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SHEEP PRODUCTION IN A RAINFED REGION  
OF TADLA (MOROCCO)

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## SUMMARY

A survey was conducted of 80 sheep-producing farms of the Beni Oukil rural community. The study region has a seasonal rainfall pattern, with most of the average 300-400 mm falling between October and April. Sheep represent the major livestock activity of the region, along with a cropping pattern that includes wheat as the major crop and barley and forage peas as secondary crops. Forty-three percent of the farms are less than 5 hectares in size; only 3 percent are larger than 50 ha. About one-third of the farms surveyed kept 20 ewes or less, one-third kept from 20 to 50, and one-third kept more than 50. Almost 100% of the ewes were reported to have lambed during the year of the study (a good year in terms of feed resources) with an average 1.3 lambs per ewe. On 15 farms selected for followup monitoring, lambs weighed an average of 6.5 kg at 30 days of age, 12.1 kg at 60 days, and 18.8 kg at 150 days, for overall preweaning gains of about 100 g/day. The major feed resources were community grazing land and fallows during the rainy months and wheat or barley stubble areas during the driest months. Other feeds sometimes used include wheat and barley straw, wheat bran, sugarbeet pulp, pea vine hay, barley grain, alfalfa hay, and grazing in barley fields during the young vegetative growth stage.

Key Words: Sheep production, Farm survey, Morocco.

## RESUME

Une enquête concernant le système de fonctionnement de 80 fermes d'élevage ovin de la commune rurale de Beni Oukil (Tadla) fut entreprise. La pluviométrie moyenne de la région s'élève à 300-400 mm; les précipitations sont saisonnières, la majeure partie des pluies tombant entre octobre et avril. L'élevage des moutons représente l'activité principale des agriculteurs à côté de la production de blé. L'orge et les pois fourragers sont également cultivés. La superficie de 43% des fermes n'atteint pas 5 ha; 3% seulement possèdent une superficie supérieure à 50 ha. Environ 1/3 des fermes étudiées possèdent un cheptel atteignant jusqu'à 20 brebis, 1/3 possèdent entre 20 et 50 brebis et 1/3 possèdent plus de 50 brebis. Les résultats ont montré que près de 100% des brebis avaient agnelé durant l'année d'enquête (une bonne année du point de vue approvisionnement en fourrages). Le nombre d'agnelages par brebis et par an est de 1.3. Dans 15 fermes choisies parmi les 80 de l'échantillon de départ, les agneaux nés durant le période de l'étude avaient atteint un poids moyen de 6.5 kg à 30 jours, de 12.1 kg à 90 jours et de 18.8 kg à 150 jours, soit un gain moyen quotidien avant sevrage d'environ 100 g/jour. Le système alimentaire repose essentiellement sur le parcours et les jachères pendant la saison des pluies et les chaumes de blé et d'orge durant les mois de l'année plus secs. Paille de blé et d'orge, son, foin de petits pois et de luzerne, pulpes seches de betterave et orge grain représentent les autres sources alimentaires utilisées. En outre les champs d'orge sont paturés en vert durant la période végétative.

## INTRODUCTION

In order to properly address the development needs for increased agricultural output, it is first necessary to understand the existing farming system (Norman, 1978; Fresco, 1984). Thus, as a complement to the sheep production research program recently initiated at the Tadla Research Farm of the Hassan II Institute of Agronomy and Veterinary Science, it was decided to undertake a survey of sheep production practices in a nearby non-irrigated farming region.

This report is from a survey which was conducted by one of the authors (Mr. Ismaili) as a thesis research project for the Third Cycle degree (equivalent to the Master of Science) at the Hassan II Institute (Ismaili, 1983). The objectives were:

1. To determine the relative importance of sheep, cattle or goats in a rainfed, mixed crop/livestock farming region.
2. To determine the age-class proportions of local flocks.
3. To gain information about the productive and reproductive performance of local sheep.
4. To study the local feeding system.

## DESCRIPTION OF THE SURVEY AREA

The area chosen for the survey is situated in the rural community of Beni Oukil, in Beni Mellal province, in the northwest section of the district covered by the Tadla Regional Office of the Agricultural Extension Service (Office Régional de Mise en Valeur Agricole). Geographically, the survey area extends from the southern part of the Khouribga phosphate plateau to the northwestern part of the Beni Amir alluvial plains, with an

altitude of 400-600 m above sealevel. It is an area typical of much of the rainfed mixed farming region that lies between the Atlas mountain ranges and the Atlantic Ocean.

The climate of the region is described as "Mediterranean arid." There are no meteorological stations within the survey area. However, records from nearby sites indicate an average rainfall within the range of 300-400 mm, with less than 200 mm falling in the worst years and more than 500 mm in the best. The rainy season normally extends from October to April, with 30-50 mm of precipitation in each of those months. May and September are transition months, with 10-20 mm, and June, July and August are the driest months, with 0-10 mm. Annual mean temperatures are about 27°C maximum and 12°C minimum, ranging from monthly mean maximums of about 40°C in July and August to about 18°C in December and January; and monthly mean minimums of 20°C (July-August) down to about 4°C (December-February). Frost is possible but rare (1-2 days per year). Predominant winter winds are humid, from the Northwest; in summer, very hot and dry winds occasionally come from the Southeast.

According to a 1976 census of 3,387 farm units in the study area, 43% of the farms were under 5 ha in size. These same farms accounted for only 12.2% of the land area. Another 30% of the farms were between 5 and 10 ha, accounting for 19.2% of the land area. The 16% of the farms that were 10 to 20 ha in size comprised 19.6% of the land area; 9% of the farms were in the 20 to 50 ha range, with 23.8% of the land area; and the remaining 3% of farms that were larger than 50 ha comprised 25.2% of the land area.

More than half of the agricultural land is planted to crops in normal years, the rest being used for communal grazing ("parcours"). Wheat is by far the predominant crop, followed by barley (on less than one-fifth of the cropland) and forage peas (planted on less than 5% of the crop acreage). Sheep comprise the major livestock enterprise.

#### METHODOLOGY

For the main survey, an average of 10 farms (the range was 7 to 12) were chosen in each of 8 villages. The proportion of farms from each size strata closely followed the overall proportions mentioned above: 34 farms of 5 ha or less, 23 farms of 5 to 10 ha, 13 farms of 10 to 20 ha, 8 farms between 20 and 50 ha, and 2 farms larger than 50 ha. All farms were visited between October and December 1982. Farmers were asked to report or recall information relating to the 12 months prior to October, 1982.

Four of the 8 villages are located within the Khouribga plateau, and are grouped together as the "northern sector" for purposes of data summary and presentation. Two of the remaining villages are located in the Beni Amir plains, the "southern sector" of this survey. The other two villages are located in a transition zone between the phosphate plateau and the alluvial plains; these comprise the "central sector." There were 40 respondents in the northern sector, 19 in the central, and 21 in the southern.

In the four villages of the northern sector, a total of 15 farms were chosen for followup visits to monitor body weight changes of the current lamb crop. These farms were also stratified across sizes: five farms of under 5 ha, four between 5 and

10 ha, and three each from the 10 to 20 and the 20 to 50 ha strata. On these farms all ewes which had lambed during the 15 days prior to the first visit were eartagged, along with their lambs. Initially 169 lambs were identified for monitoring; three months later, 93% were still surviving.

The second visit to the 15 monitored flocks was made two weeks after the first. Subsequent visits were made at intervals of 21 days. A total of 9 visits were made to each farm, between November 1982 and May 1983. All of the tagged lambs were weighed during each visit. Their dams were weighed twice: during the initial visit, within two weeks of lambing; and again in February 1983 (8 to 10 weeks post-lambing).

Feed samples were collected from the 15 monitored farms, including samples of all farm-grown feeds: barley straw, hard wheat, soft wheat, forage pea hay, and barley. These feed samples were analyzed chemically at the Hassan II Institute animal nutrition laboratory at the Rabat campus.

## RESULTS AND DISCUSSION

### Land tenure

An important difference was discovered in the land tenure patterns of the surveyed farms. In the northern sector, collective grazing areas comprised 20% of the land holdings, whereas in the southern section they did not exist. They were of intermediate importance in the central, transition zone (Table 1). Because of the absence of collective grazing areas in the southern sector, there was a greater reliance on rented land.

Table 1. Land tenure patterns on 80 survey farms, Beni Oukil.

Land tenure mode	Northern sector	Central sector	Southern sector	Overall
Total area, ha	1,271	310	922	2,650
Owned by farmer, %	48	72	59	52
Collective, %	21	10	0	15
Rented, %	18	7	38	24
Shared, %	13	11	3	9

#### Crops and livestock

Most of the cultivated land was found to be planted to cereal crops. Across the three sectors, 31% of the land had been planted to hard wheat, predominantly for family consumption; 30% to soft wheat, predominantly for the market; and 21% to barley, which was either consumed by the family or fed to livestock. An additional 2% of the land had been planted to forage peas, mostly in the northern sector (23 farms with an average of 1.9 ha each, compared with only 4 farms in each of the other sectors). The remaining 16% of the land was fallow.

In the southern sector the barley is often allowed to be grazed during the vegetative stage, particularly in years of favorable rainfall. The regrowth is then allowed to mature for harvest of the grain.

Of the ruminant livestock held by the surveyed farmers, sheep accounted for 88% of the livestock units, whereas cattle accounted for 10% and goats the remaining 2%. (One "livestock unit" is defined as five sheep weighing 30 kg, one cow weighing

250 kg, or five goats weighing 30 kg.) All ruminant livestock numbers in the region were below normal, due to adverse weather during the previous year; however, sheep numbers had begun to recover, whereas cattle and goats had not.

Flock size varied widely. Of the total number of sheep held by the 80 surveyed farms, almost one-third were in flocks larger than 100 ewes, on 9% of the farms; another 35% of the sheep were in flocks of 50-100 ewes; and most of the remainder were in flocks of 20-50 ewes. Very small flocks (fewer than 20 ewes) were important for their number (one-third of the survey farms) but less important in terms of impact on sheep production (6.7% of total sheep numbers). For the entire survey zone a correlation of .7 was observed between farm size (ha) and flock size.

Only 43% of the farmers surveyed had cattle, and usually only 1 to 6 head. Even fewer farmers (24%) kept goats, again usually 6 head or fewer.

A total of 6,334 sheep were found on the 80 farms, distributed among age and sex classes as shown in Table 2. A major determinant of flock age structure is flourine toxicity, which is common in the phosphate producing region. All farmers will sell lambs that have poor teeth, regardless of sex, rather than raising them. Breeding replacements, both male and female, are bought as adults from flourine-free areas. Some farmers move lambs of vulnerable age to a location outside the flourine problem area and bring them back only when they have all their adult teeth.

Two phenotypes dominate ewe flocks: the "Bergui" (brown head and feet) and the all-white "Sardi," which respectively comprise 43 and 33% of total ewe numbers. An additional 12% are of the

Table 2. Demographic structure of the surveyed sheep flocks.

Teeth type and number	Males	Females	% of total	
Milk teeth	94.7	26.1		
2 adult teeth	.7	2.6		
4 adult teeth	1.1	14.8		
6 adult teeth	1.3	12.1		
8 adult teeth	2.2	44.4		
Total number of animals	1,287	5,047		

black and white "Draa" type. Rams, on the other hand, are predominantly (more than 90%) Sardi. The Sardi is definitely preferred; that a higher proportion of ewes are not Sardi may be because they are higher in price.

Almost 80% of the flocks were reported to be fully owned by the interviewee. The remaining flocks were mixed: some of the animals were fully owned, whereas others were held in a sharing arrangement with a shepherd who received a portion of the lamb crop in exchange for assuming responsibility for grazing the ewes. The sharing arrangement was the most common type of agreement with non-family shepherds, who only in a few instances worked for a monthly or annual salary.

#### Reproductive performance

All farmers reported practicing non-controlled breeding. A minority of farms (one-fifth of the total) did not have their own breeding ram; instead, they borrow a ram from a relative or

neighbor. Although breeding (and lambing) can, and does, take place at any time during the year, spring breeding and fall lambing was the most prevalent. On the 15 monitored farms, 67% of the recorded lambings occurred between September and December.

In the year of the survey, an overall 95.5% fertility and 103.6% prolificacy were encountered. Most of the farms (87%) had a fertility rate between 90 and 100%. Prolificacy rates of 100 to 105% were found on three-fourths of the farms, while one farm in six had prolificacy rates of 105 to 110%, and only 10% of the farms had prolificacy rates higher than 110%.

Farmers selected for the followup monitoring were asked to recall the month of previous lambing, for those ewes selected for monitoring of their lambs. On these 15 farms the average interval between lambings was found to be a little more than 9 months.

#### Feeding system

Three distinct periods of the year were noted, with different patterns of feeding. The period of September to January was characterized by the use of byproducts and, occasionally, purchased feeds. From February to May (the rainy season) community grazing areas ("parcours") and fallowlands were used, along with forage barley (in certain areas). Finally, the cereal stubble areas were grazed during the dry months following the wheat and barley harvest in June. From June to August stubble grazing was the sole source of feed. Information from the 15 closely monitored farms indicated that some form of supplementation was initiated in September. On 7 of the monitored farms, the flocks were moved in October from the stubble to communal areas; on the

remaining 8 farms, the animals were left in stubble fields up to February.

Important variations of the above patterns were noted in the three sectors of Beni Oukil. Most of the communal grazing lands (88% of the total) are located in the northern sector; the remaining 12% are located in the central sector, while the southern sector has none. Fallowlands and the grazing of barley were therefore more important in the southern sector, where all farmers reported use of fallowlands and 18 of the 21 reported grazing barley. In fact, about half of the farmers in the southern sector were renting fallow land specifically for grazing. A common practice was to plant barley around the perimeter of a fallow field, to clearly delineate its boundaries and discourage intrusion by neighbors' flocks.

In the northern and central sectors, two-thirds of the survey farms reported access to communal lands within 3 km of their farm; all animals were taken to these areas daily and returned to the farmstead at night. The remaining sheepholders had to travel from 3 to 13 km to reach communal lands, in which case only the breeding ewes and rams, with suckling lambs, were taken to these areas, and the weaned lambs were left at home to graze on fallowlands or barley. When utilizing these more distant areas, temporary tent camps were established.

Less than half of the farmers in the northern and central sectors reported any grazing of barley.

Stubble grazing, from the time of cereal harvest up until the beginning of winter rains (when cultural practices on cropland commence), was found to be universally practiced throughout

the survey region. This practice is linked closely to annual rainfall conditions, in that during years of extreme drought when wheat either cannot be planted or fails before maturity, stubble grazing is likewise limited.

In normal years some type of feed supplement is used from October to January. However, because of the drought in 1981, 100% of the farmers reported having supplemented their entire flock for most of the period of July 1981 to February 1982. Table 3 summarizes the use of farm-produced and purchased feeds. Differences among the three sectors were minor, except that nearly all users of peavine hay were in the northern sector, and the use of fresh sugarbeet pulp was largely limited to the southern sector. Due to the severity of the year, some of the feeds listed in Table 3 as farm-produced were in fact purchased by a few of the farmers.

Table 3. Percent of farmers surveyed (n=80) who reported the use of farm-produced and purchased feeds.

Feed	% of farmers
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Farm-produced	
Barley grain	63
Cereal straw	31
Peavine hay	15
Purchased	
Bran	84
Dried sugarbeet pulp	85
Fresh sugarbeet pulp	23
Alfalfa hay	29
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### Chemical composition of farm-produced feeds

Results of analyses of feed samples from the 15 monitored farms are shown in Table 4. All of the cereal straw samples were high in fiber and lignin and low in crude protein, as expected. Peavine hay, on the other hand, had lower total cell-wall fiber (neutral detergent fiber) and higher crude protein contents, as often noted for legume crop by-products.

Table 4. Chemical composition of farm-produced feeds, Beni Oukil region (% of dry matter).

Feed	No. of samples	Crude protein	Neutral detergent fiber	Acid detergent lignin
Straw, hard wheat	$\bar{x}$ 6	4.9	67	6.8
	range	3.3-6.0	61-73	4.8-9.3
Straw, soft wheat	$\bar{x}$ 3	4.8	71	6.5
	range	3.4-5.4	67-72	5.8-7.3
Straw, barley	$\bar{x}$ 12	4.7	64	5.3
	range	2.3-6.5	60-68	3.9-7.0
Peavine hay	$\bar{x}$ 5	15.4	46	6.9
	range	14.5-16.2	37-50	6.2-7.6
Barley grain	$\bar{x}$ 5	12.2		
	range	10.9-14.6		

### Lamb mortality

Lamb mortality was recorded in the 15 monitored flocks. The highest rate was observed during the first month of life (5.3%). An additional 1.4% of lambs died during the 2nd and 3rd months, for an overall mortality of 6.7% up to 90 days of age. Among-flock variation was high, ranging from 0 in three small flocks up to a maximum of 19%.

### Ewe weight changes

During the monitoring period ewes lost weight, on the average, on all but one of 13 of the monitored farms. Average weight for 163 ewes was 33.4 kg shortly after lambing; 8-10 weeks later, 128 ewes weighed 29.8 kg, for an average weight loss of 3.4 kg.

### Lamb weight changes

For a small number of lambs (6 males and 7 females) the birth weight was recorded. The result was a mean birth weight of 2.9 kg, and a standard deviation of .7 kg.

Weights were followed between 10 and 90 days of age for 157 lambs and up to 180 days for a much smaller number. The results are summarized in Table 5. Differences between males and females were small at all ages.

Table 5. Weights at different ages for male and female lambs on 15 farms in Beni Oukil (kg).

Age (days)	Male lambs			Female lambs		
	Number	Mean	s.d.	Number	Mean	s.d.
10	86	4.3	1.0	83	4.1	.9
30	85	6.5	1.5	82	6.4	1.3
60	83	9.3	2.3	77	9.4	1.2
90	80	12.2	2.5	77	12.0	2.2
120	71	15.5	3.7	58	15.3	2.9
150	46	18.8	4.5	41	18.9	3.3
180	12	20.6	4.1	7	20.5	3.7

Based on these weights, average daily gains were calculated as 113 g between 10 and 30 days (s.d.=38 g), 92 g from 30 to 90 days (s.d.=26 g), and 119 g between 90 and 150 days (s.d.=42 g). Sex differences in gains were minor.

The difference among farms in 10-30 day average gain appeared to be associated with differences in weight of the ewes as recorded within 10 days of lambing. The 15 farms can be divided into three groups: nine with an average ewe weight of 31 kg and 10-30 day lamb gains of 98 g; four with average ewe weight of 33 kg and 10-30 day lamb gains of 122 g; and two farms with average ewe weight of 36 kg and 10-30 day lamb gains of 146 g.

#### Wool and manure production

The start of the shearing season was toward the end of April. On the 15 monitored farms, average fleece weights from 62 ewes and 7 rams were, respectively, 1.5 and 2.4 kg (quite low). About two-thirds of the wool was destined for home use, while the rest was to be sold.

Sheep manure was not reported to be used as fertilizer. It is, however, sometimes used as a household fuel.

#### General conclusions

The importance of sheep production to the farmers of Beni Oukil cannot be denied. Also, this study demonstrates the interdependence of the livestock and crop production enterprises of farmers in this region where no irrigation is available.

Productivity parameters were acceptable, compared with similar studies in other regions of Morocco. However, reproduction rates and growth parameters could be higher, as observed in

a few of the better flocks. Improvements in feeding and management are necessary if productivity is to be improved.

The risk factor is extremely important for these farmers. The years immediately before and after the survey year were years of serious drought, when flock numbers had to be reduced in proportion to the decline in feed resources.

Because of the risk of unpredictable drought, the selection of breeding stock with higher prolificacy does not appear to be a good recommendation, unless a more stable feed resource can be developed simultaneously.

For years of average or better rainfall, farm-produced feed resources supplemented with a minimum of purchased feeds would appear to allow modest improvements in flock performance. A set of feeding guidelines needs to be developed which will help the farmer provide adequate nutrition for his ewes during the last trimester of gestation, which coincides with the end of the stubble grazing season, and during the early lactation phase. This will result in a lamb crop with adequate birth weights, helping minimize the mortality which might be related to an underweight condition. Improved preweaning growth will also help achieve maximum weaning weight.

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