ÇUKUROVA UNIVERSITY
INSTITUTE OF NATURAL AND APPLIED SCIENCES

MSc THESIS

Mohannad OBAIDO

CHARACTERIZATION AND COMPARATIVE EVALUATION OF SHEEP PRODUCTION UNDER TRADITIONAL AND IMPROVED MANAGEMENT CONDITIONS OF CENTRAL SYRIA

DEPARTMENT OF ANIMAL SCIENCE

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We certified that the thesis titled above was reviewed and approved for the award of degree of the Master of Science by the board of jury on 13/07/2010.

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ABSTRACT

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CHARACTERIZATION AND COMPARATIVE EVALUATION OF SHEEP PRODUCTION UNDER TRADITIONAL AND IMPROVED MANAGEMENT CONDITIONS OF CENTRAL SYRIA

Mohannad OBAIDO

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This study was conducted on-farm with the aims of characterizing sheep production in Central Syria and comparing the production aspects of sheep managed under traditional and improved feeding during reproduction, lactation, and growth stages. Five farmers in three villages were selected for the experiment. The flock of each farmer was divided into two groups randomly to apply improved feeding practices to one half of the ewes while the other half were fed according to the farmers' traditional practices. The traditional group of each farm was followed regularly in order to characterize sheep production.

Ewes' performances were generally similar and no significant differences were observed between treatments due to the long breeding season that the ewes had, accompanied by drought and poor grazing. The effect of diets on the weight and body condition score of ewes was highly significant during the trial ($P<0.01$). However, lamb weight at birth and at 60 days of age were not affected by the treatments ($P>0.05$). The alternative experimental diet used in the improved treatment promoted a better performance in mean daily milk yield during 69 days and 62 days after weaning in improved and traditional treatments respectively ($P< 0.01$).

Key Words: Sheep husbandry, Awassi, traditional extensive system, semi-intensive system, Syria

ÖZ

YÜKSEK LİSANS TEZİ

ORTA SURİYE KOYUNCULUĞUNUN KARAKTERİZASYONU İLE GELENEKSEL VE GELİŞTİRİLMİŞ BAKIM BESLEME KOŞULLARINDA YAPILAN YETİŞTİRİCİLİĞİN KARŞILAŞTIRILMASI

Mohannad OBAIDO

ÇUKUROVA ÜNİVERSİTESİ
FEN BİLİMLERİ ENSTİTÜSÜ
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Prof. Dr. Abdurrahman POLAT

Bu çalışma orta Suriye koyunculuğunun tanımlanması yanında geleneksel ve iyi bakım, besleme koşullarında işletmelerin üreme, büyüme ve laktasyon dönemlerini karşılştırmak amacıyla çiftçi koşullarında yürütülmüştür. Üç köyden, beş yetiştirici seçilmiştir.Her yetiştiricinin sürüsü rastgele ikiye ayrılmış ve bir grup geleneksel koşullarda diğer grup da geliştirilmiş bakım besleme koşullarında tutulmuştur. Geleneksel bakım ve besleme uygulanan gruplara ait veriler aynı zamanda orta Suriye koyunculuğunun karakterizasyonu için kullanılmıştır.

Döl verimi bakımından gruplar arasında gözlenen farklar istatistiki olarak önemsiz bulunmuştur. Bunun nedeni olarak koç katımının, araştırmanın başladığı tarihten önce başlaması ve kuraklık nedeniyle meraların zayıf kalmasından kaynaklanmış olabileceği söylenebilir. Koyunların araştırma boyunca ortaya koydukları canlı ağırlık artışı ve vücüt kondüsyon skoru artışları istatistiki olarak önemli ($P<0.01$) bulunmuştur. Ancak kuzularıda doğum ve 60. gün ağırlıkları bakımından gözlenen farklar önemsiz bulunmuştur ($P>0.05$). İyi bakım ve beslemenin etkisi olarak sütten kesimden sonra, iyi bakım besleme grubunda 6 geleneksel bakım besleme grubunda 62 günlik sağılan sütler arasındaki farklar önemli bulunmuştur ($P<0.01$).

Anahtar Kelimeler: Koyun Yetiştriciliği, İvesi, geleneksel ekstansif system, yarı entansif sistem,Suriye

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1. INTRODUCTION

Livestock production accounts for one third of the agricultural revenue of the West Asia and North Africa (WANA) countries, and small ruminant production is the main agricultural activity in those areas with less than 300 mm of annual rainfall and is vital for the livelihoods of resource poor people. (Aw-Hassan et al.2003; Kassem, 2005). Sheep population reached 85 million head in the West Asian countries in 2007 (FAO, 2007). Based on ICARDA (2003) and ICARDA (2005), about 24 million farmers depend on rain-fed agriculture in the dry areas of Central and West Asia and North Africa (CWANA) for their livelihoods. Most importantly, sheep and goats provide meat, milk, wool and manure for use as fertilizer or fuel. Forty years ago the contribution of rangelands was 60- 80% of the feed supply for small ruminants. Since 1990 the demand for sheep and goat products has increased. At the same time the sheep and goat populations have grown significantly (5%) leading to rangeland deterioration due to overgrazing. Consequently, the contribution of rangelands to the feed supply has decreased by 10-15%. According to Kassem (2005), 0ther major changes that occurred along with the increase in the number of sheep were the removal of shrubs and increased allocation of land to cereals and legumes, prolonged droughts, decline in the flock size and policies for conversion of rangelands to reforestation sites. Therefore, shortage of low cost feed is the largest problem facing farmers and threatens the sector's sustainability (ICARDA, 2003). Animals are fed low quality crop residues and supplemented with expensive concentrates (Ben Salem and Smith, 2008). Feed scarcity affects the productivity of 45% of the sheep in Turkey, 39% in Syria, 11% in Iraq, and 4% in Jordan (FAO, 2009).

In 2006 the total value of agricultural production in Syria accounted for 12 % of the value of total exports while sheep exports ranked first and accounted 18.5 % of the value of the total agricultural exports (NAPC, 2007a). In 2005 agricultural sector employed 20 % of the total Syrian labor force. Moreover, most of the families live in the rural areas and depend mainly on agricultural and/or livestock production for their livelihood (NAPC, 2007b). Hence, sheep flocks are essential for the poor

farmers' household consumption as well as for generating income. Kassem (2005) reported that in 2000 the small ruminant sub-sector contributed 28% of the agricultural products and 13% of the country's economy. Also, it is estimated that 20% of the villagers are involved in the production and they depend on sheep rearing as the main source of income. According to AASA (2007a), total sheep increased from 15 million in 1998 to 22 million in 2007.

The geographical distribution of sheep in Syria shows concentration in Eastern (38.4 %) and Central Syria (26.4 %) totaling 65 % of sheep population. The other regions, namely Northern (20 %), Southern (15.0) and Costal (0.2 %) make up 35 % of the total population (AASA, 1999).

The small ruminants sub-sector in Syria faces many constraints which affect production adversely. The producers' knowledge about the nutritional requirements of their sheep and well balanced rations is limited as they rely on traditional feeding practices and get little support from the extension service. Thus, often the quantity and quality of feeds used by farmers do not meet requirements during the respective physiological stages. Also, farmers in Syria suffer from a large increase in the production costs because of: (a) increased length of duration of feed supplements and of stall feeding due to the reduced contribution of rangelands to the sheep diets (AKF, 2007), (b) the decline in the irrigated areas in some areas due to depletion of underground water reservoirs due to the high demand for irrigation water in the recent past (AKF, 2009), and (c) the cost of feed, which varies during the year due to fluctuations in feedstuff availability and price (Hartwell et al., 2008a).

Most farmers increase the interaction with cropping areas in order to utilize crop residues such as cereal straw. Additionally, the other expensive concentrates are purchased for feeding in the critical periods (Hartwell et al., 2008a). Other agro-industry by-products such as olive cake and tomato pulp (Ben Salem and Znaidi, 2008), sugar beet pulp (Schei et al., 2005), cotton seed cake (Sahin et al., 2003) have been introduced into diets of sheep and are gaining popularity.

The main objectives of this research were to characterize sheep production in Central Syria, namely in Salamieh and compare the production aspects of sheep managed under traditional and improved conditions which mainly comprise

supplementation of balanced and low cost diets during reproduction, lactation, and growth stages for increasing productivity of the enterprises.

2. LITERATURE REVIEW

2.1. Sheep Breeds in Syria

Awassi sheep, being the most widespread breed in southwest Asia, is the most important breed in Syria, Lebanon, Jordan, the Kingdom of Saudi Arabia, Iraq, Turkey and Palestine. Awassi is known in these countries under different names, like El-Awas, Aouasse, Awasi, İvesi, Sarıbaş, Ussy, Arap Koyunu, Naimi, Iwessi, Oussi, Shami, Gezirieh etc. (Gürsoy, 2005).

Awassi is the only sheep breed in Syria and is well adapted to the harsh environment and to produce milk and meat (Kassem, 2010). Awassi sheep possess a fat tail which evolved for use as energy and metabolic water in dry critical periods when feed and water shortage (Kassem, 2005). Galal et al (2008) reported that the breed has the ability to live in a wide range conditions and systems from the harsh environment in the steppe to the highly intensive management. The performance varies and sometimes the productivity reduces to the worst level when animal will be exposed to long periods of poor feeding in the steppe.

However, it is well known that the genetic capacity is affected negatively when sheep are exposed to long periods of poor feeding. Obviously this reduces productivity to the worst levels (Masri, 1996).

2.2. Syrian Sheep Populations

Table 2.1 shows the sheep population in Syria from 1985 until 2007

Table 2.1. Population of sheep in Syria from 1985 to 2007 (AASA, 2007a).

Year	population/ Head	Year	population/Head
1985	10993070	1997	13829316
1987	12668835	1999	13998460
1989	14010514	2001	12361824
1991	15193659	2003	15292722
1993	10146617	2005	19651051
1995	12075190	2007	22865366

The number fluctuated considerably as it is severely affected by drought years (Figure 2.1).

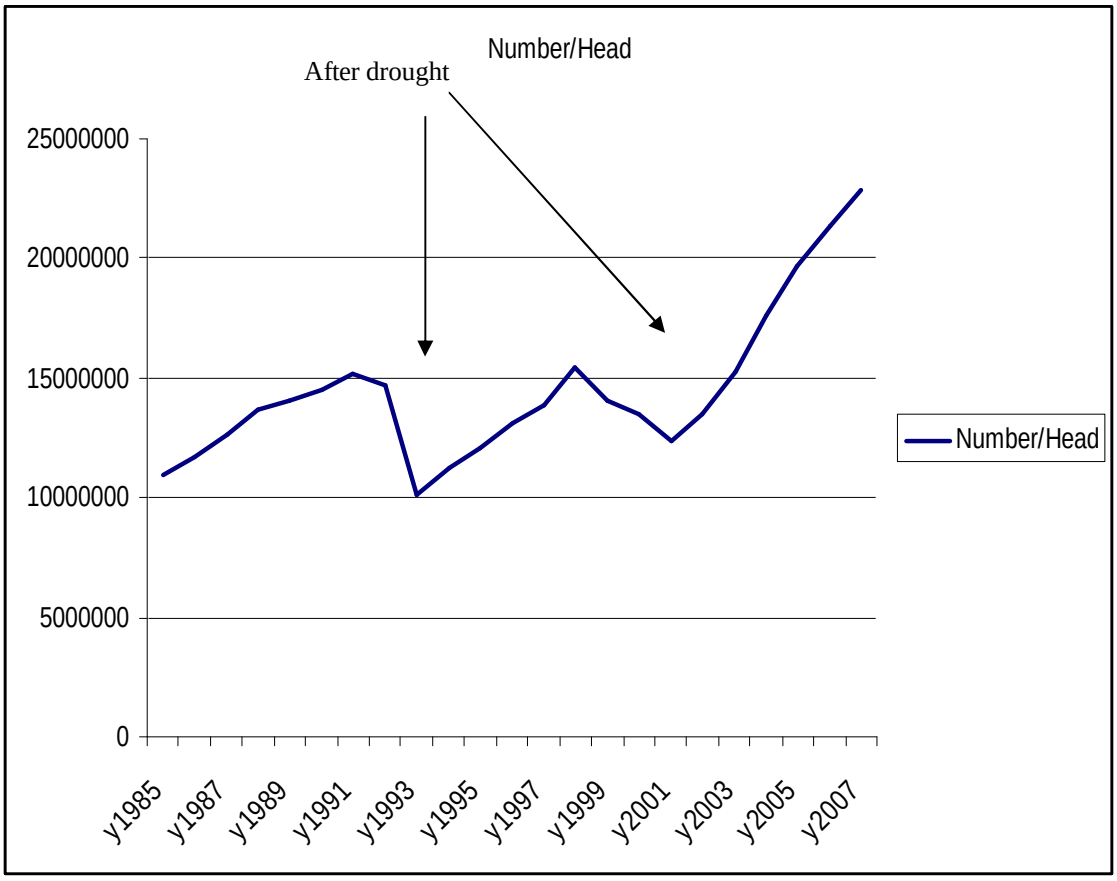

Figure 2.1. Sheep population in Syria as affected by drought (AASA, 2007).

In 2007 the sheep population reached a peak with 22 million. In drought years feed costs become very high while productivity is low resulting in large sales of adult female sheep. Cummins (2000) reported that in the low rainfall years of 1998 and 1999 the farmers lost 8.8 billion SL because of the low production of milk, meat and wool.

Table 2.2 gives the distribution of sheep (Awassi) by governorates and regions.

Table 2.2. Distribution of sheep (Awassi) in Syria (1999) (Kassem, 2005).

GOVERNORATES	Total Number	Percent of Population
Aleppo	2.310.000	16.5
Dair-Ezzor	2.220.000	15.9
Homs	2.084.000	14.9
Al-Raqqa	1.618.000	11.6
Hama	1.613.000	11.5
Al-Haseke	1.535.000	11.0
Damascus	1.282.000	9.2
Idled	487.000	3.5
Dara'a	453.000	3.2
Sweida	262.000	1.9
Quneitra	109.000	0.8
Tartous	16.000	0.1
Latakia	9.000	0.07
REGIONS		
Eastern	5.373.000	38.4
Central	3.697.000	26.4
Northern	2.798.000	20.0
Southern	2.107.000	15.0
Coastal	25.000	0.2

2.3. Source of Sheep feeds in Syria

In Syria grazing is considered to be the most important source of fodder for sheep and is provided by: (1) the western higher rainfall zones providing crop and vegetable residues, (2) the border of the cropping areas providing pastures and stubbles (3) and the vast rangelands in the drier eastern part of the country which constitute half of the Syrian land (Cummins 2000)

According to a study carried out by Cummins (2000), the Syrian feed supplies include the following:

a- Grazing: Al Badia constitutes and is classified as rangeland providing 15% of the Syrian sheep requirement. But most of these grazing lands have been degraded. Kaseem, (2005) characterized the present condition of the Al Badia as overgrazed, selectively better lands (soils) converted to arable land, characteristic shrub vegetation used as fuel, continuously prolonged droughts ,Increased desertification, sand storms, and shortage of water.

b- Concentrates: Barley grain accounts for 85% of the concentrates used for livestock consumption. Approximately 20 % of planted barley and 8% of wheat are fed as stand crops in the low rainfall years when harvesting becomes not possible or not feasible.

c- Crop residues: The major portion of Syrian agricultural stubbles comes from wheat, barley, legumes and cotton. In addition, many agricultural-industry by-products such as cotton seed cake and wheat bran are widely used.

d- Green fodder: The total area allocated for the production of green fodder is small (63000 hectares) and mostly spared for large ruminants. Most of the green fodder crops in irrigated areas are barley and maize.

e- Industrial residues: The major portion (85%) comes from sugar beet, cotton, and peanuts. The quantity produced is about 3 million tones each year.

However, according to Cummins (2000), in 1998 the dry matter of the available feed was 8.9 million tones every year, while the livestock requirement was 10.7 million tones. The feed deficiency of 1.8 million tones would be expected to become larger in the following years.

2.4. Feeding Calendars

Milking takes place in spring when the native pastures provide a considerable contribution to the sheep diets. In May the contribution of rangelands decreases, cereal harvesting starts. The flocks are then brought to graze stubbles or/and standing cereals, mostly barley, until the end of autumn (Thomson et al., 2003).

Mating takes place in summer time. In this period the body condition of ewes may be poor depending on the level of supplementary feeding during lactation. The feed quality of the stubbles declines gradually leading to further decreases in animal weights and body condition scores resulting in poor ovulation and low conception rates. In winter, during gestation and lambs suckling, concentrate mixes, cereal and legume or cereal straw are hand-fed. In addition some farmers allow their sheep to graze green cereals (Thomson et al., 2000a and Filo et al., 1994). Figure 2.2 shows the Syrian sheep feeding calendar.

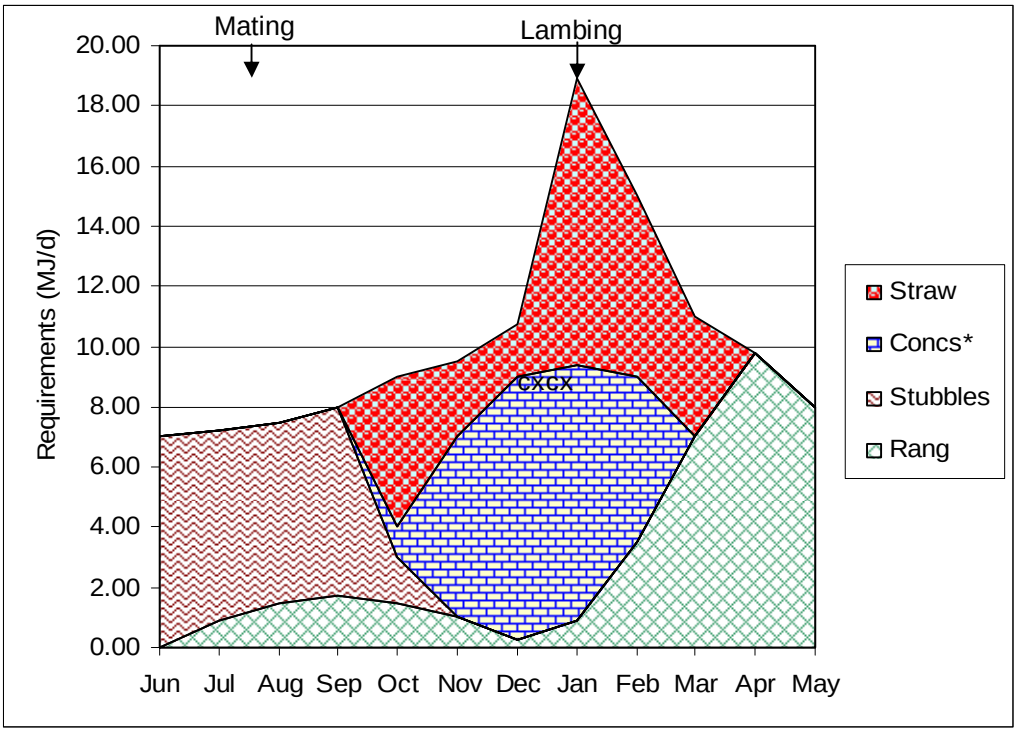

Figure 2.2. The metabolizable energy requirement of sheep and the contribution of different feedstuffs during traditional feeding cycles in north-west Syria (Cocks and Thomson, 1987).

*Concs :feed grains (including forage legume grains) and industrial by-products (brans and oil-cakes)

2.5. Production Performances

2.5.1. Milk Yield

In Syria, the estimated Awassi milk production obtained by ‘bedouin’ and

‘fellahin’ from unimproved sheep was reported to be about 60 kg/ ewe per year (40 kg yield +20 kg before weaning). It does not reflect the actual potential for milk production (Mason, 1967).

Gürsoy (2005) reported that Awassi sheep is a good-milk producer and it is considered to be the second best breed in the world, after East Friesian, regarding milk production. He mentioned that in 1998 during the lactation period the highest individual recorded milk production was 592 kg/lactation. Gürsoy (2005) calculated the lactation yields of Awassi sheep reported by many Turkish scientists in both extensive and intensive systems. He found out that the number ranged from 94.7 to 218 kg /ewe.

In a study conducted by ACSAD (1996) in Al-Kraim Research Center in Central Syria, the effect of age on the milk production was found to be significant. The average lactation milk produced was 236 kg/ewe in the milk line. More precisely, lactation milk yield increased progressively and peaked at five years old. After this age the quantity declined (Table 2.3).

Table 2.3. Effect of age on lactation milk production [1] (ACSAD, 1996)

Ewe age in years	n	Mean\ Kg	Length\days
2	21	210	179
3	24	226	162
4	37	248	173
5	22	260	168
6	22	237	170
≥7	19	234	175
Mean		236	171

[1]:from birth until the end of lactation

In Turkish Awassi Eralp (1963) studied the relationship between age and milk produced during suckling and milked yield. The study was carried out under extensive management system indicated that lactation milk yield increased until 4th lactation. Similarly suckled milk and milked yields increased until the fourth lactation. The mean lactation milk yield was estimated to be 154 kg in 167 days. The

largest yield in Iraq recorded by Eliya and Juma(1970) was obtained at four years old while the age presented by Karam et al. (1971) was between four to six years when ewe milk quantity reaches a peak.

Kassem, (2005) reported that the average lactation milk under the extensive system was 60-70 kg. He claimed that the figure would be approximately 15- 20 kg during the dry seasons.

In studies conducted and reported by Treacher, (1970), concentrate feeding in late pregnancy had a significant effect on lactation milk yield.

In the experiment carried out by Hossamo and Farid (1981) on Awassi ewes selected for high milk yield and unselected ewes (Control), two levels of concentrate feeding were tested during pregnancy and lactation. The concentrate ration fed consisted of 65 % total digestible nutrients (TDN), 2.5 Mcal/kg metabolizable energy (ME), and 16% digestible crude protein (DCP). Two treatments as feeding level were tested: (1) normal level with 750 g/ day per ewe and (2) low feed with 450g/day per ewe. The ewes were offered the feed in the period between September and February. The data were collected in terms of reproduction, growth, and milk production. (Table 2.4).

It is clearly seen in Table 4 that there were no differences between control and milk lines on the reproductive performance which were low in both groups probably due to the poor grazing season. Also, the negative effect of reduced supplementation affected weights during lambing and shearing in both lines. The differences in the ewe weight after lambing were 1.60 kg for the control line and 1.65 kg for the milk line. At post shearing and at the end of lactation season weight differences were 2.03 kg for control line and 3.69 kg for the milk line. In the milk line the milk production during 90 days after weaning was 29% more than the control line when using the normal feeding. While the difference decreased to 12.8% under low feeding level. The total milk produced in corresponding values were 32.1% and 9.3% under normal and low feeding conditions, respectively.

Table 2.4. Effect of nutrition during pregnancy and lactation on ewe performance (Hossamo and Farid, 1981)

Line	Control		Milk	
Feeding Level	Normal	Low	Normal	Low
Ewes at the beginning of mating	53	45	140	50
Ewes at the end of mating	46	44	136	49
Ewes mated (n)	41	41	123	43
Ewes mated (%)	89	93	90	88
Ewes present at lambing	40	37	116	41
Abortions	-	-	-	1
Ewes lambed (n)	27	27	79	24
Ewes lambed(%)	68	73	68	59
Twins (n)	3	0	10	4
Twins (%)	11	0	13	17
Lambs/ 100 ewes in flock	57	60	64	56
Lambs / 100 ewes mated	73	66	72	65
Lambs / 100 ewes lambed	111	100	113	117
Ewe weight after lambing (kg)	58.23	57.00	59.78	55.41
Ewe weighted difference	-1.6		-1.65	
Ewe weight after shearing (kg)	55.99	45.33	58.00	45.22
Ewe weighted difference	-2.03		-3.69	
90-day milk yield (kg)	83.92	80.08	107.77	90.31
Weighted difference [1]	-4.89		-14.81	
Total milk yield (kg)	139.67	144.83	184.57	158.26
Weighted difference	-5.88		-20.5	
Lactation length (days)	178.4	182.9	178.4	187.4
Weighted difference [1]	+5.7		+1.9	
Birth weight(kg)	4.30	4.44	4.60	4.42
Weighted difference [2]	+0.02		-0.12	
Weaning weight(kg)	16.7	16.7	17.2	17.2
Weighted difference [2]	-0.6		0.24	

[1]: Weighted difference corrected for age of ewe; [2]: Weighted difference corrected for sex and type of birth.

The mean lambs' birth weight from milk line were 9.7% more than control line in the normal feeding condition while the weaning weight at 60 days for milk line was 4.3% more than control line. Also, in the control line there was no marked effect on the birth weight under low level of feeding, whereas it had a clear effect on

milk line lambs. The standardized differences between feeding treatments were +0.02kg and – 0.12 kg for control and milk line lambs, respectively.

Table 2.5 shows an overview of milk yields reported by different authors.

Table 2.5. Awassi milk yields[1] recorded by different authors from different locations and systems.

Production system	Milk yield kg	Lactation length (days)	Authors
Extensive system	99	167	Eralp (1963)
Extensive system	60	-	Mason (1967)
Extensive system	67	87	Al-Tamimi, (1983)
Extensive system	87	112	Al-Jalili et al. (1988)
Al-Kraim Research Center - milk line, Semi-intensive	170	111	ACSAD (1996)
Extensive system	60-70[2]	-	Kassem (2005)
Extensive system in dry years	15-20	-	Kassem (2005)
Extensive to intensive	95-218	-	Gürsoy (2005)
Extensive to semi-extensive	50-250	100-180	Khazaal (2005)

[1]: the milk consumed by suckling lambs is not included; [2]: include the total milk (before and after weaning)

Gonzales et al. (1982) found out that ewe milk yield responded to the different sources of protein and the increases varied from 400 g/day to 600 g/day. The low degradable protein sources (like fish meal, linseed, and blood meal) increase milk yield more than the other sources.

An experiment conducted by Atti et al. (2006) on Sicilo-Sard ewes from the dairy experimental farm of the National Institute of Agriculture Research of Tunisia. The target was to evaluate effect of three dietary treatments on milk production. The results showed that there was no difference in milk production between the ewes which grazed green barley and received daily 300 g of concentrates per ewe and the other group which grazed perennial ryegrass with the same quantity of the concentrates (617 ml/day). But the production was higher than the third groups kept indoor and fed oat hay and silage with 500 g of the same concentrates (363 ml/day).

Also, Irshaid et al.(2003) explained that Awassi milk yield was not affected when soybean meal is replaced with sunflower seed meal in the ration.

2.5.2. Reproductive performance

In general the reproductive performance of Awassi is very poor when compared to the well known breeds of the western countries. This is reflected on the prolificacy which is the number of multiple births per hundred ewes lambing (10-15%) under extensive conditions. Year effect is pronounced in years of prolonged droughts and level of supplementation. (Gürsoy, 2005)

Table 2.6 is reported from Kassem (2005) which is actually the result of the study by Kassem (1998). Reproductive performance was studied in settled and nomadic systems. Note that flock size is fairly large. Mean number of lambs weaned /100 ewes lambed in settled and nomadic systems (74 and 77) are fairly low this is mainly due to the low rate of lambs born alive/100 ewes lambed. The high culling and replacement rates were the signs of the stressful production systems.

Table 2.6. Reproductive performance of Awassi in nomadic and settled flocks (Kassem, 2005)

Traits	Settled	Nomadic
Average flock size	201 (58-345)	402 (132-1570)
Litter size	1.02	1.07
Lambs/100 ewes lambed	82	81
Lambs weaned/100 ewes lambed	74	77
Flock mortality	3.5	3.8
Lamb mortality(birth – weaning[1])	10.7	6.4
Flock culling rate	15.3	27.5
Flock replacement	26.6	31.1

[1] Lambs are fully weaned at 2.5-3 months of age.

Masri, (1996) estimated 105 Awassi lambs born by 100 ewes and the fertility was about 90 lambs per 100 ewes.

According to Khazaal, (2005), based on information gathered from farmers, Awassi is no prolific breed as the percentage of ewes which give single lambs is about 85-90%. Twinning rate reach maximum 10-15% in the good years. In another study by Kassem et al. (1998) the prolificacy of Awassi was studied in relation to year and age effects. It was seen that in Al-Kraim Research Center flock prolificacy fluctuated from year to year. Regarding age it was clearly seen that prolificacy increased until age 5 (Table 2.7).

Table 2.7. Effect of age and year on prolificacy of Awassi sheep. (Kassem et al. ,1998)

Years	Age of ewe					
	2	3	4	5	Over 5	Mean
1979	1.03	1.06	1.10	1.18	1.20	1.11 (405)
1980	1.03	1.14	1.19	1.19	1.18	1.15 (336)
1981	1.10	1.14	1.16	1.17	1.08	1.13 (382)
1982	1.10	1.12	1.21	1.27	1.25	1.19 (492)
1983	1.02	1.08	1.15	1.19	1.20	1.13 (393)
1984	1.02	1.09	1.31	1.24	1.17	1.17 (410)
1985	1.05	1.06	1.14	1.19	1.21	1.13 (432)

Kassem(2005) mentioned that the fertility ranges from 80-85%. However the figure may drop to 60% in dry years. The twining rates are 5-7% in normal years.

Gürsoy et al, (1992a) studied reproductive traits of 15 020 ewes from 6 age groups from Ceylanpinar State Farm Awassi population. The results were more or less very similar in the sense that age was significant factor on prolificacy and maximum prolificacies were recorded at age of 4 and 5 (Table 2.8).

Table 2.8. Effect of age on reproductive performance of Awassi in Turkey (Gürsoy et al, 1992a)

Age	No and %	Ewes mated	Ewes lambed/ ewe mated	Singles	Twins	Lambs born	Lambs/ ewe mated	Lambs/ ewe lambed
2	n	2,312	2,163	2,114	49	2,212	0.96	1.02
	%	-	93.5	91.4	2.1	95.7	-	-
3	n	1,770	1,645	1,503	142	1,787	1.01	1.09
	%	-	92.9	84.9	8.0	101	-	-
4	n	3,361	3,087	2,574	513	3,600	1.07	1.17
	%	-	91.9	76.6	15.3	107.1	-	-
5	n	2,640	2,409	2,018	391	2,800	1.06	1.16
	%	-	91.2	76.4	14.8	106.1	-	-
6	n	2,771	2,547	2,203	344	2,891	1.04	1.14
	%	-	91.9	79.5	12.4	104.3	-	-
7	n	2,166	1,992	1,701	291	2,283	1.05	1.15
	%	-	91.9	78.5	13.4	105.4	-	-
Mean	n	15,020	13,843	12,213	1730	15,573	1.04	1.12
	%	-	92.1	80.6	12.5	103.7	-	-

Mortality rates of sheep in Syria are affected by feed availability as well as the environment. In an experiment carried out by Kassem (1998), lambs mortality rates from birth to weaning were between 6.4 and 10.7 (Table 2.6).

Gürsoy et al, (1992b) conducted a study to compare the differences between the Ceylanpinar State Farm Awassi population (30 000 ewes) closed for forty years with the producers' Awassi ewes with respect to reproduction and lactation performances for two consecutive years. The sample 50 ewes representing the producers' outstanding ewes were selected from the flocks of 400 producers by screening for high milk producers and named 'National Exceptional Ewes'. Ceylanpinar Awassi population was represented by two groups of ewes: Control Group was selected at random; the Exceptional Ewes were selected from the nucleus flock. The results are presented in Table 2.8 for the years 1988 and 1989 (Table 2.9)

Table 2.9. Comparison of reproductive performance of Awassi ewes managed on Ceylanpinar State Farm and national flocks (Gürsoy et al, 1992b)

Traits	Prod. Exc. Ewes		State Farm Exc. Ewes		State Farm Control Ewes	
	1988	1989	1988	1989	1988	1989
Ewes mated	48	45	54	46	55	52
Ewes Lambed	45	39	49	44	52	46
Triplets	-	-	-	-	-	1
Twins	5	4	5	6	12	11
Singles	40	35	44	38	40	34
Lambs born	50	43	54	50	64	59
Infertility	6.3	13.3	9.3	4.4	5.5	11.5
Lambs/ewe mated	104.2	95.6	100.0	108.7	116.4	113.5
Survival Rate	96.0	88.4	87.0	98.0	96.9	93.2
Litter Size	111.1	110.3	110.2	113.6	123.1	126.1

Hailat (2005) studied effect of management and environment on reproductive performance. He compared the flock in Al Badia where animals are subjected to hard environment and poor level of nutrition with well-managed flocks in the Jordanian stations, as well with performance in the dry years. The results are presented in Table 2.10.

Table 2.10. Awassi reproductive performance under varying rearing conditions (Hailat, 2005).

Reproductive performance	Traditional	University Research	Research Stations	Dry year	Intermediate year
Number of ewes in study[1]	49x343[2]	1248	453	na	na
Percent of ewes in estrus	73-87	na	na	87	73
Fertility rate% [3]	88-89	95.7	78	92	94
Abortion rate% [4]	0.49-1.3	7.03	0.4	na	na
Lambing rate% [5]	92-94	91.0	88-95	88	89
Birth rate% [6]	Na	88.8	na	104	105
Birth weight kg	4.04	na	4.2-4.5	na	Na
Weaning weight kg	15.86	na	19.5-21	na	na
Weight (one year of age)	35-36	na	48-60	na	na
Weaning rate %	94-96	na	na	94	94
Twining rate	2.5	2.56	3.5-6	na	na
Lamb mortality rate % [7]	0.51-1.57	15	4.2	6	7
Ewe mortality rate	2.22- 2.83	na	na	2	3
Culling rate % [8]	2-5	5.35	na	5	3
Replacement rate %[9]	na	17.9	na	na	na

[1] Initial number+ final number; [2]49 flocks and 343estimated ewes each; [3] pregnant ewes/ exposed ewes; [4]Aborted ewes/ pregnant ewes; [5] lambs born/ total exposed ewes; [6] number of ewes lambed/total exposed ewes; [7]lamb deaths/ lambs born(till weaning); [8]animals culled/ average flock size; [9]animals replaced/ total flock size; na: not available.

Postpartum reproductive performance of Awassi ewes is not affected by dry fat supplementation. No differences were observed in ewe litter weight, lamb weaning weight and average daily weight gain, ewe final live weight, and postpartum ovulation (Titi et al., 2008)

2.5.3. Growth and Feedlot Performance

Gürsoy (1980) presented data on the effects of production systems on growth Performance. Turkish Awassi managed under extensive and semi intensive system were compared and the differences were found to be significant (Table 2.11)

Table 2.11. Growth of Awassi lambs under extensive and semi-intensive systems. (Gürsoy, 1980)

Age	Systems					
	Extensive system			Semi-intensive system		
	Mean	Min	Max	Mean	Min	Max
Birth (male)	4.4	3.4	5.6	4.9	3.2	6.1
Birth(female)	3.8	2.9	5.1	4.6	2.9	6.0
90 days old (male)	23.2	13.1	29.4	29.4	22.0	38.0
90days old (female)	20.9	12.2	28.3	26.7	19.4	31.4
6 months old (male)	32.2	22.3	39.6	37.6	29.6	45.3
6 months old (female)	29.1	20.9	36.7	35.7	27.3	40.6
12 months old (male)	40.0	30.1	52.4	51.9	41.6	60.8
12 months old (female)	34.9	22.9	40.4	45.6	36.0	52.2

The estimated birth weights of Awassi lambs were 4.4 and 4.3 kg for males and female respectively. The average daily weight gain during suckling was 200 - 250 g. Daily weight gain after weaning was 200- 250 g between 3 and 7 months old.

However, the figure may reach 300 g when lambs are fed on high feeding level of concentrates (Masri, 1996)

Kassem (2005) gave the following growth rates by analyzing data obtained from different sources:

- Daily weight gain for males = 262- 277 g/d between 90- 150 days old.
- Daily weight gain for females= 229 g/d between 60- 90days old.
- Daily weight gain for lambs= 191- 203g/d from birth to weaning.

Also, he recoded that in settled system the daily weight gain is 233.5 g/d, and 204.2 g/d in nomadic system from birth to 60 days old.

Alkass and Juma (2005) reported the body weights of male and female Awassi at birth, weaning, yearling and adult stages as 4.5 and 4.1; 22.2 and 21.0; 43.2 and 35.5; 63.4 and 46.2 kg, respectively.

Ewe weight has a significant influence on lamb birth weight. Hence, balanced feeding for dam is a key which leads to the best lamb birth weight. Juma and Faraj (1966) tested eight classes of ewes' weight. The objective was to study the relation between ewe weight and lamb birth weight. They found out that the best weight for ewe to give the heaviest birth weight was 57.2-61.2 kg (Figure 2.3)

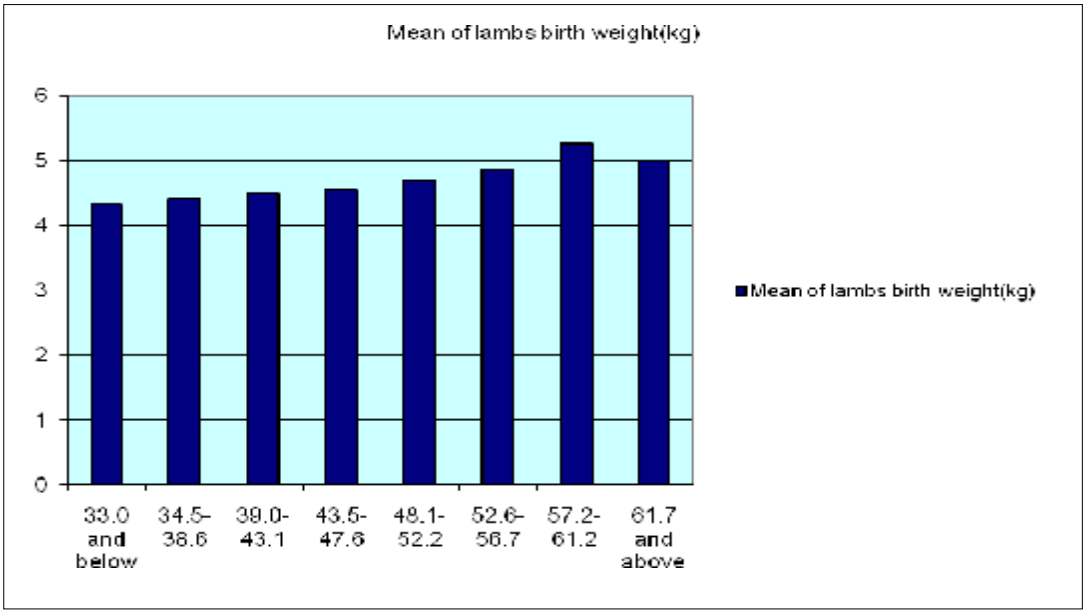

Figure 2.3. Effect of dam weight on lambs' birth weight. Juma and Faraj (1966)

Hartwell et al. (2008b) carried out a research on thee farms in Syria to compare the traditional and low-cost diets on the finishing Awassi lambs. In each farm the lambs were divided into two groups and fed traditional diet and low-cost ration. The traditional diets which formed the control, included diets components differing from farm to farm while the low-cost diet included, 48 % barley grain, 13.7 % molasses, 3.9 % broken maize, 18.6 % wheat bran, 0.6 % salt, 0.2 % mineral and vitamin mix, and 1.2 % Ca and P. The results are summarized in Table 2.12.

Table 2.12. Difference between traditional and low–cost ration for finishing (Hartwell et al, 2008b)

	Farm1		Farm2		Farm3	
	T[1]	L-C[2]	T	L-C	T	L-C
No. lambs	8	10	10	9	10	10
Concentrate consumed (kg/DM/day)	1.7	1.7	2.3	2.13	1.9	1.85
Feed Conversion Rate kg /kg weight gain feed (FCR)	7.9	6.3	9.0	6.8	7.0	5.8
Final weight gain(kg)	46.0	49.2	59.5	63.1	55.8	58.4
Total weight gain(kg)	15.6	19.3	19.0	22.7	19.9	23.0
Average daily weight (g)	213	264	260	311	272	315

[1]: Traditional; [2]: Low-cost

Total weight gains (TWG) and average daily gains (ADG) between the two treatments were not significant. The alternative diet showed no negative impacts on growth rates and weight gains.

Condition of the mother is one of the main factors influencing the lamb birth weight (Thomson and Thomson, 1953) which is affected by level of the feeding planes supplied for dam (Treacher 1970). The more sufficient feeding is provided in late pregnancy the higher birth weight is obtained(Holst et al. 1986).

Alvarez –Rodriguez et al. (2007) studied performance of Churra Tensina ewes and lambs stocked under three management systems during lactation:

treatment1 when ewes grazed during the day and were supplemented of barley meal while lambs kept indoor, treatment 2 when ewes and lambs stayed in the pasture with no supplementation and treatment3 which is the same management as treatment 2 with the addition to creep feeding was provided to the lambs. The results summarized in Table 2.13 explain that there were no differences in ewe live-weight and body condition score while milk yield was higher in treatment 3. Lambs from treatments 1 and 3 gained higher weight than treatment2.

Table 2.13.Ewes live weight (LW), body condition score (BCS), and milk yield and lambs average daily gains under different management systems (Alvarez – Rodriguez et al, 2007)

	T1	T2	T3
Ewes LW at 60 days postpartum(kg)	46.5	46	44.9
Ewes BCS at 60 days postpartum(kg)	2.61	2.44	2.67
Lambs ADG birth-45 days old (g)	276	253	308
Milk yield (g/day)	1083	1185	1531

T1: rationed grazing ewes with and lambs remain in doors;T2:continuously grazing ewes and lambs without supplementation; T3: continuously grazing
ewes and lambs with creep feeding for lambs.

Larbi et al. (2007) reported that the average daily weight gain of Awassi lambs grazed on three vetch species graduated from 116 to 159 g/d/head. In another experiment, Christiansen et al. (2000) found that lambs grazed on forage legumes (Vetch and Grasspea), have averaged 186 g daily live-weight gain per lamb

2.5.4. Wool Production

Awassi sheep has a very low quality fleece. The mean greasy fleece weight, staple length, and wool grade were reported to be 2.9 and 2.8 kg, 19.9 and 17.7 cm, 46’S and 44’S for the 2 and 3 year old ewes respectively (Gürsoy, 1980; Gürsoy, 2005). In the Al-Kraim Center average fleece weight was reported to be 2.6 and 2.7 kg for the ewes and rams respectively (Tuleimat and Farid, 1981).

According to Jordanian Ministry of Agriculture (1968), the average greasy fleece yield in Al-Fjej station was 1.0 kg/ ewe and 1.6 kg per ram. In the years between 1980 and 1984, the wool yields recorded by two Jordanian stations were 1.3 and 1.7kg/animal/year (Jordanian Ministry of Agriculture 1967).

2.6. Feeding Management

Rihawi et al (2006) carried out an on-farm research with farmers of northern Syria villages. The objective was to evaluate effect of strategic supplementation on Awassi ewes using unconventional and cheaper feeds that the farmers had not being practicing. Supplementation was applied during early mating, last third of pregnancy, and lactation (Table 2.14).

Table 2.14. Difference between traditional and strategic feeding provided during production stages (Rihawi et al, 2006).

		Alternative feeding		Traditional feeding	
Feeding period	Days	Diet	Supplement	Diet	Supplement
Mating	90	Stubble	FB1	Stubble	None
Late pregnancy	50	TWS	FB1	BS	C,B,W
Lactation(till weaning)	90	TWS	FB2,C,B	BS	BC,B,W
Lactation(weaning-dry)	60	TWS	FB2,C,B	BS	BC,B,WB

FB1:feed block containing crude olive cake, molasses, sugar beet pulp, wheat bran and urea.FB2:feed block containing molasses, wheat bran, barley grain, cotton seed meal and urea;B: barley grain, C: cotton seed meal, TWS: urea- treated wheat straw, WB: wheat bran.

Results summarized in Table 2.15 show that ewes supplemented with alternative feeding performed better than those fed traditional feed.

Table 2.15. Effect of traditional and strategic feeding on ewe performance. (Rihawi et al, 2006)

Trials	Alternative feeding	Traditional feeding	Difference %
Mating and late pregnancy			
Mating period, days	50	87	-43
Twinning rate. %	32	11	191
Birth weight, kg	4.5	3.7	15
Lactation			
60- 90 growth rate, g/d	250	178	42
Lactation and milk production period			
Milk yield[1], kg/ ewe	72	55	31
Lactation length, weeks	17	15	13

[1]Milk yield does not include milk during suckling.

El-Hag et al (1998) reported that flushing and steaming–up of desert sheep wereimportant to improve ewe productive performance in terms of lamb birth weights, and minimizing pregnancy stress of ewes. Flushing ewes was applied prior to mating and supplementary feed provided during late pregnancy. The results of the trial which was conducted in North Kordofan in Sudan showed that strategic supplementary feeding of ewes increased conception and lambing rates ($P<0.01$), reduced abortions ($P<0.01$), and resulted in higher lamb birth weights ($P<0.05$). The treatment also reduced ewe weight loss ($P<0.05$) and caused no ewe mortality. Respective lambing rates for the supplemented and control ewes were 91.7 and 41.7%.

3. MATERIAL AND METHODS

3.1. Material

3.1.1. Features of the Research Site:

3.1.1.1 Location and Population

Salamieh district is located in the eastern part of Hama province (Central Syria) between 34°45-35°20'N and 36°45- 37°45'E, covering an area of 5300 km² (Figure 3.1). The population is around 200,000, distributed between the town of Salamieh and 174 surrounding villages. From that population, 71% rely on agriculture and related activities for their livelihoods (most of the population live in the villages). It is estimated that Bedouins (settled and nomadic) account for 26% of the population (AAS, 2005).

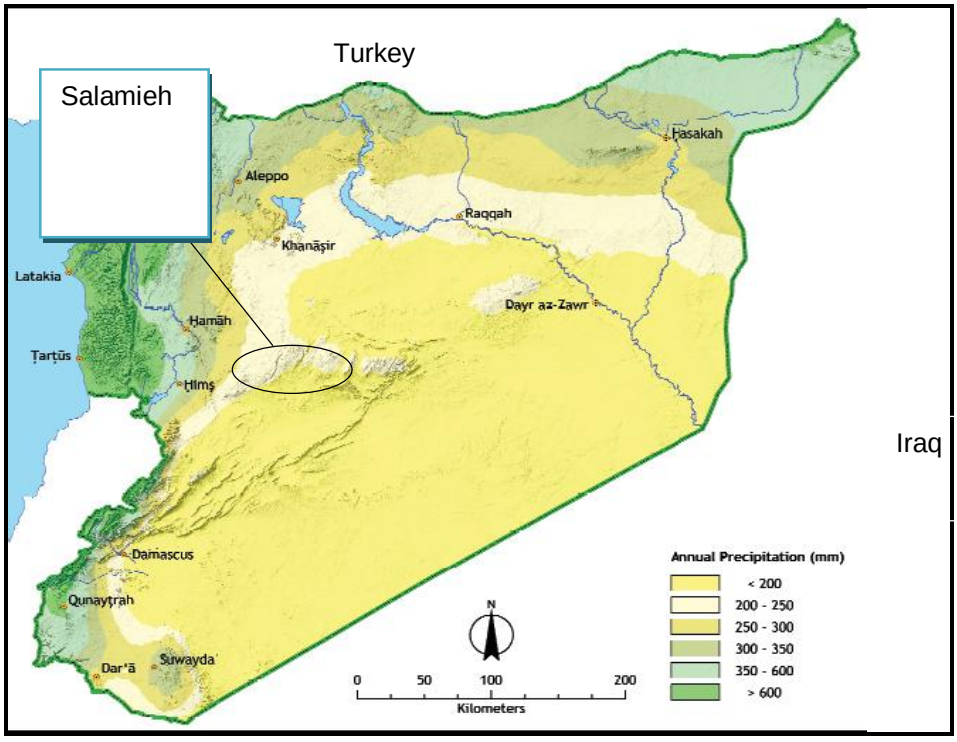

Figure 3.1. Location of the Salamieh district and average annual rainfall in Syria (www.icarda.org/INRMsite/WorkshopBookletFinal_En.pdf#search=%22khanasser%20%22)

3.1.1.2. Climate

According to the climatic information obtained from the Salamieh Agriculture Department (SAD), the average daily temperature in the study area ranges from 2 to 36°C. The maximum temperature in summer (August) reaches 40° C, while the minimum temperature in winter (January) is 0°C. Humidity shows a wide range and differs extremely between summer and winter. While maximum humidity reaches 80% in winter, the minimum humidity can be as low as 14% during summer. The average annual rainfall in Salamieh town is about 300 mm. The average rainfall is higher in the western areas of the Salamieh district (up to 350 mm) and decreases to the east to reach an average of 150 mm in the steppe (Al-Badia). The rainy season usually starts in October and lasts till May with considerable variation in rainfall distribution between years and locations within Salamieh district.

In order to organize agricultural production and to regulate land use, the Ministry of Agriculture in Syria divided the country into five administrative zones, according to average of annual rainfall (Table 3.1). These are called Agricultural Stabilization Zones (ASZs).

Table 3.1. Agricultural Stabilization Zones (ASZ) in Syria (AASA, 2007b)

Agricultural Zone	Mean annual precipitation
1a	Higher than 600 mm
1b	From 350 to 600 mm with precipitation higher than 300 mm 2 years out of 3.
2	From 250 to 350 mm with precipitation higher than 250 mm 2 years out of 3.
3	More than 250 mm with precipitation higher than 250 mm during the half of the relevant years
4	From 200 to 250 mm with precipitation higher than 200 mm during the half of the relevant years
5	Less than 200 mm

The land in Salamieh is distributed to ASZ: 2, 3, 4 and 5 (Figure 3.2 , and Table 3.2) The 200mm administrative limit, which is called “the steppe line’’, was created by the ministry of agriculture to demarcate the steppe to the east and the cultivable lands to the west (AASA, 2007b). Cultivation is banned in the steppe zone. These open access areas are occupied mainly by Bedouin tribes, who rely on livestock breeding, for their livelihoods.

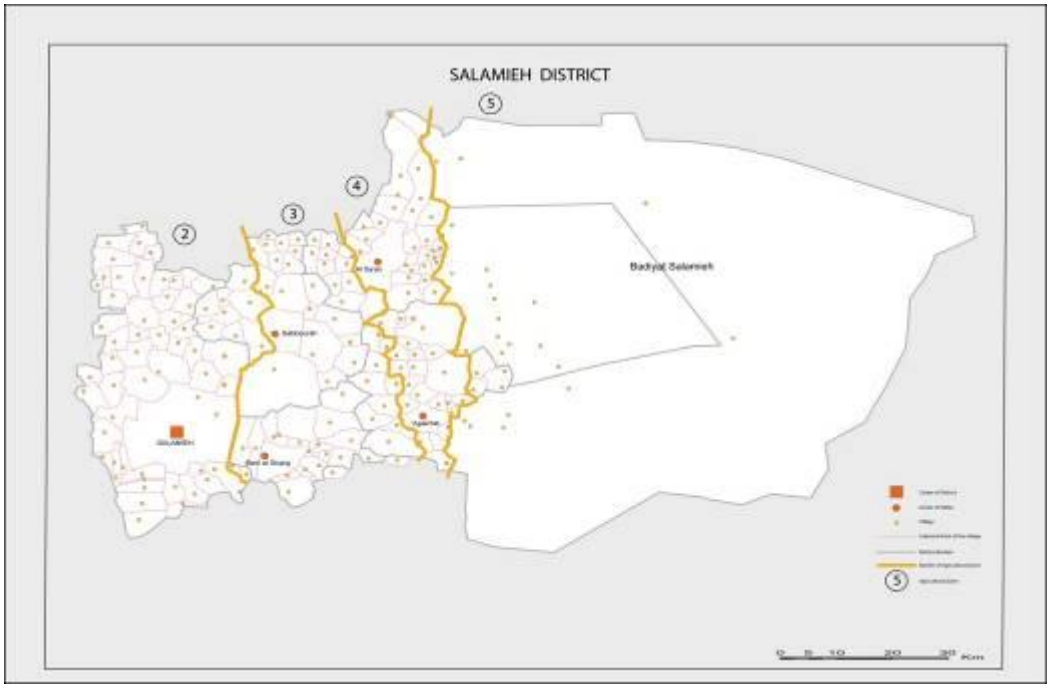

Figure 3.2. Agricultural Stabilization Zones in Salamieh district. (AKF, 2006)

Table 3.2. Irrigated and rain fed areas in the region (AAS, 2009).

Rainfall Zone	Irrigated/ ha	Rainfed/ ha	Total/ ha
2	4,039	50,438	54,477
3	3,211	34,158	37,369
4	1,589	15,532	17,121
5	386	46	432
Total	9,225	100,174	109,399

3.1.1.3. Land Use

Land use in the Salamieh district varies. Figure 3.3 shows that 50% of the lands are pastures, located mainly in the eastern part of Salamieh (Al-Badia). Cultivable land ranks second, with 35% from which 4.6% is irrigated agriculture. On rainfed lands, farmers use fallow every other year to restore soil fertility and moisture. Uncultivable lands occupy 11% of the total area consisting mainly of rocky lands, buildings, and land for public use. Finally, 3% of the lands are occupied by forests which are mainly new plantations located on the mountains (AAS, 2005).

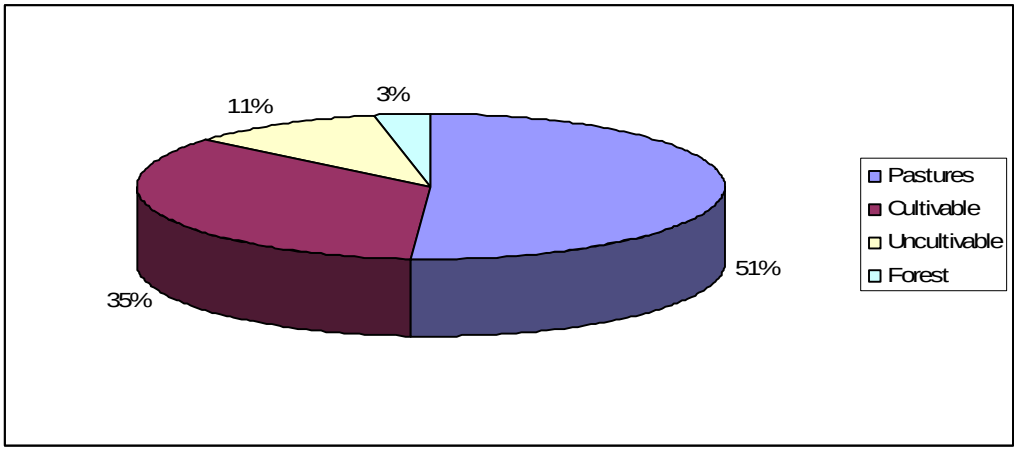

Figure 3.3.bLand use in Salamieh (AAS, 2009)

3.1.1.4. Water History in Salamieh

Salamieh was known historically for its wealth of permanent springs and marshlands. Until the end of 1940s, there were around 360 canals and springs in Salamieh areas. The huge number of Roman canals (Qanats) and tanks (Hafayer) ruins are evidence of this wealth. At the end of 1940s, because of the large increase in cotton prices and governmental policies encouraging the cultivation of cotton, farmers rushed to replace their traditional cropping systems with cotton cultivation as main crop. They dug thousands of wells, and used modern pumps to extract the groundwater (Aldebiat, 2006)

According to Oweis et al. (2002), the number of these wells increased from 1400 in 1948 to 14,000 in 1956. The result of this mismanagement of water resources was the disappearance of surface water and a large drop in the groundwater table. Since that time, rainfed agricultural land has increased and reached 95.4% of the total cultivable land (AAS, 2009).

3.1.1.5. Sheep Husbandry in the Region

Sheep breeding is considered to be the main economic sector in the region. More than 26% of rural families in the district and 82% in the steppe depend on this sub-sector to generate their incomes (AAS, 2005). Sheep graze on degraded rangeland and fallow land in spring and on cereal stubbles in summer and are supplemented with crop residues, crop by-products and grains.

Table 3.3 shows the development of the production and size of sheep flock in Salamieh district over the last forty-five years from 1964 to 2009.

Table 3.3 Population and production of sheep in the district from 1964 to 2004 (AAS, 2005)

Year	Number		Production (ton)	
	Total	Milky ewes	Milk	Meat
1964	218000	127000	8230	1504
1974	320000	210000	12700	2270
1984	830000	519000	31150	5708
1994	670000	412000	24720	4559
2004	1671000	1134000	68042	12116
2009	1300000[1]	na[2]	na	na

[1] According to not published statistic obtained from (AAS, 2009); [2] na=not available.

The data obtained from AAS (2009) showed that the sheep population in the district reached about 1.7 million and 1.6 million in 2007 and 2008, respectively. The

number declined to about 1.3 million in 2009 as a result of the drought experienced in 2007/2008 cropping season.

3.1.1.6. Local Feed Resources in the Region

Basically, the most important feed available is cereal straw, barley grain, grazing degraded rangelands, legume forages for grain or grazing, and crop residues and stubble (Table 3.4). In addition, there are some forage plants and shrubs in the steppe, mainly in the rainy season. In the district years of drought are interspersed with years of normal rainfall, making forage availability very changeable. In dry years some farmers sell parts of their flocks due to the feed shortage and the resulting very high feed prices. (AAS, 2009)

Other agro-industrial by-products are available, which can potentially be used as feed resources such as molasses. It is the cheapest source of energy for ruminants and has proved to be a good substitute for cereal grains. Wheat straw is low in nutritive value, but could be improved by adding urea.

The main feeding problems identified by the sheep producers in the district at workshops conducted by AKF (2007) included:

- The contribution of rangeland is shrinking and there is a shortage in availability of feed resources.
- The diets of sheep are based on low quality feeds and the required concentrate feeds are expensive.
- Some feed resources remain underutilized or/and inefficiently used.
- No strategic feeding is applied and supplementation is poorly managed.

Table 3.4. Distribution of fodder crops in the region (AAS, 2005).

Zone	Typical fodder crops	Area (ha)
2	Barley for grain or grazing, legume forages for grain or grazing- residues(wheat- barley- cotton- corn- vegetables)	20000
3	Barley for grain or grazing-, legume forages for grain or grazing- residues(wheat- barley- cotton- corn- vegetables)	30000
4	Barley for grain or grazing- barley and wheat residues	14000
5	Poor annual and perennial plants	50000

3.1.2. Rural Support Program in Salamieh District

The Aga Khan Foundation (AKF) is committed to reducing rural poverty, particularly in resource-poor, degraded or remote environments. The Rural Support Program (RSP) was launched in Salamieh district in 2003. The RSP included many projects to intervene for improving the livelihoods of rural people in Salamieh. Livestock Project was established to improve the farmers and mitigate the negative impacts of water shortage in the area such as low yields and incomes. The promotion of better management of flocks and the development of more efficient methods of livestock production were the strategies employed to achieve the main target (AKF, 2009).

The interventions also aim at sustaining natural resources and improving the livelihoods of local communities. The Foundation believed that the sustainability of natural resources is dependent upon the involvement of local communities. The Foundation thus believed that the involvement could be achieved through fostering community awareness of their problems and encouraging their collective action in managing their natural resources.

The AKF wished to know the impact achieved from applying balanced and improved feeding on sheep productivity. The results will be used as demonstrations and evidences to convince farmers and increase the adoption rates for the new practice. AKF gave its full support while conducting the study.

3.2. Methods

3.2.1. On- Farm Experimental Design

3.2.1.1. Selecting the Villages and the Farmers

The study targets settled or semi-settled farmers that mainly rely on stall-feeding their animals during winter and spring. To select the target villages and farmers, governmental extension staff and community leaders were engaged. Three villages were selected in the eastern direction of Salamieh city. Two of them were located in the third ASZ while the last one was in the forth ASZ. The fifth ASZ, although it includes the majority number of sheep, was excluded from the study. The villages in the fifth ASZ are housed by mobile Bedouins who manage their flock extensively which complicates the process of monitoring and following up. The second ASZ was not considered because farmers are interested in different agricultural activities and consequently density of sheep population is much smaller than in the other zones (Figure 3.4).

In community meetings conducted in the target villages in May 2007 many farmers were nominated by their community leaders to be involved in the research. The final selection of farmers for the on-farm experiment was based on the following criteria:

- Open-minded and willingness in applying the improved feeding practices.
- Size of the flock should be between 35 and 65 head to allow the division of the flocks into two.
- Enough space and good conditions in their barns.
- Classified as settled (sheep are hand-fed during winter and feed grains and crop residues) or semi-settled farmers (sheep remain near cropping areas and do not migrate).

Each nominated farmer was interviewed individually and the pre-determined criteria were checked carefully. Eventually, five farmers were appropriate and selected for the on-farm experiment (Table 3.5).

Table 3.5. Features of the farmers selected for the research.

Farmer's name	Farmer's Number	Village	ASZs	Flock size (heads)
G. Katreeb	1	Tal al Touot	3	60
M. Hallak	2	Emmil	3	40
Y. Malla	3	Al amyah	4	40
S. Malla	4	Al amyah	4	34
A. Mager	5	Al amyah	4	60

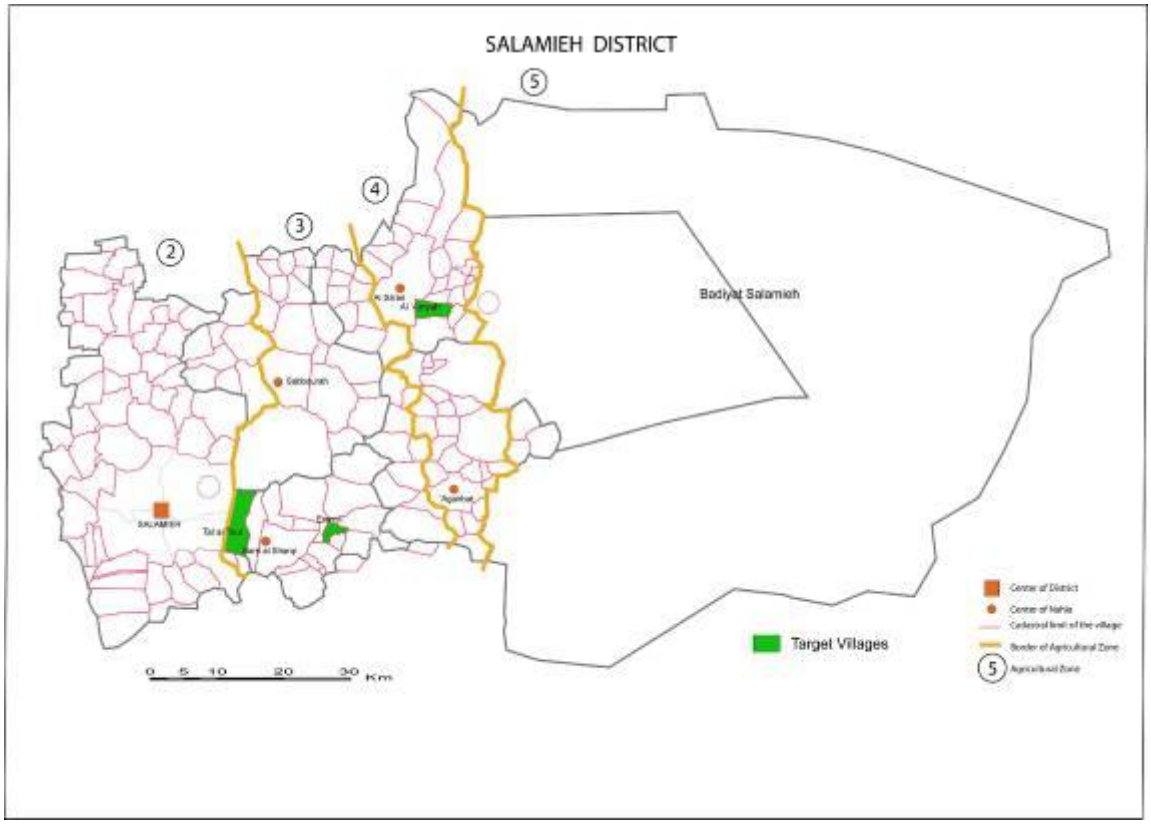

Figure 3.4. Locations of the selected villages in the district. (AKF, 2006)

3.2.1.2. Ewes Identification

Each ewe was ear-tagged using plastic tags (Appendix-Photo1) and initial data were collected about each ewe including:

- Body weights were recorded in June by using portable scale designed for sheep only.
- Body condition scores (BCS) were estimated by three experts.
- Milk production abilities of the ewes were recorded taking into consideration of the farmers' knowledge and experience and the ewes were classified into three categories; high (H), medium (M), and low (L).
- Ages of ewes were estimated according to the incisor teeth.

3.2.1.3. Dividing the Ewes

Each flock was divided into two groups randomly to apply improved feeding practices to one half of the ewes while the other half were fed according to the farmer's traditional practices. All other management practices and conditions remained the same for all ewes in the respective farm. Ti achieve relatively homogenous groups of ewes, the initial information collected on body weight, age and estimated milk production level (high, medium, low) was used to cluster the ewes into five groups using the cluster procedure of GenStat Release 9.1 (Appendix-Table 1). Then the ewes assigned to each cluster within a farm were randomly allocated to the two treatments (improved and traditional feeding). To facilitate the identification of the ewes belonging to improved feeding, the animals were marked with a green spot, while the ewes under traditional management were marked with red (Appendix-Photo 2)

3.2.1.4. Feeding Plans

The ewes allocated to traditional feeding practices received local concentrate mixtures and untreated straw. While the ewes in the improved group received the same feeds on all farms, the traditional feeding practices differed considerably between the farms and are explained for each farm in the Appendixes-Figures 1, 2, 3 and 4 and Appendix-photo 3.

3.2.1.4. (1). Feeding During Mating

The experiment started in the first week of July 2007. The district received relatively little rainfall in spring 2007 and was experiencing the beginning of a drought. Ewes were in low body condition and most of the ewes failed to show estrus. Grazing stubbles, particularly of barley, was the most frequent feeding practice observed in the farms during mating. From sampling four representative stubble fields it was estimated that the ewe consumed about 1 kg of fresh matter per day (Rihawi, 1996), with an estimated ME and CP content of 7.5 MJ and 53 g per kg DM, respectively. Thus, the cereal stubbles provided less than the daily requirements of the ewes. Thus, the ewes in the improved treatment group were supplied with 200 g of cotton seed cake mixed with 3 g salts (Na Cl), 6 g di-calcium phosphate and 1 g commercial mixture of trace minerals and vitamins per ewe and day in addition to stubble grazing. Consequently, the daily supply of the improved group reached 8.4 MJ/DM energy and 102 g CP per ewe (Table 3.6).

Table 3.6. Ingredients, daily intake and nutritive value of ration during mating.

Ingredients	Fresh	DM	ME	CP	Ca	P
	(g)	(g/kg)	(MJ/kg DM)	(g/kg DM)	(g/kg)	(g/kg)
Barley stubble	1000	933	7.5	53	4.2	1.1
CSC	200	950	7.2	277	2.1	8.9
Salt	3	1000	-	-	-	-
DCP*	6	1000	-	0	270	190
Min/vit. Mix	1	1000	-	-	-	-
Total supply	1210 g	1130 g	8.4 MJ	102 g	5.9 g	3.9 g

*: De calcium phosphate.

The estimated length of supplementary feeding varied from farmer to farmer (Table 3.7) depending on the body condition of the ewes

Table 3.7. Days on feed for improved management group during mating.

Farmer number		Breeding	
	Start	End	Length /Day
1	16-Jul	1-Sep	47
2	16-Jul	1-Sep	47
3	17-Jul	1-Sep	46
4	17-Jul	10-Sep	55
5	17-Jul	24-Sep	69

3.2.1.4. (2). Feeding During Late Pregnancy

The last two months of pregnancy is a critical period. The fetus is still only about 15% of its birth weight in end of the third month of pregnancy. The final six weeks is an important period for the ewes to be supplemented because approximately 70% of the fetal growth takes place during this period. It is expected that improved feeding during the last 6 weeks of pregnancy affects lamb birth, weaning weight, mortality rate, and lambing problems positively (Robinson et al. 1988).

According to the Department of Agriculture for Northern Ireland (1983) the estimated requirements of ewes during late pregnancy were estimated as 8.4 MJ ME and 114 g CP per day. The components used for the improved mixture were either already available on the farm or available at the local markets in the district with the exception of molasses, which was brought from a Syrian sugar factory. Wheat straw was treated with urea and the farmers were trained on the technique. The animals were fed 3 times per day. Concentrates were provided first while treated straw followed. Ration components used during late pregnancy and their nutritive value are explained in Table 3.8.

Table 3.8. Ration formulation of the mixture used during late pregnancy

Ingredients	Fresh	DM	ME	CP	Ca	P
Barley grain	(g)	g/kg	MJ/kg DM	g/kg DM	g/kg	g/kg
	483	910	11.5	127	0.90	4.00
Molasses	300	805	12.0	105	8.53	0.67
Wheat bran	69	911	10.5	166	1.10	12.60
Cotton seed meal	55.2	945	7.2	277	2.10	8.90
Sugar beet pulp	69	914	11.0	92	3.40	8.70
Urea	10	1000		2875		
Salt (Na Cl)	4.1	1000				
DCP	8.3	1000			270	190
Min/vit. Mixture	1.4	1000				
Total intake	1000 g	882.9 g	9.7 MJ	140.6 g	5.1 g	5.3 g

The total feed intake was given gradually and the amount given was increased according to the week of pregnancy. The maximum quantity was provided in the last two weeks (Table 3.9)

Table 3.9. Feed supplied per ewe during late pregnancy.

Feed	7 week before lambing (g)	6 weeks before lambing	2 weeks before lambing
Formulated mixture	250	500	800
Wheat straw treated with urea	350	800	600
Total intake as fed (g)	600	1300	1400
DM (g)	561	1214	1316
ME(MJ)	3.8	8.2	9.0
CP (g)	73	157	178

The duration of feeding is conveyed by Table 3.10

Table 3.10. Days on feed during late pregnancy

Farmer number	Gestation		
	Start	End	Days on Feed
1	15-Oct	25-Nov	41
2	15-Oct	25-Nov	41
3	15-Oct	25-Nov	41
4	10-Nov	25-Dec	45
5	20-Nov	5-Jan	46

3.2.1.4. (3). Feeding During Lactation

Requirements for energy and protein are high in early lactation. Adequate feeding during lactation aims to improve lamb growth (weaning weight), increase milk production, maintain the ewes' body condition, and reduce the time required to get the ewes into breeding condition.

Feeding requirements were calculated based on Department of Agriculture for Northern Ireland (1983) considering a 50 kg ewe (the average weight of ewe fed with improved diet was 49 kg after lambing), suckle a single lamb and an expected milk production of 1.34 kg during the first month, 1.29 kg in the second month and 0.95 kg in the last month. The voluntary feed intake was estimated of 2 kg DM/day. The average of the requirements during the three months was ME 15.3 MJ/ day. Since the lambs were with their dams and consuming part of the ration, the provided requirements were calculated with the consideration of this fact.

Feed given during lactation was mixed and crushed in feed factory for the homogeneity of the rations given to farms as improved management. In each farm molasses was added manually to the prepared feed and mixed well as the feed factory was unequipped to use molasses as a feedstuff. Also, straw treated with urea was prepared and fed to the sheep. Ration components used during lactation and the nutritive value are explained in Table 3.11

Table 3.11. Ration formulation of the mixture used during lactation.

Ingredients	Fresh	DM	ME	CP	Ca	P
Barley grain	(g)	g/kg	MJ/kg DM	g/kg DM	g/kg	g/kg
	156.7	910	11.5	127	0.90	4.00
Molasses	352.2	810	12.0	105	8.53	0.67
Wheat bran	144.7	910	10.5	166	1.10	12.60
Cotton seed cake	67.5	950	7.2	277	2.10	8.90
Corn grain	144.7	900	14.2	98	0.10	3.00
Wheat grain	115.8	900	14.0	124	0.60	3.40
Urea	9.7	1000		2875		
Salt	2.6	1000				
DCP	5.2	1000			270	190
Min/Vit. Mix	0.9	1000				
Total	1000 g	874.6 g	10.19 MJ	141.1 g	4.31 g	4.72 g

The quantities of feed offered during this stage were 1100 g concentrate mixture and 1185 g treated straw (Table 3.12).

Table 3.12. Feed supplied per ewe during lactation.

Feed	
Formulated mixture (g)	1100
Wheat straw treated with urea (g)	1185
Total intake as fed (g)	2285
Total DM (g)	2054
Total ME (MJ)	18.3
Total CP (g)	290

The feeding length applied is given in Table 3.13

Table 3.13. Length of improved feeding supplied during lactation.

Farmer number	Lactation		
	Start	End	Length/Day
1	24-Dec	1-Apr	99
2	24-Dec	9-Apr	107
3	25-Dec	29-Mar	95
4	6-Jan	19-Mar	73
5	7-Jan	27-Mar	80

3.2.2. Chemical Analysis

The feed ingredients used in both treatments were analyzed in ICARDA's Feed Analysis Laboratory (Appendix-Table 2)

3.2.3. Data and Information Collection

3. 2.3.1. Characterizing of Sheep Production

The sample of the five sheep owners was used to represent characterization of sheep production in the district. The traditional group on each farm was followed regularly and data was collected relating to the management of their flocks. Information and data collected during 2007 and 2008 contained sections on characterizing the breed used, mating, lambing, lamb growth and weaning, milking, shearing, health practices and mortality, housing, feeding calendar, milk processing, and marketing of milk and lambs. After, the information and data collection had been gathered, some inconsistencies were found in them and required revisiting the field. This was conducted in the summer of 2009. Following this, the data was cleaned and analyzed using Excel 2003.

In characterizing the breed, the main appearance features observed were head colors, horns existing, and udder shapes. 80 ewes selected randomly from the five flocks were monitored for this purpose. Also, body measurements of 20 ewes and 8

rams were recorded using sheep measurement tool developed at Çukurova University (Appendix-Photo 4). The measurements taken included; height at back, height at withers, height at rump, chest depth, body length, width at rump, width at chest, and chest circumference.

Five veterinarians who were providing animal health services in the study area were interviewed with the farmers. The aim was to highlight the most frequent ovine diseases and traditional health practice applied by farmers.

Feeding calendars and traditional feeding practices were studied on each farm. Feed supplied was monitored every fifteen days. The data collected included type and quantities of feeds offered per day, in addition to grazing practices and animal movements throughout the year. Also, Reproductive calendars were followed by recording dates of lambing and weaning for each ewe. Mating dates were estimated relying on lambing dates (mating date = lambing date – 150 days). While milking Occurrences were estimated according to the milk quantity measured every two weeks. Later, Occurrences' percentages of mating, lambing, weaning, and milking were calculated.

3.2.3.2. Reproductive Performance

The data collected from the flocks included litter size, total lambs born alive, number of weaned lambs and lamb mortality from birth to weaning. In addition to information about the flock composition changes like the sold or the dead animals was collected.

3.2.3.3. Ewe Body Weights and Conditions

Live weights and body condition scores of the ewes were taken four times during the feeding experiment (Appendix-Photos 5):

At the start of the experiment (first week of July 2007).

In the period from 21-23 August 2007 to control the ewes' condition.

At lambing.

At weaning of the lambs (60 days after lambing).

At the end of the experiment (during March and April)

3.2.3.4. Lamb Body Weights

Lamb weights were taken every 15 days from birth until weaning at the age of 60 days (Appendix-Photo 6). Also, lamb weights of traditional treatment were recorded every 15 days from weaning to the age of 113 days.

3.2.3.5. Milk Yield

Milk yield was measured every two weeks in the morning and in the evening (Appendix-Photo 7). The lactation periods fluctuated among farmers and the period of improved supplementary feeding did not cover the full lactation period which was a result of the relatively large time difference in the start of lambing between the farms. Also, one farmer weaned his animals which were fed traditionally very late. Therefore, milk yield, milking length, and mean daily milk were recorded foe each farmer. Following this mean of all farmers was calculated.

3.2.3.6. Feed Supply

The feed supplied by the farmers was monitored and type of feeds, quantities and prices were recorded for both groups of ewes.

3.2.4. Statistical Analyses

Statistical analyses were conducted using Excel 2003, SPSS 15 Version, and SAS Version 4.1.

Reproductive performance data were analyzed using descriptive statistics of SPSS. While excel was used to analyze the data of animal traditional performances

(reproduction, growth, lactation, and lamb fattening). Also, Excel was used to analyze the data related to Awassi sheep features.

Statistical analyses for comparisons of animal weights and body scores (at lambing, at weaning, at the end, birth weights, and weights at 60 days old) and milk production were carried out using mixed model (PROC MIXED of SAS) with treatment as fixed effect. Farmers were treated as a random effect. Weight at start and age were used as covariate.

4. RESULTS AND DISCUSSION

4.1. Characterization of Sheep Production in Central Syria

4.1.1. Characterizing the Breed Used

The Awassi is the only breed of sheep in Central Syria, and the majority of the population is concentrated in the eastern part of the region. The main appearance features of Awassi sheep are presented in Table 4.1. Head color was found to be overwhelmingly brown (Shakra ewe) and it was seen to be preferred by the farmers. Two other head colors were observed namely black (Absa) and brown black mixed (zhama). (Figure. 4.1) and (Appendix-Photo 8)

Table 4.1. Percentage of the main appearance features of Awassi sheep in Central Syria.

	n		n	%
Head Color	80	Brown	59	74
		Black	11	14
		Mixed	10	12
Horns	80	With horns	4	5
		Hornless	76	95
Udder shape	63	1	21	33
		2	34	54
		3	3	5
		4	5	8

n: Size of the studied animals.

Most of the ewes under observation in the studied flocks were hornless and horns were rarely seen in ewes. Farmers do not keep the ewes with horns as considered to be one of the morphological culling criteria in female stocks (Figure 4.2) and (Appendix-Photo 9)

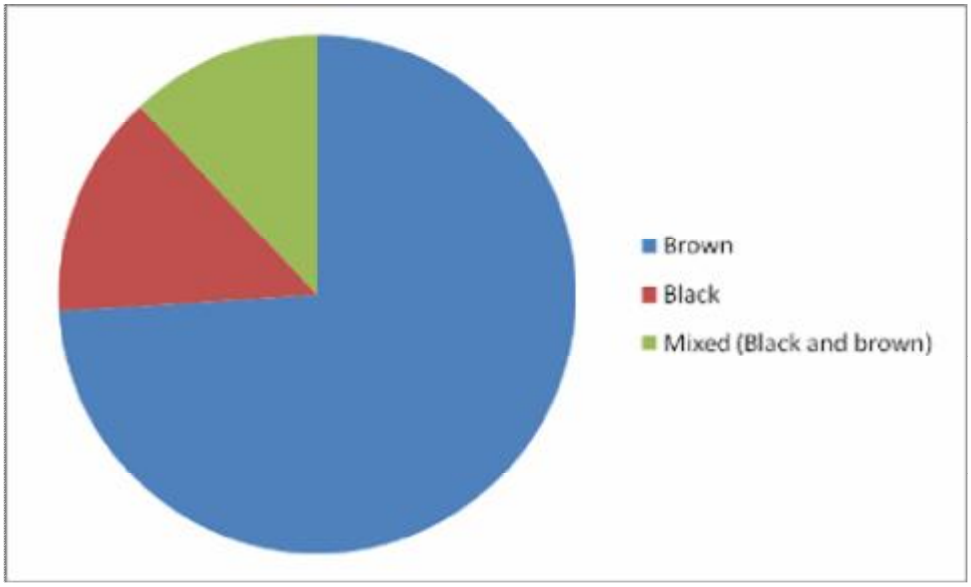

Figure 4.1. Percentage of the head color shapes in Awassi sheep.

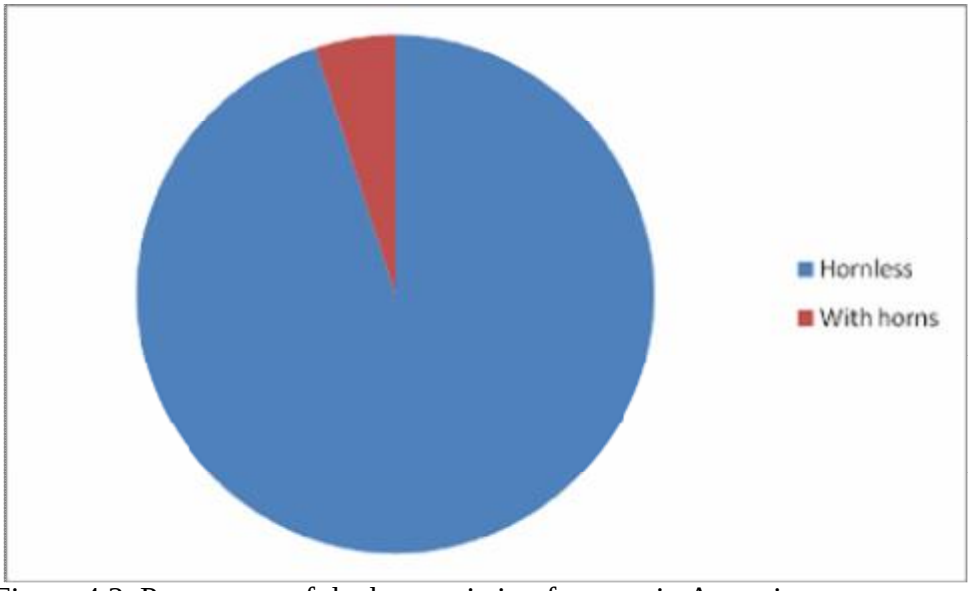

Figure 4.2. Percentage of the horn existing features in Awassi ewes

The udder and teat shapes were seen to vary greatly in the flocks. However, four distinct shapes were recorded: (1) cylindrical udder, teats set high and horizontal, (2) pear- shaped udder, teats set low and horizontal, (3) cylindrical udder, teats set low and oblique, and (4) udder with teats projecting downwards (Figure 4.3 and Figure 4.4) and (Appendix-Photo 10)

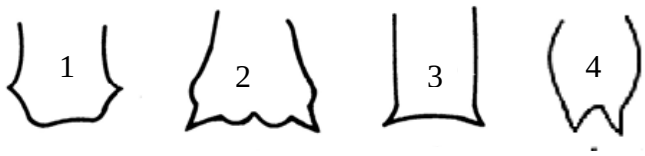

Figure 4.3. Udder Shape Classes: 1. Cylindrical udder, teats set high and horizontal; 2: Pear- shaped udder, teats set low and horizontal; 3: Cylindrical udder, teats set low and oblique; 4: Udder with teats

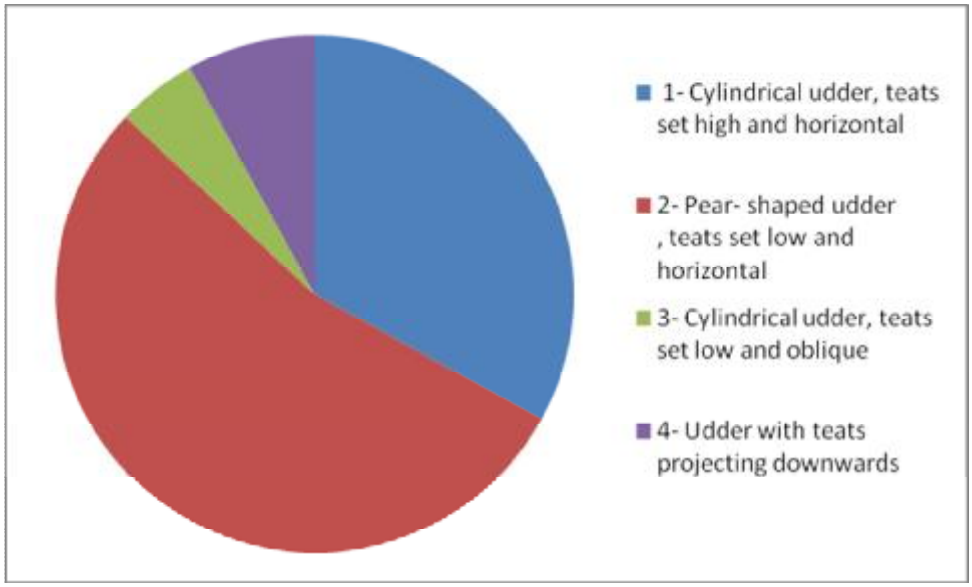

Figure 4.4. Percentage of the udder shapes in Awassi ewes.

The udder is well developed in Awassi due to its high milking ability. It is reported to be the second highest milk producer in the world. (Gürsoy, 2005). There is quite a big variation with respect to the udder types as categorized by Epstein, (1985). The most commonly encountered types were found to be cylindrical udder, teats set high and horizontal (Type 1) and pear- shaped udder, teats set low and horizontal (Type 2). They constitute 87 % of all ewes included in the study.

Mean body measurements of Awassi sheep in Central Syria, are given in Table 4.2. It is clearly seen that body measurement values for the milk and meat type Awassi in Al- Kraim Research Center as reported by Kassem, (2005) are fairly high. This difference in size may be attributed primarily to the heavy selection applied on

the Awassi sheep of Al-Kraim Research Center. On the other hand, the body measurement values of the Ceylanpınar Awassi ewes as reported by Gürsoy (2005) seem to be quite similar to the values in Table 4.2.

Table 4.2. Body measurements of mature Awassi sheep in Central Syria.

Sex	n	Body Measurements (cm)							
		Height at back	Height at withers	Height at rump	Chest depth	Body length	Width at rump	Width at chest	Heart Girth
Ewes	20	64.2 ± 0.5	66.4 ± 0.6	65.9 ± 0.7	31.7 ± 0.3	74.6 ± 1.1	21.4 ± 0.6	22.3 ± 0.6	92.4 ± 1.4
Rams	8	72.1 ± 0.6	74.3 ± 1.1	73.5 ± 0.8	33.5 ± 0.6	84.4 ± 3.4	25.0 ± 1.0	23.8 ± 1.0	95.9 ± 3.0

n: number of the measured animals.

4.1.2. Mating

Usually, rams are bought from the sheep market in the city or farmers grow male lambs from their flocks which have the appropriate appearance for breeding stock. The number of ewes joined per ram varies between 20 and 35 among farmers. Farmers cull rams at fairly old ages, five to eight years old. However, in recent times they started replacing rams every 2-3 years due to the genetic problems (such as abnormal lambs) that they frequently encounter.

In Central Syria because rams run with the flock throughout the year, ewes in oestrus are presented several times. Hence, some ewes come into heat out of season (Appendix-photo 11). Moreover, in the rainy season when cheap feed is available, ewes are capable of lambing twice a year.

The age of yearling ewes at first mating is affected by the level of feeding throughout the year and the pasture conditions in spring (the age varies between 9 and 18 months). Awassi ewes have a long breeding season. Mating begins in May and extends to the end of October. That is because farmers do not synchronize oestrus of ewes using progesterone-impregnated sponges. Ewes that do not mate in the first oestrus may be mated in the next cycle or stay infertile until the next year. Generally, farmers sell the sterile ewes when culling at the end of the season. The

peak of mating season lies between June and August. In this period ewes are fed on stand barley and cereal stubble. Ewes start consuming the nutritious components in the stubble, resulting in better body conditions and high rate of oestrus. High consumption of kernels also promote occurrence of multiple births.

4.1.3. Lambing

Most ewes lamb every year and twining rate fluctuates between two and five percent. The seasonal variation in twining rates is affected by the level of feeding and ranges which differs from year to year. Because farmers are interested in increasing the occurrence of twinning, as replacements they prefer female yearlings and young rams, which are born twins. Some times lambing may occur three times in two years. This however increases more intensive care of the lambs born. High mortality in the lambs is inevitable due to the scarcity of green fodder and high summer temperatures. Some ewes lamb in the early autumn of one year and again in the late spring of the next year.

Mean gestation length is 150 ± 4 days. In Al Kraim Reaserch Center Kassem (et al,1989a; 1989 b) reported gestation length as 151.7 ± 2.2 days.

While lambing, farmers attend and watch the process in case help is needed. Very rarely veterinary service is needed for emergency cases. After lambing lambs' umbilical cords are disinfected with iodine, the udder is cleaned and the ewes accept their lambs and suckle them. In case the dam dies, the lamb is grafted to another ewe lambing single immediately. During the lambing period lambs that are born in the field are brought to the sheep shed for few days. As soon as the newly lambed ewes recover and nurse their lambs satisfactorily they join the flock of lambed ewes. Farmers also check to see that the lamb is capable of suckling by themselves. Sometimes, dams having very large teats and the udder full of colostrum lambs have difficulty to nipple, so the farmer releases the pressure in the teat by milking some to the ground and the lamb can fit the softened teat to its mouth.

As newly lambed ewes' nutritional requirements increase, farmers allow the ewes graze green forage (like barley) planted by farmers to be used in the late

autumn. When spring starts, farmers take their ewes and lambs to graze range in the fallow lands. Some ewes that are mated again after short time of lambing are weaned early if they suckle lambs.

The suckling period lasts for two to four months depending on the state of pasture, time of birth, growth rate of the lamb, and price of lambs in the market. Furthermore, some farmers do not wean lambs but leave them with their mothers till they are sold or wean by themselves.

In Central Syria lambing period begins in October and extends until April. However, its peak occurs between November and January. This is traditionally synchronized with the availability of green forage for the highest nutritional requirements of the ewes within the annual feed calendar (Appendix-Photo 12)

4.1.4. Lamb Growth and Weaning

Lamb birth weight is affected by a number of factors such as type of birth and sex. Therefore singles and males generally have higher birth weights than multiple births and females. Moreover, within the predominant extensive system of Syria the birth weight of lambs is expected to increase appreciably depending on the amount of precipitation received which undoubtedly affects pasture productivity.

In the suckling period (Appendix-Photo 13) lamb growth rate is mainly affected by the dams' milk yield. High milking ewes' lambs grow faster as compared to the poor milkers. In the poor pastures, lambs suckle their mothers for a longer period until grazing. Type of birth and nutrition are important factors affecting weight gains (Kassem 2005). The month of birth also influences weight gain. Lambs born early in the lambing period (November and December) will gain weight better than those born late (Marsh and April) due to the accessibility to the pastures in spring season. Lambs born late will not be able to use pasture in spring because of their young age. In addition, they will be subjected to internal parasites which thrive in the high temperature. Thus, their weaning and yearling weights will be lower than those lambed early (AKF, 2007).

Farmers leave the new-born lambs with their mothers in a separate section for many days. The objective is to give lambs the chance to suckle the needed quantity of colostrums.

Lambs meet all their nutritional requirements from milk during suckling in the first 3-4 weeks. Later on, in the next weeks they start consuming small quantities of the feedstuff used by their dams, in addition to milk. This improves lamb growth and develops the stomach.

Lambs suckle their dams for about two months. During the next four weeks lambs suckle only residual milk after morning milking. Following this no suckling is allowed and lambs become weaned completely (Appendix-Photo 14). After weaning, the lambs subsist on the pasture with some hay and concentrate supplementation.

4.1.5. Milking

Lambs are partially weaned two months after lambing. Afterwards, farmers milk ewes once in the morning and allow them to suckle the evening milk for about two weeks. Later on, the lambs are completely weaned and the ewes are milked twice a day, morning and evening. Generally, ewes are milked at 09.00 o'clock in the morning and at 04.00 o'clock in the evening. The time differs according to the daylight depending on the season. The quantity of milk obtained in the morning is approximately 30% more compared to the evening milk. Milking is performed outdoors (Appendix-Photo 15) and milk is prone to be contaminated by dust and manure. To avoid milk spoilage, farmers filter it using pieces of clothes. Mostly, ewes are milked by women (wives or daughters of farmers). Before milking, animals are put in two opposite rows using strong rope which is tied around necks. (Appendix-Photo 16). Tying the animals by ropes may cause strangling. Moreover, using this milking method will prevent farmers from detecting udder diseases.

Milk yields are affected by many factors such as the genetic capacity of the ewes, age of ewes, type of birth, rainfall and the productivity of rangelands, the quantity and quality of supplementation, diseases and parasites encountered. Milking extends from January to the end of May. The total lactation in fact includes

the suckling period and milking after weaning, which actually makes up more or less seven months. This however, differs according from season to season and depending on the rainfall and productivity and availability of rangelands for grazing.

4.1.6. Shearing

In Central Syria, Awassi sheep are shorn once a year. Shearing takes place during April and May when temperature becomes higher and before the onset of hot weather. Usually, shearing is done using manual or electrical scissor. Farmers prepare clean place for shearing and they do not feed their animals three hours before shearing, in order to protect them from broses and wounds during shearing. However, many wounds are caused which are treated using traditional therapy (mixture of ash, salt and water). Farmers start shearing the flock in a fairly logical sequence. The sequence is as follows: rams, male yearlings, female yearlings, infertile ewes, The milking ewes are shorn 3-4 weeks later in order to protect them from the cold that may happen in Central Syria during April.

For shearing of the flock, sheep owner either hires a shearer or shears his flock in cooperation with other producers. Generally, 5-10 shearers work together to finish the shearing soon. A shearer may shear three animals per hour using traditional hand shear. Hence, in a day a shearer shears 24 animals.

Wool yield is about 2 kg per animal. After shearing, wool is put in nylon bags in order to be used for household needs (clothes, mattresses, quilts, pillows, and carpets). While, the surplus quantities are sold to middlemen.

4.1.7. Health Practices and Sheep Mortality

There are many ovine diseases which occur frequently in Central Syria. Enterotoxaemia is the most dangerous disease which scares the farmers most. The Disease attacks all animals and causes death in a fairly short time. To aid survival of lambs and ewes, farmers vaccinate all flocks when ewes are in their late pregnancy stage.

Pasteurellosis is regarded as one of the most important bacterial disease of sheep in the region. The disease causes fever and heavily breathing for sheep, abortion for pregnant ewes, and death for lambs. The triggering factors causing the disease are the harsh conditions (stress, hunger, and cold, hot). Some farmers vaccinate all animals (adults and lambs). While the others vaccinate only lambs in order to reduce costs.

Foot-and-mouth disease occurs less frequently and is considered to be an important cause for lamb mortality. The disease postpones pregnancy and lambing, decreases the milk yield and weakens the ewe's legs making them unable to stand. However, the disease is in control and ewes are successfully vaccinated.

Sheep pox is very rarely seen among the sheep. Mostly, infection takes place when newly infected sheep are mixed with healthy animals. The symptoms of the infection are: high body temperature (more than 40°C), loss of appetite, pustules over the animal (head, body, and among toes). Usually, the disease strikes in winter and causes death or abortion for ewes. Additionally, milk production is reduced in a lighter attack. Most farmers regularly vaccinate their flocks but some farmers vaccinate immediately following the outbreak.

Brucellosis is another disease that invariably affects sheep and can also have wider implications as it is a zoonotic disease and therefore can be transferred to humans. Many farmers, veterinarians, and consumers of sheep milk products are infected every year. Brucellosis is a main causing for sudden abortions among sheep. Organisms of brucellosis are found in milk and placenta. Hence, farmers are always recommended to burn placenta after lambing and boil or pasteurize milk before consuming or processing. Normally, farmers do not vaccinate their flock against brucellosis.

Another disease is mastitis which is an infectious disease in dairy sheep that happens in the winter more so than the summer. It is caused when teats are injured (by sharp stuffs, lambs' teeth or unexpected milking practice) or due to the dirt in the barns and on the udder, thus the infectious organisms enter into to the teat canal. The milk produced from an infected udder is thrown away as it is not suitable for processing. The symptoms of the infection are: rise of the udder temperature with

swellings on it accompanied with pain which affect appetite and milking. Mastitis causes loss of the udder and even death if farmers neglect treating the problem. Most farmers slaughter or sell the animals which do not respond to the treatments.

Diarrhea is commonly found among the lambs more than the adults. It may originate mainly from rotten feed and water from streams and small ponds. Also, it happens when the animals eat large quantities of cotton seed meal. Farmers treat the animals using the required medications.

Internal parasites are serious wide spread problem in sheep production in Central Syria. They cause great productivity losses in sheep production mainly retarded growth, low reproductive efficiency and low milk production. Usually, farmers treat their animals.

Plant poisoning is widespread throughout Central Syria and even whole country. It occurs in the pastures when sheep graze poisonous plants. Furthermore, the problem happens more frequent in the case of drought due to the poor contribution of the pasture. Based on the quantity eaten, ewes suffer from diarrhea or death. Immediate injection with medications is the common practice done by the farmers.

Among the external parasites lice is more frequently seen and is a serious problem in the hot summer. The neglected animals which live in a bad condition and poor housing are often subjected to the lice strike. Infected animals rub their bodies and later lose their appetite. To get rid of lice, farmers spray the animals with some effective insecticides. Some farmers practice dipping.

According to farmers the mortality rate caused by the health problems and the feed shortages is 10-11 % in lambs and 5-6% in adults.

4.1.8. Housing

Housing for Awassi sheep consists of shed and paddock (Appendix-Photo 16). The walls of the shed are built of either concrete or brick made of mud . The roof is wooded, concrete or metallic. The shed protects animal from the harsh weather in Central Syria; storms, rain, snow and cold in winter and the extreme hot

in summer. The paddock keeps animals when temperature is moderate as they spend part of the day in the paddock, where they are fed, milked, vaccinated. Shed and paddock are connected by gate allowing for feed and bedding to be brought into the shed and manure to be removed outside. Also, farmers prepare facility situated near the paddock for feed storage.

The gate of the store is opening towards the yard. Sometimes, it causes some animal health problems when it is kept open as animals eat big quantities of concentrates. To avoid this problem, some farmers put another door opening towards the outer side of the shed and can not be reached by animals.

Also, iron partitions in the shed or in the yard are used in order to isolate weaned lambs or lambed dams with their kids. Sometimes animals requiring special care or medication are put inside the isolated area.

Housing facilities are constructed on the little sloping land so that open paddock dries out fast after rain. Moreover, land located in a basin is not preferred due to the risk of floods taking place in Central Syria.

Barns are built near the roads. Thus, transportation of livestock, fodder and products become easier.

4.1.9. Feeding Calendar

The feeding calendar in Central Syria consists of the range grazing in spring and early summer, standing barley and cereal stubbles in summer and early autumn, irrigated crop residues in late summer and autumn and hand-fed supplements (barley grain, cotton seed meal, wheat bran, cotton seed husk, pellets, and cereal and legume straw) in winter (Figure 4.5)

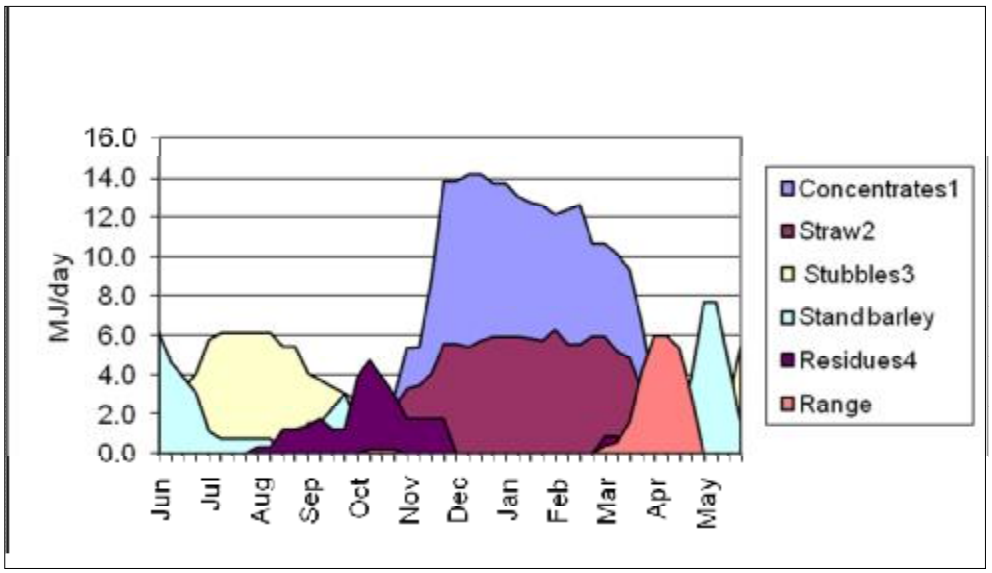

Figure 4.5. The contribution of different feedstuffs as metabolizable energy for traditional feeding cycles in Central Syria.
1: Barley grain, Cotton seed meal, wheat bran, cotton seed husk and Pellets; 2: Cereal and legume straw; 3: Cereal stubbles; 4: Corn and vegetables residues.

The reproductive calendar is divided into four stages; (1) mating peaks between June and August, (2) lambing between November and January, (3) weaning between January and April and (4) milking between January and May (Figure 4.6)

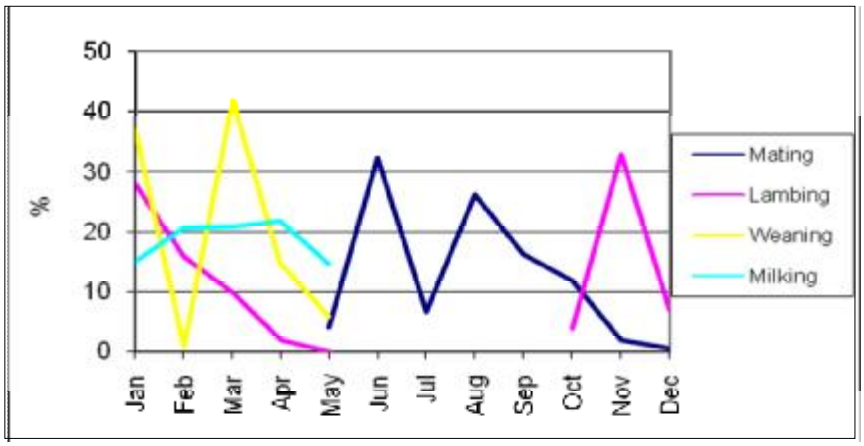

Figure 4.6. Main annual management practices in sheep production in Central Syria.

4.1.10. Milk Processing

Fresh sheep milk is not consumed in Central Syria due to its unusual flavor. Therefore it is processed into yogurt, baladi or white cheese, butter, ghee, karishe (prcessed buttermilk) or shankleesh (processed and fermented buttermilk), and labneh (concentrated yogurt). Farmers process milk both for their own consumption and for commercial purpose. Considerable quantities of milk are processed by cheese makers and milk processors using primitive equipment. The main products identified and ranked according to their importance as follow:

1. Yogurt.
2. White cheese.
3. Ghee.
4. Butter.

By products like sour karishe has some importance especially in the case of shinglish which is a mold matured dry buttermilk, sour karishe is a by product produced by ghee processing.

Yoghurt: After filtration, the milk is boiled for 2-10 minutes in an aluminum or cupper pot, then is filled into 2.5 kg buckets and left to cool down, this will enable it to form an upper creamy layer which is desired by consumers, the upper layer will be thicker if milk is poured from >25 cm height into the bucket. Some processors use a thermometer to check the proper time for culture inoculation. The culture is prepared by diluting with water or milk boiled before. The culture will be inoculated without damaging the formed upper layer by using a spoon or syringe. The inoculation rate varies 0.5 -2.8 %. Incubation is done on 45°C in summer, and on 48°C in winter by covering the yoghurt buckets with blankets for 2 hours, the incubation time is increased in winter up to 3 hours.

One major problem which the processors are facing is the high acidity developed in yoghurt, this is due to the acidic yoghurt used as a starter in yoghurt processing, cooling after incubation is a key issue to reduce bacteria activity, the

culture is also responsible for the developed acidity during transportation and marketing, especially if it is transported and stored without cooling.

If the starter ferments lactose rapidly to lactic acid, another problem arises, crumbling of yoghurt. The culture is also responsible for the texture properties this is also affected by incubation temperature and incubation time.

White cheese: After filtration, some processors separate 40-50 % of fat. Then the fat reduced milk is renneted. Rennet is smashed with some salt and dissolved in water. Some individual processors dissolve rennet in milk which reduces rennet activity leading to the use of larger quantities of rennet. Milk is renneted in plastic containers, after 30 min the curd is transferred to a cheese table, some processors stirs the curd with a spoon and let to rest for 15 min before molding, this stimulates the whey separation. The curd is directly molded using cheese cloth to form 10×10×4cm cheese cubes. Then the cheese cubes are pressed using heavy material like stones for 30 min. the cheese is unpacked from the cheese cloth and salted in brine for at least over night. The most relevant problem associated with cheese processing is the texture problem due to eye formation in the cheese which affects the marketability value of the product. To overcome this problem the producers salt the cheese using cold brine and store it in refrigerator till next day, dry salt is sprinkled between cheese layers to prevent cheese surface smearing due to yeast growth.

Butter: Electric or manual churn is used for preparing of butter. Cream centrifuged from raw milk using electrical milk centrifuging is filled to about one-half of churn volume. About an hour after churning, the butter granules reach the size of grains of wheat and, butter separates from buttermilk. During churning the temperature is kept about 12-15° C. Latter on, butter is removed and washed with clean water and is ready for consumption.

Ghee: Butter made in the previous stage is salted. Then it is put in copper vessel and heated to a temperature of more than 100 ° C. Thus, moisture is removed by evaporation, and some of the dirt and buttermilk rise to the top where it is removed with a spoon. It is then cooled and put into plastic or metallic containers which are kept in a cool place.

Labneh: (known as sour milk, concentrated yogurt) is processed by transferring the yogurt into a clean cotton bag. It is left to be drained at room temperature overnight.

4.1.11. Marketing

4.1.11.1. Milk and Milk Products

The consumption of fresh milk without processing is uncommon in Central Syria. Therefore the major quantity is marketed as milk products (yogurt, baladi or white cheese, butter, ghee, karishe or shankleesh, and labneh). Some producers process their milk using simple equipment in the kitchens. The home-made products are preferable in Central Syria. Farmers either sell products themselves to the consumers or depend on intermediaries such as wholesalers and retailers.

Other farmers sell raw milk to the middlemen (milk collectors) who provide feed in the form of payment or pay cash in advance for the season's production (Appendix-Photo 17). In both types, farmers lose money. They sell milk lower than the normal price and buy feed higher than the price in the market. Later, the milk is transported to small and medium scale processing units where it is processed and sold to the consumers or marketed in the big cities.

Another form of milk marketing is by cheese makers who set their tents close to the producers' flock. The cheese made in those tents is transported to the cities and is sold for wholesalers. Mostly, cheese makers pay in advance for the season.

Milk prices fluctuate seasonally. In a drought year when the quantities produced are limited, the prices will be very high. Moreover, the prices are open to fluctuation in the same season and updated every week to ten days (according to demand and supply)

4.1.11.2. Lambs

Awassi lambs have excellent demand and outstanding marketing. Its meat taste is the favorite not only in Syria but also in Gulf countries; therefore the export

of live lambs to the Gulf is a significant source of income for livestock breeders and has a direct impact on the prices.

Small and light lambs are marketed locally because of the preference of local consumers for small animals, while the heavier animals are used for the export purpose. When demand for meat and prices are high farmers keep lambs suckling more, as they think that lambs fed on the mothers' milk gain meat faster . This practice will decrease the quantity of marketable milk, and consequently increase the prices of milk products. This happens when rainfall and feed price are reasonable. By contrast, in drought year farmers dump markets with lambs due to the high feed prices. Thus, meat prices become very low and available for the poor consumers. Also, lamb prices are affected positively by the occasions of the *Eid* celebrations, because Moslems sacrifice lambs and distribute the meat to the poor people. (Appendix-Photo 18)

4.2. Performance of Awassi sheep in Central Syria

4.2.1. Reproduction

Awassi is not a prolific breed. Reproductive performance is rather low compared to many exotic breeds in Europe. Previous researchers' reports on the reproductive performance of Awassi sheep in Syria and Turkey are presented in Table 4.3. There seems to be quite a difference between the reproductive performances of Turkish and Syrian strains of Awassi sheep. The main reason for high twinning rate in Turkish Awassi may be due to the better nutritional status offered prior to mating.

Table 4.3 Reproductive performance of Awassi sheep in Central Syria compared to the other studies.

	Central Syria	Kassem (1998)	Gürsoy et al (1992)		Hailat (2005)
			1988	1989	
Flock size	118	201	55	52	49x343
Lambs / ewe lambed	105	82	123.1	128.3	
Ewe mortality rate	1.7	3.5	--	--	2.22-2.83
Lamb mortality from birth to weaning %	7	10.7	3.1	6.8	4-6
Lambing rate	92.4		94.6	88.5	92-94
Fertility rate%	94.1		94.5	88.5	88-89
Abortion rate%	1.7		--	--	0.49-1.3
Weaning rate %	90.8	74	96.9	93.2	94-96
Twining rate%	4.6	2	23.1	26.1	2.5

The ewes reproductive performance in the study revealed that the total lambs born alive per 100 ewes lambed were 105. While the mean percentage of the animals mortality was registered as 1.7% for adult ewes and 7% for lambs. It was also recorded that lambing rate, estimated as the percentage of ewes lambed per ewes mated, was 92.4%. Mean of aborted ewes was 1.7%. Thus, the percentage of pregnant ewes per exposed ewes (fertility rate) was 94.1%. Lamb survival rate at weaning (weaning rate) was 90.8% and twining rate was 4.6 %.

The performances of ewes managed under the conditions of Central Syria were compared with those results of Kassem (1998) who conducted his trial on ewes which were settled in the pastoral areas in Syria , as well with Gürsoy et al (1992) in Turkey and Hailat (2005) in Jordan who carried out their experiments under traditional systems . The results of reproduction performances in Central Syria were closer to Hailat (2005). However, there were some differences observed not only between the study and the other authors but also among the other scientists themselves Table 4.3 This could be because of the effect of the environmental

conditions that differed from year to year and affected the reproductive performances.

4.2.2. Growth

4.2.1.1. Body Weights and Body Condition Scores of Awassi Ewes

It was clear from the results of the study that variations in ewe body weight and condition score reflected the physiological stage of the animal (Özsoy et al. 1986). The ewe weight reached 44.3 kg after lambing it is less than the weight (48.6 kg) obtained by Kassam (1998). Because of the lambs' suckling period coupled with the poor feeding, the weight and the score declined and reached the poorest level toward the end of the suckling stage. However, the weight and the score improved rapidly after weaning, when the milk production decreased accompanied by the good feeding (grazing of stand barley and stubbles)

Average of ewe body weight and body condition score during lambing, weaning and at the end of the experiment are given in Table 4.4 and Figure 4.7

Table 4.4 Live weight and body condition score of Awassi ewe in Central Syria at various stages of physiological development.

Stage	lambing	Weaning	End
Ewe weight (kg)	44.3 ± 0.4	41.2 ± 0.4	45.2 ± 0.4
BCS	1.9 ± 0.03	1.8 ± 0.03	2.0 ± 0.04

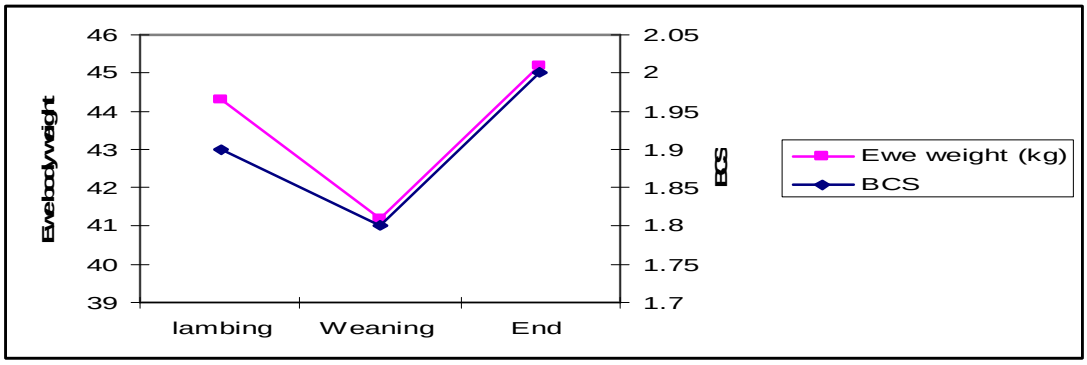

Figure 4.7. Change of ewe live weight and body condition score at various physiological stages.

4.2.1.2. Lamb growth

The study of lamb growth showed that the mean birth weight of lambs was 4.7 kg. The growth rate of Awassi lambs from birth to weaning at 60 days old was 193 g/d. The results of lamb growth presented in Table 4.5 were in agreement with the studies undertaken by ACSAD (1978), Gürsoy (1980), Kassem (2005), Masri (1996) and Alkass and Juma (2005)

Table 4.5. Average growth of Awassi lambs from birth to 60 days old.

Author	Central Syria	ACSAD (1978)	Gürsoy (1980)	Kassem (2005)	Masri (1996)	Alkass and Juma (2005)
Total number of lambs		11				
Average birth weight, kg	4.7 ± 0.1	4.7	4.1		4.4	4.3
Average weight at 60 days old, kg	16.3 ± 0.3	16.8				
Average daily growth, g/d	193	204	200	191-203	200-250	

4.2.3. Lactation

The amount of milk produced during a period of 61 days after weaning was 25.6 kg. Thus, the average daily milk production in that period was 437 g/d (Table 4.6). The figures of milk production were less than the expectation because of the bad conditions of nutritional regimes during the experiment (drought and poor grazing). This result was in agreement with Kassem (2005) who reported that the amount of milk produced under extensive system may drop to 15-20 kg per lactation during dry years. Also, the results were in agreement with Mason (1967) who reported 40 kg of milk yield for unimproved sheep owned by Bedouin and fellahin. In contrast, the results of the milk production were less than the (593g/d), (770g/d)

and (777g/d) recorded by Eralp (1963), Al-Tamimi (1983) and Al-Jalili et al. (1988) respectively.

Table 4.6. Milk production of Awassi sheep during after weaning period.

N	Traits	Mean	Min	Max
62	length of milk measurements, days after weaning	61 ± 3	27	98
	Milked yield, kg	25.6 ± 1.5	5.0	66.0
	Avg.Milk production after suckling period, g/day	437 ± 23	115	983

4.2.4. Lamb Fattening

Awassi lambs show a great variation in bodyweight gain and average daily weight gain according to age and nutritional status. At the Central Syria conditions, the experiment conducted on 65 lambs (weaned at 60 days old and reached an average weight of 17.7 kg) showed that growth rate from weaning to 113 days old was 155 g/d (Table 4.7). The results of the traditional management applied by the farmers in Central Syria were close to those recorded by Larbi et al. (2007) who presented average daily growth of 116 to 159 g/d/head. As well, similar growth rates were observed by Christiansen et al. (2000) who found that lambs grazed on forage legumes (Vetch and Grasspea), have averaged 186 g daily live-weight gain per lamb. However, the results of daily growth were less than the (200-250 g/d) and (262-277g/d) recorded by Masri (1996) and Kassem (2005) respectively.

Table 4.7. growth of Awassi lambs from weaning to 113 days old.

Traits	
Total number of lambs	65
Average weight at 60 days old	17.7 ± 0.6
Average length of fattening period, days	53 ± 2
Average daily growth, g/d	155 ± 8

4.3. Comparative Evaluation of the Performance of Awassi Raised in Traditional and Improved Feeding Conditions

4.3.1. Reproduction

Reproductive performance data recorded for all farmers in terms of lamb survival, mortality, abortion, lambing, fertility, and twining rates are presented in Table 4.8. Ewes' performances were generally similar and no significant differences were observed between treatments (Figure 4.8). This is largely attributed to the fact that ewes had a long breeding season due to the poor grazing season (peak occurred between June and August), and rams were running with the ewes all the year round, This is a common practice in Central Syria. Since treatments started in July, some ewes were apparently pregnant already (Table 4.8)

Table 4.8. Effect of improved feeding on ewes' reproductive performance

F[1]	T[2]	N[3]	Litter Size4	Ewe mortality rate %	Lamb mortality 5 %	Lambing rate%	Fertility rate%	Abortion rate%	Weaning rate %	Twining rate%
1	I	15	107	0.0	0.0	100.0	100.0	0.0	100.0	6.7
	L	24	100	4.2	9.5	87.5	95.8	8.3	90.5	0.0
2	I	25	100	0.0	8.0	100.0	100.0	0.0	92.0	0.0
	L	27	112	0.0	3.4	96.3	96.3	0.0	96.2	11.5
3	I	16	113	0.0	0.0	100.0	100.0	0.0	100.0	12.5
	L	18	118	0.0	5.0	94.4	94.4	0.0	88.2	17.6
4	I	16	100	12.5	0.0	87.5	87.5	0.0	100.0	0.0
	L	18	100	5.6	0.0	94.4	94.4	0.0	94.1	0.0
5	I	29	100	0.0	7.4	93.1	93.1	0.0	92.6	0.0
	L	31	100	0.0	14.3	90.3	90.3	0.0	85.7	0.0
All F	I	101	102	2.0	4.0	96.0	96.0	0.0	95.9	3.0
	L	118	105	1.7	7.0	92.4	94.1	1.7	90.8	5.5

[1]: Farmer; [2]: Treatment; [3]: Flock size; [4]:Lamb Born/Ewe lambing; [5]Birth-Weaning

During the experiment farmers sold part of the ewes as a result of the drought which took place during the 2007/2008 cropping season. Feeding costs had increased

substantially and the situation within the rangeland had worsened. Moreover productivity was low resulting in big sales of females in the country. Following this the percentage of the ewes sold among those using the improved treatment was 19 % which is more than the sales of traditional treatment (8 %). Possibly, this is due to the better body condition gained by improved feeding, leading to a better price per animal.

The results of the reproductive performance were in agreement with Hossamo and Farid (1981), who found that there were no differences between the two feeding levels on the reproductive performance. That was because the treatments started after the end of mating. Moreover, the conditions of the poor grazing in their experiment were similar in both experiments.

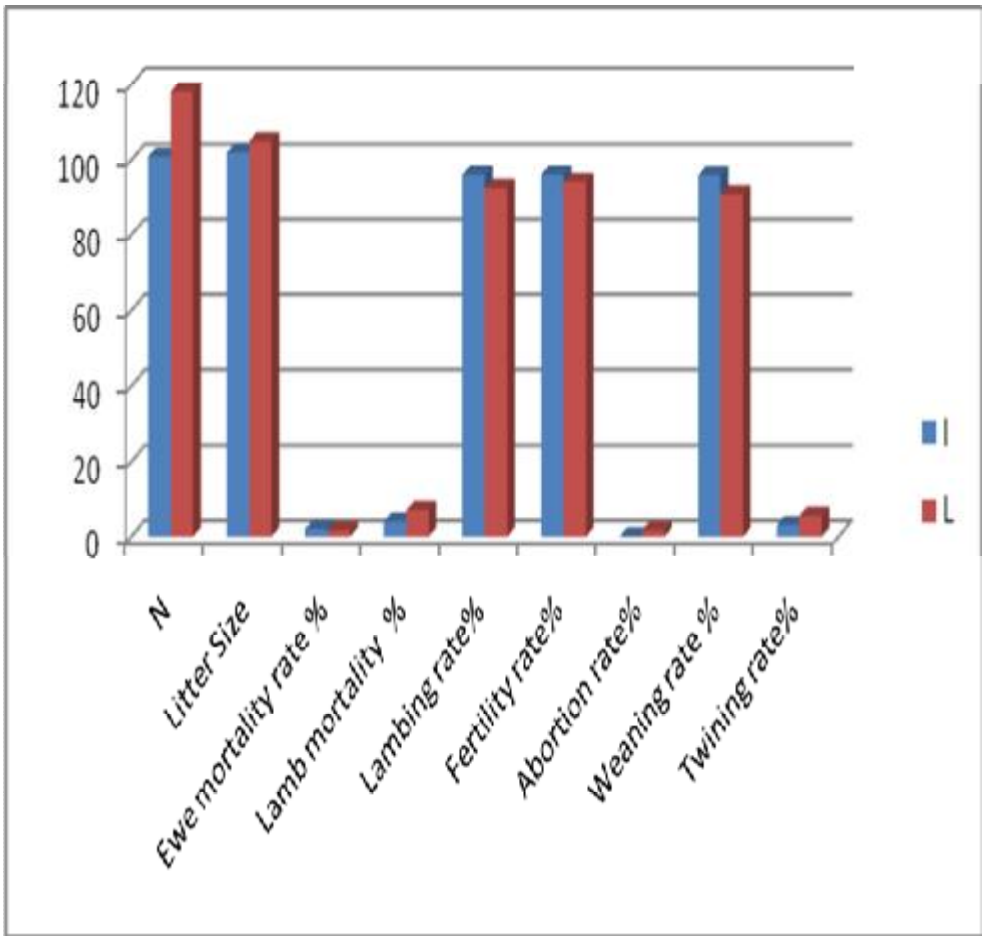

Figure 4.8. Effect of improved feeding on ewes' reproductive performance
n: flock size; I: improved treatment; L: local treatment.

4.3.2. Ewe body Weight and Body Condition Score

The data of the ewe weights during their physiological stages are shown in Table 4.9 The effect of diets on the weight of ewes was highly significant during the trial ($p < 0.01$).Also, There was a highly significant effect of the ewe's initial weight, at the start of the experiment. Improved treatment resulted in live weight increases of 4.5 kg at lambing, 4.9 kg at weaning, and 3.7 kg at the end of the trial when the ewes dried. The mean lambing weights of the ewes fed with improved and traditional rations was 48.8 kg and 44.3 kg respectively. The weaning weight was 46.1kg in improved treatment and 41.2 in traditional one. Similarly, improved treatment affected significantly the ewe weight at the end of the experiment. The weights of improved and traditional treatments were 48.9kg and 45.2kg respectively (Figure 4.9)

Balanced feeding promoted better growth rate when comparing to traditional way of feeding applied by farmers. This may be attributed to the reduced nutritive requirements provided by farmers. Local feeding management did not meet the sheep requirement from CP and ME. The results of weaning weight were not similar with the figures obtained from Alvarez –Rodriguez et al. (2007) in his experiment on Churra Tensina ewes, which showed no differences in ewe live-weight at 60 days postpartum.

Table 4.9. Effect of improved feeding on ewes' live weight.

	Treatment	Ewe weight (kg)		
		lambing	Weaning	End
Farmer1	I	45.8 ± 1.0	44.3 ± 0.8	49.3 ± 1.2
	T	42.8 ± 0.9	40.8 ± 0.7	44.6 ± 1.0
Farmer2	I	51.9 ± 0.7	45.4 ± 0.9	48.2 ± 0.8
	T	47.3 ± 0.7	39.9 ± 0.8	44.8 ± 0.8
Farmer3	I	51.1 ± 1.3	51.1 ± 0.9	50.7 ± 1.0
	T	46.0 ± 1.3	44.7 ± 0.9	46.7 ± 1.0
Farmer4	I	47.4 ± 1.2	42.7 ± 1.0	46.7 ± 1.2
	T	43.3 ± 1.1	38.4 ± 0.9	45.2 ± 1.2
Farmer5	I	47.9 ± 0.6	46.7 ± 0.8	49.8 ± 0.8
	T	42.4 ± 0.6	42.5 ± 0.8	45.5 ± 0.8
All farmers	I	48.8 ± 0.4	46.1 ± 0.4	48.9 ± 0.4
	T	44.3 ± 0.4	41.2 ± 0.4	45.2 ± 0.4

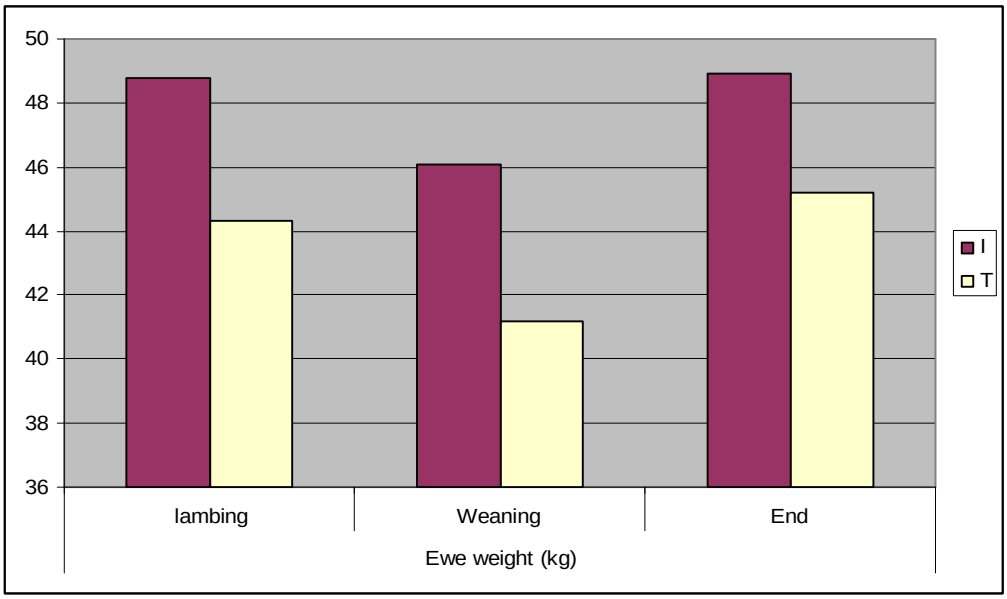

Figure 4.9. Effect of improved feeding on ewes' live weight.

The effect of diets on the body condition scores was highly significant ($P < 0.01$) as well as the effect of score obtained when the experiment started ($P < 0.01$).

The result shows that the scores of ewes fed with improved feeding were higher than those by traditional treatment. The differences were 0.5 at lambing and weaning and 0.4 at the end of the trial. At lambing, the mean of body condition scores were 2.4 and 1.9 in improved and traditional treatments respectively. At weaning, the mean scores of the ewes fed with improved and traditional rations were 2.3 and 1.8 respectively. At the end of the experiment the mean scores of improved treatment reached 2.4, higher than traditional treatment scores which recorded 2.0. (Table 4.10 and Figure 4.10)

It is clear that the alternative experimental diet used in traditional treatments promoted a better body condition score than the traditional diets provided by the farmers and the unbalanced feeding was the main factor affecting negatively on ewes' body condition. (Treacher and Filo, 1990)

Table 4.10. Mean of body condition scores of ewes during lambing, weaning, and at the end of the trial.

	Treatment	Ewe score (kg)		
		lambing	Weaning	End
Farmer1	I	2.5 ± 0.07[a]	2.3 ± 0.08[a]	2.5 ± 0.13[a]
	T	2.1 ± 0.05[b]	1.8 ± 0.07[b]	2.1 ± 0.10[b]
Farmer2	I	2.6 ± 0.05[a]	2.3 ± 0.06[a]	2.3 ± 0.07[a]
	T	2.2 ± 0.05[b]	1.8 ± 0.06[b]	2.0 ± 0.06[b]
Farmer3	I	2.4 ± 0.06[a]	2.4 ± 0.06[a]	2.4 ± 0.08[a]
	T	1.8 ± 0.06[b]	1.8 ± 0.06[b]	2.0 ± 0.08[b]
Farmer4	I	2.3 ± 0.11[a]	2.0 ± 0.11[a]	2.4 ± 0.11[a]
	T	1.9 ± 0.10[b]	1.7 ± 0.10[b]	2.1 ± 0.10[b]
Farmer5	I	2.4 ± 0.08[a]	2.3 ± 0.09[a]	2.4 ± 0.05[a]
	T	1.8 ± 0.08[b]	1.8 ± 0.09[b]	2.1 ± 0.05[b]
All farmers	I	2.4 ± 0.03[a]	2.3 ± 0.04[a]	2.4 ± 0.04[a]
	T	1.9 ± 0.03[b]	1.8 ± 0.03[b]	2.0 ± 0.04[b]

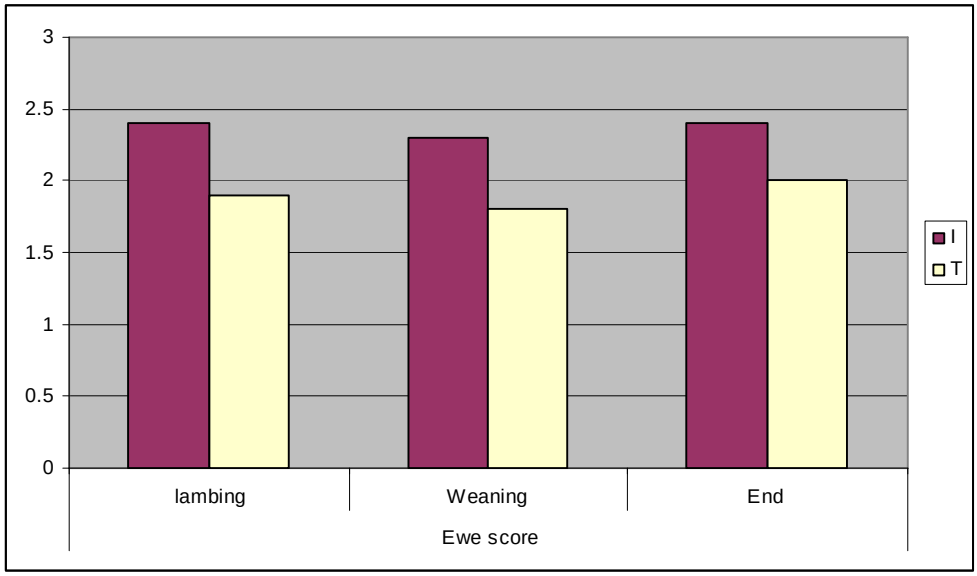

Figure 4.10. Effect of improved feeding on ewes' condition scores

4.3.3. Lamb Growth

The results summarized in Table 4.11 explain that there were no differences between mean lambs birth weights (P> 0.05). The lamb weight in improved treatment was 0.1 kg higher than in traditional one. However, the effect of the dams was highly significant (P < 0.01) (Figure 4.11).

In the experiment reported by Gürsoy (1980) examining the effect of management systems on lambs' birth weight, the lambs of the semi-intensive system were heavier than those of the extensive system; the differences were 0.5 kg for males and 0.8 kg for females. In general, the results of birth weight of both treatments were better than the figures reported by Masri (1996) and Alkass and Juma (2005) presented in Table 4.5. Also the results were not in agreement with (Treacher 1970) and (Holst et al. 1986). It is likely that this is due to the drought which took place during the research and caused a large stress on the animals.

Lamb weight at 60 days of age was not affected by the treatments (P> 0.05). Conversely, effect of ewe's lambing weight was highly significant (P < 0.01). The mean lambs' weight of improved treatment was slightly higher than farmers' traditional treatment (the difference being 0.2 kg). This is could be because Awassi sheep are good milk producers. It is considered to be the second best breed in the world (Gürsoy 2005). Thus, the milk produced during suckling covered the lamb requirements in both treatments.

DWG from birth to weaning at 60 days old was 195g which is close to the findings of Gürsoy (1980), Masri (1996) and Kassem (2005) reported in Table 4.5 However, the findings of Alkass and Juma (2005) were higher as he reported BWG as 275 g/d for females and 295g/d for males.

Table 4.11 Effect of improved feeding on lambs' weight.

	Treatment	Lamb weight (kg)	
		Birth	At 60 Days old
Farmer1	I	4.9 ± 0.2	15.5 ± 0.6
	T	4.3 ± 0.2	16.3 ± 0.5
Farmer2	I	5.0 ± 0.2	15.8 ± 0.6
	T	5.2 ± 0.2	17.0 ± 0.6
Farmer3	I	5.0 ± 0.3	18.7 ± 1.0
	T	5.0 ± 0.3	18.0 ± 1.0
Farmer4	I	4.9 ± 0.2	15.1 ± 0.7
	T	4.6 ± 0.2	13.0 ± 0.6
Farmer5	I	4.5 ± 0.1	17.5 ± 0.6
	T	4.5 ± 0.1	16.1 ± 0.6
All farmers	I	4.8 ± 0.1	16.5 ± 0.3
	T	4.7 ± 0.1	16.3 ± 0.3

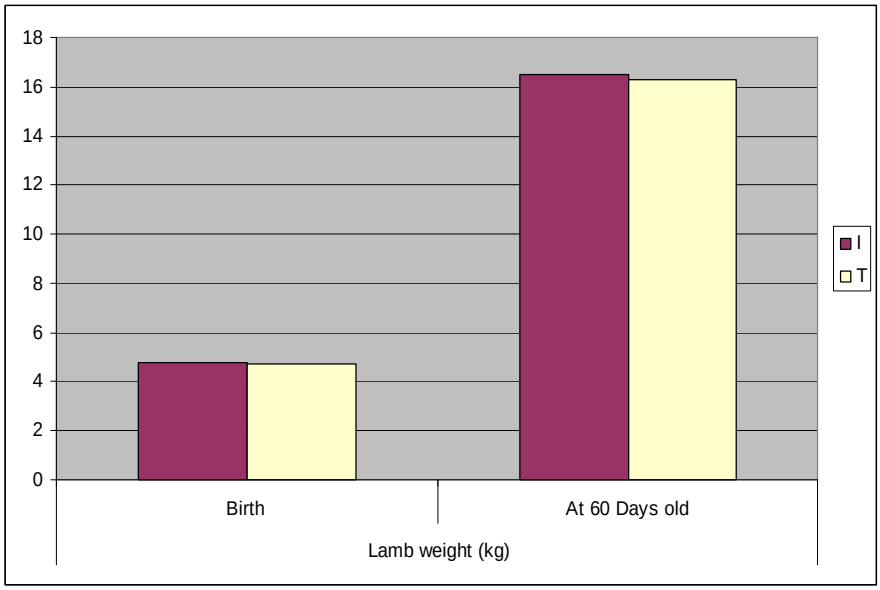

Figure 4.11. Effect of improved feeding on lambs' weight.

4.3.4. Milk Production

Because the farmers had different starting dates of milking their animals, the milk yields fluctuated due to effect of the environment and the availability of the pastures. Also, some ewes were dried early in the milking period when they came into heat second time and got pregnant.

The results summarized in Table 4.12 explain that the alternative experimental diet used in the improved treatment promoted a better performance in mean daily milk yield during 69 days and 62 days after weaning in improved and traditional treatments respectively, the treatment effect being highly significant ($P < 0.01$). The mean daily milk during considered period was 107g/d, 25% higher in the group fed with the improved feeding compared to the group fed with local diet.

Generally, the improved treatment applied in each farm showed higher milk production. The differences between the two treatments among the farmers 1,2,3,4 and 5 were 33g/d, 119g/d, 223g/d, 133g/d and 48 g/d respectively. (Table 4.12 and Figure 4.12). Generally, the milk yielded in both treatments were less than expectation. It is likely to be attributed to the farmers criteria put when culling their ewes. Thus, ewes producing good lambs and lambing twice a year have become the

favorite. This is because Awassi lambs have an excellent demand, and the export of live lambs to the Gulf has been a significant source of income for farmers more than milk.

Increase in the daily milk yield was observed in the experiment carried out by Hossamo and Farid (1981) comparing two levels of concentrate feeding during gestation and suckling (the differences recorded were 5% and 16% in the control and milk line respectively). Also, the results from the experiment agree with the findings reported in Gürsoy (2005) and Khazaal (2005), in which ewes responded when the management system was changed and yielded more milk in intensive and semi-extensive management systems when compared to extensive system.

Table 4.12 Effect of improved feeding on milk production of Awassi ewes.

Treatment	Trait	Farm1[1] (n:23)	Farm2 (n: 33)	Farm3 (n:21)	Farm4 (n:25)	Farm5 (n:28)	All farms (n:130)
I[2]	Milk yield, kg	32.8 ±3.5	43.9 ±2.6	57.5 ±6.1	31.2 ±2.4	19.7 ±1.7	36.7 ±1.5[a]
	Milking length, days	83 ±6.7	85 ±2.1	88 ±4.7	41 ±1.1	49 ±2.7	69 ±1.8[a]
	Mean daily milk, g/d	387 ±40	510 ±26	657 ±73	762 ±61	404 ±26	542 ±20[a]
T[3]	Milk yield, kg	15.4 ±4.0	33.3 ±2.6	35.3 ±6.4	24.1 ±2.3	17.7 ±1.9	25.6 ±1.6[b]
	Milking length, days	43 ±7.7	85 ±2.1	86 ±4.9	39 ±1.1	49 ±2.9	62 ±1.9[b]
	Mean daily milk, g/d	355 ±46	391 ±27	434 ±77	629 ±59	356 ±28	434 ±21[b]

[1]:the farmer weaned his ewes treated traditionally very late; [2]: Improved treatment; [3]: Traditional treatment

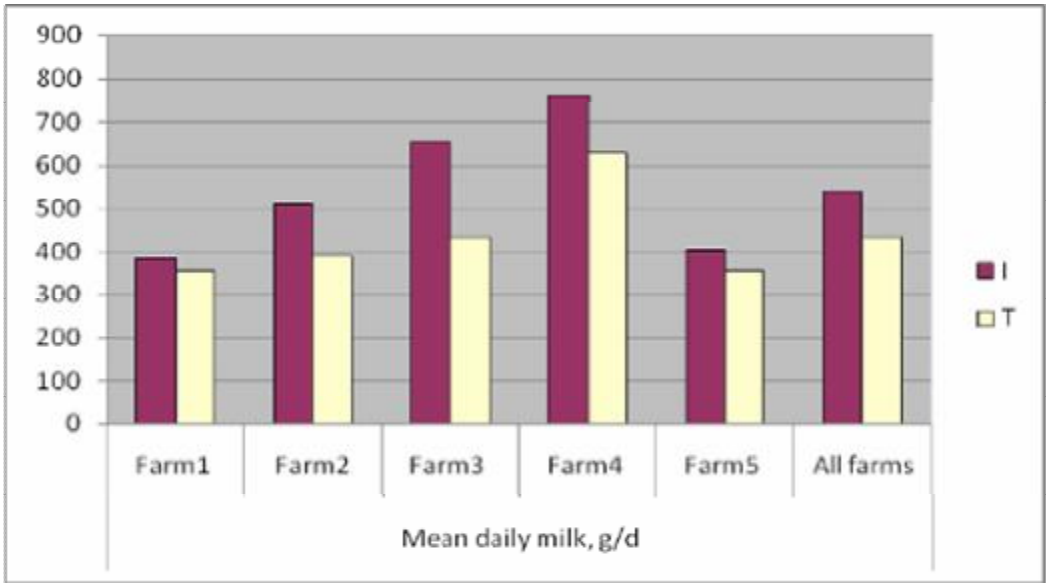

Figure 4.12. Effect of improved feeding on daily milk of Awassi ewes.
I: Improved treatment; T: Traditional treatment.

5. CONCLUSIONS AND RECOMENDATIONS

5.1. Conclusions

The following conclusions may be reached from the results of this study which tries to shed light on the extremely vital livestock production in Central Syria, namely Salamiyeh.

a-Sheep production is the most important livestock production activity and may be considered the most important portion of the annual income generated. Hence it may be regarded as the target for planning rural development in the area.

b-The production aspects of the sheep husbandry are fairly low mainly due to the genetic make-up of the Awassi sheep found in the area and the traditional management systems employed in the research area.

c-The improved management represented mainly by improved nutritional status significantly improves the body condition scores and also the liveweights of the ewes.

d- Lamb birth and weaning (60 days) weights were similar in the traditional and improved management groups mainly due to the fact that dams' milk constituted the main source of feed.

e-Milked yield after weaning was significantly increased by the improved management provided.

f-Rangelands are poor and need special management practices for increasing their productivity.

5.2. Recommendations

Sheep husbandry constitutes the majority of the income generated and also provides the most vital products for the household consumption, namely milk, yoghurt, cheese, butter, butterfat, ghee etc along with wool and manure as fertilizer

and fuel. Therefore the productivity, profitability and sustainability of this sector the following recommendations were suggested:

a- The flock sizes must be increased in order to use labor in a productive manner and at the same time increase total income of the farmers to meet their social, economical and cultural needs in the same manner as the developed countries.

b- The genetic aspects of the breeding stock must be urgently upgraded. For this purpose improved rams may be provided from the sheep research centers or imported from other countries.

c- The reproductive performance of the flocks must be improved using the already available techniques such as flushing, hormonal treatment for multiple ovulation, oestrus sychronization using exogenous hormones.

d- Lamb growth rates exhibit great variation and it is open to great successs in genetic selection. Lambs must be fattened using least cost rations.

e- Lactation performance of Awassi is extremely high and under good management conditions it is possible to get 100-150 kg/ewe. Ewe milk is extremely valuable and should be processed into very high quality products like Roquefort (French blue cheese from Lacaune sheep milk) cheese.

f- Cheap feed resources (fodder and concentrate) need to be introduced to the producers and promoted for supplementation during breeding season, lactation and lamb fattening.

g- Farmers require effective educational and training programs.

h- Transfer the tecnologies among farmers by establishing effective producers associations.

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CURRICULUM VITAE

He was born in Syria/ Salamieh, close to Hama province, in 15/06/1976. In 2001 I graduated with BSc certificate in Agricultural Science from the University of Albaath– Faculty of Agriculture. Later he was employed as head of agricultural extension unit, Hama Governorate, Ministry of Agriculture from 2001 to 2003. During that time he was responsible of planning and implementing of annual agricultural plans, while raising awareness amongst farmers regarding new techniques of agriculture and livestock activities. Since 2003 he has been working for Rural Support Program (RSP)\ Aga Khan Foundation (AKF) responsible from Livestock Project.

He is married and expecting a baby

APPENDIXES

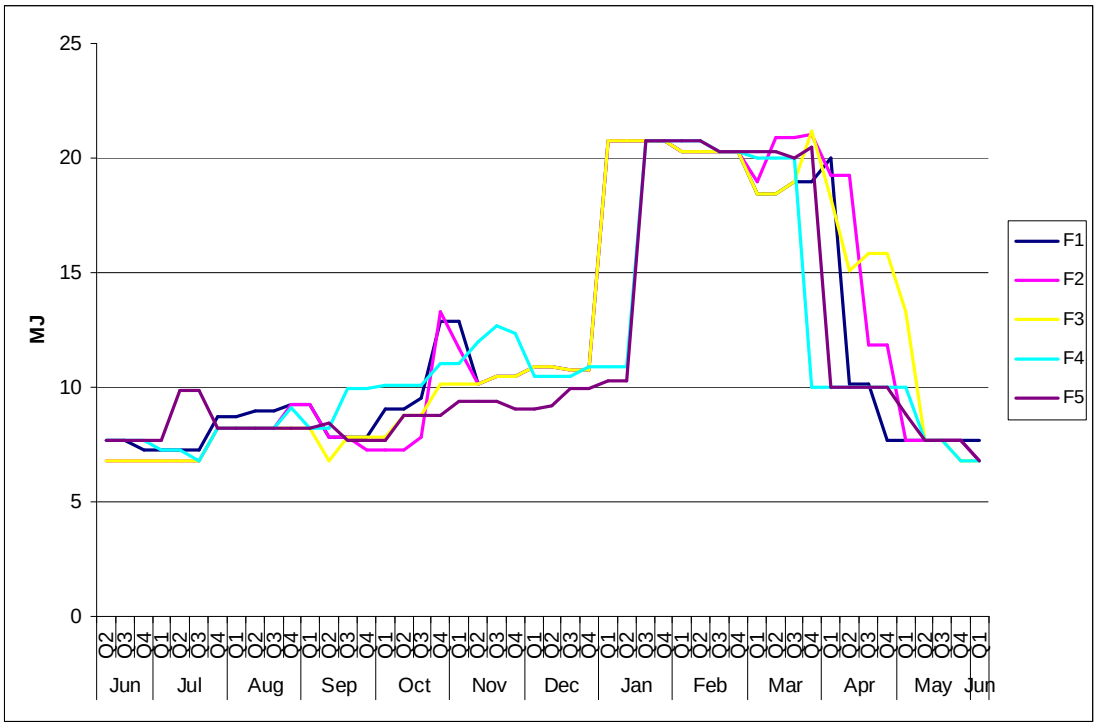
Appendix –Table 1. Dividing ewes into five groups

	Farmer				
Group	**F1**	**F2**	**F3**	**F4**	**F5**
1	22	10	9	5	15
2	9	17	11	7	8
3	12	14	13	11	14
4	7	17	7	14	7
5	10				16

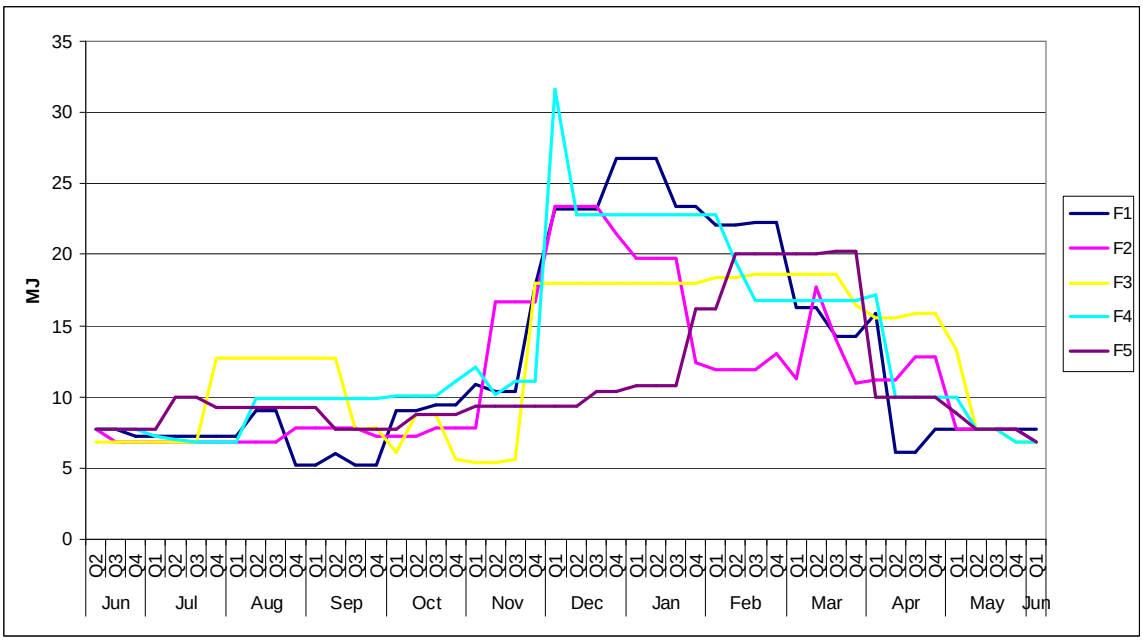
Appendix – Table 2. Laboratory analysis and calculated metabolisable energy (ME) content of dietaries ingredients

Feed	DM	OM	Ash	DOMD	ME	CP	ADF
	%	%	%	%	MJ/kg / DM	%	%
Barley grain	91.0	96.6	3.4	76.6	11.5	12.7	10.6
Cotton seed meal	94.5	95.0	5.0	48.3	7.2	27.7	34.2
Cotton seed hulls	91.4	96.6	3.4	20.6	3.1	8.3	61.5
Wheat bran	91.1	94.9	5.1	69.8	10.5	16.6	11.6
Molasses	80.5	85.1	14.9	80.0	12.0	10.5	0.0
Feed blocks for late gestation	95.4	80.0	20.0	51.3	7.7	14.9	21.3
Improved mixture for lactation without molasses	90.0	95.6	4.4	76.0	11.4	19.6	10.3
Improved mixture for lactation with molasses	95.3	92.4	7.6	78.5	11.8	16.9	6.3
Urea treated wheat straw	92.1	84.2	15.8	40.2	6.0	11.7	47.8
Traditional mixture for late gestation	94.2	91.9	8.1	65.4	9.8	15.6	22.4
Traditional mixture for lactation	90.2	95.7	4.3	77.0	11.6	15.3	9.7
Wheat Straw	93.0	85.0	15.0	30.7	4.6	5.0	48.9
Barley straw	93.1	84.9	15.1	37.3	5.6	6.2	41.2
Lentil straw	92.5	85.1	14.9	41.2	6.2	8.8	32.6

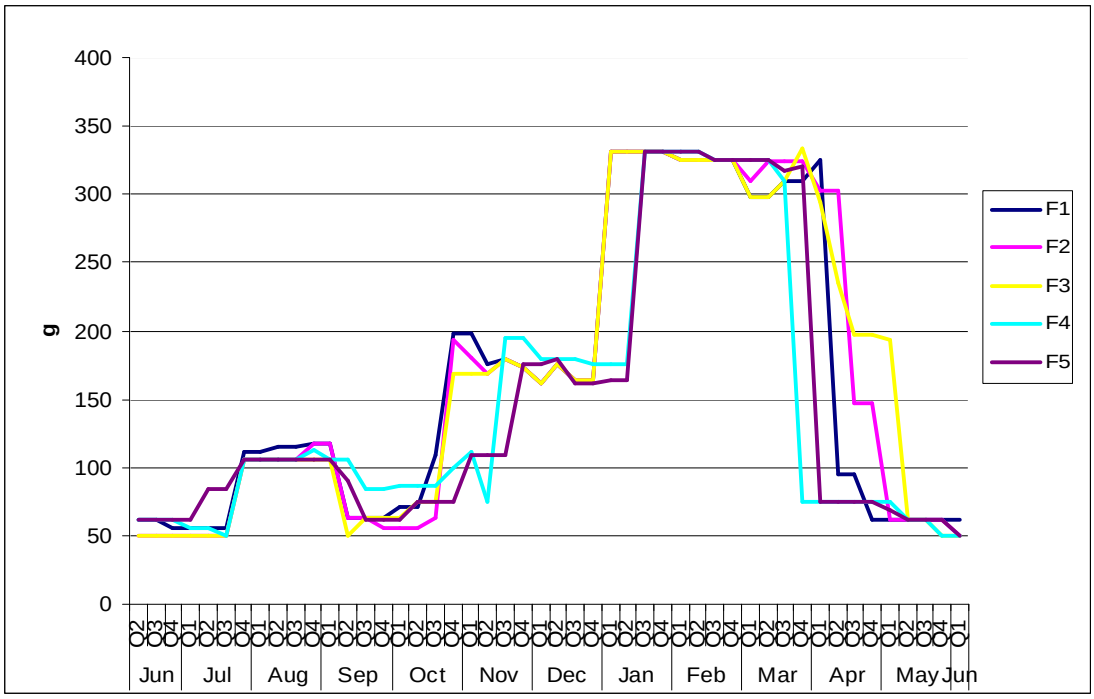
DM: Dry Matter content (%), OM: Organic Matter% , ASH:%, DOMD: Digestible Organic Matter in Dry Matter %, ME: Metabolisable Energy MJ/Kg/ DM, CP: Crude Protein%, ADF: Acid Detergent Fiber%



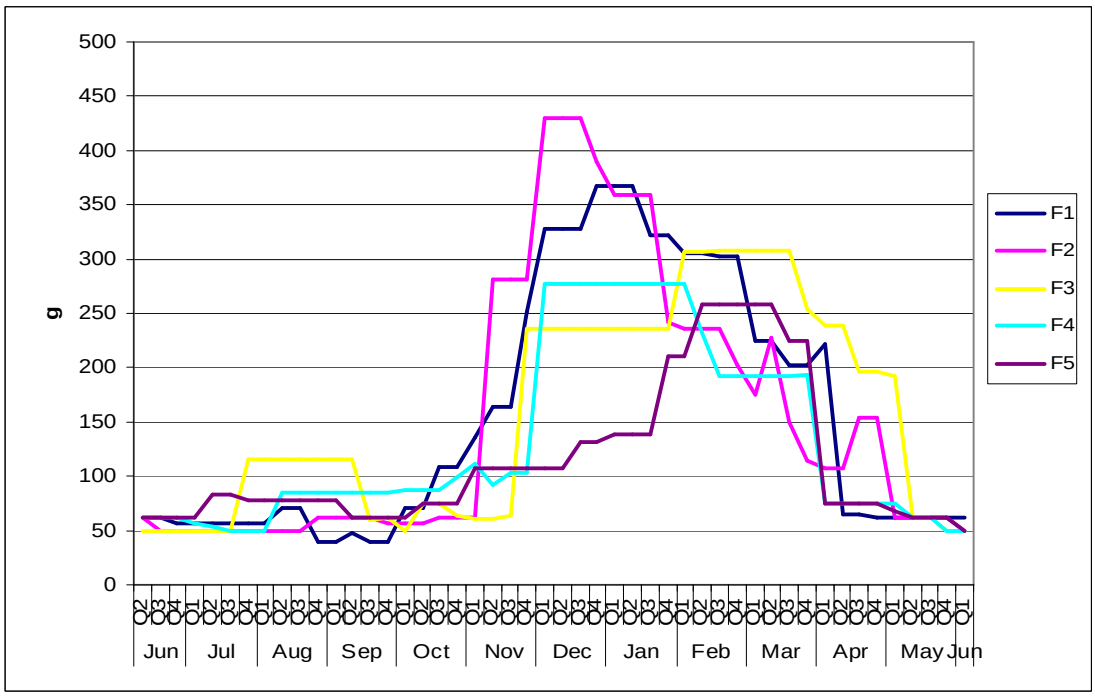
Appendix- Figure 1. Metabolisable energy intake in the improved treatment
F: farmer; Q: quarter



Appendix-Figure 2. Metabolisable energy intake in the traditional treatment
F: farmer; Q: quarter



Appendix- Figure 3. Crude protein intake in the improved treatment
F: farmer; Q: quarter



Appendix-Figure 4. Crude protein energy intake in the traditional treatment
F: farmer; Q: quarter

Appendix-Photo1. Ear-tagging with plastic tag.

Appendix-Photo 2 . Dividing the flock of each farm into two halves.

Appendix-Photo 3. Improved feeding practices applied to the ewes.

Appendix-Photo 4. Taking body measurements.


Appendix-Photo 5. Taking live weights and body condition scores of the ewes.

Appendix-Photo 6. Taking live weights of the lambs.

Appendix-Photo 7. Milk recording.

Brown and black (*zhama*) Brown (*Shakra*) Black (*Absa*)

Appendix- Photo 8. Head colors observed in Awassi sheep.

Appendix-Photo 9. A horned Awassi female.

Cylindrical udder, teats set high and horizontal

Cylindrical udder, teats set low and oblique

Pear- shaped udder, teats set low and horizontal

Udder with teats projecting downwards

Appendix-Photo 10. Udder shapes in Awassi sheep

Appendix-Photo 11. Breeding season of Awassi sheep

Appendix-Photo 12. New born Awassi lamb

Appendix-Photo 13. Suckling period of Awassi sheep.

Appendix-Photo 14. Lamb weaning and fattening.

Appendix-Photo15. Milking of Awassi ewes.

Appendix-Photo16. Preparing ewes for milking.

Appendix-Photo17. Marketing fresh milk by milk collectors.

Appendix-Photo18. A local sheep market in Central Syria.