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SMALL RUMINANT
COLLABORATIVE RESEARCH
SUPPORT PROGRAM

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SR-CRSP
NUTRITION SEMINAR

DECEMBER 22 - 23, 1980

O'HARE HILTON INN

CHICAGO, IL

SR-CRSP NUTRITION SEMINAR

December 22 - December 23, 1980

AGENDA

December 22, 1980

Opening remarks - Purpose of the Seminar

Animal Nutrition in the LDC's - Dr. D. Robinson, University of California

Minerals for Ruminants in the Tropics - Dr. J. Conrad University of Florida

Introduction to Specific Topics

Brazil: Dr. Johnson, North Carolina State University

Dr. Stott, Tuskegee Institute

Coffee Break

Peru: Dr. Van Keuren, Ohio State University

Dr. Bryant, Texas Tech University

Indonesia: Dr. Johnson, North Carolina State University

Discussion of Brazil, Peru, and Indonesia

Lunch Break

Kenya: Dr. Van Keuren, Ohio State University

Dr. Fitzhugh, Winrock International

Discussion of Kenya

Nutrition Component of Systems Analysis: Dr. Smith, Texas A&M University

Coffee Break

General Discussion

December 23, 1980

Concluding discussion

Meeting adjourns

Primary Participants

Dr. Fred Bryant	Texas Tech University
Dr. Henry Fitzhugh	Winrock International
Dr. William Johnson	North Carolina State University
Dr. David Robinson	Management Entity
Dr. Gerald Smith	Texas A&M University
Dr. Nancy Stott	Tuskegee Institute
Dr. Robert Van Keuren	Ohio State University

Secondary Participants

Dr. George Cooper	Tuskegee Institute
Mr. Jean-Marie Luginbuhl	North Carolina State University
Mr. Timothy Quick	Ohio State University
Dr. James Yazman	Winrock International

Observers

Ms. Helaine Burstein	Management Entity
Dr. George Johnson	Ohio State University
Dr. Charles Lassiter	North Carolina State University
Dr. Joseph Conrad	University of Florida
Dr. Mervin Smith	Ohio State University
Dr. William Weir	University of California, Davis

Opening Remarks - The Purpose of the Seminar - Dr. Robinson

The original design of the Small Ruminant CRSP put forth by RTI clearly identified several disciplines by name, for example, Animal Health, Animal Breeding, Range Management, Economics, etc. Conspicuous in its absence, despite its vast importance, was the discipline of Animal Nutrition.

To those closely associated with the SR-CRSP, it has been well understood that Animal Nutrition is probably the most significantly represented discipline in the program since it comprises a component of each of the following sub-programs originally outlined by RTI: Range Management, Forages, Production Systems, Byproduct Utilization, Systems Analysis, Management and even to some degree, Animal Breeding and Animal Health. However, to those less well acquainted with the details of the SR-CRSP structure, our overseas counterparts, the External Evaluation Panel, scientists in other universities and the public in general, the absence of Animal Nutrition as a discrete entity appeared to be a glaring ommission.

Recently, this ommission or the perception of it, has begun to cause some difficulty in the administration of the SR-CRSP program. For example, the EEP has been particularly critical of three sub-programs, all of them with an Animal Nutrition component; the overseas counterparts in Brazil and Kenya have failed to approve two projects, both of which had an Animal Nutrition component.

The purpose of this seminar, called by the Management Entity, is threefold:

- Define specifically the nutritional component of each sub-program.
- Determine each project's role within the context of the SR-CRSP nutrition program.
- Develop the broad, integrated, nutritional strategy of the CRSP for the LDC's.

To assist us in this task, we invited several experts with active involvement and high credibility in these very areas and are pleased to welcome all the observers and secondary participants listed.

Feeding Strategies for the LDCs

D. W. Robinson
Management Entity SR-CRSP

One conspicuous limitation to livestock production in the LDCs is the lack of adequate feeding strategies at the national, local or even family farm level. Low education, poor literacy rates, modest management skills, limited extension services or overt commitment to traditional feeding systems, and a host of other factors may all contribute to the problem.

The development of good feeding strategies may or may not be dependant upon research. Worthwhile research may or may not contribute to the development of better feeding systems. Good feeding systems and good research are not necessarily mutually dependant and are certainly not mutually exclusive. However, research programs designed to assist the small farmer and funded by grant aid probably provide the ideal milieu in which both quality research and ultimately an improved practical feeding system should come together. The Small Ruminant CRSP provides a perfect forum in which to test this hypothesis.

The purpose of this seminar is to bring together the best brains in the SR-CRSP for the purpose of designing good interdisciplinary collaborative research programs that will lead to the development of better feeding strategies for small holders the world over. We have an outstanding range and depth of skills in the SR-CRSP, but the exhaustive planning of our research has not crystalised for some reason. The following paragraphs are an emperical approach; an attempt to provide a back drop for discussion of more specific topics. The ultimate objective of the seminar is for us all to leave with our specific roles put in perspective relative to the goal of designing improved feeding strategies for the LDCs.

There are at least three components to an understanding of feeding strategies:

- essential pre-requisite knowledge
- development of practical feeding strategies
- experimental work and other research

Taking each of these in turn, some obvious sub-components are as follows -

I. Essential pre-requisite knowledge.

1. Description of existing feeding systems of the target livestock. This can only be done by local on farm observations in Kenya or the target area. An accurate description of the practical feeding system is essential.

2. Review of all the available feedstuffs produced in target area. Documentation of every potential feed in the above feeding system needs to be made.

3. Review of the chemical composition of all available feedstuffs. Each potential feed has a chemical composition. A table needs to be developed listing data of this compositon. In this way at least <u>some</u> assay data can be gleaned for ration formulation.

4. Compilation of the annual availability of digestible nutrients from the feeds above. Composition alone is meaningless without annual availability estimates -- this can only be done in country.

II. Development of practical feeding strategies.

1. Development of theoretically adequate diets to meet requirements of target livestock. This would be done on a least cost, linear programming concept such as used for more sophisticated feed regimens for livestock in USA.

2. Testing the feasibility of such diets with respect to cost, availability, etc.

3. Documentation of feeds with potential for conservation based on biological characters. Feed conservation will obviously loom large in intensive feeding systems for several reasons:
   a. To plug the "hungry gaps"
   b. Because nothing has been done yet.
   c. Because it is a high priority.

III. Research.

1. Field testing of the "optimal diet". That is the most available, practical and affordable from I & II.

2. Field testing of "new diets" implying a radical shift from existing conventions. Field testing of practical diets represents the "experimental" component of CRSP work. This and all the rest is research but research is not necessarily "experimental". In this category fall trials such as the Napier/SPV and energy and protein, etc.

3. Comprehensive field testing of conservation techniques, nutrient loss, accrued toxicity, etc. For any intensive feeding systems based on compounded diets which include concentrates, toxicities may be expected; chiefly contaminants (aflatoxins), or inherent toxins such as cyanogenic glucosides (cassava) or mimosines, etc., (leucena). These will need the experimental approach.

Robinson Presentation See attached paper, Feeding Strategies for the LDC's.

Discussion on Robinson's Points

G. Smith

We have to decide which animals we want to produce and at what level of performance. We need to know about management practices which effect nutritional requirements, eg. when is lambing season? This component needs to be considered in addition to mere ration formulation.

Fitzhugh

The Systems approach is what Smith has described. There is a need to understand the farming system as well and other components within the system before we talk about nutritional requirements. For example, going even further back, are we using the correct animal? Are sheep and goats appropriate? In Kenya, dual purpose cattle may be better than dual purpose goats.

Johnson

We need to be concerned with animal response to different nutrient level inputs to define the response function and especially, to see if increasing dietary energy concentration is worth the cost.
Do literature data on nutrient components and currently available feed composition tables have much value? For example, crude fiber is not an accurate measurement and often in the past, the conditions under which the data was collected and reported, were not defined. We do not have the resources to do an exhaustive literature search.

Robinson

The literature does have a broad value despite these deficiencies, but it is acknowledged that it is certainly not a panacea.

AID MINERAL RESEARCH PROJECT

Contract Number AID/ta-c-1153

DEVELOPMENT OF EFFICIENT MINERAL SUPPLEMENTATION REGIMES FOR GRAZING RUMINANTS IN THE TROPICS

UNIVERSITY OF FLORIDA
Institute of Food and Agricultural Sciences
Center for Tropical Agriculture
Department of Animal Science

ANNUAL REPORT

June 1, 1979 to November 1, 1980

Since November, 1974, the mineral research program has been functional in a number of tropical countries. Personal contacts have been made through visits and correspondence with scientists in these countries. Presently, there are 12 Latin American, 4 Asian and 2 African countries engaged in cooperative mineral research programs. During the 17 months included in this report, Venezuela was visited three times, while two visits were made to Bolivia, Brazil, Colombia, Costa Rica, the Dominican Republic, Ecuador, Guatemala and Peru. Single visits were made to El Salvador, Honduras, Indonesia, Jamaica, Malaysia, Malawi, the Philippines, Thailand, Senegal, Swaziland and Uruguay. In addition to giving local institution or country seminars on minerals, presentations were made at conferences or workshops at the following locations: Brazil, Cornell, N.Y., the Dominican Republic, Honduras, Jamaica, Las Cruces, N.M., Panama, Thailand, the Philippines, and Tucson, Arizona.

One of the principle goals of the program is to stimulate mineral research within the participating countries. To accomplish this, laboratories have been assisted by purchase of chemicals, consumable supplies and, occasionally, small equipment. As part of building up laboratory capabilities, three-month laboratory training short courses were held in Florida for 5 laboratory technicians one each from Uruguay, Brazil, El Salvador, Panama and the Philippines. To further assist laboratories and standardize procedures, the second edition of "Methods of Mineral Analysis for Plant and Animal Tissues" was published in English, Spanish and Portuguese and distributed to the appropriate researchers. The University of Florida Nutrition Laboratory has aided laboratories by doing some of the more difficult analyses including cobalt, selenium and molybdenum.

Experiments designed to pinpoint mineral deficiencies and excesses for specific farms and regions have moved forward in each participating country. Research data is further confirming the incidence of phosphorus deficiency and

the production benefits from supplementation. The majority of countries have likewise established borderline to severe copper deficiencies in grazing cattle.

Results from 10 mineral supplementation trials were reported in the 1979 Instituto Colombiano Agropecuario (ICA) Annual Report. The majority of the experiments compared commercial mineral supplements versus supplements containing a minimum number of minerals which previously had been established. This research promoted the concept of specifically tailored mineral supplements for distinct regions at a lower cost. The two-year results of a Colombian experiment to determine the seasonal need for minerals was completed. No benefit was derived by feeding minerals all year long versus during the 5-month rainy season only. A similar mineral supplementation experiment is now underway in the Dominican Republic where breeding cattle are fed no minerals, minerals all year long, dry season only and wet season only. The largest supplementation trial, with a duration of 3 years, has now been completed in Bolivia. Animals receiving bone meal supplementation had a 14% higer calving percentage than controls.

The etiology of two devastating cattle disease conditions in Brazil-Bolivia ("cara inchada") and Colombia ("secadera") has been made clearer this year. For two years, "secadera" on one ranch has been entirely eliminated through the use of a highly fortified mineral supplement. Cara inchada, a periodontal disease in cattle has been prevented or cured by feeding adequate levels of copper and zinc while molybdenum is a predisposing factor. For both disease conditions, the exact minerals and/or mineral interrelationships have yet to be determined.

Presently, 11 students are working toward M.S. or Ph.D. degrees in the mineral research area. The countries represented are Bolivia (2), Brazil, Colombia, the Dominican Republic, Guatemala, Malawi, Sudan and Venezuela (3).

Degree research programs are being carried out in the home countries for 7 of the 11 students. The remaining student theses involve programs with results pertinent to tropical regions.

Publications resulting from the mineral research program during the last 17 months are as follows: Journal Articles (7), Abstracts (8), Theses (16), Conference Proceedings (4) and other literature, including Annual Reports, popular articles and extension or experiment station bulletins (20). The theses represent 2 Ph.D. theses at Florida and 14 B.S. degree theses from Bolivia, Costa Rica, Ecuador, Peru and Trinidad. The majority of the theses are from Costa Rica.

Future research in each country will continue to emphasize locating mineral deficiencies or excesses through trials emphasizing laboratory chemical analyses and supplementation experiments. Tentative plans to initiate new mineral oriented M.S. or Ph.D. degree programs in Colombia, Panama, Thailand and Mexico are underway. With the renewal of the contract, expansion of the activities to Cameroon, Senegal and Sudan are anticipated.

Conrad Presentation See attached paper, AID Mineral Research Project

Discussion on Conrad's Points

Weir

Are these theses you have mentioned being lost or is the data being published or made available anywhere?

Conrad

We are not doing as much as we should. It needs to be decided how to circulate the information. We are finding definite deficiency patterns, which are at present, primarily just being described in annual reports.

Robinson

Would standardized in-house project publications be useful in bringing all this information together?

Conrad

We are more concerned about getting the information around the country so it can be used there.

G. Smith

What are you doing in Kenya, since you already have work going in Indonesia, Brazil and Peru?

Conrad

To date, just phone conversations with Winrock but we are going there in February.

Fitzhugh

Your work is a micro nutritional program focusing on specific nutrient requirements which is a direction opposite to that presented in Robinson's paper. We (CRSP) are macro oriented, towards feeding strategies. The question is, "which approach is better and where do you start?".

Conrad

You use what information is available in country because it depends on what actually is the major constraint, eg. is it the annual strategy or a very specific clinical disease? Systems can be used to identify major constraints and focus research on those constraints.

Robinson

You can not separate the two approaches. They must go together because nutritional requirements are very dependent on productivity. For example, in the dry season when protein and energy deficiencies limit growth, an animal's requirement for phophorous may be low. In the wet season, when the young animal begins to grow rapidly, demands for phosphorous may increase. Therefore increased productivity can create or make a mineral deficiency more apparent and a single value, categorically stated to be the nutrient requirement, may be misleading.

Johnson

There are eighteen countries and only two travelers in the Florida Mineral Project. Strategically, how do two people keep the program going? What is the optimum visit frequency?

Conrad

Every country is different. Two times per annum is minimum initially. As countries move nicely on their own, we concentrate on other countries instead. Some countries have almost graduated from the need for our input.

Robinson

Do you put in advice and/or hardware?

Conrad

Advice, methodology, and consumable supplies are provided but no capital investment in sophisticated equipment is made.

Quick

Does the Mineral Project do any work on dairy animals?

Conrad

Only if the animal is grazing and there is no concentrate or stall feeding.

NORTH CAROLINA STATE UNIVERSITY | AT RALEIGH

SCHOOL OF AGRICULTURE AND LIFE SCIENCES

DEPARTMENT OF ANIMAL SCIENCE
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November 21, 1980

TO: Dr. David W. Robinson, Program Director, and Principal Investigators attending the Nutrition Seminar in Chicago

FROM: W. L. Johnson

SUBJECT: (1) Plans for North Carolina State University projects in Brazil and Indonesia
(2) Suggestions for coordination among nutrition-related projects

A. Overall Objectives for Small Ruminant CRSP Nutrition Research

The following is suggested as an overall goal for our research:

"To gain an understanding of the most economical means of satisfying the nutritional needs of sheep and goats in the target areas of the Small Ruminants CRSP."

Suggested objectives for orienting specific experimental plans follow:

1. Identify critical stages of the production cycle and/or critical seasons of the year, with respect to nutrition-related stress on the animals; and identify the limiting nutrients in each situation.

2. Understand the existing feed resource

   -supply
   -nutritive value
   -acceptability by animals
   -anti-quality factors

3. Develop response functions for animal product in relation to nutrient intake, for the most important breeds and production classes in the target areas.

B. Specific Objectives of the North Carolina State University Project

Our five-year objectives were circulated after the May 1978 meeting at RTI and remain unchanged, as follows:

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

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

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

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

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

In implementing work toward these objectives, we are giving primary attention to Objective No. 1 in our First-Year Workplans overseas. This work will lead naturally to an emphasis on Objective No. 2 in the second and third years. Objective No. 3 is being given a lower priority and will be addressed on an as-needed basis, mostly within the context of adapting known technology. The fulfillment of Objectives 4 and 5 will require the accumulation of data across several years, and the attention of several Ph.D. students for thesis projects, or equivalent depth of effort.

Our supporting work on the Raleigh campus addresses Objectives 1, 3 and 4 with a more basic approach which will undergird our overseas results. Questions of methodology, for example, are addressed in our home campus studies. Future overseas participants (Ph.D. candidates) are given good hands-on training opportunities by conducting their M.S. thesis research at Raleigh; the same approach is planned for our overseas collaborators who undertake graduate studies in the U.S.

C. The NCSU Byproducts and Nutrition Project in Brazil

The nutritional problem for Northeast Brazil was described in the Integrated Program Plan published earlier this year. I quote:

"The feed base for small ruminant production in Northeast Brazil is the native Caatinga vegetation. The biggest problem in maintaining acceptable growth and reproduction rates in goats and sheep is the seasonality of herbage growth, a result of the semi-arid climatic pattern. Even in years of higher than average rainfall, the extended (six months) period with no rain causes a severe nutritional stress, particularly for animals at post-weaning, late gestation, or early lactation stages of the productive cycle. In years of most severe drought (such as 1979) the nutritional stress becomes intolerable, and if animal numbers are not greatly reduced or supplementation provided, a severe malnutrition will ensue, to the point of causing high mortality losses.

"One of the first priorities for small ruminants nutrition research, then, is to design feeding systems which will help alleviate the nutritional stresses of the dry season. The design of economically feasible systems requires knowledge not yet available about native forage plants of the Caatinga, as well as the effect of several management variables, including both Caatinga management and sheep and goat management. Knowledge about the following factors is essential, and presently insufficient:

1. Forage availability from the Caatinga, both amount and quality, in relation to soil type and water availability.

2. The effect of grazing pressure on nutrient availability from the Caatinga, both natural and improved.

3. The interaction of breeding season with the yearly climate cycle in determining reproductive efficiency of females and slaughter age of kids and lambs.

4. The effects of supplemental feeding of the does and ewes on disease and parasite manifestation and reproductive parameters, and on the growth of suckling young.

5. The effects of length of suckling period on the nutritional needs of the dam for lactation and for subsequent gestation.

6. The interaction of weaning age and level of supplementation on kid and lamb performance.

7. Species (sheep vs goats), breed within species, and individual animal effects on efficiency of reproduction and growth under nutritional stress or with supplemental feeding."

At the time the above was written, the participation of the Utah State range project was as yet unconfirmed. EMBRAPA is now certain of their support toward meeting the knowledge gaps implied in items 1 and 2 above.

All of the remaining items (Nos. 2-7) will involve a strong nutrition research component and an intensive interdisciplinary approach with scientists representing the reproduction, range, health, breeding, management, and economics disciplines. The sociologists and systems people will be needed, as well, to guide us toward practical and feasible solutions.

With EMBRAPA nutritionists, we agreed to be guided by the following specific objectives over the five years of planned collaboration:

1. Study the availability of various crop residues and by-products for use in dry season supplemental feeding, and to determine their nutritional value.

2. Develop guidelines for dry season feeding systems for does and ewes (pre- and post-partum), and study the interaction of breeding season with supplementation requirements.

3. Develop practical guidelines for supplemental feeding of weanling kids and lambs.

4. Develop recommendations for crop residue storage and treatment methods, to maintain or enhance nutritive value.

5. Study the predictability of animal performance from laboratory analyses of grazed and harvested forages, browse plants, and crop residues.

6. Accumulate data which will lead to a better understanding of the nutrient requirements of native and improved goats and hair sheep in the semi-arid tropics.

Work has begun this year with collection of crop residue samples from selected areas of the Northeast. Corn, beans and cotton are the main crops available. A dry season feeding trial has also been carried out (August-November), using weanling Santa Inez wether lambs, on corn residue-based rations (with an energy and protein supplement). Average gains were around 120 g/head/day; the initial weight was just over 20 kg, final weight around 40 kg with excellent body condition. The economics have yet to be calculated. For next year, similar trials should be planned with an attempt to minimize ration cost.

Also for 1981, it is imperative that we start some work with breeding females. We have proposed a central experiment with different breeding

F. Some Suggestions for Intra-CRSP Coordination

The benefits to be gained from close communication among all nutrition-related projects are self-evident. The key to a successful joint endeavor can be summarized in one word--communication. To elaborate the point, a few concrete suggestions are ventured:

1. Share experimental outlines (during the planning stages of experiments).

2. Circulate publications in draft form, for review and comments.

3. Meet as a group at least once a year. This could be in conjunction with the Technical Committee meeting, or at the time of the ASAS meeting.

4. Invite other P.I.'s and their principal collaborators from overseas institutions to participate in major workshops or similar discipline meetings at our principal overseas sites.

5. Appoint one of the nutritionist P.I.'s to serve as the discipline coordinator, to rotate annually. His duties would be to edit an annual progress report; to call and chair an annual nutrition group meeting; and to serve as a spokesman and liaison for the group as a whole.

As we listen to each other's plans and discuss our joint effort, some major omissions may become evident. Perhaps an adjustment of workplans can solve the problem, or perhaps we will need to seek additional collaborators (and funds). One goal which we ought to pursue vigorously, is to establish the presence of a full-time, first class nutritionist at each major overseas site. This will help achieve continuity and intensity to our research efforts.

G. Proposal for a Tropical Small Ruminant Nutrition Workshop at the 1981 ASAS Meeting

This idea was introduced in an earlier communication, the response to which was virtually non-existent. I urge reconsideration of the idea, and its implementation at least on a modest scale. If each project could invite (and pay for) one overseas participant, and if we meet together in a structured way for just one day, we will have begun an important dialog which can only lead in a constructive direction. At least, that is one person's opinion.

COLLEGE OF NATURAL RESOURCES
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DEPARTMENT OF
RANGE SCIENCE
801-750-2471

MEMORANDUM

TO: Fred Bryant, Tom Cartwright, Hank Fitzhugh, William Johnson, Nancy Stott, Dave Robinson, Bob Van Keuren

FROM: John Malechek

SUBJECT: Material for Nutrition Seminar

DATE: November 21, 1980

As per Hank Fitzhugh's suggestion in his memo of 29 October, please find enclosed my current thoughts on research planning and priorities for north-eastern Brazil. I look forward to our discussions next month.

Outline of Range Nutrition Research on Sheep and Goats

for the

Caatinga Region of Northeastern Brazil

John C. Malechek, Principal Investigator

(Prepared for the SR-CRSP Nutrition Seminar, Chicago, Dec. 22-23, 1980)

Introduction and Approach:

Native forage plants (mainly shrubs) from the Caatinga vegetation association constitute the bulk of the annual diets of sheep and goats in northeastern Brazil. This forage source is augmented seasonally by various crop by-products and in a few areas by grazing on improved pastures, largely bufflegrass (Cenchrus ciliaris). Most of the native caatinga shrub species are deciduous and lose their leaves at the onset of the extended dry season. Few herbaceous forage plants exist in the understory of native caatinga. Therefore, the annual nutrition of grazing animals appears to be a cycle of "feast and famine" with adequate (marginal?) forage during the wet season and inadequate forage during the dry season.

Possibilities apparently exist for forage improvement by manipulation of caatinga vegetation. Where cleared, there is a profuse invasion by apparently palatable and productive annual herbs during the wet season. Where cleared and seeded to bufflegrass, increases of 10X in annual forage yields have been observed. However, this latter approach is expensive and the value of cured bufflegrass to sheep and goats is not well known, but is probably low.

Before any effective grazing management programs or experiments can be planned, information is needed on the forage status of native stands. This would include the following:

a. Relative seasonal palatabilities of caatinga species

b. Nutritional value of caatinga species, including N-content, digestible energy content, phosphorus content, and perhaps other macro- and micro- nutrient contents.

c. Seasonal dietary botanical composition of sheep and goats in caatinga

d. Chemical content of diets and forage intake of the grazing animals (seasonal basis)

e. Seasonal availability of individual forage species to sheep and goats.

Once studies are underway on the above questions, manipulations of the caatinga stands should be attempted. As a first step, this should include:

a. Selective thinning of unpalatable species

b. Complete clearing

The same set of questions as posed above would then be asked as they pertain to the new forage plant communities that develop in manipulated caatinga stands. Changes in plant community composition over time should be monitored and its impacts on animal nutrition measured.

As a third step in this progression, the appropriate questions from the preceeding list would be addressed to the improved pasture/bufflegrass situation.

When these data are all in hand, comparisons can then be drawn on the seasonal nutritional status of sheep and goats over a continuum of forage community conditions, ranging from presumably the poorest situation (untreated native caatinga) to the presumed "best" (improved pastures).

The above would comprise what I view as "baseline" information on range animal nutrition; Call it Phase 1. As nearly as possible, existing (traditional) stocking rates and grazing practices would be simulated in this phase.

Phase 2 would entail grazing rate and grazing season trials, designed and based on information resulting from Phase 1. The purpose of these experiments would be to test "improved" management practices, integrating such practices as supplemental feeding, use of crop by-products, animal health measures and even "improved" animal genotypes, in collaboration with CRSP animal breeders. Appropriate nutritional assessments would be carried out in this phase.

Use of intensively stock goats (perhaps in conjunction with controlled burning) to suppress caatinga regrowth following clearing or thinning would be an interesting off-shoot grazing management practice. This practice should also be evaluated nutritionally.

Phase 3 is envisaged as the long-term evaluation of these "improved" grazing management practices in terms of animal nutrition and production as well as plant community change. I would hope that Phase 3 would be initiated about the time CRSP activities are being terminated. Hopefully, these experiments would then form the nucleus of a grazing research and nutrition program to be carried forward by our Brazilian collaborators.

At this point, we should have a general understanding of grazing animal nutrition under several intensities of management input, in comparison to the traditional system. This would be an opportune time to begin mechanistic studies that would deal with the "why" of particular

plant and animal responses. Presumably, the level of scientific training and sophistication among our Brazilian colleagues would, at this point, be sufficiently advanced that they could carry this phase forward with little or no direct input from U.S. scientists.

Training Component:

Most of work outlined above will be accomplished largely by graduate students who will reside in Brazil for periods of one or more years. These will be American graduate students and LDC graduate students. Probably most of the Brazilian graduate students would come from present EMBRAPA staff ranks.

In addition to collection of these data as a service to the overall project, Ph.D. students will be expected to design their own research projects. These should relate to the general questions of the over-all project, but should be sufficiently distinct in purpose, specific objectives, and methodologies that the student can clearly see and define the sub-project as "his own". In many cases, these graduate student projects may serve to add depth to the general project objectives by looking into cause-effect relationships involved. These studies should be mechanistic in design and should serve as tests for current ecological and nutritional theory.

Students involved in MS studies will not be expected to go beyond the depth of work specified in the general project objectives. They may identify one component of the project that particularly interests them and pursue that component as outlined in the project workplan.

Summary:

In my view, the following nutrition-related questions need immediate answers.

1. What plant species are acceptable to animals as forage and at what seasons?

2. What is the productivity (availability) of this forage on a seasonal basis?

3. What is the nutritional value of this forage?

4. How does forage nutritional value correspond to known requirements for maintenance, growth, lactation, gestation?

5. What supplements are necessary; What is available?

6. How does manipulation of caatinga affect forage availability and nutritive value?

7. How does manipulation of caatinga affect forage availability and nutritive value?

8. What changes are necessary in traditional grazing management practices?

Tuskegee Institute

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M E M O R A N D U M

TO: Dave Robinson and Principal Investigators attending the Title XII SR-CRSP Nutrition Seminar

December 18, 1980

FR: Nancy M. Stott

RE: Plans for Tuskegee Institute projects in Brazil

The overall objective of the Tuskegee Institute project remains basically the same as set forth in the Integrated Program Plan, namely to examine the effectiveness of management systems in increasing the production of goats, especially young kids for meat purposes.

Specific objectives of the program can be described as follows:

1. To measure the production of goats under intensive and extensive management systems.

2. To provide an interaction and exchange of information between Tuskegee Institute personnel and Brazilian scientists during the initiation, implementation and interpretation of the research program.

3. To expand the knowledge base in the area of goat meat production by acquiring currently available information and publishing research findings.

Tuskegee Institute project will address the interaction of various management practices on parameters such as:

- number of offspring born
- livability of offspring
- birth weight of kids
- daily weight gain
- days to slaughter weight
- dressing percent
- age at onset of puberty

Possible management techniques which will be evaluated include:

- early vs late weaning of kids
- comparison of intensive and extensive management systems
- nutrition/health interaction

W. L. Johnson's Presention See attached Paper, Memo from W. L. Johnson

Johnson

It was originally not known what projects would be in Brazil, but it was thought that there would not be a range project. Certainly one was needed to investigate Caatinga utilization because the Brazilians perceived most of their problems were related to range management. My project was initially going to focus on byproduct utilization but it was later expanded into a fully fledged nutrition project. Malechek's project is going to be the backbone of range related nutrition work.

However, we made some assumptions about working in Brazil which have proven to be inaccurate:

1. EMBRAPA would furnish the necessary personnel resource base.
2. The animal and laboratory facilities would be well established.

However, prior events have borne out that things happen rapidly in Brazil when the Brazilians feel they are important.

Johnson Presents Malechek's Proposal See attached Paper, Memo from Malechek

Johnson

The project focuses on animal/native range resource interaction. Seasonal effects are very important. The results of Malechek's work on the Caatinga will influence decisions on dry season supplementation practices and other nutritional and grazing management recommendations. The Nutrition and Range Projects will share laboratories and personnel.

Stott Presentation See attached Paper, Plans for Tuskegee Institute

Stott

It is Tuskegee's intention to make our objectives more narrow and specific. We also want to cooperate on the Brazil nutrition goals with the Nutrition and Range Projects.

Cooper

We will confine ourselves to nutritional management, ie. we will look at selected management problems especially in relation to nutrition, perhaps at specific areas associated with certain parameters ie. growth, lactation and gestation. There is no definition of nutritional standards for goats, especially for meat production. We will look at this in Brazil and at Tuskegee as well. We have completely switched locations back to Sobral and although we have not yet identified a specific collaborator there, we are optimistic about finding someone since our objectives have been modified.

Lassiter

The lack of information on nutritional requirements on goats is deplorable. What is the data base and what are the chances of generating one?

Cooper

We can not work on meat and milk simultaneously so we will start with meat. We'll begin by looking at sheep requirements and try to quantify as much as possible based on those.

Johnson

Environmental effects and breed differences make temperate data inappropriate in North East Brazil.

Weir

Are you going to be looking at extensive or intensive production?

Cooper

We'll look at both.

Johnson

Ederlon would like to see more work done on the requirements of grazing goats.

Weir

What techniques would you use to do this?

Johnson

Esophogeal fistulas and indicators.

Conrad

What is the real commitment already made by EMBRAPA to goat research? Is there enough at Sobral? Do you need or can you get more if it becomes necessary?

Johnson

They have built the center which is a substantial commitment. Rapidly increasing oil prices have pushed inflation in Brazil to over 100% per annum and EMBRAPA has been subjected to a hiring freeze making expansion of Sobral difficult. Due to this recently instituted freeze, they lost an Agricultural Economist who they were just about ready to employ, but they have brought in three new health people.

Conrad

EMBRAPA is going to have trouble supporting some other Centers. Why not transfer people to North East Brazil to the Center at Sobral?

Johnson

This is a legitimate concern and a useful option.

Fitzhugh

Would like people to identify just how much SY support is avalable to the SR-CRSP at each location.

Robinson

For Brazil, Memoria has line itemed the EMBRAPA contribution and that does not account for buildings or percentage of personnel time.

Fitzhugh

Not concerned about politics, but rather whether the number of SYS will accomplish our goals. We're unrealistic about our objectives given our funding and the constant emphasis on fiscal restraints.

Cooper

We need to establish priorities over a period of time and over time we can accomplish them.

Robinson

I endorse Fitzhugh's point. We are going to have less money in the future in real terms, but we still keep making grandiose plans. We need to equate high ideals and what we can physically do with our real dollars budget and our capabilities. Things can only get worse.

Johnson

Sometimes things go better than anticipated. We accomplished more than we expected to in Brazil.

Weir

How stable is the personnel situation in EMBRAPA?

Johnson

Not very. We are always going to be dealing with young people.

Robinson

This is why we can not just keep sending graduate students. They need us to send stable senior scientists.

Weir

Are you going to be working on extensive vs intensive systems, one or the other, or both?

Johnson

The system is semi-extensive. The animals are grazed during the day and brought in at night to protect them from predators.

Robinson

How likely is technology transfer between Brazil and Kenya where the production system situations are similar?

G. Smith

We would like to see this happen.

Fitzhugh

We are focusing on a highly intensive system in Kenya, more so than what is found in Brazil.

Lassiter

What about the rainfall pattern in Brazil?

Johnson

All the rain comes between January and May and is concentrated in a few showers. After the rainy season it just gets progressively drier. Crop residues are fed to cattle and small ruminants. Most farmers grow corn, beans, and cassava on a few hectares of irrigated land. The animals are turned loose in the fields after harvest.

Weir

Is silage possible?

Johnson

Yes.

Lassiter

Is there such a thing as a standard ration?

Johnson

Browse on the Caatinga is the standard ration.

Lassiter

Is there such a thing as an adequate ration?

Robinson

Only for a short period of the year.

Fitzhugh

Whether a given ration is adequate tends to be species specific ie. under a given set of conditions, goats look good, cattle poor,and sheep somewhere in-between.

Weir

This must vary from day to day and sector to sector.

Johnson

The species mix is uniform over a large geographic area. We do not know as much about the seasonal mix. Cattle, at the end of the rainy season, are skinny. This may be due to a mineral deficiency.

Robinson

Need to see exactly what the goats are eating. Is anyone doing this?

Johnson

Fistulated animals are ready to go. Malechek will be looking at this.

Robinson

What about parasite burdens? Goats do not eat off the ground as much as cattle do. Could their superior appearance be related to fewer parasites rather than better nutrition? Are goats as susceptible to Cu/Mo deficiency as cattle? Is it health, nutritional factors or some interaction that causes cattle to look poor and goats good? This is an important question to answer.

R. W. Van Keuren
Nutrition Seminar
Chicago, Ill.
Dec. 22-23, 1980

Peru

As we look at livestock production and nutrition in Peru we see a major problem, if not the major problem, of inadequate quality of forage and feed during all of part of the year, together with low quality of the feedstuff. Severe nutritional stress during all or part of the year is common. In addition to reviewing the literature available on forage and livestock production in Peru and our own observations, we asked several Peruvian scientists regarding the general problem of animal nutrition. Of the current 14 million head of sheep in Peru, 99% are in the Andean region, at the 3500-4500 meter altitude (14,000'). 85% of the cattle are there also. The 3 million alpaca in Peru are at this altitude and on up to 5000 meters (16,000'). This region is primarily rangeland. Dr. Arturo Florez, head of forage and range research at the National Agrarian University, UNA, reports that over 80% of the range is overgrazed, less than 20% in good or excellent condition. He feels that recovery of this overgrazed land and the resulting improvement in nutrition and animal production as being the single most important area for the SR/CRSP in the Sierra. Dr. Ricardo Valdivia, IVITA animal nutritionist, gave this list for studies needed at IVITA's LaRaya alpaca station in the southern Sierra: (1) climate-basic meteorological data, (2) soil surveys, (3) vegetation surveys, (4) animal nutrition-digestibility, rate of passage, and VFA studies; (5) strategy for providing feed during the dry season, (6) forage conservation, and (7) economic evaluation of feeding systems. Ing. Enrique Nolte is head of goat research at UNA, and his assessment of the two most pressing problems among goat producers at this point are: (1) nutrition-both quantity and quality deficiencies, with the problem of sufficient feed during the dry season especially acute, and (2) internal parasites, esp. in young goats. Robert Cochran, our research associate in Peru, has been there since July, traveling widely with

our Peruvian co-workers, as well as reviewing Peruvian literature, much of it in Spanish and available only locally. His evaluation is that the most pressing need for animal production and nutrition is the development of the forage and feed resources.

In Peru we are fortunate to have a foundation of information on range and cultivated forages, thanks to the work of such experienced researchers as Ing. Parodi and Dr. Florez, supported in part by various international programs of the US (N. Car.), Canada, Germany, and New Zealand. In the Sierras we are dealing with the same forage species and varieties used widely in northern United States, familiar names such as Ranger, Buffalo, Rhizoma, and DuPuits alfalfa, Kenland red clover, Pennlate and Latar orchardgrass, per. and annual ryegrass, and ladino and white clover. These respond very well to irrigation in the Sierras, and the value of irrigated cultivated forages has been shown in terms of yield and lamb gains. There is a need for continuing effort on evaluating new and better varieties and how to manage these forages under grazing under this environment, but major emphasis needs to be on integrating the cultivated forages with the range. Simply increasing the forage or feed for livestock is not the final answer to improving livestock production and nutrition. The final results that we want is increased off-take, more meat, milk, and fiber. To achieve this we are concerned with the development of what we might call a "nutrition delivery program," the most economical method of satisfying the nutritional needs of sheep and alpaca in the Sierra. Nutrition is a very general term and we see nutrition in the situation in the Sierra as providing adequate quantity of feed throughout the year and adequate quality during the critical production periods. We see cultivated forages as a means of intensifying and extending range production, taking pressure off the range where overgrazing generally exists, and providing better nutrition for a portion of the flock at gestation, early lactation, and during lamb growth and finishing.

We are interested in seeing what we can do to wean and finish lambs at younger ages on high quality cultivated forage. Currently 18-24 months are needed for finishing sheep in the Sierras. Potentially we can do this in 40% of that time, or approximately 5 months. Concurrently the ewe lambs can be developed more quickly and perhaps become reproductively active at an earlier age. Increased lambing percentage also by the ewes would be possible with better nutrition. Obviously such research calls for a close joint effort between animal scientists and agronomists, both US and Peruvian. Not only is there a need to integrate the cultivated forage research with the range studies, but with the breeding project where sheep with different production potential exist or will become available from the breeding effort.

As we have been discussing the research that we are planning in Peru, already we see other opportunities from this joint effort. There will also be a need for fine tuning of practices. We may learn that certain mineral deficiencies may occur or other limiting factors that will require special in depth studies. The intensification of forage resources is likely to result in new challenges, particularily in the disease area, e.i. internal parasites and foot rot.

We are fortunate in Peru to have an exceptionally fine group to work with, both Peruvian and US researchers. From early on the Texas Tech range management group has strongly encouraged the Ohio forage and nutrition project to join them in Peru. They have gone out of their way to be helpful and support us to get established in Peru. Such a spirit of cooperation between institutions both US and overseas is needed to make the SR/CRSP effort succeed.

Our long range goal should be to aid countries such as Peru to develop their own capabilities to do the research needed in their own country, whether it be range research or sheep and alpaca nutrition. More immediately we need to apply what is now known to making improvement in animal production as rapidly as possible because of pressing needs for food and fiber.

Kenya

In Kenya we are dealing with an entirely different situation in terms of crops and climate compared with Peru, tropical in Kenya vs temperate in Peru, but still the same basic problems of inadequate quality and quantity of feedstuffs to meet productive needs of the small ruminants. We are dealing with small farms, which are primarily involved with food crop production, and too small to support large ruminants. Traditionally agriculture has been a slash and burn agriculture, with intermittent fallow allowing natural release of fertility for another crop. Small ruminants fit well into the agricultural system of Kenya's wet tropics, to utilize the wide range of food crop by-products and forages available. Since commercial fertilizers are generally too expensive, emphasis needs to be on an integrated soils-crops-livestock system suitable for small farms, a total closed system with the livestock manure an integral part to recycle nutrients back through soil again. Sterling Wortman, President of Rockefeller Foundation, points out the importance of this in his article, World Food and Nutrition: The Scientific and Tech. Base, July 4, 1980 issue of Science. Here legumes, both as food crops and as forage for livestock, are needed to provide protein for both human and animal nutrition, as well as nitrogen to the soil for improving non-legume production. As in Peru, there are periods of low feed production-that must be planned for; and we are concerned with developing year-around animal nutrition delivery programs for the small ruminants. Again we need to develop total feed programs that supply the changing nutritional needs for breeding, lactating, growing, and finishing phases. Again as in Peru, we are not only concerned with merely increasing forage and feedstuff production, but using them to increase meat and milk production, resource intensification, if you will.

As in Peru we have a foundation of information on the forages and crop by-products available. Our basic task initially is to develop combinations of these feedstuffs that meet the year-around nutritional needs of the animals; what we would like to call integrated nutrition management. We don't know all of the answers on goat nutrition, but we can certainly go a long way to improve its general level of nutrition.

In the wet tropics of Kenya, we find a long list of food crop by-products available - from maize, from pulse crops, sugar cane, banana, cassava, sweet potatoes, plus a long list of tropical forage grasses and legumes, and fodder trees and shrubs. Developing a nutrition program from such feedstuffs is an interesting challenge. One concern is what happens to ruminants subjected to frequent changes in feedstuffs with the rumen requiring a period of time to become adapted to these changes in diet.

The original plans for the SR/CRSP as developed by the N.C. Research Triangle group and its consultants has come under criticism for not putting enough input into nutrition. When the Ohio group was contacted regarding participation as a forage and nutrition project, we called one of the consultants concerning the views on livestock feeding and nutrition. He explained that they believed that by far the greatest problem in animal nutrition in the LDC's was the need for adequate quantity and quality of feed and to improve feed production. Four of the 17 projects included were directly related to improving the feed resources and their utilization. Because sheep and goats are commonly found in range conditions, two were range projects. Because by-products were important in parts of the world, a by-product project was included. And finally a forage project because cultivated forages were also important. Two additional projects with elements of feeding were included, the two dairy goat production projects. The systems analysis project is also concerned with nutrition,

requiring forage and feed analysis, intake, etc. to develop their models. We were advised by the Research Triangle that an integrated forage and animal research project was called for - emphasis on developing complete programs, or systems, packages that would provide adequate quantity and quality of feed throughout the year to meet the changing nutritional needs of the animals, not bits and pieces research where we might evaluate pasture grazing of fattening lambs or a particular feedstuff, etc. Rather to look at the real world of the producer facing periodic feed shortages, rapidly changing forage maturity, changing nutritional demands of the flock or herd, etc. It seems to me that all of us recognize the importance of animal nutrition in the total program. It is inherent in all of the projects. Perhaps it simply needs to be more clearly spelled out.

I believe that our current goal should be to bring present knowledge to bear on improving the production of small ruminants and to develop the research capabilities of the Kenyans. We are dealing with a matter of priorities. Kenya has a rapidly growing population and needs to improve its food production as fast as possible.

Van Keuren Presentation See attached Paper, R. W. Van Keuren, Nutrition Sem.

Weir
Have you had any luck getting into the Spanish literature?

Van Keuren
Yes, we have. US libraries are not adequate for the needed material. We must go to host countries where there is much literature in Spanish. That's why our literature review is late.

Johnson
IICA put a bibliography together in the early 70's. Is anyone keeping them up to date?

Van Keuren
Do not know the status of these.

Bryant
The most recent one was published 4-5 years ago on alpaca in Bolivia.

Lassiter
You have described various production systems in Peru and suggested a move towards more intensive ones. Is there a money factor involved in moving towards more intensive systems?

Van Keuren
The SAIS have the capital to do this. Campesinos may have more problems.

Bryant
Campesinos are not usually involved in irrigation, just bofedales if they control them.

Lassiter
It appears we're creating technology beyond the means of the Campesinos.

Weir
What about ensiling?

Van Keuren

Oats are a possibility.

Bryant

Van Keuren is talking about smallholders getting together.

Van Keuren

We may be able to get them to cooperate. There is some indication they do this with cropping already.

Luginbuhl

Most seed for cultivated forages is imported, very expensive, and bred under conditions different than those in which they will be used. Is there any local attempt to produce seed adapted to local conditions?

Van Keuren

We know what does well, and will try to carry on some seed production starting with small garden areas.

Johnson

Climate inhibits seed productivity at high altitudes, ie., alfalfa will not flower. This means seed production needs to be done elsewhere.

TEXAS TECH UNIVERSITY

Through the eyes of a rangeman, the central problem in Peru, with respect to the 14 million sheep and 3 million alpaca, is one of improper grazing management. Poor grazing management directly affects the nutrition of these herbivores because the quantity and quality of nutrients available to them is usually significantly reduced. If we realize that well over 95% of the small ruminants in Peru receive all of their nutrients from the range, then studies in Range Nutrition become extremely important.

Range Nutrition studies are different from classical nutrition because:

1. With no metabolism stalls there is no control over quantity of consumption.
2. With selectivity of grazing herbivores there is no control over quality of consumption.
3. With added energy costs of travel and environmental stress (heat, cold, wind), there are no clear estimates of nutritional requirements.

Consequently, researchers in Range Nutrition must resort to techniques other than conventional ones used the laboratory.

Presented today are some objectives that my Peruvian counterparts and I have listed. These have been categorized as specific, long-term, and short-term (Tables 1-3). The specific objectives served as an umbrella under which long term and short term objectives were developed.

Long term objectives will be evaluated through animal performance measured under several years of different grazing strategies. These strategies include traditional practices by local herdsmen as contrasted against conventional ones at different stocking rates. In conjunction with the Ohio Forages Projects, these long term grazing strategies will also be evaluated as to how animals respond when afforded supplement from cultivated forages as compared with those who derive all their nutrients from range vegetation. Lastly, the most important evaluation will be one of quantifying the impact animals have on the grazing resource.

Short term studies are designed to identify the extent and timing of protein and energy deficiencies occuring naturally on native range throughout the year. Where possible, esophageal fistulated animals will be used to quantify these relationships, along with the positive and/or negative impacts of other sympatric herbivores.

Gaps that must be plugged in the feeding strategies of small ruminants include:

1. Compilation of and chemical assays of crop residues and agricultural by-produts that have potential as protein or energy supplements to range vegetation.

2 The harvest, processing, storage, and preservation of these potential feed sources, along with excess native forage produced during the rainy season.

Table 1

SPECIFIC NUTRITION OBJECTIVES

1. Evaluate nutritional quality of available forage

2. Identify the extent and timing of protein and energy deficiencies of sheep when

   a. Grazed under traditional management practices and stocking rates
   b. Grazed at traditional stocking rates but under a rotational system
   c. Grazed at various stocking rates under rotational systems
   d. Grazed with cattle under a rotational system

3. Define protein requirements of Alpaca

4. Define energy requirements of Alpaca

5. Evaluate nutritional deficiencies of Alpaca under traditional grazing practice

6. Evaluate nutritional deficiencies of Alpaca under rotational grazing systems

7. Nutritional value of Alpaca diets as influenced by sheep

Table 2

LONG TERM STUDIES THAT INDIRECTLY INVOLVE NUTRITION THROUGH THE EVALUATION OF ANIMAL PERFORMANCE

Lamb crops, birth weight, weaning weights, and fiber production as influenced by:

A. Sheep under different management strategies

1. Rotational vs continuous year-long grazing at the same stocking rate

2. Different stocking rates under rotational grazing

3. Sheep and cattle vs sheep only, under rotational grazing

4. Sheep use of improved pastures and range vs range only

B. Alpaca under different management strategies

1. Rotational vs continuous year-long grazing at the same stocking rate

2. Different stocking rates under rotational grazing

3. Alpaca and sheep vs Alpaca only, under rotational grazing

4. Alpaca use of improved pastures and range vs range only

Table 3

SHORT TERM STUDIES THAT DIRECTLY INVOLVE ESTIMATES OF NUTRIENT INTAKE

1. Nutritive value of grasses on the Altiplano at various stages of phenology

2. Year-long nutritive content of sheep diets under rotational vs continuous year-long grazing on the Altiplano, Peru

3. Protein requirements of Alpaca for maintenance, gestation and lactation

4. Energy Requirements of Alpaca for maintenance, gestation and lactation

5. Year-long nutritive content of Alpaca diets under rotational vs continuous year-long grazing on the Altiplano, Peru

6. Nutritive levels of sheep diets on the Altiplano as influenced by cattle grazing

7. Year-long dietary nutrient levels and dry matter intake of sheep under rotational grazing at different rates of stocking

8. Year-long dietary nutrient levels and dry matter intake of Alpaca under rotational grazing at different rates of stocking

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Grazing treatments:

a) Traditional.

b) Rotation under 4 stocking rates.

c) Rotation with cattle and sheep.

A. Availability - Air-dried Forage Production.

* 1. Production curves of 5 major grass species - standing crop on each range site at zero grazing - potential forage availability.

* 2. Standing crop bio-mass (kg/ha), by plant species on each grazing treatment (feedback), 4 times each year at the end of the dry season, the middle and end of the rainy season and the middle of the dry season, presented as:

a) Kg of forage/head.

b) Kg of palatable forage/head.

B. Nutrient Value - CP - IVDOM.

** 1. Arturo Florez is initiating studies now on chemical analysis of 5 primary grasses at different stages of phenology.

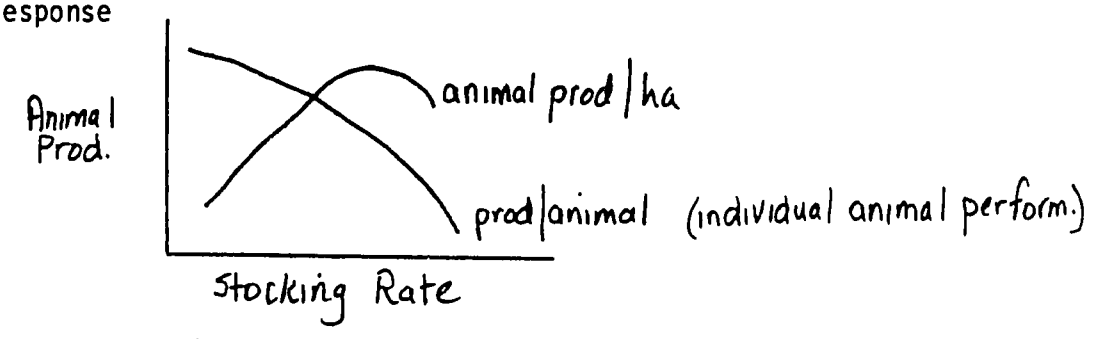
*** 2. Nutrient deficiencies for sheep - esophageal fistulated sheep used to sample the grazing treatments.

*** 3. Intake - IVDOM and total fecal collection-total fecal output and % that is indigestible allows one to predict dry matter intake.

** 4. Animal performance - lamb crops, weaning weight, wool production

** Production Cycle - Late Gestation, Early Lactation, Breeding

** Production Response



*** Genotype

* Feedback

Anticipation that we can achieve the objective:

* High ** Low *** Very Low

Bryant Presentation See attached Papers, Texas Tech plus 3 Handouts

Bryant
How much overlap is there in where alpaca and sheep are located?
There are problems with fistulating alpaca because they have thin, easily torn esophogus.

Fitzhugh
Why focus on alpaca, why not llama?

Bryant
The Peruvians are more interested in the alpaca. Many smallholders have a few alpaca.

Van Keuren
Llamas are a beast of burden.

Fitzhugh
The situation is reversed in Bolivia.

Robinson
80% of the alpaca are in Peru; 80% of the llamas are in Bolivia.
What mechanism are you or anyone else for that matter going to use to define nutrient requirements? What parameters will you look at and what techniques will you use?

Bryant
This is going to be difficult. We will need to get help from Animal Science people. One approach, using metabolism stalls at La Raya, is to vary protein and hold energy constant and vary energy and hold protein constant.

Robinson
For what production trait or level are you trying to get the nutrition requirement?

Bryant
Reproduction is poor in the alpaca. We'll target this and fiber production.

Lassiter

What's the most limiting factor in the Highlands?

Bryant

Dry Season - Protein

On over-grazed range - Dry Matter

Weir

Why not just see if supplementation gives a response, ie., minerals, protein, energy?

Bryant

This is the approach Range project is taking in conjunction with Forages project.

Johnson

This could provide an opportunity to get some answers about costs as well.

Robinson

The alpaca is a mystical animal just like the buffalo to the Asian or the camel to the Arab. For example, the people at La Raya claim they will not eat supplement. Do you believe it?

Bryant

Alpaca eat supplement in Bolivia.

Fitzhugh

How are supplements fed?

Bryant

Four alpaca are put in a small quarter hectare pen. The supplement is put in elevated exposed boxes. They try to force the alpaca to eat it under less than ideal conditions. The animals do not get anything else to eat.

Weir

Will they eat alfalfa?

Bryant
I do not know.

Robinson
They supposedly do not get bloat, perhaps another mystical attribute.

Bryant
We plan gross nutrient estimates but there is no money for in depth studies. Long term data is going into Cartwright's model. The Central Sierra site is SAIS Pachacutec.

Yazman
How practical is a variable stocking rate?

Bryant
We are not using that. We'll use a set stocking rate to compare continuous vs rotational grazing schemes.

Fitzhugh
How are you going to control grazing on the rotational scheme?

Bryant
We'll fence each treatment.

Fitzhugh
Is this feasible monetarily?

Bryant
We're looking at the management of one herd. A herder can control the animals. Electric fences are getting relatively inexpensive and may be within practical means for the SAIS's.

Weir
What about land tenure?

Bryant
Community land, private animals, and continuous year long grazing.

Johnson (to Bryant)
What about different strategies to aim at communidades vs SAIS. Even the Peruvians have great difficulty coping with this issue.

Robinson
In addition, the Quechua areas are not really Campesino people. Can Range cope with their project's objectives which are very ambitious in view of the money situation.

Lassiter
Maybe Weir's idea about looking at supplement effects, rather than looking at nutrition requirements is something to consider.

Johnson
Maybe, at least look at thresholds.

Yazman
There has been useful work done by Mott in Brazil, using this approach.

Robinson
I like this approach ie. protein vs energy. I think its energy since decreased energy intake leads to decreased protein synthesis.

Weir
Add to this seasonality.

Conrad
You should keep open mind about whether its protein or energy. It may very well be both.

Report of Trip to Indonesia by the Principal Investigator
of the Nutrition Project, Small Ruminants CRSP
September 20-October 14, 1980

W. L. Johnson

Summary

It is increasingly evident that the Small Ruminants CRSP made a wise choice by including Indonesia as an overseas collaborating worksite, and that the early foundations for collaborative research have been well laid. Enthusiasm is generally at a very high level for all aspects of the SR-CRSP in Indonesia. For the nutrition-related projects, early progress has been made in several areas, and agreement was reached for continued implementation of the first-year workplan. Several aspects of the training program were also discussed.

Itinerary

Most of the Principal Investigator's time was spent at the Lembaya Penelitian Peternakan (LPP) or Animal Husbandry Research Institute in Bogor. Detailed conversations were held with each member of the nutrition and forages research staff, individually and as a group, and also with investigators in related fields.

In addition to the time spent at LPP, visits were made with persons from the following institutions:

USAID/Jakarta (Dr. Ernesto Lucas)
International Agricultural Development Services, Bogor (Dr. Ed Oyer)
Ford Foundation, Jakarta (Dr. Walter Coward)
Institut Pertanian Bogor (Bogor Agricultural University; Dr. Toha Sutardi, Animal Nutritionist)
Gadjah Mada University, Yogyakarta (Dr. Soedono, Dean of Animal Husbandry, and Dr. Soekanto, Animal Nutritionist)
Rockefeller Foundation, Yogyakarta (Dr. Loy Crowder)
PPPT, Ciawi (Dr. Harry Wharton, Project Manager; Drs. John Roberts, John Petheram, Brian Lowery and Neville Yates)
University of Melbourne Research Network on Utilization of Fibrous Agricultural Residues (Drs. Norman Tulloh, G. R. Pearce, and Peter Doyle)

Progress, Plans and Personnel in Nutrition Projects

Coordination - The nutrition program at LPP is very much a team effort and should continue so. The leadership for SR-CRSP activities is being shouldered by M. Rangkuti and Andi Djajanegara for animal feeding and nutrition and feed utilization, M. E. Siregar for forage agronomy, and Dr. Neil Thomas as nutrition research coordinator for N. C. State University.

Village baseline survey - Data is now being processed from the practice survey village in West Java (Ciburuy). The LPP village enumerators are now located in the two West Javan villages which have been selected for baseline data collection (about 130 producer units in each village). Conversations are underway between LPP and provincial government leaders in East and Central Java; one of these two provinces is expected to provide two additional villages for baseline survey. The questionnaires for baseline data collection have been completed. The feeding information will be limited to a description of cropping systems (with crop residue and byproduct availability to be inferred)and qualitative information on types of feed offered to small ruminants, and whether purchased or provided from within the

farming unit.

Neil Thomas will oversee the collection, summarization, and analysis of the baseline feeding data; Wayan Mathius has been assigned to assist him. Also, a new staff member assigned to the Margawati Station in West Java, Bambang S., will assist in day-to-day liaison with the village enumerators. If the survey proceeds in East Java, a similar arrangement will be made with a member of the LPP Grati Station staff.

The possibility was discussed that an LPP nutritionist who is currently on leave for M.S. studies at IPB might be interested in using part of the baseline survey data for his M.S. thesis.

Monitoring village feeding programs - Planning is already underway for the more intensive monitoring program which will involve a selected group of small ruminant producers in the same villages as the baseline survey. Dr. Thomas is working with a local metal-works to design and build drying ovens for use in the villages. He will also coordinate the team effort to plan the animal and feed data collection, the feed sampling procedures, and training of village staff for these activities.

Carried out over a period of a year, the monitoring activity will provide a wealth of information on how feeds, breeds, health, cropping systems, and management interact in the village socio-economic environment to determine animal productivity. It will also be the source of large numbers of samples of commonly used feedstuffs, the analysis of which will provide a useful profile of their nutritional value. Samples will be taken at the moment the feed is offered to animals, and will be dried immediately in forced-air ovens at about 60°C. Minimum analyses to be performed are crude protein (Kjeldahl N); total cell-wall fiber (by neutral-detergent extraction); and *in vitro* digestibility of dry matter (by Van Soest's modification of the Tilley and Terry procedure). For selected samples, a more complete fiber profile will be determined, including hemicellulose, cellulose, lignin, and acid-insoluble ash (by acid-detergent and permanganate extractions). All of the above work will be done at the LPP labs in Bogor under the general supervision of Anni Djajanegara and the day-to-day help of Abdur Rays, Rosasri, and their laboratory assistants.

Arrangements are expected to be finalized with Dr. Soekanto at Gadjah Mada University for analysis of several minerals: Ca, P, Mg, Zn, Cu, Mn and Fe. Institutional and financial details must still be worked out. For a few very select samples, it may be desirable to send them to the United States (through standard USDA channels) for Co, Mo and Se determinations.

Nutrition/breed interactions - The entire LPP staff for nutrition, forages and breeding met together to plan for the implementation of the SR-CRSP work plans in breeding and nutrition, both of which call for the evaluation of goat and sheep breed performance at more than one level of energy input. The existing feeding program and feed resource base at the two LPP farms (Cilabut and Cicadas) were reviewed. The current feeding program at both farms includes a high level of concentrates (ground corn, rice bran and coconut oilmeal). Plans call for expanding the experimental breeding herds to include about 50 breeding females each, of five types: Cacang goat, Etawah goat, fattail sheep, priangan (East Javan) sheep and Central Javan sheep.

My recommendations for the conduct of joint nutrition/breeding research at the two LPP farms have subsequently been discussed with Dr. Eric Bradford, Principal Investigator, UCD breed evaluation project, and can be summarized as follows:

1. Concentrate the experimental breeding herds at Cilabut, where water is not a factor limiting feed production. Use the Cicadas farm for reserve animals,

for seasonal growth trials with a pasture or cut-and-carry forage base, and for dry season growth trials with a stored or purchased feed base.

2. Expand the present breeding herds conservatively so as not to exacerbate a feed supply crisis.

3. Name one person with supervisory authority for forage production, animal feeding, and management at both stations. This person will be charged with implementing the research project plan as developed (and occasionally modified) jointly by the genetics and nutrition project leaders.

4. Place initial emphasis on characterizing the present feeding program in more rigorous detail. Included should be careful observations of feed dry matter intake, and sampling of feed offered (possibly also of orts) for crude protein, NDF and in vitro DM digestibility determinations.

5. Proceed with planning for a second nutritional level which will be achieved on an all-forage diet. The definition of "forage" in this case should be broadly interpreted to include grasses, legumes, and crop byproducts such as cassava or sweet potato foliage. As a first approximation, such a diet might include equal parts of napier grass (leaves only, harvested at 21-28 days regrowth), gliricidia (or leucaena), and cassava leaves. Some preliminary ration testing for intake and animal performance would be recommendable.

As a practical approach, minimum acceptable performance levels might be established in advance, and the health and feed management programs be re-evaluated if actual performance falls short. Such mimimum standards should be set with village conditions in mind and include such parameters as growth rate (replacement breeding animals), growth rate (for market), mortality, fertility, and weaning weight/age.

This project is crucial to the ultimate credibility of virtually all of LPP's breed selection and feeding recommendations, and should be given very careful thought. Implementation should not out-pace a carefully thought-out plan. This will require the attention of all nutrition and breeding project leaders. It was suggested by Mr. Rangkuti that Hamzah Pulungen might assume a key role in the Cilabut/Cicadas feeding research upon his return (November 1980) from M.S. studies at IPB.

Feed evaluation trials, LPP - This is an ongoing aspect of LPP's research program. Andi Djajanegara has been conducting a series of trials designed to evaluate crop residues such as rice straw for small ruminants, including the effect of alkali treatment. With the promised support of the University of Melbourne, through its new network for evaluation of fibrous feedstuffs, this line of research will be continued.

An experiment was started by Budi Haryanto during my visit to compare the intake of four forages when all are offered free choice to West Javan sheep or kacang goats. This first "preference" trial includes banana leaves, sweet potato foliage, cassava leaves and napier grass as the forages on offer. Half the animals receive 200 g of concentrate per day, the others none. An additional group of sheep are being offered one of the same four forages as its sole diet, for voluntary intake and subsequent digestibility measurement. It is hoped that data from these experiments can be included in an M.S. thesis for Mr. Haryanto at N.C. State. He has been accepted by our Graduate School for January 1981 admission.

The coordination of feed evaluation trials is the responsibility of Mr. Rangkuti, Andi Djajanegara, and Neil Thomas (particularly for assistance with experimental design and statistical analysis). Two new junior staff members, Muchji and Sudaryanto, are expected to assume day-to-day supervisory responsiblity.

Another new LPP junior scientist, Ms. Busnia Betta, is currently studying for the M.S. degree at IPB, and is expected to participate in feed evaluation studies.

Animal performance experiments - Andi Djajanegara is presently the leader of an LPP project designed to relate lamb and kid growth rates to dietary protein levels and sources. Wayan Mathius is his assistant. The possibility was discussed that data from this very excellent study might be summarized in time to present an abstract for the July 1981 ASAS meetings in Raleigh.

At Gadjah Mada University, Dr. Soekanto plans to conduct an experiment with native and Etawah does, to test the effect of differing energy levels on health and reproduction. Although the project is partially supported by the Rockefeller Foundation, the possibility was discussed that the scope of the project might be broadened with CRSP support. We are awaiting a further proposal from Dr. Saekanto.

Ms. Prapti at PPPT is starting some experiments to evaluate the cellulose digestibility of common feedstuffs. Close coordination and collaboration with her research is recommended.

Carefully controlled experiments in which all factors are held constant except levels of one or another nutrient (protein, energy, or important limiting minerals) and resulting productivity is precisely measured (growth rate, milk production, conception rates) should soon become the central focus of the CRSP nutrition projects. These are the kinds of experiments which will yield hard data to support recommended interventions or changes to existing feeding practices. They will also contribute to the long term goal of establishing nutrient requirement tables for local breed types under local management and climatic conditions. Naturally, the design of such experiments should take into account the information which will come out of the village baseline and monitoring surveys.

Forage production and agronomy - Mr. M. E. Siregar is the leader of this research area. He has proposed several projects for SR-CRSP financing, either with U.S. or Indonesian funds. My current recommendations are as follows:

1. Work with forage grasses should emphasize high yield (due to limited land area), maximum voluntary intake (small ruminants on rations of unsupplemented tropical grasses seem to suffer from energy deficiency), and high protein/low fiber/ high dry matter digestibility. Of these several attributes yield alone is now being given too much attention; it is inherently incompatible with high quality and intake. Experiments looking at yield and quality response to sheep or goat manure, and experiments where harvest interval is the major variable are definitely needed. Also, for their sparing effect on nitrogen and expected positive effect on animal intake, the association of legumes such as centrosema, siratro and stylo should be attempted with all forage grasses, rather than continuing to think of grasses alone.

2. The protein needs of animals can be partially supplied with tree legumes such as gliricidia, leucaena, caliandra and sesbania. These plants have the added advantage of essentially zero space requirements, that is, they can be grown along fencelines and ricefield terraces. The animal evaluation phase of work with these legumes should be given priority emphasis.

3. Other work with forage grasses or legumes, and the relative emphasis to be placed on this work versus food-crop byproducts, should be deferred until results of the village surveys are known and studied.

Laboratory development at LPP - The feedstuffs analysis lab at LPP is presently taxed to capacity. Accelerated research activities in any or all of the above areas will result in hundreds of additional samples for routine fiber, protein, and *in vitro* digestibility determinations. Equipment needs for an expanded laboratory

capacity have been identified and will soon be shipped from the U.S. Most of the reagents and glassware can be purchased locally by LPP with this year's or next year's budget. Thought is also being given to how to optimize the human resource, and get maximum use of laboratory facilities by the present staff of technicians and assistants. For example, the idea of staggered shifts was discussed and may be workable.

Overall Impressions

A lot of progress has been made with SR-CRSP activities in the few months since the Principal Investigators first visited LPP in January and the Memorandum of Understanding was signed in February. Granted, some activities are proceeding faster than others and there have been some unexpected delays as well as some surprises with things moving faster than expected. The overall balance is that good, steady progress has been registered!

LPP was in the process of budget planning for the 1981-82 fiscal year during my visit. The results of this planning reflect very favorably on the attitude of collaboration with the SR-CRSP. If budgetary progress and personnel reassignments proceed as currently being discussed, the climate for truly productive collaborative research in Indonesia will far exceed early expectations. Let's hope we can all live up to the challenge presented to us by the enthusiastic positive attitude now strongly in evidence.

Appreciation

My hearty thanks to Dr. Roestandi, Dr. Panjaitan, Mr. Rangkuti, Mr. M. E. Siregar, and Dr. Neil Thomas for their splendid cooperation in organizing a 14-day agenda which was efficient and effective for the joint planning which needed to be done. My appreciation also to Andi Djajanegara, Budi Haryanto, Joel Levine and other persons who contributed time and ideas to our planning effort, and whose continued hard work will tip the balance toward a successful collaborative research program.

W. Johnson Presentation See attached Papers, Previous Paper, Indo. Trip Report

Johnson

Production system in Indonesia is zero grazing and limited tethering. The animals are confined 24 hrs/day at all times. The animals are well fed in the villages (cut and carry) and poorly fed on the research stations. We need to find out about what's happening in villages. On the experiment stations the animals are fed concentrates and cultivated forages, ie. napier grass which has a high yield and very low digestibility and intake. The Village Survey Progam is going well.

Yazman

Why do the villagers keep animals?

Johnson

The primary reason is for their manure production. We do not know how much the animals contribute to the income or nutrition of the villagers. The survey will answer that.

G. Smith

What will be the effect on the CRSP if P3T comes into closer contact with LPP?

Johnson

The facilities look nice but they do not have the capability of doing an ADF.

Weir

Are nutrient evaluation techniques being standardized?

There was general agreement among the participants, that they were.

Conrad

Sometimes small investments in equipment will net large returns in productive output, ie. dilutors for mineral analyses and voltage regulators.

Fitzhugh

Concerning standardized analytical methods for nutrients, how about writing up a standardized set of techniques for the CRSP?

There was general agreement among the participants, that this was a good idea.

G. Johnson

Do the Indonesians regulate animal numbers by feed supply?

Johnson

Space and labor appear to be limiting. They have not begun to touch the available feed supply. Five females is a large holding. W. Java receives 4m of rain a year. It is well distributed and they have good soil with high fertility.

WINROCK
INTERNATIONAL

MEMORANDUM

TO: Participants - SR-CRSP Nutrition Seminar DATE: December 5, 1980

FROM: Hank Fitzhugh

SUBJECT: Nutritional Strategies for Dual Purpose Goats in Small Farm Systems (Kenya)

The goal is to develop practical strategies for meeting the year-round nutrient requirements of dual purpose goats utilizing low-cost feed resources available on small farms.

Current availability and use of feed resources by livestock on small farms will be assessed by the Small Farms System Survey. Feeding value for these and alternative feed resources suitable for dual purpose goats will be evaluated by the Forage and Feed Resource Program.

The Nutritional Strategies Program will focus on the following objectives:

1. Estimation of feed requirements for growth, lactation and fertility of dual purpose goats under tropical conditions.

2. Comparison of feed requirements and efficiency of goats and alternative livestock, especially dual purpose cattle.

3. Formulation of nutritionally balanced rations utilizing low cost forage and feed resources available to small farmers; these resources may include off-farm sources, such as browse on communal grazing lands and purchased supplements.

4. Development of appropriate techniques for processing and preserving feed resources to improve their nutrient value and to carry over surpluses for use in seasonal periods of short supply.

This work is expected to be done in close collaboration in Kenya with the Ohio State led Forage and Feed Resource program which has a principal objective of evaluating nutrient value of locally available and/or introduced forages and other feed sources. Knowledge of these nutrient values will be used in formulation of nutritional strategies to meet projected animal requirements on a year-round basis. Hypotheses to be tested are that these experimental rations (which will tend to be most practical, least cost, etc.) do meet nutrient requirements. Tests will be against control rations known to meet animal requirements for various production activities (lactation, growth, reproduction).

WINROCK INTERNATIONAL LIVESTOCK RESEARCH & TRAINING CENTER/Petit Jean Mountain/Morrilton, Arkansas 72110, U.S.A./Telephone (501) 727-5435
TWX 910-720-6616

Another set of hypotheses to be tested are that dual purpose goats and dual purpose cattle do not differ for traits such as dietary preference, efficiency of ration utilization, productivity.

The objectives emphasize development of feed and animal management practices which are suited to needs of small farmers. Experimental comparisons of feed harvest, processing and storage technology (generally that shown to work elsewhere) will be first evaluated under closely controlled experimental conditions, but principal evaluations will use on-farm testing.

HAF:io

Participants

Fred Bryant
Thomas Cartwright
William Johnson
John Malechek
Nancy Stott
Robert Van Keuren

cc: David Robinson

Title: Development of Nutritional Strategies for Dual Purpose Goats in Small Farm Systems

Participating Institutions:

-Ministry of Livestock Development
-University of Nairobi
-Winrock International Livestock Research & Training Center
-Ohio State University

Participants:

Principal investigator - H. A. Fitzhugh, Winrock International
Co-Principal Investigator - M. Wanyoike, U. of Nairobi
Investigators - D.S. Kitivo, J. Kevelenge, Karachi, MLD
C.N. Karue, Berhane, U. of Nairobi
J. A. Yazman, Winrock International

Trainees - M.S. candidate, U. Nairobi (to be named)
M.S. candidate, U.S. university (to be named)
Funding to be provided by Winrock Int'l. grant

Other participants: W.O. Ochieng, Two Technical Officers (to be named), MLD

Participants in Nutritional Strategies program will collaborate closely with those in Forage and Feed Resources program.

Long Term Goals and Objectives:

The goal is to develop practical strategies for meeting the year-round nutrient requirements of dual purpose goats utilizing low-cost feed resources available on small farms. Current availability and use of feed resources by livestock on small farms will be assessed by the Small Farms System Survey. Nutrient values for these and alternative feed resources suitable for dual purpose goats will be evaluated by the Forage and Feed Resource Program. Thus, the Nutritional Strategies Program will focus on the following objectives:

(a) Estimation of feed requirements for growth, lactation and fertility of dual purpose goats under tropical conditions.

(b) Comparison of feed requirements and efficiency of goats and alternative livestock, especially dual purpose cattle.

(c) Formulation of nutritionally balanced rations utilizing low cost forage and feed resources available to small farmers; these resources may include off-farm sources, such as browse on communal grazing lands and purchased supplements.

(d) Development of appropriate techniques for processing and preserving feed resources to improve their nutrient value and to carry over surpluses for use in seasonal periods of short supply.

Background: Dual purpose ruminants fit small farm systems by converting forage and feed crop residues/by products to milk and meat. Cattle and goats both fit the role. However, dual purpose goats may have an advantage on small farms because the feed required for one cow and followers will meet the needs of 4 to 5 does and their followers. The cow will produce, at best, a single calf per year and produce milk for 6 to 7 months. By breeding the does to kid in different seasons, at least one doe will be lactating every day of the year ensuing a small but continuous supply of milk for family needs. Also, most well nourished goats will kid 3 times each two years and produce twins or even triplets, which means approximately 10 to 12 kids available for sale each year from a five doe herd. The income from sale of kids, as well as meat, would also be substantial.

In order to attain this genetic potential for milk and meat production by dual purpose goats, adequate nutrition must be provided on a year-round basis. Fluctuations in nutrition would sharply decrease milk yield and persistency, lower fertility and reduce kid growth rate. Thus strategies must be developed which continuously provide adequate nutrition based on low cost forage/feed sources, available to small farm operators. Methods of processing (e.g. chopping) and preservation of feed sources must be initiated in terms of their practicality for smallholders.

Development of these nutritional strategies require knowledge of nutrient requirements for maintenance and production (growth, fertility, lactation). Little is known about these requirements for goats; however, requirements for cattle are well known. Therefore, goats and cattle will be compared simultaneously in feeding trials using small farm feed resources. These simultaneous comparisons will improve the precision of estimated nutrient requirements for goats because cattle, whose requirements are well known, can be used as a comparative control.

Simultaneous comparisons of goats and cattle has the further practical advantage of evaluating and demonstrating which species best fits the needs of small farmers in Kenya. The two species differ markedly in daily dry matter intake (approximately 3% for lactating cows and 5-6% for lactating does) and in diet selectivity. These marked differences can potentially be both an advantage or disadvantage for either species, making it central that they both be evaluated.

Work Plan: The Nutritional Strategies Program will be conducted in three phases:

Phase I - Research on Experimental Stations, Ministry of Livestock Development Stations at Maseno, Kitale and others. Experiments requiring frequent and detailed data collection - weekly weights, dairy feed intake/refusals, in vitro analyses of ration and fecal composition, etc. - require the control possible on stations. Such experiments are needed to identify the best options for on-farm testing.

Phase II - Testing on Progressive Small Farms.

Nutritional strategies having the best potential value for small farmers will be evaluated in collaboration with progressive small farmers, who are interested in trying new ideas. These farmers will be identified through the Small Farm Survey and through recommendations from Extension Service.

Phase III- Testing on Typical Small Farms.

The best appropriate nutritional strategies - in combination with the most appropriate goats (kidding project), health program, feed resources base and socio-economic program - will be extensively evaluated on typical small farms throughout Western, Nyanza, and possibly other provinces. This extensive testing will be coordinated by the Extension Service with technical support from the SR-CRSP.

Details of Work PLans and Budgets are given for the respective experiments in this program (see attachments).

(a) Work Plan

Phase I (1980-81)

Maseno

-Develop Maseno Station (Oct. 80-May 81)

-Initiate Maseno goat vs. cattle comparisons (May, 81)

Kitale

-Initiate Kitale experiment on effect of ration processing and diet selectivity of young goats and calves (Jan. 81)

Phase II (1981-84)

-Identify progressive small farmers

-Field test best nutritional strategies

Phase III (1985-)

-Field test dual purpose goat program on typical small farms.

1. Title: Comparison of Goats and Cattle for Milk & Meat Production

2. Participating Institutions:
   Ministry of Livestock Development
   UNDP/FAO Sheep and Goat Development Project
   University of Nairobi
   Egerton College
   Winrock International Livestock Research & Training Center
   Ohio State University
   Washington State University

3. Participants:
   Principal Investigator - H.A. Fitzhugh, Winrock Int'l
   Co-Principal Investigator - N. Wanyoike, Un. Nairobi
   Investigators - D.S. Kitivo, MLD
   E.W. Allonby, FAO
   J.A. Yazman, M.W. Sands, Winrock Int'l
   T.C. Quick, Ohio State
   P. Sayer, Washington State
   Trainees: (see Nutritional Strategies project)
   Other Participants - - Ochieng (Station Manager) and
   Two Technical Officers (to be named), Naseno Station, MLD

4. Long Term Objectives

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

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

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

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

Dual purpose (milk, meat) animals supply high quality animal protein to improve family nutrition as well as sale of a highly desired market commodity. Principal dual purpose ruminants appropriate to Kenya are cattle and goats. Cattle are better established and accepted as milk producers; goats are primarily known for meat production under more extensive pasture conditions in Kenya. However, dairy goats have certain advantages over dairy cows for small scale farmers. Several goats can be maintained at productive levels on the same nutrients required by a single cow (approximately 5 does equal 1 cow). This allows:

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

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

Despite these apparent advantages for goats, cattle predominate as producers of milk even on small scale farms in Kenya.

Arguments have been advanced concernining the relative efficiencies of goats and cattle especially in the conversion of low opportunity feed resources, such as marginal land, forage, hop by-products and residues.

Questions have been raised about the efficiency of labor use, since five goats likely require more labor than a single cow; seasonal labor shortages might severely constrain the value of goat systems.

Little is known about the feed preferences of goats and cattle, especially relative to the small farm feed resources.

The relative magnitude of health and management problems for cattle and goats under confinement must be evaluated.

5. Objectives (1980-81) - Maseno Station

(a) Construct confinement housing facility suitable for individual feeding of lactating does and cows and for growing kids and calves.

(b) Develop sufficient feed crop production to supply year round feed requirements for experimental animals.

Cropping plan to be developed in collaboration with Forage and Feed Resource Project.

(c) Obtain dual purpose goats and cattle; screened for health problems.

(d) Initiate experimental comparisons of lactating does and cows.

6. Work Plan (1980-81)

(a) Time Schedule

October, 1980 - March, 1981

1. Construct housing facility
2. Cultivate 70 acres and plant crops.
3. Obtain does and cows, preferably pregnant dairy crosses.

March - April, 1981

1. Pre-experiment adaptation period for animals in confinement.
2. Finalize procedures for harvesting and feeding, sampling for composition analysis, milking and weighing and data recording.

May - December, 1981

1. Comparison of feed requirements, nutrient utilization and productivity.
2. Preliminary analyses of monthly data.

May, 1982

1. Complete first experimental production year
2. Analyze data.

(b) Procedures.

(1) Comparisons will be made between goats and cattle on experiment stations in environments representative of small scale farming areas. Initial comparisons will be made at the Naseno Station. Feed resources will be those found on typical small farms or those which are agronomically suitable and show special promise as feed resources (recommended by Forage and Feed Resource Project).

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

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

Different types of feed will be available in separate feeders in order to measure preferences. Nutrient values of rations placed in feeders and of refusals will be assessed to evaluate effects of selective feeding and to estimate requirements and efficiency of nutrient use.

(2) Experimental animals will be of similar type - mature second or later parity dual purpose females. Goats will be sampled from

first crosses or back crosses of European dairy breeds on East African or Galla Goats. Cattle will be sampled from similar crosses of European dairy breeds on East African Zebu or from some existing populations of Kenya grade cattle. Animals will be selected from MLD herds or from private Kenyan herds.

Experimental groups will be compared on a metabolic weight ($W^{.75}$) basis. For example, five 50 kg does have approximately the same metabolic weight as one 400 kg cow. Total numbers of each species will depend on land available for feed production, facilities, labor and availability of suitable genotypes from each species. However, a minimum number per year will be 10 cattle and 25 goats. These minimum numbers will be sufficient only with replication across several years.

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

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

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

- amount, type and composition of feed provided and refusals
- milk yield, persistancy of lactation, milk composition
- weight changes of mature females and growth of their progeny throughout production year
- disease and parasite problems, symptoms, treatments and responses.

(4) To develop appropriate means of feed preservation for locations where erractic rainfall pattern or lack of irrigation do not allow year-around harvest of fresh feed, feed preservation (hay, ensilage) techniques will be investigated. Also, processing methods, including chemical and mechanical treatments, of low quality crop residues and other feedstuffs may be evaluated.

Labor requirements, financial inputs and value of marketable (milk, meat, hides) products will be assessed. Observations will be made on the fertilizer value of manure produced by confined goats and cattle.

(c) Resource Needs - Masemo Station

(1) Personnel

1 - Technical Officer (Grade J or higher) - to supervise experiment and collection of data.

1 - Technical Assistant (Grade G)

1 - Secretary (Grade E)

2 - Clerks (Grade D)

1 - Artisan (Grade C)

1 - Driver (Grade C)

1 - Tractor Driver (Grade C)

20 laborers (Grade A/B) milking, feeding, pen cleaning - 12
feed planting, harvesting, storing, chopping, mixing - 8

(2) Animals

25-50 dual purpose does, preferably pregnant, and 2-4 parity

10-15 dual purpose cows, preferably pregnant and 2-4 parity

(3) Equipment

Pickup

Tractor, and implements

Feed cart

Forage chopper (manual)

Livestock scales

(4) Land

Assuming each unit (1 cow or 5 does) will require 15 kg dry matter (55% Dig) per day, plus 20% more for progeny, each unit will require 6.5 MT dry matter per year. Assuming 5 MT average dry matter yield per hectare, land for 15 cows and 50 does would be 32.5 ha.

(5) Facilities

Technical staff housing

Confinement housing, with fenced exercise area, for 15 cows, 50 does and their progeny.

Each individual feeding pen, as well as the general facility, must provide access to drinking water. Preference is for a raised storage tank to be filled at night from Station's supply when regular demand is lowest. Buckets placed in each pen can be filled periodically through day.

7. Training

a. Workshops for MLD extension staff and producers in collaboration with Maseno FTC

b. Trainees - (1) Univ. Nairobi

(1) U.S. university

supported by Winrock Int'l grant

8. Anticipated Achievements

a. Information to develop recommendations for management of dual purpose ruminants on small farms.

b. Extension level and scientific reports.

9. Budget

Annual Operating Budget (1980–81)

	Estimated Total	Source: CRSP	Source: NLD
1. Technical and support personnel – salaries for NLD employees			
Grade J (1)	35,000		35,000
G (1)	21,000		21,000
D (2)	19,150		19,150
C (3)	23,350		23,350
A/B (2)	122.400	61.200	61,200
Total	220,900	61,200	159,700
2. Trainees			
Stipends, feeds			
U.Nairobi (1)	45,000	45,000	
U.S. Univ. (1)	50,000	50,000	
Travel	15,000	15,000	
Workshops (2)	15,000	7,500	7,500
	125,000	117,500	7,500
3. Vehicle operation	75,000	45,000	30,000
4. In Kenya Travel and Per Diem	75,000	50,000	25,000
5. Facilities Development Land preparation, planting	25,000	15,000	10,000
6. Supplies	25,000	25,000	
1980–81 Recurrent Expenses Sub-Total	545,900	313,700	232,200
1980–81 Capital Expenditures			
Vehicle Purchase			
Pickups (1)	75,000	75,000	
4WD (1)	45,000	45,000	
Tractor Purchase	125,000		125,000
Staff Housing	150,000		150,000
Livestock Housing & Experimental Facility	100,000	75,000	250,000
Experimental equip. scales, forage chopper	25,000	25,000	
Livestock	47,500	47,500	
Capital Item Sub-Total	567,500	267,500	300,000
1980–81 Budget TOTAL	1,113,400	581,200	532,200

Footnote to Budget

1. Salaries of U.S. and Kenyan scientists are not included in budget.

2. CRSP funds include approximately 350,000 KSH from Winrock Int'l and 230,000 KSH from site development funds administered by the Management Entity. There may be some duplication of expenses with the Forage and Feed Resource Project.

Title: Comparison of goats and cattle in their efficiency of available feed resources and the effects of ration formulation in feed/ration selectivity and utilisation.

Participating Institutions: MLD
UNDP/FAO, SGDP
UON
Winrock International
Ohio State University

Participants:

P.I. - H. Fitzhugh, Winrock International
Co. P.I. - M. Wanyoike, University of Nairobi

Investigators:
1. Kusewa, Kevelenge, Baya, Mbugua, Waweru - N.A.R.S., Kitale.
2. Kitivo - SGDP.
3. J.A. Yazman, M. Sands - Winrock Intern.
4. Van Keuren, Quick - Ohio State University.

Trainees: (see Nutritional Strategies Project).

Long terms Objectives:

a) Assess the feeding value of feed resources identified as being available on small farms (Farm Systems Survey of Small Farms) and their utilisation in year round feeding systems for ruminants.

b) Investigate differences in the efficiency of utilisation of available feed resources between goats and cattle as well as the effect of feed processing on this.

c) Come up with a recommendation for balanced rations using available feed resources in year round feeding systems.

On small scale farms where feed supply is most often the limiting factor to realising the production potential of the dual purpose cow, the dual purpose goat may be a possible alternative. The goat being a smaller animal will move easily, meet its nutrient requirements for 60 maintenance and production potential. The goat has the added advantage over the cow of having the most catholic taster of all farm livestock and consumes a wide range of plant species in many stages of maturity, their seeds, tubers, roots, leaves and stems. An assessment of the physiological differences in the manner in which nutrients are utilised by the goat and other species of domestic livestock, especially the cow, within the tropical environment is necessary (Nutritional strategies). This would permit the identification of feeds which are not only useful and easily accessible to the goat but also these which would improve their economic efficiency.

On the same feed goats have been shown to be more selective than cattle. However, very little is known on the effects of processing on this selectivity, which is one of the main assets of the goats, now on the relative efficiency with which the feed is utilised for meat or milk production.

It should however be emphasised that where feed supply (either grown on farm or purchased) is not a limiting factor, a larger animal (e.g. the cow) will be better suited to large scale production.

Objectives (1980-81) - N.A.R.S., Kitale

1. Construct stalls suitable for individual feeding of mature goats and cows and for proving kids and calves. Renovate existing digestion crates at the station for kids and calves.

2. Develop a source of sufficient feed supply for the

duration of the experiment (5-6 months).

3. Obtain dual-purpose (½-3/4 dairy bred) goats and cattle (which should be screened for health problems).

4. Initiate experimental comparisons of goats and cattle:
   Expt. 1: The effects of feed processing using castrated males at approximately 12-18 months of age.

   Expt. 2: Digestibility study using young weaner goats and calves.

Work Plan (1980-81)

a) Time schedule: October 1980 - March 1981.

1. Construct housing facilities
2. Cultivate 4-5 acres and plant crops (bana grass and sweet potato vines)
3. Obtain the animals

March - April 1981

A 4 week adaptation period for animals in confinement.

May 1981

1. Assess effects of processing (chopped as whole plant on intakes and feed selection.
2. Analyse the data.

June - August/September 1981

- Comparison of feed intake, feed digestibility, LWG at different levels of sweet potato vines using the best processing method as determined in experiment 1.

b) Procedures:

Comparisons will be made between goats and cattle initially on bana (napier) grass and sweet potato vines (other crops will be used later at the recommendation of the Forage and Feed Resource Program). These two crops; bana grass and sweet potato vines, are widely distributed in the high potential small scale farming regions the former grown specifically for fodder and the latter as a food crop by-product.

The initial comparison will be made at the Kitale Research Station. Field trials at a few selected progressive farms will be done using feeds available on these farms as soon as possible after the initial results. The farms to be used in the trials may be identified from the Small Farms Systems Survey.

Feed will be cut and carried to the animals in confinement. Zero grazing management will be necessary for accurate intake and digestive efficiency comparisons and it is also appropriate to intensively farmed areas. The feed will be offered ad. lib. The nutrient values of feeds offered and refused will be assessed to evaluate the effects of selection and to estimate nutrient digestibility. In addition total faecal collections will be taken for five days every other week during experiment 2 (see objectives 1980/81).

In expt. 1, the ration offered will consist of 40% sweet potato vines (SPV) and 60% bana grass in the dry matter either chopped (1-2 cm chop length) or whole plant. In expt. 2, SPV, which is fed as a protein supplement, will be offered at 5 different levels, viz: 0, 20, 40, 60 and 80% of the ration dry matter. The rest of the ration will consist of bana grass. Performance of the animals on the different levels of protein intake as well as the efficiency of protein digestion will be assessed.

The experimental animals in each trial will be of similar type (see comparison of Goats and Cattle for Milk and Meat Production for breed specifications and source of animal supply). The total numbers of each species will depend on the land available for feed production, facilities, labour and availabilit of animals. However, a minimum number of 5 cattle and 20 goats in Experiment 1 and 15 calves and 15 kids in Experiment 2 will be the target. The experimental animals will be carefully screened for diseases and parasites prior to the start of the experiments. Herd health programs will be applied. The financial cost and labour requirements will be recorded.

Criteria: Measurements will be taken on:-

- amount and type of feed offered and refused.
- Chemical composition of feed offered and refused as well as faecal analysis in Expt. 2.
- Liveweight changes.
- Disease and parasite problems, symptoms, treatments and responses.

Resource Needs:

Personnel: Technical Officers: To supervise experiment, data collection and laboratory work (Kevelenge, Baya, Mbugua and Waweru).

5 Labourers for feeding, pen cleaning, harvesting feed, chopping and mixing.

Casual labourers for planting (approx. 10 people for 14 days),

Animals: Expt. 1: Young but mature size animals of approximately 12.18 months of age. All to be castrated males with some dairy breeding (½-3/4 dairy bred).

Expt. 2: Young growing crossbred goats (½-3/4 dairy bred) probably acquired as weaners at 22 kg liveweight. Young weaner calves crosses of European dairy breeds or E.A. Zebu.

Equipment:

Tractor for ploughing and harrowing - access for 3 days and ½ a day throughout the feeding trials for feed hauling.

Feeding Stalls: 5 and 20 individual feeding stalls for mature cattle and goats respectively. 15 digestion crates(stalls) and 15 individual feeding stalls each for the young growing kids and calves.

Feed chopper
Laboratory facilities
Weigh bridge (livestock scales)
Land - 4 ha. (2 each under napier and SPV)

Facilities: Technical staff housing.
Individual housing for the animals with access to fresh drinking water.

Anticipated achievements:

Preliminary information towards recommendations for feed processing and provision of a balanced ration to dual purpose ruminants on small farms.

BUDGET

Annual Operating Budget (1980-1981)

	Estimated Total	SOURCE CRSP	SOURCE MLD
1. Technical and Support Personnel	32,500	-	32,500
2. In Kenya Travel and per Diem	5,000	5,000	-
3. Facilities development			
- Land preparation	4,000	4,000	-
- Casual labourers 10 for 14 days @ 20/day	2,800	2,800	-
4. Laboratory analysis	10,000	10,000	-
1980-81 Recurrent expenses sub-total	54,300	21,800	32,500
1980-81 Capital expenditures			
- Renovation of digestion crates	8,500	8,500	-
- Construction of individual feeding stalks.			
- Forage chopper	5,500	5,500	-
- Animals			
Cattle	24,500	24,500	-
Goats	6,400	6,400	-
CAPITAL ITEM SUB-TOTAL	44,900	44,900	
1980-81 Budget TOTAL	99,200	66,700	32,800

Fitzhugh Presentation See attached papers and 3 Handouts.

Fitzhugh

It is generally assumed that there will be an adequate amount of feed most of the year in Kenya. We are focusing on dual purpose goats and home use of the milk, not a commercial operation. Goats breed all year and have a 5 month gestation which means having several goats makes milk available all year. This is in contrast to having 1 cow which means no milk about 1/2 the year. In addition, kids are a cash crop in the farming system.

Bryant

What are you calling efficiency?

Fitzhugh

We are looking at production efficiency which does not partition maintenance, lactation or reproduction. Efficiency will essentially be yield/hectare.

Johnson

Where are Maseno & Kitale?

Fitzhugh

Describes where they are located.

Quick

The literature and data from old colonial research is available and forms a basis for starting to see possibilities in Maseno.

Yazman

We should not limit ourselves to only looking at the feed resources presently produced by the small farmer. We need to look at supplemental residues, byproducts etc.

Fitzhugh

Dairying is a prevalent activity in Kenya. In some cases we are introducing dairy animals to people that have not traditionally raised animals, in other cases, we are introducing a species switch from cows to goats.

Van Keuren Presentation See attached Paper, Previous Paper

Johnson
What are available facilities for back-up lab work?

Quick
At this point, just land. We will bring scales, a mill and a drying oven. Facilities are actually there but personnel time is very short and samples are backed up. We may have to take samples to the States.

Lassiter
What commitment has GOK made to project?

Fitzhugh
On a scale to 1-5, GOK maybe 3-4

Smith
What's happening with the FAO Project?

Fitzhugh
The Sheep and Goat Development Project is a joint GOK & FAO venture. It has been active since the early 70's and will terminate at the end of '81. Whereas the CRSP is a research program, the FAO project is primarily an extension project. If the project is terminated the CRSP will get some pressure to pick up some of the funding, role and activities of the FAO Project. In response to the strong pressure to put senior people in Kenya, I have freed up money to hire to senior nutritionist for 2 years.

Robinson
What is the status of the Kabete proposals?

Quick
I do not think PAC has seen them yet. The projects were slightly revised from the original submissions.

Fitzhugh
They all were approved except Forages.

Van Keuren
The Forages Project intends to always have a long term person in Kenya.

Nutrition Components of the Systems Analysis Project

The systems analysis project involves the construction of simulation models of sheep and goats that incorporate functional biological relationships. Basic nutritional concepts of feed intake, nutrient requirements and partition of nutrients are among the key relationships included in the model. The driving variables for simulation of production systems are the components of the nutritional environment in terms of forage quality and quantity and the use of feed supplements.

The systems project will assist other projects in the extension and application of biological data. The effects on flock productivity of altered nutrition of various classes and age groups during different seasons will be among those management alternatives examined by simulation. Biological input-output data will be made available to the economics project so that economic assessment of these and other management alternatives can be made.

A number of nutritionists at Texas A&M are being used as consultants during the model development process. In addition, we have made tentative plans for Dr. Norman Graham from CSIRO at Sydney to hoin our group for 2 to 3 months. Dr. Graham is an outstanding sheep nutritionist who has been modelling sheep for a number of years and will be available to interact with other projects as appropriate.

Smith Presentation See attached Paper, Nutrition Components of Sys. Analysis

Please refer to morning comments about synchronizing genetic potential with feed resources and management. We need to look at many choices and see where the biological efficiency is.

$$\frac{\text{output}}{\text{input}} \quad \frac{\text{productivity}}{\text{feed}}$$

The model does not assume a particular level of productivity and then impute nutrient requirements using standarized tables like NRC. You can specify feed and genetic potential and predict productive outcome. The model structure is pretty well put together but it has not yet been validated. We are thinking in terms of energy and protein as the driving variables and water quality and quantity will probably come up as well.

Fitzhugh

Where are you going to get the data? We spent the morning saying there was a woefully inadequate supply.

Smith

We'll use whatever we can and compare the validation with experimental data that the CRSP generates. We'll build the sheep model first and then modify it for goats.

Johnson

Will there be an assumption that the wool sheep model applies to hair sheep?

Smith

The major differences are primarily just differences in fiber.

Conrad

Is it appropriate to put money considerations in the model?

Smith

I do not think so. We would rather look at intermediate results which are biological. Optimization is not part of the simulation.

Fitzhugh

Modeling fills in knowledge gaps with programmer's input. I do not see good coordination between what the CRSP is doing experimentally and what the model is doing.

Smith

Some projects are collecting appropriate data. Range and Breeding are examples. Within the next year we will be at some sites comparing and evaluating production systems. We view ourselves as a service project. We will be most responsive to extension efforts via simulations.

Fitzhugh

My greatest concern is that wool sheep models are not appropriate for hair sheep and that the model will be extended without it being validated.

Smith

Knowledge gaps will "identify themselves" as systems people interact with program people.

Fitzhugh

Would prefer the systems people were more communicative about what they need.

Discussion

The purpose of generating Table I was to agree upon and outline by category, the major nutrition goals of the SR-CRSP. W. L. Johnson's Handout (November 21,1980, page 1), was the template upon which the initial objectives were based. In order to clarify these primary objectives, each one was examined to determine which projects were meeting which goals in each of the overseas sites. The following series of comments is the discussion which ensued as the objectives were modified and refined to produce the final version of Table 1.

Fitzhugh

What about preservation and processing? Let supply imply that notion in Objective 2, Seasonal Availability .

General Question

What about health?

Healthy animals are assumed. This may not be a good assumption. What about health/nutrition interactions?

Fitzhugh

Remember, we're not looking for the nutrient requirements for high producing animals.

Johnson

We're looking at genotype-environmental interactions.

Fitzhugh

Adaption would be a breeder's primary goal and one of the most important traits to look at.

Johnson

We would like ultimately to be able to come up with the recommendation for example, to use Breed A with good nutrition or Breed B with poor nutrition.

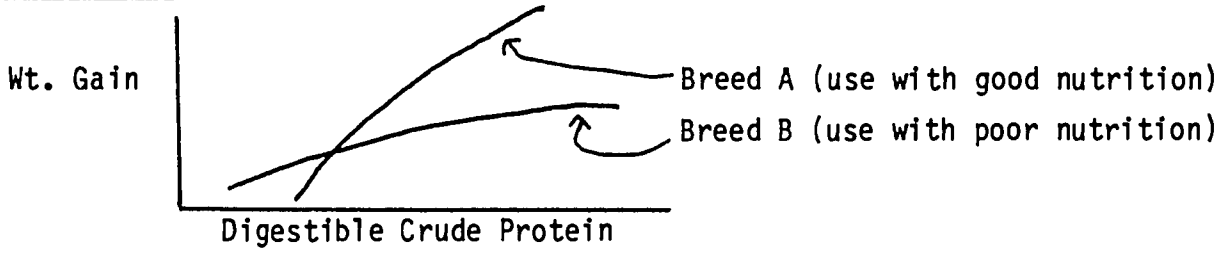
Fitzhugh

Maybe we should assume there is no high level of nutrition.

Johnson

That's a potentially dangerous assumption.

Robinson's interpretation of Genotype - Environment Response Function.



Johnson

Would like room to work at both levels.

Weir

Economics should have some effect on this.

Fitzhugh

A 1,000 liter goat could make it in the highlands in Kenya UNDER PROPER MANAGEMENT, but this is incompatibile with the general situation in Western Kenya. A definition of high level there could be a 300 liter production level.

Robinson

An important consideration and critical question that should be addressed is: To what extent do you want to intervene with improved nutrition, better genotypes, etc?

General Conclusions from Discussion

Because the SR-CRSP covers a wide range of eco-climatic zones, there are substantial differences among the feed resources and production/management systems in the selected overseas work sites. It is therefore unlikely that very much of the nutrition data collected at one site will be transferrable to the other sites. Despite this situation, much can be learned if similar types of work are conducted at each location using a uniform, standardized set of techniques.

Decemeber 23, 1980

William Johnson proposed that there be a SR-CRSP Nutrition get - together at the ASAS Meetings in Raleigh, July 1981. There followed a dicussion which addressed whether the meeting should be held at the ASAS Meetings or the upcoming April Technical Committee Meeting and what topics should be discussed. Johnson reiterated that he thought it was important that the Nutrition PI's maintain the momentum from the current Seminar and that they decide when and for what purpose they would again meet. It was ultimately decided that Johnson and Bryant form a sub - committee to generate and circulate a list of possible agenda items for a Nutrition Workshop at the April Meeting. It would focus on forage analysis techniques with a view to putting out a manual of standardized SR-CRSP experimental and laboratory nutritional research methodology.

Robinson

The objectives listed in Table I still appear to be "pie in the sky" especially considering how many of them are barely off the ground. The chart we have generated would only work at addressing EEP concerns if everyone really does what they say they will do and he seriously doubts this is possible. He suggested they more thoroughly scrutinize Table I with a re - emphasis on the commitments people were willing to make.

The entire group went across Table I by topic block to more closly examine the actual implementation of the nutrition objectives of the SR-CRSP. Each Project was encouraged to think about assigning a priority ranking to each of the objectives they stated would be accomplished. The following series of comments is a summary of the discussion which ensued as Table I was refined to produce Table II.

Discussion of the Problems of Feed Sample Analyses

Ohio's forage work in Kenya was discussed. In order to monitor seasonal availability, monthly subsamples of 25 - 30 feeds are being collected in conjunction with the Village Survey activities. In addition, feeds are being planted at the Maseno Station whenever possible. The problems they are encountering collecting, drying, weighing, and analysing this large volume of

material are representative of the types of problems confronting all the projects. It is recognized that the processsing of all these CRSP samples could quite easily overwhelm the capacity of the counterpart laboratories, in terms of both available equipment and labor. It was suggested that samples could be shipped to the US for analysis, especially for those assays which are complicated or require access to sophisticated equipment. It was also suggested that a priority list be drawn up defining:

1. Which assays must be run on all samples in order to acquire the minimum amount of information necessary to assess the value of a given feed.

2. Which analyses are of secondary importance and need only be run on selected samples.

General Conclusions about Ration Formulation and Testing

There is currently insufficient data available on tropical feed and animal resources to successfully formulate rations by matching the specific nutrients available in a given combination of feeds with the specific nutrient requirements of the animal. It is also highly unlikely that the SR-CRSP, given its present resources, could generate enough of this data to enable rations to be devised based on the actual nutrient requirements for maintenance, growth and production. Given this situation, it was recognized that the SR-CRSP must conduct its nutrition work with alternative approaches that make the best use of existing information and are closely aligned with the practical needs of the local farmers. Two basic approaches will be employed to formulate and test rations comprised of native feedstuffs, introduced forages and/or improved pasture. Productive output and biological efficiency expressed in the terms most appropriate to each situation, will be used as baseline indicators of plant and animal performance.

1. Compare Rations with Negative Control.
   - Feed the ration that is prevalent in the area and compare the response of the animals to those on a "normal" ration with additional supplementation, ie. energy or protein.

2. Compare Rations with Positive Control
   - Compare animal response on a local or experimental ration to performance on a control ration known to be adequate for the desired production level.

TABLE I	KENYA	BRAZIL	PERU	INDONESIA
A) FEEDS				
1) STANDARD METHODOLOGY				
2) SEASONAL AVAILABILITY	Winrock/Ohio	Utah	Texas Tech/Ohio IVITA/La Molina	North Carolina
3) NUTRITIONAL VALUE (Chemical Comp.)	Ohio	North Carolina Utah/Tuskegee	Texas Tech/Ohio IVITA/La Molina	North Carolina
4) INTAKE & DIGESTION/METABOLISM	Ohio/Nairobi	North Carolina Utah/Tuskegee	Texas Tech/Ohio	North Carolina
5) ANTI - QUALITY FACTORS	Ohio	Utah	*	P3T
B) ANIMALS*				
1) CRITICAL STAGES OF PRODUCTION CYCLE	Winrock	North Carolina Utah/Tuskegee	Texas Tech/Ohio	North Carolina
2) PRODUCTION OBJECTIVE	Winrock	Utah/Tuskegee	Texas Tech/Ohio	North Carolina
3) PRODUCTION RESPONSE	Winrock/Ohio	North Carolina Utah	Texas Tech/Ohio	North Carolina
4) GENOTYPE	Winrock/UCD	(Breeding) Texas A&M	Texas Tech Montana/Ohio	North Carolina/UCD
C) MANAGEMENT				
1) FEED PROCESSING & PRESERVATION	Ohio	North Carolina	*	N/A
2) INTERACTIONS				
a) SHELTER/PROTECTION	Winrock	Utah/Tuskegee	Texas Tech/Ohio	N/A
b) DISEASE	Washington	UCD	*	North Carolina/UCD
c) FEEDBACKS/GRAZING STRATEGIES	Winrock/Ohio	Utah	Texas Tech/Oh[illegible]	N/A

* The Texas A&M Systems Analysis Project will make contributions to all the objectives in Category B (ANIMALS).

TABLE II	KENYA	BRAZIL	PERU	INDONESIA
1) MONTHLY ASSAYS				
A) ALL SAMPLES				
a) IN VITRO DIGEST, NDF, CRUDE PROTEIN	Winrock/Ohio	North Carolina Utah/Tuskegee	Texas Tech/Ohio	North Carolina
B) SELECTED SAMPLES				
a) ADF, LIGNIN, CELLULOSE, HEMICELL.	Ohio	North Carolina Utah	Ohio	North Carolina
2) PLANTINGS/ANNUAL DRY MATTER PRODUCTION	Ohio	Utah	Ohio	LPP
3) INTAKE, IN VIVO DIGESTIBILITY, SELECTIVITY	Ohio	North Carolina Utah/Tuskegee	Texas Tech/Ohio	North Carolina
4) LITERATURE REVIEW	Ohio	North Carolina Utah	Texas Tech/Ohio	North Carolina
5) ANTI - QUALITY MONITOR (Not Research)	Ohio	Utah	*	P3T
6) CRITICAL PROD. CRITERIA (Full Prod. Cycle)	Washington Winrock/UCD	Texas A&M Winrock/Tuskegee	Texas Tech/Ohio	North Carolina
7) PRODUCTION RESPONSE	Winrock/Ohio	North Carolina Texas A&M/Tuskegee	Texas Tech/Ohio	North Carolina/LPP
8) GENOTYPE	Winrock/UCD	(Breeding) Texas A&M	Montana	North Carolina/UCD
9) FEED				
A) PRESERVATION	Ohio	*/EMBRAPA	*	N/A
B) PROCESSING	Winrock/Ohio	*/EMBRAPA	*	N/A
10) INTERACTIONS				
A) DISEASE	Washington	North Carolina UCD/Tuskegee	*	North Carolina/UCD
B) SHELTER/PROTECTION	Winrock	Utah/EMBRAPA	*	N/A
C) MANAGEMENT	Winrock	North Carolina Tuskegee	Texas Tech/Ohio	N/A
11) FEEDBACK/ANIMAL OR HARVESTING SYSTEM	Winrock/Ohio	Utah	Texas Tech/Ohio	N/A