementation experiment are being used, but now the mating is controlled and half of the ewes are being bred to St. Croix rams.

6. Introduction of improved grasses and legumes into the rubber plantations. T. Ibrahim, M. Sanchez and W. L. Johnson.

Over fifty species and varieties of grasses, legumes and other

forage plants are being tested for their adaptation to the local conditions of soil, rainfall, temperature, parasites, and diseases. The species came from parts of Indonesia, Malaysia, and Australia. The forages are planted in 3x5 m plots as pure stands, and once established are harvested on a monthly basis to determine yield and persistence. Preliminary results indicate that a few species do not germinate, grow well, or persist after repeating harvest, while others are very promising.

A selected group of grasses (5 species) and two legumes (Centrosema Pubescens and (Pueraria javanica) of known performance in local conditions, were planted in associations of one grass and one legume. They were planted at the beginning of the year and after a period of establishment have been harvested monthly. Dry matter yields have shown similar production with all associations but greater proportion of the legume component with the Star grass mixtures.

A reduced group of the above forages are being planted now in a new area where rubber trees will be planted in 3 planting densities (450, 500, and 550 trees per ha). The plots include grasses and legumes in pure stands and in associations.

7. Preference and palatability of forage from legume trees. T. Ibrahim and M. Sanchez.

Two trials were conducted to assess the preference of forage from Leucaena leucocephala var. cunningham and Salvador type, Calliandra callothyrsus, Gliricida sepium and Albitzia by local sheep, and the palatability of Leucaena, Gliricidia and Calliandra. The sheep preferred the leucaenas the most and Gliricidia the least. In the intake trial, the intake were as follows: Leucaena > Calliandra > Gliricidia. The intake of Gliricidia increased with time, as has been previously observed.

8. Preference of five grasses and two legumes in associations by sheep. T. Ibrahim and M. Sanchez.

A preference trial was conducted with 20 adult ewes of three breeds: local, St. Croix and F<sub>1</sub> local x St. Croix. The animals were observed during two days while grazing the plots planted with the grass-legume associations. The frequency of animal visits to each plot was recorded. The results indicate a greater preference for Paspalum plicatatum and the least preference for Setaria. Centrosema pubescens is preferred over Pueraria javanica. The St. Croix sheep eat higher, which means that they mainly consume the grasses. Local sheep eat closer to the ground, selecting more legumes.

9. Rotational grazing of sheep in the rubber plantations. M. Sanchez.

## I. Rotational grazing under old rubber trees.

A grazing trial is being carried out with a flock of ewes to determine the carrying capacity of the pasture under old rubber trees and the effect on the species composition. Twelve 1 hectare paddocks were fenced with an electric fence. The species composition was determined before the first grazing period and will be determined again after 6 and 12 months of grazing. Results after the first complete rotation of all paddocks indicate a carrying capacity of at least 4.4 sheep per ha. The number of animals was increased for the second cycle. After the first grazing, the pasture was improved by removing non-preferred species and by replanting the bare areas.

## II. Rotational grazing under young rubber trees.

Another independent grazing trial is under way to determine the carrying capacity and the effect on the two main species present in the pasture: Pueraria javanica and Mikania cordata. The composition of each half ha paddock is being determined before the first grazing by adult ewes with their lambs. The soil compaction as the result of the grazing will be measured. The first grazing cycle has not been completed yet. So far, 7 paddocks have been grazed with over 100 ewes. The divisions are made with a movable electric fence.

## 10. Outreach Research Project. I. Supplementation of pregnant and lactating ewes. E. Sembiring, M. Boer and M. Sanchez.

Forty eight ewes were distributed among 12 farmers in two communities in order to test and demonstrate improved management and feeding practices. Half of the ewes were bred to a local ram and half to a St. Croix ram. The first nutrition study is the supplementation with PKC to half of the ewes during later pregnancy and lactation. Each farmer is supplementing two ewes, one of each breeding treatment, and has two as controls. The birth and weaning weights, survival percentage, and the second conception rates will be assessed in the two supplementation treatment groups.

## PUBLICATIONS

### Theses

Haryanto, B. 1988. Fiber utilization by Indonesian kacang goats fed mixed native grass forage supplemented with zinc and nitrogen. Ph.D. thesis. North Carolina State University. Raleigh, USA.

### Journal Articles, Refereed (Supporting)

Prabowo, A., J. W. Spears and L. Goode. 1988. Effects of dietary iron on performance and mineral utilization in lambs fed a forage-based diet. J. Anim. Sci. 66:2028.

### Manuscripts Submitted or in Press (SR-CRSP)

Johnson, W. L., A. Djajanegara. A pragmatic approach to improving small ruminant diets in the Indonesian humid tropics. J. Anim. Sci. (Submitted).

### Technical Communications

Haryanto, B. and W. L. Johnson. 1987. Estimation of rumen microbial protein production by fecal nitrogen fractionation. Paper presented at the Conference on rumen function. Chicago, Illinois. Nov. 17-19, Vol 19:49.

Haryanto, B. and W. L. Johnson. 1988. Strategies for supplementation of native grasses with local feeds, for sheep and goats in village farming systems of the humid tropics. Paper presented at the VI World conference on animal production. June 27 - July 1, 1988. Helsinki, Finland. (Abstr. no. 7.104 p:681.

Haryanto, B. 1988. Forage selectivity by goats under stall-fed system. Paper submitted to the Seminar in Univ. Diponegoro, Semarang.

Haryanto, B. 1988. Peningkatan efisiensi pemanfaatan hijauan olehternak ruminansia melalui manipulasi ekosistem rumen. Makalah temu tugas sub-sektor peternakan. Kendal, Jawa Tengah.

Haryanto, B. 1988. Indigestible fiber as a possible factor affecting voluntary dry matter intake by small ruminants. Paper to be presented at the Seminar "Pertemuan Ilmiah Ruminansia." Pusat Penelitian dan Pengembangan Peternakan. Bogor. Nov. 8-10, 1988.

Haryanto, B. and W. L. Johnson. 198 . Fiber utilization by goats fed mixed native grasses supplemented with zinc and nitrogen. I. Intake, digestibility and passage of the feed. Paper to be submitted to the on Agric. Res. Service.

Haryanto, B. and W. L. Johnson. 198 . Fiber utilization by goats fed mixed native grasses supplemented with zinc and nitrogen. II. Rumen characteristics and estimates of microbial protein production. Paper to be submitted to the NC Agric. Res.

## Service.

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- Martawidjaja, M. 1987. Perbandingan sistem kandang panggung dengan kandang lantai tanah. (Comparison between platform type and litter type of sheep- goat houses.) Majalah Ilmu dan Peternakan. Vol. 3(2):79.
- Pulungan, H. and A. Parakkasi. 1987. Studi perbandingan pencernaan bahan kering dari beberapa jenis bahan makanan ternak dengan tehnik in situ dan in vitro. (Comparative study of dry matter disappearance of some feedstuffs by in situ and in vitro techniques). Majalah Ilmu dan Peternakan 3(1):37.
- Pulungan, H., M. Rangkuti, T. Haryati, Erlinawati and T. Rustandi. 1988. Pengaruh berbagai tingkat pemberian kulit biji coklat (*Theobroma cacao* L.) dalam ransum ternak domba. (Substitution levels of cacao seed shell as a supplement for confined sheep fed elephant grass). Paper accepted (in press) in Majalah Ilmu dan Peternakan vol. -
- Pulungan, H. 1988. Peranan rumput lapangan sebagai ransum pokok ternak domba. Makalah temu tugas sub-sektor peternakan. Kendal. Jawa Tengah.
- Pulungan, H. and A. Djajanegara. 1988. Pengaruh pemberian ampas tahu terhadap kenaikan berat badan kambing dan domba yang memperoleh rumput lapangan sebagai makanan basal. (The effect of soybean curd waste supplementation to native grass as the basal roughage on the performance of sheep or goats). Paper presented at the Seminar in Univ. Djenderal Soedirman. Purwokerto.
- Pulungan, H. 1988. Potensi pencernaan in situ serat (NDF) dan nitrogen dari beberapa species rumput lapangan dan rumput gajah. (In situ potential degradability of cell walls and nitrogen of several native grass species and napiergrass). Paper to be presented at the Seminar "Pertemuan Ilmiah Ruminansia". Pusat Penelitian dan Pengembangan Peternakan. Bogor.
- Sudaryanto, B. 1988. Pengaruh sulfur dalam mendetoksikasi asam sianida. Paper presented at the Seminar Pengembangan Peternakan Pedesaan. Univ. Djenderal Soedirman. Purwokerto.
- Sudaryanto, B. 1988. Pemanfaatan daun singkong sebagai bahan makanan ternak domba. Makalah temu tugas sub-sektor peternakan. Kendal. Jawa Tengah.

- Sudaryanto, B., T. Sutardi, T. R. Wiradarya and A. Girindra. 1988. Pemanfaatan daun singkong sebagai pengganti ransum basal pada domba. Paper presented at the Seminar in Univ. Diponegoro. Semarang.
- Sudaryanto, B. and E. Djameludin. 1988. Detoksikasi sianida daun ubikayu dan efek kroniknya pada kambing. Warta Penelitian dan Pengembangan Pertanian. Vol. 9 (4-6):10.
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- Yulistiani, D., M. Rangkuti and A. Wilson. 1988. Pengaruh pemberian biji kapas pada ransum rumputgajah untuk domba yang sedang tumbuh. (The effect of utilization of cottonseed in napiergrass ration for growing lambs). Paper submitted to the Seminar "Pertemuan Ilmiah Ruminansia". Pusat Penelitian dan Pengembangan Peternakan. Bogor.

### Training

Four Indonesian and one U.S. scientist have been fully or partially funded for training during 1987-88.

Dr. Budi Haryanto completed a Ph.D. in May 1988 from North Carolina State University. Mr. Simon Ginting is on study leave from Sungai Putih attending the University of Missouri pursuing a Masters that is fully funded by the SR-CRSP. The research of Mr. Hamzah Pulungan is partially supported by the SR-CRSP. He is pursuing a Ph.D. at the Bogor Agricultural Institute. Mr. Akhmad Prabowo is completing a Ph.D. program at the University of Florida. Dr. Alice Reese completed a Ph.D. in May of 1988. Her research, evaluating the potential of utilizing sheep to graze under rubber trees, was completed at Sungai Putih, North Sumatra, Indonesia.

## 1987-1988 Annual Report

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

Host Country: Indonesia

U.S. Institution: University of Missouri-Columbia

Host Country Institution: Balai Penelitian Ternak (BPT)  
(Indonesia)

Personnel: Principal Investigator:  
Michael F. Nolan

Resident Scientist:  
Patrick Ludgate

Collaborating Scientist:  
Atien Priyanti  
Kedi Suradisastra  
Sri Wahyun  
Sri Wening Handyani

### RESEARCH RESULTS

The scope of the Sociology Project in Indonesia was reduced in 1987-88, both to accommodate the needs of other SR-CRSP work sites and to accord with the agreement that responsibility for the social science effort in Indonesia will alternate between the Sociology and Economics Projects. 1987 was a transition year, with Sociology's resident scientist departing in the summer and Economics' resident scientist arriving in Fall 1987.

While the origin of resource inputs into the Indonesia program has shifted, the thrust of the social science projects remains the same. The primary goal for the past three to four years has been to facilitate development of the Outreach Pilot Project (OPP) in West Java and its derivative in North Sumatra. A second objective has been to invest significant resources in enhancing the capabilities of the socioeconomic research unit within the Research Institute for Animal Production (RIAP) via graduate degree training and private support for research by counterpart scientists.

Complete details of OPP activities are given in the Economics/Indonesia section of this annual report. In essence, the OPP is an applied research demonstration effort, and the data collected are used by social and biological scientists alike. The role of the social science projects has been to coordinate the on-

farm data collection efforts. Thus, the inputs and outputs of this activity are not those of traditional discipline-based studies in the social sciences.

In 1987-88 two longterm trainees returned to Indonesia--one Ph.D. from the Sociology Project and one from Economics. Their increasing involvement in the Indonesia program should allow resumption of some disciplinary studies in 1988-89.

Synthesis of a Decade of Research on the Sociology Project. Results of the OPP efforts are highlighted in a book in progress which anthologizes sociology studies of "Plants, Animals, and People" in all five host country sites.

#### **PUBLICATIONS\***

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

Lipner, M. and M.F. Nolan. Forthcoming. Dilemmas of Opportunity: Social Sciences in CRSPs. In C.M. McCorkle, ed. The Social Sciences in International Agricultural Research: Lessons from the CRSPs. Lynne Rienner Publishers, Inc., Boulder (supporting).

##### **Technical Communications**

Gaylord, M.S. and P.R. Bilinsky. 1986. Outreach Pilot Project: A Case Study of a Small Ruminant Farming Systems Research and Extension Project in West Java. Selected Proceedings of Kansas State University's 1986 Farming Systems Research Symposium -- Farming Systems Research & Extension: Food and Feed. Kansas State University, Manhattan, KS. P. 620-628.

Nolan, M.F., M.E. Lipner, and C.M. McCorkle. 1988. Sociology in the SR-CRSP: Research Highlights and the Dilemmas of Participation. American Society of Animal Science, Rutgers University (supporting).

Priyanti, A., A. Wilson, D. Yolistani, P. Bilinsky, and S. Mawi. 1986. Report on the Second Annual Outreach Pilot Project (OPP) Farmers' Meeting. SR-CRSP Working Paper No. 88. Bogor.

##### **Verbal Presentations**

Bilinsky, P. 1987. Working with Farmers: Some Lessons from the Outreach Pilot Project. Masters of Agricultural Science International Students Seminar. U. of Melbourne, Australia.

Gaylord, M., P. Bilinsky, R. Jensen, and M. Rangkuti. 1986. Activities of the SR-CRSP in Indonesia. USAID Seminar, Jakarta, Indonesia.

Suradisastra, K. 1987. Adoption Processes, Technology Transfer, and SR-CRSP Field Research in West Java, Indonesia. Seminar in Agricultural Education, University of Missouri-Columbia.

Suradisastra, K. 1986. Field Research in Indonesia: A Key for Development. Student Seminars on International Development, sponsored by the International Student Programs, Center for International Programs and Studies, and the Interdisciplinary Minor in International Development Program at the University of Missouri-Columbia.

### Training

#### **Degree Oriented**

- o Sri Wahyuni, Indonesian, MS in Rural Sociology, Institute Pertanian Bogor, in progress.
- o Sri Wening Handyani, Indonesian, MS Rural Sociology, UMC, in progress.

## MAJOR ACCOMPLISHMENTS

1. Reproductive performance of ewes in the Outreach Pilot Project, as measured by percent of lambs born and percent weaned, increased by 40% and 50% respectively over the previous year's performance. A major part of this improvement is attributed to the application of feeding and management recommendations developed in the SR-CRSP.
2. Thirteen Technological Packages (Tech Packs) are now available and are being tested on farms to assess their economic and social acceptability.
3. Following a small pilot study on pricing efficiency and the marketing of small ruminants in mid-1988, a large-scale study was initiated to gather data concerning livestock markets, slaughter houses, middlemen, and the marketing strategies of small ruminant farms.
4. More information on testing the hypotheses that a major gene controls prolificacy in Javanese sheep was collected during the year. If confirmed, this finding could increase substantially the production in areas where adequate feed resources are available throughout the year.
5. Higher growth rates and reduced amounts of wool (less heat burden) have resulted from cross breeding hair sheep, introduced by SR-CRSP, with local breeds.
6. Positive effects in growth were noted from adding zinc and protein from legume tree foliage to the normal grass diet for growing Kacang goats.
7. Over 50 publications were produced during the year, and one M.S. and two Ph.D.s completed their degrees.

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

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\* Member of Board of Directors  
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