

Small-scale lamb fattening systems in Syria; future development and opportunities.

Hartwell, B.W.^{1,3}, L. Iñiguez², W.F. Knaus³, M. Wurzinger³,

¹The Royal Veterinary and Agricultural University, Grønnegårdsvej 2, 1870 Frederiksberg C., Denmark. bwh@kvl.dk; ²International Center for Agricultural Research in Dry Areas, P.O. Box 5466, Aleppo, Syria,

³University of Natural Resources and Applied Life Sciences, Gregor-Mendel-Strasse 33, A – 1180 Vienna, Austria

Abstract

Small-scale intensive Awassi lamb fattening production systems emerged the last decade in Syrian rural and peri-urban areas. The Gulf's affluent markets and enhanced local demand for Awassi sheep meat prompted this development. A study characterizing 241 lamb fattening systems found that lamb fattening is an efficient income-generating option for small-scale farmers and a family employment source, though largely constrained by feeding costs and animal health issues. Prompted by this finding, a research strategy was formulated to produce least-cost rations as options for farmers to improve their economic returns. Cost-effective rations for fattening using locally available feedstuffs were tested in an on-station environment. The most promising least-cost ration was then implemented on-farm in collaboration with farmers. Cost-benefit analysis and carcass evaluations demonstrated the feasibility of producing at lower costs, though seasonal and yearly feed price fluctuations cannot be ignored in this regard. To ensure sustainable development of small-scale lamb fattening systems, further research is needed to learn more about least-cost rations, assess simple measures to curb disease-related problems, identify and articulate production and marketing policy issues required, and to assess preliminary conditions to establish a profitable fattening enterprise as a technological option for small producers.

Keywords: Small-scale farms, Awassi, cost-benefit, labour, Syria

Introduction

A rapid population increase, urbanisation and improved income growth coupled with changing food habits and demand driven markets are major influences on the predicted future increase in consumption of livestock products in the developing world (Delgado et al. 1999; FAO, 2002). These trends are also seen in the Middle-Eastern countries, where a local demand for the meat and milk of small ruminants is on the rise. In Syria mutton and lamb account for more than 77% of the total red meat consumption (Bahhady et al. 1997) and is expected to increase by 34% in 2020. This opens opportunities for sheep producers to capitalise on, and for intensified production to take place in view of positive price differentials for their products. In addition to its domestic demand, Syria has a comparative advantage for marketing lambs in the Gulf countries where current prices for lamb meat are favourable.

Reflecting the described market scenario, the reforms and economic liberalization that have opened opportunities for the livestock sector, intensive lamb fattening systems have mushroomed during the 1990s especially in the peri-urban areas of Syria. Excellent revenues from live animal export combined with the banning of cultivation in the rangelands has further encouraged many livestock production systems to move from low input and low productivity systems, towards more intensified feeding systems (Vercueil and Cummins, 2003) However, little if any

information exists on the emerging lamb fattening production systems in Syria regarding their characteristics; the way they have developed; their distribution; and the constraints, opportunities and risks these systems confront.

Through a three-phase study of fattening systems in Syria, the works presented in this article, aims at filling the information gaps on lamb fattening systems, targeting in particular the identification of key production constraints that could be mitigated by technological interventions while understanding the characteristics and peculiarities of the productions systems involved.

Methodological approach

To investigate the problems and constraints to lamb fattening systems in Syria, a three phase research methodology was developed;

Phase 1:

In order to assess the existing systems and production forms associated with lamb fattening, 241 farmers engaged in lamb fattening production in Syria were interviewed regarding their coping strategies, feeding practices, management, labour input and market access. Feeding costs and the curbing of health issues were identified as two of the major factors constraining the income margins from lamb fattening from the farmer survey (Hartwell et al. 2006a).

Phase 2:

Cost of feeding lambs for fattening were tackled through an on-station feeding experiment at ICARDA, Syria. The aim was to test the suitability of including less expensive local feedstuffs like molasses into the fattening diets limiting the use of more expensive grain feeding. A feasible ration was developed containing barley, maize, wheat bran, cotton seed cake and molasses, supplemented with urea-treated wheat straw. Furthermore, an carcass evaluation from the experimental lambs was conducted, comparing characteristics such as meat/fat ratio, weight of fat tail and dressing percentage. The best performing experimental ration, in terms of cost and weight gains, were later introduced to farmers through an on-farm experiment.

Phase 3:

A third phase of the research methodology tested how the optimised experimental fattening ration would perform in an on-farm setting. Results showed that an improved lamb fattening ration could be successfully introduced into small-scale farm environments not at the expected lower costs of feeding but in terms of increased live weight gains from optimized feeding and mineral/vitamin supplementations.

The approach represented a unique possibility to examine a farmer-defined problem, addressing the problem by controlled on-station experiments, supplemented with farmers inputs and training, to testing an experimental option with farmers, on-farm. The on-farm experiment targeted small-scale farmers as small-scale fattening activities have mushroomed the last decade. Furthermore, small-scale livestock farms are in transition in Syria due to a rapid population increase, land scarcity, and market forces, which make the production systems vulnerable to feed price and market fluctuations.

Characterisation of lamb fattening systems in Syria

In **phase 1**, data were assembled from a survey of 241 farmers engaged in lamb fattening in Syria, mainly by collecting information from key-persons in each of the different provinces surveyed. Key-persons were generally extension officers, people at sheep markets, and individual farmers. The survey revealed three major types of lamb fattening production systems; intensive, semi-intensive and semi-extensive. Independent typologies were determined with batch size as the main variable. The locality of interviewed farmers, size of lamb batches for the individual farmers interviewed and rain fall zones of Syria is shown in Fig. 1.

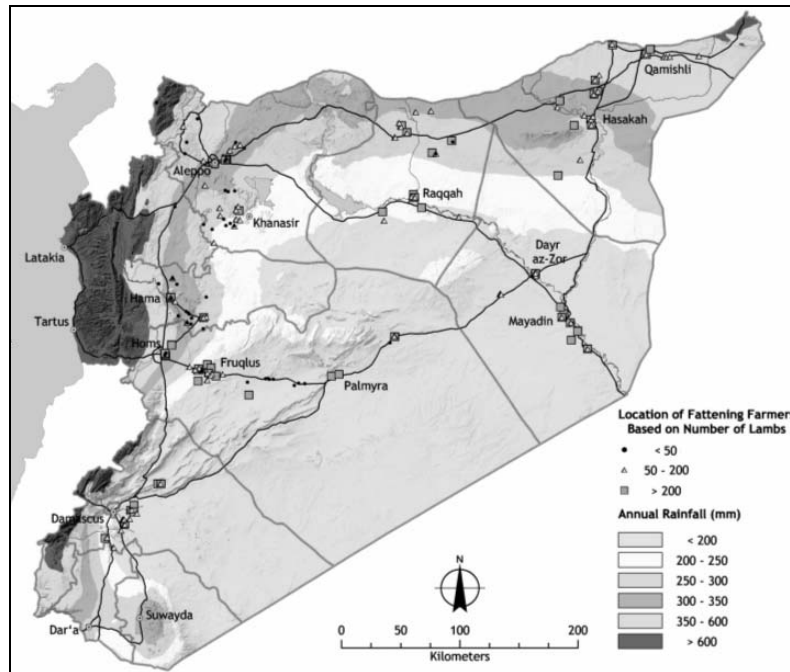


Fig 1. Map of Syria including rainfall zones, district borders and size of lamb fattening production systems

Rain fall zones or agro-ecological zones (Swaid, 1997) were important determinants for which type of fattening systems were practiced. Less fattening was observed in the drier areas following a gradient from dry to higher rain fall zones where lamb fattening had a long standing tradition. Mainly intact male Awassi lambs are fattened in Syria. Imports and exports are controlled by the Syrian General Meat Company (Bourn, 2003)

Lambs were usually fattened for a one to four month period, depending on the individual management system used, price fluctuations, market access, feed availability and age of lambs.

Typologies in fattening systems

Semi-intensive lamb fattening system

The dominant lamb fattening system (77%) was a semi-intensive system involving 2-3.5 batches of lambs per year. The term “*semi-intensive*” is used in this context to describe a system where farmers do not have lambs year round but only when cash is available to purchase a suitable batch. The number of lambs per fattening batch also relies on cash available. Feeding strategies rely on a combination of grazing (if available) and concentrates. Many small-holders

close to urban areas were involved in these systems as the livestock production form fitted well with other household employment strategies. Farmers indicated that fattening lambs for some months a year was part of a wider livelihood strategy ensuring an income from different sources of combined agricultural production and off-farm labour. Furthermore, most of the farmers practicing these systems previously had small flocks of sheep. But they shifted production form from traditional sheep rearing to fattening production due to the convenience of not having to provide for the sheep year round. Furthermore, due to land reforms, the imposed no-cropping zones by the government and limiting grazing options due to degrading rangelands, traditional sheep herding is becoming increasingly problematic in Syria (Bourn, 2003).

Fig. 2. provides an example of a seasonal lamb production cycle for a semi-intensive system. Winter feeding will mostly rely on expensive concentrates and a little grazing. This is reflected in the farmers' income margins from the lamb production, as feeding costs are high in this season.

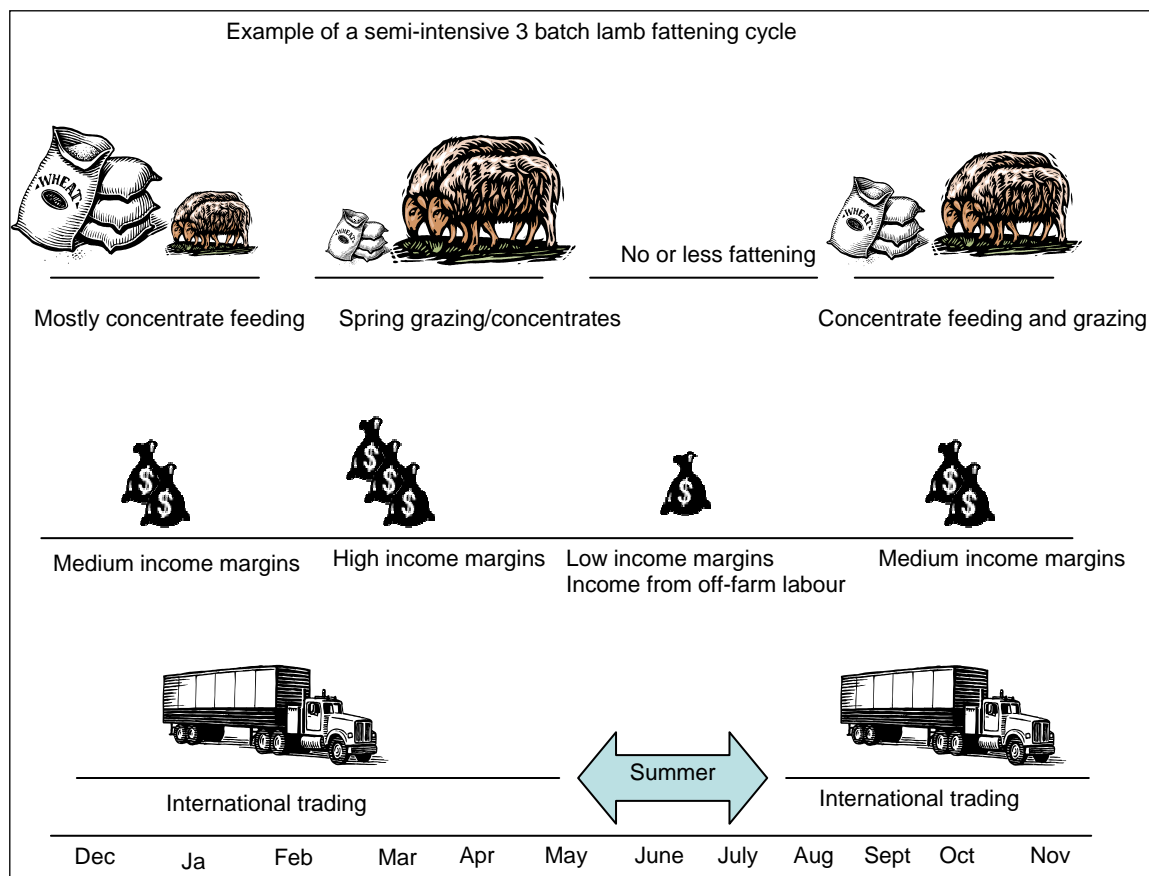


Fig. 2. An example of a semi-intensive 3-batch lamb fattening cycle, seasonal changes in feeding strategies coupled with trading patterns and income margins.

However, international trading is usually good in the autumn, winter and spring and the extra money spent on feeding will bring a high return when selling the live animals, as long as trading is maintained. Spring is the favourite season to fatten as there will be grazing available and less concentrates are needed. However, as lambs from the lambing season (Dec. – Feb.) are ready for intensive fattening at this time, many farmers may fatten at the same time. This may

weigh down the prices when too many lambs are marketed at the same time. Closure of the export markets poses the biggest risk for farmers, as this would result in low prices for their lambs. Export markets are overseen by the Syrian General Meat Company and licences for export are obtained from the Ministry of Economics (Bourn, 2003). The dynamics of the export markets are governed by how many animals are exported/imported or if the recipient country reports of many diseased animals. In the latter case animals are sent back to Syria and trading is closed until the disease is under control. Disease is one of the two major constraints, next to feeding costs, that influences negatively on farmers income from fattening.

Heat exhaustion during the long transportation to the main Gulf outlet market, Saudi Arabia, is common among animals being transported during the hot months of summer. Therefore, most farmers prefer not to fatten lambs during summer as international trading is slowed down or stopped. Some farmers use these months to engage in off-farm labour in Syria or neighbouring countries like Lebanon and Saudi Arabia (Ghosh et al. 2004a).

Fig. 3 shows the percentage of farmers in the survey who indicated that they had other income than from lamb fattening. Most farmers had an income from cropping, various off-farm labour, and shop keeping.

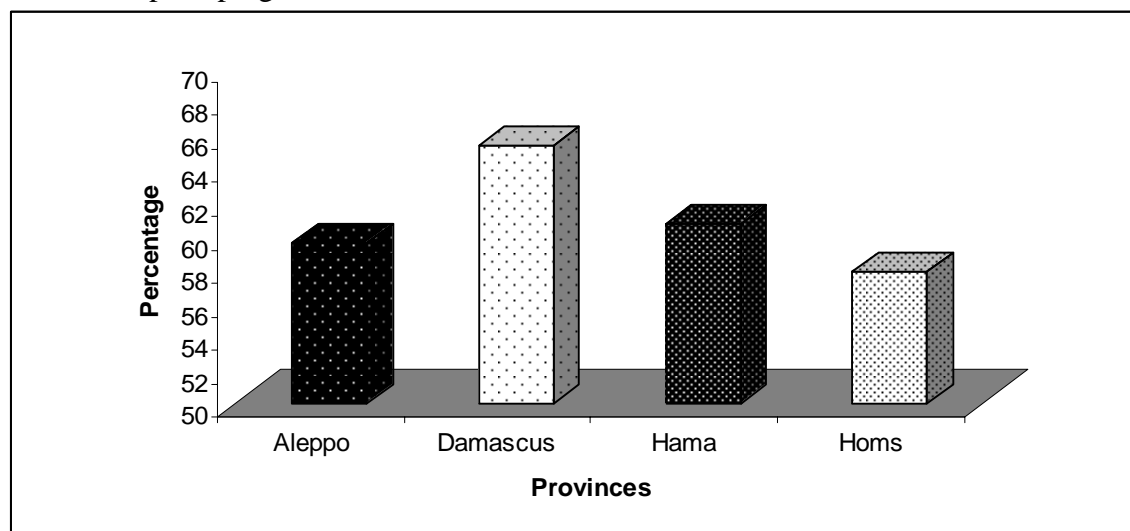


Fig. 3. Farmers having additional income from off-farm labour.

During autumn, fattening will rely on a combination of concentrate feeding and grazing (if available). Grazing of the lambs depend on how early the rain falls. However, international trading has picked up again after the summer months and prices are again high.

Other important influences on the income from lamb fattening is the traditional holidays of Eid, where the demand for Awassi lamb meat is high. The Eid holidays are moving during the calendar, but if small-scale farmers can target these holidays there are good profits to be made (Bourn, 2003)

Semi-extensive fattening system

The next most common fattening system was a semi-extensive system (13%) involving 1-1.5 batches per year. These systems were mostly practiced by farmers that had traditional sheep production systems, and in good rainfall years with plenty of grass and when cash allowed, kept lambs produced from their flock for fattening. Traditionally, farmers or Bedouins practice the sell-off of lambs at the age of 2 – 3 months to more intensive fattening units located near urban centres.

Some of those interviewed who practised a semi-extensive fattening system, were practicing transhumance with grazing of their sheep flocks in the desert in the winter and spring, and then migrating to the northern parts of Syria for grazing on stubble, vegetable and cotton fields in summer and early autumn. In some cases it was found that some members of a family would practice transhumance with sheep flocks, while other family members had become sedentary staying close to urban areas, with easy access to markets. Sedentary family members would then rear lambs for fattening produced by the family. The extended family patterns were seen to be important to sustain these systems.

Intensive fattening system

The least frequently practiced lamb fattening system was the highly intensive system (10%) which involved 4-5.5 batches of lambs per year. The highly intensive systems were mostly practiced by full-time fattening farmers, or government fattening facilities e.g. for providing meat to the army. The private fattening systems were usually supported by wealthy investors from urban areas, where the day-to-day responsibilities fell on either a partner or a hired caretaker who would be in charge of the labour force, buying/ selling lambs and feed supply. These systems were mostly observed in urban areas, next to sheep markets, and mainly produced lambs especially for export.

From Fig. 4 it can be observed that a province such as Homs, located in a low rainfall zone with large areas classified as desert had the largest proportion of semi-extensive systems. The intensive and semi-intensive systems were more common near Aleppo, Damascus and Hama. Aleppo has a long standing tradition in lamb fattening and one of the main export markets is located there. Damascus is a newer emerging fattening province.

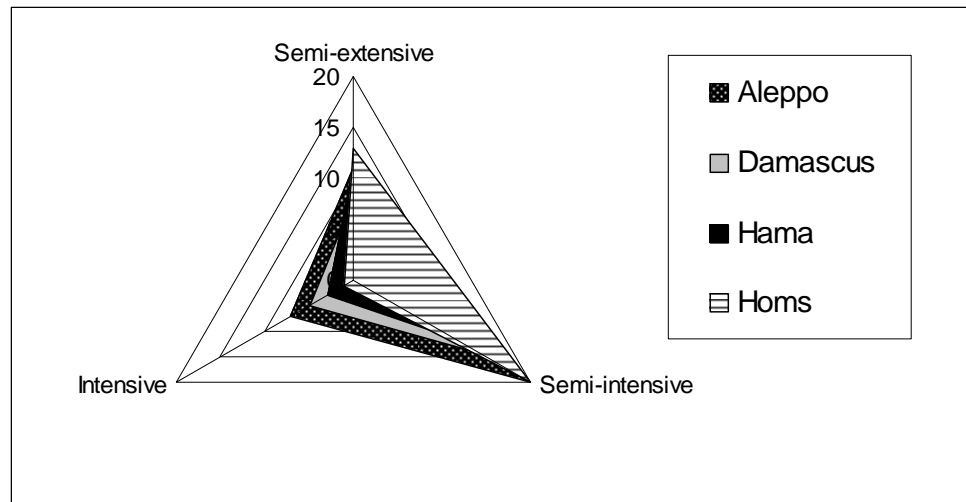


Fig. 4. View of the distribution of semi-intensive to intensive lamb fattening systems over four major provinces in Syria, based on number of farmers.

In Damascus land is scarce, but it was observed that the fattening systems were supported by wealthy town dwellers with a willingness to invest in intensive lamb fattening enterprises. More farmers in Damascus used imported concentrate feeds and ready mixed rations than in the other provinces, and batch sizes were also larger. This could indicate that fattening activities in Damascus province were based on investors with plenty of cash. The province of Hama is located in an agricultural zone, and an equal distribution of the three typologies of lamb fattening systems was observed. In Hama, as in the case of Aleppo province, lamb fattening farmers benefited from utilising residues from crop production and stubble grazing for fattening.

It was observed that most of the interviewed farmers, engaged in lamb fattening, had prior experience in keeping sheep flocks, as tradition for most livestock farmers in Syria. On average, the farmers interviewed had 23.4 years of experience in the fattening business. However, farmers in for example Aleppo were found to have been engaged in fattening for longer than was the case for farmers in Damascus, which suggests that the activity has expanded from the more traditional and higher rainfall areas to the non-traditional dry areas. This is in agreement with the observation that shifts towards more intensified sheep production are occurring in Syria (Vercueil and Cummins, 2003; Bahhady et al. 1997; Nordblom et al. 1995). In the more traditional fattening provinces, such as Aleppo, more farmers were found to be including lambs produced by their own flocks in the fattening batches, whereas in Damascus it was observed that the lamb fattening systems are mostly based on lambs not produced on the farm in question, but rather acquired from outside sources.

The interviewed farmers expressed that one of the reasons for shifting production from sheep flocks to fattening lambs were that keeping small flocks of sheep were no longer economically feasible. This mainly because of the limited access to free communal grazing, and the need to provide for feeding, shelter, and herding year round. Furthermore, due to favourable international trading and if investments were available, lamb fattening gave a better economic rate of return than traditional sheep production.

Lamb fattening represented an option for farmers with experience in sheep rearing to engage in a production system that did not require attendance year round. Moreover, the activity depended on investments available, either from the farmer himself or investments from wealthier urban dwellers. By engaging into lamb fattening production, small-scale farmers were presented with an option to combine off-farm work, cropping and intensive livestock fattening production, which did not require large landholdings. This represents an important transition trend in livestock production systems, as agricultural landholdings are decreasing due to inheritance laws, government interventions and a rapid population increase. (Abdelali-Martini et al. 2003; Bourn, 2003),

Landholdings are not a determining factor for farmers to engage in lamb fattening as the production form requires little land, and this was reflected in the relatively small landholding of some of the farmers interviewed (fig.5.) The distribution and size of land holdings in 4 provinces in Syria, showed that Aleppo province, a traditional agricultural province with higher rainfall and a high population density had small land holdings per farmer. Landholdings of lamb fattening farmers were small in Damascus, mainly due to high population pressure. Homs province covers a large area, classified as both cropping land and deserts. The largest landholdings were seen in the non-cropping zone (Bourn, 2003) in the deserts of Homs, used mostly by farmers and Bedouins for grazing.

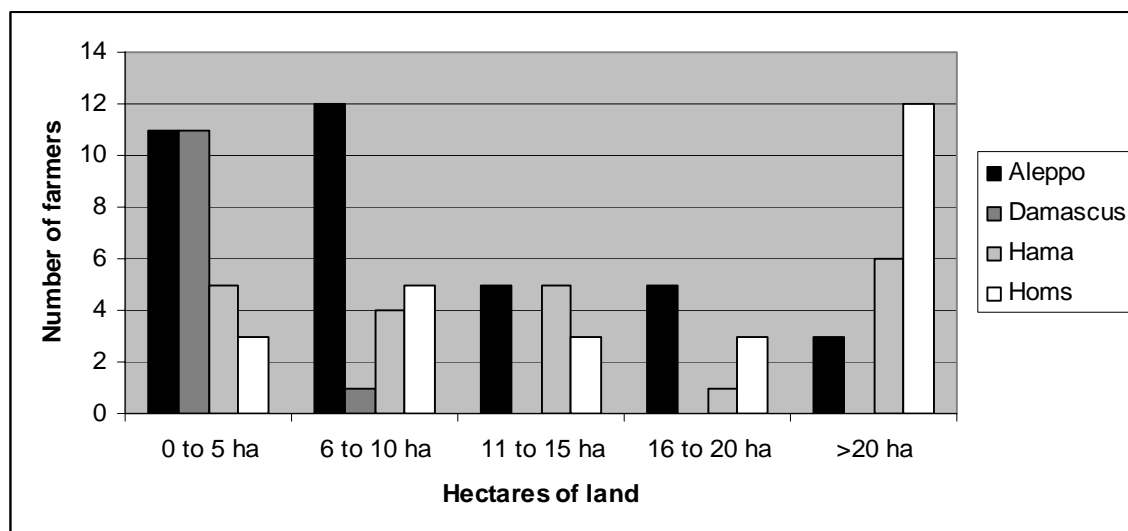


Fig. 5. Number of farmers owning land with a distribution from 0.3 to more than 20 Hectares (n=95).

Importance of labour in small-holdings

In the seven provinces surveyed, households average 13 persons and are often headed by a man. Household size responds to the people living under the same roof at the time of the interview. Usually the whole family is involved in the management and feeding of the lambs being fattened; no significant ($P>0.05$) relationship between household size and the number of lambs and between household size and the number of batches per year were found in the survey.

In terms of the labour, family members play multiple roles during fattening activities. In almost all cases (98%) men played a direct role in the fattening of lambs and were the main decision makers. Such direct roles include buying feeds, buying and selling animals, general supervision, and the mixing of feeds.

The study found 66% of women were involved in fattening mainly concerning daily feeding, care and management of the lambs, but never as decision makers. Abdelali-Martini et al (2003) suggest that a feminization of the agricultural sector is occurring in Syria, where women are involved as a labour force but not as decision makers. Results from the survey supported this observation and results showed that women usually provided labour for cleaning out the animal pens, feeding the animals, and watering the animals. Furthermore, girls (64%) played a role within the fattening process, mostly by helping the older women with their chores. In this context it is important that the labour contribution of women and girls to the fattening process is taken into account when implementing technologies for improving livestock systems. Training of women and children within livestock production management, simple preventive health measures and feeding is an important consideration, especially for government, extension and agricultural research (Abdelali-Martini et al. 2003).

It was also found that 70% of the boys who were a part of the families interviewed played a role in the lamb fattening process. Boys' labour contribution included grazing the animals each day, and helping the men and women with their chores, for example by providing help with feeding. The term "boys and girls" refer in this context to children that are not married that lived under the same roof at the time of the interview.

Main constraints to production

The survey identified two main constraints: Feeding costs and the curbing of health issues which influenced the income margins from lamb fattening. Feed costs and nutritional optimization of rations provided for lambs fattened in various systems in Syria was sought tackled through research, described in Phase 2 and 3. Tackling health issues were not within the specific scientific competence of the researchers involved in the project, and as such, the issue of health will only be dealt with in the *lessons learnt* paragraph. For more detailed information regarding animal health issues the reader is kindly requested to consult specialised researchers at ICARDA currently undertaking studies into veterinarian medicine and epidemiology.

How to overcome production constraints?

Phase 2 and 3 of the research methodology addressed the constraint of high feed costs of lamb fattening. High and fluctuating feed prices influenced negatively on farmers income from lamb fattening. To tackle this farmer-defined problem, an on-station feeding trial was conducted for 90 days at ICARDA with 36 Awassi lambs, looking at the prospects of integrating cheaper locally available feedstuffs into fattening diets utilised by farmers. Two alternative iso-nitrogenous and iso-caloric diets were formulated, utilizing barley, wheat bran, cottonseed cake, maize or faba beans, molasses and mineral/vitamins, supplemented with urea treated wheat straw (Hartwell et al. 2006b). The total cost of the best performing experimental ration did not result in cost savings. However, the ration included locally available feedstuffs and introduced molasses as an alternative to more expensive grain feeding, at a less fluctuating price. The experimental ration

was tested in **phase 3** with farmers on three farms in the north-eastern part of Syria, an area known for lamb fattening. The experiment lasted 73 days using lambs bought from the farmers at the market price of the day. In both the on-station and on-farm trial, the lambs were slaughtered at the Aleppo slaughterhouse at the end of the experiment and the carcasses were evaluated for different variables such as carcass weight, dressing percentage, tail and pelvic fat. Furthermore, each carcass was evaluated by butchers for the meat to fat ratio (Hartwell et al. 2006b; Hartwell et al. 2006c). A separate meat tasting panel was conducted at ICARDA, to conclude if there were any differences in taste, colour or odour from the meat from the lambs receiving the experimental rations.

The reason for testing the experimental ration on-farm was two-fold; to see how the ration would perform in a “true” environment and, importantly, how farmers would respond to the inclusion of feedstuffs usually not fed to fattening lambs.

On-farm experience

Farmer participation

Farmers involved in the on-farm experiment were chosen from a community workshop held by ICARDA. The workshop included; farmers, extension officers, local veterinarians and ICARDA researchers. Three farmers participating in the workshop volunteered to take part in the proposed on-farm trial, and each farmer allocated 20 of their lambs to the experiment. Farmers own rations were provided to 10 lambs (control) and another 10 lambs were fed the experimental ration. Thus the control rations differed in composition at each farm.

Each farmer was provided with a notebook to write down essential comments during the week when the researcher was not there. This could be comments on, disease outbreaks, changes in animal behaviour, eating patterns, etc. Also small observations were noted. These notes created a basis for the weekly discussions with the farmers. Every week lambs were weighed at the respective farms and calculations on weight gains and weekly profits were made with farmers. This approach combined with collaboration with an ICARDA and government veterinarian, created a good working environment where lamb nutrition and cost of feeding were the main focus, but health issues could be tackled if problems arose. Farmers furthermore, participated in training courses arranged by ICARDA and a larger workshop for farmers and policy makers (ICARDA, 2005a; ICARDA, 2005b). The holistic approach created an atmosphere of commitment, and facilitated a learning environment for farmers as well as researchers, as to understand how and why the different rations worked as they did, and what needed to be done in the future.

The experimental ration preformed well in all three management systems and was well received by all the farmers. A slightly lower feeding cost for the experimental ration was obtained. However, due to a higher live weight gain by the lambs receiving the experimental diet, the total gain per kg live weight were higher for the lambs fed the experimental ration versus the control (Hartwell et al. 2006c). The results of the on-farm feeding trial experiment is described in details in Hartwell et al. (2006c), but in this chapter emphasis will be on the particulars of the farmers feeding and management systems, for a later discussion on the lessons learnt.

Feeding and management strategies, the case of farmer A, B and C.

The three farmers (A, B and C) represented different management styles and the individuality that exists in lamb fattening systems in Syria.

Two farmers (A, B) had a sheep flock, besides the lamb fattening activity. On both these farms milking sheep was kept only to cover household consumption of dairy products such as yoghurt and cheese. The lambs produced in December to February were included in the spring fattening period and additional lambs were bought from the local market or from the “Badia” (desert). Farmer A followed a strategy of buying lambs at different ages during the year, fattening continuously, and selling off lambs when market prices were high. He relied heavily on concentrate feeding, supplemented with wheat or barley straw of own production, although he would supplement with some rangeland grazing especially in spring. In summer he would sell off the lambs and keep his ewes on wheat and barley stubble.

Farmer B bought lambs directly from the “Badia” (desert), and had a reputation for being a very experienced fattening farmer. He was often contracted by other farmers to go to the Badia to select lambs for fattening. Lambs selected directly from the Badia were known to be healthier than lambs bought from markets, having been isolated from other lambs growing up. Lambs bought from markets had a high risk of disease contamination having been exposed to lambs from different sources during transportation and mixing with other lambs at markets. Farmer B practiced a system where he fattened more slowly than farmer A and C. He incorporated residues from his harvest of vetch (as a protein source) and from vegetable and olive production. He would often change feeding strategies to find the cheapest feedstuffs available. The slow feeding strategy resulted in a longer fattening period but also at a lesser cost. Furthermore, he would gain a slightly higher price at the market as his lambs did not put on much fat on their fat tails, a characteristic that influence the price setting for live weights of his lambs. At the slaughterhouse evaluation, farmer B’s lambs also scored the best quality (more meat than fat).

Farmer C practiced intense lamb fattening with no grazing, only concentrate feeding supplemented with wheat or barley straw. He would “exercise” the lambs every day for a couple of hours by walking them in the village areas.

None of the three farmers fed grain produced on their land to the lambs. Grain produce were sold to the government and smaller amount to private markets. Subsidised grain could be bought from government sources at specific times of the year and at the local market during the rest of the year. All farmers bought feeds per batch to economise the feed expenses. None of the farmers fattened lambs during summer as at this time the temperature is high, lambs would not gain enough weight, and the international trading stops.

Health issues

Besides cost of feeding, expenses to cover treatments for sick lambs and cost of veterinary services were considered to be a major economical constraint by farmers. The farmers stated during the on-farm trial, in correlation with findings from the larger survey, that there are high incidences of disease in fattening systems. One problem is the spread of disease when transporting lambs from around the country to the bigger markets in Aleppo and other major towns, and mixing of lambs at markets. These constraints pose a challenge for the sustainability

of the lamb fattening systems and the epidemiology of disease patterns and spread needs to be further studied (Thomson, 1997). Farmers spend a lot of money combating different diseases in the flocks once in their farms and very little preventive work was exercised.

Lessons learnt, future considerations and opportunities: A discussion.

Although the experimental ration was well received on-farm and generated a higher live weight gain than the control, there are some considerations that need to be addressed.

The use of urea wheat straw in lamb fattening systems: Farmers participating in the experiment were sceptical to invest labour into processing urea treated straw. Urea treated straw was regarded by all three farmers as an extra labour burden that was not economically beneficial for the limited returns in terms of increase live weights. Farmers use mostly barley or legume straw with a relatively high protein content (4 – 7%) (Møller et al. 2005) in small quantities for lamb fattening. Straw was fed to keep the rumen healthy and not as a source for fast growth. Furthermore, most farmers, both interviewed in the larger survey and the farmers in the on-farm experiment, fed their lambs several times a day, based on experience. The practice of splitting the daily rations over several feedings, decrease the risk for acidosis from the heavy concentrate load, maintaining the rumen pH at a stable level. For some systems, as the one practiced by farmer A, where fattening are done slowly and over a longer period, the allocation of urea treated straw could be beneficial as the straw to concentrate ratio were higher than on the other two farms. However, as the availability of straw from different grain production is widely available in Syria, a thorough cost-benefit analysis of feeding different straws in lamb fattening systems should be conducted. Schiere (1995) describes the importance of viewing straw treatment in a holistic manner, and evaluating carefully how straw treatment fits to the production outputs required for a given livestock system. More studies of the impact of utilizing urea to treat roughage or utilize it as fertilizer for crops, should be conducted, in order to maximise the benefits for the farmer, a given farming system and expected production outputs.

Minerals and vitamins: An interesting study was conducted by White et al. (1995) concluding that livestock vitamin and mineral deficiencies are common in Syria, particularly deficiencies relating to a lack of vitamin E, selenium, copper, zinc and sodium. Micro and macro nutrient deficiencies may be related to some of the health problems in lamb fattening systems in Syria. Mineral/vitamin supplements were not used by any of the three farmers in the on-farm study, and when introduced through the experimental ration, farmers expressed an interest in using it in the future. Commercial mineral/vitamin mixes were easily available in the local feed markets. Further studies in this relevant subject have to be conducted. Studies should include feed analysis for micro and macro nutrients, but also analysis of the composition of the plants grazed in the rangelands and an evaluation of the soil nutrients and deficiencies. Thus, the failure to provide supplements during intensive feeding regimes may exacerbate the health problems already affecting farmers' livestock. It is of outmost importance that the benefits of using these nutrients are demonstrated to farmers in order to improve the output from lamb feeding systems.

Molasses: Beet molasses is produced in large quantities in Syria, and mainly used in the alcohol industry, bakeries and exported. Farmers were well aware of the benefits from feeding

beet residues from pressed beets, but it is not common to use molasses as a feed source. Farmers were interested in starting to use molasses in fattening as molasses were a cheap source of energy and they observed that the lambs liked it. One farmer started to mix straw with molasses after the experiment and observed that lambs ate more straw this way. However, in the few factories around Aleppo and Hama producing molasses, no commercialization for livestock feeding had yet occurred. Farmers had to get the molasses themselves directly from the factories, a process that required some paper work and permissions. This could be a challenge that the agricultural extension could tackle by organising interested farmers in transporting, obtaining permissions etc. Furthermore feed companies could get involved by including molasses in some ready feed mixes easy to use for farmers and at a competitive price contra the concentrate mixtures that farmer mix themselves. The introduction of ready feed mixes at competitive prices could provide farmers with an option of fattening lambs with a more standard and targeted feeding strategy (for age and intensity) and with a more uniform result. Targeted socio-economic research could be applied to analyse the possible distribution chains, farmers' perceptions, and economical benefits.

Technological research and implementation: There exist large amounts of research papers and books on the topic of sheep nutrition and recommendations for improvements. However, often implementations of recommendations are difficult due to lack of collaboration between research and extension, lack of understanding of the farmers' strategies, limitations, or traditional knowledge systems. In recent years these constraints to technological implementation has received more attention. The experience from the on-farm research showed that positive results could be obtained by combining training of women, men and young people at workshops and the involvement of extension and other stakeholders. Especially when introducing new technological interventions in nutrition and management. The technologies, concepts and ideas were better understood by stakeholders by implementing a holistic approach to learning. Furthermore, training could be formed to fit individual farmers' needs and expectations. The individuality of farmers should never be underestimated and an intervention that works well on one farm may not necessarily be suitable on another. In this aspect the experience of farmer to farmer workshops/schools and visits, has proven to be beneficial as it creates a platform for farmers to share knowledge with other equal-minded farmers (Ahmed, 1993; ICARDA, 2005a). An entry point into making a technological intervention successful may in many instances be the access to talented facilitators that may act as a voice, or "spokesperson" on behalf of communities on different development issues. A local or out-side facilitator may assist an development process by taking the lead at training sessions, workshops and other processes towards development, and ensure a sustainable implementation, follow-up and feed-back of technological interventions. The key is to create trust among researchers and stakeholders through a long-term involvement, and a holistic approach to development, that targets issues relevant for stakeholders.

Animal health issues: A huge task for research in the fields of epidemiology, preventive and clinical diagnosis and treatment emerges from the analysis of farmers claims. Disease spread and infections are not controlled effectively in Syria. Veterinarian checks are done at markets and in the recipient countries. However, to overcome the severe economic constraints to small-scale farmers a registration mechanism of disease patterns and epidemics has to be formulated and implemented. Farmers use enormous amounts of money on medicine that are either administered by themselves or in collaboration with a private or government veterinarian.

Treatments of clinical cases are at best, random. Simple measures such as isolation of diseased animals from the rest of the flock and other preventive measures are rarely seen. Most treatments are based on knowledge farmers have collected from fellow farmers and family traditions. Farmers in the survey called for more information on lamb fattening, sheep production and health on a whole, from the government extension services. Research that could curb disease outbreaks in lamb fattening enterprises, via epidemiological, preventive and diagnostic measurements would have a huge impact on small-scale lamb fattening farmers. If a collective action is implemented with the participation of government, NGO, extension services and farmers the impact would be quickly measurable. Furthermore, a huge un-exploited potential rests in the local knowledge of farmers into alternative, herbal medicine for disease treatment of animals. It is important to collect this local knowledge of farmers as the effect and extend of alternative treatments in lamb fattening systems, lacks documentation.

Disease outbreaks in a flock of livestock is, however, a sensitive issue, as farmers are not pleased to admit that they have a particular disease in their flock in fear of not being able to sell their animals and suffer an economic loss. This may be one very difficult and sensitive issue to overcome in implementing a country-wide disease prevention and epidemiological programme in Syria.

Breeding: It would be interesting to research the possibilities for developing a line of Awassi sheep with better potential to put on more muscle than fat, and still retain the desirable traits required of the breed by the consumers. Another potential researchable issue would be to utilise the high fertility of the Awassi breed. The Awassi are capable of lambing three times in two years (Epstein, 1985), and this could create a possibility of producing lambs for seasons with high prices.

Carcass quality: One hypothesis is that the Awassi has leaner meat than other non fat-tailed breeds, however, the slaughter characteristics and meat to fat ratio of the Awassi needs to be further studied. In the on-farm study (Hartwell et al. 2006c) it was found that there was a significant difference ($P < 0.005$) between lamb carcasses traits following different management and feeding strategies, influenced by age of lambs and intensity of concentrate feeding. There was a relationship between increased age and intensity of concentrate feeding and an increased deposition of fat. More studies are required to understand the partition of nutrients for fat and meat deposition in Awassi in which the fat tail is an adaptive trait to overcome feed scarcity. It was also clear from the on-farm study that slaughter house staff preferred meat from animals with a smaller fat tail relative to the carcass. The effect of carcass quality and consumers' preferences, upon small-scale farmers' management and feeding systems and economic strategies needs to be further studied.

Markets: Syrian farmers fattening Awassi lambs have a comparative advantage to sell their animals to international markets in the Middle East. Especially in the wealthier Gulf countries, as traditionally Awassi lambs are highly priced (more than 3 USD/kg) compared to other imported breeds such as Australian Merino. Selling and buying of lambs are almost always mediated by middlemen at local markets and larger middlemen in recipient countries where large profits are made to sell onwards to the Gulf. The role of middlemen in lamb fattening is still not fully examined, especially their function in money transactions and their importance for the survival of small-scale farmers. However, as Syrian farmers receive high prices for their live

animals sold at local markets, compared to the world markets, the biggest constraint is when international trading is stopped by governments due to disease outbreaks or too many lambs being exported threatening the meat supply to national markets. When the international markets close, the national market prices drop and the income-margins of the farmers often decrease drastically. Thus, market prices fluctuate over the year. More research is needed to understand the mechanisms that govern the market accessibility and price settings for small-scale farmers. Furthermore, there is an import of non-Awassi sheep from neighbouring countries and from countries as far as Bulgaria and Romania (Bourn, 2003). Very little is known about this trade; who buys these animals, why these animals are imported, what happens to these lambs after importations occur, and government policies. The Syrian government has implemented a policy to avoid depletion of the national animal stocks, in which it states that for every single Awassi leaving Syria two non-Awassi should be imported to ensure that enough meat availability (Bourn, 2003). Non-Awassi sheep meat is sold at a lower price making meat from sheep more accessible for the less wealthy. Investigating the international sheep trade in Syria, export as well as import patterns, could produce an indication of the potential impacts, sheep trade have on the economies and survival of small-scale farmers. Through a holistic understanding of the market forces dominating the sheep trade, a targeted effort to adjust small-scale lamb production systems to future demands and development goals could be initiated, and thereby, ensure their survival.

Transport: Welfare and economical losses from transportation of animals for export markets, is a potential researchable issue. Often lambs are transported over long distances and days by trucks when exported to neighbouring countries. More information about the problems experienced by middlemen, truck drivers and governments regarding live animal transport is needed, in order to overcome some of the major constraints (e.g. heat exhaustion, death, injuries). The development of potential guidelines and improved technologies to export transportation practices through research could contribute to the minimization of the economic losses inflicted upon stakeholders when animals are injured or die under transportation. Furthermore, improved guidelines and practices would contribute to improving the overall welfare of the transported animals.

Economics, education, labour and gender issues: The transition from traditional sheep production systems to lamb fattening may influence positively/negatively on the level of education, labour and gender patterns. It could be interesting to investigate if an increased income from lamb fattening increased the educational level of children in households. Often children, especially girls, will only complete a few years in school. However, there is evidence of the better the household economy the better the educational level of the children (Behrman and Knowles, 1999). Studying the links between income and education of children will lead to a better understanding of the impact of education on the youth, the sustainability of small-scale farmers and the ability and willingness of the next generation to develop and improve livestock production in Syria. Good experience has been obtained from ICARDA involving training of women groups and youth training in sheep production issues (ICARDA, 2005a), and more research and training has to be targeted towards these two stakeholder groups. Women and youth contribute significantly to the overall economic return from lamb fattening in terms of labour input, and training and education is vital to ensure a continuous development of the systems.

Household income impact on human nutrition: There exist a potential for researching the relationship between household income from lamb fattening and the impact on human nutrition, especial child nutrition. Lamb fattening systems generally generates a good income. Fifty-two % (n=241) of farmers interviewed in the survey declared that they had what they described as a “medium” good income (surplus in most cases) and 38% said that they had a “good” income (always a surplus) from lamb fattening. Several interesting studies has been conducted on child nutrition and the relationship between household income, agricultural production system, and child stunting (Ghosh et al. 2004a; Ghosh et al. 2004b) in Northern Syria. It was found that households in marginal environments in Syria, depending on off-farm labour and traditional barley/livestock agriculture were vulnerable, mainly in terms of food availability, especially protein under-nutrition (Pellet and Ghosh, 1997). Lamb fattening activities may offer these farmers an option of improved income in periods where they are not working off-farm, by combining lamb fattening with investments from wealthier town dwellers, with cropping. It could be an interesting approach to combine the finding of Ghosh et al. (2004a) and Ghosh et al. (2004b) and investigate if the change from traditional sheep production to lamb fattening activities could affect positively the nutritional status especially in children due to an enhanced income.

Consumers: Consumers in the Middle East prefer Awassi lamb meat. The consumers' preference to Awassi lamb meat is rooted in tradition and religious customs. More information on the consumers' preferences and the marketability of lambs by small-scale farmers need to be collected. In many instances urban consumers prefer to know the origin of the meat they are consuming or even to buy directly from a known farm. This is a niche that could be exploited by small-scale farmers to generate a better income, avoiding fees for middle men and transportation, and also to value their products.

Another researchable issue relates to the relationship between consumer preferences and human health due to consuming a diet high in fat. In the Middle Eastern culinary traditions, fat from the sheep fat tail is used in many dishes. However, the high ingestion of animal fats has a health impact upon the increasing urban population in Syria (Musaiger, 2002). The links between increased urbanisation, food habits and human health risks needs to be studied more in detail, in particular in urban and peri-urban fattening systems. A more in-depth understanding of changes of food habits, impact on human health, consumer preferences and the potential impacts of these changes on small-scale sheep producers needs to be addressed.

Conclusion

In Middle Eastern countries like Syria, where rural livelihoods are mainly governed by agricultural activities and livestock rearing, documenting local knowledge and experiences is of the utmost importance. This allows researchers and decision makers to support and develop a sustainable future for farmers engaged in livestock activities. Research results on the economics of fattening production systems and production ceilings should be made available to policy makers. Including these systems as an entry point for development will thus create an enabling environment in which farmers can further develop their livelihood earning options.

Lamb fattening seems to be a profitable enterprise and fits well with the livelihood strategies of farmers, providing an attractive income generating activity. Lamb fattening activities are

beginning to move away from the use of extensive systems towards more specialized and more market oriented forms of production. This movement has been triggered by the favourable prices available in both local markets and, in particular, in the Gulf, which has resulted in farmers viewing these systems as suitable income generating options. Fattening provides a source of employment for many members of the family involved, and men, women and children undertake different aspect of the work entailed. Positive results have been obtained by providing training to stakeholders in lamb fattening production systems. Studying the relationships between incomes, training and educational levels of stakeholders in small-scale lamb fattening systems, especially that of women and the younger generation is vital. Furthermore, there is a link between household income and child growth and development (nutrition). Analysing the economical, educational and nutritional relationships and links may contribute to ensuring the development and survival of the small-scale farms in a time of transition.

Feeding regimes rely mainly on concentrates and by-products available; however, such feedstuffs are expensive and prices vary over different seasons, something which most farmers think are a major constraint to the financial benefits that can be obtained from lamb fattening. Beet molasses were introduced as an alternative feedstuff to farmers with a potential of decreasing costs of concentrate diets for lamb fattening in Syria, and the inclusion of molasses showed a potential due to its low price. The on-farm experimentation showed that there is a considerable economic return to be made by farmers in optimizing the rations provided to fattening lambs. Nutritional and health issue constraints may be tackled by providing mineral and vitamin mixtures to lambs being fattened. However due to the seasonal and yearly fluctuations of the feed prices the profitability of a given ration composition should be evaluated according to the concentrates available and the prices at different times of the year to make the most profit from the enterprise. Technological implementations and developments should be conducted in collaboration with farmers to fit the individuality of the management and feeding systems that exists within lamb fattening in Syria.

A sound epidemiological assessment of fattening systems and of the animal health conditions associated with them is required, as this will allow researchers to determine the incidences of the most common diseases and the severity of their effects. Furthermore, investigations regarding disease patterns related to transportation and animal welfare needs to be well documented to avoid losses of animals which may lead to economical losses for the stakeholders.

Consumers in the Middle East prefer meat from the Awassi sheep breed, and these preferences influence on the production of lambs by small-scale farmers. Further studies of consumer preferences for meat from the Awassi sheep breed, farmers' income strategies, meat market prices and carcass quality should be conducted. Dietary preferences, especially for fatty foods, and increased urbanization may lead to a string of health problems for the consumers. The links between human health, urbanization and digestion of animal fats should be investigated as these links needs to be better understood in order to prepare small-scale fattening systems for the future trends of consumers.

References

- Abdelali-Martini, M., Goldey, P., Jones, G.E. and Bailey, E. 2003. Towards a Feminization of Agricultural Labour in Northwest Syria. *J. Peasant Studies*, Vol. 30, No. 2. 71 – 94
- Ahmed, S.E.S. 1993. Technology transfer and adoption: ICARDA's experience. *CIHEAM. Cahiers Options Méditerranéennes*, vol. 1(5):107 - 116
- Bahhady, F., Thomson, E.F., Boulad, M., 1997. [Red meat production, marketing and trade in Syria](#). In: Belhadj, T., Boutonnet, J.P., Di Giulio, A. (Eds.), *Filière des Viandes Rouges dans les Pays Méditerranéens. Red Meat Industry in the Mediterranean Countries*. CIHEAM-IAMZ (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 35). Séminaire International sur la Filière des Viandes Rouges dans les Pays Méditerranéens, Zaragoza, 1998, pp. 89-100
- Behrmann, J.R. and Knowles, J.C. 1999. Household Income and Child Schooling in Vietnam. *The World Bank Economic Review*, Vol. 13. No. 2: 211 – 256.
<http://www.worldbank.org/research/journals/wber/revmay99/pdf/article1.pdf>
- Bourn, D. 2003. Livestock dynamics in the Arabian Peninsula. A regional review of national livestock resources and international livestock trade. *FAO*. 86 pp.
- Delgado, C., Rosengrant, M., Steinfeld, H., Ehui, S., Courbois, C., 1999. Livestock to 2020: The Next Food Revolution. 2020 Vision Initiative, Food, Agriculture and the Environment. Discussion Paper 28. International Food Policy Research Institute (IFPRI), Washington, DC, USA. 83 pp.
- Epstein, H. 1985. The Awassi Sheep with special reference to the improved dairy type. *FAO Animal Production and Health paper*, 57, Rome. 282 pp.
- FAO, 2002. World Agriculture: Towards 2010. Food and Agriculture Organization (FAO), Rome, Italy.
http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/V4200E/V4200E00.htm Last accessed on 09.08.2006.
- Ghosh, S., Pellet, P.L. and Aw-Hassan, A. 2004a. Dietary Pattern and Socio-economic Status of Rural Households in Marginal Areas of North West Syria. Abstract. International Research on Food Security, Natural Resource Management and Rural Development. Deutscher Tropentag. October 5 – 7, 2004. www.tropentag.de/2004/proceedings/node124.html
- Ghosh, S., Pellet, P.L. and Aw-Hassan, A. 2004b. Poverty, Food Systems and Nutritional Well-being of Children in North West Syria. *Ecology of Food and Nutrition*. Vol. 43. No. 1-2. Jan. – Feb.: 107 – 148
- Hartwell, B.W., Iñiguez, L., Mueller, J., and Knaus, W.F. 2006a. Characterization of Awassi lamb fattening in Syria. 38 pp. (*Submitted*)

Hartwell, B.W., Knaus, W.F., Iñiguez, L. and Madsen, J. 2006b. Growth responses, slaughter characteristics and economic benefits in cost-effective rations using local feed resources for fattening Awassi lambs in Syria. 15 pp. (*Submitted*)

Hartwell, B.W., Iñiguez, L., Knaus, W.F. and Wurzinger, M. 2006c. Participatory On-farm Implementation of Low-cost Feeding Technologies for Finishing Awassi Lambs. (*Under editing*)

ICARDA, 2005a. ICARDA Annual Report 2004. International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria. 121 pp

ICARDA, 2005b. Sustainable Agricultural Development for Marginal Dry Areas. Khanasser Valley Integrated Research Site. ICARDA/BMZ/Bonn University/AECS. Workshop on “Sustainable Agricultural Development for Marginal Dry Areas”, ICARDA, Aleppo, January 12-13, 2005. Workshop document. ICARDA, Aleppo, Syria. p. 38 - 39

Musaiger, A.O. 2002. Diet and prevention of coronary heart disease in the Arab Middle East Countries. Medical Principles and Practices. 11(2):9 - 16

Møller, J. Jørgensen, R., Helleshøj, M.E., Weisbjerg, M.R., Søgaard, K., and Hvelplund, T. 2005. Foddermiddeltabel – Sammensætning og foderværdi af fodermidler til kvæg. Dansk Kvæg. Rapprt 112. 64 pp.

Nordblom, T.L., Goodchild, A.V., Shomo, F., 1995. Livestock feeds and mixed farming systems in West Asia and North Africa. Available at: <http://www.fao.org/wairdocs/ilri/x5462e/x5462e0f.htm>. Last accessed on March 7, 2005.

Pellett, P. and Ghosh, S. 1997. Global nutritional problems with special attention to the role of animal food in human nutrition. Global Agenda for Livestock Research. (Eds.) E.F. Thomson, R. Von Kaufmann, H. Li Pun, T. Treacher and H. Van Houten. Proceedings of a Consultation on Setting Livestock Research Priorities in West Asia and North Africa (WANA) Region. 12-16 November, 1997, ICARDA, Aleppo, Syria. 25 p.

Schiere, J.B. 1995. Cattle, straw and system control, a study of straw feeding systems. Ph.D. thesis, Department of Animal Production Systems, and the Department of Agricultural Economics, Wageningen, The Netherlands. 216 pp.

Swaid, A. 1997. Syria country paper. Global Agenda for Livestock Research. (Eds.) E.F. Thomson, R. Von Kaufmann, H. Li Pun, T. Treacher and H. Van Houten. Proceedings of a Consultation on Setting Livestock Research Priorities in West Asia and North Africa (WANA) Region. 12-16 November, 1997, ICARDA, Aleppo, Syria. 5 p.

Thomson, E.F. 1997. Small ruminant research in the Medium-Term Plan of ICARDA. Global Agenda for Livestock Research. (Eds.) E.F. Thomson, R. Von Kaufmann, H. Li Pun, T. Treacher and H. Van Houten. Proceedings of a Consultation on Setting Livestock Research Priorities in

West Asia and North Africa (WANA) Region. 12-16 November, 1997, ICARDA, Aleppo, Syria. 9 p.

Vercueil, J., Cummins, G., 2003. The livestock sector and policies in Syria. In: Fiorillo, C., Vercueil, J. (Eds.), *Syrian Agriculture at the Crossroads*. FAO Agricultural Policy and Economic Development Series 8, 219 – 246.

White, C.L., Treacher, T. and Bahhady, F.A., 1995. Mineral and Vitamin Status of Sheep in Syria, Jordan and Turkey. In: Masters, D.G., Shunxiang, Y., De-Xun, L. and White, C.L. (Eds). *Mineral Problems in Sheep in Northern China and Other Regions of Asia*. Proceedings of a workshop held in Beijing, People's Republic of China, 25 – 30 September, 1995, pp. 61 – 67.