ÇUKUROVA UNIVERSITY
INSTITUTE OF NATURAL AND APPLIED SCIENCE

MSc THESIS

Amin AL-JUNDI

MILK YIELD AND LAMB GROWTH OF SYRIAN-AWASSI SHEEP GRAZE ON CEREAL AND CEREAL-LEGUME MIXTURE FORAGES

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 23/03/2010.

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ABSTRACT

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The aim of this study was to evaluate the performance of Syrian Awassi sheep grazing in spring on improved forages (sole barley, barley-grasspea, barley-vetch, sole oat, oat-grasspea and oat-vetch). 30 Syrian Awassi lambs were used to evaluate the lamb growth, and 18 lactating ewes in the milk yield experiment. The experiment of lamb growth was conducted in participation with a farmer in Al-Barkum village (adjacent to ICARDA), while the experiment of milk yield was done in ICARDA station.

The forages dry matter yield (DMY) was significantly differed at ($P < 0.05$) among the treatments. The average dry matter yield was 3600 kg/ha. The average daily live-weight gain (ADG) of the lambs was 132 g/head/day. The total average of milk yield (MY) was 1110 g/head/day. Milk composition (MC) such as (Protein, Fat and Total solids) was significantly affected by treatments.

It was concluded that cereal-legume mixture forages do improves forage quantity and quality and could be used to cope the feeding gap in spring, and improve marginal income of poor farmers and livestock keepers.

Keywords: Dry Matter Yield (DMY), Average Daily Live-wieght Gain (ADG), Milk Yield (MY) and Milk Composition (MC).

ÖZ

YÜKSEK LİSANS TEZİ

BUĞGAYGİL VE BUĞDAYGİL-BAKLAGİL KARIŞIMI YEM BİTKİLERİNDE OTLATILAN SURİYE İVESİ KOYUNLARININ SÜT VERİMİ İLE KUZULARIN BÜYÜME PERFORMANSI

Amin AL-JUNDI

ÇUKUROVA ÜNİVERSİTESİ
FEN BİLİMLERİ ENSTİTÜSÜ
ZOOTEKNİ ANABİLİM DALI

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:Prof. Dr. Veyis TANSI

Bu çalışmada, ilkbaharda çeşitli yem bitkilerinde (arpa, arpa-mürdümük, arpa-fiğ; yulaf, yulaf-mürdümük, yulaf-fiğ) otlatılan Suriye İvesi koyunlarında büyüme ve süt verim performanslarının ortaya konulmasına çalışılmıştır. Büyüme performansı için 30 baş kuzu ve süt verimini saptanması için 18 baş koyun kullanılmıştır. Kuzu büyütme performansı çalışması Al-Barkum köyünde bir yetiştirici ile süt verimi çalışması ise ICARDA istasyonunda yapılmıştır.

Kaba yemlerdeki kuru madde oranı uygulamalar arasında istatistiki olarak farklılık göstermiştir ($P < 0.05$). Ortalama kuru madde üretimi 3600 kg/ha'dır. Kuzuların günlük canlı ağırlık artışı ortalaması 132 gram, koyun başına süt verimi ise ortalama 1110 g/gün olarak bulunmuştur. Farklı uygulamalar koyunların süt kompozisyonu üzerine istatistiki olarak etkili bulunmuştur.

Buğdaygil-baklagil karışımı yem bitkilerinde kalite ve kantitenin iyileştiği ve bu tip karışımlarla ilkbaharda otlatma yapılması, küçük ölçekteki yetiştiricilerin gelir seviyesini yükseltebilecektir.

Anahtar Kelimeler: Kuru madde, Günlük canlı ağırlık artışı, Süt verimi, Süt kompozisyonu.

To whom of which their picture will never be canceled from my heart/ My father and my two beloved brothers

To the ever spring of love/ my mother

To whom I share with them every little filling of love and life/ Mine and my wife family

To my partner in the sweetness and difficulties of the life/

My ever love Rihab

To the best gift we have received in our life/ The ever candles

Ali, Hanin and Farah.

To our honored Ethiopian daughter / Aster Jaber Sadik

To all those I exchange with them feelings of love and experience of enjoyable life/ My friends

FOREWORD

Sheep husbandry is the major family income for most of the Syrian bedouins and maybe more than 50 percent of the families income in the rural areas.

As a result of the growing demand for meat and milk, increased number of livestock are grown leading to an increased pressure on the feed resources

Performance of Awassi sheep, as well as the livestock in general, is completely affected by the feed resources and feeding management. The forage yield of the Syrian rangeland, cultivated fodder and crop residues in addition to imported fodders are still under the limits of demands of livestock production.

Small livestock producers may affected by poor grazing conditions than wealthy producers. The small livestock holders usually have little number of animals as a margin activity in their farms to provide daily supply of milk for the family use and maybe process the surplus production and sell them in the market.

Small livestock producers may improve their income from the little number of animals they have by improving grazing resources in terms of quantity and quality, such as planting mixture forages instead of monoculture plantation of cereals.

ACKNOLEDGMENT

I would like to express my deep grateful to the International Center for Agricultural Research in Dry Areas (ICARDA) and the University of Cukurova (Department of Animal Science) for giving me the opportunity to pursue my study towards the master degree.

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1. INTRODUCTION

Production of small ruminant has considerable significant economic and social value in West Asia and North Africa (WANA) countries. They are particularly important in the region's dry areas, where they are the main agricultural output and the most important source of livelihoods for the poor. Meanwhile the rapid human population growth has been a major factor in increasing demand for small ruminant production (Aw. Hassan et al., 2008). The increased number of livestock required increasing forage production quantity. In Syria, as in most regions of the Mediterranean Sea, winter is characterized by low and erratic rainfall. This makes year-round maintenance of pastures and production of forage crops for livestock both difficult and costly (Delogu et al., 2002). Moreover, in Syria, the rangeland (steppe) constitutes 55 % of the total land of the country where the major number of Awassi sheep are raised. Unfortunately the Syrian steppe contribution as source of free grazing has reduced dramatically over the past 30 years under the heavy grazing and shrubs uprooting for fire-wood. This has led to a sever shortage in feed resources.

To overcome the feed shortage, the problem was faced at three levels, which are: Farmers; Governmental and Agricultural research institutions.

Farmers in the marginal zone (<300 mm) has intensified barley plantation on annual or biannual bases with no consideration to the problem of soil fertility (Christiansen et al., 2000). The expansion in barley plantation was because it does not cost much and does not need much care, and in case it failed to give grain it can be rented as standing fodder for sheep raiser. Meanwhile, the area planted with other cereals such as the oat reduced due to low utilization of oat as fodder in animals feeding, even thought the oat is not of less important than barley in terms of forage production and nutritive value (AASA, 2007).

In another hand, the government has opened the gate for fodder importation through the General Establishment of Fodder (GEF), and the private sector. Meanwhile, national and resident international agricultural research centers such as the General Commission for Scientific Agricultural Research (GCSAR), and the International Center for Agricultural Research in Dry Areas (ICARDA), led research

trials to test the exiting fodder production system and/or to introduce new technologies and more productive and drought tolerant varieties.

Intercropping of legumes in the cereal production system, to capture the benefit of nitrogen fixation by legumes to improve soil fertility and cereals productivity, was one of the strategies to integrate livestock with forage crops farming system in marginal area in Syria. Legume forages can be planted as monoculture for grain and straw or in mixture for spring grazing or for hay production (Abd El Moneim et al., 1995). Karadag et al., (2003) reported that the forage quality of cereal hay is generally lower than that required to meet production goals for many livestock classes, thus the intercropping of legumes with cereals for forage production is an important practice showing several environmental benefits and higher nutritional value. In addition, Annual legumes and cereals such as common vetch, hairy vetch, grasspea, oat and barley are possibly the most viable fodder sources in this area (Lithourgidis et al., 2006; Tuna and Orak, 2007).

Since animal output (meat and milk) is considered as the most reliable means for determining the quality of forage crop (Mott and Moore, 1985), thus measuring yield of forages and studying the performance of animals grazing on these crops becoming essential. The objective of this study:

1. Compare forage yield of cereals as pure and in mixture with legumes.
2. Assess the growth rate of Syrian Awassi lambs grazing on cereal and mixture forages pasture.
3. Assess the milk yield of Syrian Awassi ewes grazing on cereal and mixture forages pasture.

2. LITERATURE REVIEW

2.1. Demand for Meat and Milk in Syria

The Syrian Arab Republic lies on the eastern cost of the Mediterranean Sea. It has border with Turkey from the north, Jordan and Palestine from the south, Iraq from the east and Lebanon and the Mediterranean Sea from the west. The climate is a Mediterranean type with rainy winter and dry and hot summer.

Syria has one of the highest growth rate populations among the developing countries. The population of Syria has increased between the years 1998 and 2007 from 15.5 million to more than 22.3 million, with growth rate of 3.4 % per year. This high growth rate of population has increased the demand for food products of plant and animal origin (grains, vegetables, fruits, meat, milk and eggs). Thus, there has been an expansion in land area planted and livestock numbers during the past decades. In the year 2007, it was estimated that 46.5 % of the total population leaves in the rural areas, and about 1 million are working in agriculture and forestry. Also it was estimated that the livestock production value constituted 40 % from the total value of the agriculture products (AASA, 2007).

Cattle, Awassi sheep and goat are the main sources for meat and milk. Awassi sheep constitute, almost, 90 % of the livestock population in Syria. The Awassi sheep population increased from 15.5 million in 1998 to over than 23 million in 2007. Figure 2.1, shows Awassi sheep percentage from the livestock national herd in 2007. Consequently, according to AASA (2007), it was estimated that, between 1998 and 2007, the Awassi sheep average percentage contribution in production of meat and milk was 75% and 33% respectively from the total livestock meat and milk production, Figure 2.2 and 2.3.

Awassi sheep meat is a major ingredient of the traditional Syrian cuisine, and because of its recognized quality, it is widely desired in the people of the Golf states (Kassem, 2005). Small quantity of the Awassi milk consumed locally as fresh and the rest are processed to dairy products such as yogurt (16%), cheese (22%), ghee (6%) and (8%) butter, (AASA, 2007).

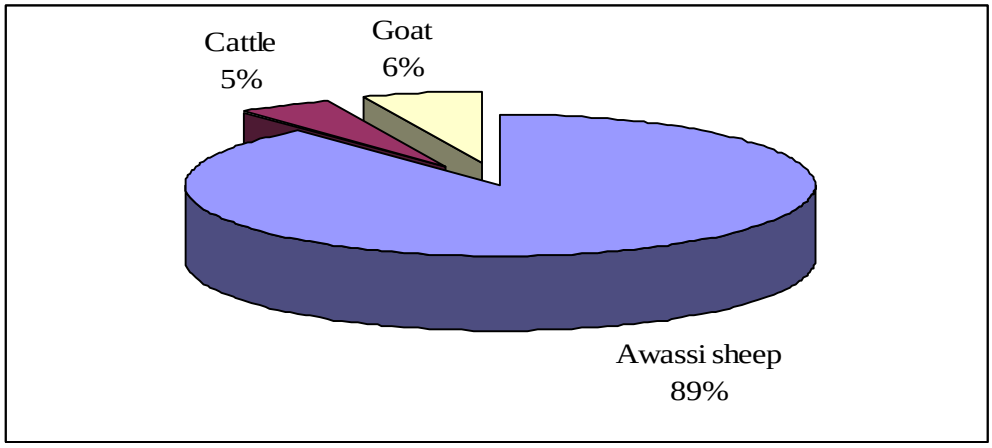


Figure 2.1. Livestock Number Percentage (1998-2007), (AASA, 2007).

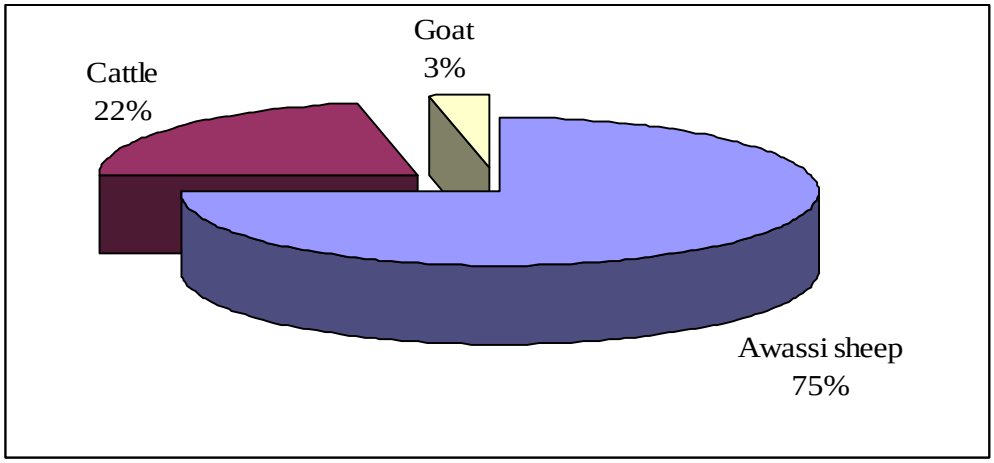


Figure 2.2. Livestock Meat Production Percentage (1998-2007), (AASA, 2007).

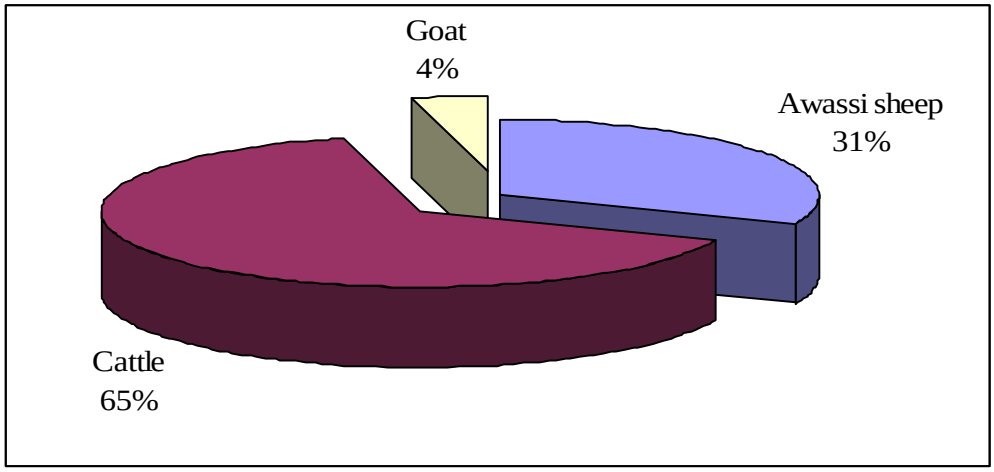


Figure 2.3. Livestock Milk Production Percentage (1998-2007), (AASA, 2007).

2.2. Awassi Sheep Production Systems in Syria

The Awassi sheep is the only sheep breed in Syria; it is grown under different systems and for different purposes. Based on feed resources and the nature of flock movement during the annual cycle, Kassem (2005) described the small ruminant production systems in Syria, that have been developed by shepherds through hundred of years, and distinguished the following systems.

2.2.1. Extensive Production System

This is the predominant production system because the majority of flocks live in limited-rainfall marginal areas. In summer and autumn, flocks move to cultivated areas to graze cereal stubble and irrigated crop residues. Flocks return to their home base once winter rain falls and pasture starts to grow in the steppe. In this system, flocks move over greater distances and to a larger number of locations during the annual feeding cycle than flocks in the semi-extensive system.

2.2.2. Semi-extensive Production System

In this system, flocks are kept in cultivated areas during winter months. However, in February the flocks must leave the cultivated areas for grazing areas in the steppe to avoid damaging the crops. Animals are moved back into cultivated areas upon crop harvest to graze cereal stubbles. By the end of summer, the flocks are moved back to their villages.

2.2.3. Intensive Production System

The intensive production system is mostly used for animals fattening. Under this system the animals are permanently confined in pens and feed supplementary fodders. Generally, the flocks are located in high-rainfall mixed farming areas where crop production is generally more important than animal production.

2.3. Livestock Feed Resources in Syria

2.3.1. Rangeland

In Syria, rangeland (steppe) constitutes 55 % of the total land of the country. It characterized with Mediterranean climate condition with low rainfall (< 200 mm) and high temperatures in summer accompanied with high evaporation rates causing salinity problems in the oasis lands. This climate condition supports a short season of natural vegetation during spring (March- April) providing some feed to the local Awassi herds. The Syrian steppe suffering accelerated desertification because of the over grazing, uprooting of perennial shrubs for firewood and the random movements of Bedouin trucks.

Previously, the ranges made a considerable contribution to feed supply, amounting up to 50% of the diet of sheep and goat, however, the progressive degradation and recurrent droughts has reduced this contribution to 20-25% of annual fodder needs (Kassem, 2005).

2.3.2. Cultivated Forages

2.3.2.1. Monoculture Forages

In Syria, forage production is less than livestock needs. Barley constitutes the major supplementary feedstuff for livestock production in Syria. It is produced as rainfed crop (> 97%), in areas receive less than 300 mm rainfall. The other cereal fodder crop, but of less importance is oat. Oat is produced as rainfed crop in the costal area, with rainfall > 400 mm, for green grazing. Between 1998 and 2007, the average area planted with barley was about 1.3 million hectares, while areas planted with oat declined from 325 to 1 hectare, Figure 2.4.

In Syria, cereals are sown in autumn (October- November) and harvested in summer (June- July), and under irrigation condition, livestock keepers may plant barley as early as August to be grazed until early spring, then fertilized, irrigated and

left for grain production. Maize also planted as summer irrigated fodder crop, and grains are used mainly for poultry feed production, while the plants residues are grazed by cattle and sheep after harvesting.

In another hand, legume forages are produced in less quantity and used as supplementary feeding for livestock. Grasspea is planted in more than 99% under rainfed conditions for grain and straw production, while only 60% of common vetch is planted under rainfed conditions. Between 1998 and 2007, the average area planted with grasspea, common vetch and bitter vetch was 15000, 14000 and 8500 hectares respectively with average grain yield of 750, 750 and 450 kg/ha of the same order (AASA, 2007), Figure 2.5. When these crops fail to give good grain yield, it is usually utilized for grazing animals. Other legumes such as and alfalfa and clover are planted, with irrigation, in limited areas for cattle grazing.

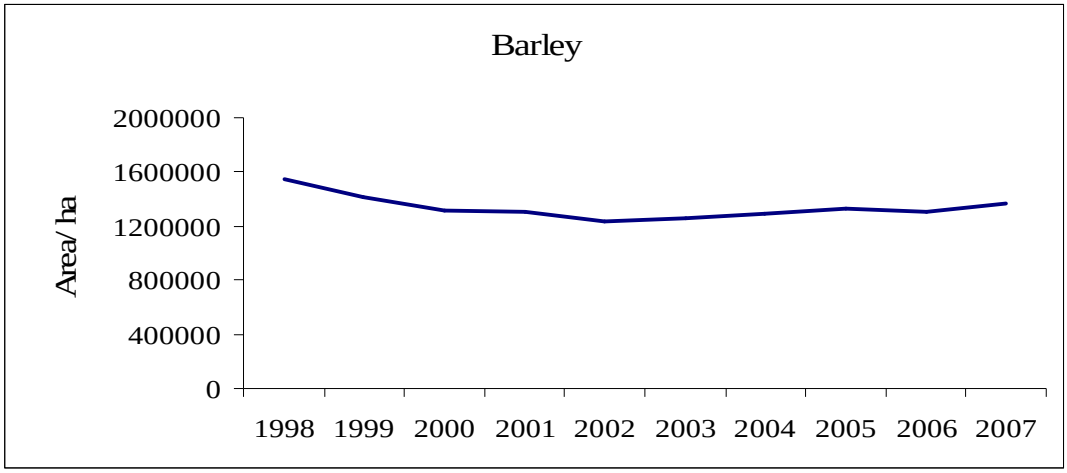
2.3.2.2. Mixture Forages

In Syria, planting of mixture forages is not mentioned in the annual agricultural plan of the Ministry of Agriculture and Agrarian Reform (MAAR), thus there is no official document that defines the exact area planted with mixture forages.

The expansion in mixture forages cultivation was introduced in large scale by some research projects which were implemented by ICARDA in northern part of Syria since 1980's (Tully et al., 1985). Medic, vetches and grasspea were the most legumes that have been introduced in rotation or in mixture with barley to gain the benefits of legumes fixation of the atmospheric nitrogen and thus help to improve soil fertility.

2.3.2.3. Stubbles and Crop Residues

Stubbles, crops residues and agricultural byproducts are becoming an important feedstuff sources. Market for crop residues are developing and provide about 40% of all small ruminant feed, while feed grains and other concentrates provide about 40% of small ruminant diets (Nordblom and Shomo, 1995).



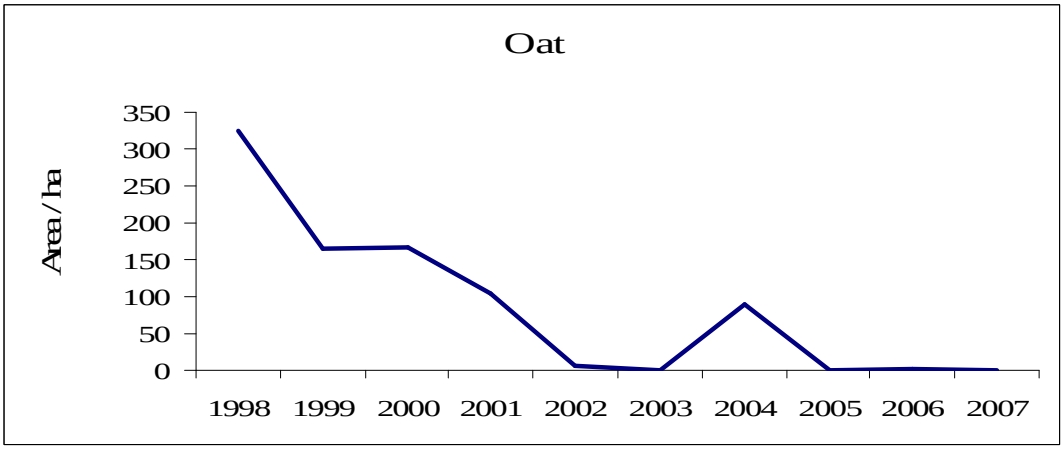


Figure 2.4. Barley and Oat Plantation Area (ha), (AASA, 2007).

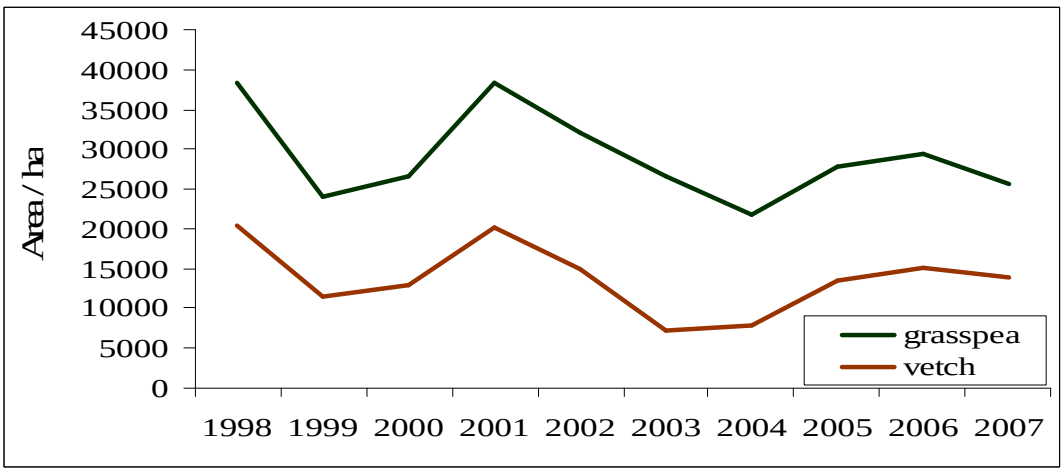


Figure 2.5. Vetch and Grasspea Plantation Area (ha), (AASA, 2007).

2.4. Forage Yield

Generally, crop productivity varies according to cultivars, weather condition, plant management and utilization. Under Mediterranean condition, barley, oat, wheat and triticale of cereals and vetch and grasspea of legumes are the most forage crops produced as monoculture or in mixture to support small ruminant production, (Thomson et al., 1990; Thompson et al., 1992 and Anil et al., 1998).

2.4.1. Monoculture Crops

Barley, as a major fodder crop in Syria, has received comprehensive studies on its yield under different management systems. Yau et al., (1989) studied the effects of green stage grazing on rainfed barley in northern Syria (yield and economic returns) and they have found, in five years of the experiment period, that the forage yield was higher in Tel-Hadya, with average rainfall of 325 mm, than in Breda, with average rainfall of 275 mm. Also the yield was affected by the management and grazing reduced the biological yield in both sites, but reduction was higher in Breda (drier area) than in Tel-Hadya (wettest). Generally, grazing has reduced both grain and straw yield, but increased the net revenue which was higher in Breda than in Tel-Hadya. Effect of management on the barley yield was also the subject of 7 years study by Christiansen et al., (2000), whom conducted on-farm trials with forage legume-barley compared with fallow-barley rotations and continuous barley in north-west Syria. It was concluded that introducing common vetch and chickling had made a significant increase in dry matter yield in barley in comparison to barley-fallow or continues barley plantation, (as a result of improving soil fertility by legumes), and barley-fallow gave better forage yield than the continues barley.

Growing cereals for fodder and spring grazing is very common practice in the Mediterranean region (Delogu et al., 2002). El-Shatnawi et al., (2003) studied the defoliation of wall barley under sub-humid Mediterranean conditions. The barley was clipped in two weeks interval starting in 28 February until May. It was found

that clipping plants on 28 February and 15 March produced shorter plants but encouraged tillering, and clipping plants on 15 March and 15 April inhibited seed production. The researchers concluded that defoliation during the early vegetative stage optimized seed yield and forage quality and quantity. Recently, Francia et al., (2006) studied the influence of different management systems (dual-purpose with one and two grazing, soft-dough harvest for silage, full maturity grain only) on grain yield, forage and whole plant production, and on quality-related traits of barley and oat. It was found that barley reacted positively to the dual purpose systems (one and two grazing) and had higher production of total biomass than oat.

In another hand, Thomson et al., (1990) studied the nutritive value and yield of some forage legumes and barley harvested as immature herbage, hay and straw in north-west Syria. The forages were measured for dry matter yield, voluntary feed intake and digestibility. It was conclude that the digestibility and voluntary feed intake of barley was lower than that of legume forages, especially at the immature stage. Again, Thomson et al., (1992) conducted on farm trial for seven years to investigate the use of land left fallow after a barley crop to grow feed legumes for small ruminants, and common vetch, forage pea and common grasspea were grown. It was found that barley yields were higher after legume than after fallow, and common vetches yielded more herbage than grasspea, while animals preferred grasspea on common vetch at grazing.

Studying the agronomic potential of five grasspea (Lathyrus sativus L.) lines produced in ICARDA with five local varieties under rainfed condition in semi-arid region of Turkey, Karadag et al., (2004) reported that there were a significant differences between varieties, and that the average dry matter yield affected by years (climate condition) and it varied between 1775 to 4852 kg/ ha^{-1} in 2002 (average rainfall 399 mm) versus 968 to 1685 kg/ ha^{-1} in 2003 (average rainfall 223 mm), also he reported that dry matter yield varied between 1596 kg/ ha^{-1} from the local variety azureus to 3269 kg/ ha^{-1} from ICARDA variety 452.

2.4.2. Mixture Forages

Intercropping legumes with cereals or grasses for forage production is an important and well-established practice in some countries of the Mediterranean basin (Lithourgidis et al., 2006). Furthermore, choice of cereal species affects the performance of intercrops grown for forage, while the choice of a legume species and compatible plant densities are very important for high forage yields and quality in intercrops with cereals (Jedel et al., 1993, Altinok et al., 1997).

Lithourgidis et al., (2006) experimented common vetch with oat and triticale at two seeding ratios, (55:45 and 65:35), and found that oat and triticale monocultures as well as both common vetch-oat mixture provided greater forage yield than mixture of common vetch with triticale and monoculture common vetch and both mixtures of common vetch with oat, produced about 34 and 29% respectively more forage yield than the monoculture common vetch, but about 18 and 21% respectively less than the monoculture oat. In another study for Lithourgidis et al., (2007), yields, quality and the growth rate of sole crops of common vetch, barley and winter wheat, and intercrops of common vetch with barley and winter wheat using seeding ratios of 55:45 and 65:35 was studied. It was found that the greatest dry matter yields were obtained with wheat and barley sole crops, while the lowest yield was obtained with common vetch sole crop. The intercrops produced about 13-30% more dry matter than the common vetch sole crop, but 12-23% less than cereal sole crops. In similar study, Dhima et al., (2007) studied the competition indices of common vetch and cereal intercrops in two seeding ratio, where they used wheat, barley, oat and triticale in two seeding rates with common vetch, and crops were measured for the land equivalent ratio (LER), relative crowding coefficient (RCC), aggressivity (A), competitive ratio (CR), actual yield loss (AYL) and intercropping advantages (IA). It was concluded that the LER, and RCC values of were greater for the common vetch-wheat (55:45) and the common vetch-oat (65:35), and the A, CR and AYL values were grated for barley and oat than for triticale and wheat. These findings indicated that barley and oat were more competitive partners than wheat and triticale as common vetch was affected more in

mixture with these two crops.

The role of intercropping on yield potential of common vetch with oat cultivated in pure stand and mixtures was the study subject of Tuna and Orak (2007). It was found that highest plant of oat (112.7 and 129 cm) in the years 2000 and 2001 respectively, was obtained from the pure stands of oat while the lowest plant height (118.2 cm) and (122.7 cm) were from the 25% vetch + 75% oat mixture in the first and second years respectively. Also it was found that herbage and dry matter yields of mixture were more productive than pure vetch sowing and it decreased with the increase of legumes in the mixture. More recently, Yolcu et al., (2009) did a study to evaluate yield and quality of annual legumes (grasspea and common vetch) and barley as sole crops and in intercrop in spring frost condition for animal feeding. It was found that the legumes especially injured by frost in 2007, and a significant differences in dry matter yield, forage quality, dry matter intake and digestible dry matter were found between all plants. The highest dry matter yield was found in sole common vetch, sole grasspea and sole barley in the first year (586.8 mm rainfall) with values of 2899.7, 2887.0 and 2733.0 kg/ ha^{-1} respectively. In the second year (493.9 mm rainfall) and because of frost the legumes were injured, and the intercrop, barley, sole grasspea, sole common vetch and common vetch-barley yielded 2361.2, 2161.6, 1166.1, 367.9 and 199.7 kg/ ha^{-1} of dry matter respectively. Regarding forage quality, sole common vetch and sole barley had good properties in dry matter yield, and crude protein, while sole grasspea, common vetch-barley, sole common vetch and intercrops showed good quality properties in dry matter intake and digestible dry matter. It was also reported that the dry matter yield was affected by the rainfall quantity and showed lower yield under lower rainfall condition.

2.5. Awassi Sheep Performance

2.5.1. Awassi Breed

The Awassi sheep is the most numerous and widespread breed in south-west Asia. It is the only sheep breed in Syrian Arab Republic and the dominant type in

Iraq, the most important sheep and the only indigenous breed of sheep in Lebanon and Jordan. In the north of the Kingdom of Saudi Arabia, it is bred under desert conditions (Kridli et al., 2007). In Turkey, the Awassi sheep makes up one percent of sheep herd number (Epstein 1982).

Syrian Awassi is a fat tail sheep breed with face and legs are either brown or black or mixed color. Males have wrinkled and curved horns (25-60 cm), while females are polled. The body is somewhat long, and udder is moderate size and rarely pendulous with teats varied extremely in size and orientation. Animal's weight varies from 42 to 56 kg in ewes and from 64 to 85 kg in rams. Fertility in Awassi breed ranges from 80 to 85%. Generally, it is well adapted to the harsh environment and dry–hot condition of the Mediterranean (Kassem, 2005).

2.5.2. Awassi Lamb Growth

The Awassi sheep mate primarily during the period of May–July, produce about 1.05 lambs per ewe under extensive conditions (Epstein, 1985).

Awassi lambs show a great variation in bodyweight gain and average daily weight gain according to age and nutrition status. Under on-farm condition, Christiansen et al., (2000) found that lambs grazed on forage legumes (Vetch and Grasspea), have averaged 186 g daily live-weight gain per lamb. In another experiment conducted in ICARDA station in 2005 and 2006, Larbi et al., (2008) reported that the average daily weight gain of Awassi lambs grazed on three vetch species graduated from 116 to 159 g/head. In another hand, Iniguez et al., (2007) conducted a grazing trial to compare on farm fattening performance of two Awassi genotypes: pure Syrian Awassi and crossbreed lambs (first generation crossbreed with Turkish sires and Syrian dams), the lambs fed on three diets (grazing green barley supplemented with an expensive concentrate for control and another two diets: Semi-intensive feeding based on vetch grazing with minor supplementation with a low cost diet; and intensive feeding based exclusively on feeding with the low-cost concentrate used in the semi-intensive diet) and they reported that the average daily weight gain of Syrian Awassi lambs was 305 g/day versus 316 g/day for the

crossbreed lambs. Kassem (2005) reported that, under intensive breeding condition, in the Awassi Sheep Genetic Improvement Center (Syria- Salamieh), male lambs grew most quickly between 90 and 150 days old, attaining growth rate of 262-277 g/day, but females achieved their maximum growth rate 229 g/day when they averaged 60-90 days old, meanwhile under settled (semi-extensive) and nomadic system (extensive), the growth rate of Awassi lambs (from birth to 60 days age) recorded 233.5 and 204.2 g/day, respectively.

2.5.3. Awassi Milk Yield

Farmers in Syria, as in the rest of WANA countries, wean their lambs at about 90 days (usually during March and April). Before weaning, ewes are milked once a day to obtain any residual milk, while after weaning the ewes are milked twice a day until the ewe's milk dries up naturally (usually during June and July), (Nefzaoui et al., 2008)

Epstein (1985) reported that Awassi ewes produce 40–60 kg of milk per 150 day lactation under extensive conditions, while Kassem (2005) reported that the Awassi ewe’s milk yield under extensive production systems averaged 60-70 kg per lactation, a figure which includes both surplus milk obtained during suckling until weaning, and milk obtained after weaning. In the Al-Kraim, Agricultural Research Center, in 1996, the milk yield (includes suckling milk) has averaged 134 kg over 153 days of lactation, in the meat line ewes contrasting with 237 kg over 171 day of the milk line. Production until weaning (at 60 days), and from weaning to end of lactation was 67 and 170 kg in the milk line versus to 57 and 76 kg in the meat line. In the study it was also found that milk yield increased progressively and significantly until five year of ewe's age, at which point it start to decline. Thomson et al., (1992) reported that daily milk yield of ewes grazing vetch, grasspea and common grazing were 526- 543 g/ head.

2.5.4. Awassi Milk Composition

Lactation curves, in yield and milk composition, are mainly conditioned by several factors including breed, stage of lactation, milking system and feeding in sheep (Bocquier and Caja, 1993), as well as in other dairy ruminants. Moreover, milk yield and milk composition (fat, protein, casein and serum proteins, but not lactose) are negatively correlated in sheep (Fuertes et al., 1998).

As ewe's milk is mostly transformed into cheese, its quality is mainly comprised in fat and protein concentrations, as they are valuable routine parameters to predict cheese yield (Pellegrini et al., 1997). With regard to ewe's milk composition, the lowest values in fat, protein and casein are observed during the "suckling and milking" period or immediately after weaning, rising with stage of lactation afterwards (Gargouri et al., 1993).

Level of nutrition, mainly referred to energy level or level of feed intake, is a main factor affecting milk yield and milk composition in dairy ruminants. Milk fat content is negatively correlated to energy balance, while milk protein content is positively correlated and shows a lower and flatter slope. Also effect of concentrate is positively associated to the energy level of the diet as a result of its high digestibility and energy density (Bocquier and Caja, 1993).

According to Fadel et al., (1989) the milk of Syrian Awassi ewes contains an average percent of 6.8 fat, 17.8 solid not fat and 5.26 protein percent, while Karam et al., (1971) reported 5.58, 10.92 and 19.41 as an average percent of fat, solids not fat and total solids for Iraqi Awassi. Uraz (1983) reported average percent of 6.6 fat, 11.6 solid- non- fat and 5.7 protein and 5.0 lactose for Turkish Awassi genotype.

3. MATERIAL and METHODS

3.1. Experiment 1

3.1.1. Awassi Lambs Performance

3.1.2. Site and Date

3.1.2.1. Site Description

The experiment was conducted (on farm) in Al-Barkum village in participation with local farmer. The farm locates to the north-east of ICARDA station, 30 Km south of Aleppo city in northern Syria. The farmer uses the land to grow barley every year. The land at the experimental site is gently slopped; the soil is radish, deep but moderately covered with small size gravels on the surface. The climate is a Mediterranean type with rainy winter and hot dry summer. The rainfall season started in September 2008 and finished in May 2009, and the rainfall in the area was 290 mm according to the closest metrological station of ICARDA.

3.1.2.2. Treatments

To compare lambs performance on cereals as pure stand and in mixture with legumes, six treatments were tested:

1. Pure barley
2. Barley with grasspea
3. Barley with common vetch
4. Pure oat
5. Oat with grasspea
6. Oat with common vetch

All seeds used were of ICARDA station production. Every treatment was replicated two times on 150 m^2 plot area.

3.1.2.3. Planting Management

In November 2008, seeding machine with ducks-foot cultivators was used to sow the seeds at 15-20 cm depth. Seeding rate was 120 kg/ha and cereal to legume ratio was 50:50.

3.1.2.4. Animals Management

A total of 30 weaned Awassi lambs were used in the experiment. The lambs were purchased from the animal local market of Aleppo on 4/4/2009. The lambs were housed for in a pen belongs to the farmer, and vaccinated for enterotoxaemia and treated with antibiotic and subcutaneous injected for internal and external parasites.

A day before grazing started the 30 lambs were allocated to the treatments, as of 5 lambs per treatment, (the average initial weight of lambs groups were organized to be equal among plots, as much as possible), then, lambs were marked and tagged in their ears according to their treatments and reps distribution.

Lambs were grazing in plots for 12 hours, between 06:00 am and 06:00 pm, with free access to water, and when coming back to the pen, all lambs were fed with supplementary diet of about 250 g/head. The grazing lasted for 28 days between April 6^{th} 2009 and May 4^{th} 2009.

3.1.2.5. Data Collection

3.1.2.5.(1). Forage Yield

Quadrate of 0.25 m^2 was used for forage production measurements. Three harvesting were done at before, during and after grazing. At each harvesting, five quadrates were clipped in each plot and were collected in material sac, and then they were dried in oven-drying for 48 hours at 65 °C for determining the dry matter (DM) concentration.

3.1.2.5.(2). Sward Height

Forage height was measured at each time the clipping was done. The height of cereal plants in the quadrate were measured using 1 cm intervals graded meter.

3.1.2.5.(3). Animals Live-Weight

Live-weight of the lambs was measured on weekly basis from the start of grazing. Lambs average daily live-weight gain (AVDG) was determined using the formula: AVDG (g/head/day) = $(W_f - W_0)$ x 1000 / n , where W_f refers to the final weight of the lambs, W_0 refers to the lambs weight at start of the trial and n refers to the total number of grazing days between the two weights. The lambs total weight gain (WG/kg) was calculated by subtracting initial weight from final weight.

3.1.3. Statistical Analysis

Data were analyzed using GenStat program, Release 11.1. General Analysis of Variance was used to test statistical significance of treatments effect.
Forage yield and height were analyzed as a Completely Randomized Plot Design with 6 treatments and 2 replicates.

For lamb's growth analysis, lambs were used as replicates and forage composition as treatments. Means of sward height forage yield and lambs live-weight in the grazing period were separated using Duncan method (LSR) at 0.05 level of probability.

3.2. Experiment 2

3.2.1. Milk Yield of Awassi Sheep

3.2.2. Site and Date

3.2.2.1. Site Description

The experiment was conducted at ICARDA's research station at Tel- Hadya, (35° 55' N; 36°55' E, altitude 362 m), 35 km south of Aleppo in northwest Syria. The climate is a Mediterranean type with rainy winter and hot dry summer. The first rainy day was recorded on 22 August 2008, while last rainy day was recorded on 20 May 2009. Total precipitation received was 290.5 mm distributed on 80 rainy days in 9 months. Maximum rainfall (84.3 mm) was recorded in February 2009 while the lowest rainfall (4.0 mm) was recorded in May 2009, (Appendix 1).

3.2.2.2. Treatments

Three treatments were used: (1) Pure barley; (2) Barley with grasspea; and (3) Barley with common vetch. Each treatment was replicated three times with grazing plot size of 300 m^2. All seeds used were of ICARDA station production.

3.2.2.3. Planting Management

In November 2008, seeding machine with ducks-foot cultivators was used to sow the seeds at 15-20 cm depth. Seeding rate was 120 kg/ha and cereal to legume ratio was 50:50.

3.2.2.4. Animals Management

A total of 18 lactating Awassi ewes (after lambs weaning at 60 days old) were used in the experiment. The ewes were from ICARDA sheep flock.

Before experiment started, the ewes were vaccinated for enterotoxaemia and bastiorellus. Ewes were distributed as of 6 ewes per treatment.

Ewes were entered to plots after morning milking (06:00 am) and stay grazing until evening milking (04:00 pm). The ewes were milked by hand and milk yield was recorded at time. Before evening milking the ewes were feed with 0.5 kg of concentrate per head, (Appendix 2). The grazing period lasted for 30 days between April 4th 2009 and May 2nd 2009.

3.2.2.5. Data Collection

3.2.2.5.(1). Forage Yield

Quadrate of 0.25 m^2 was used for forage production measurements. Three harvesting were done at before, during and after grazing. At each harvesting, five quadrates were clipped in each plot and were collected in material sac, and then they were dried in oven-drying for 48 hours at 65 °C for determining the dry matter (DM) concentration.

3.2.2.5.(2). Sward Height

Forage height was measured at each time the clipping was done. The highest cereal plants in the quadrate were measured using 1 cm intervals graded meter.

3.2.2.5.(3). Animals Live-Weight

Live-weight of the ewes was measured on weekly basis from the start of grazing. The ewes total weight gain (WG/kg) was calculated by subtracting initial weight from final weight.

3.2.3. Statistical Analysis

Data were analyzed using GenStat program, Release 11.1. General Analysis of Variance was used to test statistical significance of treatments effect.

Forage yield and height were analyzed as a Completely Randomized Plot Design, with 3 treatments and 3 replicates.

For ewes body weight growth, ewes were used as replicates and forage composition as treatments. Means of sward height forage yield and ewes live-weight in the grazing period were separated using Duncan method (LSR) at 0.05 level of probability.

4. RESULT and DISCUSSION

4.1. Result

4.1.1. Forage Yield

4.1.1.1. Forage Yield in Experiment 1

The dry matter yield (DM) of the pure cereal and cereal-legume mixture were significantly different ($P < 0.05$) among grazing period. The highest dry matter yield 4510 kg/ha was obtained from the pure barley (BB) treatment, and the lowest dry matter yield 2214 kg/ha was obtained from the oat-vetch (OV) mixture, (Table 4.1).

Ranking between 4510 and 3843 (kg DM/ ha), no significant difference was recorded in forage yield among the pure barley (BB), barley- grasspea (BG) and barley- vetch (BV) treatments, while ranking between 3408 and 2579 (kg DM/ ha) a significant difference in forage yield was found between pure oat (OO) and oat-grasspea (OG) with oat- vetch (OV) treatments. Also ranking between 3941 and 3320 (kg DM/ ha), no significant difference were found in forage yield between pure barley (BB), barley– vetch (BV), pure oat (OO) and oat- greasspea (OG).

Table 4.1. Forage-on-Offer at Al-Barkum, northwest Syria.

Treatment	n	Forage-On-Offer (kg DM/ ha)			Mean
		4/4/2009	19/4/2009	7/5/2009	
BB	5	3400 a	6584 a	3547 a	4510 a
BG	5	3142 a	5391 ab	3290 a	3941 ab
BV	5	2975 ab	5302 ab	3250 a	3843 ab
OO	5	2488 bc	4765 bc	2971 a	3408 b
OG	5	2795 ab	4646 bc	2519 a	3320 b
OV	5	1891 c	3633 c	2214 a	2579 c

Means in columns, with different letters, differ significantly at ($p<0.05$).
Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch, (OO) Pure oat, (OG) oat- grasspea and (OV) oat- vetch.

4.1.1.2. Forage Yield in Experiment 2

The dry matter yield of the pure barley and barley-legume mixture were not significantly different among grazing period (Table 4. 2).

The highest dry matter yield 4815 kg DM/ ha was obtained from the barley-vetch (BV) treatment, and the lowest dry matter yield 4687 kg DM/ ha was obtained from the pure barley (BB) treatment.

Table 4.2. Forage-on-Offer at Tel- Hadya, northwest Syria.

Treatment	n	Forage-On-Offer (kg DM/ ha)			Mean
		30/3/2009	19/4/2009	6/5/2009	
BB	6	3693 a	5424 a	4943 a	4687 a
BG	6	3770 a	5630 a	4913 a	4771 a
BV	6	3609 a	6166 a	4670 a	4815 a

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.2. Sward Height

4.1.2.1. Sward Height in Experiment 1

The highest sward height 70.1 cm was obtained from the barley-vetch (BV) treatment, and the lowest 48.4 cm was obtained from the oat-vetch (OV) treatment.

The sward height of the barley and barley- legumes mixture were significantly different ($p<0.05$) from those of oat and oat- legumes mixture among grazing period, (Table 4. 3).

No significant difference of sward height was found among the pure barley (BB), barley- grasspea (BG) and barley- vetch (BV) treatments. Also no significant difference of sward height was found among the pure oat (OO), oat- grasspea (OG) and oat- vetch (OV) treatments.

Table 4.3. Sward height at Al-Barkum, northwest Syria.

Treatment	n	Sward height (cm)			Mean
		4/4/2009	19/4/2009	7/5/2009	
BB	5	76.40 a	88.3 a	44.7 a	69.8 a
BG	5	71.90 ab	85.4 a	36.6 a	64.6 ab
BV	5	69.50 ab	84.4 a	56.4 a	70.1 a
OO	5	60.60 bc	65.3 b	44.6 a	56.8 bc
OG	5	61.70 abc	65.0 b	39.4 a	55.4 c
OV	5	52.40 c	56.1 b	36.7 a	48.4 c

Means in columns, with different letters, differ significantly at ($p<0.05$).
Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch, (OO) Pure oat, (OG) oat- grasspea and (OV) oat- vetch.

4.1.2.2. Sward Height in Experiment 2

The highest sward height 80.2 cm was recorded from the pure barley (BB) treatment and the lowest 74.9 cm was recorded from the barley-grasspea (BG) treatment, (Table 4.4). No significant differences were recorded between the treatments means.

Table 4.4. Sward height at Tel-Hadya, northwest Syria.

Treatment	n	Sward height (cm)			Mean
		30/3/2009	19/4/2009	6/5/2009	
BB	6	81.27 a	88.07 a	71.33 a	80.22 a
BG	6	84.93 a	81.27 a	58.53 c	74.91 a
BV	6	84.84 a	85.87 a	63.13 b	77.89 a

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch, (OO) Pure oat, (OG) oat- grasspea and (OV) oat- vetch.

4.1.3. Animal Performance

4.1.3.1. Lambs Growth

The changes in live weight of lambs are presented in appendix 3. The initial average weight of lambs at start of the experiment was about 25 kg per lamb while the final average weight was about 28.7 kg, which means that the lambs have gained an average weight gain of 3.7 kg/head.

During the 28 days grazing period the lambs average weight gain graduated from 2.76 kg for the lambs grazed on barley-vetch (BV) treatment to 5.46 kg for the lambs grazed on pure oat (OO) treatment.

The best weight gain 1.78 kg was recorded during the second week, while the lowest weight gain 0.08 kg was recorded during the first week, (Table 4.5). No significant difference was recorded between lambs weight means.

Table 4.5. Weight gain of Awassi lambs, Al-Barkum, northwest Syria.

Treatment	n	Weight gain (kg/head)				
		Week 1	Week 2	Week 3	Week 4	General
BB	5	1.12 a	1.24 a	0.42 a	0.24 a	3.02 a
BG	5	0.66 a	1.52 a	0.82 a	0.38 a	3.38 a
BV	5	0.08 a	1.20 a	0.34 a	1.14 a	2.76 a
OO	5	1.38 a	1.78 a	1.12 a	1.18 a	5.46 a
OG	5	1.36 a	0.98 a	0.74 a	0.64 a	3.72 a
OV	5	1.20 a	0.66 a	1.00 a	0.96 a	3.82 a
Mean	5	0.97	1.23	0.74	0.76	3.69
SE		0.48	0.64	0.37	0.43	1.30

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch, (OO) Pure oat, (OG) oat- grasspea and (OV) oat- vetch.

The general average daily weight gain (ADG) was 132 g/head/day. The best ADG 195 g/head/day was recorded by the lambs group grazed on pure oat (OO) treatment, while the lowest ADG 99 g/head/day was recorded by the lambs group

grazing on barley-vetch (BV) treatment, (Table 4.6). No significant difference was recorded between treatment means of the lambs average daily weight gain.

Table 4.6. Average daily gain of Awassi lambs, Al-Barkum, northwest Syria.

Treatment	n	ADG (g/head/day)				
		Week 1	Week 2	Week 3	Week 4	General
BB	5	160 a	177.1 a	60.0 a	34.0 a	107.9 a
BG	5	94.3 a	217.1 a	117.1 a	54.0 a	120.7 a
BV	5	11.4 a	171.4 a	48.6 a	163.0 a	98.6 a
OO	5	197.1 a	254.3 a	160.0 a	169.0 a	195 .0 a
OG	5	194.3 a	140.0 a	105.7 a	91.0 a	132.9 a
OV	5	171.4 a	94.3 2 a	142.9 a	137.0 a	136.4 a
Mean	5	138	176	106	108	132
SE		79.8	86.5	49.7	57.3	44.7

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch, (OO) Pure oat, (OG) oat- grasspea and (OV) oat- vetch.

4.1.3.2. Ewes Body Weight

The variation in Awassi ewes liveweight is presented in table 4.7. The ewes average body live weight graduated from 60 kg in the beginning of the experiment to 62.3 kg in the end of it. The weight gain of ewes grazed on pure barley (BB), barley-grasspea (BG) and barley-vetch (BV) was 2.4, 2.8 and 1 kg during the 21 days of grazing period. No significant difference in the body live weight was recorded.

Table 4.7. Variation in Awasssi ewes liveweight (kg) during grazing at Tel- Hadya.

Treatment	n	Ewes weight (kg)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	57.8 a	57.2 a	57.8 a	60.2 a	58.42 a
BG	6	61.0 a	59.8 a	61.0 a	63.8 a	61.58 a
BV	6	62.0 a	59.3 a	62.0 a	63.0 a	61.17 a
Mean	6	60.03	58.80	60.30	62.3	60.39
SE		2.73	2.63	2.73	2.54	2.36

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.3.3. Milk Yield

The average morning, evening and total milk yield decreased during grazing period. Changes in morning and evening milk yield are shown in Figure 4.1 and 4.2.

In general, the average total milk yield decreased from 1383 to 908 g/head/day during the grazing period. The highest milk yield (1465 g/head/day) was recorded in week 1 from the ewes grazed on barley-vetch (BV), while the lowest (852 g/head/day) was recorded in week 4 from the ewes grazed on pure barley (BB) treatment. A significant difference in milk yield production at $p<0.05$ was recorded among treatments means, (Table 4.8).

Table 4.8. Milk yield changes of Awassi ewes, Tel- Hadya..

Treatment	n	Milk yield (g/head/day)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	1290 a	1133 a	905 b	852 b	1045 b
BG	6	1393 a	1112 a	888.3 b	862 b	1064 b
BV	6	1465 a	1303 a	1105 a	1010 a	1221 a
Mean	6	1383	1183	966	908	1110
SE		111.2	126.4	52.3	57.0	24.7

Means in columns, with different letters, differ significantly at ($p<0.05$).
Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

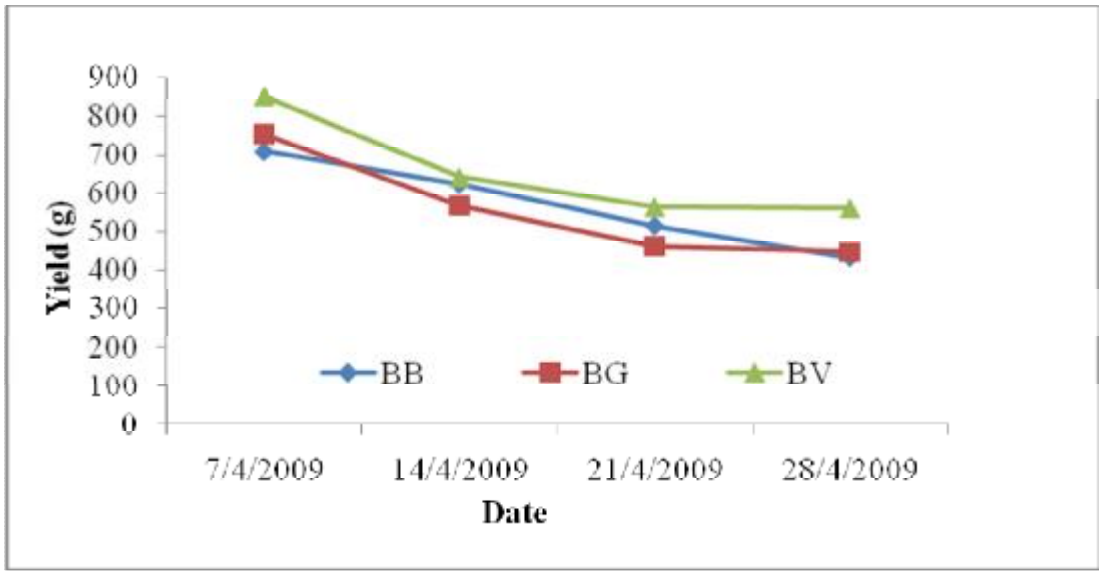


Figure 4.1. Morning milk yield (g/head/day) of Syrian Awassi ewes graze on (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

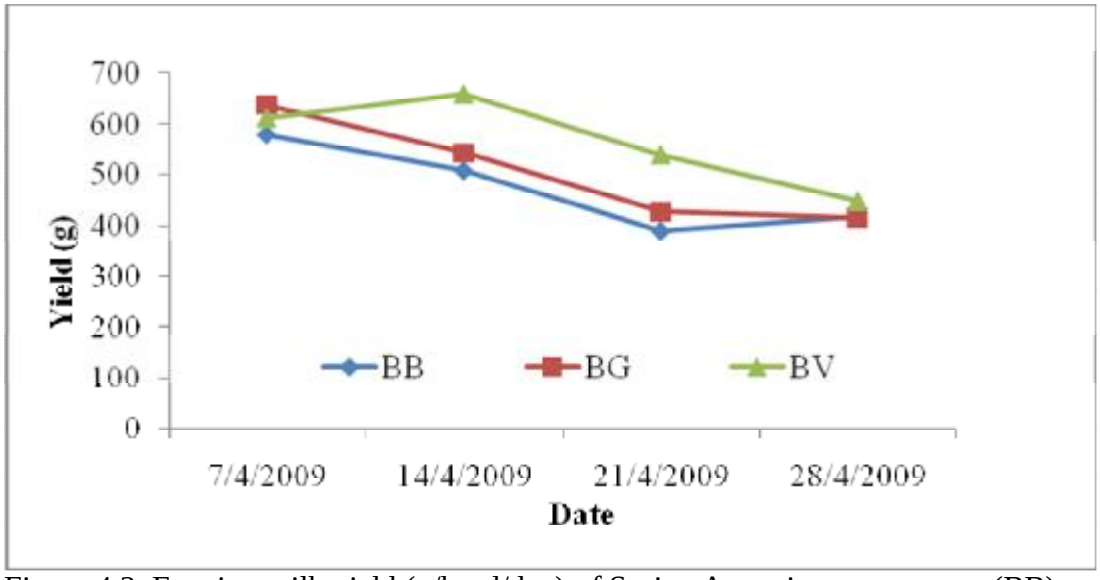


Figure 4.2. Evening milk yield (g/head/day) of Syrian Awassi ewes graze on (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.3.3. Milk Composition:

4.1.3.3.(1). Protein Content

Table 4.9 summarizes the milk protein content changes during the grazing period. The general mean of protein content averaged 5.850 (g/kg) and it was ranked between 6.034 (g/kg) from pure barley (BB) treatment to 5.612 (g/kg) from the barley- grasspea (BG) treatment. The protein content of treatments means was significantly differed at ($p<0.05$).

Table 4.9. Milk protein content changes of Syrian Awassi ewes.

Treatment	n	Protein content (g)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	5.983 a	5.877 a	6.265 a	6.012 a	6.034 a
BG	6	5.485 a	5.445 a	5.708 a	5.808 a	5.612 b
BV	6	5.733 a	5.768 a	6.102 a	6.017 a	5.905 a
Mean	6	5.734	5.697	6.025	5.946	5.850
SE		0.188	0.143	0.193	0.414	0.146

Means in columns, with different letters, differ significantly at ($p<0.05$).
Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.3.3.(2). Fat Content

Table 4.10 summarizes the milk fat content changes during the grazing period. The general mean of fat content averaged 5.621 (g/kg) and it was ranked between 5.861 (g/kg) from pure barley (BB) treatment to 5.271 (g/kg) from the barley- grasspea (BG) treatment. The fat content of treatments means was significantly differed at ($p<0.05$).

Table 4.10. Milk fat content changes of Syrian Awassi ewes.

Treatment	n	Fat content (g)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	5.838 ab	5.385 a	5.508 a	6.712 a	5.861 a
BG	6	5.028 b	4.833 a	5.122 a	6.100 a	5.271 b
BV	6	6.030 a	5.492 a	5.707 a	5.693 a	5.730 a
Mean	6	5.632	5.237	5.446	6.168	5.621
SE		0.299	0.240	0.338	0.414	0.321

Means in columns, with different letters, differ significantly at ($p<0.05$).
Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.3.3.(3). Lactose Content

Table 4.11 summarizes the milk lactose content changes during the grazing period. The general mean of lactose content averaged 5.010 (g/kg) and it was ranked between 5.038 (g/kg) from barley- vetch (BV) treatment to 4.978 (g/kg) from the barley- grasspea (BG) treatment. The lactose content of treatments means was not significantly differ.

Table 4.11. Milk lactose content changes of Syrian Awassi ewes.

Treatment	n	Lactose content (g)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	5.120 a	5.082 a	4.898 a	4.950 a	5.013 a
BG	6	5.122 a	5.088 a	4.930 a	4.773 a	4.978 a
BV	6	5.122 a	5.052 a	5.068 a	4.910 a	5.038 a
Mean	6	5.121	5.074	4.966	4.878	5.010
SE		0.109	0.126	0.190	0.180	0.106

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.3.3.(4). Total Solids Content

Table 4.12 summarizes the milk total solids content changes during the grazing period. The general mean of total solids content averaged 17.18 (g/kg) and it

was ranked between 17.61 (g/kg) from pure barley (BB) treatment to 17.37 (g/kg) from the barley- vetch (BV) treatment. The milk total solids of treatments means was significantly differed at ($p<0.05$).

Table 4.12. Milk total solids content changes of Syrian Awassi.

Treatment	n	Total solid content (g)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	17.64 a	17.04 a	17.37 a	18.37 a	17.61 a
BG	6	16.33 b	16.07 a	16.46 a	17.38 a	16.56 b
BV	6	17.58 a	17.02 a	17.57 a	17.32 a	17.37 a
Mean	6	17.18	16.71	17.14	17.69	17.18
SE		0.367	0.345	0.404	0.515	0.396

Means in columns, with different letters, differ significantly at ($p<0.05$).
Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.1.3.3.(5). Solids -Non- Fat Content

Table 4.13 summarizes the solid -non- fat milk content changes during the grazing period. The general mean of solid -non- fat content averaged 11.42 (g/kg) and it was ranked between 11.75 (g/kg) from pure barley (BB) treatment to 11.23 (g/kg) from the barley- vetch (BV) treatment. The solid -non- fat content was not significant between treatments means.

Table 4.13. Milk solid –non- fat content changes of Syrian Awassi ewes.

Treatment	n	Solid non fat content (g)				Mean
		7/4/2009	14/4/2009	21/4/2009	28/4/2009	
BB	6	11.80 a	11.65 a	11.86 a	11.66 a	11.75 a
BG	6	11.31 a	11.23 a	11.34 b	11.28 a	11.29 a
BV	6	11.55 a	11.52 a	11.87 a	9.96 a	11.23 a
Mean	6	11.55	11.47	11.69	10.97	11.42
SE		0.187	0.133	0.149	0.937	0.499

Treatments: (BB) Pure barley, (BG) barley-grasspea, (BV) barley-vetch.

4.2. Discussion

Spring grazing is a major problem facing lamb fatteners. To meet the animal nutrition requirements, Syrian farmers developed many grazing system among which grazing the cereal forage until certain limit is one system and grazing of mixture forages is another. Weather condition plays a key role in forage production. The total precipitation received in 2008-2009 season was 290.5 mm. distributed on the fall months (Sep- Oct- Nov), winter months ((Dec- Jan- Feb) and spring months (Mar- Apr- May) as of 62.1, 164.8 and 63.6 mm. respectively. The total rainy days were 80 days distributed on the season as 23, 40 and 17 days in fall, winter and spring months respectively. The temperatures were in the usual range of their months and the minimum temperature was recorded in January (0.5 $^{\circ}$C), but no frost was occurred.

4.2.1. Forage Yield and Sward Height

The normal weather condition resulted in normal development in plants growth. The seeds were planted in November and germinated in late December and flowered in March and interred maturity stage during April when grazing started.

By mid May the whole forages became matured and started becoming yellow with the increased weather temperature.

At Al-Barkum village, barley monoculture has shown better forage yield in comparison with oat monoculture, since the beginning of the experiment. At first and second clipping measurements barley yielded 28 % more DM forage than oat, and this yield difference reduced to 16% at the end of grazing. Explanation for this result could be the high tillering capability and the more efficient of using the soil moisture by barley than oat under the same weather condition, which is agrees with the finding of Francia et al., (2006).

In another hand, the reduction in dry matter yield in the last measurement may reflects the response for defoliation by grazed lambs since grazing was occurring during the reproductive stage, which is the most critical period for the grass according to Moser and Perry (1983).

Generally, monoculture barley and oat showed greater growth rate than in mixture with legumes and this result agrees with the findings of Lithourgidis et al., (2006) and Tuna and Orak (2007), but contrasting the findings of Karadag and Buyukburc (2003) . Also, pure barley (BB), barley-grasspea (BG) and barley-vetch (BV) dry matter yield were higher than the monoculture pure oat (OO), oat-grasspea (OG) and oat-vetch (OV) by 24.4, 15.7 and 32.9 % respectively. The explanation of these results is may be due to the competition between crops as stated by Caballero et al., (1995). The aggressivity (A) and competitive ratio (CR) of cereal to legumes were studied by Dhima et al., (2007), and found that cereals were of higher values of (A) and (CR) in their mixture with common vetch.

At Tel- Hadya, pure barley, barley- grasspea (BG) and barley- vetch (BV) have produced almost the same amount of forage dry matter yield. This is may be due to the better soil quality and also the low grazing activity by ewes.

In another hand, sward height increased during the first two weeks of grazing reflects the positive effect of the rainfall received during March and the unstable grazing practices of the grazed animals, while the later reduction towards the end period of grazing reflects the effective grazing.

Oat monoculture and in mixture with legumes recorded a significant difference in average sward height than that of barley and it mixtures, especially in the last measurement, which may indicates the grazing preference of oat on barley at green stage, and/or the less capability of oat to re-growth after cutting in comparison with barley as been reported by Francia et al., (2006), whom concluded that barley has many advantages on oat and other cereals. It has particular morpho-physiological traits that make it more suitable to dual-purpose cultivation than other cereals; it is highly efficient in the utilization of water and nutrients in limiting conditions; High capacity for tillering, and high capacity for re-growth after grazing than oat that enables it to set seed after re-growth.

4.2.2. Animal Performance

The time of entering animals to graze in Al-Barkum and Tal- Hadya agrees with the recommendations of Christiansen et al., (2000) to starting grazing after lambs weaning where forages are in early flowering stage of legumes. The stocking rate in the first and second experiment was about 166 lambs and 40 ewes per hectare respectively which are exceeding the average stocking rate that have been applied by Christiansen et al., (2000) which was 20 to 30 sheep per hectare. This high stocking rate forced us to terminate grazing in shorter time than what was planed because no more forages were available for the animals.

Animals have lost some weight at first week of grazing before start gaining again towards the end of grazing. This react is natural and due to change of diet (nutritional conditions) and place.

4.2.2.1. Lambs Growth

The Awassi lambs average daily weight gain ADG (132 g/day) recorded in this experiment is less than the 186 g/day recorded by Christiansen et al., (2000) for Awassi lambs grazed on legumes (vetch and grasspea), while it is close to the results obtained by Larbi et al., (2008) who reported that the average daily weight gain of Awassi lambs grazed on three vetch species graduated from 116 to 159 g/day.

Against to what was expected, the highest ADG (195 g/day) was recorded from the lambs group that grazed on pure oat (OO) treatment and the lowest ADG (98.6 g/day) was recorded from the lambs group that grazed on barley- vetch (BV) treatment, while ADG for the rest groups have ranked between 108 and 136 (g/day).

The two extreme values of ADG, could be due to grazing activeness, and forage palatability. The field observation showed that the animals in the mixture plantation plots concentrated on grazing the legumes more than cereals until it was completely disappeared by the end of second week. The other reason may be the short period of the experiment (28 days) and the limited grazing plots area which was not enough to predict the effect of legumes. This conclusion may supported also by

the finding of Rihawi et al., (2008) who reported an ADG of 267 g/day for Awassi lambs grazed in spring on common vetch with little supplementation for 49 days.

Generally, field observation showed that grasspea was more desired by lambs than vetch, and this agrees with the field observation of the farmers reported by Christiansen et al., (2000).

Finally, the ADG of Awassi lambs under the experiment condition was closer to the extensive fattening system followed by farmers on the margin of their farms. Also the result obtained is less than that could be reaching under intensive fattening with so many different diets. Using of corrugated cardboard at 10 and 20% in fattening ration of Awassi lambs, Abo Omar (2001) reported an ADG of 205 g/day while Haddad et al., (2001) reported ADG of 287 (g/day) for Awassi lamb fed on finishing diet that contained 16% of crude protein (CP). This findings show the high potential of Awassi lambs for high growth rates when adequate diets are available.

4.2.2.2. Milk Yield

Total average of milk yield (1110 g/day) agrees with the finding of Al-Samarai et al., (2009) of their experiment in the year 2007, but makes the double of the same experiment result on 2006. Also the result is better than the (806 g/day) and the (950 g/day) average yield recorded by Habib (2004) for Syrian and Turkish Awassi ewes respectively, grazed on three vetch species. This shows the big variation in milk production according to feed conditions. In Al-Kraim research center (Kassem, 2005), daily milk yield, after lambs weaning at 60 days old, was 1500 g/day over 111 days of lactation in the Awassi ewes improved for milk production , and 780 g/day over 97 days of lactation in the meat line.

Taking into consideration the good nutritional condition but not oriented breeding program of the Awassi sheep herd in ICARDA, the milk yield is close to that of Al-Kraim Awassi herd of meat line

Generally, the ewes grazed on barley– vetch (BV) mixture showed higher daily milk yield production than ewes grazed on pure barley (BB) and barley – grasspea (BG), but this was attributed since the first milk yield measurement. This

result could be due random selection of ewes based on their body weight and not on their milk production record or on their age. Such an effect was mentioned by Kassem (2005) who reported a graduate increase in milk yield, from improved milk line Awassi ewes, from age 2 and 3 years and a maximum daily milk yield at age 4 to 5 then reduced, while this curve was not clear in the improved meat line.

4.2.2.3. Milk Composition

The average protein content value (5.85 %) is higher than the 5.26 % reported by Fadel et al., (1989) but close to the 5.7 % of Turkish Awassi ewes (Uraz, 1983), while the average fat content value (5.62 %) is lesser than the 5.8 % reported by Fadel et al., (1989) but it match with the 5.6 % of Turkish Awassi ewes reported by Uraz (1983). In another hand, the average solids- non- fat content value (11.42 %) is lesser than the 17.8 % reported by Fadel et al., (1989) but close to the 11.6 % of Turkish Awassi ewes reported by Uraz (1983). Meanwhile, the average lactose content value (5.01 %) is similar to the percent reported by Uraz (1983), but the average total solids content value (17.18 %) is lesser than the 19.4 reported by Karam et al., (1971). Generally, ewes grazed on barley- grasspea (BG) has shown lesser milk protein, fat, total solids content than pure barley (BB) and barley- vetch (BV) treatments, unlike for lactose and solides- non- fat content which were not significantly differ between treatments. This unexplained result could be due the miss behaviors of ewes which were trampling on forage more than grazing, and maybe because the period of milk data collection was not long enough.

5. CONCLUSION and RECOMMENDATIONS

5.1. Conclusion

This study was conducted to evaluate the milk yield and the growth rate of Syrian Awassi sheep grazing on cereal and mixture forage pasture. Commonly, the importance of legume forages is well known, but during spring, grazing of monoculture legumes, may cause some physiological problem to the animals, thus planting with cereal crops in mixture may improve forage quality and quantity.

In this study, although there was a variation in response to forage treatments, it was found that average daily live-weight gain of lambs did not significantly affected by forage treatments. Meanwhile, milk yield and some milk contents such as (Protein, Fat and Total solids) were significantly affected by treatments.

Generally, the presence of legumes has made the reduction in milk yield went dawn slowly, while milk components concentrated with the advance in milking days.

This experiment confirmed the fact that have been reported by many scientists that the cereal monoculture produce more herbage and dry matter yield than the mixture forages. Meanwhile, the experiment showed that barley may produce more forage yield than oat does, but field observation showed that oat, until maturity, was more desired by Awassi lambs than barley. This may related to palatability, since palatability of forages is very much tied with the stage of growth and with advance in plant growing stage, a higher concentration of fibrous materials accumulates in the plant cells wall, and sensible reduction in grazing activeness was noticed.

5.2. Recommendations

Cereal-legume intercrops improves forage quality and could be used to cope the feeding gap for lactating ewes and growing lambs in spring, and this, in returns, improves the marginal income of small farmers and livestock keepers.

Based on the results, we recommend

1. To reconsider using oat for forage production and increase area of plantation in Syria.
2. Encouraging farmers to plant mixture forages for spring grazing, to gain better meat and milk outputs from the Awassi lambs and ewes.
3. We recommend giving more consideration, in the future, to experiment applying condition, regarding animals age, sex, duration of the experiment and laboratory analyses, to ensure that the effect of mixture forages on animals performance be more visible.

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- I work to the Ministry of Agriculture in Syria since 1994.
- I have worked to the International Center for Agricultural Research in Dry Area (ICARDA)
- I am married and have three children.

APPENDIX

Appendix 1. Temperature (°C) and Rainfall Data at Tel-Hadya, (2008-2009)

Month	Temperature		Precipitation	
	Maximum	**Minimum**	**Total**	**Rainy days**
Sep-08	34.1	18.8	26.1	6
Oct-08	27.5	12.5	16.6	8
Nov-08	21.9	6.5	19.4	9
Dec-08	12.8	0.7	42.6	12
Jan-09	11.9	0.5	37.9	10
Feb-09	14.2	4.7	84.3	18
Mar-09	17.1	5.0	36.2	6
Apr-09	24.0	7.7	23.4	6
May-09	30.1	11.2	4.0	5
Total			**290.5**	**80**

Appendix 2. Feedstuff Used for Milked Ewes in Tel-Hadya.

Feedstuff	**Proportion**	**DM%**	**CP%**	**ME MJ kg**
Barley grain (white)	60	90.5	13.2	11
Wheat bran	15	97.2	17.1	11
Cotton seed meal	15	96.8	29.2	9
Sugar beet pulp	10	97.4	7.4	5
Total	**100**	**93.00**	**15.5**	**10.0**

Appendix 3. Variation in Liveweight of Awassi.Lambs.

Treatment	6/4/2009	13/4/2009	20/4/2009	27/4/2009	2/5/2009
BB	25.04 a	26.16 a	27.40 a	27.82 a	28.06 a
BG	23.76 a	24.42 a	25.94 a	26.76 a	27.14 a
BV	25.92 a	26.00 a	27.20 a	27.54 a	28.68 a
OO	25.18 a	26.56 a	28.34 a	29.46 a	30.64 a
OG	24.64 a	26.00 a	26.98 a	27.72 a	28.36 a
OV	25.22 a	26.42 a	27.08 a	28.08 a	29.04 a
Mean	24.96	25.93	27.16	27.90	28.65
SE	1.7	1.7	1.9	1.9	2.1

Treatments: BB (Barley);BG (Barley-Grasspea); BV (Barley-Vetch); OO (Oat); OG (Oat-Grasspea); OV (Oat-Vetch).

Appendix 4. Changes of Morning Milk Yield (g).

Treatment	7/4/2009	14/4/2009	21/4/2009	28/4/2009
BB	710 a	625 a	515 a	433 a
BG	755 a	568 a	462 a	447 a
BV	852 a	643 a	565 a	562 a
Mean	772	612	514	481
SE	75.8	67.4	70.3	55.8

Treatments: BB (Barley); BG (Barley-Grasspea); BV (Barley-Vetch).

Appendix 5. Changes of Evening Milk Yield (g).

Treatment	7/4/2009	14/4/2009	21/4/2009	28/4/2009
BB	580 a	508 a	390 a	418 a
BG	638 a	543 a	427 a	415 a
BV	613 a	660 a	540 a	448 a
Mean	611	571	452	427
SE	63.5	85.6	39.9	43.0

Treatments: BB (Barley); BG (Barley-Grasspea); BV (Barley-Vetch).

PHOTOS: Field Activities








MAP: Syrian Arab Republic