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FEEDING SYSTEMS AND SHEEP HUSBANDRY IN THE BARLEY BELT OF SYRIA

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Feeding Systems and Sheep Husbandry in the Barley Belt of Syria
(Futterwirtschaft und Schafhaltung im Gerstengurtel Syriens)

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INTRODUCTION

Many countries of North Africa and the Near East can be broadly divided into three major agro-ecological zones. The first zone receives at least 350 mm annual rainfall and although cash and tree crops dominate the farming systems, small ruminants are found on most farms. The second zone, known as the "barley belt", receives 200 to 350 mm annual rainfall. Barley is the principal crop and small ruminants are numerous with meat, milk and wool being the main outputs. The third and driest zone, where rainfall is below 200 mm, is covered with natural pastures which merge into desert where annual rainfall is below 150 mm.

This paper describes the feeding systems and sheep husbandry in the Syrian sector of the west Asian barley belt which extends from Jordan to Iraq. In addition, an outline is given of research into farming systems which stabilize the fragile ecosystem and provide more feed to sheep. The information presented is taken from surveys and research conducted by the International Center for Agricultural Research in the Dry Areas (ICARDA) over the past eight years.

THE BARLEY BELT IN SYRIA

The barley belt in Syria occupies the zone between the region of mixed cropping in the west and northeast, and the steppe and desert to the south and east. The belt is generally flat and has an altitude between 300 and 500 m above sea level. The hot, dry season lasts from June until September and mean daily air temperatures reach 36°C, while the maximum can reach 45°C. Rainfall, which

occurs in winter and spring, decreases from 350 mm at the wet border, to 200 mm at the dry border of the belt. Mean winter temperatures range from 0 to 5°C. Large variations in annual rainfall and poor seasonal distribution have marked effects on crop yields.

At the beginning of the nineteenth century there were few villages in the barley belt, which was still covered by natural pasture (Lewis, 1955). But as the population increased, settlements gradually spread into the drier areas. During the 1940's and 1950's tractors were introduced and cultivation slowly extended across the belt. Today barley is even sown at favourable locations within the steppe zone. However, government policy prohibits cultivation in areas to the south and east of the 200 mm isohyte.

The cultivation of traditional grazing lands and a rapidly expanding sheep population have increased the grazing pressure on the steppe. Not surprisingly, overgrazing is slowly destroying this non-renewable resource. At the same time, inappropriate farming practices in the barley belt, such as barley monoculture, are responsible for low crop yields (Jaubert, unpublished). Erosion is severe in many areas and cultivation is no longer possible. There is an urgent need to introduce farming practices which both stabilize the soil and increase the feed production of the belt.

FEEDING SYSTEMS

The following section considers the sheep feeding systems found in the barley belt. The annual feeding cycle can be conveniently

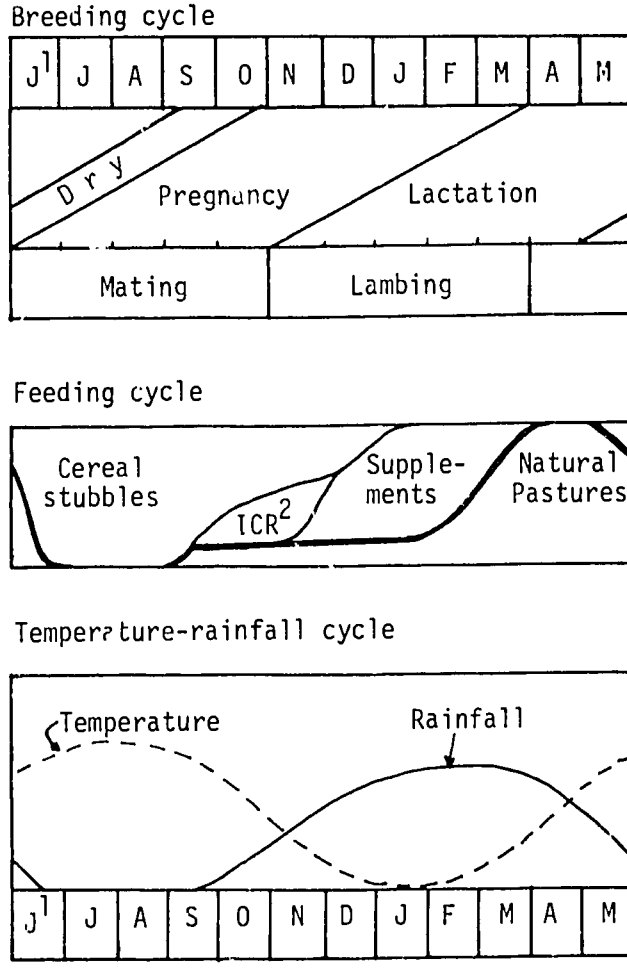
divided into four phases which coincide with the four seasons of the year (Figure 1).

Winter

Winter, from November to February, is the period of late pregnancy and early lactation of ewes, and when sheep graze natural pastures and fallows. However, following a series of drought years in the early 1960's, the Government started to provide subsidized feed to members of sheep and range cooperatives. Farmers soon realized the benefits of these supplements on flock productivity and, because meat prices were high, purchased additional feed on the open market. The supplements used include barley and wheat grain, barley, wheat and lentil straw, cottonseed meal and hulls, cotton seeds, sugar-beet pulp, wheat bran and often waste bread.

Except at Bir and Hazm, on the border of the steppe, surveys conducted by ICARDA consistently show the high levels of supplements being fed to sheep in winter (Table 1). Assuming an estimated maximum metabolizable energy (ME) requirement of 15 megajoules (MJ), supplementary feeds covered daily needs except at the border of the steppe where more natural pastures are available. It is probable that the daily trek to and from pastures, when sheep may walk 5 to 10 km, is unnecessary since the extra energy in the pasture ingested may not cover the extra energy needed for walking.

Figure 1. Breeding, feeding, temperature and rainfall cycles in Syria.



[1]Months of year; [2]Irrigated crop residues

Table 1. Daily levels of dry matter and metabolizable energy from supplements offered to sheep at three locations in the barley belt of Aleppo Province (Data from 1978 to 1985).

Location	Mean annual rainfall (mm)	Level of supplements		Sources
		Dry matter (kg)	Metabolizable energy (MJ)	
Bueda	275	1.8	17.0	1
Mouhaseneh	220	1.6	13.8	2
Bir/Hazm	<200	0.9	7.5	2

Sources:
1. Jaubert and Oglah, 1985; 2. Thomson, unpublished data

Spring

In spring, when ewes are in mid- to late lactation, the natural pastures can support sheep and supplementary feeding ends during March, depending on the rainfall and temperature during the previous winter. Many flocks move from the barley belt to the steppe but some flocks stay in the villages provided there is sufficient natural grazing.

Summer and autumn

Lactation ends in early summer and mating takes place from June to September. The cereal harvest starts in late May and the flocks which moved to the steppe in spring return to graze stubbles until autumn when they graze irrigated crop residues following the cotton and summer crop harvest. If these feed resources become exhausted, flocks may be taken further west to areas where cereal stubbles are more plentiful.

BARLEY AS A FEED CROP

Barley is the most important source of nutrients for sheep in the barley belt. Whenever possible farmers attempt to sow a large enough area to be self-sufficient in barley. But, as in northeast Syria where farms are large and fewer farmers own sheep, barley is grown as a cash crop. The grain is sold and the stubbles grazed in summer and autumn by migrating flocks.

Barley is a multipurpose crop which can be used for green or mature stage grazing, for harvesting as grain and straw, and for stubble grazing. This makes it ideal for the highly variable climate since farmers can make decisions on the use of the crop at various stages of growth.

If farmers face a shortage of feed in winter, or if the crop is poor as in drought years, barley can be grazed at the green stage in January and February. This practice is more common in the west than the northeast of Syria (Mazid and Hallajian, 1983). In the

northeast there are complex rental arrangements between land owners, share-croppers who sow and harvest the crop and sheep owners whose sheep graze the crop for a limited period in January and February (Nordblom, 1983a).

Barley may also be grazed at the mature stage in drought years or when crops are very poor. The decision to harvest or graze depends on the expected grain yield (Nordblom, 1983b). Crops are machine harvested provided the grain revenue is high enough to cover the establishment and harvesting costs. In 1982, the yield threshold at which these costs equalled the gross revenue was 321 kg per ha (Mazid and Hallajian, 1983). Adding straw revenue to the grain revenue considerably lowers the decision threshold.

One survey conducted in northern Syria showed that more barley is grown continuously in the northeast than in the northwest where it is grown in rotation with fallow (Somel, Mazid and Hallajian, 1984). Of the farmers interviewed, only 22 percent used nitrogenous fertilizer and 21 percent phosphatic fertilizer. Eighty-five percent of soils sampled in that survey were moderately or severely deficient in phosphate, and organic matter content was generally below one percent. Since little fertilizer is applied, and little sheep manure returned to the land, the soils in the barley belt have become increasingly impoverished. Decreasing crop yields reported during the past 30 years are evidence of this "mining" activity (Jaubert, unpublished) and today grain yields of 500 to 700 kg per hectare are common.

The importance of barley as a feed crop is shown in Table 2.

Table 2. Percentage contribution of barley grain, barley straw and other feeds to metabolizable energy (ME) in supplements offered to sheep at several locations in Aleppo Province.

Location	Percentage contribution to ME(%)		
	Barley grain	Barley straw	Other feeds
VLS (1980)[1]	45.3	24.6	30.1
Bueda[2]	29.4	36.5	34.1
Mouhaseneh[2]	28.9	30.9	40.2
Bir/Hazm[2]	36.5	20.0	43.5

[1]Village Level Studies (ICARDA, 1980).
[2]See Table 1.

One third of the metabolizable energy from supplements fed in winter comes from barley grain, and one quarter from barley straw. These findings are used to estimate the relative contribution of the barley crop and natural grazing to the annual energy needs of an Awassi ewe yielding 110 kg milk (Table 3). This approach is more reliable than using an estimate of the contribution of natural pasture. The barley crop provides 53 percent (2234 of 4193 MJ), and natural pastures 27 percent at the annual metabolizable energy

Table 3. Estimation of annual metabolizable energy (ME) needs of an Awassi ewe yielding 110 kg milk, and the contribution of barley as grain, straw and stubble to those needs.

Phase of reproductive cycle	Days	Major feed[1]	ME needs (MJ)	Contribution of barley (MJ)
Pregnancy:				
- early	50	St+ICR[2]	442	309 (0)[3]
- mid	50	Sp+NP	493	235 (391)
- late	50	Sp+NP	544	265 (442)
Lactation:				
- early (60 kg milk)	60	Sp+NP	974	511 (852)
- mid (40 kg milk)	60	NP	826	0 (0)
- late (10 kg milk)	30	St	339	339 (0)
- dry period	65	St	575	575 (0)
Total	365	-	4194	2234(1685)

[1]St = cereal stubbles; ICR = irrigated crop residues; NP = natural pasture; Sp = supplements. [2]ICRs cover 30% of ME needs. [3]Total contribution of supplements.

Assumptions:

1. Maintenance needs (MEm) of 50 kg ewe = 6.8 MJ/day (MAFF, 1984).
2. Extra MEm for activity = MEm + 30%.
3. ME needs for 1 kg milk = 7.4 MJ (MAFF, 1984); total milk yield equals 110 kg.
4. Supplements cover 100% of ME needs during last 100 days pregnancy and first 60 days lactation. Natural pasture covers activity allowance and all ME needs in mid-lactation.
5. Ewe needs 0, 15 and 30% additional to MEm during first, second and third trimester of pregnancy, respectively.
6. Barley grain and straw account for 60% of ME in supplements, and stubbles cover all ME needs.

needs. Other supplementary feeds and crop residues provide the remaining 20 percent.

The importance of barley in the farming system is shown in Table 4 as a balance sheet of all barley grain physical flows. The system balance is the difference between flows-in (purchases) and flows-out (sales) from the system, corrected for changes in the start and end stocks. The results are taken from a three year survey conducted in Aleppo Province where the barley belt merges into the steppe (Thomson, unpublished). Averaged over three years, these farmers were sowing 35 ha barley which had an average yield of about 570 kg per hectare.

Rainfall in the first year of the survey was below average, crop yields were poor and farmers purchased heavily to feed their sheep. This gave a negative system balance of 11,983 kg. In 1980-81 yields were good and farmers sold surplus barley, hence the positive systems balance. Over the three years farmers sold 10,216 kg barley grain and fed about the same quantity to their sheep.

Table 4. Barley grain physical flows (kg per flock per year).

	Year of survey (annual rainfall, mm)[1]			Mean
	78/79 (164)	79/80 (280)	80/81 (244)	
Flows:				
in (purchases)	-11961	-6032	-5279	-6976
out (sales)	833	15676	9724	10216
change in flows (1)	-11128	9644	4445	3240
Stocks:				
end	2200	14508	15489	12320
start	3056	2441	14508	7341
change in stocks (2)	-856	12067	981	4979
System balance (1+2)	-11984	21711	5426	8219

[1]Average of measured rainfall at Raqqa and Khanaser.
Source: Thomson (unpublished data).

SHEEP HUSBANDRY

This section outlines sheep husbandry practices with particular emphasis on reproduction, mortality, grazing management and output of sheep products. More detailed information is published elsewhere (Thomson and Bahhady, 1983a; Thomson and Bahhady, 1983b).

Reproduction

The mating season of the Awassi breed lasts from June to September and most lambs are born in December and January. Average lambing rate is 86 percent, ranging from 68 to 100 percent, and five percent of births are twins which is typical of a breed adapted to such harsh conditions. This satisfactory level of fertility is possible because rams remain in flocks throughout the year and any ewes which are temporarily anoestrus, or fail to conceive or return, are remated.

Although difficult to verify, some authorities consider that fertility in the national flock has improved since the introduction of supplementary feeding 25 years ago. This partially explains the rapid expansion of the sheep population from 3.5 million in 1961, following three years of severe drought, to over 13 million in 1983 (Statistical Abstracts, 1984).

Mortality

Poor health and diseases are common amongst sheep flocks in the barley belt, but average mortality levels are below 15 and 8 percent in the case of ewes and lambs respectively (Thomson and Bahhady, 1983b). However, infections by helminth parasites do occur, especially in flocks which migrate in autumn to the wetter areas in the west. A government vaccination program successfully controls sheep pox but outbreaks of enterotoxaemia, anthrax and foot-and-mouth disease occur because insufficient vaccine is available. Outbreaks of these diseases can increase lamb mortality to 30 percent.

Grazing management

Depending on the time of year, flocks are taken to graze natural pastures near villages and in the steppe, fallow land, cereal stubbles and irrigated crop residues. They receive all their nutrients from these resources except in winter when energy and protein rich supplements supply all their needs. As mentioned above, it appears unnecessary for flocks to graze poor pastures when they are receiving large amounts of supplements. There is even evidence that farmers offer more supplement to flocks which go to graze communal village pastures than to flocks which remain in the village (Jaubert and Oglah, 1985).

Output of sheep products

Apart from the surplus barley grain sold by farmers, the main outputs from the barley belt are lambs, cull sheep, milk products and wool. Sales of lamb and cull sheep account for 70 to 75 percent of flock revenue, milk products 20 to 25 percent and wool five percent.

Lamb and cull ewe sales. Most male lambs are sold at three to five months old when they weigh at least 20 kg, whereas female lambs are generally kept as flock replacements. Since about 22 percent of the breeding ewes are culled every year, revenue from sales of cull ewes often accounts for 50 percent of total sheep sales.

Milk products. Lambs are weanned at two to three months old. However, partial milking of some ewes starts before weaning to provide milk for family consumption. The long lambing season

lengthens the period during which milk is available to the family.

Total milk yield is about 100 to 120 kg for a five month lactation. After weaning, all milk is converted into yoghurt (leban), cheese (jibneh) and clarified butter (ghee). Yoghurt is made daily for home consumption but some is sold if there is a nearby town. Cheese and ghee are made in spring and sold or stored for use in summer and autumn. The milk products consumed by families are major sources of protein, vitamin A, calcium and phosphorus (Thomson, Bahhady, Termanini and Mokbel, 1986).

Wool. Wool, the least important product from the flock, is of carpet quality and some is used by the family while the rest is sold. Shearing is in May and uncleaned fleeces weigh about two kg.

RESEARCH NEEDS

More research is needed to study crop husbandry practices which conserve the fragile soils of the barley belt, and which increase output of feed crops. Research on these aspects has been conducted at ICARDA for the past eight years and those aspects which aim to stabilize the soil and promote a better feed supply are outlined in the following section.

Soil conservation and better crop husbandry

Arresting further degradation of soils in the barley belt should be possible with better crop husbandry and by introducing forage and pasture legumes. Better crop husbandry includes crop rotations,

replacement of soil nutrients and organic matter, and minimum tillage. Research shows the potential yield increases that could be expected if the traditional barley-fallow rotation or continuous barley cropping were replaced by barley-forage legume rotations to which fertilizer is applied (Table 5). Better recycling of nutrients would also be helpful. However, because estimated stocking rates are only 1 to 2 sheep per ha cultivated land, returning all sheep manure to the soil would only have a marginal effect on soil nutrient and organic matter contents. Indeed, much of the manure is already being effectively used for irrigated crops.

Table 5. Yields (kg/ha) of grain, straw and hay in barley-barley, barley-fallow and barley-vetch rotations (Breda 1982/83, rainfall 285 mm).

Rotation	Barley yield		Vetch hay yields
	Grain	Straw	
Bo/Bo	450	920	-
Bo/F	810	1220	-
Bnp/F	2080	2980	-
Bnp/Bnp	1440	2240	-
Bo/Vo	700	1120	1460
Bo/Vp	1300	1540	2170
Bnp/Vo	1800	2470	2270
Bnp/Vp	2060	3010	3000

B = barley, V = vetch, o = no fertilizer, n = 20 kg N/ha, p = 60 kg P O /ha except Bnp/Vp where p = 30 kg P O/ha.
Source: ICARDA (1985).

Annual forage legumes

The annual forage legumes such as common vetch (Vicia sativa), woolly pod vetch (V. Villosa subsp. dasycarpa) and chickling (Lathyrus sativus), are ideal crops for fallow land which is plentiful in the barley belt. They may be used for grazing, or harvested as hay, straw and grain. The grazing option would help reduce pressure on the natural pastures in spring when good seed-set is essential to the survival of the native annual species. Conservation as hay, grain and straw provides feed for the winter when the sheep's needs are greatest but the natural pastures very poor.

Annual pastures

Pasture legumes such as annual Medicago species are ideal for growing in rotation with cereals. Under proper management they can be grazed during the six month lactation period of local Awassi sheep. However, at present, research focuses on adapting the medic-cereal system to areas receiving above 300 mm annual rainfall. Intensive research is needed to develop the technology for drier areas. Such research will include use of medics as permanent pasture.

Improved natural pastures

Research to improve the productivity of natural pastures is also being carried out at ICARDA. These pastures are often heavily degraded because of overstocking and soil erosion. The economics of applying phosphate fertilizer are being studied (ICARDA, 1986).

However, since pastures are communal grazing areas, one of the greatest obstacles to improving their productivity is uncontrolled grazing.

CONCLUSIONS

In the past 30 years the barley belt of Syria has become an important region for producing sheep feed and barley has probably replaced the steppe as Syria's principal feed resource. However, inappropriate crop husbandry practices are causing a gradual degradation of the soils and erosion is progressing at an accelerating rate. New husbandry practices are urgently needed and many of them are being studied at ICARDA. Results from these studies indicate that barley yields could be doubled and fallow land can be used to produce forage crops. Adoption of improved crop husbandry practices will enable the barley belt to support a much larger national sheep flock and thereby contribute to feeding the rapidly expanding human population.

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