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Development Needs of the Dairy Farms in Kosovo

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Tiivistelmä

Kosovo itsenäistyi 17.2.2008 ja sen väkiluku on noin 2 000 000. Lähes puolet ihmisistä on työttömänä. Väestö on nuorta, sillä suurin osa on alle 30-vuotiaita.

Ilmasto ja maaperä ovat lähes ideaaliset maanviljelyyn, mutta kuivuus voi vaivata. Kotitarveviljelyä on paljon. Keskitilakoko on noin kaksi lehmää ja kaksi hehtaaria. Joitakin suuriakin tiloja on. Maanviljely on usein tehotonta ja koneistus on vanhaa tai sitä ei ole lainkaan.

Opinnäytteessä kerrotaan Kosovon maatalouden nykyperuspiirteet maitotalouden osalta. Työssä kerrotaan lisäksi suomalaisesta lypsylehmän ruokinnasta, maidon luokittamisesta ja hyvistä lypsylehmän oloista. Näitä verrataan Kosovon vierailun tuloksiin. Vierailu tehtiin 11.–18.3.2012, minkä aikana vierailtiin 13 lypsykarjatilalla.

Vierailtujen tilojen koko oli 6-115 lehmää. Joka tilalla käytiin läpi albaniaksi ja englanniksi kyselylomake sekä lisäksi kuvattiin lehmät ja nuorkarja sekä niiden olot, maitohuoneet ja koneistus. Lisäksi kahdella tilalla oltiin mukana lypsyllä. Kyselylomakkeella haluttiin selvittää mm. työrutiinit, lypsylehmien ja nuorkarjan ruokinta, hedelmällisyysasioita sekä tilan tulevaisuuden suunnitelmat.

Kyselyn perusteella selvisi, että eläimet voivat hyvin tiloilla. Ruokinta on kuivaheinävaltaista, mutta eläimille annetaan myös jonkun verran maissisäilörehua ja kotoisia väkirehuja. Poikimaväli on liian pitkä ja keinosiemennyksessä on ongelmia.

Kyselylomakkeen tulosten perusteella tehtiin parannusehdotus. Kiimantarkkailussa ja ruokinnassa olisi parantamisen varaa. Lisäksi vasikoille ei tulisi juottaa antibioottimaitoja. Positiivisiakin asioita löytyi: sorkkahoito on hyvää, eläinten kuntoluokat ovat kohdillaan sekä tilalliset pitävät ammatistaan sekä ovat kiinnostuneita kehittämään maataloutta. Työn lopussa esitellään kuvineen hyvät lypsyrutiinit esivalmisteluineen sekä neuvoja kiimantarkkailuun. Työn tuloksia käytetään tulevien maatalousneuvojien koulutusmallin suunnittelemisessa Kosovossa.

Avainsanat
maitotalous, Kosovo, lypsylehmä, ruokinta, kiimantarkkailu

SAVONIA UNIVERSITY OF APPLIED SCIENCES **THESIS**
Abstract

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Abstract

Kosovo is a country that has been independent since 17th February 2008. The population is about 2 000 000 people. Almost half of the people are unemployed and most of the people are aged less than 30 years.

Climate and the soil are almost ideal for farming but drought may cause problems. There is plenty of subsistence farming. An average farm size is about 2 cows and two hectares. There are also some big farms. Farming is usually inefficient and machinery is primitive or it is not used.

The thesis tells of the current situation of dairy production in Kosovo. There is also theory about Finnish feeding practices, classification of milk and about conditions that a cow likes. These things are compared to the results received. The visit to Kosovo was made during 11th-18th March 2012. 13 dairy farms were visited during the visit.

The farm size among farms visited was 6-115 cows. A questionnaire was made in each farm in Albanian and in English. Besides that photos were taken from cows and young stock, their surroundings, milk rooms and machinery. Milking was attended in two farms. Questionnaire is about working routines, feeding of cows and young stock, fertility and the future plans.

As a result well-fare of the animals is fine. Feeding is hay-based but also maize silage and concentrate e.g. wheat are given. The time between calving is too long. There are also problems with artificial insemination.

From the results received was made a suggestion for improvement. Heat detecting and feeding could be done better. Calves should not be given antibiotic milk. Positive things occurred, too. Taking care of hooves is well-done, cows are fine if condition scoring, farmers like their profession and they are interested in improving dairy production. At the end of thesis is shown with photos some advices about right preparing system before milking and heat detection. The results of the thesis will be used when training new advisors in Kosovo.

Keywords

dairy production, Kosovo, a dairy cow, feeding, heat detection

CONTENTS

1 INTRODUCTION

The dairy sector is one of the fast-developing sectors of agriculture in Kosovo. Unfortunately farming and agriculture is mostly inefficient. Machinery is mostly primitive or it is not used. Usually farming is subsistence farming but there is plenty of potential for developing agriculture. The soil is mostly suitable for agriculture and the climate is warm enough. Drought can cause problems in some parts of Kosovo.

Client organization of the thesis is TAGAK (Training of Agricultural Advisors in Kosovo) -project. Behind the project works the Savonia University of Applied Sciences in Finland, ProAgria Centre Finland and the University of Pristina in Kosovo. The goal of the project is to train 20 agricultural advisors from 3 municipalities (Vushtrri, Skenderaj and Fushe Kosove) and secondly the Ministry of Agriculture, Forestry and Rural Development (MAFRD) as well as the Agriculture and Veterinary Faculty of the University of Pristina in Kosovo. The project begun in October 2011 and will last for 24 months. (Project plan 2011.)

The thesis will give information about the current situation of dairy production in Kosovo: breeds used, feeding, milk yield and machinery. Knowing about these things is important because they cannot be improved if the basics are unknown. The work is about commercial and semi-commercial farms that are willing to develop. Also readiness to change is better when it is about bigger farms. The developing part will include data from the farms that will have a developing plan. Also the methods used and results received from visits to farms are told: e.g. their working and feeding methods. The thesis is limited to dairy cows because dairy production is currently developing fast and extra knowledge is crucial. A visit to Kosovo was made during 11th – 18th March 2012. Evaluation about different methods was done and compared to regular methods in Finnish. The information received will also be given to Pristina University in order that people there can use it when training new advisors. Evaluation is based on Finnish dairy cow methods and knowledge and each of them is presented in the thesis.

2 DAIRY SECTOR IN KOSOVO

2.1 Dairy farms and processors

It is estimated that the number of Kosovo farms is about 83000. There are less than two cows on average in a farm. Oscillation in milk production causes also problems. Milk production is higher in summer than in winter. (Nushi & Selimi 2009, 5-7.) Processors have trouble using all the milk in the summer when the cows are in full production (Hammann 2005, 4). The majority of dairy farmers (93.8 %) have up to four cows but only 1% of the farms have more than 10 cows. According to estimations only 3,6 % of farmers supply milk to commercial dairies. The quality of milk is poor in general but liters produced have increased during the past few years. It is estimated that the consumption of milk per person per year is about 160 liters and increasing. (Nushi & Selimi 2009, 5-7.) There are approximately 155 000 dairy cows in Kosovo (Hammann 2005, 3).

An average farm has a field of about 2,2 hectares. Crop yields on average per hectare are wheat: 3,9 tons, barley 2,5 tons and grain maize 3,9 tons. (Vehapi 2009, 22.)

Milk production is concentrated in the private sector since the public sector collapsed during the transition in the 1990's and especially during the war in 1999. Milk production is a very important agricultural activity. Only about 10 % of milk produced is delivered to dairies for processing. The rest is used for feeding calves and for own consumption or sold as raw milk or white cheese on the various local unregulated (green) markets. Commercial and semi-commercial farms sell milk to one of the dairy processors. Two systems are currently in place for the collection of raw milk. From larger commercial farms the milk is collected directly by the dairy processors, while smaller farmers bring it to central, privately operated milk collection centers. It is transported to the dairy plant either by the processors or by intermediaries. A large number of small dairy farmers make milk collection expensive especially in the case of low-quality milk. Processors are aware of this problem and try to improve the quality of milk delivered by the system of higher prices paid for good-quality milk. (Nushi & Selimi 2009, 4.) There are 16 registered and certified dairy processors in Kosovo (Jahja-Hoxha 2012b).

Large number of farms is managed by young inexperienced farmers or by farmers with insufficient knowledge of farm management of dairy farms. This is the main rea-

son of bad production results and high production costs, which is directly correlated with economic balance of such farm. Main problems which lead to such condition are: high mortality level of dairy cattle and calves, low production of milk per cow due to different health problems or improper feeding, high percent age of culled cows due to mastitis and other pathological conditions, reproductive problems caused by variety of factors among which the most important is bad farm management, low hygiene conditions at the farm and low and under pay milk obtained by these farms. (Hammann 2005, 5.)

2.2 Breeds used

The dominant breeds are Holstein (Black and Red), Brown Swiss, Simmental, and Montbeliard. In the Alps (mainly in Austria and Italy) and some mountain areas in Kosovo Tyrol Grey can be found as well, (Bytyqi, Rrustemi, Mehmeti, Kryeziu, Gjinovci & Gjonbalaj 2010, 276). Kosovo is still dominated by crossbreeds, originated from the native breed Busha. It is told that Busha has a high resistance against different diseases and good adoption to extensive breeding conditions. Recently, in commercial farms can be seen crossbreeds of imported breeds such as Simmental x Holstein, Simmental x Brown Swiss, Holstein x Brown Swiss. (Bytyqi et al. 2010, 277.)

The insemination practice of cows is based on natural and artificial insemination. The natural inseminations are apparently used more. Unsuccessful inseminations, lack of timely estrus detection and other failures have caused the use of artificial insemination to be at a lower rate even in the commercial farms. (Bytyqi et al. 2010, 277.)

According to Ardita Jahja-Hoxha (2012c) only a veterinarian is allowed to inseminate the cows. It may cause timing problems because vets are busy. They may take care first of more important issues like sick animals. There are seminologs who inseminate the cows in Finland. Veterinarians do not inseminate in Finland.

2.3 Milk yield, quality of milk and antibiotic residues

Annual milk yield per cow varies from 1500 – 6000 liters of milk depending on the farm and breed used. More productive breeds like Simmental and Holstein usually located on bigger farms can produce 5000 and more liters while local breeds like Busha can produce only between 1500 – 2500 liters yearly. (Nushi & Selimi 2009, 13.) Average milk yield in Kosovo is estimated to be about 1800 liters per cow per year (Vehapi 2009, 22). Compared e.g. to Slovenia where annual milk yield per cow

is 5500 liters and about 4200 liters in Serbia. (Nushi & Selimi 2009,13). Many cows have good genetic potential for higher amounts of milk (Bytyqi et al. 2010, 275).

It is said that the quality of milk is poor in general. In a study of 50 dairy farms 64 % of the farms produced milk in III-class (Musliu, Gjonbalaj, Sharifi & Meqe 2009, 49). A study of 13 largest commercial farms in Kosovo shows that 78,45 % of the milk was in Extra-class in 2008. The same number in 2009 was 70,88 %. (Bytyqi, Zaugg, Sherifi, Hamidi, Gjonbalaj, Muji & Mehmeti 2010, 173-175.) Numbers of the quality of milk in general in Kosovo was asked even from the Ministry level but no numbers were available.

Table 1 tells of information about milk classification in Kosovo and milk prices for a farmer in the Pristina region. The numbers can be referred to Finnish standards, see table 3. Finnish standards are stricter than in Kosovo. The milk price is very good if in Extra class.

TABLE 1. Milk prices and the quality of milk in Kosovo (Jahja-Hoxha 2012a).

Number of bacteria pmy/ml
Extra ≤ 80000
I-class 80000-100000
II-class 100000-300000
III-class 300000-500000
If number of bacteria >500000, milk cannot be sold

Somatic cells pcs/ml
Extra ≤ 300000
I-class 300000-400000
II-class 400000-500000
III-class 500000-750000
If number of bacteria >750000, milk cannot be sold

Milk prices for a farmer in Pristina region
Extra: 0,42 €/l
I-class: 0,38 €/l
II-class: 0,35 €/l
III-class: 0,30 €/l

There is no data available about the health situation, infectious diseases or fertility from Kosovo. Also no numbers from insemination practices or time from one calving to another was available.

There are some problems considering artificial insemination. Choice of semen is very small. Normally there is only given a choice of breeds. E.g. no choice for semen for calving ease, increasing milk production and improving legs or udder is offered. (Dobbler 2005, 8.) The quality of semen is poor in general. It may be taken care of badly and there can be no live semen left when getting it to the cow. The semen can be in the thaw water for 45 minutes. Maximum time there should be 5 minutes. (Dobbler 2005, 9.) Some violent procedures like pulling calve may weaken the fertility. Especially if pyometria or endometritis evolves after violent actions it may turn up problems. Many cows do not receive a proper treatment. (Dobbler 2005, 8.)

2.4 Feeding

The cattle are mainly stall rather than pasture fed which makes costs higher (Nushi & Selimi 2009, 14). Hay is the most common feed during the winter time (Bytyqi et al. 2010, 278). Hay consists of grasses (in natural and sown meadows) or Lucerne (alfalfa). Silage production is increasing which reduces production costs of animal products. Silage production also brings more security for farmers for winter feeding but the yields are still variable and dependent on rainfall. In regions where irrigation is possible farmers perform much better. From table 2 can be seen estimated crops of different forage. (Kamberi 2009, 26.)

TABLE 2. Estimated crops of different forage in Kosovo (Kamberi 2009, 26).

	Hectares	Production, t	Yield, t/ha
Forage and green cereals	96 766,10		
Meadow hay	66 381,10	184,7	2,8
Grass	7 899,50	30,6	3,9
Alfalfa	14 617,50	61 554,90	4,2
Clover	2 261,30	7 471,50	3,3
Vetch+Oats	329,6	1 461,20	4,4
Wheat (green)	674,8	3 320,00	4,9
Barley (green)	79,7	109,9	1,4
Oat (green)	3 595,20	13 338,60	3,6
Maize (green/silage)	788	11 388,60	14,4

Normally cattle are kept indoors from the second part of November until the end of April. Grazing the animals usually begins in the second half of May. (Bytyqi et al. 2010, 277-278.)

A dairy cow needs to be fed properly if wanted it to give more milk. If fed well, the cow is healthy, shows heats well and becomes pregnant regularly which secures milk production. Especially when it is about high productive cows like Holstein, feeding is very important. If the Holstein receives too low energy content feed, it loses weight, becomes ill and produces less milk. Native breeds can survive with less food but their genetic potential for producing high amounts of milk is lower. Big ruminants like dairy cows require good forage and also concentrate is mostly needed. The cows have to have free access to roughage at all times. A dry cow needs nutritional fodder: plenty of fibers in forage but it must not be fed too much. The specie of grass chosen is very important: it has to be suitable for the cow but also for the area cultivated. There is no information available whether preservatives are used or not when doing silage in Kosovo.

2.5 Climate and soil

The climate of Kosovo is typically semi-continental with average annual rainfalls of 631 mm and average temperature of 11°C during the last 20 years. (Bytyqi et al. 2010, 277.) Typical for the climate are warm summers and cold winters with Mediterranean and Alpine influences. Average temperature within the country ranges from +30 °C (summer) to –10 °C (winter)). Due to unequal elevations in certain parts of the country, there are differences in temperature and rainfall distribution. That is why the country is divided into three climatic areas: Climatic Area of Kosovo (Rrafshi i Kosovës), Climatic Area of Dukagjini (Rrafshi i Dukagjinit) and Climatic Area of mountains and forest parts. (Climate 2011).

December and January are regarded as the coldest months, July and August as the warmest months of the year. The maximum rainfall rate is reached between October and December. Between November and March, snowfall can be expected in Kosovo, even in the flat parts of the country. The highest snowfall rates can be expected in the mountain regions of Kosovo. (Climate 2011).

Half of the land of Kosovo (53%) is cultivated (Bytyqi et al.. 2010, 277). Figure 1 shows how land is relatively used.

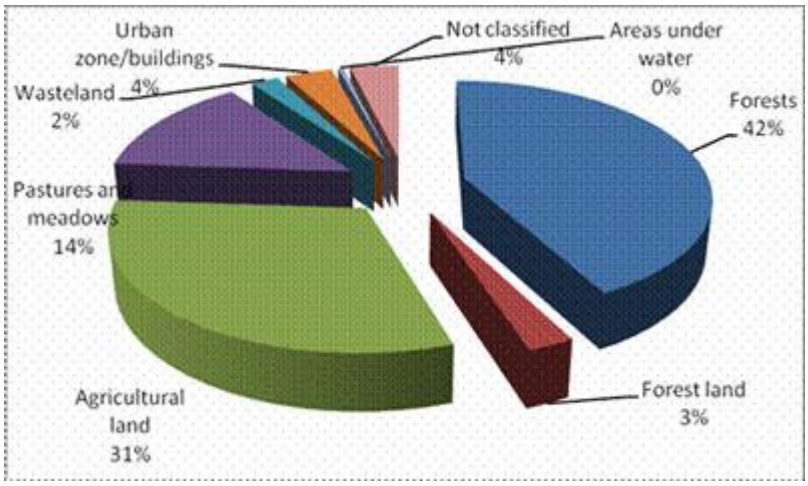

FIGURE 1. Relative land use in Kosovo (Kamberi 2009, 5).

From figure 2 can be seen how agricultural land is used in Kosovo. Most arable areas are in lowland zones in the north and east of the country. The number of pastures has decreased since 1988, mainly because of the war in Kosovo. Some meadows are reportedly being naturally recolonized with trees since grazing has stopped. There is no data on the use of fertilizers on grassland and pastures. The most frequently used fertilizers are mixtures of nitrogen, phosphorus and potassium, traditionally known as NPK fertilizers and in at least 90% of cases the content of these nutrients is 15:15:15. NPK fertilizers are generally used for basal dressings during land preparation. If applied to grasslands and meadows they are usually used in late winter or early spring. (Kamberi 2009, 27.)

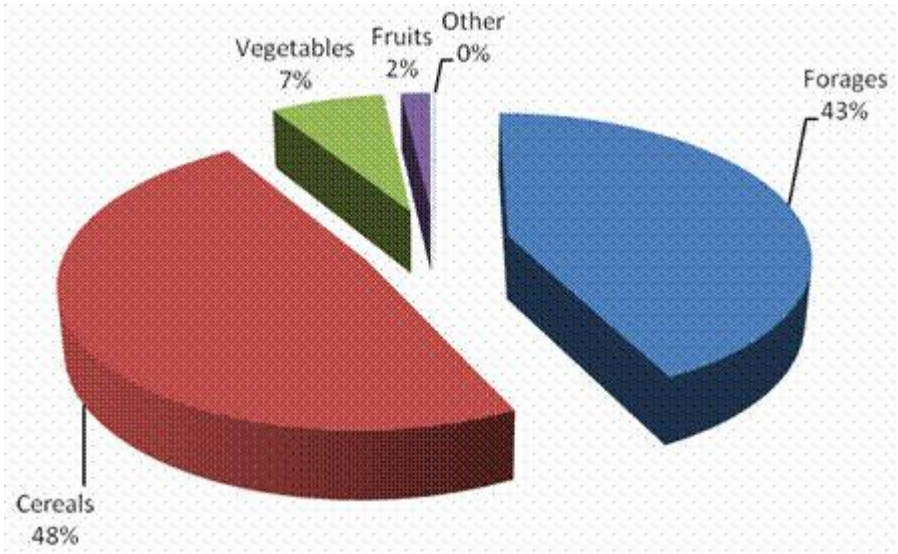

FIGURE 2. Structure of the use of agricultural land (Kamberi 2009, 26).

3 FINNISH STANDARDS OF RAW MILK QUALITY, HEALTH CARE AND FEEDING

3.1 Quality standards of raw milk in Finland

Table 3 shows Finnish standards for good raw milk. Nothing must be added or deleted from the milk. The milk must not be delivered if there any doubts that it may be rejected or that it may include chemical residues. If the milk does not fulfill the standards the farmer has to do something about it. The farmer has to have production methods that secure the standards required. The farmer has to tell the processor if the milk produced cannot be delivered for further use. (Maidonlaatukäsikirja 2011, 20.) 95% of Finnish dairy farmers achieved the best standards of milk in 2010 (E-class). According to Taipale (14.12.2011) Finnish milk has the best quality in the European Union (EU). Finnish standards were chosen because people know how to produce good milk. Also the milk yields are big in Finland that may tell the knowledge in feeding, fertility, health and conditions for cows are good. Number of somatic cells and number of bacteria are strict but they can be achieved by hard work.

TABLE 3. Quality standards of raw milk in Finland (Maidonlaatukäsikirja 2011, 20).

Feature	**Target value**	**The pass mark**	**Rejection limit**
Residues of antibiotics	-	-	+
Smell/look	normal	normal	abnormal
Acid number	<1,4	≤3	
Temperature	≤4°C (not frozen)	0-6°C	>10°C
Freezing point loss	≤ -0,520°C	-0,512 - -0,560°C	added water
Somatic cells	<250000 pcs/ml	≤400000 pcs/ml (in geom. average of 3 months)	repetitive crossing
Number of bacteria	<50000 pmy/ml	≤100000 pmy/ml (in geom. average of 2 months)	repetitive crossing
Butyric acid	<1000 pcs/l	<3500 pcs/l	repetitive crossing

Colostrum must not be sent to processors and it must be milked separately 8 times and over the course of four days. If a cow milks less than 6 liters of milk daily, it must not be sent to the processors because of possible mistakes in smell or taste. This may concern e.g. cows that will be dried. (Maidonlaatukäsikirja 2011, 21.)

3.2 How milk standards mentioned can be achieved?

3.2.1 Residues of antibiotics

When a cow has a bad case of mastitis it must be cured by antibiotics. Milk must not be used for human consumption. Every antibiotic has a withdrawal time before it can be used for human consumption. Antibiotic residues must be tested after the withdrawal time because every cow has a different system and systems get rid of antibiotics differently. There are reliable tests for testing residues: e.g. T101-test and Delvo-test. T101-test was changed into the Delvo-test at the end of 2011 in Finland.

When the antibiotic test shows a negative result for residues and the mastitis is cured, milk can be delivered to the processor (Maidonlaatukäsikirja 2011, 47). If milk with antibiotic residues is delivered into processors it will ruin huge amounts of milk and plenty of milk and work will be wasted.

A cow treated by antibiotics has to be milked last or separately. The milking machine has to be washed right after antibiotic milk. Teats that are milked daily must not use any cream that includes antibiotics. (Maidonlaatukäsikirja 2011, 49.)

3.2.2 Sensory quality assessing

The smell and the look of the milk must be normal. Milk must be white with no clumps, obstacles or any other strange things. The smell of milk must be fresh and not e.g. rancid. Normal smell and look can be achieved by good hygiene in milking machinery, the milk tank, clean udder and teats and with cows with no mastitis.

The acid number tells how much of the fat of milk has decomposed (lipolysis). The number gets bigger depending on how much fat has decomposed. The acid number gives information for the farmer and advisors about milk quality. When fat decomposes free fatty acids form and they taste bad, as if the milk is rancid. If the result of the acid number is <1,4 the risk of bad taste is small. If the result is 1,5-2,9 the risk of bad taste has risen but is acceptable. The reasons affecting the bad taste must be checked if the risk has risen. If the number is >3, milk tastes really bad. (Happoluku 2011.)

The farmer has to observe the smell and look of the milk regularly. By right working methods the acid number can be held down. A clean and well-working milking machine, clean milking and udder, gentle milking (right vacuum and without “air strikes”), a clean and well-working milk tank (temperature, cooling time and right speed of mix-

er), the proper size of the milk tank (occupancy of at least 50% within four milking times), right ventilation in the milk room and enough clean water for the cows and cleaning machinery give good results. Also milking cows that are going to become dry should be milked separately. (Maidonlaatukäsikirja 2011, 43.)

3.2.3 The temperature of the milk

When the milk truck arrives milk must be $\leq 6^{o}C$. The preservative temperature is less than $4^{o}C$ but it cannot be frozen because freezing causes taste errors in milk. The milk tank has to work properly: cooling capacity is enough if cooling of $1^{o}C$ requires max 20 minutes after the milking. The mixer in the tank may not cause any foam or cream on the surface of the milk. The temperature has to be +5 - $+25^{o}C$ in the milk room and ventilation has to be efficient enough. Milk cannot be used for human consumption if its temperature has been $>6^{o}C$ for more than three hours. (Maidonlaatukäsikirja 2011, 40.)

By defining the freezing point of the milk you can tell if any water has been added into milk. The freezing point varies a bit according to breed, feeding and lactation. Normal value is -0,520 - $-0,535^{o}C$. The more water there is in the milk the closer the freezing point is to $0^{o}C$. There must be guidance on how to use the milking machines cleaning program. Cleaning water may not be mixed in milk. The milking machine must be dried after cleaning. Also feeding of the cows has to be balanced. (Maidonlaatukäsikirja 2011, 38.)

3.2.4 Somatic cells

There are always cells in the milk. They are white cells that protect a cow and the udder against diseases. When there are more than 100000 pcs/ml of cells in milk the structure of it changes. The amount of cells tells the situation of the health of the udder of the cattle. If the cells are high cows are not completely healthy and the farmer loses income. When a cow has mastitis it milks less than healthy cows, causes costs for treatment and extra work. If a cow would be slaughtered because of mastitis, it would be very expensive. (Maidonlaatukäsikirja 2011, 47.)

Milking technique is an important thing affecting udder health. The milking machine must be ok: maintenance and testing have to be done regularly. By using a cell test it can be discovered if the cows have mastitis. When mastitis is found action needs to be taken. The cow's environment has to be good: the stall, tether and sleeping pad

has to be dry and clean. Ventilation has to be ok because humidity and gases from rumen and manure weaken health. (Maidonlaatukäsikirja 2011, 47.)

3.2.5 Number of bacteria

The aim for the bacteria amount is less than 50000 pmy/ml. Things that effect the number of bacteria in milk are temperature and time. Also production hygiene in the farm and preservation time in the milk tank has an influence on the amount of bacteria. Growth of bacteria is slow in low temperatures and increases if the temperature rises. The number of bacteria does not usually change within two days of the milking if the preservation temperature is under +4^{o}C. Bacteria that like cold conditions are dominant species in the milk tank. (Maidonlaatukäsikirja 2011, 45.)

Good results can be achieved by good milking hygiene. The stall has to be clean and dry. From manure or dirty litter bacteria or spores can be transferred into the milk. Hands have to be washed before starting milking. Teats have to be cleaned by a moist (not wet!) towel. Tops of teats must not be forgotten. Each cow has to have its own towel. The whole udder must not be wet because water drops may drain into the milking machine and bring dirt along with it. Using running water in milking sections is not recommended. Cutting hair from the udder makes cleaning the udder easier. Teats have to be dry before a milking machine is put into action. Take at least four milk sprays into a separate container from each teat in order to reduce the bacteria amount in milk. Put the milking machine carefully onto the teats and avoid “air strikes”. The machine may suck bacteria and dirt into the milk. When taking off the milking machine it must be done with care and avoiding “air strikes”. (Maidonlaatukäsikirja 2011, 45-46.) If the udder is quite empty, milking should be started within 2 minutes of the starting preparations. If the udder is full, milking should be started within a minute of the starting preparations. (Manninen, Nyman, Laitinen, Murto & Hovinen 2006, 25.) If the milking machine is put too late onto the teats after preparation, the milk amount is smaller, milking is slower and more milk will be left in the udder (Manninen et al. 2006, 26).

3.2.6 Butyric acid

Butyric acid is harmful for making cheese because it causes error intercourse. Butyric acids make milk taste and smell bad. Also palatability and feed values of silage weaken because of butyric acid. Butyric acid spores are mostly found in soil and animals bowels. That is why when making silage care has to be taken that silage cannot include any soil or manure. Good milking hygiene cannot necessarily guarantee good

milk if there is butyric acid in the silage. A cow's digestive system cannot destroy butyric acid spores which is why manure includes plenty of butyric acid spores. Manure in the stall will stick onto the udder and teats and there is a high risk that it will transfer from the stall into the milk. Good milking hygiene is very important because 90% of butyric acid spores will come to milk from milk and the teats. (Maidonlaatukäsikirja 2011, 56.)

Good milk has less than 1100 pcs/l butyric acid spores in the milk. Milk without any doubts has <400 pcs/l. spores. If a farm has >3500 pcs/l spores it has to do something to fix things. (Maidonlaatukäsikirja 2011, 57.)

3.3 Health care in a dairy farm

Figure 3 shows information on what things effect on dairy production. Feeding is one of the factors that effect on annual milk yield. When aiming to a good economical result, all sectors have to be invested in. E.g. bad condition in barn may hinder good feeding and lead to worse result than expected. (Kyntäjä, Nokka & Harmoinen 2010, 5.)

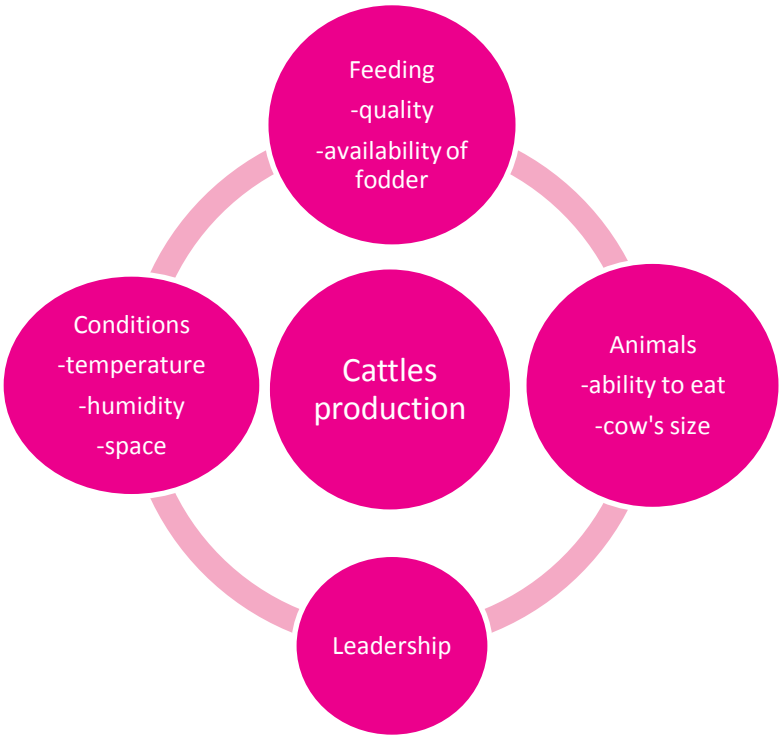

FIGURE 3. Things effecting on dairy production (Kyntäjä et al. 2010, 5.)

3.3.1 Protecting from infectious diseases

When buying an animal abroad the buyer can require the seller to give information about the health of the animal. Animals have to be examined in case of infectious diseases and a guarantee is required. Proceeding like this, possible diseases will not spread to the farm or to neighbors. A certificate of animal health can be asked from a farmer who is selling an animal. (Lampinen, Yliaho, Harmoinen & Teräväinen 2003, 12.)

Only obligatory visitors like a vet and artificial inseminator should be allowed into the cow house. When an animal is going to be sold the animal picker must not walk through the cow house. e.g. walking on a feeding table is forbidden. If possible the farmer should bring the animal to the door and give the animal to the animal picker outside. If the picker has to come inside he should be given protective footwear and clothing. Also washing and disinfecting hands and shoes should be possible. If a visitor comes from abroad he should not have been handling animals within 48 hours. (Lampinen et al. 2003, 12.)

If a farmer goes abroad to a cow house he has to ask for protective footwear and clothing. A farmer should stay away from his own cow house for at least 48 hours after coming back from abroad. Washing the clothes well, disinfecting and going to sauna is recommended after the trip. If diarrhea occurs, it should be examined in case of salmonella. (Lampinen et al. 2003, 12.)

Other animals like cats and dogs do not belong in the cow house. A few cats are acceptable if they catch mice and rats. Rodents are not allowed and fodder has to be protected from birds that may spread diseases. (Lampinen et al. 2003, 12.)

Hygiene in general decreases the risk of having diseases. Taking off the manure regularly, cleaning up the boxes and getting rid of flies reduce the risk. If the density of animals is too high, it increases infectious pressure because diseases spread with the help of secretion and touch. (Lampinen et al. 2003, 12.)

It is possible to make an animal's resistance better by having good conditions for cows. Also enhancing methods of production and offering an opportunity for natural characteristics behavior for cows reduces their stress and resistance becomes better. Planning feeding, analyzing fodder and condition scoring cows regularly ensures the

quality and quantity of feeding. It also makes the possibility of staying healthy better. (Lampinen et al. 2003, 13.)

3.3.2 Conditions that a cow likes

The right size of the stall and right softness increase the time that the cow lies, reduces claw diseases, teat trapping and skin failures, increases the wellness of the cow, increases milk production and makes calves grow faster. A cow needs 60-130 liters of water per day depending on the temperature of the environment, production level and fodder used. The quality of water has to be good. Condition and cleanness of drinking vessels has to be taken care of. Requirement for a dairy cow's vessel is to give water at least 10 liters per minute. (Lampinen et al. 2003, 17.)

The size of the stall can be estimated by measuring some things from a cow. Table 4 tells how it is done. It also advises what the cow's needs are and how a cow shows it. (Hulsen 2007a, 51.)

TABLE 4. A comfortable stall for a dairy cow (Hulsen 2007a, 51).

Need of a cow	**Cow's signal**	**The size of the cubicle**
A good starting position for lying down.	Cow stands straight in the cubicle.	Neck rail 0,83 x height at the withers. The length of bed 1,2 x withers height.
Possibility for using head as counterbalance when lying down.	A cow can lie down by using head as a counterbalance.	Deterrent strap 0,7 x withers height.
Soft landing for a comfortable surface.	A cow lies down soon after arriving to cubicle. Hocks and knees are unblemished.	≥ 10cm litter and mattress or rubber mat and litter all together.
Long enough cubicle, space for the head.	A cow lies straight.	Open in front 1,8 x height at the withers. Wall in front 2,0 x height at the withers. Brisket locator 1,2 x withers height measured from rear kerb.
Width enough cubicle.	A cow lies comfortably on her side.	2,0 x the width of the hook bone.
Possibility to ruminate comfortably.	A cow is able to stretch her head forward at an angle.	
Possibility for lying foreleg stretched out.	A cow can lay foreleg stretched out.	
Easy to get up.	A cow gets up smoothly by using head as a counterbalance. Neck rail is not on her way.	See above (neck rail and head rail).
The comfortably of the cubicle in general.	90% of the cows are lying in cubicle. ≤ 10% of cows has knee or other injuries. Cows are clean. It is easy for cows to get up and lie down.	

If an adult cow could choose and has enough food, it lies more than half of the day. The rest of the day a cow eats and only short moments are for taking care of the hair and body or socializing with the others. When lying down, a cow wants a soft and proof place. If the surface of the stall is too hard, a cow avoids lying down because a strain is put on its knees. Sufficient lying down time improves the condition of the udder and claw and also secures sleep. (Valros, Teräväinen & Helin 2005, 55.) An adult cow sleeps about four hours during the day, about 0,5 hours at a time (Valros et al. 2005, 54).

Exercise or grazing year-round is good for claw health. The snow purifies the claw of dirt and manure. If exercising is continued after grazing, a cow gets used to cold weather smoothly. Dry and cold weather is not harmful for a high productive cow. Grazing also improves fertility and offers stimulus for cows. (Valros et al. 2005, 53 – 54.) Table 5 shows what effects on bovine's well-being.

TABLE 5. Things that affect a bovine's well-being (Valros et al. 2005, 44).

Place to lie down	At least one/bovine	Enough space	Well littered, soft and proof	Warm and no draft (esp. for calves)
Conditions	Well littered	No draft	Well lit	Low noise
Passage	Clean and proof	Flexible material		
Company	8 weeks old calves belong in a group, if possible even earlier	Heifers get used to company	For adult bulls a stable group	
Feeding	Free access to roughage at any time	Enough space for eating		
Water	Enough water vessels	A cup or a pool is better than a nipple	Water flow for dairy cows 10-20 l/min, for calves 1-2 l/min, the others 4 l/min	
Caring	Pleasent contact to human	Positive caring is very important for calves	In a group box everybody should be paid attention to	

3.3.3 Minimum requirements and recommendations for the environment of the cow

The Finnish Ministry of Agriculture and Forestry (MMM) states minimum requirements in general for bovines. The place to be has to have enough space, protection, light, be clean, safe and the place has to consider the bovine's natural characteristics behavior as well as possible. Bovines have to be able to be taken care of and treated easily. The bovines place has to offer enough protection against the cold, heat and humidity. The place to be has to be planed, built and taken care of in a way that everything is safe for a bovine. Animals must not run away and everything has to be as fire safe as possible. Bovines have to be able to be removed from the building fast in an emergency. Bovines have to be able to stand and rest in a natural position but also move and get up naturally. There has to be enough space for resting in case

they all want to rest at the same time. Passages and doors have to be big enough that bovines can move smoothly and safely from one place to another. (MMM 2005.)

Recommendations for a bovine's place are that boxes and stalls have to placed in a way that bovines can see actions that happen in the building. They also have to have the possibility to socialize with other bovines. There should be a separate box for a sick or injured bovine and the bovine should see other bovines if possible. There should be a fire alarm in the building that can be heard anytime during the day. The farmer should be prepared for an emergency and he should have equipment to put down the fire. (MMM 2005.)

Requirements for the building for bovines are ventilation has to be efficient enough in order to delete harmful gases, dust and extra humidity. Also the temperature has to be proper for a bovine. If the ventilation system is mechanized there has to be an alarm system that tells if something is broken. There should not be any high noise in the bovine's building. Bovines should not be exposed to a noise over 65 dB(A) for a long time. Lightning has to be proper, too. Structures have to be checked every day. In case something is broken it has to be fixed as soon as possible. Manure should not contaminate any fodder. (MMM 2005.)

MMM (2005) recommends the following about the conditions for the cows. If the lightning of the cow house is mainly based on artificial light it should be lighted during the daytime 9 a.m. – 5 p.m. and the relative humidity should be maximum 80%. From table 6 can be seen recommendations of maximum contents of harmful gases and impurities in the cow house. Ppm tells content of the matter in parts per million.

TABLE 6. Recommendations of maximum contents of harmful gases and impurities by MMM (2005).

	Maximum content
Ammonia, NH_3	10 ppm
Carbon oxide, CO_2	3000 ppm
Carbon mono oxide, CO_x	10 ppm
Hydrogen sulfide, H_2S	0,5 ppm
Organic dust	10 mg/m^3

Comfortable temperature for a dairy cow is +5 - +15 ^{o}C: critical temperatures are -15 – (-25)^{o}C and +23 - +30^{o}C. Good temperature for heifers is +10 - +20^{o}C: critical temperatures are 0 – (-15)^{o}C and +23 - +30^{o}C. Calves need warm conditions and the best temperature is +15 - +25^{o}C: critical temperatures are the same as for heifers. High temperature causes a cow heat stress because the animal is not able to evaporate heat from the body. If the temperature goes below the critical point, the animal uses more energy to produce warmth and its production becomes lower. (Kivinen, Ahokas, Poikalainen, Teye, Hautala, Tamminen, Veermäe & Pajumägi 2008, 31.)

3.3.4 Udder health

An infection is an invasion by a disease-causing organism. Inflammation is the body's immune response to foreign substance and objects such as bacteria. Subclinical mastitis shows no visible signs of disease or infection in the milk or udder. The immune system mounts a mild response to an udder infection by sending more cells to the udder. Special techniques can be used to detect these changes such as cell counting and milk conductivity tests. Clinical mastitis is a visible inflammation by changes in the milk and swelling and pain of the udder. The immune response is strong. The body temperature may rise and in some cases the cow becomes sick. There are two different types of mastitis bacteria: contagious bacteria are transmitted from cow to cow via milk. Environmental bacteria enter cow from the environment. There are five things that are affecting udder health: monitoring, infection pressure, resistance, milking and treatment. (Hulsen 2007b, 4.)

Some environmental bacteria are always present such as Escherichia coli (ECO) and Streptococcus uberis (SUB). They can be controlled by having dry cubicles, clean bedding and clean outdoor conditions especially for dry cows. Klebsiella is usually present in wet saw dust. Pseudomonas is in contaminated water, the teat dip or teat cloths. (Hulsen 2007b, 8.) Yeasts occur usually in the environment and on the skin of the cow. Yeasts are not bacteria and are not susceptible to antibiotics. (Hulsen 2007b, 45.) Staphylococcus aureus (SAU) can be found from the skin of the udder and in the milk. Coagulase Negative Staphylococci (STC) usually causes mastitis for heifers in early lactation. Streptococcus dysgalactiae (SDY) causes mastitis with a high cell count. It usually causes mastitis from damaged teats. Streptococcus agalactiae (SAG) survives only in milk and can spread only via milk. (Hulsen 2007b, 44.) Cubicles should be cleaned at least twice a day, ideally during milking. They also should be freshened up twice a day e.g. during your rounds. (Hulsen 2007b, 14.) Cows should stand for at least 30 minutes after milking once the last cow has been

milked. 30 minutes is enough to seal up the teat openings which reduce risk of udder infection when they next lie down. Waiting for fresh feed after milking helps cows stand long enough after milking. (Hulsen 2007b, 15.)

A farmer should have monthly/yearly routines to take care of the udder health. Infection pressure should be reduced e.g. by clean surroundings. Resistance of the cow should be as strong as possible. It can be achieved by good food supply in each stage of lactation, good quality of water, a safe and good place to lie down and good passage ways. The milking machine has to be in good shape, mastitis should be treated at an early stage and a recovering cow should have good conditions. Treatment is important. Mastitis should be identified at an early stage and treated immediately. Monitoring, setting targets for udder health, keeping accurate and detailed records of mastitis, checking on a monthly basis% of new infections and reviewing everything once more is very important. (Hulsen 2007b, 4.)

3.3.5 Numbers when assessing fertility

It is important for a cow to calve regularly. Table 7 shows information about goal and alarm numbers when assessing a dairy cow's fertility. (ProAgria 2012.) If a cow calves regularly every 365 days, she has enough time to recover after the calving and there is also time for a 2 months dry period. The dry period should not be too long because of the risk of gaining. If a cow is inseminated only once per calving it is cheaper compared to several inseminations. It makes the dairy production more profitable. If a heifer is too old or young when calving for the first time, she may have increased risk for problems with calving.

TABLE 7. Goal and alarm numbers when assessing the fertility of the dairy cow (ProAgria 2012).

Numbers when assessing fertility	**Goal**	**Alarm**
Time from a calving to another	365-375 days	400 days
Inseminations per pregnancy	<1,6	2
Time from a calving to first insemination	60-80 days	85 days
Age when a heifer calves for the first time	24-25 months	not younger than 22 months

3.4 Feeding of dairy cows

3.4.1 Successful feeding

30 % of costs in dairy production come from fodder itself and about 65 % of its variable costs. The way how feeding is done also has a significant effect on work and machinery costs. When investing feeding effects planning and building costs but also building or machinery investments that have been done on set lines for the feeding system. The most important thing when planning feeding is the farmer's view of his farm and its future. Figure 3 shows important things that have an effect on a cow's dairy production. (Kyntäjä et al. 2010, 5.) Knowing theoretical issues about feeding is important in order to understand the effects of feeding. The basics are presented in the next chapters.

3.4.2 The most important nutrients for a dairy cow

Carbohydrates are the most important energy source for a cow. A cow receives energy from fodder that is about a third of its energy change into warmth and only about a quarter is available for dairy production. Indigestible energy goes into manure which is about a quarter. Digestible energy loss happens also in urine and in fermentation gases. (Kyntäjä et al. 2010, 11.) Figure 4 tells more specific how energy is divided in a cow's digestion and metabolism if a cow weights 560 kg, milks 26 kg/day and gains 170 g/day and it's total eaten energy (BE) 100 % is 329 MJ (Kyntäjä et al. 2010, 12).

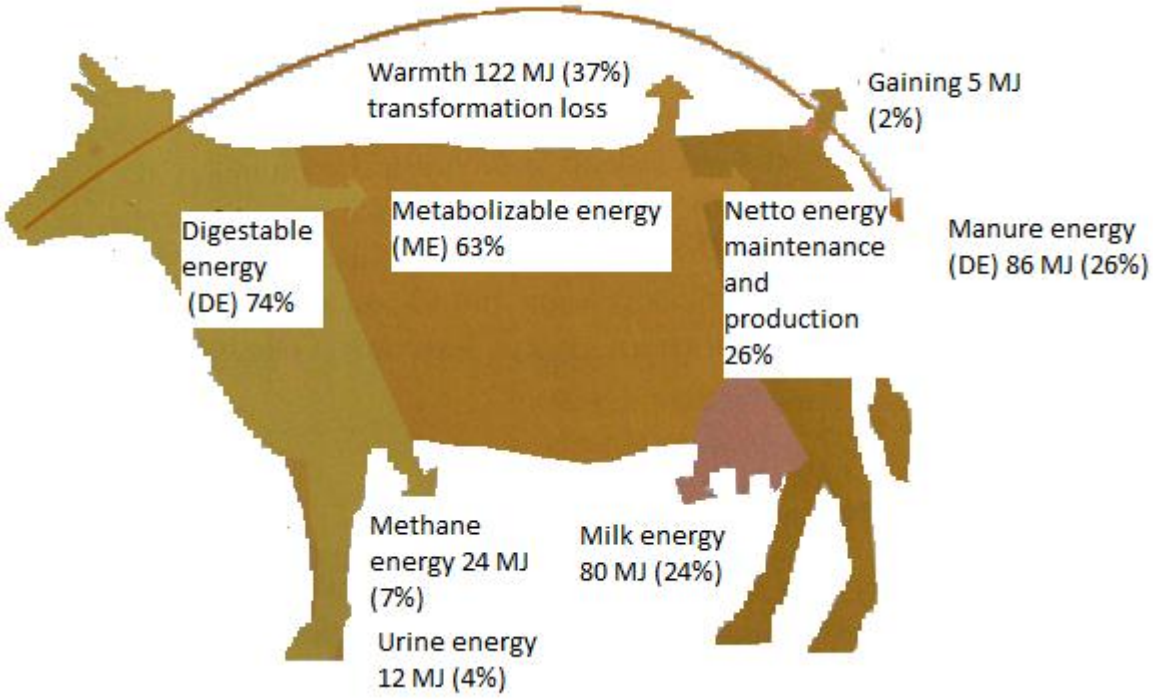

FIGURE 4. Energy dividing in a cow's digestion and metabolism (Kyntäjä et al. 2010, 12.)

Proteins are building materials for tissues and organs and they are necessary in every organ function. A proteins basic unit is amino acid and basically protein requirement is amino acid need. They join into peptides. Polypeptides form into proteins that can be very different from each other. (Kyntäjä et al. 2010, 11.)

A cow needs minerals and trace elements in many organ functions e.g. in digestion, as a bone building material, muscle function and in fetus growth. Need of minerals increases when production becomes higher. Figure 5 clarifies how a dairy cow uses minerals and trace elements. For forming spit and for digestion fluids are needed Na, Ca, P, MG, K and Cl (1). For building and developing material for bones is needed Ca, Na, Cu, P, MG and Mn (2). For corpse fluid balance maintenance is Na, Ca, K and Cl (3). For muscle and nerve functions are needed Ca, Mg, P, Na, K, Mn and Se (4). For metabolism reactions, enzyme- and hormone actions are needed Ca, Na, Cu, Zn, P, Mg, Fe, S, Cl, Mn, I and Se (5). For production and fetus growth are needed Ca, Cu, Zn, P, Mg, Mo and Mn (6). (Kyntäjä et al. 2010, 13.)

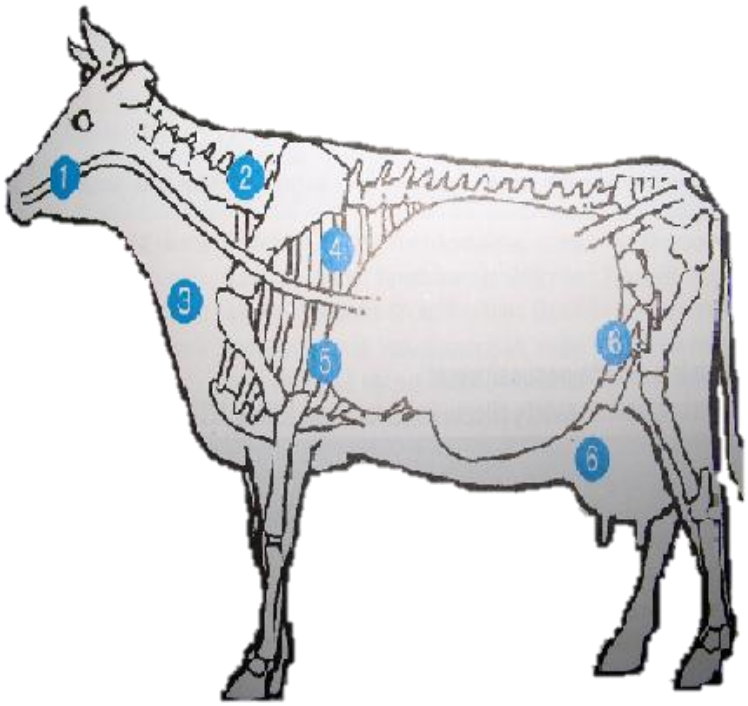

FIGURE 5. Minerals and trace elements in a dairy cow's organs (Kyntäjä et al. 2010, 13.)

3.4.3 Important vitamins for a dairy cow

Vitamins are necessary for metabolism but their need is small compared to other nutrients. Some of the vitamins have an effect on the quality of animal production. (Kyntäjä et al. 2010, 14.) Vitamin A is needed for sight maintenance, bone growth and maintenance of fertility but also epithelium tissue growth and maintenance. A-vitamin can be received as carotene from early development stage grass plants. Carotene is destroyed easily by oxidation that is fostered by warmth, light and humidity. In dried hay carotene loss can be massive. In silage carotene loss is smaller depending on pre-drying time, conditions and way of preservation. Receiving A-vitamin from fodder is necessary because it cannot be made in organs. (Kyntäjä et al. 2010, 15.)

Vitamin D is an important part of the metabolism of calcium (Ca) and phosphorous (P) but it also participates on bone forming. A cow receives D-vitamin from precursor in the skin with the help of the sun. Fodder plants have very rarely D-vitamin though there is as an exception in sun light pre-dried grass fodder. D-vitamin is stored less in organs than A-vitamin. (Kyntäjä et al. 2010, 15.)

Vitamin E is an important antioxidant. It prevents polyunsaturated fatty acids oxidation and also oxidation products injurious effects. E-vitamin maintains also cell membrane structure. E-vitamin appears plenty in grass plants but is destroyed partly during drying and preservation. Vitamin content is reasonable in dried grain and protein plants but in fresh preserved grain there is no E-vitamin. Constant receiving of E-vitamin is necessary because it cannot be made in organs and it cannot be stored. (Kyntäjä et al. 2010, 15.)

Vitamin K has an influence on coagulation of the blood and metabolism of calcium. K-vitamin appears quite a lot in green fodder. Also microbes produce it in rumen and in the intestine, so a cow does not need any extra portion of it and should not suffer lack of K-vitamin in normal circumstances. (Kyntäjä et al. 2010, 15.)

Vitamin B is needed for metabolism of carbon hydrates, fat and proteins. A cow normally receives enough B-vitamin because it is being produced in microbe synthesis in rumen and also basic fodder contains B-vitamin. Sometimes it benefits if biotin, niacin and choline has been given. (Kyntäjä et al. 2010, 15.)

Vitamin C is an important oxidant. It participates in cell medium forming and maintains several tissues and organ functions. C-vitamin is exceptional because a cow is able to synthesize it in its system which is why there is no need to give extra. (Kyntäjä et al. 2010, 15.)

3.4.4 The basis of feeding

The energy values for ruminants and horses are based on metabolisable energy (ME). ME with ruminants tells the energy requirement for dairy production, growth and system maintenance (Kyntäjä et al. 2010, 11).

Presenting the energy values as mega joules has several advantages: one additional calculation is deleted and mega joule is an international standard. The transparency of feed evaluation is improved when a national modification within animal feeding sector is no longer used. The concentration of metabolisable energy is calculated according to a British method (MAFF 1975, 1981, 1984). For further information on comparison of energy evaluation systems, see: Kaustell, K., Tuori, M. & Huhtanen, P. 1997. Comparison of the energy evaluation systems of feeds for dairy cows. Livestock production science 51, 3: 255–266. (MTT 2011a.)

3.4.5 Energy requirements of dairy cows

Table 8 shows an equation how much energy a dairy cow needs per day if milked a certain amount of milk. An example of energy requirement for a cow that weighs 650 kg and produces 40 kg energy corrected milk (ECM) per day: Energy requirement (MJ ME/day) = $650^{0.75}$ × 0.515 + 5.15 × 40 kg ECM/day = 272 MJ ME/day. (MTT 2011a.)

An example of energy requirement for a cow that weighs 550 kg and produces 20 kg energy corrected milk (ECM) per day: Energy requirement (MJ ME/day) = $550^{0.75}$ × 0.515 + 5.15 × 20 kg ECM/day = 161 MJ ME/day. The effects of housing type (tied-up or loose-housed), grazing or temperature are not taken into account in energy requirements of dairy cows. (MTT 2011a.)

TABLE 8. Energy requirements of dairy cows (MTT 2011a).

Energy requirements of dairy cows (MJ/day)	
Maintenance (MJ/day)	Live weight$^{0.75}$ × 0.515
Milk production (MJ/kg ECM)	5.15 × ECM (kg)
Live weight change (MJ/kg LWC)	34 MJ × kg live weight gain
	28 MJ × kg live weight loss
Pregnancy (MJ/day)	7 months: 11
	8 months: 19
	9 months: 34

The feed evaluation system uses constant feed values irrespective of the feeding situation. The feeds do however have important associative effects, which can be taken into account by using correction equations. The following correction equation was taken into use in year 2010 and is based on a large data set of production experiments (MTT 2011a.): Corrected ME-intake (MJ/day) = Uncorrected ME-intake (MJ/pv) - (-56.7 + 6.99 × MEm + 1.621 × DMI - 0.44595 × CP + 0.00112 × CP^2) DMI = Dry matter intake kg/day, MEm = Uncorrected ME concentration of the diet MJ/kg DM, CP = Crude protein concentration of the diet, g/kg DM. The correction equation indicates that ME intake is reduced if dry matter intake increases, diet has a high energy value or diet has a low crude protein concentration. The effect is curvilinear so that the benefits from increased crude protein concentration become smaller at higher concentrations. (MTT 2011a.)

In some cases (particularly for dry cows with low feed intake energy concentration in the diet), the correction term produces negative values. In that case, the energy intake will increase compared to the calculated values. The increase will be taken into account up to 2 MJ/day. (MTT 2011a.)

The energy corrected milk (ECM) yield can be calculated according to Sjaunja et al. (1990) based on milk composition (MTT 2011a): ECM (kg) = Milk production (kg) × (383 × fat-% + 242 × protein-% + 165.4 × lactose-% + 20.7) / 3140. If lactose concentration has not been determined, the following equation can be used: ECM (kg) = Milk production (kg) × (383 × fat-% + 242 × protein-% + 783.2) / 3140

3.4.6 Protein requirements of dairy cows

Table 9 shows how protein needs for a dairy cow can be calculated.

TABLE 9. Protein requirements of dairy cows (MTT 2011c).

Metabolizable protein (MP; AAT) requirement of dairy cows	
Maintenance (g/day)	1.8 × live weight$^{0.75}$ + 14 × DMI (kg/day)
Milk production (g/day)	(1.47 - 0.0017 × ECM (kg/day)) × protein yield (g/day)
Live weight change (g/kg LWC)	233 g × kg live weight gain 138 g × kg live weight loss
Pregnancy (g/day)	7 months: 75 8 months: 135 9 months: 205

An example of MP requirements for a dairy cow, that weighs 650 kg, consumes 25.3 kg DM/day, produces 40 kg energy corrected milk (ECM) and 1240 g milk protein per day: MP requirement (g/day) = 1.8 × 650$^{0.75}$ + 14 × 25.3 kg DM/day + (1.47 - 0.0017 × 40 kg ECM/day) × 1240 g milk protein/day = 2324 g MP/day. (MTT 2011c.)

An example of MP requirements for a dairy cow, that weighs 550 kg, consumes 14.9 kg DM/day, produces 20 kg energy corrected milk (ECM) and 620 g milk protein per day (MTT 2011c): MP requirement (g/day) = 1.8 × 550$^{0.75}$ + 14 × 14.9 kg DM/day + (1.47 - 0.0017 × 20 kg ECM/day) × 620 g milk protein/day = 1303 g MP/day.

If the dry matter intake of the cow is not known, it can roughly be estimated using the energy requirement and an average diet energy concentration (i.e. 11.5 MJ ME/kg DM). This method assumes that the cow is in energy balance (not using or building body energy reserves). An example: a cow weighs 650 kg and produces 30 kg ECM/day, so that her energy requirement is 221 MJ ME/day. Dry matter intake (kg/day) = 221 MJ ME/day / 11.5 MJ ME/kg DM = 19.2 kg DM/day. (MTT 2011c.)

In the year 2010 update, feed PBV values (protein balance in the rumen) became more positive. After this change, the rumen is in protein balance when the average diet PBV value is close to zero. In ration formulation, negative diet PBV values should not be accepted for dairy cows. The adequacy of nitrogen for rumen microbes can also be judged from milk urea concentration, which should be over 17-18 mg/dl. (MTT 2011c.)

3.4.7 Feeding in practice

To ensure access to fodder at all times it has to be taken care of that there is always ability for silage or total mixed ratio (TMR). There has to be left overs 5-10 % of roughage given. (Kyntäjä et al. 2010, 95.) If a cow eats e.g. 40 kg of roughage per day, there should be nearly 4 kg of left overs (Kyntäjä et al. 2010, 120). Hygiene of the fodders and nutritional values has to be good. Every cow has to have at least 75 cm of eating space in loose housing. There has to be access to drinking water at all times. Passageways have to be wide enough but also there has to be enough cross passageways. Leg health has to be well taken care of especially in loose housing, in order to secure the cow's access to fodder and water. (Kyntäjä et al. 2010, 95.) A lactating cow needs for maintenance and production 3 – 4 kg water per produced milk kg which means 4 – 6 kg per eaten dry matter kilo. The account includes water in roughage and drunken water. If a cow does not have access to water at all times it reduces dry matter intake and milk production. There is variation in water consumption among cows but temperature effects also on water consumption. (Kyntäjä et al. 2010, 15.) Figure 6 shows things affecting a cow's real intake of fodder (Kyntäjä et al. 2010, 39).

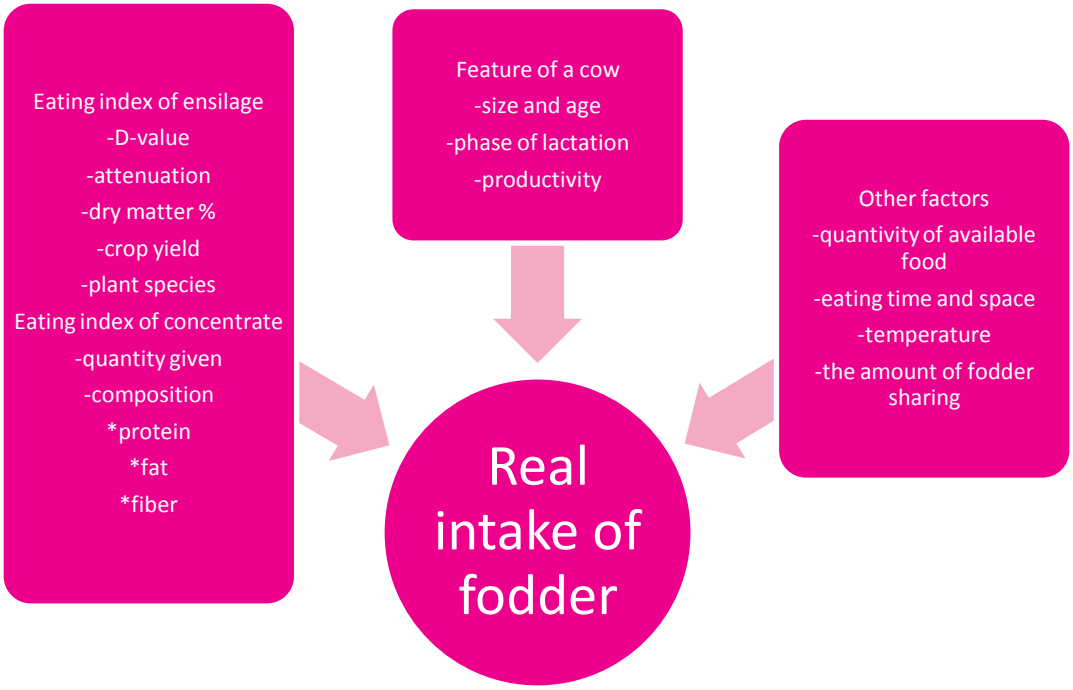

FIGURE 6. Things effecting a dairy cow's eating (Kyntäjä et al. 2010, 39).

If pH in rumen is near to neutral (pH 5,5 – 7) the rumen's microbe action is at its best. Acidosis can be talked about if pH is <5,5. It may mean the cow has received too much concentrate or plenty of sugar fodder. At this point a cow becomes sick. If pH in the rumen is >7 it can be talked about as alkaline rumen. This may happen in spring when grazing with high urea and it makes the cow ill. (Kyntäjä et al. 2010, 116.)

Concentrate should be given a maximum of 3-4 kg at a time in order to reduce risk of pH changes in the rumen. Concentrate should be given several times per day. If pH in the rumen falls, it hinders microbe action and may cause loss of appetite and increase risk of laminitis. Giving silage before concentrate evens pH in the rumen. TMR evens also pH in the rumen when milk yield is increasing after calving. (Kyntäjä et al. 2010, 116.) A cow's diet should include daily at least 25% (rather more than 30%) of roughage fibers when roughage's D-value is more than 680 g/kg dry matter (Kyntäjä et al. 2010, 118). If a cow milks about 30 kg/day she should be given about 21 dry matter kg intake of fodder (D-value of ensilage 680 g/kg dry matter) from which 40% of concentrate consists of 80% barley and 20% turnip rape (Sairanen, A. 2012a). That means about 10, 5 dry matter kg silage (42 fresh kilos if dry matter-% is 25%) and 8, 5 dry matter kg of concentrate (7, 72 fresh kilos of barley and 1, 93 fresh kilos of turnip rate if dry matter-% is 88%).

D-value is widely used in Finland and in Nordic countries but rarely in Europe. D-value can be calculated MJ ME * 0,016= D-value. (Sairanen, A. 2012c.) D-value is the most important single value that represents the quality of silage. Target value is 680-700 g/kg dry matter. If D-value improves by percentage point, it increases milk yield 0,5kg per day and dry matter intake 0,17 kg per day. (Kyntäjä et al. 2010, 84.) D-value tells information on success of harvest time (Kyntäjä et al 2010, 83). If D-value is low, more concentrate has to be given in order to achieve better milk yield (Kyntäjä et al. 2010, 76).

Feeding of a dry cow is important. When the cow is going to be dried her diet has to be changed into a less energy content feeding. Plenty of fibers have to be given e.g. straw or hay beside small amount of silage. (Kyntäjä et al. 2010, 112.) Minerals given have to consist of low calcium-phosphorous relation or without any calcium. The risk of milk fever reduces this way. (Kyntäjä et al. 2010, 113.) Giving concentrate has to be started three weeks before the expected calving. This period has to contain the same feed as after the calving. (Kyntäjä et al. 112.) The amount of concentrate given should be 3-4kg at the expected calving date. If the rumen microbes adjust to concentrate it reduces the risk of laminitis after the calving. (Kyntäjä et al. 113.)

3.5 How to evaluate if the feeding is successful?

3.5.1 Condition scoring

Figures 7 – 11 advice how condition scoring can be made (Condition scoring 2012). After doing condition scoring estimation of feeding is possible to do. If cows are too thin or fat, feeding must be changed.

A. =paralumbar fossa
B. = the between paralumbar fossa and lumbar vertebrae
C. =lumbar vertebrae
D. =the skin under the lumbar vertebrae, edge
E. =hook bones and pins
F. =rump plate
G. =the space between hook bones
H. =tail hollow

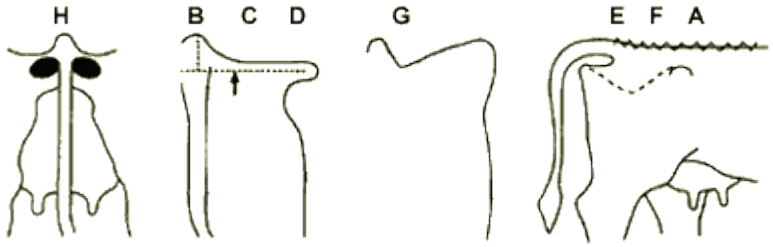

FIGURE 7. Condition scoring 1.

- paralumbar fossa can be seen well, sharp (A)
- the space between the paralumbar fossa and lumbar vertebrae is clearly sunken (C)
- more than half of the lumbar vertebrae can be seen
- lumbar vertebrae edge is very sharp (D)
- between hook bones there is a deep hole (G)

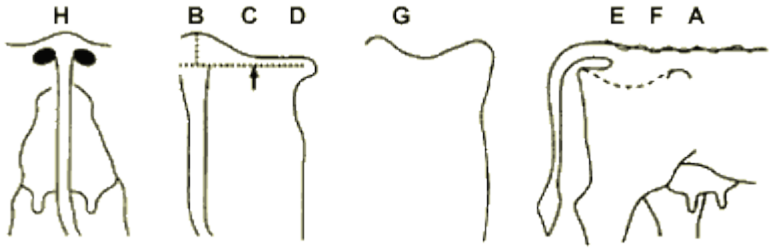

FIGURE 8. Condition scoring 2.

- some of the paralumbar fossa can be seen, sharpish (A)
- between the paralumbar fossa and lumbar vertebrae is a clear hole (C)
- ½ - 1/3 of the lumbar vertebrae can be seen, round
- lumbar vertebrae edge can be clearly seen (D)
- there is a clear hole in the rump plate (F)
- the space between hook bones is clearly down (G)

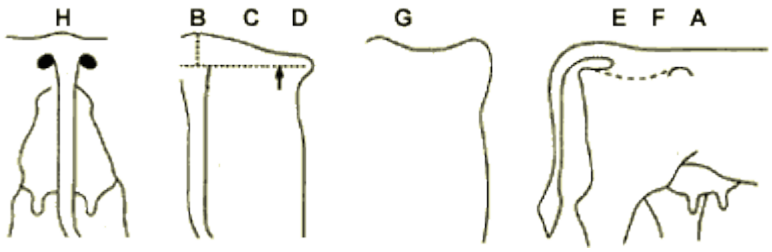

FIGURE 9. Condition scoring 3.

- paralumbar fossa are round, the back line can be clearly seen (A)
- the between paralumbar fossa and lumbar vertebrae is clearly concave (C)
- less than ¼ of lumbar vertebrae can be seen: can be felt if pressed
- lumbar vertebrae edge is small (D)
- rump plate is down, figure U can be seen (F)
- the between of hook bones is only a bit down (G)

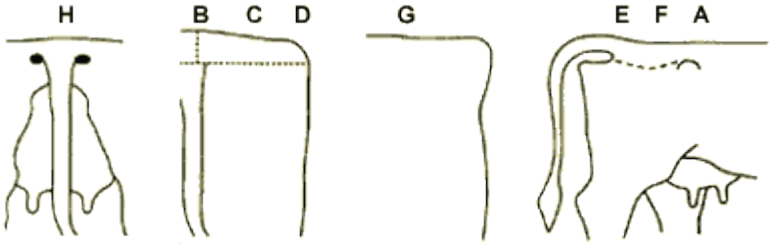

FIGURE 10. Condition scoring 4.

- paralumbar fossa cannot be felt, the back line is even (A)
- the between of paralumbar fossa and lumbar vertebrae is almost even C)
- lumbar vertebrae cannot be seen: a smooth and round edge (B)
- lumbar vertebrae edge is straight (D)
- rump plate is slightly down, a gently sloping U-figure can be seen (F)
- the between of hook bones is smooth (G)

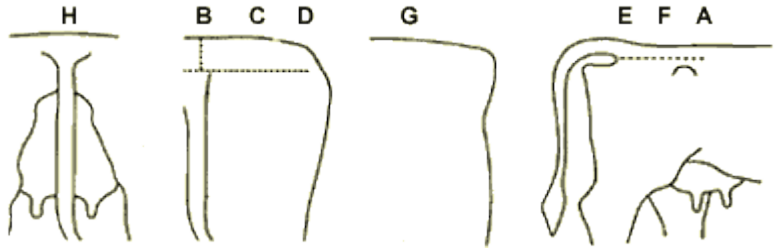

FIGURE 11. Condition scoring 5.

- paralumbar fossa are covered by fat (A)
- between paralumbar fossa and lumbar vertebrae is plump (C)
- lumbar vertebrae are lost in fat (B)
- lumbar vertebrae edge is covered by fat (D)
- rump plate is plump (F)
- between hook bones is plump (G)

Condition scoring of dairy cows gives us important information about feeding and its state. Table 10 shows briefly what scoring tells us (Hulsen 2005, 63). Scoring can be done at least three times during the lactation: after the calving, 2-3 months after calving and before the dry period. If feeding is successful, the condition score value should fall a maximum 0,5 in the beginning of lactation. A genetically high milk yielding cow's condition score may fall under 3. A cow's condition score should not change much during the end of lactation. Especially during the dry season gaining has to be avoided. If a cow has lost plenty of weight, it has to be gained during the lactation. (Kyntäjä et al. 2010, 118 – 119.)

TABLE 10. What does the condition score tell us (Hulsen 2005, 63)?

Reference point	Evaluation	Signal	Possible actions
Average score	Within normal range	Good: the cows are getting enough energy	Maintain the current situation
	High	Risk that food intake will be poor at the beginning of lactation.	Ensure that cows are not too fat when they enter the dry period. Pay attention to dry matter intake of fat cows at the beginning of lactation.
	Low	Insufficient energy intake and poor resistance to disease.	Improve dry matter intake. Increase the energy density of the ration.
Spread of scores	Wide	Big difference between cows in both energy intake and energy requirements.	Determine how intake differences develop. Standardise the requirements: establish production and breeding groups.
	Narrow	Good: the cows have sufficient energy.	Maintain the current situation
If you find any problems, you need to investigate further.			

From tables 11 and 12 can be seen goal marks for a single cow and for the whole cattle when condition scoring. A good goal for condition is 3-3,5.

TABLE 11. Goal marks for a cow in condition scoring (Condition scoring 2012).

A single cow	
A dry cow	3,5
Calving	3,5
Insemination 2 months after calving	3
Heifer	
Insemination	3
Calving	3,5

Condition scoring can be effected by fodder portion's protein distribution strategy. If the tolerance of condition scoring wants to be reduced in cattle high amounts of protein fodder should be avoided in the beginning of lactation. On the opposite extreme, at the end of lactation concentrate that has higher protein composition can be given. It gives more milk but cows do not gain. If high amounts of protein are given in the beginning of lactation it may accelerate milk production and mobilization of tissues to

energy which may cause condition score dropping off too much. (Kyntäjä et al. 2010, 120.)

TABLE 12. Goal marks for whole cattle in condition scoring (Condition scoring 2012).

A whole cattle			
Cows	Days after calving	In average	Variation
Calving cows	-10 - +10	3,5	3,25-3,75
Beginning of lactation	30-50	3	2,75-3,25
Middle of lactation	51-90	3	2,5-3,25
End of lactation	>180	3,25	3-3,5
Dry cows		3,5	3,25-3,75
Heifers			
-insemination		3	2,75-3,25
-calving		3,5	3,25-3,75

3.5.2 Observing functioning of rumen and digestion

Composition of dung should be observed daily especially with cows that have calved recently. The structure of dung tells mostly the amount of fiber in feeding. The goal is that dung goes smoothly through the grate but there should be also something on the grate. When dung splashes well when hitting the ground, fodder fiber content is proper. (Kyntäjä et al. 2010, 117.) If the dung is too loose animals are dirty. The size of cubicle, air conditioning, littering and tidiness in general also has an effect on the dirtiness of animals. (Kyntäjä et al. 2010, 118.)

Fullness of rumen tells if the cow has eaten enough roughage during the past few hours. Fullness can be estimated from behind the left hand side. If there is a “give way” sign under the lumbar vertebrae the eating is insufficient. Another reason for emptiness of the rumen can be too rapid degrading of fodder in the rumen. If many cows have “give way” signs in the rumen access to roughage and composition of fodder should be checked. Especially recently calved cows should be paid attention to in order to make sure that beside concentrate also their roughage consumption is seen to. (Kyntäjä et al. 2010, 118.)

3.5.3 Milk composition indicators

By evaluating milk composition the success of the feeding can be estimated. Protein, fat and urea contents tell information about the cow's nutrition and the balance of the feeding. Milk should contain at least 2,9% of protein, 3,25% of fat and the annual milk yield should be at least 6000 liters. (Kyntäjä et al. 2010, 120.)

Protein content tells information about the energy balance of the cattle. If the content is low, there can be some shortages in feeding. The protein content changes almost the same however as the energy is increased in feeding, e.g. by increasing concentrate amount or giving more digestible silage. (Kyntäjä et al. 2010, 121.) From fat content can be estimated roughage-concentrate balance. If energy intake increases fat content usually decreases. If energy intake increases by more digestible silage fat content usually increases. If the fat content is less than protein content an evaluation about concentrate and roughage balance should be done. Usually the amount of concentrate is too big compared to roughage eaten. The situation can be difficult after calving when a cow eats plenty of concentrate and less roughage. (Kyntäjä et al. 2010, 122.)

From the urea content of milk it can be estimated to see if there is enough raw protein in feed or is there enough digestible protein in the rumen. Normal urea content is 25-35 mg/100ml. Too high urea content >40 may effect becoming pregnant in a negative way. If the urea is high, there is too much protein in the feed. Urea content should not be <20 because there is quite a low protein content in the feed. (Kyntäjä et al. 2010, 123.)

4 RESEARCH METHOD USED

When doing the thesis it was done a questionnaire, an interview, observation and evaluation. These techniques were combined when finding out the development needs of Kosovo farms. It was crucial to see the farmers in action in their own farms which is why the visits are the most important things. Besides the visits it needed to be done research interviews and participatory observation.

An interview is an inadequate term for the range of ways in which people may give the information and insights sought. Both questionnaires and research interviews are usually seen as part of the survey main method. (Gillham 2003, 59.) The most important point is not to be rigid about what can be or cannot be done in case studies (Gilham 2003, 59-60). Interviewing is appropriate for a small amount of people, especially if there is only one researcher. Interviewing gives important information from key or representative people. (Gillham 2003, 61.) Interviewing is a good technique when having accessible people and the most important questions require an extended response with prompts and probes to clarify the answers. (Gillham 2003, 62.)

Doing questionnaire needs time. Questionnaires have to be usually filled in by the respondent without any assistance which is why questionnaire design and development is crucial. (Gillham 2003, 79.) Doing a questionnaire is one of the most traditional ways of collecting research data and it is been used since 1930's. (Aaltola & Valli 2010, 103). The thesis questionnaire was filled in when interviewing and some questions was able to be clarified. A questionnaire has to inspire confidence (Aaltola & Vallila 2010, 105). A questionnaire can be sent via post to a big number of people, it can be done to a big group with the researcher attended or not (e.g. in a class room), as an interview, as a phone conversation or it can be done as an E-mail or as an Internet questionnaire. (Aaltola & Valli 2010, 107-113).

Observation is looking, listening to what people say, watching what people do and asking clarifying questions (Gillham 2003, 45). Observation is of two main kinds: participant is being involved (qualitative) and detached/ structured is watching from outside in a carefully timed and specified way (quantitative). Observation is the most direct way of collecting data. A risk of choosing observation is that people observed may play some kind of role when observed. (Gillham 2003, 46.) Observation as a method may seem an easy one. An observer may have another observer observing

the same things at the same time. It is good if wanted things to be checked. Observing is a slow technique when getting know the target. (Gillham 2003, 47.) When observing, informed consent has to be always asked from the observed (Aaltola & Valli 2010, 162). Doing notes is very important (Aaltola & Valli 2010, 164).

The questionnaire (see appendix 3) was mostly done by Tiina Kokko but also, Ardita Jahja-Hoxha from Pristina University, Hilkka Kämäräinen and Kati Partanen from Savonia University of Applied Sciences helped. The questions were selected to find out the real improvement needs of Kosovo dairy sector. Especially the critical points effecting on the quality of milk wanted to be found out. Also knowing specific feeding methods was important.

Each farmer was interviewed by questionnaire by Donika Habipaj and Tiina.Kokko in farms. If the farmer did not know e.g. the quality of milk it is mentioned in the results. Two farms were visited twice because also milking was seen there. Information received was saved right after the visit to Kosovo because everything is fresh in mind. Results are written phased and understanding is deepened at the same time. Results are compared to things in general in Kosovo, e.g. the quality of milk, feeding and fertility. Proposal and evaluation for improvement is made according to the state of things in Kosovo and it is compared to things done in Finland. The final proposal is done according to the farms visited. Common sense and experience in the field of agriculture are used when evaluating and analyzing the results.

The farms visited were selected by Ardita Jahja-Hoxha and her team at the Pristina University in Kosovo. Most of the farms were selected because they are co-operating with the university somehow. Some farms visited were selected at random. All farms are semi-commercial or commercial farms and they are different from each other. The farm size varies between 6-115 cows; some have a pipeline milking system, some bucket milking system and one farm is milking by hands. The goal was to visit different farms and to find out the real improvement needs of the dairy sector in Kosovo. Three of the farms visited were surprise visits when looking for small farms. Those farms did not have time to do any preparations or cleaning before the visit.

Tiina Kokko would have wanted to see farms of 1-3 cows but it did not unfortunately happen because Ibadete Kraniqi or Donika Habipaj did not know their location. However, there are plenty of such small farms in Kosovo. These small farms of 1-3 cows represent most of the Kosovo farm size.

A visit to Kosovo was made from 11th – 18th March 2012. The visit was supposed to be from 20th – 26th February 2012 but it was cancelled because of massive snowfall in Kosovo. The method used is evaluation and there were plenty of things to observe and interview. A student Ibadete Krasniqi from Pristina University knew where the farms are located and she was a driver. Donika Habipaj worked as an interpreter because people on the farms could not speak in English. The language used was Albanian. Ibadete Krasniqi is doing her Master's thesis on the economics of Kosovo agriculture. The interpreter was good enough and the questionnaire was well translated from English to Albanian and the opposite. Information was removed from a person to another reliably. There were no misunderstandings after explaining some words because every farmer did not understand e.g. the word lactation. The interpreter had some experience of agriculture. She did not know everything in English but Tiina Kokko taught her the missing words.

It was possible to see the milking in two farms. Information about milking methods was collected by asking and writing down from other farms. Working equipment, machinery and feeding methods were seen in every farm. Farmers were told that they are able to do their work like they usually do when observing and asking. Also the reason for observing and asking questions were told. Tiina Kokko did not know the farmers beforehand but Ibadete Krasniqi did. 2-4 hours were spent in each farm depending on their interests on telling and showing things. All farmers were interested in being interviewed and being part of the research but some people are more open than others. Every interview was done in farms. Almost 350 photos were taken from cow houses, cows, calves, conditions in general, milk rooms, machinery, farmers and manure pits.

The results cannot be generalized because the number of farms visited is so small. Besides that farms were probably one of the best in Kosovo because almost all of them are already co-operating with the University of Pristina. Farms were visited in their normal atmosphere and no preparation with feeding, milking, cleaning etc. were required from farmers. No milk or feed samples were collected from the farms. Roughage, concentrate and milk were evaluated by senses: the look and the smell.

5 FARMS VISITED

Farm #1

The farmer is young, has 6 cows and his father started farming in 2001. He has an elementary school education and he co-operates with his neighbors when farming. His fields are mostly nearby and he does his maize silage and hay by himself. Concentrate is bought. Manure is used as a fertilizer for the fields. He does some subsistence farming e.g. peppers, potatoes and onions. About one cow yearly is slaughtered for his own needs and he sells some for people in the village. The water that he drinks is analyzed and it comes from Lake Badovs. The farmer does not know the analyzing result but says the quality of water is good. He also has a well of his own but he does not drink the water. A veterinarian takes care of animal registration and marks the animal by EU-marks. He sells all of his male calves born after two months and keeps good female calves. The farmer does not sort waste.

The farmer milks by hands. He cleans the teats with warm water and dries with a towel that is used for every cow. He takes first drops before he starts milking. The milk is cooled in the freezer but according to the farmer the milk does not freeze. It is transported by a car in a bucket to a next door farm from where it is transported to the processor. The milk looks and smells normal. The farmer says he does not know the quality of the milk. He milks twice per day. Milk samples are taken once per week.

Lactating cows are mostly fed by maize silage but also with hay. The farmer gives 4-5kg of concentrate for each cow per day. The concentrate consists of corn, barley, sunflower and soya. Dry cows and heifers are fed mostly by hay but they receive some maize silage. They are given 3kg of the same concentrate as lactating cows. The cows graze during the summer. Calves are given milk only during the first 3 months. Milk is given from a feeding bottle first but then from a bucket. The milk amount per day is 9 liters and it is fed in 3 portions during the day.

The cows are very calm, a bit dirty but their udders are clean. The cows are not afraid of people not even a stranger. The cows seem to be well-treated and they look fine. They are not too fat or thin and there are no sick animals at the moment.

The cowshed is old and is made of orange bricks. The cows are fastened by ropes. The feeding table is very narrow and it is next to the wall so there is no possibility to

walk on the table. The feed is poured from the cubicle to the table by wheelbarrow. There are only small lamps and it is dim there. The air is fresh and the cowshed is cool. Manure is taken off by hands. Drinking water for cows is carried by hands.

The farmer would want to expand up to 10 cows and have a higher cowshed. He believes in dairy production and thinks it is a good business. The farmer did not tell which water (from well or lake) he uses for cleaning and as drinking water for cows. The cows should have free access to water at all times.

Farm #2

The farmer has 115 cows and has his own processor where they produce yoghurt and they deliver the products to shops. The farmer has an education as an economist. He has 12 workers on the farm, 7 at the processor and 7 on the fields. The furthest field is 1km away from the farm so everything is nearby. Maize silage and hay is done by themselves but half of the concentrate is bought and half is done by themselves. They do not produce meat besides dairy production. Manure is used as a fertilizer for the fields. Water is analyzed and it comes from Lake Badovs. The result is not available but the quality of water is said to be good. The veterinarian takes care of the animal registration and does the marking by EU-marks. Waste is transported by the firm Kamal Profis from the farm but waste is not sorted. The claws of the cow are cut twice per year in spring and in fall. If a cow is in late pregnancy, her claws are cut 30 days after calving. The farmer has his own hoof trimming device.

The farmer has a pipeline milking system. A worker cleans up the teats by wood fiber and no water is used. Every cow has her own wood fiber clump and it is thrown into the manure after use. The worker does not take the first drops but uses dipping after milking. Milk is cooled in a milk tank “LactoFrise”. According to the worker cooling to $+4^{o}C$ takes about 30-40 minutes. Milk is transferred to the processor by their own removable milk tank. Their quality of milk in bacteria is in I-class and in cells it is in Extra-class. They milk twice per day. Milk samples are taken every day because of their own processor. The milk smells and looks normal. They measure the milk amount from every cow regularly every month. Liners are changed every 6 months or after 4000 milking times. A maintenance man comes every 3 months to check the milking system. The vacuum and oil are checked daily. There is a good manure pit in the farm.

Feeding is done by a mixer. Lactating cows have access to TMR at any time but basis for feeding per cow per day is 30-40kg of maize silage + 2kg of hay + 4kg of corn + 2kg of barley + 0,5kg sunflower + 1,7kg soya. Dry cows and heifers are fed with 15kg of maize silage, 3kg of hay or straw but only 3kg of concentrate with the same recipe as lactating cows. Only dry cows graze. Calves have access to roughage and concentrate at any time 7-200 days after birth. Milk is given for 90-100 days and about 10% of calve body weight daily. Feeding is done 3 times per day and it is done with a feeding bottle. Calve concentrate is bought. There is a proper silage silo made of cement with good walls.

The cows are calm and most of them are clean. Udders are clean. There are some very thin cows, condition scoring 2 but most of the cows are fine. Their hair is shiny and they are not afraid of people. According to the farmer there are 14 cases of mastitis yearly and some laminitis. The farmer says they have mastitis because of bad hygiene. There is a cow suffering from laminitis now. They have no rumen problems.

The farm is an old kolkhoz and they have many cowsheds made of bricks. Feeding tables are good and feed is given by mixer to the cows. The cowshed is dim though there are fluorescent lamps. The air is fresh and it is cool in the cowshed. Manure is taken off by hands.

The farmer would like to expand the number of cows. He wishes to have a straight pipe from the cowshed to the processor to avoid using the removable tank.

When watching the milking, the time between cleaning and putting the milking machine to the cow is long and it should be shorter.

Farm #3

There are 8 cows and tens of goats and sheep on the farm. The man who answered the questions is a worker at the farm and he has a high school education in trade. Fields are nearby. Maize silage and hay are done by themselves but hay has to be bought sometimes. Concentrate is mostly bought. They do not produce meat besides dairy production. Manure is used as a fertilizer for the fields. Water is not analyzed and water comes from a well of their own. Water cannot be drunk because they do not know the quality. The veterinarian takes care of registration and animal marking by EU-marks. Sometimes students come and train marking. Waste is not sorted and they are collected to the dump. There is a traditional Kosovo vehicle called motor

cultivator on the farm. They do some subsistence farming e.g. wheat and corn. Old or bad cows are sold in auction.

Preparation for milking is done with warm water, a paper towel and by taking the first drops. They have a bucket milking system and they use dipping after milking. Milk is usually cooled in a milk tank “LactoFrise” but it was broken during the visit. Instead of this the milk is cooled in a freezer. Milk is transferred 7km away to a processor by a car and milk bucket. The quality of milk in bacteria is in I-class and in cells in II-class. Maintenance is done by themselves and they change liners every six months. They milk twice per day. There was not any milk to see at the farm during the visit.

Feeding is done by hand. Lactating cows have access to roughage at any time but basis for feeding is 25kg of maize silage + hay + concentrate 3kg (51% corn, 6% soya, 20% sunflower, 20% wheat, 1% chalk, 1% salt, 1% Premiks). Dry cows and heifers are fed by silage and hay but they get only 2kg of concentrate with the same recipe as lactating cows. The cows graze for two months in the summer. Calves receive milk 10-12 liters per day for 3 months. During the first month they are fed 3 times per day but for the next 2-3 months they are fed twice per day. Calves have access to concentrate at any time. Silage silo is built to the ground and soil is covered by plastic.

The cows are calm and they continue ruminating when people enter the room. The animals are clean in general. According to the worker the cows have mastitis once per year. They have no other health problems with the cows.

The cowshed is made of bricks and cement. The lamps are bad but the air is fresh and the cowshed is cool. Manure is taken off by hands. The worker says they give antibiotic milk for calves. Sometimes they throw away the antibiotic milk.

Farm #4

There are 12 cows on the farm. Farming was started with 1-2 cows in 2001. The man who answered the questions is the farmer’s son and has a high school education. Maize silage and hay are made by themselves. Silage has to be bought a little. Concentrate is bought (wheat) but it is ground at the farm. 2 cows are slaughtered for their own use every year. Some cows are sold to markets with the help of a butcher. Fields are nearby. Manure is used as a fertilizer for the fields. Water is analyzed and it is said to be good. The veterinarian takes care of animal registration and does the

marking. Waste is not sorted and they are taken to the dump. They do some subsistence farming e.g. chickens, onions and peppers that are also sold to markets. The manure pit is next to a road and there is only soil under the manure.

Preparation is done with warm water, paper towels, first drops and dipping after milking. They have a bucket milking system and they change liners every six months. Maintenance is done by the farmer. Hoses of the milking machine are a bit dirty but otherwise everything is clean. The quality of milk in bacteria is in I-class but they do not know their cell classification. Milk is cooled in a freezer but it does not become frozen. Milk is transferred by a car and a milk bucket to a collection point 1km away from the farm.

Feeding is done by hand. Feeding of lactating cows is mostly done by hay but some maize silage is also given. Concentrate (corn, soya, wheat, barley) is given 7kg per day. Cows are given salt, too. Feeding of dry cows and heifers is the same but only 2kg of concentrate is given. Cows graze during the summer. Calves are given milk for 3 months and they get 10-12 liters of milk per day. They are fed in the beginning from a feeding bottle but later from a bucket. Calves are fed 3 times per day during first month but for 2-3 months they are fed only twice. They receive some concentrate and some roughage.

The cows are a bit jumpy but they are clean. According to the farmer they suffer mastitis twice per year and mastitis occurs usually in the summer. The cows do not have any other diseases. The cows are not too thin or fat.

The cowshed is old and made of bricks but the furniture inside is good. It is dim in the cowshed but the air is fresh and it is cool there. Manure is taken off by hands. The feeding table is wide and there is enough space for feeding and moving. Unfortunately there are two calves fastened to the wall and they stand on the table.

The farmer wants to expand up to 15 cows. He would like to have a good milk room where he would be able to cool the milk properly. He would also like to have his own shed for heifers and calves. Antibiotic milk is mostly given for calves.

Farm #5

There are 13 dairy cows on the farm and farming was started in 2010. The farmer is young and very interested in agriculture though he did not have any experience of

agriculture before he started farming. He has a high school education in chemistry and technology. Maize silage, hay and concentrate are self-made. The furthest field he has is 10km away but mostly the fields are nearby. Some meat is produced for his needs and some is sold to people in the village. Manure is used as a fertilizer for the fields. The quality of water is said to be good but the result of analyzing is not available. The veterinarian takes care of registration and does the animal marking. Waste is burned. The farmer has some subsistence farming e.g. potatoes, spinach and peppers. The manure pit is in a hill and is soil-based.

The farmer has a bucket milking system. Preparation is done with warm water and with a towel that is used for every cow. First drops are sometimes taken, sometimes not. Maintenance of the milking machine is never done. The milking machine looks clean. The farmer's quality of milk is in I-class, both bacteria and somatic cells. There was no milk to see during the visit. Milk is cooled in a neighbor's tank that is 1,5km away from the farm. Milk is transferred in a milk bucket and by a car.

Feeding is done by hand. Maize silage, hay and concentrate are done by the farmer. Feeding of lactating cows is hay-based because silage is given about 3kg per day. Cows get 3kg of concentrate (corn, wheat, soya and sunflower). Feeding of dry cows and heifers is the same except their concentrate portion is 1,5kg. Cows graze a little and they are given salt. Calves are given a little of hay and concentrate. They are fastened during the day and night but are loose in the morning and evening when they are able to drink straight from the cow's teat as much as they like twice per day.

Some of the cows are dirty but mostly they are clean. The cows are calm but the bull fools around when he is passed. The cows had diarrhea during last summer but otherwise they have been healthy. Every cow is 3,5 in condition scoring. Saw dust and straw is used as litter.

The cowshed is quite new and it is made of bars. It is dim but the air is fresh in the cowshed. Manure is taken off by manually. The feeding table is wide enough even for a tractor.

The farmer would like to have a pipeline milking system. He wants to expand his dairy production, build a new building for calves and heifers but also a proper milk room and cooling system. He started farming because he wanted to be self-employed. He did not have any experience of farming before starting a business. He

does not even have any relatives that have been farming. He just wanted to do something reasonable. The farmer thinks dairy production is a good business.

Farm #6

There are 13 cows on the farm. The farmer has a high school education as a metal welder. Maize silage and hay are self-made but concentrate is bought. The furthest field is 2km away from the farm but fields are mostly nearby. The farmer produces meat for his own needs and the butcher helps with slaughtering. Manure is used as a fertilizer for the fields. The farmer does not know the quality of the water. The veterinarian takes care of registration and does the animal marking. Waste is not sorted. There is some subsistence farming e.g. bees, chickens, onions, peppers, corn and wheat.

The farmer has a bucket milking system. Preparation is done with warm water, individual towels, first drops and CMT (California Mastitis Test) is sometimes used. The milking machine looks quite clean but there is some dirt in the hoses. Liners are changed every 6 months. Vacuum and oil is checked every day and maintenance is done if necessary. The farmer's quality of milk is in I-class, both bacteria and somatic cells. Cooling is usually done in a milk tank "LactoFrise". According to the farmer when it is cold, he cools the milk outside. There was no milk to see during the visit. Milk is picked up from the farm to a collection point.

Feeding is done by hands. Feeding of lactating cows is hay-based but the cows get some maize silage beside hay. The concentrate portion is 1kg per day. Feeding of dry cows and heifers is the same as lactating cows but they do not receive any concentrate. Calves are given milk for the first 3 months straight from the cows' teat. Also some hay and salt stone is given. Cows graze during the summer.

The cows are mostly clean and they do not seem to mind visitors. The farmer says the cows have not had any mastitis this year but two cows have been sick because of rumen. The farmer thinks it is because of bad food. The cows do not have any leg problems, maybe because they have rubber mats.

The cowshed is made of bricks, the windows are small and it is dim. The air is fresh. The feeding table is quite narrow but otherwise the furniture is in good shape. Manure is taken off manually.

The farmer thinks the price of milk differs a lot. Especially in summer there is an overproduction of milk. The farmer is not going to expand production but maybe his son will.

Farm #7

There are 18 cows on the farm. The farmer has a high school education as a construction worker. Maize silage and hay are self-grown but concentrate (wheat) is bought. The furthest field is 3km away but mostly fields are near to the farm. The farmer produces some meat for his own needs. He also sells meat to markets or people in the village. A butcher comes to the farm and does the slaughtering. Manure is used as a fertilizer for the fields. Water is analyzed but the farmer does not know the result. The veterinarian takes care of animal registration and does the marking with EU-marks. Waste is not sorted and everything is taken to the dump. There is some subsistence farming e.g. 30 chickens, potatoes, beans, onions, peppers and plums.

There is a bucket milking system on the farm. Preparation is done with warm water, separate towels for each cow and cells are checked by CMT every time. The milking machine looks quite clean but there is some dirt in the hoses. The milk tank is very clean. There was not any milk to see at the farm. The milk is picked up every morning to a collection point by a pick-up. The farmer cleans the milking machine by hot water, washing liquid and a brush. Maintenance is done by the farmer. If he does not know what is wrong, he asks a maintenance man. The farmer's quality of milk is Extra in somatic cells but bacteria is in II-class. The cows are milked 3 times per day when the calves need milk but milking is done twice per day normally.

Feeding is done by hands. Feeding is hay-based and some maize silage is given for lactating cows. Concentrate (wheat) is given 3kg per day. Feeding of dry cows and heifers is the same but concentrate is given 2kg per day. Calves are given milk for the first 3 months 12 liters per day in three portions. Concentrate is given about 1kg per day. Cows graze during the summer.

The cows are calm and very clean. The cows have mastitis and leg problems sometimes. The legs are treated by the farmer himself. There are also problems with rumen sometime because of bad feed.

The cowshed is quite new and the furniture is in good shape. It is dim because of small lamps but the air is fresh. The feeding table is wide but windows are small. There is a possibility to open the windows when it is warm. The manure pit is made of cement and has a proper wall and floor. Urine is separated.

Wolves have caused problems this year because of the hard winter. Wolves suffer from insufficient feed and have eaten some dogs. The farmer would like to expand up to 30 cows, have a pipeline milking system and change some field machinery. The farmer would also like to have more cows with high genetic potential for big milk numbers. On the other hand, he values his native breeds because they are so strong compared e.g. to Simmental.

Farm #8

The farmer has 28 cows and they are stalled. The farmer has a secondary school education and he started farming in 2004. Concentrate (wheat and barley) and maize silage are self-made. Fields are near to farm, the furthest distance is 1km. The farmer raises 30 cows or bulls for slaughtering every year. He sells the animals when their weight is 600kg. A cow is slaughtered for the farmer's own needs every year and a butcher helps him. Manure is used as a fertilizer for the fields. The veterinarian takes care of animal registration and marks animals by EU-marks. Bio waste is thrown to the fields but other wastes like plastic are burned. There is no subsistence farming.

The farmer has an old-fashioned bucket milking system. Preparation is done with warm water and a bucket; teats are cleaned by hands without any towel. Water is thrown towards the udder and teats are scrubbed by hands. Plenty of water is left in the cubicle and first drops are not taken. Hands are washed before starting milking. It was not allowed to see near the milking machine but the milk tank was awful, with brown and yellow matter on its walls. The vacuum sounds irregular and very fast. Maintenance is done by the farmer. The farmer's quality of milk is in III-class in bacteria and in I-class in somatic cells. The cows are mostly milked twice per day. The milk is picked up every two days. The milk smelled normal but there were some brown spots in it.

Feeding is done by hands. Lactating cows are given straw and silage and 5kg of concentrate (50/50 barley and wheat) and 1kg of soya. Feeding of dry cows and heifers is the same but 2kg of concentrate is given per day. Calves are given milk for 3-4

months, some roughage and about 1kg of concentrate. The cows graze during the summer.

The cows are peaceful but very dirty. They do not mind strangers and do not kick when milking. The calves have had problems with diarrhea and an antibiotic had to be used. Some calves seem to have ringworm but it was not told if they are treated. According to the farmer the cows have not had any mastitis lately. The calves especially have hairless spots on their neck, maybe because the neck rail is in the wrong place.

The cowshed is made of bricks. It is dim there because of poor lighting. The air is fresh. The feeding table is wide and most of the cubicles are the right size for the cows. Manure is taken off by hands.

The farmer would want to renovate the whole building according to standards and to have a pipeline milking system. He had had many problems with mastitis in the beginning. The only reason for the problems was that the farmer did not know how to do things. The farmer would also like to have a new building where he could raise beef cattle. A mixer and machinery for taking off the manure from the cow shed is wanted, too. The farmer would want to use CMT and use antibiotic treatments for dry cows. Antibiotic milk is given for calves or thrown away.

The milk tank looked awful because of the massive brown and yellow matter on the walls. I wonder how many bacteria were growing in it. According to the farmer the processor lied about his quality of milk and they do not want to pay a better price. I do not believe the processor lies about bacteria.

It was not allowed to go behind the cows for some reason. Was there something that was wanted to be hidden, some disease or was it so dirty there? The most important thing to develop is to improve hygiene and tidiness in general. The farmer has a round tank with only a small hole in it. It requires an automatic washing program and a human can wash this kind of tank properly only when going into the tank. Nobody has strength to do that day after day. I wonder why the farmer does not buy a tank that is easy to wash.

Farm #9

There are 12 cows on the farm. The farmer has a high school education. Concentrate is bought and it is ground and mixed at the farm. Hay and maize silage are self-made. Fields are mostly near to farm but the furthest field is 5km away. A bull is raised every year for own needs. Bad or old cows are sold to markets or to the butcher. The farmer has his own well but it is used e.g. for watering. Drinking water comes from Lake Batlov. Analyzing result of the water is not available. Manure is used as a fertilizer for the fields. Wheat is also given some artificial fertilizer. The veterinarian takes care of animal registration and marks the animal with EU-marks. Paper and plastic are burnt for heating but other waste is thrown somewhere. There is some subsistence farming e.g. bees, corn, turkeys, wheat, chickens and onions.

The farmer has a bucket milking system. Preparation is done with water, paper towels and first drops are taken. There was not any milk to be seen. The milk tank and milking machine looked clean. Maintenance is done by the farmer and liners are changed three times per year. The quality of milk is in I-class both in bacteria and somatic cells. The cows are milked twice per day. Milk is transferred to the collection point by the farmer himself by a car and milk buckets. The collection point is 3km away from the farm.

Feeding is done by hands. Lactating cows are given about 10kg of hay and 15kg of silage. 10kg of concentrate (corn, wheat, barley) is given per day in three portions. Also salt is given a little. Feeding of dry cows and heifers is the same but 5kg of concentrate is given per day. Calves receive 13 liters of milk from a bottle in three portions per day. Calves are also given some hay and some concentrate. Antibiotic milk is mostly thrown away but sometimes given for calves. The cows graze during the summer.

The cows are quite clean, calm but are a bit amazed by photographing and strangers. Some cows are a bit fat but most of them are 3,5 if condition scoring. There are no sick cows at the moment. A cow has had multiple mastitis lately and it is going to be slaughtered after calving. According to the farmer the other cows do not have any problems with mastitis. There have not been any problems with legs or rumen. There was one abomasums surgery two years ago but it was not successful.

The cowshed is made of bricks. It is very dim because of poor lighting. The windows are small and when entering there is a strong smell of ammonia. The feeding table is

very narrow and it is next to the wall. Silage and hay are given by a wheel barrow. Feed is poured from the backside of the table, next to a cow. Manure is taken off by hands. Silage silo is very simple. Its walls are made of soil and there is plastic as a floor to hinder contamination with soil.

The farmer would like to expand up to 17 cows. New hay storage was built last summer. According to the farmer they do fine with milking business. There is a big family living in the farm but people do not work in any other place. Occasionally they do some selling work. The garden is very neat and the buildings are in good shape.

Farm #10

There are 8 cows on the farm. The farmer has a high school education in trade. Concentrate is bought but hay and maize silage are made by the farmer. Fields are nearby. Some meat is produced for family needs. The butcher comes to the farm and does the slaughtering. Some meat is also sold to the market. The farmer has his own well but the water is not analyzed. Drinking water comes from the water supplier and it is analyzed but the result is not available. Manure is used as a fertilizer for the fields. The veterinarian takes care of animal registration and marks animals by EU-marks. Waste is burnt sometimes and sometimes somebody comes and picks them up. There is some subsistence farming e.g. chickens, cucumber, peppers, potatoes, beans and water melons.

The farmer has a bucket milking system. Preparation is done with warm water, one towel that is washed between cows and first drops are sometimes taken. The look and smell of the milk was fine. There is some dirt in the milking machine hoses but the tank (LactoFrise) is clean. The milking machine is brand new and maintenance is done by the farmer. The quality of milk in bacteria is in II-class but number of somatic cells is not known. The cows are milked twice per day. Milk is picked up at a collection point which is 5km away from the farm.

Feeding is done by hands. Feeding of lactating cows is hay-based and about 10kg of maize silage is given. 5kg of concentrate is given per day. Salt is also given a little. Feeding of dry cows and heifers is the same but 3kg of concentrate is given per day. Calves get their milk straight from the cows' teats which is why specific numbers of milk given is not known. Calves receive also some concentrate and roughage. The cows graze during the summer.

The cows are peaceful and were eating silage when entering the cowshed. They do not mind strangers and some are actually willing to eat trousers. The cows are clean and are not too thin or too fat. There are no sick cows at the moment. The farmer says they do not have any mastitis, problems with rumen but sometimes something with legs. The farmer has his own hoof trimming place.

The cowshed is made of bricks, is dim because of poor lightning and small windows but the air is fresh. The feeding table is quite narrow. Manure is taken off by hands. Silage silo is made of soil and plastic.

The farmer would like to expand up to 15 cows with a pipeline milking system, to have good hay storage and a proper silage silo.

Farm #11

There are 37 cows on the farm. The farmer has a veterinarian technician education. Hay, maize silage and wheat are self-grown. Soya and sun flower are bought. The furthest field is 13km away from the farm but some fields are near to the farm. Some meat is produced for the farmer's own needs and for markets. The butcher comes to the farm and does the slaughtering. The farmer has his own well and quality of water is good. It is used for drinking and everything else needed. Manure is used as a fertilizer for the fields. The veterinarian takes care of animal registration and marks the animals by EU-marks. Waste is burnt. Potato, chickens and some supplies from the garden are grown as subsistence farming.

The farmer has a bucket milking system. Preparation is done with warm water, with one towel that is washed between cows, first drops are taken. Some udders have to be scrubbed in order to empty the udder well. The look and smell of the milk is good. The milking machine and milk tank are clean. The quality of milk is in Extra-class. The cows are milked twice per day except for cows that have just calved. Maintenance is done by the farmer and liners are changed every 5 months. Milk is transferred to the collection point by the farmer. Milk is transferred by a car to the collection point 7km away from the farm.

Feeding is taken care of by a mixer. Lactating cows are given 45kg of maize silage and some hay. 5 – 14kg of concentrate (wheat, sun flower, soya and corn) is given per day per cow. Some salt is also given. Feeding of dry cows and heifers is the same except 2kg of concentrate is given per day. Calves are given 6 liters of milk per

day for the first 3 months and some hay and concentrate. The cows do not graze but they go out walking as therapy.

The cows are peaceful and interested in humans. The cows are clean and very strongly built but they are not fat. There are no sick cows at the moment. There is mastitis once per year, no leg problems but two cows have been sick because of rumen.

The cowshed is made of bricks and painted white. There is poor lightning in the cowshed but the air is fresh because of big doors that are open. Manure is taken off by hands. Silage silo is made of cement and looks proper. The manure pit is next to a river without any walls or floor.

The farmer would like to have a loose housing cowshed of 40 cows. The farmer has two cows that milk 40 liters per day. They are the farmer's best cows, related to each other and he is very proud of them.

Farm #12

There are 20 dairy cows on the farm. The farmer has a high school education from the Faculty of Biology. Hay and maize silage are self-made but concentrate (wheat and soya) is bought. Fields are mostly near to the farm but the furthest fields are 3km away. The farmer sells his old or bad cows to markets. The cows are slaughtered at the latest after their 7^{th} lactation. Water comes from the water supplier and it is said that the quality of water is good. Manure is used as a fertilizer for the fields. The veterinarian takes care of animal registration and marks the animals by EU-marks. Waste is not sorted. Pears, apples, tomatoes, potatoes, beans, peppers and onions are grown for the farmer's own needs.

The farmer has a pipeline milking system. Preparation is done with warm water; separate towels for each cow, first drops and dipping are used after milking. The milking machine and milk tank are very clean. The quality of milk is in Extra-class. The cows are milked twice per day. Maintenance is done by the farmer and liners are changed every six months. If the farmer is not able to fix things he calls a maintenance man. A processor picks up the milk.

Feeding is done manually. Lactating cows are given about 15kg of hay, 18kg of silage and 8kg of concentrate and some salt. Feeding of dry cows is the same but 3kg

of concentrate is given. Heifers are given 8kg of hay, 8kg of silage, 2kg of concentrate and some salt. Calves are given 8 liters of milk for the first 3 months. Also water, hay and some concentrate are given. The cows do not graze.

The cows are a bit jumpy and are suspicious. The cows are clean in general. One cow is very sick in rumen at the moment. The farmer wants her to survive because she has not had any female calves. There are two mastitis cases during the year but cows have not had any problems with legs. Some cows are skinny but mostly cows are 3 if condition scoring. The growth ring of the horn of the calves is destroyed with acid. According to the farmer it is an easy and less painful procedure for the calf than burning them at a high temperature. The costs are about 8€/ 6 calves. The farmer has burned the growth ring of the horn before.

The cowshed is made of bars and cement. The air is fresh and lightning is quite good because of fluorescent lamps. Manure is taken off manually. Silage silo is made of cement. The manure pit is next to the silo and dung is put on soil in a hill.

The farmer would like to have a cowshed with loose housing. He has been a farmer since 1979 and says he produces the best milk in the region.

Farm #13

The farmer has 30 cows. The farmer has a high school education. Hay and maize silage are self-grown. Concentrate (wheat and corn) is bought but it is ground at the farm. Some of the fields are near but the furthest is 6km away from the farm. The farmer sells his old or bad cows to markets or to people in the village. Some meat is produced for the farmer's own needs with the help of a butcher. Water comes from the water supplier and it is said that the quality of water is good. Manure is used as a fertilizer for the fields. The veterinarian takes care of animal registration and marks animals with EU-marks. Waste is not sorted and they are thrown somewhere. The farmer has chickens for his own needs.

The farmer has a pipeline milking system. Preparation is done with warm water, paper towels and first drops are taken. The milking machine and milk tank (LactoFrise) are very clean. The quality of milk is in Extra-class. The cows are milked twice per day. Maintenance is done by the maintenance man who comes every six months. A processor picks up the milk from the farm.

Feeding is done manually. Lactating cows are given about 20kg of hay, 5kg of silage, about 5kg of concentrate per day and some salt. Feeding of dry cows and heifers is the same but 1kg of concentrate is given. Calves receive their milk straight from the cow's teat and are able to have it as much as they like for the first 3 months. The cows do not graze.

The cows are quite clean and are not disturbed because of visitors. The cows are healthy now but there are 4-5 cases of mastitis per year and some leg problems. Legs are self-treated because the farmer has his own hoof trimming device.

The cowshed is made of bars and cement and is very neat. The furniture inside is in good condition but it is dim there. The air is fresh. Manure is taken off by hands. Silage silo is on soil with some plastic without any walls. The manure pit is also on soil.

The farmer would like expand up to 50 cows and change the breed for a more productive one. Also some machinery for taking off the manure is wanted.

Antibiotic milk is thrown away but some is given to the dog. There is an aggregate at the farm in case of power failure. Many farmers told that power failures are common in Kosovo.

6 RESULTS FROM THE VISIT

From table 13 can be seen a summary of the farms visited. All farms are bigger than an average farm but most of farms visited had 10-20 cows. The number of cows in each farm is between 6-115 cows and the number of field hectares varies between 6-430 hectares. The number of lactations per cow on average is 3,85 and the number based on the farmer's estimations. An average milk yield per cow per year is 4521 liters. Cows calve every 14,38 months (432 days) on average and the number is based on estimations. 5 farms used only artificial insemination, 5 farms used only natural insemination and 3 farms used both methods when getting cows pregnant. No farmer had any education in farming. All cowsheds are stalled. Roughages or concentrates were not analyzed. More specific information about farms can be found from the next chapters.

TABLE 13. A summary of farms visited.

Farm size	**Number of farms**	**Number of cows**	**Number of farms**
>100ha	2	>100	1
40-100ha	3	31-99	1
21-39ha	3	21-30	2
10-20ha	2	10-20	6
< 10ha	3	<10	3
	13		13

Table 14 tells of information about the quality of milk in bacteria and in somatic cells. There seems to be more problems with bacteria than with somatic cells. If a farm is small, the less information about the quality was available. Reasons for "no information" was not available. About 38% of the farms are in Extra-class in somatic cells but only 23% of farms are in Extra class in number of bacteria.

TABLE 14. A summary of milk quality and number of farms in each class.

	Extra	I-class	II-class	III-class	No information
Somatic cells	5	5			3
Number of bacteria	3	6	2	1	1

Time between calving is quite long, 432 days in general. It may tell of the lack of knowledge when inseminating or heats are not well detected. It may also tell about bad fertility or about insufficient feeding. Milk amounts annually are not so high that it would have an effect on fertility. For farms that use artificial insemination, the time between calving is 444 days on average. For farms that use natural insemination, the time between calving is 396 days. For farms that use both natural and artificial insemination, the time between calving is 470 days. As a conclusion, a bull is the best heat detector, a man comes next and the combination between a bull and a man is the worst. It was not asked if they use any fertility treatments for cows by a veterinarian. It is not a surprise that a bull is the best. Surprising is the fact others fall behind so much. It would be very interesting to know how things are done if time from one calving to another is 470 days. There must be something very wrong at the farm.

Lactations per cow is good, 3,86 in general. Some farmers have cows aged 15 years, especially if they have native breeds. According to the farmers native breeds are stronger, healthier and they have better fertility but they give less milk compared to breeds with high genetic potential for high milk amounts.

Antibiotic milk is given very often for calves. Some farmers told that the veterinarian tells them to do so. Antibiotic milk should always be thrown away. Using it for calves increases resistance of bacteria against antibiotics and a more effective antibiotic has to be developed. It costs money and diseases are more difficult to cure if new antibiotics cannot be developed as fast as they should. Some farmers said calves get diarrhea if they are given any antibiotic milk. Veterinarians should be advised not to tell to give antibiotic milk for calves. Only good milk should be given for calves.

Most of the farmers milked twice per day. 2 farms milked 3 times per day when calves have been born in the spring. Calves are fed 3 times per day which is why they milk 3 times per day. According to latest research results if you milk your cows 3-4 times per day in the beginning, they give more milk compared to a group that has been milked twice per day. Most farms have some problems with bacteria but cells were not considered as a problem. Getting rid of bacteria is easier than getting rid of cells. Good hygiene is the answer to everything. It is hard to say whether the bacteria comes from the water used or is the machine so dirty. Milk tanks were usually very clean and it was very clean in general in the cowshed. The farmers described in very specific information how they do the cleaning with the machine or the udder. Everything seemed to be ok. Mostly only the milk hoses were dirty but maybe that is

enough. Advice would be to change all hoses and start taking advantage of the vacuum that they have in the system. Besides that there is only hot water, washing liquid, a clean bucket and putting the vacuum hose to the vacuum pipe is needed. The machine is able to suck the water as well as milk and hoses will be clean for sure. Rinsing can be done the same way. Also doing regular maintenance is very important. Teats have to be clean and dry when putting the milking machine into teats and first drops has to be taken. From photo 1 can be seen one kind of bucket milking system. Liners are changed in some farms every six months.

PHOTO 1. One kind of bucket milking system in Kosovo.

A normal filtering system in Kosovo can be seen from photo 2. The fabric and the sifter-combination are washed after use and it is used multiple times. This system is largely used in Kosovo when having a bucket milking system or milking by hands. A single use filtering system is used when having a pipeline milking system.

PHOTO 2. A normal milk filtering system if having a bucket milking system.

Animal registration was quite well organized. The veterinarian takes care of registration and marks all animals. Some animals were missing their ear marks, especially calves. Some cows had dropped the ear mark but mostly it was hanging on the cow collar. Animals were able to be detected. It was told that the time in how soon registration has to be done differs. When an animal is sold or slaughtered there is seven days time to register the event. When a calf is born there is 20 days time to register.

Not every farmer had an understanding of the meaning of lactation and it had to be explained. Male calves are usually sold right away or after 3 months. Good female calves are mostly kept but bad ones are sold right away or after 3 months.

Manure pits are very primitive in general. Most farmers put the manure there where is place for it. A farmer had a manure pit next to a river without any proper structure. There was only a “bridge over troubled water” and it is possible to expand your manure pit as far as you wish. From photo 3 can be seen a normal sight of a manure pit without any walls or floor.

PHOTO 3. A normal manure pit in Kosovo.

The health situation seemed to be good. Some calves were suffering from ringworm on a farm that can be seen from photo 4. This same farm had problematic diarrhea among calves that had to be treated by antibiotics. The animals were very dirty there, too. Only one farmer had problems with mastitis and there was only one cow that was problematic on the farm. She was going to be slaughtered. However, farmers seemed to understand that a cow has mastitis when she has fever and clinical symptoms. Only these are cured by antibiotics. In my opinion if a farm has somatic cells e.g. 400000 in general there is a problem with mastitis. Only one farm had big problems with cow's legs, laminitis. There were some problems with rumen but mostly the reason for them was bad or rotten feed. There was a surgery of abomasum in a farm but it was not successful. Farmers were mostly satisfied with their situation.

PHOTO 4. Calves that have ringworm.

A normal Kosovo farm is small, the cowshed is old and cows are stalled. This kind of farm can be seen in photo 5. Walls are thin and there is plenty of draught in the cowshed. There is no air conditioning, windows are small and it is dim in the cowshed because of inefficient lamps. Feeding tables are usually narrow and calves are fastened to a wall wherever they have place. Calves have good conditions and they are standing on soft bedding. Some cows have rubber mats. A common litter used is wheat or barley straw and normally there is a soft bedding of it. Manure channels are normally low and manure is taken off by hands. Machinery is usually old and small.

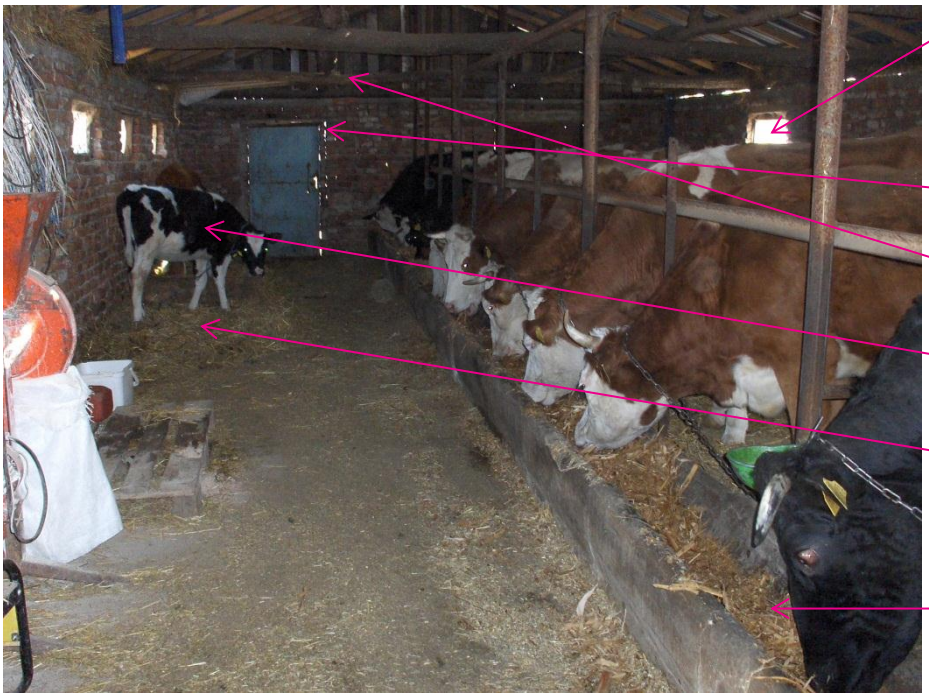

PHOTO 5. Look of a normal semi-commercial farm in Kosovo.

Feeding is mostly hay-based and concentrate is given in various amounts. Concentrate is usually very fine ground, see photo 6. Wheat, barley, sunflower, corn and soya are used in concentrate. Silage is normally made of maize. It depends a lot on the farm what is the quantity of silage and concentrate given. According to Auvo Sairanen (2012b) there is no problem with fine ground concentrate but there is no advantage of giving it. A dairy cow is able to receive everything needed if the husk of grain is broken. There is no harm done for a cow if giving fine ground concentrate but it may decrease pH in rumen faster than rougher concentrate especially if given a big amount of concentrate. If so, a rougher concentrate is better.

PHOTO 6. Fine ground concentrate was given for cows.

Milk is mostly collected to private collection points. In photo 7 can be seen a collection point. Milk is picked up at the collection point from big farms but a small farm takes it themselves to the collection point. If a farm is big enough people from the processor come and pick up the milk. There was a possibility to visit one collection point and it was told that 36000 litres of milk goes through the collection point every month. Milk is picked up from the farms by a normal car e.g. a van with a milk tank on it. Some farmers put the milk in their neighbours' milk tank after cooling it in a freezer or right after milking.

PHOTO 7. A private collection point.

Some weird things occurred with the water. No farmer knew the analyzing result but they knew water is analyzed. The quality of water is told to be good. Some farmers did not know where their water comes from. A common answer was that water comes from the water supplier.

Waste is not sorted on the farms. Some farms were very messy and waste was everywhere in the neighborhood. Some farms were clean. Burning waste is common but burning of plastic is doubtful because of harmful substitutes that are released into the air. Waste was seen e.g. in rivers, trees and fields.

7 CONCLUSIONS

The animals and the feed

In accordance with the farms visited the welfare of the animals is in general fine. Calves and cows have soft beddings of barley or wheat straw. Saw dust was used in two farms. Some cows have a rubber mat that is good. Animals are relatively clean and they are not too fat or thin in general. Most of the cows are 3-3,5 when condition scoring. Only a few dry cows were too fat. Manure behind the cows looked nice and no diarrhea was seen in the cowsheds. According to this feeding is ok even though I think it is not well planned, e.g. almost every cow gets the same amount of concentrate regardless of how much it milks or if is it dry. Maybe giving plenty of hay compensates fiber given. Silage and concentrate given should be analyzed. It is important especially if having any problems, e.g. with fertility. It is easier to find an answer if it is known how much, e.g. minerals, trace elements, possible mold and pH there are in the feeds. The most important thing is to know what feed is possibly missing and is there something too much. It is possible to fix feeding with minerals if the quality of feed given is known. Feeding is usually done manually and it is hay-based. Concentrate and maize silage is given in various amounts. Grazing and feeding should be better planned in general. Cows may graze in ditches and probably feeding values are not the best there. Pastures that are well taken care of give more milk from the cows and cows stay healthier. Also the watering system in some areas would be good.

A very positive thing was to notice farmers take care of their cows' hooves. Three farmers did have a hoof trimming device of their own and some co-worked with their neighbors. One farmer took care of the hooves regularly twice per year. Dairy cows hooves were not too long in general on the farms visited. It was not seen on the farms visited that any of the cows were suffering from being severely lame.

The health situation and the hygiene

The health situation seems to be rather good. One farm had problems with calve diarrhea and ring worm. Besides this the animals were very dirty in the farm. One farm had a problematic cow with multiple mastitis but mastitis in general was not considered as a problem. To be honest if somatic cells are 400000 in general, cows have problems with mastitis. Farmers should be told what kind of milk should not be put into the tank. Do they know a sick teat can be milked separately and the other three

can be milked into the tank? Do they know which result from CMT cannot be put into the tank? Even one sick cow may ruin the whole milk portion in the tank and may reduce the price paid for the milk. Effects of the one cow are bigger if the amount of milk in the tank is small. Do farmers know when a vet should be invited to the farm and treat the mastitis with antibiotics? Antibiotic residues should also be tested.

It is hard to say whether farmers have good hygiene or not. Many farmers seem to do things right. What is the reason for the big number of bacteria in the milk? The water? Or are the things done the way they are told? Water is told to be analyzed and the quality of it is said to be good but nobody knew the exact result. The farmers described their washing routines well and everything seems to be ok. I wonder if they would be able to wash a bucket milking system with the help of a vacuum. Hoses would be easy to clean up and washing would be fast. All that is needed is a clean bucket, warm water for first rinsing, hot water, washing liquid, vacuum and hot rinsing water. Washing with a brush is slower and hoses are difficult to keep clean. Every cow house was neat inside though some farms were unclean outside. Results of the analyzed water should be given to farmers. Also the water from wells should be analyzed. If there are plenty of bacteria in the water, the bacteria will die if the water is boiled for ten minutes. Advice is to change all hoses at the same time and start washing the bucket milking system with the help of a vacuum after that. See appendix 1 where can be seen the right preparing routine before milking and cleaning a bucket milking system with the help of a vacuum. Equipment should be washed after every usage.

Every cow should have her own towel or as much as required in order to achieve a clean udder and teats. Towels should not be wet but moist. Using water is not recommended when cleaning up the udder. Dirty water drops may drain from the udder to the teats and allow bacteria into the milk. First drops should be taken and if needed also CMT. The milking machine should not put onto the teats before the udder is ready and the milk comes properly. If using dipping or spray after milking, there should be left a drop of it at the top of the teat. See appendix 1.

Is the temperature of milk measured after milking? It should be cooled down to $<4^{o}C$, preservative temperature, as soon as possible but it should not be frozen. I wonder if farmers who cool down the milk in a freezer measure the temperature of the milk regularly. I guess there is no problem with the temperature of the milk if having a proper milk tank. Temperatures would be good to write down on paper before milking

and right after milking. Do they mix the milk in their buckets every once in a while? It should be done regularly. Every farmer should have a proper cooling system.

The farms visited were bigger than an average farm that has two cows. The farmers that have a pipeline milking system seem to have a better quality of milk both in bacteria and in somatic cells than farmers that have a bucket milking system or are milking by hands. It would be interesting to know what the quality of milk is in general in small farms like those which have two cows. Do they know it at all? Maintenance is usually done by the farmer on every farm. It would be good if a professional would check the system at least once per year. Every farmer should also use a single use filtering system and not a fabric that is washed after use. Reference Bytyqi, Zaugg, Sherifi, Hamidi, Gjonbalaj, Muji & Mehmeti 2010 tell about the good situation in the biggest commercial farms in Kosovo when talking about the quality of milk. It shows that the farms that put effort on their business can be successful.

The fertility and its challenges

Fertility and the time from one calving to another causes problems for some farmers. Time from one calving to another was the longest when using both artificial and natural insemination. I am not sure but in these cases do they use a bull if cows do not become pregnant after trying artificial insemination several times? Or do they use a bull for certain cows and artificial insemination for certain cows? But first should be solved basic things like is the feeding right? Is the timing right when using artificial insemination? Do the farmers know the right timing with the behavior of the cows or with slime? See appendix 2 where different slimes can be seen when the cow is in heat. When does the vet come when he is being called for insemination? Right away or the next day? Would it be possible to arrange courses for farmers in order that they would be able to inseminate by themselves? Do they have any breeding plans in general? Or would it possible to train seminologs that only inseminate cows for their living? They would drive from a farm to another and use the sperm wanted for each cow. These people do good work in Finland. Are there any limitations with law in Kosovo because only veterinarians are allowed to inseminate? How easy or difficult would it be to train seminologs?

Numbers of dairy cows fertility in Kosovo were not available. It would have been interesting to know e.g. how many times do they inseminate cows per calving in general, how many days it takes to start inseminating after calving, how old heifers are when they calve for the first time and how many days is required from one calving to

another in general. These information can be found out by asking, e.g. by professionals from Pristina University. According to results of the thesis, time from one calving to another is too long. It should be improved e.g. by better heat detection, timing and feeding. See chapter 3.3.5. to see the Finnish numbers when evaluating fertility of the dairy cow.

Easy and cheap things to improve farming

Next things which would be possible to proceed with in Kosovo. Using protective clothing when moving from one farm to another is a simple thing which could be realized. Testing antibiotic residues can be easily done if equipment is bought for that. The temperature of milk should always be measured when cooling it. The temperatures would be good to write down. Giving good conditions (see tables 4 & 5) for cows makes their resistance of bacteria against diseases stronger. A good temperature, e.g. reducing heat stress, can be achieved with air conditioning and with cool water sprays. A key to better udder health is explained in chapter 3.3.4. Feeding is an important part of dairy production that has effects in heats, milk production, consistence of milk and a cow's resistance against diseases. Look for hints from chapter 3.4.

Condition scoring, composition of dung and fullness of rumen are easy ways to evaluate if the cow is ok. All of these tools can be used on every farm and there are no requirements for costs. These should be known on every farm. Check chapters 3.5. A regular maintenance for milking machine should be done yearly. Also checking the vacuum, oil level and functioning of the milking machine in general daily is important.

There could be some improvements when talking about calves. It is good that calves are given milk during three months but also roughage, concentrate and water should be offered for calves right from the beginning. Some farmers do it already but some do not. Of course calves do not eat much in the beginning but giving roughage and concentrate is important. Rumen evolves better if given concentrate and roughage beside milk. Antibiotic milk should not be given to calves because it causes resistance to antibiotics and more effective antibiotics have to be developed

More challenging improvements for farming

Book keeping on everything is very important. E.g. how many times a cow is inseminated per pregnancy, what medicines (and how often) are given for cows, milk yields produced (measuring them monthly), the time between calving, how old are the heifers when they calve for the first time would be good to know. Knowing the facts

makes the economy of the farming easier to count. Also problems and positive things can be found easier.

Milk composition indicators give information about feeding e.g. protein and fat contents can be affected by feeding, see chapter 3.5.3.

Is it possible to arrange a study trip abroad for farmers? It would be good for farmers to see normal farms where pastures, feeding and milking are fine. If financing is a problem would it be possible to get some money from some project? Farmers should pay a part of the trip.

8 DISCUSSIONS

The topic of the thesis was given in October 2011. The topic seemed very interesting and especially dairy cow feeding is close to my work at MTT Maaninka Agrifood Research Center. I have always been interested in international things and sharing my knowledge with others. Progress of the thesis was quite slow in the beginning. Limiting the subject took a long time. It was hard to search references for the thesis because farming in Kosovo is quite primitive and very few reliable information or statistics are made. Most of the references used are in English and electrical. First impression I had, Finland was at same situation in agriculture in 1960-70's. The war that was in Kosovo not so long time ago, gave an interesting aspect to the thesis and visiting Kosovo.

When talking about the questionnaire I would add some things to the formula if I would do it again. Things would be do they use any fertility treatments for dairy cows, how old are heifers when they calve for the first time and do they use any artificial fertilizers on the fields. It was asked about artificial fertilizers from some farms but not from everybody. Also things about plant protection and matters used would be interesting to know. It would be good to know if they use any preservatives when doing silage. If thinking about the time spent in Kosovo, it should have been at least two weeks. Time for observing milking would have been longer and it would have been possible to see how things are really done. Also visiting more farms would have been possible.

I wore protective shoes on every farm visited. People were amazed by them because people do not use them in Kosovo. To be honest, there was no point using them because the interpreter and student who was with me every day, did not have any. I asked them to put one on but they refused. I had always one extra with me. Several farms were visited during a day and possible viruses or bacteria were very effectively removed from one farm to another. At least I pointed out how things should be done. Trousers and boots that I had were left in Pristina in case of the risk of spreading possible diseases from Kosovo to Finland.

Farms visited were different from each other but in a way the farms are good in general. Farms of 2-4 cows were not seen and that is a shame. For some reason I was not taken to any. Maybe these farms are so primitive that they were not allowed to be

seen. It was asked anyway. When the information was received from farms more references were needed. Information received begged more questions which is why more references were required in order to analyze the results better.

I have to doubt if using your senses to evaluate the quality of milk is good. There was a possibility almost in every farm to watch and smell the milk they had in tanks or buckets. Even though I knew there were too many bacteria or cells in the milk the smell and look was fine. Maybe using senses is only good when evaluating if there is any e.g. butyric acid in the milk.

When listening to Albanian day after day several hours a day, I learned to understand some Albanian. To my surprise on the second day while listening to answers in Albanian, I was writing the answer in Finnish to the questionnaire. This happened before the interpreter had translated the answer to me. People at the farms were surprised as well. It was a great week and I hope I will be able to go there later in the summer when the hills are blooming. The smell of coal in my clothes reminded me of the trip for weeks.

Every farm visit was nice. Farmers were friendly and seemed to be interested in a Finnish visitor. Questions were answered freely by the farmers. It was nice visiting Kosovo farms, thank you!

9 FIGURES, PHOTOS AND TABLES

FIGURES

PHOTOS

TABLES

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Appendix 1. A correct preparation technique before milking and advice on how to wash a bucket milking system with the help of a vacuum.

Wash teats with a moist towel. Every cow should have her own towel and as many as required in order to have clean teats.

Remember to wash also the top of the teat.

Wash also the environment of the teat and make sure no dirty water runs to the teats.

Take abundant first spurts (3-4 times) into a container and dry the teat after that with a clean and dry towel. Most of the bacteria and cells are in the first spurts. Wait until milk comes down and start milking. This should be within 2 minutes after starting the preparations (Manninen, Nyman, Laitinen, Murto & Hovinen, 2006).

If dipping is used a drop should be left at the top of the teat.

Washing the bucket milking system with the help of a vacuum. Rinse the milking machine with warm water and put the vacuum hose into the vacuum pipe. Mix the washing liquid and hot water (+65 - +70^{o}C) in a bucket. Suck water and air alternately; dirt is removed efficiently. The bucket can be brushed at this point and water can be poured. Put a bucket of hot water through the system. Remember to have new and clean water. The bucket has to be brushed and rinsed once more in order to avoid washing liquid residues.

Appendix 2. Advice on how to detect heats

A cow normally becomes in heat 50 days after calving. She may have heats before that but do not inseminate her earlier than two months after calving. The normal time between heats is 18-24 days. The heat lasts about a week and it can be divided into three parts: proestrus, (standing) heat and metestrus.

Heats should be detected at least three times per day. Besides this the time should be right: the cows should not have anything else to do. E.g. a good time to detect heats is between feeding, early in the morning and in the evening. Slime can be seen the best when the cows are lying down.

Every finding should be written down. The cows have to be recognized. The cows that are going to be in heat should be known.

These cows are in heat within 1-3 days. The slime may be grey and it cannot be stretched between the fingers. It may break or slip away from the fingers. The slime can be watery. Do not inseminate yet! At this point she may moo or jump towards other cows. The slime looks the same after the heat. This period is called a proestrus.

If the cow jumps on any cow (the black cow), she is going to be in heat within 1-3 days. If she is active in the evening, inseminate her the next day. If she is active in the morning or during the day, inseminate her the next day. But a reminder: if the cow lets another cow jump to her back and does not run away (the brown cow) she is in heat. If she is willing to stand under another cow in the evening, inseminate her the next day. If she is willing in the morning, inseminate her the same day. At this point a cow may withhold milk or moo. Standing under another cow is called a standing heat.

This cow is in heat. The slime is thin; it can be easily stretched between the fingers without breaking it. The slime reflects light. If seen this in the evening, inseminate her next day. If this is seen in the morning, inseminate her during the day. The cow can be restless. The slime becomes watery and grey after the heat.

Standing heat: the brown-white cow is in heat and lets the black cow jump on her back (does not run away).

Bleeding is a sign that a cow has been in heat for 1-3 days ago. USUALLY there is no point to inseminate her anymore. Wait another 21 days to see for the next heat. Heifers may still become pregnant but most of the cows not if bleeding. Every cow does not bleed. Bleeding or the amount of it does not tell how good or bad the heat has been. This period is called a metestrus.

Appendix 3.

Things that need to be known from the farms

1. Name of the farmer
    a. address_____
    b. education_____
    c. area where the farm is
    _____
2. Permission for photographing?
    _____
3. Number of cows and their breeds?
    _____
    _____
4. How many liters of milk do your cows produce per year?
    _____
5. What is the quality of milk?
    a. Total bacterial count TBC
    _____
    b. Somatic cell count SCC
    _____
    c. Protein % _____
    d. Fat % _____
    e. Lactose % _____
6. How milk is delivered to the processor?
    a. Type of transport
    _____
    b. Equipment _____
    c. Cooling _____
7. How are they fed?
    a. Roughage, consist?
    _____
    b. Concentrate, consist?
    _____
    c. Minerals, consist?
    _____
    d. Are they analyzed?
    _____
8. How often do cows calve?
    _____
9. How do cows become pregnant?
    _____
10. How many lactations per cow on average?
    _____

11. What is done when the calf is born?

    _____

    a. cows?
    b. bulls?
12. How many times per day do you milk?

    _____
13. Do you take any samples (fat, protein, cells, lactose) from the milk?

    _____
14. How many times?

    _____
15. How many hectares do you have of field, is it own/rented?

    _____ How near are they?

    _____

    _____
16. Do cows graze? _____ How many hectares of pasture do you have?

    _____
17. How are roughage and concentrate made?

    _____ Machinery or buying?

    _____
18. Any subsistence farming? _____ What is cultivated?

    _____

    _____
19. What is done with the manure?

    _____

    _____
20. Do you produce meat besides dairy production?
    a. How much? _____
    b. How? _____
    c. What is done for the cows that are bad and will be put down?

       _____

       _____
    d. Where do cows slaughtered go?

       _____
    e. How are they slaughtered?

       _____
    f. What kind of transport?

       _____
    g. Where are they slaughtered?

       _____
21. What is the quality of water?

    _____

    _____
    a. Is it analyzed, result?

       _____

       _____
    b. Where does it come from?

       _____

22. Waste disposal? How is it organized? Do you sort out waste, e.g. bio waste and mixed waste?

_____
_____
_____
_____
_____

23. How is animal registration organized?

_____
_____
_____

24. How are animals marked?

_____
_____
_____

Things observed

1. Milking methods

_____
_____
_____

2. Milking hygiene

_____
_____
_____

3. Look of milk (colour, smell, any clumps etc.)?

_____
_____

4. Milking machine?

_____

    a. When is maintenance done?

    _____

    b. How clean is it?

    _____
    _____

5. Milk yield _____
6. Farmers behavior while working with cows

_____
_____
_____
_____
_____
_____

7. Feeding methods of lactating cows
    a. Machinery? _____
    b. Manually? _____
    c. How much roughage, what?
    _____
    d. How much concentrate, what?
    _____
    e. How much minerals, what?
    _____
8. Feeding methods of dry cows
    a. Machinery? _____
    b. Manually? _____
    c. How much roughage, what?
    _____
    d. How much concentrate, what?
    _____
    e. How much minerals, what?
    _____
9. Feeding methods of heifers
    a. Machinery? _____
    b. Manually? _____
    c. How much roughage, what?
    _____
    d. How much concentrate, what?
    _____
    e. How much minerals, what?
    _____
10. Feeding methods of calves
    a. Machinery? _____
    b. Manually? _____
    c. How much roughage, what?
    _____
    d. How much concentrate, what?
    _____
    e. How much minerals, what?
    _____
11. Manure, any contamination with fodder?
    _____
12. Any sick cows at the moment?
    _____
    a. What is their disease?
    _____
        i. If mastitis, is the bacteria known?
        _____
    b. Any frequent and common diseases the cows have?_____
    _____
    _____

c. What other diseases do they have?

13. Type of buildings

Milking parlor

Feed storage

14. Working environment (lights, humidity, temperature)?

15. Something else?


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