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ASPECTS OF SHEEP HUSBANDRY SYSTEMS IN ALEPPO PROVINCE OF NORTHWEST SYRIA

by

E. F. Thomson, F. Bahhady,
Adnan Termanini, and Abdul Karim Ferdawi

FARMING SYSTEMS PROGRAM

International Center for Agricultural Research in the Dry Areas
(ICARDA)
Box 5466, Aleppo, Syria

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E.F. Thomson and F. Bahhady
(Assisted by: Adnan Termanini and Abdul Karim Ferdawi)

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SUMMARY

1. This report presents the results from a series of interviews on selected topics of sheep husbandry systems in NW Syria. The major objectives of the study were to:
 1. Investigate the recent evolutionary aspects regarding the interdependencies between the cropped and steppe areas and the changes in the husbandry systems over the last 20 years,
 2. Increase our knowledge of crop-livestock interactions with particular emphasis on the role of barley, and
 3. Generate knowledge on specific husbandry practices necessary for the correct management of the three experimental sheep flocks at Tel Hadya.
2. The interviews were held between April 1981 and June 1982. Group interviews, each involving four farmers, were held in five villages in the cropped areas and 17 farmers were interviewed at three locations in the steppe area. All farmers had been involved in previous FSP surveys.
3. There has been a weakening of the links between the cropped and steppe areas during the last 20 years. The introduction of the tractor in the 1950's and supplementary feeding in the 1960's were two major events which started this development. The consequence has been that barley cultivation has extended deeper into the steppe, supplementary feeding is available during the winter months, water

can be transported to flocks during summer, and stubbles are available for grazing by steppe based flocks in summer. The result of these changes is the destruction of the delicate native plant cover, wind erosion and settlement of nomadic sheep owners who can remain in the steppe throughout the year now that feed and water resources are available.

4. Sheep are heavily dependent on cereal stubble grazing during the summer and irrigated crop residues in autumn. In winter, crop residues form an important component of their diet. Of particular importance are cereal and lentil straw. Barley occupies an increasing proportion of the total cultivable area as one moves towards the drier cultivated areas. Nearly all of the grain and straw is consumed by sheep and goats. It is a multipurpose crop since it can be utilized when immature as green fodder, and when mature as grain and as straw. At estimated grain yields above about 350 kg grain per ha, farmers machine harvest barley; below that threshold it is either hand-harvested and threshed into grain and straw, or grazed as the mature crop in-situ. Barley therefore is a crop which provides farmers with several options regarding its use.
5. The major conclusions of the study are:
 1. There has been a weakening of the links between the cropped and steppe areas during the last 20 years. This has been largely due to the introduction of the tractor and supplementary feeding,
 2. The opportunistic cultivation of barley in the drier areas has short term advantages to the steppe farmer but in the long term the practice destabilizes the ecosystem and could have irreversible consequences,

3. Barley can be grazed at the green stage, or when mature harvested for grain or grazed in-situ, the residue can be grazed or collected and fed to sheep in winter. It's almost exclusive utilization for sheep suggests it should be considered as a pasture and forage crop, and
4. Greater efforts should be made by the Farming Systems and Pasture and Forage Improvement Programs to conduct on-farm trials which investigate management and utilization of annual and perennial pasture and forage species as alternatives to existing barley/fallow based systems.

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1. INTRODUCTION

Between 1978 and 1981 a diagnostic survey was conducted by ICARDA's Farming Systems Program (FSP) on sheep husbandry systems in the driest areas of Aleppo Province in NW Syria. During the course of the survey the complexities of the interdependence of the steppe and cropped areas, the dramatic changes that were taking place in the steppe and the effect of these changes on the environment were considered to be topics of such importance that they justified further study. It was considered that an understanding of the reasons behind these changes would assist scientists and government institutions design research programs and policies which will ensure the long term productivity and stability of these areas. In addition, there were several aspects of local sheep husbandry systems that needed to be carefully understood in order to appropriately manage the experimental sheep flocks at Tel Hadya, ICARDA's research station (ICARDA 1982c). Therefore a sample of farmers were interviewed about these issues between April 1981 and June 1982.

The renewed need to address certain specific questions concerning a farming system illustrates two aspects of the four stage¹ farming systems research approach being practised by the FSP at ICARDA. Firstly, the stages are not discrete but interactive. For example, information regarding production constraints identified during the initial diagnostic stage provides the stimulus for conducting research to find solutions to these constraints at the experimental or design stage. Secondly, a lack of information noted at the experimental stage makes it necessary to return to the diagnostic stage to collect further information. For example, insufficient

1. The four stages are diagnostic, design (or experimental), testing and extension (Gilbert, Norman and Winch, 1980).

knowledge was available from previous surveys necessary for the appropriate management of the experimental flocks at Tel Hadya. These two examples illustrate how the farming systems research approach is iterative with information flow in both directions between the four stages.

The objectives of the studies on aspects of sheep husbandry systems in Aleppo Province were to:

1. Investigate some of the changes in the interdependence of the steppe and cropped areas that have occurred during the last 20 years,
2. Describe some of the changes that have occurred in the farming systems of the steppe during the last 20 years,
3. Increase our knowledge of crop-livestock interactions with particular emphasis on the role of barley in sheep feeding systems in areas receiving less than 250 mm annual rainfall,
4. Generate knowledge of specific sheep husbandry practices in order to correctly manage the experimental flocks at Tel Hadya in a manner similar to practices applied in the region, and
5. Extend the understanding of local husbandry practices not covered by earlier surveys.

The farmers interviewed during the study reported here were involved in the 1978/81 Steppe Survey (ICARDA 1981, 1982c), and the 1981/82 Sheep Performance Survey (ICARDA 1981, 1982c). The questionnaires used were, by design, descriptive rather than quantitative. The study complements a detailed survey of barley production systems in NW Syria conducted in 1981/82 (ICARDA 1981, ICARDA 1982a). Nordblom (1983b) addressed the question of whether to harvest or to graze mature grain crops; he presents in an explicit manner some of the issues regarding grazing and harvesting of barley crops presented below.

This report pays particular attention to the interdependence of the crop and steppe cropped areas, to mature barley and stubble grazing practices in the area studied and to the sheep husbandry systems of Aleppo Province. Some information regarding sheep husbandry systems has been taken from earlier FSP reports (ICARDA 1980a, 1980b).

2. THE SAMPLE

Between March 1981 and June 1982 farmers were interviewed at eight locations in Aleppo Province and one location in Raqqa Province. Four group interviews were held with the mukhtar and at least three other farmers in each of the five villages included in the previous Village Level Studies (ICARDA 1980a). These villages represent agricultural zones 1, 2A, 2B, 3 and 4. Of the three remaining locations, one is in zone 4 and two in zone 5 in Aleppo and Raqqa Provinces. Six individual farmers were interviewed monthly at each of these three locations between 1978 and 1981 during the Steppe Survey (ICARDA, 1981). The eight locations in the survey and the rainfall isohyets are shown in Figure 1. The agricultural stability zones are defined in Appendix 1.

Information on the number of farmers in the sample, family size, area of land cultivated and flock size is shown in Table 1, by location. There was a tendency for family size and the area of land cultivated to be larger in zone 5 than in zone 1 to 4. (Further information on the five villages in zones 1 to 4 is presented in the next section). As the rainfall decreases, moving down the transect from zone 1 to zone 5, mixed cropping gives way to barley and sheep dominated farming systems. Thus, in zone 5 nearly all the cultivated area is sown to barley. As expected, flock sizes are markedly higher in the steppe than in zones 1 to 4. These contrasts in the productivity of the soils and the proportion of total farm income derived from sheep are major differences between the farming systems across the transect.

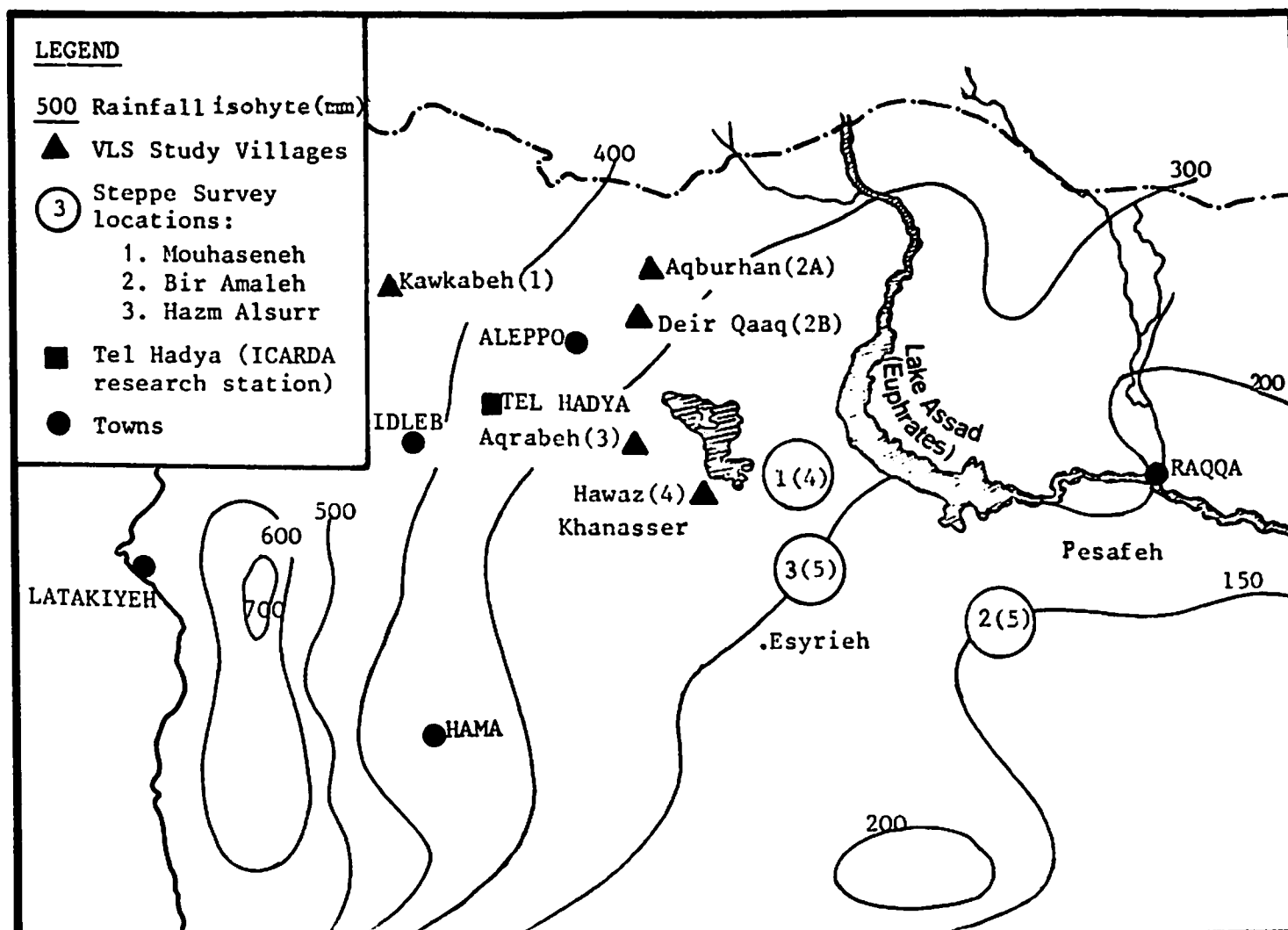


Figure 1. Map of NW Syria showing location of five VLS villages, three steppe locations, ICARDA's principle research station Tel Hadya, and rainfall isohytes. (Numbers in parenthesis represent agricultural stability zones).

Table 1. Size of sample, family, holding and flock according to agricultural zone.

Agric. zone ^a	Number of farmers interviewed	Family size ^d	Rainfed land per household (ha) ^d	Flock size (including goats) per family ^d
1	3 ^b	7	10.1	12
2A	4 ^b	7	12.9	18
2B	4 ^b	9	23.6	23
3	4 ^b	9	18.2	19
4	4 ^b	6	19.7	11
4	5 ^c	14	39.0 ^e	100
5	6 ^c	11	22.0 ^e	292
5	6 ^c	10	47.0 ^e	306

^a For definition see Appendix 1.

^b Number of farmers in group interviews.

^c Number of farmers individually interviewed.

^d Taken from VLS (ICARDA, 1980a) and Thomson and Bahhady (1983)

^e Area of barley/wheat; area under fallow not known.

3. SHEEP IN THE FARMING SYSTEMS OF ALEPPO PROVINCE

In order to indicate the importance of sheep and goats¹ compared to crops in the farming systems in NW Syria, some background information from zones 1 to 4 is presented in Table 2. Similar information from zone 5 was not available.

Sheep and goats are found in all villages across the rainfall transect. Whereas at the higher rainfall pole of the transect they have a distinct income stabilizing function in a crop dominated farming system, towards the drier zones livestock account for an increasing proportion of the farmer's revenue. As rainfall decreases, both sheep and goat numbers and village cultivated areas increase, but in village 4² they both decrease. Thus stocking rates per cultivated hectare are remarkably constant except in village 4. This may imply that a stocking rate has evolved which is a function of some factor limiting livestock numbers such as availability of forage, communal grazing area, or stubble area.

Goats are particularly important for providing milk products for the household outside the main lactating season of ewes which extends from May till November. They are found across the transect but are of little importance in zone 5.

During the last ten years sheep and goat numbers have generally decreased except in villages 2B and 4. Three important reasons for this decrease are:

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1. Numerically, goats come second to sheep in the West Asia/North Africa region. However this report emphasises sheep husbandry systems.
 2. Village or locations are referred to according to their agricultural stability zone (see Table 1 and Figure 1).

Table 2. Some background information on the villages sampled in 1977/79 according to agricultural stability zone. (Data from zone 5 not available).

	Villages (by stability zone)				
	1	2A	2B	3	4
Mean annual rainfall ¹ mm	500	330	300	290	220
Total sheep in village ¹	230	600	980	1080	290
Total goats in village ¹	210	110	70	130	40
Total rainfed area ¹ ha	400	500	870	1060	590
Fallow (% of rainfed area) ³	1.0	2.0	46.0	43.3	16.0
Sheep/goats per hectare ¹	1.1	1.4	1.2	1.1	0.6
Forage crops, ha/head sheep+goats ^{2,4}	0.10	0.40	0.20	0.30	1.40
Barley, ha/head sheep+goats ⁵	0.01	0.26	0.16	0.17	1.20
Lentils, ha/head sheep+goats ⁵	0.05	0.12	0.01	0.08	0.00

1,2,3 Taken from Tables 3.1, 3.7 and 3.8 respectively (ICARDA, 1980a).

4 Includes barley, vetch and lathyrus spp. and lentils. The latter is included on account of its large contribution to livestock feed as straw.

5 Estimated from data in Tables 3.1 and 3.8 (ICARDA, 1980a).

1. Tractors and machinery have greatly extended the cropped area at the expense of communal grazing,
2. Farmers have migrated to towns to take up part or full time employment. Although many still return to their village for planting and harvest, they no longer own livestock, and
3. In 1952 the Syrian government introduced a law prohibiting access of goats to forested areas. This reduced goat numbers to a greater extent in wetter areas.

The increase in sheep and goat numbers in village 4 occurred because the government provided medium term loans to help farmers buy sheep. Sheep numbers in village 2B increased during the last 10 years because before land reform the landlord prohibited farmers from owning sheep. The current importance of sheep in village 2B can be attributed to the close proximity of the Aleppo market and the associated demand for yoghurt.

The large proportion of fallow in the mid rainfall villages is noteworthy. In the higher rainfall zones there is sufficient rainfall for annual cropping of most fields. At the drier end of the transect many of the farms are subsistent; because average yields are low, a large proportion of the area is cropped annually in order to provide the household and livestock with a minimum of wheat and barley. This factor takes priority over the benefits of fallowing.

An indication of the current use of forage to support livestock is provided by the area of forage crops per head of livestock. These figures include barley grain and straw and lentil straw as forage fed to livestock. If barley and lentil straw are excluded from the total, the areas of other forages are insignificant.

4. INTERDEPENDENCE OF CROPPED AND STEPPE AREAS

4.1 Introduction

The cropped and steppe areas are linked by the seasonal movement of sheep between them. Traditionally, sheep flocks based in zones 1 to 4 move to the steppe in spring for two to three months and steppe based flocks move to zones 1 to 4 in summer and autumn to graze cereal stubbles and irrigated crop residues. However, there is evidence that this movement between the two areas is decreasing. Thus, all 17 farmers in the steppe stated that they move less often to zones 1 to 4 during the summer than 20 years ago. This finding was confirmed by the response of 66 percent of farmers in zones 1 to 4 who replied that farmers from the steppe move less frequently to the wetter areas during summer. Furthermore, two thirds of farmers in the sample from zones 1 to 4 stated they move less often to the steppe in spring than they did 20 years ago. Again, this was confirmed by two thirds of the farmers in the Steppe Survey.

The introduction of the tractor and supplementary feeding were the two main events which started a decline in the close ties between the steppe and the higher rainfall cropped areas of zones 1 to 4. One consequence of this change was an increase in the number of nomadic farmers who have settled along the wetter margin of the steppe in zone 5. These and other aspects are discussed in the following sections.

4.2 Introduction of the Tractor

The tractor was introduced into Syria during the 1950's and has been responsible for major changes in the farming systems. In zone 5, in particular, it made possible the cultivation of land for the production of barley, and the transport of water and feedstuffs to sheep. This illegal cultivation¹ of the native steppe where zone 5 borders on zone 4 has both positive as well as negative aspects. It is undesirable since it destroys the native vegetation cover which protects the very fragile soil from wind erosion in particular. As a result the grazing area in this belt, which could be the most productive if correctly managed, has declined dramatically. The advantage of cultivation is that it provides feed for the sheep, as grain and straw for winter, or even in summer in dry areas when direct grazing occurs since grain yields are too poor to cover harvesting costs (Nordblom, 1983b). The stubbles provide the summer feed for the sheep and, together with the availability of water, enable flocks to stay in the steppe throughout the driest and hottest period. After a winter of poor rainfall when there is a severe lack of grazing, steppe based flocks still move to the wetter areas in summer.

1. Under a 1964 Syrian law it is prohibited to cultivate land below the 200 mm rainfall isohyete.

4.3 Supplementary Feeding

Supplementary feeding of sheep began in the early 1960's following the serious drought between 1959 and 1961 which severely reduced the sheep population in Syria (MAAR, 1979). Today supplementary feeding has reached such a magnitude that it appears to cover the nutrient needs of flocks in autumn and winter (ICARDA, 1981). The intake of native pasture grazed during the period of minimum plant growth may only marginally exceed the extra energy requirements incurred through walking and grazing activities. Apart from giving sheep exercise, a practice which is emphasised by farmers, it is questionable whether there remains a need for sheep to graze during the period of maximum supplementary feeding. Resting the steppe in early spring would allow plant development through to seed production. However, this would extend the period of supplementary feeding; also, the present system of grazing rights does not encourage farmers to rest the steppe since it would be grazed by others instead. In some areas where settlement is occurring, a degree of steppe management is practised since farmers can claim grazing rights in specified areas close to their house.

The practice of supplementary feeding has several consequences. Firstly, flocks from zone 1 to 4 are less dependent on steppe grazing in spring. Secondly, it has introduced a buffer into the steppe system which helps maintain the sheep in years of low rainfall and associated grazing scarcity. Today the steppe carries a large sheep population which it can only sustain in "good" years. "Good" years occur perhaps only one year in every five. Therefore the sheep population is far in excess of the long term carrying capacity of the native pasture.

The policy of supplementary feeding has exceeded its original objective of decreasing fluctuations in sheep numbers and has thus contributed to the steady increase in the national sheep flock. Although this expansion may be desirable in terms of increasing the supply of red meat in an area of deficit, it is being achieved to the detriment of the steppe which may become permanently damaged if incorrectly exploited.

4.4 Settlement

The construction of houses in zone 5 by farmers who were originally nomadic is a further consequence of the introduction of the tractor, the growing of barley, supplementary feeding and the ability to transport water large distances. Settlement began in the mid 1950s and is particularly noticeable along the margin between zones 4 and 5 in Aleppo and Raqqqa Provinces. Today these settled farmers live close to an area of land where they grow barley. Although this is state owned land, the farmers agree between themselves how to divide it up. They are based at their house throughout the year except in the spring when they may move with their flock deep into the steppe. Those who do not move are generally in areas where there is adequate communal steppe grazing which is supplemented with concentrate feeds. From June till November the sheep graze cereal stubbles. Water is moved to where the sheep are grazing, in some cases as much as 70 km from a well or river.

Thirteen of the 17 farmers in the 1978/81 Steppe Survey said that they were moving to new grazing areas less frequently during spring than 20 years ago. This is a further consequence of supplementary feeding. The construction of a house is the natural outcome of the reduced need to move so often.

4.5 Other Aspects

Farmers in zones 1 to 4 gave three major reasons to explain the reduced movement of flocks from these zones into the steppe in spring: 1) a reduction in the grazing area in the steppe due to increased cultivation; 2) a deterioration in the quality of the remaining grazing and 3) introduction of supplementary feeding. Other reasons for this development were: the original tribal ties of village farmers who originally came from the steppe have weakened; the individual flock sizes are too small; many farmers do not have a tent or a tractor necessary for living in the steppe; and steppe farmers increasingly claim grazing rights on the land close to their houses.

In contrast to the above opinions, the farmers in the zone 1 to 4 sample who believed that more flocks move from higher rainfall zones to the steppe in spring, stated that this occurs because of improved transport, less communal village grazing and increased sheep numbers in villages.

The size of the individual steppe flocks that still move to the higher rainfall area in summer has decreased over the last 20 years. This is due to a change in the practice of sheep ownership from one of share arrangements between steppe farmers and town merchants or landlords to one where flocks are owned exclusively by steppe farmers.

In good years, lambs are still sent from some villages in zones 1 to 4 to the steppe in spring under contract to the steppe farmers. The animals may stay for up to three months and gain up to six kilograms liveweight. This is worth from SL 70¹ to SL 90 at 1981 prices. The per head monthly

US \$ 1 = approx. SL 5.40

costs of keeping sheep in the steppe are SL 1-3 for shepherding and SL 2 for water. Transportation to and from the steppe costs SL 4 per head. It appears that the current rationale for sending lambs to the steppe is to reserve the village communal grazing for lactating ewes, save supplementary feed and fatten lambs at very little cost. However, if lamb growth in the steppe falls below one to two kilograms in three months, the profitability of the practice becomes marginal.

5. IMPORTANCE AND UTILIZATION OF FORAGE CROPS

5.1 Introduction

In approximate order of importance, the crops in Aleppo Province that provide feed for sheep are barley, wheat, lentils, broad beans, vetch and lathyrus (ICARDA, 1980a). Most of the barley crop, whether as grain or straw (tibn), is destined for consumption by sheep and goats. The straw of wheat is either grazed in-situ or kept as winter feed. The straw of lentils which remains after threshing has an important place in the diets of sheep and goats because it has a higher protein content than cereal straws. Lentil straw contributes to the diet of sheep and goats in the rainfall zone from 250 up to 450 mm where the crop is principally grown. Vetch and lathyrus are mainly grown in the wetter areas. They are allowed to mature, both the grain and straw being fed to sheep and goats. In zones 4 and 5, forage crops such as vetch and lathyrus are not grown.

The barley crop in Syria is particularly important to sheep because it provides both grain, straw and stubble grazing. In the following section special attention will be given to the multi-purpose nature of this crop since it can be utilized in several ways as follows:

1. Grazed when immature to provide green fodder,
2. Grazed in-situ as a mature crop when the grain yield is very poor as can happen in dry years,
3. To provide both grain and straw for inclusion in supplementary feeds,
4. For sale to other farmers or merchants to provide cash income, and
5. As stubble grazing.

5.2 Grazing Immature Barley

The extent of the practice varies across the province and is less common in NW Syria than in NE Syria (ICARDA, 1982a). In wetter areas immature barley may be grazed to prevent lodging of good crops and to provide feed for ewes in early lactation. In drier zones the decision to graze immature barley depends on the availability of alternative grazing, and the cost of supplementary feedstuffs (Nordblom, 1983a).

Farmers believe that grazing of the immature crop has little effect on grain yields provided the crop is less than 20 cm high when grazed. Normally, grazing takes place from mid-February to mid-March. It was difficult to obtain information on grazing pressures. However, a "light" grazing over 15 to 30 days is common.

5.3 Grazing Mature Barley In-Situ

The data presented in this section is taken from farmers interviewed in zones 4 and 5. As rainfall decreases the probability increases that the grain yield of barley will fall to a threshold below which it is more economical to graze the crop in-situ than to combine harvest the crop. Thus, at yields below about 352 ± 67.2 kg/ha (mean $\pm$ SD) farmers in zones 4 and 5 considered it uneconomic to machine harvest barley. A simple model that illustrates how this threshold varies with changes in the price of grain and residues and harvesting costs has been developed (Nordblom 1983b).

Up to 73 ± 43.8 kg/ha of grain is thought to be lost by the combine harvester. However, this is not all wasted because whole ears are eaten by sheep grazing the stubble and the individual grains germinate after the first rains to provide volunteers which are grazed if the field remains fallow during the coming year.

The season has a marked affect on the area of barley which remains for grazing. Most of the sample farmers in zones 4 and 5 stated that in good years only small areas of the mature barley crop remains as direct grazing for sheep. These areas may be reserved for ewes in poor condition instead of feeding them supplements in summer. In the dry year 1978/79, sheep grazed mature barley for up to 150 days and farmers paid up to SL 200/ha rent for mature barley crops.

Over 70 percent of respondents considered that there has been an increasing tendency during the last 20 years to graze mature barley. It remained unclear whether this is because rainfall decreased during that period, because a greater area of barley is now grown in dry areas where the probability of inadequate rainfall is high, because of lower soil fertility or because input/output cost relationships have changed. Jaubert (1983) has studied this question and considers that a decline in soil fertility is the principal cause of poorer yields.

The increasing use of barley as "conserved" feed in-situ again emphasises the need to consider barley as a multipurpose crop.

5.4 Barley Grain

The importance of barley grain in the diets of breeding stock and fattening lambs is considerable and is a subject which falls outside the scope of this report. It is sufficient to say here that barley grain provided between 35 and 60 percent of the metabolizable energy in sheep diets fed in the six villages studied (ICARDA, 1980a).

5.5 Cereal Straw and Stubbles

In this section wheat straw and stubble are considered with barley straw and stubble. Cereal straw which remains in the field after combine harvesting and the associated stubble provide the basal diet for sheep throughout the summer into autumn when supplementary feeding starts. In zones 4 and 5 the duration of stubble grazing varies from one to five months depending on the season. Grazing rents vary between zero and SL 200/ha depending on grazing quality and the season. They tend to be higher in poor years. In the wetter zones farmers with sheep allow them to graze their own stubble for 15 days before allowing the communal flock access (ICARDA, 1980b).

By the end of autumn the stubbles in zones 3 to 5 have been heavily grazed several times and little material remains. In areas with above 300 mm annual rainfall, stubbles are often burnt in order to facilitate seedbed preparation, particularly since the quantities of material remaining after grazing can be considerable depending on crop yield and the intensity of grazing by village sheep and transhumant flocks (ICARDA, 1980b).

Cereal straw has an important place in the winter rations of sheep and goats. It represents up to 40 percent of the metabolizable energy consumed by sheep (ICARDA, 1980a). This figure can be higher in zone 5. Wheat straw was found to represent 54 percent of total straw fed as supplements in the six villages during winter.

6. GENERAL ASPECTS OF SHEEP HUSBANDRY

6.1 Grazing, Herding, Supplementary Feeding and Watering

This section pays particular attention to grazing, herding, supplementary feeding and watering practices across the villages in the study.

6.1.1 Grazing Land: The agricultural land across the different zones can be broadly classified as follows:

1. Cultivated land, which includes fallow (zones 1 to 4).
2. Grazing land, where either the soil has been removed by erosion as on sloping land (all zones), it is too stony and shallow for cultivation (all zones), or rainfall limits cropping as in the steppe (zones 4 and 5).
3. Land under tree crops (zones 1 and 2).

A distinction can be made between communal village grazing in the cropped zones 1 to 4 and the state owned steppe grazing in zone 5.

Communal village grazing: Much of this is found very near to the villages but additional areas are found away from the village centre. Large differences in the area of the communal village grazing are found, ranging from near zero to one third of the total village area. For example, a village situated on deep soil in zones 1 and 2 will have little communal grazing because nearly all the land is cropped annually. A village in zone 4 can also have little communal grazing because a high proportion of the land must be cultivated in order to supply the subsistence needs of the farmers and their livestock.

The area of communal village grazing has decreased during the last 20 years following expansion of the cultivated area made possible by the introduction of the tractor. Grazing pressure on the remaining areas has therefore increased resulting in deterioration of the native vegetation and the associated carrying capacity.

Steppe grazing: Before 1958 the steppe area was tribal land. This enabled a degree of rangeland management control which became less possible after Land Reform in 1959 when the steppe became state land. The tribal control of steppe grazing weakened. Thus Land Reform is one of the factors that has indirectly contributed to the decline in the carrying capacity of the steppe over the last 20 years. These aspects will not be expanded here as they lie outside the scope of this report. Readers with an interest in the subject are referred to Bahhady (1981).

6.1.2 Herding Practices: Herding practices depend primarily on flock size and agricultural zone. Three main practices can be identified:

1. The sheep owner himself, or one of his family, herd the sheep. This practice applies to flocks of all sizes.
2. Farmers owning less than 30 sheep cannot justify paying a shepherd to manage their flock. Their sheep join the village flock during the day and return to their respective owners at night. In this case a village shepherd is employed by the individual sheep owners. The practice is most common in zones 1 to 4 where flock size tends to be small.
3. Large flocks are herded by a hired shepherd. This practice is found across all zones but particularly in zone 5 where flock size is often over 100 head.

A village shepherd is employed to herd sheep, particularly when they are grazing stubble in summer and autumn. He receives SL 2 to 3 per month per ewe. This wage is increased to SL 5 to 6 when a shepherd provides rams for mating ewes. Owners of large flocks pay shepherds SL 600 to 700 monthly, and in zone 5 they also provide food, clothing and tobacco.

6.1.3 Supplementary Feeding: This is a complex subject which lies outside the scope of this report. It is reported in detail elsewhere for zones 1 to 4 (ICARDA, 1980a), and for zone 5 (Thomson and Bahhady, 1983). Only a brief outline is presented here.

Village based flocks: From May till November sheep in zones 1 to 4 graze cereal stubble, communal village land, fallow lands and irrigated crop residues. Usually all categories of sheep are mixed together.

Supplementary feeding can begin in autumn and continue till March depending on the season. This relatively new practice began about 20 years ago following a series of severe drought years. Sheep and goats receive supplements of barley, cotton seed cake, cotton seed hulls, wheat bran, sugar beet pulp, lentil and cereal straw in different combinations. The barley and straws (tibn) are produced on the farm but other constituents are bought either from the local market or through the General Organization of Feed (GOF). In spring, sheep from these zones may move to zone 5 for about three months depending on the season.

Barley grain supplied 35 to 60 percent of the metabolizable energy (ME) across the transect (see ICARDA, 1980a) with both wheat grain and lentil straw diminishing in importance from the wetter to the drier areas. Cereal straw becomes increasingly important in the opposite direction. In zone 4 it represented 33 percent of the ME in the supplementary diets. Industrial by-products, such as sugar beet pulp and cotton seed cake, accounted for 10 to 37 percent of the ME intake.

In small flocks below 30 head, all sheep categories receive supplements together. In the larger flocks ewes move into a separate flock about 14 days before they lamb and receive extra supplements.

Steppe based flocks: Sheep based in the steppe also graze cereal stubbles from May until November, either in the steppe cultivated areas, or after moving to the higher rainfall cropped areas. In winter and spring they are based in the steppe and today are very dependent on supplementary feeding.

6.1.4 Watering: In summer and autumn sheep flocks in zones 1 to 4 receive water from a river or village wells. In zone 5 during the summer and autumn, water is transported to flocks using mobile water tanks. This transportation became possible with the introduction of the tractor and is a key factor which makes it possible for these flocks to remain in the steppe throughout the summer.

Transporting water to large flocks grazing stubbles during the long hot summer in the steppe is a major activity. For this reason farmers in zone 5 usually own at least one 4000 to 5000 litre capacity tank which can be carried on a trailer. Today four wheel mobile tanks, which hold about 6000 litres and cost about SL 20,000 in 1981, are being increasingly used. In the marginal area between zones 4 and 5, the village well supplies the needs of the sheep and fewer water tanks are needed.

The distances that farmers transport water vary considerably depending on the proximity of a water source. In extreme cases during the hottest period, farmers are known to transport water to large flocks twice daily over 150 km for each round trip. However, the frequency of transportation varies considerably depending on the season, flock size and distance from the water source.

Estimated daily water requirements per ewe can reach 10 litres. At a monthly water charge of SL 3 to SL 5 per head, watering a 400 head flock in summer can easily cost between SL 1200 and SL 2000 per month.

In winter and spring little watering is necessary since sufficient moisture is supplied from grazed pasture.

6.2 Reproductive Aspects

The level of sheep fertility in a flock is a major factor affecting profitability. Background information follows on management of breeding stock and attitudes regarding fertility.

Rams: The ratio of one ram to 35 ewes recorded during the study agrees with the value reported earlier (ICARDA, 1980a). Rams usually remain with ewes throughout the year. Thus any ewes in oestrus outside the main breeding season are mated. This leads to a wide distribution of the lambing season which makes feeding of ewes less precise because they are at different stages of gestation or lactation during the period of supplementary feeding. However, this system of running the rams continuously with the ewes does ensure that lambing percentages, expressed on an annual basis, exceed 80 percent of fertile ewes and that milk is available for household consumption over a long period of time.

When communal flocks are large, the number of rams is increased. If flock size is too small to justify a ram, the ewes are mated by other rams in the communal flock. Farmers with larger flocks choose their own ram which joins the communal flock. Rams are usually selected from within owner's flocks but are sometimes bought from a market. Farmers prefer rams with a

large frame, black face, "roman" nose and good quality wool. Rams are culled if they have poor libido, low fertility, poor progeny or disease.

Ewes: Of particular interest is the extent of farmers' knowledge regarding the factors which affect ewe reproductive activity. This subject was investigated using a separate questionnaire applied to the 17 farmers in zones 4 and 5. Special attention was paid to the effect of lactation, feeding and body condition on oestrus activity. Results are expressed as percentages of positive answers to the questions.

In most cases (75 percent) farmers considered that lactation suppresses oestrus, but once lactation ends ewes begin cycling (100 percent). In some cases though, ewes cycle during lactation, particularly if they have been well fed and hence are in good body condition.

All farmers agreed that feeding is the overriding factor determining oestrus activity. Thus, in winter, oestrus activity during lactation can be enhanced by supplementary feeding. Such supplementary feeding is not practised in summer (86 percent) except when the body condition of the individual ewes is very poor. In years of below average rainfall, the area of barley in zones 4 and 5 which is not harvested increases, thus releasing more feed to the sheep. This aspect again shows the value of barley as a buffer in the farming systems.

Opinions of farmers vary regarding the effect of body condition on conception rate. However, a majority (82 percent) consider that ewes in poor condition remain anoestrus.

The spread of the mating season is affected by the quality of natural grazing and the stubbles. Within flocks it averages about 37 days (range 20-60 days). If the quality of the grazing has been good, the mating, and therefore the lambing, season is shorter. This is highly desirable since supplementary feeding can be more closely matched to the needs of the ewe. It is unclear whether grazing mature barley tends to "synchronize" oestrus within the flock and whether the practice acts as a form of "flushing" in poor years if body condition of ewes is poor before stubble grazing starts.

The body condition of the ewes during the 1981 mating season (June-August) was judged by farmers to be average and return rate of ewes to be about 15 percent (range 5 to 30). Return rate is considered to be more a question of ram sexual activity (77 percent) than ewe body condition.

Lambs: Across flocks the main lambing season extends from November till late March. However, some lambs are born outside this main period. Lambing in November and December is preferred because lambs are already about 90 days old in March when they can be weaned onto spring pasture. This helps reduce concentrate feeding and frees the ewe's milk for sale as milk products. The lambing season continues into March if feeding was poor during the previous summer's mating season as is the case after below average rainfall in winter and spring. Alternatively, when ewes enter winter in good condition, some come into oestrus soon after lambing and new lambs are born in summer. Thus, three lamb crops in two years are possible.

Generally, farmers prefer the lambing season to be concentrated over a short period. However, in villages 1 and 2B this is not the case because there is a good market for milk products nearby. A long lambing season is therefore preferred in these villages.

Lambs are mainly born in a small shed. Straw is used as bedding. Mismatching is not a problem as few ewes refuse their young. The desirability of twins varies considerably between farmers. Although they may generate more income, the feeding of the mother must be generous in order to sustain good growth rates from her lambs. Weaning generally takes place at three months of age, although if there is a nearby market for yoghurt, lambs are weaned at one month. Male lambs are frequently weaned later than female lambs in order to maintain good growth rates.

6.3 Flock Structure and Culling Rates

Details on flock structure have been described elsewhere (ICARDA, 1980a). Suffice to say here that, across the transect, average flock size increased from below 20 in zone 1 to above 40 in zone 2 but then fell to below 20 in zone 4 before increasing again dramatically in zone 5 (see Table 1). Ninety percent of ewes were pregnant in November, and yearling lambs represented about 20 percent of the female animals in the flock. This latter value represents a 20 percent culling rate. Ewes generally have their first lamb when two years old. Thus, the average rate of turnover in the flock is once in five years. Farmers reported that ewes can remain fertile until about eight to 10 years of age. Ewes of all ages are culled because of poor milk production, barrenness, loss of teeth, disease or when the farmer needs to raise cash.

The term "barren ewes" needs careful definition. Barrenness is considered to refer to ewes which fail to conceive over one breeding cycle. Although estimates of the rate of barrenness in flocks are not available, levels are probably low because farmers quickly identify and cull out ewes which fail to become pregnant.

6.4 Milking Practices

Weaning of lambs signals the beginning of milking which lasts between four and five months. Thus the lactation of a ewe may exceed 200 days. At a daily peak milk yield of 0.6 to 0.7 kg, average milk production of a ewe ranges from 70 to 80 kg excluding the consumption of the lamb.

Milk products are an important component of the family diet throughout the year. For home consumption, yoghurt is produced in spring, and cheese and ghee in early summer. The excess production is sold mainly as cheese or ghee. Villages close to Aleppo find a ready market for yoghurt. These milk products represent about 20 percent of the income from sheep (ICARDA, 1980a).

6.5 . Wool

Shearing takes place annually in late April and early May. Fleeces weigh 2 to 2.5 kg. Farmers appreciate that feeding has a marked effect on yield. Some wool is kept for home use, the rest being sold at the market. Revenue from wool represents about 5 percent of the total revenue from sheep products (ICARDA, 1980a).

6.6 Goat Husbandry

A brief mention of goat husbandry is warranted since goats are found mixed in with the sheep flocks across the transect except in zone 5. The main reason for keeping goats is that they extend the period during which milk is supplied to the farm household. Kids are generally born in February. Peak daily milk yields of one to two kg are reported with total lactation yields of 200 kg spread over 200 to 230 days. The male kids are sold when still young and female kids kept as replacement stock.

6.7 Problem Areas

A small part of the questionnaire considered some of the major problems facing farmers. Most farmers in the sample wished to increase their flock size, principally because it would raise their income. But a lack of cash and feedstuff availability were the main factors preventing this expansion. They considered that the government should pay special attention to these problems.

Farmers would be helped considerably by a monthly visit to their area by vets and other government workers who would then appreciate more clearly the farmers' problems. Here specific mention was made of the late arrival of feedstuffs from the General Organization of Feed after a season of grazing shortages, and a discrepancy between what the farmers feel and what the Ministry of Agriculture and Agrarian Reform considers to be the minimum supplementary feed requirements of a ewe in winter.

Farmers are not generally interested in methods of intensification, such as three lamb crops in two years, because they do not have the feed basis and technical back-up facilities to do so.

7. DISCUSSION

The stimulus for the short studies presented in this Report was to document certain sheep husbandry practices not treated in detail by the previous VLS survey (ICARDA, 1980a). An in-depth understanding of the reasons farmers have for using a particular practice assists the development of new or modified practices. These will then have a better chance of being accepted by farmers.

In this concluding section an attempt is made to assess whether the objectives of the studies were attained and to highlight major aspects of the farming system which merit further attention. It was realised at the outset that the value of information derived from a small sample is only valid within the immediate proximity of the farms studied. In spite of these limitations, statements can still be made that guide scientists in the identification of objectives and the generation of research hypotheses.

The results presented in the Report made it possible to achieve the objectives of the studies presented above. A broad picture of the complexities of the interaction between the steppe and cropped areas, of the evolutionary trends in the steppe and cropped areas over the last 20 years, and of specific sheep husbandry practices has been generated. Crop-livestock interdependencies and evolutionary aspects are currently being treated in more detail by Jaubert (1983) and Nordblom (1983a, 1983b). The studies also illustrate how FSR is an iterative process whereby information gaps identified at the design stage can be filled by returning to the diagnostic stage.

Discussion follows on some of the major aspects mentioned in the Report which justify, and are receiving, further attention by ICARDA researchers.

The first question that arises is the viability of the recently evolved farming system involving the extension of barley cultivation into zone 5. The long term implications of this practice have yet to be appreciated, particularly the susceptibility of the area to wind erosion. The soils have a delicate structure which can easily be destroyed once the native vegetation cover has been removed by tillage. These areas are being continuously overgrazed and therefore are already exposed to destructive forces. One question that must be asked is: How can the long-term stability of the ecosystem be improved? Certainly one solution is to reduce the grazing pressure on the native steppe. In areas that have been cultivated it will be necessary to plant palatable perennial drought resistant pastures and shrubs. Research on these aspects is likely to be given more emphasis by ICARDA in the future.

The factors which allow settlement in the steppe including the impact of motorized transport, have been discussed. The final result of these changes is that, in summer, steppe based sheep flocks are less dependent on the stubbles in the higher rainfall areas. This is one aspect which has led to a weakening of the links between the two areas under study. A second aspect is the introduction of supplementary feeding. This practice has reached such proportions that it is given as one major reason why fewer flocks need to move from the cropped zones to the steppe in spring.

A second question which arises is the need to consider the barley plant in toto. It has multiple uses, one of which is to provide grain for inclusion in the diets of breeding and fattening sheep; the straw residues, whether collected and fed or grazed with the stubble in-situ, are an essential element of the farm system. In summer the stubbles have enormous significance since they maintain most of the national breeding flock. This phase of the breeding cycle spans the mating season, and ewe fertility is a major factor affecting flock profitability. The impact of plant breeding strategies on the nutritive value of straws of cereal and food legume species is also now the subject of research at ICARDA.(ICARDA 1982c).

Some research to define the relative value of grain and straw is needed. Firstly, moving from zones 2 to 5, barley becomes increasingly important in the crop rotation. Secondly, the probability that a mature crop will be grazed rather than harvested increases as rainfall decreases and thus, the value of straw assumes increasing importance. It is suggested, therefore, that further research should be devoted to these questions, particularly the trade-off in terms of total nutrients supplied to the animal when the quality of the straw is increased. The results from the FSP Barley Survey (ICARDA, 1982a) show to what extent barley is grazed at the green and the mature stage. Nordblom (1983a) has presented a theoretical treatment of the former aspect. A second paper by Nordblom (1983b) helps define the yield level at which the decision is made to graze rather than harvest a mature barley crop under different price conditions.

A significant effort is being made by the Pasture and Forage Improvement Program (PFIP) to define the species and agronomic practices which will make possible the better utilization of fallow and communal grazing areas. Within the study area, the greatest potential for replacing fallow is in those areas receiving 250 to 350 mm rainfall where fallows represent a larger proportion of the total cultivated area. Below 250 mm rainfall, fallows represent a small proportion of the cultivated areas under study. This raises the question: What area of forage is required to feed a ewe from the beginning of November through till the end of March? This would cover the last third of pregnancy and the first months of lactation. These periods, which are critical in determining lamb performance and milk production, coincide with a critical shortage of both natural and stubble grazing. A 50 kg ewe yielding 800 g milk daily requires 12.7 MJ ME (MAFF, 1975). If 1.5 kg of vetch hay dry matter containing 8.5 MJ ME/kg DM were fed for 150 days, thus covering nearly 100 percent of the maintenance and production energy needs of the ewe, 225 kg of vetch hay would be required. This could be supplied from 0.225 and 0.056 ha of forage in the 200 and 400 mm rainfall areas yielding 1000 and 4000 kg/ha respectively. A farmer with 30 ewes would require in zone 1 about 1.7 ha, or in zone 4, 6.75 ha of vetch to feed them for 150 days.

Several studies in both the FSP and PFIP are already in progress which show that vetch, for example, can yield 1600 kg DM/ha (ICARDA, 1982b) at 200 mm annual rainfall. However, greater efforts to test these forages in farmer-managed trials need to be made. This work has already started. Verification of the parameters used in the example outlined above is an important aspect of these trials which should probably take priority over those designed to improve grazing areas. Farmers are motivated to increase

output from their sheep and land by using low risk practices. It will be difficult to convince farmers of the value of applying limited resources, for example fertilizer, to improve communal village grazing. This would need to be done by common consent and would be very difficult to achieve in practice.

The main conclusions of this study are the following:

1. There has been a weakening of the links between the cropped and steppe areas during the last 20 years. This has been largely due to the introduction of the tractor and supplementary feed.
2. While the opportunistic cultivation of barley in the drier zones has considerable advantages to the steppe farmer, the practice destabilizes the ecosystem and could have irreversible consequences.
3. Barley can be grazed at the green stage, or when mature harvested for grain or grazed in-situ; the residue can be grazed or collected and fed to sheep in winter. Its almost exclusive utilization for sheep suggests it should be considered as a pasture and forage crop.
4. In view of the large area of fallow and illegally cultivated land, expansion of on-farm trials investigating management and utilization of annual and perennial pasture and forage species is recommended.

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9. APPENDIX

APPENDIX I Agricultural Stability Zones in NW Syria

The official classification of the Ministry of Agriculture is based on rainfall, and identifies five Agricultural Stability zones, the first of which is divided into two sub-zones. These are:

Zone 1 a	Average rainfall over 600 mm
Zone 1 b	Average rainfall between 350 and 600 mm
Zone 2	Average rainfall between 250 and 300 mm and not less than 250 mm in two years out of three.
Zone 3	Average rainfall over 250 mm and not less than this in one year out of two.
Zone 4	Average rainfall 200-250 mm and not less than 200 mm in one year out of two.
Zone 5	Below 200 mm, and covering the rest of the country.