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Small Ruminant

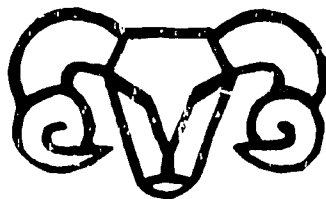
Collaborative Research Support Program

Annual Report for

Morocco

Program Year Seven

1985-1986



Small Ruminant CRSP
University of California
Davis, CA 95688

PN ABC-153

THE SMALL RUMINANT
COLLABORATIVE RESEARCH SUPPORT PROGRAM
(SR-CRSP)
ANNUAL REPORT FOR MOROCCO
PROGRAM YEAR SEVEN
1985-1986

Edited and Compiled by the Management Entity

**SMALL RUMINANT
COLLABORATIVE RESEARCH SUPPORT PROGRAM
ANNUAL REPORT
MOROCCO 1985-1986***

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SMALL RUMINANT CRSP

IN MOROCCO 1985/86

ANNUAL REPORT

INTRODUCTION

Both sheep and goats are important in Morocco, but to date the SR-CRSP has chosen to focus on sheep. With 12-15 million sheep, Morocco has one of the highest densities of sheep of any country in Africa.

Sheep are kept in all areas of the country. There are three general types of production: use of range, which involves extensive transhumance; mixed crop - livestock systems, involving particularly sheep and cereal grains; and intensive confinement production in small flocks in oases in valleys on the north edge of the Sahara desert. The first two of these comprise the bulk of the nation's sheep, and there is overlap between the two systems in some areas.

A common feature of both the range and sheep - cereal systems is very heavy stocking rates and severe overgrazing. This is reflected in low offtake and high mortality rates. The latter are found both seasonally and due to longer term climatic variations. An example of seasonal variation is the 25% mortality of ewes in winter in a communal grazing area, described in the CRSP Nutrition project current annual report. The susceptibility of the national flock to variation in rainfall is evidenced by a reduction from an estimated 15 to 16 million head of sheep to less than 12 million during a recent two-year drought. Clearly the numbers kept during good years exceed substantially the long term carrying capacity of the country, given the other livestock kept.

The SR-CRSP in Morocco has four projects: Range and Nutrition, on which work was initiated in late 1981, and Sociology and Breeding, begun in 1982. Thus the Morocco CRSP has been less comprehensive, with a lower total funding level, than those in Peru, Brazil, and Kenya, with 6 or 7 projects each. The Morocco CRSP is also the only one in which the collaborating institution is a University, rather than a Ministry. IAV (The Hassan II Agronomy and Veterinary Institute) has a very active USAID-funded faculty training program at the doctoral level, managed by the University of Minnesota. A substantial number of well-trained young scientists are returning to the Institute to carry out their doctoral research, and to establish research programs following completion of their doctorates. For this and other reasons, the SR-CRSP in Morocco appears to be regarded by host country scientists as more of an institution building program than is the case for the SR-CRSP in other countries.

Based on the interests of IAV scientists, the four CRSP projects developed in several different geographic areas and production systems.

The Range project is being carried out by three Moroccan co-PI's, working in different ecosystems, and has had two different U.S. PI's. The greatest

contribution of the range project has been to develop a data base of grazing impacts on rangeland that is rapidly deteriorating, because of excessive grazing. Research is focussed on these impacts on Artemesia herba-alba range, the Jaaba forest, and the Middle Atlas mountains. Considerable progress has been made in understanding the systems studied, and in developing knowledge of what stocking rates should be. However, due to the importance of animal numbers to producers, and the existence of long standing traditions of management, interventions such as lower stocking rates, are extremely difficult to implement.

While the Range project work is carried out mostly in different areas of the Middle Atlas, the Sociology project has worked, to date, primarily on a study of a communal grazing system in the High Atlas. Here again, the conclusion is that there are no obviously feasible methods which can dramatically increase small ruminant productivity; there are opportunities for marginal increases, but these animals are part of a delicately balanced system which may not benefit from or even tolerate major interventions.

The Nutrition project has focussed on research on feeding value and methods of utilization of by-product feeds, particularly wheat stubble because of its exceptional importance in the diet of Moroccan sheep. Trials are being carried out to evaluate carrying capacity of stubble fields for gestating ewes (the principal class of animals using this resource), and to evaluate different supplementation strategies. Feeding trials have also been carried out during the past year on citrus and beet pulp and on carob meals, other by-products of Moroccan agriculture. Several of the feeding trials have been carried through to include body composition and carcass evaluation of the animals used.

Work on the Nutrition project, particularly the surveys of production systems, has reinforced the conclusion that sheep are an extremely important part of cereal grain farming systems in Morocco, and that there is the potential for substantial increases in productivity of the sheep in these systems.

The Breeding project took as its primary goal the evaluation of the genetics of the prolific D'Man breed from the oases of Southern Morocco, and of its potential, in combination with a larger sized but less prolific Moroccan breed, to contribute to increased productivity of sheep for cereal producing and irrigated areas of the country.

Work on this goal required experimental facilities, and the Breeding project took the lead in developing facilities for sheep research at IAV's Tadla Application Farm in Central Morocco. The Nutrition project also contributed to this development. As a result, there is now a very good 1000-head sheep research facility, with breeding pens, units for feeding research, and some basic laboratory capability. Of at least equal importance is the presence of trained support staff at Tadla, capable of keeping the necessary records, collecting biological samples, doing laparoscopies, etc. for a comprehensive research program.

The first phase of the D'Man and Sardi comparisons has been completed, with the results showing that the D'Man has very high potential for increasing productivity of Moroccan sheep under a moderate level of nutrition and

management. This comes about not only through higher prolificacy, but also through transmission of longer breeding season and earlier puberty, and a higher efficiency of males. The next phase of the research, involving study of several different proportions of D'Man and Sardi inheritance, is providing animals for three doctoral dissertation research projects on reproduction and production. Studies on physiological responses to heat stress are also being carried out by members of the IAV Physiology Department.

The 1985 EEP report recognized that the CRSP lacked the funding and personnel to work in all areas of Morocco, and suggested that future work be focussed on the mixed crop-livestock production system, for which work can be carried out at the Tadla Farm or in the Tadla region. Also, a shift in emphasis away from use of irrigated forages, e.g. alfalfa, and toward more work related to the rainfed cereal production system has been suggested by IAV participants. Since the Nutrition and Breeding projects are already actively involved at Tadla and in the use of cereal by-products, it is expected that those two projects will continue in general along current lines, with the planned addition of on-farm trials in the future. The Sociology project report indicates an intent to respond to these recommendations and to shift the site of the major activities to the Tadla area in the coming year; some activity in the High Atlas will be continued.

With the development which has occurred at Tadla and three projects to be involved in the area, there are now the facilities and a substantial proportion of the scientific and support personnel available for a comprehensive approach to research on one of the important sheep production systems in Morocco. An active program is underway, and given continuation of SR-CRSP and IAV funding, and collaboration among IAV Departments, the next few years could be a very productive period.

The Range project will probably continue to function fairly independently of the other CRSP projects. During 1986-87, funding for the project is coming from the USAID/University of Minnesota program. Also, this project is currently without a U.S. PI, and its future as a CRSP project is uncertain. The importance of the range resource to small ruminant production in Morocco is unquestioned, but there is a question, not yet resolved, as to whether the SR-CRSP has the resources to support work in all the major production systems of the country.

TRAINING-SR-CRSP SPONSORED STUDENTS IN DEGREE PROGRAMS IN US.

<u>NAME</u>	<u>DEGREE</u>	<u>PROGRAM</u>	<u>TRAINING DATES</u>	<u>NATIVE COUNTRY</u>
UNIVERSITY OF MISSOURI				
Artz, Neil ^{6,11}	PhD Range Management	Missouri	8/84 - 12/84	US
Mendes, Lloyd ^{4,6}	MS Range Management	Missouri	4/84 - 11/85	US
NORTH CAROLINA STATE UNIVERSITY				
Aitboulahsen, Ahmed ²	PhD Animal Nutrition	North Carolina	1/86 - 12/89	Morocco
Ilham ¹⁰	PhD Animal Nutrition	North Carolina	6/84 - 6/87	Morocco
Luginbuhl, Jean-Marie ⁶	MS Animal Nutrition	North Carolina	6/79 - 1/83	Switzerland
Mann, Debora ²	MS Animal Science	North Carolina	9/78 - 7/84	US
Rihani, Nacif ¹⁰	PhD Animal Nutrition	North Carolina	8/85 - 8/88	Morocco
TEXAS TECH UNIVERSITY				
Mounsif, Mohamed ⁸	MS Range Science	Texas Tech	5/85 - 12/86	Morocco
UNIVERSITY OF CALIFORNIA/BREEDING				
Boujenane, Ismail ⁵	PhD Genetics	UCD Breeding	9/83 - 6/88	Morocco
Bourfia, Mohamed ⁷	PhD Animal Breeding	UCD Breeding	9/85 - 1/86	Morocco
Chafik, Azziz ⁵	MS Animal Breeding	UCD Breeding	9/84 - 9/85	Morocco
Derquaoui, Lahsen ⁹	PhD Endocrinology	UCD Breeding	9/86 - 3/86	Morocco
Lasslo, Laurel ²	PhD Genetics	UCD Breeding	7/80 - 6/82	US
Neira, Roberto ²	PhD Animal Genetics	UCD Breeding	4/81 - 8/82	Chile
UTAH STATE UNIVERSITY/RANGE				
El Aich, Ahmed ¹	PhD Range Management	Utah/Range	6/81 - 9/86	Morocco
Anderson, Val ⁶	MS Range Management	Utah/Range	6/82 - 5/85	US
Artz, Neil ⁶	PhD Range Management	Utah/Range	6/81 - 3/83	US
Berkat, Omar ³	PhD Range Science	Utah/Range	10/81 - 7/84	Morocco
Hussein, Mohamed ²	MS Range Management	Utah/Range	12/80 - 12/83	Sudan
Narjisse, Hamid ²	PhD Range Management	Utah/Range	8/79 - 5/81	Morocco

M-4 CORRECTED

FOOTNOTES

- 1 Attending Colorado State; partial support
- 2 Partial support
- 3 At Texas A&M, but overseas research supported by Utah and Texas Tech
- 4 Degree from Utah State, study site Morocco
- 5 Supported by Minnesota/IAV Training Program
- 6 Research conducted in Morocco
- 7 Support 11 weeks at UCD working on doctoral dissertation
- 8 Supported by University of Minnesota program, training at Texas Tech
- 9 Currently in Morocco conducting research SR-CRSP support provided for research
- 10 Research support only
- 11 Partial support, 1 semester at Missouri while working on dissertation work in Morocco

TRAINING OF OVERSEAS DEGREE CANDIDATES OVERSEAS WITH CRSP SUPPORT

STUDENT	PROGRAM/INSTITUTION	SUPPORT	DATES	NATIVE COUNTRY
NORTH CAROLINA STATE UNIVERSITY				
Abdoulhouda, Youssef	<u>2eme</u> Animal Production National School of Ag., Meknes	North Carolina	10/84 - 7/85	Comoro Islands
Berrami, Ali	<u>3eme</u> cycle Animal Nutrition Hassan II	North Carolina	10/84 - 7/85	Morocco
Boumri fag, Mohamed	<u>2eme</u> Animal Production Nat. School of Ag., Meknes	North Carolina	10/84 - 7/85	Morocco
Bouzekraoui, A ³	<u>2 eme</u> Animal Science Nat. School of Ag., Meknes	North Carolina	10/81 - 7/83	Morocco
Coulibaly, Medibo	<u>2eme</u> Animal Production Nat. School of Ag., Meknes	North Carolina	10/84 - 7/85	Mali
Essadi, M ²	<u>2eme</u> cycle Animal Science ENA Meknes	North Carolina	10/81 - 7/83	Morocco
Fadili, Moussa El	<u>3eme</u> cycle Animal Nutrition Hassan II	North Carolina	10/83 - 7/85	Morocco
el Haddani, Mohamed	<u>2eme</u> Animal Production National School of Ag., Meknes	North Carolina	10/84 - 7/85	Morocco
Hafidi, M ³	<u>2eme</u> Animal Science National School of Ag., Meknes	North Carolina	10/81 - 7/83	Morocco
el Hilali, Ahmed ³	<u>3eme</u> Animal Nutrition Hassan II	North Carolina	10/84 - 7/86	Morocco
Igmoullan, Ahmed	<u>3eme</u> cycle Animal Nutrition Hassan II	North Carolina	10/81 - 7/82	Morocco

STUDENT	PROGRAM/INSTITUTION	SUPPORT	DATES	NATIVE COUNTRY
NORTH CAROLINA STATE UNIVERSITY (cont.)				
Kabbali, Ahmed ³	PhD Animal Nutrition Hassan II/ Univ. Minnesota	North Carolina	11/86 - 2/86	Morocco
Khal, Mohamed	3eme cycle Animal Nutrition Hassan II	North Carolina	10/81 - 7/82	Morocco
Koyandondri, Leon	2eme Agricultural Economics National School of Ag., Meknes	North Carolina	10/84 - 7/85	Central Africa
Legdali, Nadia	2eme cycle Animal Production National School of Ag, Meknes	North Carolina	10/83 - 7/84	Morocco
Lemharzi, L ²	2eme Animal Science National School of Ag., Meknes	North Carolina	10/82 - 7/84	Morocco
Maharzi, Latifa El	2eme Animal Production National School of Ag, Meknes	North Carolina	10/83 - 7/84	Mali
Mountassir, N. ²	2eme Animal Science National School of Ag., Meknes	North Carolina	10/81 - 7/83	Morocco
Oumzai, Fatima	2eme cycle An. Production National School of Ag., Meknes	North Carolina	10/83 - 7/84	Morocco
Rahal, Boudour Ben	2eme Agricultural Economics National School of Ag., Meknes	North Carolina	10/84 - 7/85	Morocco
Sahnoun, Abdelatif	3eme cycle Animal Nutrition Hassan II	North Carolina	10/81 - 7/82	Morocco
Semeqa, Djibril	2eme cycle Animal Production National School of Ag., Meknes	North Carolina	10/83 - 7/84	Mali

STUDENT	PROGRAM/INSTITUTION	SUPPORT	DATES	NATIVE COUNTRY
UTAH STATE UNIVERSITY/RANGE				
Ait Mhamd, Thami ³	3eme cycle Range Management Hassan II	Utah/Range	9/82 - 7/83	Morocco
Chergaoui, Abdelaziz ³	3eme cycle Range Management Hassan II	Utah/Range	9/80 - 3/82	Morocco
Darfaoui, El Mostafa ³	3eme cycle Range Management Hassan II	Utah/Range	9/81 - 7/82	Morocco
Harkousse, Mohammed ³	3eme cycle Range Management Hassan II	Utah/Range	9/81 - 7/82	Morocco
El Honsali, Mohammed ³	3eme cycle Range Management Hassan II	Utah/Range	9/82 - 7/83	Morocco

¹ Support for thesis research only

² Partial support

³ Student's supported mainly by Minnesota project. SR-CRSP support is minimal.

SR-CRSP SPONSORED INFORMAL TRAINING

<u>Subject Matter</u>	<u>Participants</u>	<u>Trainer</u>	<u>Project</u>	<u>Location</u>	<u>Dates</u>
Training in statistical data using micro computer	Mahdi Mohammed	Missouri	Missouri	Missouri	6/1/86 - 9/1/86

INDIVIDUAL TRAINING INCLUDING PARTIAL SUPPORT TO ATTEND PROFESSIONAL MEETINGS *a

Name	Training	Project	Dates
A. Lahlou-Kassi	Third International Congress on Genetics Applied to Livestock, Lincoln, Nebraska	UCD Breeding	7/16-22/86
F. Guessous	American Society of Animal Science, Manhattan, Kansas	UCD Breeding	7/21/86-8/10/86
Ahmed El Aich	American Society of Animal Science Manhattan, Kansas	Texas Tech	7/26/86-8/9/86
M. Bourfia	Second World Merion Conference, Madrid Spain	UCD Breeding	4/20-24/86
Omar Berkat Arturo Florez Hamid Narjisse	International Society for Range Managment	Texas Tech	2/8-16/86
6-11 Ahmed Kabbali	American Society of Animal Science, Athens, GA	North Carolina	8/6-17-85
A. Lahlou-Kassi	Symposium on Sheep Production, European Association of Animal Production	UCD Breeding	9/22-29/85
A. Lahlou-Kassi Hamid Narjisse Eric Bradford	Planning Workshop on Agricultural Networks, ICARDA & AID, Jordan	UCD Breeding	3/16-21/85

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- I. Project Title:** Genetic Improvement of Sheep and Goats
- II. Host Country:** Morocco
- III. Principal Investigator:** G. Eric Bradford
- IV. Personnel:**
- Host Country Co-Workers:
- A. Lahlou-Kassi
S. Denlamlih
I. Boujenane
A. Tibary
L. Derqaoui
M. Bourfia
R. Boukhliq
- U.S. Co-Workers:
- Y. Berger
L. Iniguez
T. Famula
D. Van Liew
M. Dally

V. Project Goals:

The goals of the Morocco breeding project are as follows:

1. To determine the genetic basis of the high prolificacy of the D'Man breed, and to investigate methods of utilizing this prolificacy through crossbreeding and improved management.
2. To develop selection criteria to improve meat and wool production of Moroccan breeds or new crossbred populations.

Work on improved management is carried out in cooperation with Nutrition and other CRSP projects.

VI. Research Accomplishments

The breeding project at Tadla continued on schedule in 1985-86. The second lamb crop from mating Sardi, D'Man and F_1 rams and ewes in a 3 x 3 diallel cross was produced in October and November 1985. These along with the lamb crop born in Spring 1985 provide approximately 400 contemporary ewes representing purebreds of prolific and non-prolific breeds, reciprocal F_1 's, F_2 's, and reciprocal backcrosses to both parent breeds. These sheep will provide material for a detailed analysis of the inheritance of prolificacy in

Moroccan sheep, and an estimate of the proportions of prolific and non-prolific breed inheritance needed to achieve specified levels of prolificacy. The numbers of ewes produced have fully met target figures. If the reproduction of these ewes can be measured as planned over the next 3 to 4 years, the genetic material available should provide one of the best studies anywhere to date on inheritance of prolificacy, with respect to both scientific and agricultural goals. IAV faculty members Boujenane and Derqaoui completed the first phase of their studies for the doctoral degree during the year and returned to Morocco. They will play a key role in the next phase of the research, by collecting and analyzing ovulation rate and puberty data, on the breeding groups described above, for their doctoral dissertations.

During the year, data from the first phase of the Tadla breeding project, on purebred and F_1 performance, were prepared for publication, and three papers were submitted to the Journal of Animal Science in May 1986. Data on fertility, puberty, breeding season, ovulation rate, pre- and post-natal survival, and lamb growth were included.

The first season's data on physiological responses of Sardi, D'Man and F_1 lambs to high temperature stress were collected, and this work will be continued in summer 1986.

The year round monitoring of estrus and ovulation in Sardi and D'Man ewes kept under two photoperiods: the Tadla photoperiod (32° N), and that for Edinburgh, U.K. (56° N) begun in January 1985 was continued throughout the 1985-86 project year.

The wool quality and color scoring protocols developed in 1985 have been applied to the lambs born in 1985, and the data will provide information on the pattern of inheritance of these traits in Moroccan sheep breeds. Also, selection for wool production was initiated in a group of Sardi ewes.

VII. Significance of Findings

The D'Man breed appears to transmit its high prolificacy in an additive fashion in crosses with a less prolific breed. Thus by varying the proportion of D'Man inheritance, it should be possible to set mean litter size at any desired level between that of the non-prolific breed (1.0 in young ewes, 1.2 in mature ewes, for the Sardi breed involved in this study) and that of the D'Man (1.8 in young ewes, 2.4 in mature ewes). This will permit a close matching of prolificacy to different management levels, and thus more efficient lamb production in different production systems in Morocco.

The D'Man breed appears to transmit its early puberty, high fertility and long breeding season in a dominant fashion, resulting in F_1 ewe performance in these traits significantly superior to mid-parent average. Furthermore, use of the D'Man ram results in higher fertility in his Sardi ewe mates, and thus a crossing program involving the D'Man breed results in improved reproduction in the first as well as later generations.

Both breeds involved in this study, and in particular the D'Man, have higher than average prenatal survival rates. This has added to general knowledge of genetic variation in prenatal survival in sheep, and represents a significant contribution to available evidence in favor of the existence of

such variation. The relative performance of the Moroccan breeds provides added support for the earlier decision, suggested by Moroccan participants and supported by the project PI, to utilize genetic variation among Moroccan breeds, rather than importing foreign breeds, to effect genetic improvement in productivity of the Moroccan sheep population.

VIII. Future Directions

The on-station research plan for the next 3 to 4 years is to evaluate the various genetic groups produced in 1985 and 1986. This will involve study of breeding season and photoperiod response (Lahlou-Kassi), litter size and its components (Boujenane), puberty in females (Derqaoui), male fertility (Tibary, physiological response to heat stresses (Benlamlih) and wool production (Bourfia).

On-farm testing of animals of intermediate prolificacy such as F₁'s D'Man, 3/4 Sardi is the next step needed, and in terms of genetic material available could begin anytime. However, project participants have not yet agreed on how this should be organized or when it should be initiated. Results being obtained each year from the on-station work will contribute to ability to plan on-farm tests, but taking the first steps towards the latter now would increase the probability of having an effective testing program in place when the next phase results from Tadla Farm are in.

IX. Funding

Subgrant Amount: \$81,528 + 14,089 indirect = \$95,617

Matching Amount: \$47,817

Estimated Host Country Contribution: \$35,000

MOROCCO

Breeding - University of California

Books and Chapters in Books

Bradford, G. E. 1985. Selection for Litter Size. Chap. 1, p. 3-18 in: Genetics of Reproduction in Sheep. Eds. R. B. Land and D. W. Robinson. Butterworths, London. **UCD-Breeding**

Theses-(Supporting)

PhD

Garcia-Betancourt, O. J. 1981. Genetic Analysis of a Crossbreeding Experiment Using Improved Dairy Goat Breeds and Native Goats in a Dry Tropical Environment. University of California, Davis. **UCD-Breeding**

Gonzalez, G. E. 1982. Factors Affecting Estimates of Genetic Parameters for Economic Traits in Sheep. University of California, Davis. **UCD-Breeding**

Lasslo, L. L. 1982. Direct and Correlated Responses to Selection for Weaning Weight in Sheep in Two Environments. University of California, Davis. **UCD-Breeding**

Journal Articles, Refereed (SR-CRSP)

Johnson, D. W., Y. M. Berger, A. Idrissi and M. Hamli. 1985. Dystrophie Musculaire Induite par Carence en Selenium: Diagnostique, Traitement et Controle. 15 eme Journees de l'ANDA, IAV, Hassan II.

IAV/Hassan II/UCD-Breeding

Journal Articles, Refereed (Supporting)

Bradford, G. E., J. F. Quirke and T. R. Famula. 1986. Fertility Embryo Survival and Litter Size in Lines of Targhee Sheep Selected for Weaning Weight or Litter Size. J. Anim. Sci. 62:895. **UCD-Breeding**

Bradford, G. E. and J. F. Quirke. 1986. Ovulation Rate and Litter Size of Barbados, Targhee and Crossbred Ewes. J. Anim. Sci. 62:905. **UCD-Breeding**

Finley, C. M., J. R. Thompson and G. E. Bradford. 1984. Age Parity-Season Adjustment Factors for Milk and Fat Yield of Dairy Goats. J. Dairy Sci. 67:1867-1872. **UCD-Breeding**

Iniguez, L. C., G. E. Bradford and Okeyo A. Mlwai. 1986. Lambing Date and Lamb Production of Spring Mated Rambouillet, Dorset and Finnish Landrace Ewes and Their F₁Crosses. J. Anim. Sci. 63:715-728. **UCD-Breeding**

Lasslo, L. L., G. E. Bradford, D. T. Torell and B. W. Kennedy. 1985. Selection for Weaning Weight in Targhee Sheep in Two Environments. I. Direct Response. J. Anim. Sci. 61:376-386. **UCD-Breeding**

Lasslo, L. L., G. E. Bradford, D. T. Torell and B. W. Kennedy. 1985. Selection for Weaning Weight in Targhee Sheep in Two Environments. II Correlated Effects. J. Anim. Sci. 61:387-397. **UCD-Breeding**

Quirke, J. F., G. H. Stabenfeldt and G. E. Bradford. 1983. Resumption of Ovarian Function in Autumn Lambing Dorset, Rambouillet and Finnish Landrace Ewes. Theriogenology 19:243-248. **UCD-Breeding**

Quirke, J. F., G. H. Stabenfeldt and G. E. Bradford. 1985. Onset of Puberty and Duration of the Breeding Season in Suffolk, Rambouillet, Finnish Landrace, Dorset and Finn-Dorset Ewe Lambs. J. Anim. Sci. 60:1463-1471. **UCD-Breeding**

Quirke, J. F., G. E. Bradford, T. R. Famula and D. T. Torell. 1985. Ovulation Rate in Sheep Selected for Weaning Weight or Litter Size. J. Anim. Sci. 61:1421-1430. **UCD-Breeding**

Manuscripts Submitted or In Press (SR-CRSP)

Berger, Y. M., G. E. Bradford, A. Essaadi, D. W. Johnson, M. Bourfia and A. Lahlou-Kassi. Performance of D'Man and Sardi Breeds of Sheep in Purebred and Crossbred Matings on an Accelerated Lambing Schedule. III. Lamb Mortality, Growth and Production Per Ewe. J. Anim. Sci. Submitted. **IAV/Hassan II/UCD-Breeding**

Bradford, G. E. and H. H. Meyer. 1986. Economic Evaluation of Breeding Objectives for Sheep and Goats: Practical Considerations and Examples. Proc. 3rd. Wld. Congr. on Genetics Applied to Livestock Production. Lincoln, Nebraska. (In Press). **UCD-Breeding**

Bradford, G. E., A. Lahlou-Kassi, Y. M. Berger, I. Boujenane and L. Derqaoui. Performance of D'Man and Sardi Breeds of Sheep in Purebred and Crossbred Matings on an Accelerated Lambing Schedule. II. Ovulation Rate and Embryo Survival. J. Anim. Sci. Submitted. **IAV/Hassan II/UCD-Breeding**

Lahlou-Kassi, A., Y. M. Berger, G. E. Bradford, R. Boukqliq, A. Tibary, L. Derqaoui and I. Boujenane. Performance of D'Man and Sardi Breeds of Sheep in Purebred and Crossbred Matings on an Accelerated Lambing Schedule. I. Fertility, Litter Size, Post Partum Anestrus and Puberty. J. Anim. Sci. Submitted. **IAV/Hassan II/UCD-Breeding**

Manuscripts Submitted or In Press (Supporting)

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Abstracts (Supporting)

Garcia, O., J. Bravo, B. Kennedy and E. Garcia. 1982. Crossbreeding of Imported and Native Goats in a Dry Tropical Environment II. Production and Reproduction. Proc. 3rd Int'l. Conf. on Goat Prod. and Dis., Tucson, AZ. P. 509. **UCD-Breeding**

Garcia, O., E. Garcia, B. Kennedy and J. Bravo. 1982. Crossbreeding of Imported and Native Goats in a Dry Tropical Environment I. Survival and Growth of Kids. Proc. 3rd Int'l. Conf. on Goat Prod. and Dis., Tucson, AZ. p. 510. **UCD-Breeding**

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Berger, Y. M., A. Lahlou-Kassi, G. E. Bradford, L. Derqaoui, I. Boujnane, M. Bourfia, M. Ghezoui, M. Drissi. 1983. First Ann. Rpt. SR-CRSP Breeding Project. IAV Hassan II 21 pp. **UCD-Breeding**

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Oral Presentations (Supporting)

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Bradford, G. E. 1985. Animal Breeding for Developing Countries. Am. Soc. Animal Ann. Mtg. Also given to Animal Breeding Class at NCSU. **UCD-Breeding**

SR-CRSP

ANNUAL REPORT

1985-86

- I. Project Title:** Nutrition and Confinement Feeding for Sheep in Semintensiv e Production Systems in Morocco
- II. Host Country:** Morocco
- III. Principal Investigator:** William L. Johnson
- IV. Personnel:**
- Host Country Co-Workers:
Dr. Fouad Guessous
Nacif Rihani
A. Outmani
A. Berrami
M. El Fadili
A. El Hilali
Dr. Ahmed Kabbali
B. Hassib
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A. Bouzekraoui
M. Coulibaly
M. El Haddini
M. Essadi
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N. Legdali
L. Lemharzi
N. Mountassir
F. Oumzai
D. Semega
- U.S. Co-Workers:
Dr. W. L. Johnson
Jean-Marie Luginbuhl
Rex Gaskins

V. Objectives and Rationale

Sheep in Morocco are very much integrated into the total farming system, especially in the dryland cereal production areas. Farmers depend on their sheep for cash income. Thus it is important to sheep producers to maintain good productivity (growth and reproduction) for their flocks. Feed resources, however, may be a serious limiting factor. In order to make maximum use of cereal byproducts (stubble and straw), much more information is needed about how to use other locally available feeds, of higher quality, at the right times and in the right amounts to optimize economic efficiency.

Specific objectives for collaborative research on sheep nutrition and feeding systems in Morocco are as follows:

1. To characterize the nutritional contribution and limitations of wheat stubble when grazed by ewes.
2. To study supplementation strategies for optimizing reproductive performance of ewes of native breeds, as reflected by number and weight of lambs born and weaned.
3. To characterize the feeding value of locally available forages and by products.
4. To relate the growth and fattening performance of lambs of native breeds and their crosses, to dietary ingredients and nutrient concentrations.

VI. Research Accomplishments

1. Performance of pregnant Sardi ewes grazing wheat stubble during the dry season. A. Outmani, F. Guessous, W. Johnson, and J. Luginbuhl.

Sixty-four Sardi ewes were bred in May-June 1985, and assigned to one of four treatments, in two blocks:

Control - Confined, fed alfalfa hay and beet pulp ad libitum.
Low SR, NS - Grazing wheat stubble, 12 ewes/ha, no supplement.
High SR, NS - Grazing wheat stubble, 24 ewes/ha, no supplement.
High SR, AH - Grazing wheat stubble, 24 ewes/ha, alfalfa hay supplement.

For the final six weeks (approximately) before lambing, all groups were subdivided to receive one of two levels of concentrate supplementation:

Low C - 50 g barley grain, 200 g cottonseed meal (per day)
High C - 300 g barley grain, 200 g cottonseed meal (per day)

Ewe weight changes (preliminary data) are shown in Table 1. It is of interest that during the first four weeks, the ewes grazing on wheat stubble gained weight, while the pen-fed controls lost weight (differences significant, $P < .01$). Undoubtedly the nutritional contribution of weeds and grain gleanings was especially important during this period. During the second month the unsupplemented high stocking rate group lost more weight than any other treatment ($P < .01$); performance differences among the other three treatment groups were not significant ($P > .05$).

Lambing data is not available at this time; however, there appeared to be a tendency for lambs of the high SR, low C ewes to have lower birth weights. Lamb weights were followed for several weeks post-partum, with all ewes on the same diet, to test for carry-over effects of treatment during gestation on lactation.

Table 1, Weight Changes (g/day) for Pregnant Sardi Ewes:

Treatment	Initial weight (kg)	Weight gain		
		1st 4 wks	Next 6 wks	Next 4 wks
Control	49.3	-65	2	
- Low C				243
- High C				286
Low SR, NS	49.5	125	-13	
- Low C				143
- High C				212
High SR, NS	50.5	53	-58	
- Low C				101
- High C				182
High SR, AH	49.3	115	10	
- Low C				37
- High C				114

Estimates of DM intake and rate of passage were made with some of the grazing ewes, by use of Cr-mordanted neutral -detergent-extracted wheat stubble fiber administered in capsules.

2. Nutritive value of dried citrus and beet pulps. Nacif Rihani, Fouad Guessous, and William L. Johnson.

Ten Sardi rams were fed at maintenance level (40 g DM per kg metabolic wt per day) diets containing alfalfa hay alone or with 40% or 60% replacement by beet pulp or citrus pulp, in a latin square design with five 21-day periods. Urea was added to the four diets with citrus or beet pulps, to equalize N concentration with that of the alfalfa hay. Seven-day total fecal collections were carried out to estimate digestibility of the diets. Chemical composition of the feeds is shown in Table 2; digestibility of the diets is shown in Table 3.

Digestibilities of beet pulp and citrus pulp, calculated by difference, were organic matter 84 and 87%, NDF 85 and 82%, and crude protein 66 and 52%. Calculated net energy for maintenance was 1.70 and 1.91 Mcal/kg DM for beet and citrus pulps, respectively; net energy for gain was 1.11 and 1.26 Mcal/kg DM. Beet and citrus pulps produced in Morocco appear to be good sources of energy for sheep; however, they must be adequately supplemented with protein and phosphorus.

Table 2, Chemical Composition of Beet Pulp, Citrus Pulp, and Alfalfa Hay Fed to Sardi Rams in a Digestibility Trial:

Chemical fraction	Beet pulp	Citrus pulp	Alfalfa hay

-		% of dry matter	
Crude protein	10	6	16
Neutral-detergent fiber	40	15	45
Acid-detergent fiber	21	9	
Soluble CHO	18	31	
Pectins	9	11	
Calcium	.6	2.1	
Phosphorus	.08	.03	
Lignin	2.7	2.7	

Table 3, digestibility of diets with citrus or beet pulps fed to Sardi rams:

Diet	Digestibility, %		
	Organic matter	NDF	Crude protein

Alfalfa hay (AH)	59	42	73
AH + 40% beet pulp	69	48	69
AH + 40% citrus pulp	75	67	70
AH + 60% beet pulp	71	49	70
AH + 60% citrus pulp	76	55	62

3. Evaluation of Carob Meal in Diets for D'Man x Sardi lambs. A. El Hilali, F. Guessous, A. Outmani, and W.L. Johnson.

Thirty lambs, seven to nine months in age and ranging in initial weight from 22 to 35 kg, were assigned to diets containing 0, 15, or 30 % carob pulp meal, along with 38, 22, or 6% citrus pulp; 20, 21, or 22% cottonseed cake; and in all diets, 30% alfalfa hay, 10% beet pulp, and 2% minerals. At the end of a fattening period, half the animals of each treatment were assigned to a seven-day digestibility trial with total fecal collection, and the other half were slaughtered. The data are being used by Mr. El Hilali for his 3rd cycle thesis, and not available at this writing.

4. Energy levels in diets for gestating ewes. F. Guessous, A. Outmani, A. Kabbali, and W. Johnson.

Sardi ewes were assigned to six treatments one month after breeding. Three of the treatment groups received 100% of tabular energy recommendations for maintenance during the 2nd and 3rd months of gestation while the other three groups received 80% of recommended levels. For months 4 and 5 of gestation, the 100% and 80% groups were each reassigned to receive 100, 130, or 160% of recommended maintenance energy levels. Animals were confined; rations were made up with a wheat straw base. Lambing data will be available, along with post-partum growth of lambs. Diet digestibilities will be estimated during the 3rd and 5th months of gestation. The trial was initiated early in 1986.

5. Study of energy utilization for growth and re-growth after weight loss in lambs of three genotypes. Ahmed Kabbali, E. Allen, W. Johnson, and D. Johnson (Collaborative with the University of Minnesota).

Lambs of three genotypes (Timahdit, D'man, and D'man x Isle de France) were assigned to four levels of energy intake: ad libitum, medium, maintenance, and sub-maintenance. Sub-M lambs were subsequently allowed to regain lost weight, at different rates. Information has been generated on feed intake and efficiency, carcass composition, and energy requirements for maintenance and growth, as well as the influence that "compensatory gain" has on these parameters. The results have been defended by Dr. Kabbali as a dissertation presented to Hassan II Institute, for the Ph.D.

Allowing lambs to lose weight during short periods of feed shortage is a strategy which may prove to be economically efficient. Refed lambs did not suffer in overall efficiency at time of final slaughter, compared with normally fed animals.

Deuterium oxide was used to estimate body composition, as well as slaughter and proximate analysis of samples from half the carcass. Coefficients of determination were highly acceptable for the deuterium-derived estimates, which will permit body composition estimates without slaughter in future trials.

Data will be presented more completely in a future report.

6. Survey of sheep production in the Dir commune, El Hajeb region (Meknes). A. Kabbali, B. Hassib, and W. Johnson.

Eighty-five farms in the Dir commune were surveyed. Sheep are important in the region, accounting for 68% of the animal units on surveyed farms. Livestock were found to account for 60-70% of farm income, and sheep production for 40-60%. Income from the sheep enterprise is used to partially finance investments in other agricultural activities. Communal grazing lands and cereal stubble accounted for about 70% of the feed resources. One of the consequences of a high degree of dependence on communal areas during the winter months is a high mortality rate (25%), apparently due to a feed shortage. Some differences in feeding practices were noted between the plains and foothills sections of the region. Further surveys are planned, with the objective of gaining a better understanding of production practices in the region.

VII. Significance of Findings

Each farm survey we conduct, whether in the Tadla or Meknes region, underscores the central role played by sheep in cereal-producing areas. Research leaders and rural development planners need to place a lot more emphasis on finding ways to improve the productivity of sheep in Moroccan mixed farming systems.

That feeding constraints exist is also certain. In fact, native breeds of sheep in the rainfed, mixed farming regions have genetically adapted themselves to marginal feeding conditions, being able to produce one healthy lamb per year under near-maintenance levels of feeding. However, high

mortality rates and low twinning percentages could both be improved with the proper diet provided at the proper time.

Options exist, but recommendations cannot yet be made to farmers with assurance of cost-effectiveness. More information is needed about the exact requirements of these native breeds, and how they will respond to given increments of nutrient intake. It appears that improved feeding will involve a cash outlay to purchase supplements from off-farm sources, or changes in agronomic practices to take advantage of opportunities to produce legumes or high quality crop residues. These options must be carefully studied so that when recommendations are made, it will be with the assurance that farm income will be improved.

It is evident that lambs of all native breeds will respond to feedlot fattening diets. Whether or not to promote this practice is now an economic decision. Further research can continue to accumulate information on the feeding value of locally available ingredients.

VIII. Future Directions

No major change in the direction of collaborative research in Morocco is planned. Emphasis will continue to be placed on the wheat stubble system, in order to find the minimum levels of energy and protein (rumen soluble and/or by pass) supplementation which will result in optimum lambing performance for ewes and growth performance of lambs.

For post-weaning lamb growth, a wider range of options need quantitative study, so that the producer will be able to manipulate growth rates in appropriate response to feed availability and prices, and changing marketing opportunities for his lambs.

It is expected that on-farm surveys will continue, in closer collaboration with economists and sociologists, in order to gain a more complete understanding of the options available to farmers and the criteria by which they make management decisions. It is also expected that farm surveys will lead logically to on-farm testing of appropriate new feeding ideas.

IX. Funding

Subgrant for 1984-85:	\$48,210
Subgrant for 1985-86:	37,125
Matching by NCSU, 1984-85:	21,865
Matching by NCSU, 1985-86:	21,840
Estimated matching by Hassan II & ENA, 1984-85:	15,000
Estimated matching by Hassan II & ENA, 1985-86:	15,000

(Estimates are for 12 month program years, and are net of institutional overhead charges).

MOROCCO

Nutrition--North Carolina State University

Theses

M. S

Aboulhouda, Youssouf, and Modibo Coulibaly. 1985. Croissance Compensatrice Chez les Ovins. Influence sur les Performances de Croissance et les Resultats d'Abattage (Compensatory Growth in Sheep. Influence on Growth and Slaughter Parameters). Memoire de fin d'etudes. ENA Meknes, Morocco.

IAV/Hassan II/NCSU-Nutrition

ben Rahal, B. and Leon Koyandoudri. 1985. Place de l'Elevage Ovin Dans les Exploitations Agricoles du Dir (Region d'El Hajeb). (The Place of Sheep Production on Farms of the Dir, El Hajeb Region). Memoir de fin d'etudes., ENA Meknes, Morocco.

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Boualil, A. 1983. Valeur Nutritive de la Luzerne Produit dans la Vallee du Ziz: Campagne 1982 (Nutritive Value of Alfalfa Produced in the Ziz Valley in 1982. IAV Hassan II, Rabat, Morocco.

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NCSU-Nutrition

Abstracts (SR-CRSP)

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ENA/Minn./NCSU-Nutrition

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IAV/Hassan II/NCSU-Nutrition

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Technical Communications (SR-CRSP)

Guessous, F., N. Rihani, A. Igmoullan and W. L. Johnson. 1985. Valeur Nutritive des Principaux Aliments Utilises par les Ovins dans les Valleees du Ziz et du Draa. In: Projet Petits ruminants, Premier Bilan IAV Hassan II, Morocco.
IAV/HassanII/NCSU-Nutrition

Guessous, F., N. Rihani, A. Kabbali and W. L. Johnson. 1985. Rapport General du Sous Groupe Nutrition du Projet Petits Ruminants. In: Projet Petits Ruminants, Premier Bilan.
IAV/Hassan II/NCSU-Nutrition

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Luginbuhl, J. M. and W. L. Johnson. 1983. Feeding Value of Tall Fescue and Coastal Bermudagrass Hays Cut at Two Stages of Maturity. Animal Sci. Rpt. 235. **NCSU-Nutrition**

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Johnson, W. L. 1985. Recent Research in Forage Fiber Utilization by Small Ruminants at NCSU. Invited Seminar, IAV Hassan II, Rabat, Morocco. **NCSU-Nutrition**

Kebbali, Ahmed. 1984. Use of Deuterium Oxide to Estimate Body Composition in Live Animals. National Seminar on Biotechnology, Meknes, Morocco. **ENA/NCSU-Nutrition**

Rihani, N. 1985. Comparative Nutritive Values of Sugar Beet Pulp and Citrus Pulp. Feeds for Ruminants Conf. Nat'l Ass. of An. Prod., IAV, Hassan II, Rabat, Morocco. **IAV/NCSU-Nutrition**

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Oral Presentations (Supporting)

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McCann, L. 1985. Mineral Composition of Some Moroccan Feeds. Feeds for Ruminants Conf. Nat'l Ass. An. Prod., IAV, Hassan II, Rabat, Morocco. **U. Minn./ IAV-Nutrition**

SR-CRSP
ANNUAL REPORT
1985-86

- I. Project Title:** Improving Range Resources
- II. Host Country:** Morocco
- III. Principal Investigator:** Fred C. Bryant
- IV. Personnel:**
- Host Country Co-Workers:
- H. Narjisse
O. Berkat
A. El Aich
A. Dakkak
- U.S. Co-Workers:
- R. Sosebee

V. Introductory

In October, 1984, Texas Tech assumed responsibility for the range component for research in Morocco. Research goals for the project at that time were essentially unchanged. Each Co.-P.I. had clearly defined objectives to accomplish. Efforts were made, however, to consolidate research sites and attempt to integrate the research effort with other SR-CRSP Projects. Research was focused on three broad areas: range improvement, range ecology, and range animal nutrition.

VI. Research Accomplishments

From experiments in the Jaaba oak-forest much has been learned about the nutrition of free-ranging goats and sheep. Nutritional stress periods have been defined, along with estimates of proper stocking and herd management. Further, forage dynamics have been extensively studied and documented.

At Timhatid, in the Middle Atlas mountains, research has accomplished an understanding of proper stocking levels. In particular, researchers have documented those effects on nutrient flow, dry matter intake, and animal production

At the Boumia study site, research has been focused at understanding how grazing affects plant communities dominated by Artemisia herba-alba. Establishment and management of bunch grasses in this plant community also have received considerable attention.

VII. Significance of Findings

Research findings from the Jaaba oak-forest and Timhatid have application throughout Morocco where those zones prevail. Proper stocking rates and herd management are particularly applicable. Data from Artemisia

herba-alba research at Boumia will be applicable to more total area of Morocco, but animal production is perhaps not as intensive as in the formerly mentioned regions. Thus the number of animals and producers affected may not be as large. Even though Artemisia herba-alba range is slightly different in other regions of North Africa, concepts developed should be applicable. Since most of the rangelands belong to the community, application of research results must be finely meshed with the social structure and constraints of these herdsmen.

VIII. Future Directions

Since Texas Tech may not be involved past September, 1986, future research directions are assumed to continue as currently planned.

IX. Funding

Subgrant Amount:	\$239,850 (\$69,000 for Morocco)
Matching Amount:	\$111,928
Host Country Contribution:	\$200,000 (facilities, animals and technical support staff)

MOROCCO

Range Management - Utah State University and Texas Tech University

Theses--(SR-CRSP)

PhD

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M. S.

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Ba Mamadou, A. 1980. Etude des Preferences Alimentaires et de la Valuer Nutritive des Ration des Ovins sous l'Influence du Taux de Charge. (Station Pastorale de Timahdite dans le Moyen Atlas.) IAV, Hassan II, Rabat, Morocco. **IAV/Hassan II/Utah-Range**

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Chryaa, A. 1982. Etude des Effets de la Charge et de la Saison sur les Preferences Alimentaires des Ovins a la Station Pastorale de Timahdite. (Effects of Season and Stocking Rates on the Sheep at the Timahdite Feeding Behavior Experimental Station.) IAV Hassan II, Rabat, Morocco. **IAV/Hassan II/Utah-Range**

Darfaoui, E. M. 1982. Etude des Ressources de l'Activite Pastorales et du Comportement Alimentaire des Caprins dans la Vallee Rheraya (Haut Atlas Occidental). (Study of Range Resources and Goats Feeding Behavior in the Rheraya Valley, High Atlas.) IAV, Hassan II, Rabat, Morocco.

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IAV/Hassan II/Utah-Range

El Maghraoui, A. 1979. Les Effects de la Mise en Defens sur les Preferences Alimentaires des Ovins dans le Moyen Atlas. IAV Hassan II, Rabat, Morocco.

IAV/Hassan II/Utah-Range

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IAV/Hassan II/Utah-Range

Journal Articles, Refereed (SR-CRSP)

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Utah-Range

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O'Rourke, J. T., R. E. Banner and J. Sleeper. 1981. Rise and Fall and Rise of the Moroccan Range Science Empire. Proc. 14th Int'l. Grassland Congr., Lexington, KY.

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Abstracts (Supporting)

Gay, C. W. and P. Bartel. 1985. Planning Work to Achieve Project Objectives. 39th Ann. Mtg. Soc. Range Mgt. Abstr. 012.

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Nolte, D., J. Kitts, R. Banner and B. Kabdi. 1985. Possible Method to Control Indiscriminate Breeding in Moroccan Sheep Flocks. 39th Ann. Mtg. Soc. Range Mgt. Abstr. 417.

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Artz, N. E., B. E. Norton, and J. T. O'Rourke. 1985. Management of Common Grazing Lands: The Case of Timahdite, Morocco. Board on Sci. and Tech. for Int'l Development (BOSTID), Nat'l Res. Council. Sympt. on Communal Grazing. Annapolis, Md. 27 p.

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IAV/Hassan II/Utah-Range

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IAV/Hassan II/Utah-Range

Verbal Presentations (SR-CRSP)

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IAV/Hassan II/Utah-Range

SR-CRSP
ANNUAL REPORT

1985-86

- I. Project Title:** Sociological Analysis of Small Ruminant Production
- II. Host Country:** Morocco
- III. Principal Investigator:** Michael F. Nolan
- IV. Personnel:**
- Host Country Co-Workers:
 - A. Hammoudi
 - M. Mahdi
 - A. Driouchi
 - H. Narjisse
 - Students of INAV and ENA
 - U.S. Co-Workers:
 - J. L. Gilles
 - L. Mendes

V. Project Goals

The goals of the Rural Sociology (RS) project in Morocco are as follows:

- A. To study traditional methods of pasture management in Morocco to see if they can be adapted to the needs of range science.
- B. To document animal husbandry practices of small sheep and goat herd owners in Morocco.

This approach has sought to identify potential areas for intervention in the area of small ruminant production.

VI. Research Accomplishments

Subproject: Agro-Pastoralism in the Rhiraya Valley

This has been a continuing activity since 1982. The objective is to identify ways that increases in small ruminant production can be achieved without upsetting the delicate balance between agriculture and animal husbandry or the fragile ecology of the area. This study has had two components -- a general study of the livestock production systems and a study of a traditional pasture management system -- the agdal. Field work on the latter component was finished in late 1985 and reports by M. Mahdi and Lloyd Mendes are now in progress. A paper based on these findings was presented at the Workshop on Common Property Resource Management.

During 1985, economic studies under the supervision of A. Driouchi of the Ecole Nationale d'Agriculture and A. Eddebaïr of INAV-Hassan II were

conducted to identify the economic contribution of small ruminants to mountain households and several production parameters. These field studies will continue until summer of 1986 and analysis will follow.

Household surveys in the villages of Wenskraa and Imsaker l'Bour were conducted. Preliminary data analysis will begin in the summer of 1986. Follow-up surveys will take place in 1986 and 1987.

VII. Significance of Findings

Although the productivity of small ruminants is very low, in the High Atlas Mountain there does not appear to be a means to dramatically increase their productivity. Small ruminants occupy a specialized niche in the mountain economy. Intensification of small ruminant production can lead to competition for resources with other farm enterprises and may not improve total family income. A number of small changes in management practices could improve productivity. Land tenure systems for pasture usage may permit the introduction of range management practices.

VIII. Future Directions

In response of suggestions by the EEP, sociological research in the Rhiraya Valley will be substantially reduced in future years. Some on-going monitoring research will continue but at a very low level. Beginning in the Fall of 1986, 80% of total research effort will be concentrated in the Tadla area. This research will concentrate upon the identification of barriers to the adoption of production packages produced at the Tadla research station.

IX. Funding

Subgrant:	\$250,000
Morocco:	29,125
Matching:	83,400
Host Country Contribution (estimate)	
Morocco	5,000

MOROCCO

Sociology - University of Missouri

Books and Chapters in Books

Gilles, J. L. 1985. Socioeconomic Context for Environmental Improvement. In: The Improvement and Management of Semiarid and Arid Rangelands. Chap. 2. (Ad Hoc Panel of the Advisory Committee on Technology Innovation.). Natl. Acad. Press., Wash. D. C. **U. Mo.-Sociology**

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Gilles, J. L. 1982. Organizing for Pastoral Development: Themes from Traditional Systems. Ag. Admin. 11:215-225. **U. Mo.-Sociology**

Manuscripts Submitted or In Press (SR-CRSP)

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Artz, N., J. O'Rourke and J. L. Gilles. 1984. Social Inputs in Range Development Planning. Proc. 2nd Intn'l Rangeland Congress. Adelaide, Australia. **U. Mo.-Sociology**

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U. Mo.-Sociology

Mendes, L. R. 1985. Production Agro-pastorale Chez les Berberes du Haut Atlas Occidental. (Agropastoral Production among the Berbers of the Western High Atlas). Monthly talks to Club Alpin Francais, Oukaïmeden, Morocco.
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Mendes, L. R. 1986. Adaptation in the Western High Atlas Mountains. Symp. on Social Science and Agricultural Research: The Experience of the Small Ruminant CRSP, University of Missouri, Columbia.
U. Mo.-Sociology

Verbal Presentations (Supporting)

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U. Mo.-Sociology

Gilles, J. 1985. Sociologists in Range Management. Intn'l. Range Mgt. Seminar, Utah State University.
U. Mo.-Sociology