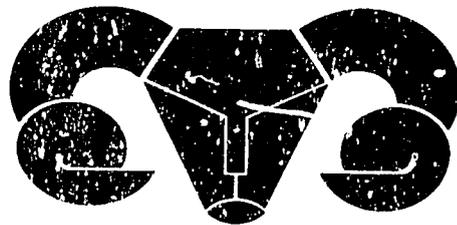


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**Small Ruminant  
Collaborative Research  
Support Program**

**Annual Report for  
Morocco**

**Program Year Nine  
1987-1988**



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

## COLLABORATING ORGANIZATIONS

### Federal (U.S.):

United States Agency for International Development  
Science and Technology Bureau

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

### Overseas Collatorators:

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

KENYA--Kenya Agricultural Research Institute

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

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

### Participating Institutions:

University of California, Davis

Colorado State University, Fort Collins

Montana State University, Bozeman

University of Missouri, Columbia

North Carolina State University, Raleigh

Texas A&M University, College Station

Texas Tech University, Lubbock

Utah State University, Logan

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Winrock International Institute for Agricultural Development,  
Morrilton, Arkansas

**SMALL RUMINANT COLLABORATIVE RESEARCH SUPPORT PROGRAM**

**ANNUAL REPORT FOR MOROCCO**

**1987-1988**

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

## 1987-1988 ANNUAL REPORT

### Introduction

Work continued on three projects during 1987-88: Range Nutrition, and Genetics and Reproduction. Field research in Sociology, the fourth component of the Morocco CRSP, ended in 1986, but some publications from this work continued in 1987-88.

A set of Stipa tenacissima (alfa grass) pastures, fenced for study in the fall of 1987-88, are producing some very interesting results. This is the major plant component in large areas of eastern Morocco ranges and is extensively grazed. However, annual production was found to be only a fairly small fraction of the standing crop of this species, which is apparently of very low palatability to sheep. It was virtually uneaten at low and moderate stocking intensities, and was only 12 to 21% of the diet of sheep or goats under heavy stocking intensities. This means that competition for the scarce grasses of other species and rare forbs in the Stipa community are normally under extremely heavy grazing pressure.

A study of Artemesia herba-alba, a dominant shrub species of arid range lands of Morocco, is also being carried out. An important part of this study is the evaluation of recovery (or non-recovery) of the natural plant community following plowing (for cultivation), which unfortunately is being done increasingly in these very marginal lands.

A third range study is the characterization of human populations, agricultural practices, and relative emphasis on crops and livestock, based on a sample of 72 farms of the Artemesia/Stipa ecosystem. Approximately 80% of the farms engage in both crop and livestock production, with similar emphasis on the two activities across the entire sample but considerable variation in emphasis within farms. Among livestock, sheep were much more important than cattle or goats.

Stubble-grazing studies on soft-wheat stubble supported preliminary conclusions from earlier work: that stubble provides nutrition permitting gains in weight of lambs or ewes for about the first month of grazing, but that supplementation is necessary thereafter to prevent weight loss. Concentrate supplementation of ewes was necessary in late pregnancy to prevent low birth weights and poor postnatal lamb weight gains.

Inclusion of 20% carob pulp in lamb diets had a positive effect on weight gain and feed consumption, whereas levels of 30 and 50% depressed both. Substituting carob pulp for barley reduced diet digestibility.

Analyses of data from D'Man, Sardi, F<sub>1</sub>, F<sub>2</sub>, and backcross groups of ewes have shown that the superior prolificacy of the D'Man breed is inherited in an essentially additive manner. This, plus the similarity and performance of F<sub>1</sub>'s and F<sub>2</sub>'s, indicates that groups of any mean prolificacy level desired over the range of the two parent breeds (i.e., 1.1 to 1.2 for Sardi, 2.0 to 2.4 for D'Man, depending on ewe age and the level of nutrition) can be produced by varying the proportion of inheritance of these two breeds in a cross from 0 to 1. With regard to other traits, there appears to be favorable heterosis in fertility and in growth rate, and possibly in age at puberty. Work has been initiated on development of a 50%D, 50%S synthetic breed that should have suitable production potential for the better feeding and management conditions of the country, and be useful as sires in matings with non-prolific breed ewes to give some increase in prolificacy and productivity over the latter in somewhat more extensive conditions. In the driest areas, the pure non-prolific sheep breeds are likely to be the best adapted and the most suitable.

The projects have produced nineteen journal publications or book chapters, five abstracts, six theses, and ten other reports in the past year.

## 1987-1988 Annual Report

Title: Genetic Improvement of Sheep and Goats

Host Country: Morocco

U.S. Institution: University of California, Davis

Host Country Institutions: Institut Agronomique et Veterinaire (IAV) Hassan II, Rabat, Morocco

Personnel: Principal Investigator:  
G. E. Bradford, Ph.D., PI

Collaborating Scientist:  
A. Lahlou-Kassi, D. Sci.  
I. Boujenane, D. Sci.  
S. Benlamlih, Ph.D  
A. Tibary, D. Sci.  
R. Boukhliq, M.V.Sc.  
L. Dergaoui, M.V.Sc.  
M. Bourfia, Ph.D.

### Research Results

Analyses were completed of data from the first two lamb crops produced by 365 ewes of 9 genetic groups: purebred D'Man, purebred Sardi, reciprocal F<sub>1</sub>'s, reciprocal backcrosses to both parent breeds, and F<sub>2</sub>'s. The results show that the D'Man breed transmits its superior prolificacy in an essentially additive manner. This provides the possibility of creating groups of sheep with mean litter sizes at any desired level between about 1.1 and 2.2, just by crosses involving these two Moroccan breeds. While there are few production/management systems in Morocco that can utilize the highest of these levels, we believe there are areas and farms within areas of the country that can benefit greatly from an increase in prolificacy above the typical 1.1 of practically all sheep in the country except the D'Man. With 25% D'Man, a mean litter size of 1.3 to 1.5 is obtained, depending on age of the ewes and level of nutrition; with 50%, 1.6 to 1.9. Comparison of F<sub>1</sub> and F<sub>2</sub> performances, which were quite similar, suggests good prospects for maintaining desired levels of prolificacy in later generations of a crossbred (synthetic) population. Furthermore, the D'Man contributes earlier age at puberty and a more rapid relative growth rate to the crosses.

Studies of the physiology of D'Man and Sardi sheep indicate

substantial differences between the two. D'Man sheep have higher relative feed intake (contributing to their higher relative growth rate), higher  $T_3$ ,  $T_4$  and insulin levels, and higher water turnover rates. Experiments are currently underway to investigate cause and effect relationships among these endocrine and performance variables. As indicated by the differences described, the growth performance of Sardis, though lower in relation to their body size than that of D'Mans, is less depressed by very high ambient temperatures.

In early 1988 a small research flock of 'D'Man' goats, from the same region and with some performance similarities to the D'Man sheep, was established at Tadla Farm.

A program to characterize the soundness and fertility status of sheep and goat breeding males on farms in Morocco, and to implement practices for improving fertility in flocks and herds, has been initiated with support from the CRSP.

A manual on sheep production in Mediterranean regions, with emphasis on Moroccan production systems, has been drafted and is nearing completion.

## PUBLICATIONS

### Articles in Journals and Symposia

- 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 on accelerated lambing. III. Lamb mortality, growth and production per ewe. Small Ruminant Research (in press).
- Boujenane, I., A. Chafik, M. Khallouk, and M. Kerfal. 1988. Déterminisme génétique de la taille de portée et ses composantes chez la race D'Man. 18èmes Journées de L'ANPA, Rabat.
- Boujenane, I., M. Khallouk and M. Kerfal. 1988. Parametres genetiques des performances de reproduction des arebis de race D'Man. Proc. 3rd World Congr. on Sheep and Beef Cattle Breeding (Paris) 2:653-656.
- Boujenane, I., A. Chafik, G. E. Bradford and Y. M. Berger. 1988. Taille de portée et ses composantes chez les brebis D'Man, Sardi et DxS. Proc. 3rd World Congr. on Sheep and Beef Cattle Breeding (Paris) 2:657-660.
- Bradford, G. E. 1988. Contributions of physiology and genetics to

improving reproductive efficiency in sheep. Proc. 3rd World Congr. on Sheep and Beef Cattle Breeding (Paris) 2:523-527.

Bradford, G. E. and Y. M. Berger. 1988. Breeding strategies for small ruminants in arid and semi-arid areas. pp. 95-109 In E. F. Thompson and F. S. Thompson (Eds.) Increasing Small Ruminant Productivity in Semi-Arid Areas. ICARDA, Aleppo, Syria.

Bradford, G. E., P. J. Burfening and T. C. Cartwright. Evaluation of production and reproduction of sheep, goat and alpaca genotypes in the Small Ruminant CRSP. J. An. Sci. (accepted).

Bradford, G. E., A. Lahlou-Kassi, Y. M. Berger, I. Boujenane and L. Derqaoui. Performance of D'Man and Sardi breeds of sheep on accelerated lambing. II. Ovulation rate and embryo survival. Small Ruminant Research (accepted).

Brown, D. L., S. R. Morrison and G. E. Bradford. 1988. Effects of ambient temperature on milk production of Nubian and Alpine Goats. J. Dairy Sci. pp. 2485-2490.

Lahlou-Kassi, A., Y. M. Berger, G. E. Bradford, R. Boukhliq, M. Tibarry, L. Derqaoui and I. Boujenane. Performance of D'Man and Sardi breeds of sheep on accelerated lambing. I. Fertility, litter size, postpartum anestrus and puberty. Small Ruminant Research (accepted).

Quirke, J. F., H. H. Meyer, A. Lahlou-Kassi, J. P. Hanrahan, G. E. Bradford and G. H. Stabenfeldt. 1987. Natural and induced ovulation rate in prolific and non-prolific breeds of sheep in Ireland, Morocco and New Zealand. J. Reprod. Fertil. 8:309-316.

Quirke, J. F., G. H. Stabenfeldt and G. E. Bradford. 1988. Year and season effects on oestrus and ovarian activity in ewes of different breeds and crosses. Animal Reproduction Science 16:39-52.

### Abstracts

Bourfia, M. and R. W. Touchberry. 1988. Litter live weight at birth with varying levels of D'Man germplasm. Proc. VI World Conference on Animal Production. p. 736.

Bradford, G. E. and Y. M. Berger. 1988. Variation in ovulation rate and litter size. Proc. VI World Conference on Animal Production. p. 737.

Lahlou-Kassi, A. 1988. Characteristics and experiences of D'Man breed. Proc. VI World Conference on Animal Production. p. 731.

### Theses

Boujenane, I. 1988. Ovulation rate, embryo survival and litter size in D'Man and Sardi breeds of sheep and their crosses. D. Sc. Thesis. Hassan II, Rabat (Studies supported by Univ. Minn./Hassan II/USAID program; research supported by SR-CRSP).

### Training

I. Boujenane. Doctoral program, U.C. Davis (see comments under Theses above.) Mr. Boujenane expects to complete the Ph.D. at the University of California, Davis during 1989.

The research of two other graduate students was supported in part by funds from this project:

Nathalie Bogui, Ivory Coast. Ph.D. program, Genetics. Research area: Effect of crossing lines of sheep selected for growth rate and for multiple births on reproduction and production.

William Cushwa, U.S. M.S. program, Animal Science. Research area: Genetic and management factors affecting out-of-season breeding in sheep.

A one-day Workshop was held at IAV in Rabat, Morocco (Jan. 26, 1988) with approximately 45 participants from the Institute, Ministry of Agriculture, and Extension Agencies (ORMVA,, DPA, etc.) to discuss the Sheep Production Manual being produced by the SR-CRSP.

## 1987-1988 Annual Report

Title: Range Research for Increasing Small Ruminant Production in Morocco

Host Country: Morocco

U. S. Institution: Utah State University

Host Country Institution: Institut Agronomique Et Veterinaire Hassan II

Personnel: Principal Investigator:  
John C. Malechek

A. Morocco  
Co-Principal Investigator  
Dr. Hamid Narjisse, IAV  
Co-Investigator  
Dr. Ahmed El Aich, IAV  
Co-Investigator  
Dr. Omar Berkat, IAV

B. USA  
Co-Investigator  
Dr. Fred Provenza, USU

### RESEARCH RESULTS

This was a transition year for the Utah Range Project, as well as for the Moroccan Range component of the SR-CRSP. Effective October 1, 1987, the Utah Range Project transferred all activities (except minor "linkage" involvement) from Brazil, where it had been located for the past 8 years, to Morocco. This renewed a brief relationship between Utah State University (USU) and the Institute Agronomique Et Veterinaire - Hassan II (IAV) that had existed in the early 1980's under leadership of Co-Principal Investigator James O'Rourke.

Principal Investigator Malechek made a site visit to Morocco in June of 1987 in anticipation of this transition. Visits to potential experimental sites were made with Moroccan co-investigators Narjisse, Berkat, and El Aich, along with SR-CRSP Board representative Arch Alexander. A revised workplan was then submitted in September of 1987, and work was begun in earnest. The remainder of this report section describes progress of this work from the standpoint of three sub-projects.

A. Sub-Project: **Definition of an optimal grazing system for the Stipa tenacissima (alfa grass) plant community**

Personnel: Hamid Narjisse and John Malechek

Accomplishments: The objectives of this sub-project are to evaluate the production potential and seasonal variation of the important Stipa plant community which covers much of the arid steppe region of eastern Morocco. Also, this component seeks to assess the palatability and nutritional value of Stipa to sheep and goats under low, moderate, and high stocking pressure. This information will ultimately provide a basis for selecting appropriate range improvement measures.

A replicated set of pastures (3 treats. x 2 reps) were fenced at the El Faija site in the fall of 1987. These included three stocking rates that would result in approximately 30%, 50%, and 100% utilization of the annual yield of Stipa. Sheep and goats obtained from area producers are being used in these trials. Sampling began in March of 1988.

Preliminary samples (based on 3 bi-monthly sampling periods) indicate the following: Stipa tenacissima is the major plant component in the community, with standing crop biomass levels of 2000 kg DM/ha in March and May and 1600 in July. However, annual production appears to be modest, with the following amounts being measured in an enclosure protected from grazing: March, 100 kg; May 210 kg; and July, 85 kg DM/ha. Amounts of current year's growth of Stipa foliage, measured in the three grazed treatments in July, were 40, 57, and 64 kg DM/ha for the light, moderate, and heavy stocking rates, respectively.

Stipa seems to be very low in palatability to both sheep and goats. It was virtually uneaten by both species in the light and moderate stocking intensities, but was eaten slightly under heavy stocking. For example, it constituted 21% of the diet of sheep and 12% of the diet of goats in March and 14% for both species in May. July samples were awaiting analysis.

Given this low dietary usage of Stipa, animals seem obliged to compete for the extremely scarce grasses of other species and the rare forbs found in the Stipa community. The aggregate of these other species found in diets of both sheep and goats varied between 73 and 92% in March, 51 and 76% in May, and 81 and 90% in July.

From a purely qualitative standpoint, diets of both sheep and goats appeared nutritionally adequate in March and May (July data not yet available). Crude protein was similar for both sheep and

goats and ranged from 12-14% in March to 9-11% in May. Lower values occurred under the heavy stocking rate. In vitro organic matter digestibility varied from 60-69% in March to 52-57% in May. Energy levels followed a similar pattern of decline with advancing maturity and increased stocking rate.

B. Sub-Project: **Productivity and dynamics of the Artemisia herba-alba plant community as affected by season and grazing.**

Personnel: Omar Berkat and John Malechek

Accomplishments: The other major plant community of the arid rangelands of Morocco is the Artemisia herba-alba community. Artemisia is a low-growing shrub that is an important forage component for sheep and goats across the whole of North Africa and into the Mid-East. It is often found growing in association with Stipa, but it also exists in virtually pure stands over vast areas of rangeland. The community has been subjected to extensive misuse by overgrazing and by attempts at dry-land cropping in many areas. Understanding the dynamics of this community and how it responds to such impacts is crucial to preventing or forestalling desertification as well as potentially increasing small ruminant production.

This component of the research is located at the Plain de l'Aarid Research Station near Midelt. Two components are involved. The first includes detailed measurements of plant yields and morphological changes in response to four levels of sheep grazing (very light, 0.5 ewe/ha/yr; light, 1 ewe/ha/yr; moderate, 2 ewes/ha/yr; and heavy, 3 ewes/ha/yr). Plant material is harvested before and after grazing for each of the following four components: Artemisia, other shrubs, grasses, and forbs. Changes in plant biomass reflect grazing impacts. Additionally, a detailed analysis is being conducted of shoot morphology of Artemisia as affected by grazing. Data on all of these components have been collected monthly from February through July and are now being analyzed.

The other major component of this sub-project relates to land disturbance by plowing. In an area where the history of disturbance by plowing during the 1969-1981 period is well documented, eleven situations are being evaluated in terms of plant community composition, plant age class, soil seed banks, and soil features including depth, texture, organic matter content and nitrogen content. This project component will define how plant communities recover or fail to recover from plowing and the rate of this recovery process.

C. Sub-project: **Characterization of farms in the Artemisia-**

### Stipa ecosystem, Ain Beni Mathar region.

Biological interactions of animals with plants and soil resources are mediated by farmers. In order to gain a perspective on social and economic factors that govern land use decisions, the types of farms and their products must be ascertained.

The Ain Beni Mathar region of eastern Morocco (located south of the city of Oujda) is an important agricultural and pastoral area lying in the Artemisia Stipa ecosystem. In order to characterize the Ain Beni Mathar agropastoral production system, 72 individual farms were selected for a production survey that was begun in Fall of 1987. Farms in four general sub-districts were surveyed, including: Ouled Ben Aissa, Ouled Hammadi, Ouled Kaddour, and Fokra.

Questions on the human population included size of family, main agricultural activity, auxiliary activities, and type and amount of family labor. Questions relating to agriculture included size of farm, type of crops produced, distribution of irrigated and dry land suitable for cropping, amounts of crops harvested, and how crop products are utilized, i.e., whether consumed by humans, fed to livestock, or sold.

Most of the farms have less than 50 ha of crop land and less than 3 ha of irrigated land (Table 1). The quantity of rangeland is not reported. Cereals (mainly barley) are the main crop produced, while lucerne is an important forage crop.

In terms of livestock, sheep are the dominant species (Table 2). Flocks of 70 or more animals are the most typical. Most farms do not have goats, and the few that do, have 10 or fewer heads. Analysis of herd demography (Table 3) indicates that 64% of the average herd consists of adult (> 2 yrs) females.

The sheep feeding system is mainly based on rangeland grazing with some supplementation of roughages (lucerne or straw) or concentrates in summer, fall, and winter. Stipa rangelands are used mainly in winter, while Artemisia ranges are mainly used in spring. Stubbles of cereals are used in summer.

Most (82%) of sheep are marketed as lambs of 6 mo of age, usually between March and July.

In summary, of 72 farms surveyed, 5.6% were not engaged in agricultural activity, while 15.2% were engaged solely in crop production. However, the general characterization was agropastoral, with 41% more concentrated in livestock and 45% more concentrated in crop production. Fourteen percent were judged as balanced between the two enterprises.

A subset of 40 farms was selected for a more detailed

analysis of reproductive performance, feed calendar, and rangeland use. A smaller subset of 16 farms will be used to study animal growth and feed consumption.

It should be pointed out that these data are preliminary and have not been controlled for respondent bias.

Table 1. Distribution of total cropland and irrigated land on farms near Ain Beni Mather.

<u>Irrigated Land</u>		<u>Total Agricultural Land</u>	
<u>Hectares</u>	<u>Percent of Farms</u>	<u>Hectares</u>	<u>Percent of Farms</u>
without	20.0	without	4.2
0.00 - 0.25	7.1	0.00 - 1.99	6.9
0.25 - 1.00	28.6	2.00 - 4.99	12.5
1.00 - 2.00	17.1	5.00 - 9.99	13.9
2.00 - 3.00	18.6	10.00 - 19.00	22.2
3.00 - 5.00	8.6	20.00 - 30.00	13.9
		30.00 - 50.00	16.7
		>50	9.7

Table 2. Percent of farms having livestock numbers indicated.

<u>Subdistrict</u>	<u>Cattle Herd Size</u>					
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5-7</u>
Ouled Hammadi	66.7	0.0	8.3	8.3	0.0	16.7
Foukra	39.1	8.7	26.0	4.3	13.0	8.7
Ouled Kaddour	50.0	12.5	25.0	6.3	6.2	0.0
Ouled Ben Asissa	47.6	23.8	23.8	4.8	0.0	0.0

<u>Subdistrict</u>	<u>Sheep Flock Size</u>					
	<u>0</u>	<u>1-10</u>	<u>11-20</u>	<u>21-40</u>	<u>41-70</u>	<u>&gt;70</u>
Ouled Hammadi	33.3	0.0	8.3	25.0	0.0	33.3
Foukra	21.7	8.7	17.4	17.4	8.7	26.1
Ouled Kaddour	31.2	12.5	0.0	12.5	12.5	31.3
Ouled Ben Asissa	9.5	0.0	9.5	9.5	38.1	33.3

<u>Subdistrict</u>	<u>Goat Flock Size</u>					
	<u>0</u>	<u>1-10</u>	<u>11-20</u>	<u>21-30</u>	<u>31-40</u>	<u>&gt;40</u>
Ouled Hammadi	97.1	0.0	8.3	0.0	0.0	0.0
Foukra	69.6	13.1	8.7	4.3	0.0	4.3
Ouled Kaddour	50.0	25.0	12.5	6.3	0.0	6.3
Ouled Ben Asissa	61.9	23.8	9.5	4.8	0.0	0.0

Table 3. Sex and age structure of sheep flocks in four subdistricts.

	O. Hammadi		Foukra		G. Kadour		O. B. Asissa	
	M	F	M	F	M	F	M	F
0-3 Mo	0.0	0.0	1.7	2.2	1.4	1.8	0.8	0.8
3-6 Mo	6.4	6.4	2.6	4.3	3.4	7.9	3.8	4.2
6-12 Mo	1.9	6.4	3.2	17.3	5.7	7.9	3.6	3.6
1-2 Yrs	0.0	3.2	1.3	11.2	0.0	11.7	0.4	3.5
2-6 Yrs	3.9	59.0	3.2	43.8	2.8	42.5	3.6	65.1
>6 Yrs	0.0	12.8	0.1	9.0	0.4	14.5	0.1	11.2
Totals	12.2	87.8	12.0	87.8	13.7	86.3	12.3	88.4

## PUBLICATIONS

### Manuscripts Submitted or in Press

- El Aich, A., M. Touibi, and L. R. Rittenhouse. 1989. Food intake by free-grazing sheep and resource productivity. Appl. Anim. Behav. Sci. Submitted.
- El Aich, A., A. Moukadem, and L. R. Rittenhouse. 1989. Feeding station behavior of free-grazing sheep. Appl. Anim. Behav. Sci. Submitted.
- El Aich, A., M. Jebbanima, and D. A. Jameson. 1989. Dynamic simulation of livestock of the Mzigue Village, High Atlas Mountain, Morocco. Agr. Syst. Submitted.
- Narjisse, H. 1989. Feeding and behavior of goats on rangelands. Book chapter in Goat Nutrition. PUDOC (The Netherlands). In review.

### Training

<u>Student's Name</u>	<u>Degree</u>	<u>Institution</u>	<u>Home Country</u>
Moussa Abdenahman	MS	IAV	Morocco
Merzak Salim	MS	IAV	Morocco
N'Grade N'Goumeye	MS	IAV	Niger
Lhafi Mohamed	MS	IAV	Morocco
Mirabet Mohamed	MS	IAV	Morocco
Guermai Abdelhafid	MS	IAV	Morocco
Nana Madjo	MS	IAV	Cameroun
Ed Abd Abdelkrim	MS	IAV	Morocco
Hsain Abderrazek	MS	IAV	Morocco

## 1987-1988 Annual Report

**Title:** Nutrition and Confinement Feeding for Sheep in Semi-intensive Production Systems in Morocco

**Host Country :** Morocco

**U. S. Institution:** North Carolina State University

**Host Institutions:** Hassan II Agronomy and Veterinary Institute  
National School of Agriculture, Meknes

**Personnel:** Principal Investigators:  
W. L. Johnson  
K. R. Pond

Collaborating Scientist:  
Dr. Fouad Guessous,  
IAV Hassan II, Rabat

Dr. A. Kabbali, ENA Meknes  
Nacif Rihani, IAV Hassan II, Rabat  
A. Ilham, ENA Meknes

**Third Cycle (M.S.) Students:** M. Bouzekraoui  
M. Ouchkif

**Second Cycle Thesis Students:** G. Ayouba  
M. Bayaddou  
Aziai Alaoui  
D. G. Boukori

**North Carolina State University, Raleigh (USA):** Dr. Jean-Marie Luginbuhl  
Dr. Jerry W. Spears  
Ms. Lennie J. Samsell  
Ms. Oluseum Odwumi  
Ms. Sylvia Buntinx

### RESEARCH RESULTS

A. Utilization of wheat stubble by sheep: Effect of protein supplementation on intake, diet composition and animal weight. Guessous, F., A. Outmani, E. Dahbi, J. E. Garrett and W. L. Johnson.

Forty eight lambs (initial weight 36 kg) were randomly divided

into 6 lots of 8 animals each and assigned to 6 fenced fields of soft wheat stubble (stocking rate of 24 animals/hectare). The 6 lots were randomly assigned to three treatments; A, B and C. Animals in treatment A grazed stubble only while those in B and C received, after four weeks of grazing, a supplement of 300 g of alfalfa hay or 130 g of cottonseed meal/head/day, respectively. During the first four weeks of the trial, average gain per animal did not differ among treatments A, B and C (1.9, 1.5, and 1.4 kg/head,  $P > .05$ , respectively). Lambs in treatment A were the only ones that lost weight between week 4 and week 8 (-1.8, 2.4, and 1.6 kg/head, for A, B, and C,  $P < .01$ ). Treatment had a pronounced effect on weight loss between week 8 and week 12 of grazing (-2.3, -1.7, and .5 kg/head,  $P < .01$ ).

Treatment had no effect on chemical composition of extrusa collected on stubbles ( $P > .05$ ). However, period of sampling (2nd, 6th, and 10th week of grazing) had an effect on the ash (23.0, 13.5, and 13.5% of OM), crude protein (8.1, 5.6, and 5.9% of OM) and cell wall content (71.4, 76.6, and 76.0% of OM). In vitro organic matter digestibility (IVOMD) of extrusa averaged 44.0% and was not affected by treatment or period. However, IVOMD tended to decrease between the first and second periods of sampling. Organic matter intake for treatment A did not differ among the 3 periods of sampling (47.5, 44.1, and 46.3 g OM/kg body weight<sup>.75</sup>).

B. Utilization of wheat stubble pastures by ewes in late gestation. Outmani, A., J-M. Luginbuhl, F. Guessous and W. L. Johnson.

A three month field trial was conducted with 48 mature Sardi ewes to investigate the effects of stocking rate and supplementation on wheat stubble availability, biomass, chemical composition, dry matter intake and diet quality, and to test the effectiveness of supplementation in late gestation on ewe and lamb live weights.

Six lots of eight animals each were assigned to six fenced plots of wheat stubble, resulting in two lots per experimental treatment. Animals on treatment A (12 ewes . ha<sup>-1</sup>) and B (24 ewes . ha<sup>-1</sup>) grazed stubble alone for 10 weeks. Animals on treatment C (24 ewes . ha<sup>-1</sup>) received alfalfa hay at .5% live weight after four weeks of grazing. At the start of the 11th week of grazing, corresponding to the last five to six weeks of gestation, alfalfa supplementation was discontinued and animals from each plot were randomly divided into two subgroups receiving either a high (200g cottonseed meal and 300 g whole barley) or a low (200 g cottonseed meal and 50 g whole barley) daily concentrate supplementation. At lambing, all ewes were removed from the stubble and given an identical pen-fed ration.

Stocking rate had no effect on biomass throughout the trial. Amount of wheat stubble and weeds did not differ up to the fourth week of grazing but declined sharply thereafter ( $P < .05$ ). Residual grain totally disappeared during the same initial period. Crude protein and fiber fractions of weed-free wheat stubble were similar up to the fourth week of grazing. Thereafter, crude protein decreased ( $P < .05$ ) and fiber fractions increased ( $P < .05$ ), except for acid detergent lignin which remained constant.

Crude protein and ash content of esophageal fistula extrusa samples decreased ( $P < .05$ ) and neutral detergent fiber increased ( $P < .05$ ), with increasing stocking rate. In vitro digestibility of extrusa dry matter and ewe dry matter intake tended to be lower at the higher stocking rate.

Stocking rate had no effect on ewe performance or treatments A and C during the first four weeks of grazing. Animals on these same treatments maintained their live weights during the next six weeks; during that period, however, daily weight loss of animals on treatment B averaged 50 g.

Concentrate supplementation during the last four weeks of gestation doubled live weight gain of ewes on treatment A, compared to animals on treatment C ( $P > .05$ ). Increasing concentrate level nearly doubled ewe live weight gain. Lamb birthweight averaged 4.2 kg for treatments A and C. Lamb live weight gains were similar on both treatments, suggesting that ewes on treatment A had been fed adequately and produced enough milk for normal lamb growth rate.

C. Influence of nutritional treatment on body parts and organs of mature Timahdit and D'Man ewes. Kabbali, A. and W. L. Johnson.

Thirty-two mature ewes (16 Timahdit and 16 D'Man) were used in this experiment. Eight were slaughtered as an initial group. Twenty-four were assigned to three nutritional treatments to quantitate their effects on various body parts and organs. In addition, the influence of level of nutrition on body organ response was examined. Results indicated that a 16 and 26% reduction in live weight of mature Timahdit and D'Man ewes was associated with reductions of 12 and 30% for carcass, 28 and 39% for digestive tract and visceral organs, and 65 and 75% for internal fat, respectively. Reduction of body parts and organs was not influenced by genotype.

D. Influence of level of carob pulp on diet digestibility and lamb performance. Ouchkif, M.

Trial 1. Performance of lambs assigned to four diets containing 0, 20, 30 and 50% carob pulp was compared.

Incorporation of 20% carob pulp in the diet had a positive effect on weight gain and feed consumption. Daily gain and feed intake averaged 213, 234, 189, and 132 g, and 77.6, 96.5, 97.9, and 95.7 g dry matter/kg body weight<sup>75</sup>, respectively. Feed conversion ratios increased with increasing level of carob pulp. No difference in carcass yield was observed between diets. Substituting carob pulp for barley reduced diet digestibility.

Trial 2. Three groups of lambs were assigned to diets containing 20% carob pulp and either 12, 14, or 16% crude protein. Animal performance was lower than in trial 1. Daily gain and feed intake averaged 111, 137, and 143 g, and 75.8, 73.9, and 83.7 g dry matter/kg body weight<sup>75</sup>. Diet digestibility was not affected by protein level.

E. Effect of calcium (CaCO<sub>3</sub>) supplementation on performance of growing Timahdit lambs. Azizi Aloui, K. My and M. Bayaddou.

Growing Timahdit lambs were assigned to diets containing five levels of calcium carbonate for a period of 60 days. Weight gain differences were observed during the last 20 days of the experiment, between the control (99 g/day - no CaCO<sub>3</sub> addition) and the CaCO<sub>3</sub> treatments (181 g/day). Non-significant differences were noticed in feed consumption and lamb organs development. Results indicated that trial length was insufficient for calcium effect to be fully expressed.

F. Effect of supplementation with four calcium sources on performance of growing Timahdit lambs. Boukari, D. G. and G. Ayouba.

Thirty growing Timahdit lambs were assigned to diets containing four different calcium sources, and a control, for 60 days. Calcium source had an effect on dry matter intake during the entire experiment. Overall feed conversion ratios and average daily gain, however, were not affected. A significant effect of calcium source on average daily gain was observed during the last 20 days of the trial.

## PUBLICATIONS

### Journal Articles, Refereed (SR-CRSP)

Guessous, F., A. E. Hilali and W. L. Johnson. 1988. Influence du taux d'incorporation de la pulpe de caroube sur la digestibilité et l'utilisation des rations par des ovins à l'engraissement. *Reprod. Nutr. Develop.* 28:93.

Ismaili, D., F. Guessous and N. Rihani. Systèmes alimentaires pour ovins dans une zone bour du Tadla (Commune des Beni Oukil) (1). Hommes, Terres et Eaux 15:5.

#### Journal Articles, Refereed (Supporting)

Reffett, J. K., J. W. Spears and T. T. Brown, Jr. 1988. Effect of dietary selenium and vitamin E on the primary and secondary immune response in lambs challenged with parainfluenza<sub>3</sub> virus. J. Anim. Sci. 66:1520.

Reffett, J. K., J. W. Spears and T. T. Brown, Jr. 1988. Effect of dietary selenium on the primary and secondary immune response in calves challenged with infectious bovine rhinotracheitis virus. J. Nutr. 229.

#### Manuscripts Submitted or in Press

Guessous, F., N. Rihani, A. Kabbali and W. L. Johnson. Improving feeding systems for sheep in a mediterranean rainfed cereals/livestock area of Morocco. J. Anim. Sci. (Submitted).

Outmani, A., J-M. Luginbuhl, F. Guessous and W. L. Johnson. 1988. Utilization of wheat stubble pastures by ewes in late gestation. Small Ruminant Research (Submitted).

#### Theses

Azizi Alaoui, My. K. and M. Bayaddou. 1987. Effet de l'apport calcique sous forme CO<sub>3</sub>Ca sur la performance d'agneaux en croissance de race Timahdit. 2nd cycle Memoir, ENA Meknes.

Boukari, D. G. and G. Ayouba. 1987. Effet de la supplémentation de calcium par quatre sources de calcium sur les performances des agneaux Timahdit en croissance. 2nd cycle Memoir, ENA Meknes.

Ouchkif, M. 1988. Influence d'incorporation de proportions élevées de pulpe de caroube sur la digestibilité et l'utilisation de la ration par les agneaux a l'engraissement. 3rd cycle Memoir, Hassan II Agron. and Vet. Institute, Rabat.

Taaroufi, A. 1987. Production, valeur nutritive et exploitation des prairies á base de medicago par des ovins de l'U.R.E.O.

de Had Soualem (S.N.D.E.) 3rd cycle memoir, Hassan II. Agron. and Vet. Institute, Rabat.

### Verbal Presentations

Rihani, N., F. Guessous and A. Berrami. 1988. Utilisation de quelques sous-produits de l'agro-industrie pour l'engraissement des ovins. Seminar, National Assoc. Anim. Prod., Rabat.

### Abstracts

Guessous, F., A. Outmani, E. Dahbi, J. E. Garrett and W. L. Johnson. 1987. Utilization of wheat stubble by sheep: effect of protein supplementation on intake, diet composition and animal weight. 38th EAAP. Ann. Meet., Lisbon, Portugal.

Kabbali, A. and W. L. Johnson. 1987. Influence of nutritional treatment on body parts and organs of mature Timahdit and D'Man ewes. 38th EAAP. Ann. Meet., Lisbon, Portugal.

### Training

The research of seven second and third cycle students has been supported by the SR-CRSP. In addition, the research of Nacif Rihani is partially supported by SR-CRSP. Mr. Rihani has completed the course work at the University of California, Davis and completing the research for a Ph.D. in Morocco.

## 1987-1988 Annual Report

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

Host Country: Morocco

U.S. Institution: University of Missouri-Columbia

Host Country Institution: Institut Agronomique et Veterinaire Hassan II

Personnel: Principal Investigator:  
Michael F. Nolan

U.S. Co-Investigator:  
Jere L. Gilles

Collaborating Scientist:  
Abdellah Hammoudi

### RESEARCH RESULTS

Field research for this project ceased in 1986 and all analyses except that of the Chef de Foyer (household head) study were completed by July 1987. There is no longer a sociological research component in Morocco.

Synthesis of a Decade of Research on the Sociology Project. Gilles is editing an anthology on the sociology of range management worldwide, with several articles treating SR-CRSP research on this subject. Findings from Morocco are highlighted along with those from Sociology research in the other four host countries, in a special review paper published in 1987.

### **PUBLICATIONS\***

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

#### Books and Chapters in Books

Gilles, J.L., M. Mahdi, and A. Hammoudi. 1986. Ouakaimedene, Morocco: A High Mountain Agdal. In National Research Council, eds., Proceedings of the Conference on Common Property Resource Management. National Academy Press,

Washington, DC. P. 281-303.

Manuscripts Submitted or in Press

Gefu, J.O. In press. Goats: Analysis of Factors Associated with Herd Management in Kano State, Nigeria. International Goat and Sheep Research Journal 3(1) (supporting).

Technical Communications

Gefu, J.O. 1982. Socio-economic Characteristics of Goat Producers and Their Husbandry Practices in Northern Nigeria. Proceedings of the Third International Conference on Goat Production and Disease. Tucson, AZ, P. 422-427 (supporting).

Gefu, J.O. and I.F. Adu. 1982. Observations on the Herd Size of Sheep and Goats Under Traditional Production Systems in Kano State, Nigeria. World Review of Animal Production 18(2):25-28 (supporting).

Gefu, J.O. and I.F. Adu. 1984. Understanding Small Ruminant Production in Northern Nigeria. World Review of Animal Production 20(3):35-38 (supporting).

Gilles, J.L. 1986. Revamping Range Management: A Sociological Agenda. Annual Meeting of the Rural Sociological Society, Salt Lake City.

Gilles, J.L. 1986. Sociological Contributions to Range Science. The Cross-CRSP Conference, "Bringing People In: Social Research in International Agricultural Development." University of Missouri-Columbia.

McCorkle, C.M., M.F. Nolan, K. Jamtgaard, and J.L. Gilles. 1987. Highlights from Sociological (CRSP) Research on Small Ruminants. Pastoral Development Network, Paper 24d. Overseas Development Institute, London (22 p.) (supporting).

Mendes, L.R. 1987. Communal Pastures, or Agdals, in One Part of Morocco's Western High Atlas Mountains. International Rangeland Development Symposium -- Institutions for Rangeland Development: Strategies and Lessons Learned. Winrock International, Morrilton, AR.

Mendes, L.R. 1987. Ecological Constraints and Opportunities in Livestock Production: An Example from Morocco's Western High Atlas. Annual Institute on Livestock in Development. International Learning and Livestock Center of Heifer Project International, Perryville, AR.

## MAJOR ACCOMPLISHMENTS

1. Given the low dietary usage of Stipa by both sheep and goats because of its poor palatability, the animals competed for the scarce grasses of other species and rare forbs, placing them under extremely heavy grazing pressure.
2. Studies were initiated to understand the dynamics of the Artemisia community, in order to comprehend the impact of grazing and plowing on the sustainability of this major plant ecosystem of Morocco and adjoining areas of the Middle East.
3. Seventy-two farms in the Artemisia Stipa ecosystem were selected for a production survey in late 1987 in areas where sheep are the dominant species of small ruminants. Approximately 80% of the farms were engaged in both livestock and crop production. Most of the sheep are marketed as lambs at six months of age, usually between March and July.
4. As a substantiation of earlier findings, the grazing of wheat stubble provided nutrition sufficient to increase the weight of lambs or ewes for about the first month of grazing; after that, protein supplementation was necessary to maintain weight.
5. Concentrate supplementation of ewes during the last month of gestation prevented low birth weights and poor postnatal lamb weight gains.
6. The D'Man breed of sheep transmits its superior prolificacy in an essentially additive manner that provides for the possibility of producing groups of sheep with mean litter sizes at any desired level between 1.1 and 2.2 lambs. This finding will enable producers with more intensive production/management systems to increase their offtake through a planned breeding program.
7. The project produced nineteen journal publications or chapters in books, five abstracts, six theses, and ten miscellaneous reports.

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

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