Animal Husbandry II

Sheep and Goat

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TÁMOP-4.1.2.A/1-11/1-2011-0009

University of Debrecen, Service Sciences Methodology Centre

Debrecen, 2013.

Tartalom

Az ábrák listája

A táblázatok listája

Tárgymutató

Service Sciences
Methodology Centre

NEW SZÉCHE

Animal Husbandry II

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TÁMOP-4.1.2.A/1-11/1-
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1. fejezet - 1. The importance of small ruminant sector (sheep and goat)

1. The main products of sheep and goats

The sheep and goats as the species domesticated firstly in order to use them for meat, milk production and exploit them to produce raw fibre materials for clothing point of views. The sheep descended from several wild breeds in South-East Asia and East Africa and it was kept in small flocks with the Neolithic farmers. The first signs about the use of “domesticated sheep” were found to be around 10,000 years ago. In the case of goats, these first signs were discovered from the years of between 10,000 and 11,000 years ago.

Now, these species are kept in the whole world except the North and South Arctic’s. Many kind of breeds were developed from the several original wild breeds. The number of sheep breeds (including varieties adapted to different environments, and the man made breeds) is well above the 500 ones, someone say that the number of sheep breeds are closing to on thousand. In the case of goats, the number of breeds is somewhat fewer than that of sheep, but much more than 300 different breeds are in the statistics and in the registers.

However, both sheep and goats could tolerate the cold and warm environmental conditions, yet the goats could be kept under the harsh conditions (hot and humid) than that of sheep. Many breeds from both species are kept in semi-desert and desert regions of the planet. At the same time, the biggest number of them are kept mainly under the continental conditions.

These breeds were firstly kept for meat and later on for milk production, but their skin had also a very big importance in the clothing. The wool firstly appeared about 2,500 years BC in the case of sheep, and the mohair from Angora goats has been used since 1,500 years BC.

As the number of human populations in the different parts of the world, started to increase, the number of sheep and goats kept also increased, however, in the meantime other species of animals (horse, cattle, pig, donkey, various kinds of poultry, etc.) were domesticated, and their meat and milk has started to get more and more importance in the human life being.

Nowadays, the sheep and goats are kept mainly in the least favourable areas of the world, however, many of them also bred in the intensive environmental conditions as well.

Their milk and meat production ability has been in the target of the human aims, along with the increase of wool production, and improve the wool production traits.

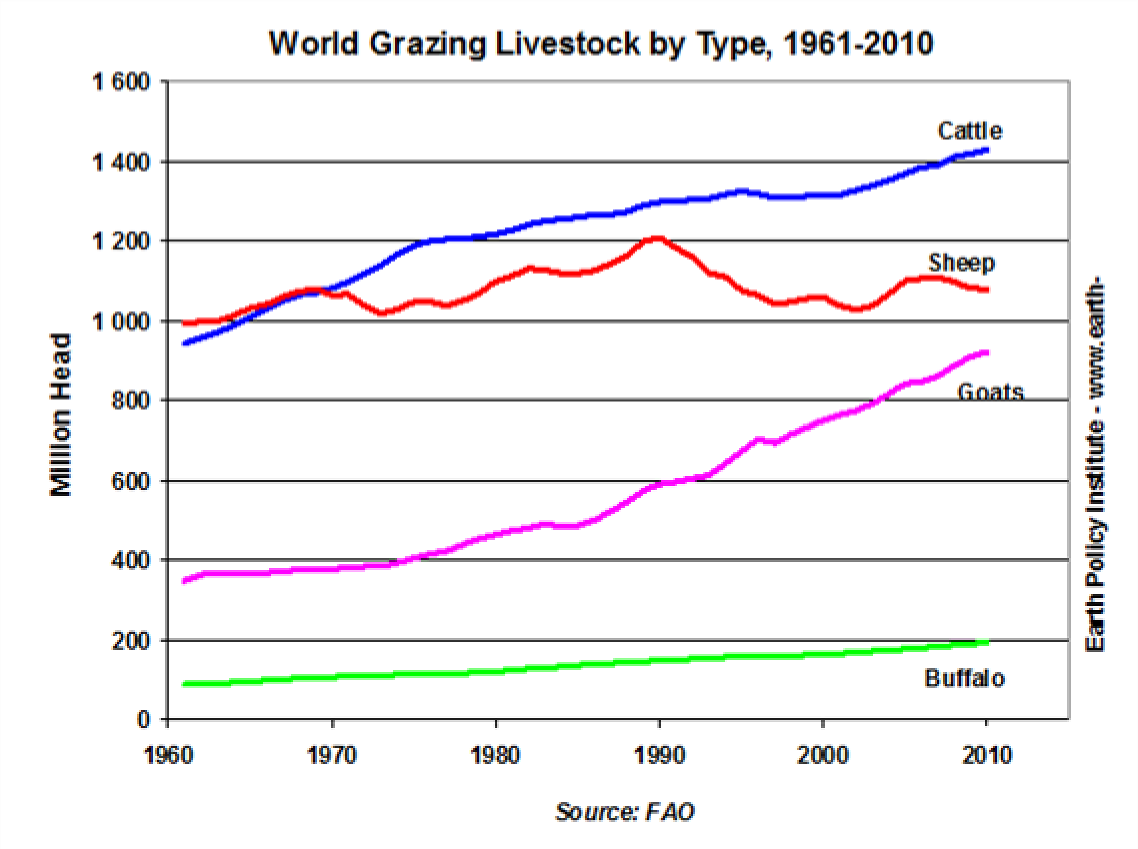
Beside the meat, milk, wool, fibre, skin and manure production, a new kind of utilisation of these species was developed over the last couple of decades, which is the pet or accompanying animals. Most of them are dwarfs (having only small body sizes), but a very new phenomenon developed in China, where the very much wealthy people are keeping a kind of big bodied sheep, which is very rear, being only a couple of heads kept in the world.

2. The number of sheep and goats kept

However, the number of sheep kept was fluctuating during the last fifty-sixty years there was an increasing tendency until the early 1990’s, and more or less reduced since then. At present there are about more than 1.1 billion heads of sheep kept in the world according to the FAO (2011) announcement (Figure 1.) Parallel to this the number of goats was gradually increased since the 1960’s and it has a quite intensive elevating tendency since the mid 1980’s. At present, the number of goats kept is closing to 900 million heads (it is about 865 million).

The number of cattle (beef and dairy together) exceeded the number of sheep in the early 1960’s already and the difference is continuously increasing. The forth very important ruminant for human is the buffalo, which has a slow but continuous elevating trend in the number of heads kept, mainly in South East regions of the planet, and its number is approaching to 200 million of heads.

1.1. ábra - Figure 1: The changes in the number of grazing type animals



There was an interesting trend happened in the number of sheep in the world meaning that China became the biggest sheep breeding country (Table 1.) followed by India and Australia. The two dominating big sheep breeding countries (United Kingdom and Spain) are on the 8th and the 14th grade of the rank.

In the case of goat numbers the dominance of China is no douth leading the list of twenty biggest goat breeding countries by more than 20 million heads (Table 2.). India has the second grade on the rank, and these two countries are keeping more than 25% of the total number of goats in the planet. However, Greece, Spain, and France are very important goat breeding counties in Europe, no European country is involved in the first twenty biggest goat keeping countries.

3. The meat production of sheep and goats

The sheep and goat meat production has practically more than doubled gradually over the last almost fifty years being 6.0 million tonnes in 1961 and 13.2 million tonnes in 2009, according to FAO data (U.N. Food and Agriculture Organization (FAO), ProdSTAT, electronic database, at faostat.fao.org, updated May 2011).

1.1. táblázat - Table 2: Biggest goat keeping countries in 2008 (heads, FAO, 2011)

Country	No	%	Country	No	%
China	149,376,747	17.33	Indonesia	15,805,900	1.83
India	125,732,000	14.59	Kenya	14,478,300	1.68
Pakistan	56,742,000	6.58	Somalia	12,700,000	1.47
Bangladesh	56,400,000	6.54	Niger	12,641,352	1.47

Nigeria	53,800,400	6.25	Tanzania	12,550,000	1.46
Sudan	43,100,000	5.00	Burkina F.	11,805,000	1.37
Iran	25,300,000	2.94	Mali	10,150,350	1.18
Ethiopia	21,884,222	2.54	Brazil	9,500,000	1.10
Mongolia	19,969,400	2.32	Mexico	8,831,000	1.02

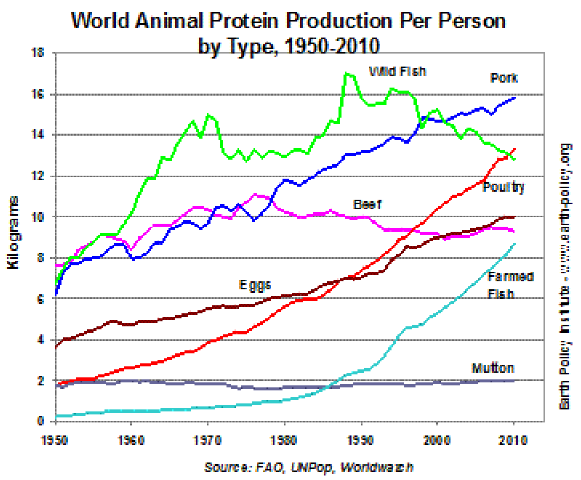
1.2. táblázat - Table 3: Goat and sheep meat production (t) in 2008 (FAO, 2011)

World, continents	No. goat slaughtered	Goatmeat production	Sheep meat production
World	398,408,444	4,918,696	8,255,295
Africa	95,748,031	1,151,612	1,262,476
America	10,608,084	149,530	404,666
Asia	279,445,153	3,469,818	4,111,405
Europe	11,556,540	121,139	1,185,587
Oceania	1,050,636	23,595	1,291,159

According to the FAO (2011) data, about six hundred million heads of sheep and almost four hundred million heads of goats are slaughtered annually, and the meat production of the goats (4.92 million t) is less than 60% comparing to sheep meat (8.255 million t) production. More than 70% of goat meat is produced in Asia, and Africa is reasonable a little bit more than 23 %. The other continents are having only limited rations comparing to these two.

There is only one similarity in the case of sheep meat production (Asia is the leading continent having nearly 50% of the total sheep meat production), but the distribution of the production is not so concentrated. Africa and Oceania have equally more than 15%, Europe has a little bit more than 14%, and America is responsible for the leftover (less than 5%) of the meat production.

1.2. ábra - Figure 2: The meat production tendencies by animal species



Over the last sixty years, the meat production per capita underwent a huge change, especially in the case of pork, poultry and fish, as well as eggs, while it was increased up to late 1970’s in the case of beef, and gradually reduced hereafter (Figure 2.) and the mutton production reached the level of 1960 again by 2010.

The mutton production per head has not changed much between mid 1950’s and 2010 (it was about 2.0 kg), however, in the 1980’s it was reduced to 1.8 kg. That means the mutton production practically could not coop with the enlargement of the elevation of human population.

Comparing to this picture a kind of tremendous increase could be observed in the case of pig and poultry meats. The first one increased from about 6.2 kg to 10. 1 kg, while the second one was lifted up from 1.8 kg to 13.2 kg/head of human. The increase in pig meat production was more than 61%, while in poultry meat production this number exceeded the 700%.

The beef production increased up to the mid 1970’s (11.2 kg/ head), but gradually decreased since after and nowadays is about 9.2 kg. Over this period the egg production calculated for one human head was increased from 3.8 kg (1950) to 10.1 kg (2010), and the increase was almost 166%. The wild fish catching (production, dominantly from salt water) was increased from 6.4 kg (1950) to little bit above 15 kg / head in 1970. It was followed by a reduction up to mid 1980’s (13.1 kg), from an other wave started until 1990 (17.1 kg) followed by a deceasing trend since after, and in 2010 its level was about 13 kg. The farmed fish production has goat a totally different tendency: from 1950 (less than 0.5kg) it had a slow graduating increase until early 1990’s (2.2 kg), from when a very intensive lifting up situation could be observed and by 2010 its level approached the 9 kg per human head.

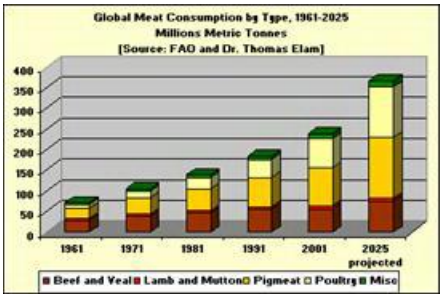
Comparing to these calculated data to the absolute production results the picture is a little bit different. The total mutton production of the world increased from 5 million tonnes (1950) to 14 million tonnes (2010). The pork production increased from 16 to 109 million tonnes between 1950 and 2010. The poultry meat production underwent a huge elevation from 4 million tonnes (1950) to 92 million tonnes (2010). The farmed fish production did not change much between 1950 and 1970, but it had also a tremendous increase between 1976 (4 million tonnes) and 2010 (60 million tonnes). The wild fish production started from the level of 17 million tonnes (1950) and reached the 89 million tonnes in 2010. The egg production also had a great elevation from 1950 (9 million tonnes) to 2010 (69 million tonnes). The total milk production more than doubled between 1961 (344 million tonnes) and 2010 (723 million tonnes).

The average mutton consumption in the World did not changed much over the last sixty years (FAOSTAT, 2012). While it was 1.8 kg/head in 1950, and 2.0 kg/head in 2010, and has not changed since 2005. During this period, the poultry meat consumption practically multiplied. It was only 1.7 kg/head in 1950, and reached the 13.3 kg/head in 2010. The pig meat consumption also had a very strong increase over the last sixty years, started from 6.2 kg/head, and reached the 15.8 kg/head in 2010. The beef consumption had a wave during this long period, started from 7.6 kg/head, and it was practically over the 10.0 kg/head between 1967 and 1991, and decreased hereafter, and its measure was 9.3 kg/head in 2010.

According to the evaluation of Scott Champion (CEO, Beef + Lamb New-Zealand, 2012) the mutton and lamb meat consumption per capita is quite different: 12.88 kg in New-Zealand; 9.67 Australia, 2.07 Africa; 1.69 Europe; 1.67 Asia; 1.09 Canada; 0.71 Mexico; 0.59 in Latin America and Caribbean’s, 0.4 in USA. In his forecast the mutton and lamb meat production will intensively increase in the world between 2010 and 2020, in which Asia will dominate (1,790 kt) having 63% of the total growth, and China will be responsible at least half of it. In other continents the increase will be much smaller: Africa 749 kt; Oceania 132 kt; Latin America and Caribbean’s 66 kt, NAFTA (North America) 22 kt, and some reduction could be forecasted for Europe (-16 kt) (kt = 1,000 tonnes carcass weight equivalent).

Beside of this the mutton and lamb meat consumption will increase even higher extent. The growth in Asia (1,864 kt) will consist of the 66% of the global increase between 2010 and 2020, and China will be responsible at least half of this value. The other continents will have much less elevation in consumption: Africa 771 kt; 67 kt Latin America + Caribbean’s, 31 kt NAFTA; 1 kt Oceania; and 66 kt reduction could be forecast able in the case of Europe for this period. According to his forecast data, the biggest increase will happen in the case of pig meat, followed by poultry and beef meat, and mutton (Figure 3).

1.3. ábra - Figure 3: The expected meat consumption from various resources



However, the biggest increase in mutton and goats meat production could be expected in Asia, still the world consumption data is depending on the meat export of the two biggest exporters (New Zealand and Australia). These two countries are responsible more than two thirds of the total sheep meat export in the world. Some goat meat data is also involved in their export, but the sheep meat is over dominating one.

There has been a tremendous change in the export products of New Zealand. In the year 1970/1971, the frozen carcasses were dominating, and the ration of bone-in cats did not reach the ten %. By the time, 2009/2010 the frozen carcasses consisted less than 5% in the total export and the ration of frozen bone-in cats rapidly increased during the last thirty years. Since 1990/1991 the ratio of frozen boneless cuts started to increase and in 2009/2010 reached the ten %. Parallel to this the fresh chilled meat ratio has more intensively increased over this period and exceeded the 30% within the whole export.

The most up to date change in the sheep meat export is that the first half of the carcasses are going to China and the rear half (the better quality) is going to Europe and USA, as well as partly to Arab Emirates and Saudi Arabia. This tendency could be followed in the case of Australian export as well.

According to the latest data (Colby, 2013), New Zealand exported total 348,720 t of sheep meat in 2012, from which 65,720 t were fresh chilled meat (the other part was frozen). From this enormous amount of meat 133,340 t arrived to European Union, and 215.380 t to other part of the world. From the fresh chilled meat 46,820 t exported to EU and 18,890 t to other part of the world. Until 2012 the biggest importer was United Kingdom (UK - in 2011 60,490 t total and 25,209 t fresh meat), and China was on the second stage on the rank (43,870 t total sheep meat). In 2012 the order of these two countries was changed: China stepped forward and imported the biggest amount of sheep meat (77,570 t) and United Kingdom was pushed down to the second stage (65,060 t total sheep meat). Concerning the data of first two months in 2013 the advantage of China (26,83 t; 37% increase) is even bigger than that of UK (16,610 t). The amounts of sheep meat exported to other countries were individually much smaller in these years.

Looking at the data of Australian sheep meat export (257,350 t in 2011 and 310,900 t in 2012) one could realise that the EU does not play such an important role receiving only limited amount (16,450 in 2011 and 16,390 t in 2012) of sheep meat from there. The most important importer countries for Australia in 2012 were China (56,000 t), USA (44,480 t), and United Arab Emirates (24,200 t), Saudi Arabia (17,130 t), and the UK was only the fifth on the rank (14,120 t). Studying the data of January and February 2013 together, the import (7,060 t) of China was more than 12 % comparing to the same time of 2012. During this time, the total import to EU was only 920 t.

4. The wool and fibre production

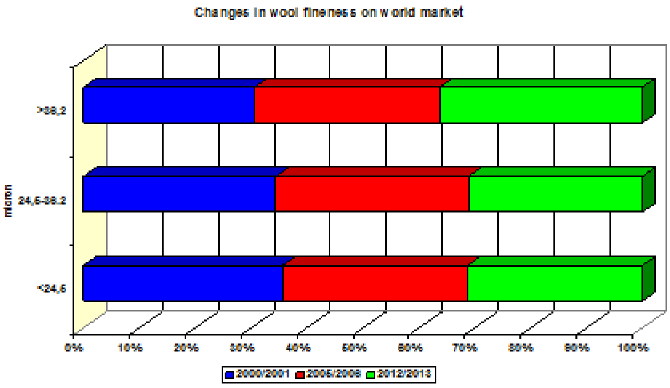
The wool production of the world was a little bit over the 1,1 million tonnes of clean wool, which was over the 2,3 million tonnes of raw wool (Table 1.). This number is seems to be very big amount still the wool is representing only 1.5% of the total world fibre production.

The biggest wool producing countries are Australia (nearly 245 thousand tonnes), China (165 thousand tones) and New Zealand (almost 131 thousand tonnes). The biggest European wool producer (UK) was only the 11th on the rank (22 thousand tonnes).

According to the evaluation of Landmark Operations (Australia, Wool Economy Focus; 2nd Quarter 2012/2013) the world wool production in 2012/13 is predicted to increase by just 1% from 2011/12 level, which is estimated to be at the lowest level in 70 years. By micron category, the largest increase is expected to be in the broad wool (32.6 micron and broader) and the smallest increase predicted to be for fine wool (24.5 micron and finer). This continuous trend was seen in the past decade, with a declining proportion of fine wool and an increasing share of courser wool (Figure 4.).

This is the result of a continued shift around the world towards sheep for meat, rather than for wool. It suggests that the volume of wool for use in clothing will continue to be limited in the future, which will help support prices for this wool. Based on their prediction the raw wool demand likely to remain weak at least until the first quarter of 2013 and with wool being relatively expensive compared with other fibres, a sustained and sustainable improvement in wool prices is unlikely until there are firm signs of improvement at retail.

1.4. ábra - Figure 4: Changes of wool fibre rations in the world production



In general, when speaking about wool most people think about sheep, however, goats are producing fibre and wool as well.

According to FAO (2011) data the goat fibre production did have a strong decreasing tendency almost all over the world. Goats kept for mohair production have an annual production of 5,000 t annually nowadays, however, the world production reached the 25,000 t in the early part of the 1990's. As a consequence of the movements happened over the last 20 years South Africa became a dominating role in this market – having about 850,000 heads of Angora goats, and producing more than 60% of the mohair sold mainly to the European markets. The USA (Texas) is on the second stage on the rank having about 200,000 Angora goats. These two countries producing now about the 95% of the total mohair production of the world.

Turkey used to get the dominance role on this mohair market, having more than 6 million heads of Angora goats in the 1960's, but nowadays only 150,000 heads are kept on the goat farms there. Their annual mohair production fallen down from 1,379 t to 174 t.

The other important hair goat is the cashmere goat, producing the finest fibre, and which is practically a group of various goat breeds, with about 20 million heads. The cashmere originated from the high mountains regions of Asia from where its name was given (after the country of Kashmir). However, the cashmere is produced (from Asia to Oceania, and to even Europe and USA) in the several corners of the world, yet China is dominating producer (8,000 t) giving more than half of the raw cashmere fibre available on the world (15,000 t). The second one on the rank is Mongolia (3,000 t), the third is Iran (1,500 t), and all the other countries could produce only 2,500 t annually.

If anybody compares the cashmere and mohair production to the sheep wool production (more than 1.1 million t of clean wool in 2012) one could see the difference among their amounts. The quantity of sheep wool seems to be very large but it gives only the 1.5% of the total fibre used in the world annually.

5. The milk production of sheep and goats

However, the goat and sheep milk production are playing a very important role in various parts of the world, the total goat milk constitutes around 2.2% of total milk production, followed by sheep milk 1.3% and camel milk around 0.2%. The buffalo milk is consists of nearly 13% of the world total milk production.

While cattle milk is produced all over the world, the sheep milk production is mainly located to Asia and Europe. The goat milk production is dominating in Asia, Africa and Europe. In several parts of the world more sheep or goat milk is consumed than cattle milk (and in some part of the world more sheep and goat meat are consumed than beef and pig meat).

China is the most important one on the list of twenty biggest sheep milk producing countries (Table 4.) producing more than 12% of the world production. From the European countries Romania is the third-, Italy the forth-, Spain the seventh-, France the tenth, and Bulgaria is on the 17th, and Portugal is on the 18th on the rank.

Looking at goat milk list India is far the biggest producer country, having more than 26.5% of the world production. Bangladesh is on the second (14.36%), Sudan on the third (9,5%), Pakistan on the fourth (4.6%), and the most important European countries on the list are France (fifth with 4.02%), Greece (sixth with 3.12%) and Spain (seventh with 3.04%). China is only the (1.76%) twelfth on this rank.

1.3. táblázat - Table 1: World sheep population and wool production according to IWTO and FAO Statistics

Country	**No of sheep heads**	**FAO Statistics 2011**		**Country**	**Clean raw wool in tonnes**
	IWTO	**Countries**	**No of sheep heads**	**IWTO**	**IWTO 2012**
China	134,000,000	China	138,840,000	Australia*	244,958
CIS	79,529,000	India	74,500,000	China	165,090
India	74,731,000	Australia	73,099,000	New Zealand	130,870
Australia	73,099,000	Sudan	52,079,000	CIS	98,457
Iran	54,000,000	Iran	49,000,000	India	36,800
Sudan	52,079,000	Nigeria	38,000,000	Argentina*	33,337
Nigeria	36,230,000	United Kingdom	31,634,000	South Africa*	28,065
United Kingdom	31,395,000	New Zealand	31,132,000	Sudan	27,500
New Zealand	31,130,000	Pakistan	28,086,000	Iran	24,750
Pakistan	28,078,000	Ethiopia	25,509,000	Uruguay*	24,693
Ethiopia	25,254,000	South Africa	24,303,000	United Kingdom	22,016
South Africa	24,600,000			Other Countries	265,488
Turkey	20,923,000			World Total	1,102,064
Spain	18,181,000				
Syria	15,046,000				
Other Countries	386,030,000				
World Total	1,084,305,000				

* Production on seasonal basis (e.g. 2010/11); Source: IWTO (International Wool and Textile Organisation) Wool Statistics 2012 – cited by British Wool Marketing Board, 2013; CIS – independent countries of former Soviet Union

1.4. táblázat - Table 4: Sheep, goat and cattle milk production and total milk production of the top 21 countries in the World in 2009 (FAOSTAT, 2011)

Sheep		**Goat**		**Cattle**		**Total milk production***	
County	**x1000 ton**	**County**	**x1000 ton**	**County**	**x1000 ton**	**County**	**x1000 ton**
China	1,150.0	India	4,114,290	USA	85,859.4	India	112,114.3
Syria	706.0	Bangladesh	2,226.9	Indonesia	45,140.0	USA	85,859.4
Romania	600.4	Sudan	1,475.0	China	35,509.8	China	39,946.4
Italy	599.5	Pakistan	719.0	Russia	32,325.8	Pakistan	34,362.0
Iran	577.0	France	623.5	Brazil	29,112.0	Russia	32,561.7
Sudan	513.0	Greece	484.0	France	23,341.0	Brazil	29,255.8
Spain	506.7	Spain	472.0	New-Zealand	15,400.0	France	24,217.7
Somalia	465.7	Iran	429.1	UK	13,236.5	UK	13,236.5
Algeria	260.0	Somalia	394.9	Poland	12,447.2	Italy	13,063.2
France	253.3	Niger	276.1	Italy	12,219.5	Turkey	12,542.2
Afghanistan	186.0	Indonesia	276.0	Pakistan	11,985.0	Poland	12,467.2
Mali	152.6	China	272.4	Turkey	11,583.3	Ukraine	11,609.7
Niger	126.6	Russia	234.9	Netherlands	11,468.6	Netherland	11,468.6
Indonesia	120.0	Mali	223.8	Ukraine	11,363.5	Mexico	10,718.7
Mauritania	113.1	Algeria	220.7	Mexico	10,549.0	Argentina	10,366.3
Egypt	107.9	Belarus	218.2	Australia	9,388.0	Australia	9,388.0
Bulgaria	87.3	Ukraine	218.2	Canada	8,213.3	Canada	8,213.3
Portugal	82.1	Jamaica	203.4	Japan	7,909.5	Japan	7,909.5
FR Macedonia	75.0	Turkey	192.2	Colombia	7,547.1	Iran	7,905.4
Albania	75.0	Mexico	169.7	Iran	6,620.0	Colombia	7,545.1
Saudi Arabia	73.9	Brazil	143.8	Spain	6,251.4	Sudan	7,428.0

Total milk	9,272.7	Total milk	15,510.4	Total milk	585,234.6	Total milk	703,596.1

* including camel (1,840,201 t) and buffalo (92,140,146 t) milk as well.

Concerning the total milk production of the world India is sitting on the first stage of the rank (15.93%), followed by USA (12.2%), China (5.68%). The biggest European milk producers are France (seventh with 3.4%), UK (eight with 1.88%) and Italy (ninth with 1.86%) on the rank.

6. The changes in the sheep and goat sector of the EU and its reasons

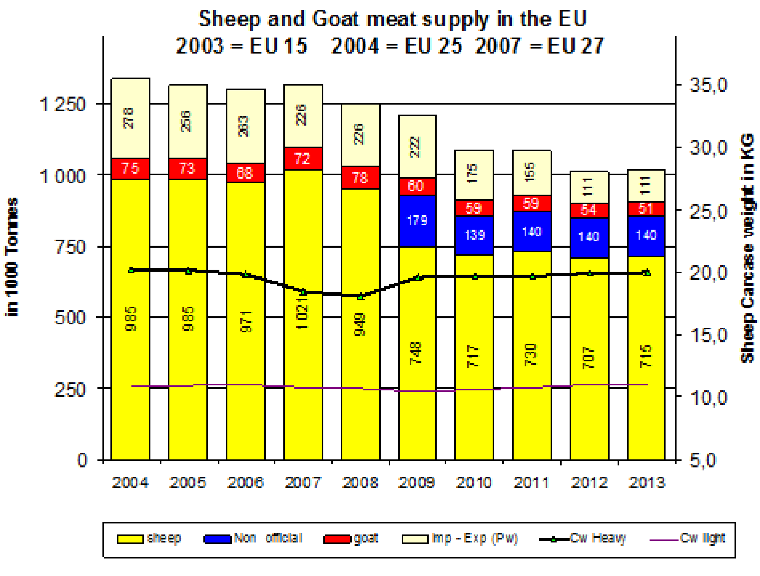
Since the accession of the EU-10 and EU-2 member states the sheep and goat number of the EU has continuously and gradually decreased. There are several reasons of this reduction. The biggest one is the serious draught (especially in Spain) over the last couple of years.

The global economic crises is the second one meaning that the costumers could afford to buy less expensive lamb meat and mutton from the shrinkening income. The third one is the increased prices of the cereals and forages on the market. The fourth one is that the present costumers do not know this kind of meat properly, and having a lack of knowledge how to prepare/cook it for food. Most of the meat are offer to buy in big cuts and the size of families is declining.

The next serious problem is the high land prices. In several regions, the flock sizes are rather low, and the profitability of sheep and goat farming are low. Being a shepherd or a goat farmer is not a fashionable job, young people do prefer to work and live in the town and cities.

All above these, the quantity of sheep (including goat) meat imported to the EU has gradually been decreasing, which has a negative effect on the availability of this product on the market.

1.5. ábra - Figure 5: The sheep and goat meat exploitated in the EU (DG AGRI, 2013)



The total sheep and goat meat supply of EU has been gradually reduced over the last couple of years (Figure 5.), and at the same time the amount of imported meat has also fallen back. With the increasing sheep number of Romania the un-officially slaughtered number of sheep appeared within the EU, but luckily, its number and its quantity have been slowly decreasing. The amount of goat meat has also reduced over this period.

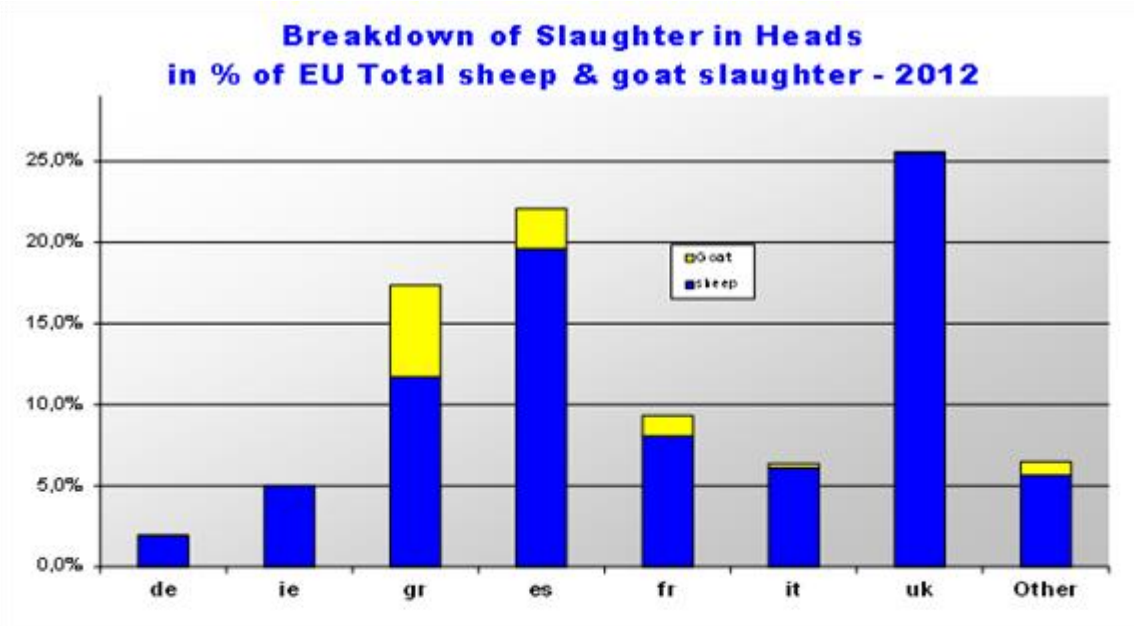
The average carcass weight was steady in the case of heavy (20 kg) and concerning the light lamb as well (10.5 kg).

Because of all the above-mentioned effects on sheep and goat industries the average meat consumption has been gradually but slightly decreasing, it was 2.1 kg/head /year in 2012, and other small reduction has been forecasted.

The total number of ewes is about 55 million head, while the number of female goats is less than 12 million heads. About 45 million heads os sheep and 5,7 million heads of goats were slaughtered in 2012, within the EU. About 26% of sheep are slaughtered in UK, 19% in Spain, 12% in Greece, 8% in France and about 6% in Italy. The biggest goat number is slaughtere in Greece, followed by Spain, France and Italy (Figure 6).

The total sheep meat production is rather affected by the two big sheep breeding countries. The total breeding live stock population in Spain was less than 12.2 million heads, while the total sheep number exceeded the 16.8 million heads in 2012, which means an 8% reduction comparing to the previous year. Beside the sheep there were 2.85 million goat kept in the country. The population size increased by about in the UK in 2012, and it was about22,9 million head, including 14.4 million heads of ewes.

1.6. ábra - Figure 6: The ratio of sheep and goats slaughtered in various countries

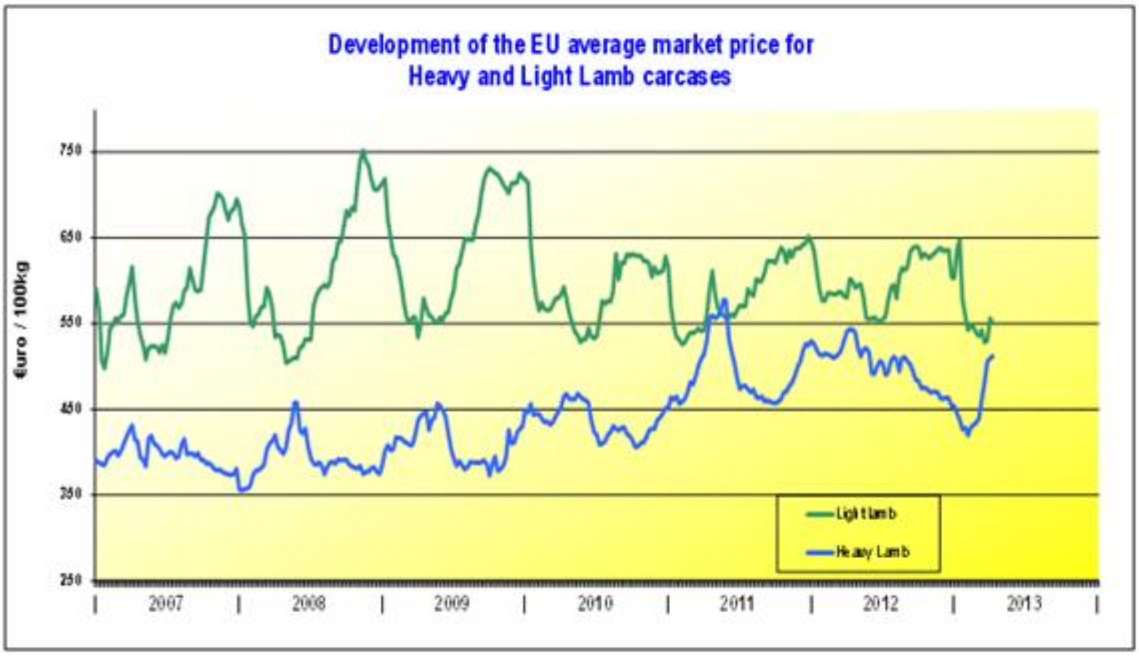


Spain produced 133,090 t sheep and goat meat in 2012, while the UK production was 276,000 t within the 900,905 t total EU production. The amount produced in the first one is still reducing in 2013, but in the second one a slight increase forecasted.

The value of the sheep farming is also affected by the available meat prices. There were and are serious seasonal differences in the level of prices and one could observe that the prices was well below the level of 2009 during the last two years in the case of light lamb, but it was similar to the level of 2010 concerning the heavy lambs in the first quarter of 2013 (Figure 7.).

Comparing the heavy lamb prices of EU to the lamb prices originated from New Zealand the difference is rather significant: on an average the New Zealand lamb is about 2€/kg cheaper than the ones produced in the EU at the end of the first quarter of 2013, but this difference could be observed more or less during the previous years as well.

1.7. ábra - Figure7: Price breakdown of the heavy and light lamb meat prices in the EU (DG AGRI, 2013)


Development of the EU average market price for
Heavy and Light Lamb carcases
€uro / 100kg
750
650
550
450
350
250
2007
2008
2009
2010
2011
2012
2013
Light lamb
Heavy Lamb

2. fejezet - 2. Basics of genetics

1. The chromosome and its structure

There are somatic cells and gametes. The nucleus is found in the chromosome. All cells are in one set of chromosomes inherited from the maternal parent, and one with the same structure (the same chromosome, the genes of the same property), that is homologous sets of chromosomes from the father. The double set of the chromosomes are called diploid chromosome number (2n). The sex of gamete cells or somatic cells contain at half the number of chromosomes, haploid. The chromosome number are different in different species: 8, chickens 36, pigs 38, men 46, chimpanzees 46, sheep 54, cattle 60, horses 64. The chromosomes distinguish: physical or autosomal chromosomes and sex chromosomes. The sex chromosome found in the sex determining genes. These chromosomes can be notated X and Y. The Y chromosome is determined by the sperm. The male specimens heterogametes produce X and Y chromosomes of the females as sex chromosomes XX, only X chromosomes produce gametes. The birds than, butterflies the sex chromosomes are different from the above.

2. DNA

The genetic information in eukaryote the deoxyribonucleic acid (DNA-) molecule base its order carries it in the form of a genetic code. DNA with a double spiral construction makro molecule, which is a nucleotide, consists of units. All nucleotides unit one nitrogen- (N-) content integral base - that there may be adenine (A), on timin one (T) guanin (G) and citozin (C)-, one it sugar with a coal atomic number (dezoxi-ribose) and a phosphate group creates. The sugar phosphate running the spine of the molecule in the two parallel but opposite directions a frame constitutes it. The four kinds of base is attached to the sugar components. From the construction of the bases the adenine on one of the chains the other chain with timin two hidrogen with bandage, the guanin with the citozin three hydrogens attach to bandage. DNA is a quite resistant compound chemically because the reaction picture bases look in the direction of the inside of the double helix. The double helix-structure Watson, Crick and Wilkins American researchers it was written down first in 1953.

3. DNA-sequence

The order of nucleotides.

4. Recombinant DNA

DNA molecule is made by joining two or more different DNA molecules.

5. Genetic code

Three consecutive DNA nucleotides produce a code.

Classical inheritance of knowledge

The animals can be observed or measured properties of the phenotype, genotype and which surrounds the animal environmental impact result. Such as color, formation of horn, body length, number of nipples, weight, specification, quantity of milk produced per day, the amount of lactation, annual wool production, etc. All the genes of an individual produce the genotype of the individual. A gene is defined by an attribute in loci (locus) alleles consolidation. The quality or qualitative properties are those that affect one or a few genes. For example: formation of horn, the color. The quantitative influence of multiple genes or quantitative properties. Such as egg production, wool weight, body weight, prolificacy, etc.

6. Mendel's laws

I. law: the law of the uniformity: if homozygous individuals are mating, their offspring phenotype and genotype are identical.

II. law : the law of the split: If individuals from F1 are mated (heterozygous), in F2 generation grandparents' genotype and fenotype will appear.

III. law: the law of the independent combinant. If at the same time two different gene-mediated chromosome inheritance property analysis, we find that the two properties are inherited independently, and the phenotype appears. An example of formation of the horn-black-red color inheritance may be placed as an example. If a black pair with individuals homozygous polled red, horn homozygous individuals with the F1 generation of Mendel's first law, all individuals will be heterozygous hornless and black. The second generation is the second law of fission, because the grandparents splitted phenotypes, but also appear in new combinations. Hornless independence of the black color, the color red is independence the horn, so can be an individual, who is black and have horn and can be red, and hornless too. The phenotypic ratio of fission two genes (dihibrid) dominant-recessive inheritance is 9:3:3:1. Unless inheritance and epistatis this ratio changes.

IV. law: the law of the gamete purity law: haploid gametes contains only one allele of a gene.

7. Chromosomal abnormalities

The number of chromosomal aberrations and in shape has long been known. Serious disorders involve as many genes are affected. These are listed below.

Inversion is called when a chromosome is replaced with the gene sequence. Example the genes line was ABCD and will be ACBD. The reason for this is that the chromosome be rolled round BC locus.

Deletions and duplications in the case where a piece of chromosome omitted and connected to a portion of the homologous chromosomes. If the original gene line was ABCD, the BC phase is eliminated (deletion), and then ulinked to the homologous chromosome, and then ADE ABCBCDE gene line will formed.

Translocation is called when the chromosome is broken and a piece connected to the other chromosome. For example, if a piece of the X chromosome from, where they were broken off, and sex ulinked genes ulinked to an autosomal, then the property will not be connected to sex.

Reciprocal translocation is a rare case where two non-homologous chromosomes exchanged parts.

Normally, the zygote included haploid gametes. If meiosis was not perfect, and the gametes are diploid, then those from the merger of multiple chromosome numbers of offspring are created. This may be tri-, tetra or polyploidy. You may, for example, porcine, more sperm to fertilize an egg with. The tetra polyploidy currently used farm salmon and carp, because they weigh more than two diploid individuals of. The odd (3,5) chromosome assembly of individual are not able to reproduce sexually. Robertson types of chromosomal translocations, the two chromosomes, which are close to the centromere of chromosomes are located at the centromere ulinked together. Most often cattle described for 1/29 translocation Robertson's, which means that the first and the twenty-ninth chromosome integrated. While the majority of chromosomal abnormalities born animals die before maturity, so it will not be to the next generation, it is Robertson's translocation from the still unexplained reasons, no exception.

8. Allele

An allele is one of a number of alternative forms of the same gene or same genetic locus. In the nature the most occured gene variant called as a wild type.Let us see the booroola genes and its effect on reproduction. In Australia at the end of the 1950 years, big reproducibility for a gene was observed in the booroola merino stock. The researchers identified the gene and SNP, which caused the high reproduction in 2002. This bone morfo genetic receptor gene (BMPR-1B) is working abnormally because of a mutation. That variant of the gene, that the mutation, the allele with a wild type do not carry it (Fec+), this yields a normal litter number. Fecb, which leads to a big litter number, is the mutant variant of the gene.

The Australian merino in the type of so-called medium single Booroola name on a new South- Wales farm at the mothers two, three, sometimes yet fiver twin deliveries appeared. This the stock on some twenty years at it was submitted to thorough watch and examinations. The big one so-called Fec defining reproducibility (fecunditi-booroola) gene monofakctorial fecundity, and expounds his effect in the woman sex exclusively. Fecb gene heterozigosity in ewes carrying on a manner with some 1,5, the homozigosity the ovulation number of ones carrying on a manner increases by some three though. According to this 0,8-1,0, concerns1,0-1, 5 increase with a lamb delivery the number was born to lambs.

9. Centimorgan (cM)

A centimorgan (abbreviated cM) or map unit (m.u.) is a unit for measuring genetic ulinkage. It is defined as that distance between chromosome positions (also termed, loci or markers) for which the expected average number of intervening chromosomal crossovers in a single generation is 0.01. It is often used to infer distance along a chromosome.

10. Genetic markers

All identifiable DNA pieces like that, section, -sequence, the inheritance of which we call it a traceable, genetic marker. The markers based on we assign it into two groups: the one type (marker I), and the two type (marker II) into the group of markers.

11. Genotype Assisted Selection - GAS

If one of the production ones are genes defining a characteristic known, then the gene for us his favourable allele directly selected, so we may make direct selection with regard to the questionable gene. The largest benefit of the assay, how onto ancestry information, neither there is not need for the measurement of the performance, and sex independent one, the animal any age performable. Currently but only some genes like this known in the sheep. Such as the callipyge gene, that qualifies the animal for extra meat production, you are the booroola gene, which causes big reproductibility. In Hungary the szndrői economy, they are in the substance of suffolk stoch which individuals carrying a callipyge mutation. Booroola gene carrying substance for example prolific merino, which can be hit on farm of University of Debrecen stock breeding.

12. Gene mapping

It is defined in the course of the genetic map, that the given genes, concerned DNA sections on exactly which chromosome, in what kind of order space is taken up. More of the types of the genetic maps (physical, connected, comparator) exists.

13. Heterozygote

If it is an individual the diploid carries alleles differing in it cells looking at a particular characteristic (the homologous chromosome some one-one its member on the same one lokus different allele can be found), we call it heterozygote then. Some other way: the individual inherited two different alleles from the two parents (for example AB or ab its genotype).

14. Homozygote

If it is an individual, the diploid carries identical alleles looking at a particular characteristic in his cells (the homolog chromosome for both of a pair's members on the same one lokus the same allele can be found), we call it homozygote then. Some other way: the individual inherited an allele just like that from the two parents (pl. AA, or aa the genotype).

15. Sheep genome

The sheep genome, similarly to the genome of the polycellular animals, two heads consist of a part: nuclear and mitochondrial from a genome. The every single cell of the organization of the sheep carries the full genetic substance of the sheep, some special ones disregarding a cell, like what the red blood cells, from which grew totally the nucleus is missing in their state.

16. Kariotype

Kariotype reports a given individual's chromosome set, including the number of the chromosomes, and they his structural construction. For the sheep altogether 26 the sex chromosome of a couple of autosoma and two sex choromosomes (X and Y) is, from among which three metacentric (the threading the chromosome is on his middle), the rest of the acrocentric (the threading on one of the ends of the chromosome can be found).

17. Marker Assisted Selection – MAS

Morphological, biochemical or one based on DNA/RNA variation marker is used for indirect selection of a genetic determinant or determinants of a trait of interest (e.g. productivity, disease resistance, abiotic stress tolerance, and/or quality) during MAS.

18. Microsatellite

The microsatellites are type II markers, that from repetitive units (tandem repeat) they recover. The repetitive units the most mostly dinucleotide units, but they may be tri- or tetranucleotids. The next example an one like that microsatellite shows, the repetitive units of which dinucleotides (GT), the number of the recurrences though n=11, teht (GT)11:

….TCTTMCATTTTGTCTCTCTCTCTCTCT

CTCTCTATGATATTTCT…..

The microsatellites one's alleles differ in the number of the recurrences. Their additional feature, that they settle down in the genome being dispersed randomly, degree variability is showed, the mendel the rules of inheritance are observed, and what the practice is his viewpoint with an essential, plain technique demonstrable. The microsatellite-markers their characteristic holding applicable onto a genetic map, ancestry onto cheque or the measurement of a genetic diversity.

19. Mutation

The cell passing his base order, you are the result of his changing being hereditary for his number, which is not recombination. The mutation may be a gene or a chromosome mutation. We call it a dot mutation if one single base is replaced as the result of the mutation. May be found it is, that a base, you are even a whole section falls out of the DNA chain, you are possibly new bases get wedged in. The former one deletion, it is for falling out, the latter one though for getting wedged in, insertion enter sporting event.

20. Comparative map

The comparative mapping utilizes the phenomenon that it is single genes largely preserved between the different mammal races, like what you are the mouse, the pork and a man even the genes of the sheep and the horned cattle. This in a case, if it manages to identify it for example and to map a gene in the horned cattle, then the information utilizable onto mapping the gene in a sheep and reversely. The sheep and the bovine race stand most near to each other genetically, that the horned cattle microsatellites it deciding proportion it too, that can be found in the sheep, even informative one, like this excellently applicable in the genetic map.

21. QTL (quantitative trait loci)

In the sheep, similarly to other species, the most important measure of value characteristics, their nature caught with a quantitative character, a constant distribution is showed in a phenotype. The reason of this it, that more genes define the characteristic collectively, and the environment has an influencing effect on it. The genes defining these characteristics collectively QTL enter sporting event.

22. Scrapie

The scrapie has a great interest in European Union, during the last decade. This illness (TSE- Transmissable Spongiform Encephalopathy) is not hereditary, expression the existence of an inherited tendency necessary. The illness to BSE (the inflammation of bovine spongy brain) it was qualified as quite dangerous because of the similarity of truth, and from the aim of the opportunity of the prevention genetic examinations did its row. A method like that was drawn up building upon the results of the examinations, for which from blood samples, DNA it is possible to establish it with examinations the individual, the genotype of scrapie, that is onto the illness truth apitude there may be establish with a good result. The protein of the prion with the examination of DNA different genetic variants can be identified (ARR; AHQ; ARH; ARQ; VRQ), that they join resistance capacity with different strength. All individuals ket with a genetic variant (genotype) endures, from among which one from the father, it inherits the other one from the mother.

3. fejezet - 3-4. Production traits

1. Meat production trait

In Hungary, lamb and mutton meat are dominantly consumed as stew/ragout, or rarely a kind of soup, but other kinds of foods are not really made. The average lamb/mutton meat consumption is 300 g per year per person. In the down-towns and in the capital the lamb and/or mutton meat consumption is not typical; however, it is available in the supermarkets. The traditional lamb or mutton meat are cooked in the country (as a kind of stew), often in festivals, animal fairs, food exhibitions. Wherefore the people are prejudiced against the mutton meat because of its fatty flavour, the meat must be altered to satisfy the consumer preferences and/or improve the knowledge about this kind of meat.

There is a strong correlation between sensory attributes. Because the tenderness is a major factor for consumer acceptability of meat the low or high score for tenderness attract the low or high score for flavour, juiciness, and overall acceptability (Bunch et al., 2004). Juiciness is related to both the capacity of the muscle to release its constitutive water (initial juiciness) and the infiltrated fat content (sustained juiciness) (Dryden & Marchello, 1970); however initial juiciness and moisture content were in negative correlation (Hoffman et al., 2003).

The sensory values and quality of lamb meat are influenced by several factors. As the **breed** can influence the acceptability of meat, several studies were made on comparing the meat of wool and hair sheep breeds (Fahmy et al., 1992; Horcada et al., 1998; Brzostowski et al., 2004; Teixeira et al,. 2005). The hair sheep (especially St. Croix lambs) meat were preferred to the wool sheep lamb meat (Bunch et al., 2004), and than coarse-wool breeds (Ducket & Kuber, 2001). Breeding groups had a greater impact on tenderness than on flavour or juiciness. (Bunch et al., 2004). The lamb from fine-wool breeds had more intense flavour than coarse-wool breeds (Ducket & Kuber, 2001), while prolific breeds (Romanov and Finnsheep) had a higher percentage of off-flavour than a standard meat-type breed such as the Suffolk breed (Fahmy et al., 1992). Crossbreeding influenced only some of the sensory parameters. The meat of crossbred lambs had significantly higher tenderness and juiciness than the meat obtained from purebred Pomeranian lambs (Brzostowski et al., 2004). After Hoffman et al. (2003) breed did not have a significant effect on the sensory quality of lamb meat, except for Dormer x South African Mutton Merino lambs which only showed a significantly higher initial juiciness compared to Suffolk x Merino lambs.

Meat flavour is also impacted by **nutrition** of the lambs before slaughter (Melton,1990; Fischer et al., 2000; Sanudo et al., 2000; Gorraiz et al., 2000; Bunch et al., 2004). Intensity of flavour is increased with grazing, while grain feeding resulted more accepteble flavour (Ducket & Kuber, 2001) of lamb meat.

Since the consumer preferences and cuisine traditions are various, the meat flavour is also different according to the **slaughter weight** (Horcada et al., 1998; Beriain et al., 2000). The heavy carcasses had more flavour intensity than the light ones (Teixeira et al., 2005).

The **age** (in relation with the weight) of lambs at slaughtering may also increase the likelihood of off-flavour in meat of male lambs (Rousset-Akrim et al., 1997; Notter et al., 1991).

The **sex of lambs** can also alter the flavour of meat. Significant differeces could be found between the meat of female and male lambs (Mushi et al., 2008; Lind et al., 2011).

Consumers could distinguish lambs according to their origin and their preferences. Dominantly well trained panellists were making sensory examinations of various meat (including lamb meat), but even on family level the not trained panellist could make differences among breeds of lamb according to their preferences. The cultural background and previous experiences or knowledge are affecting the preferences of the panellist (Ward et al., (1995; Sanudo et al., 1998, 2000).

Although the sex of the lamb has significant effect on meat quality, the acceptance of the lamb meat according to gender of the panellist has not been studied. Also limited information is available about the effect of age and the occupation of the panellist on the ratings of sensory attributes of lamb meat.

The ability to produce complex properties of meat includes three main parameter groups. The first consists of the growth characteristics of the intensity, duration, and characterized by the concept of capacity, good moderate heritability, measure them in daily weight gain (net and gross) and is used as a slaughter age. The weight gain is dependent on the type of sex, age and mode of fattening. The value can be between 100 to 600 grams of the above factors. The maturing varieties of the adult body weight of 50-55% can be characterized. This is true even if some varieties of almost every good meat hoof shape. The growth rate, duration and capacity for each of the four basic types (high-intensity short-duration, high-intensity, long duration, low intensity, short-duration, low intensity, long duration) has its significance. These features greatly affect the species crosses - maternal, paternal line - to use. The second group of parameters consists of the cutting properties of the slaughter weight (body guzzle percent) of valuable meat parts (pistol thigh, leg, loin, shoulder, rates etc.) and tissues (soft tissue and bone) ratio previously belonged to this group. After accession to the EU body conformation (body form) - which it is mandatory role in determining the price - has increased in importance. The pure-bred breeding success of selection can be done to improve the cutting parameters, as is generally well inherited. The third group of meat quality properties comprising increasingly important in the future will be increased. The quality characteristics of the objective and subjective elements are present. The color, the smell, the meat pH, cooling and cooking loss, the flavor and aroma are the most important factors determining the quality of the meat.

2. High heritability values, resistance, tolerance technology, the useful life

The resistance can be inherited and acquired properties; role is greatly enhanced. The movement of animals between farms, longer deliveries, centralized fattening, both general and specific habitat communicable disease resistance increases the importance of complex properties. The endurance technology - although grazing properties to be considered in all animals - especially intensive milking sheep enterprise, utmost importance. 100-120 days a year in the case of sheep milked the udder morphology and properties of other head can be given high priority in the selection of age. The udder irritability is a well hereditary characteristic. Extensive technology especially in the hoof sensitivity may limit the applicability of the breed. One example is the addition of merino and awassi well. In the former medium, and the latter is highly sensitive. The abnormal foot development, organizational strength is the weakness of the qualities that are most associated with the technological tolerance. Today, a number of genetic markers are known that disease resistance ability or predispositions, tell us. Today, the practice of the useful life can be evaluated differently in different species. This is more important the ruminant species (cattle, sheep), such for example pigs. This is due to the loss of a different disposition rate. In practice, the domestic sheep losses on the disposition and cull animal between hogget difference the price at between 12-22 thousand HUF. The one-year service life accordingly decreasing from 0.2 to 0.5 births per sheep numbers offset by an increase in sales. The shorter the retention time of breeding, the greater the need for the yearly additional losses as lamb. The above-mentioned value is needed more lamb of income generation for the reduction of the useful life. The performance of sheep living (number of calving, number of lambs lambed, lambs raised rates) are very big differences. The life performance of selection yields a very positive impact on growth. The 8-10 postpartum ewes (6-8 years of age) is a good indicator for. Sire good breeding strategy for the genetic progress to "a genetic wear" is greater than the biological aging. Accordingly, it may be desirable for four years sire exchange.

3. Appetite

For heavy producing animals is important absorption capacity of the feed. Digestion in the rumen of sheep long because a lot of high-volume, 30-60 kg/1000 kg dry substance, but produce high performance ewes (3-5 liters of milk production, take 3-4 only) a lot more protein and energy. In this case, it is particularly important that the ewes are able to feed a large amount of record. The economic efficiency of ewes affected by the dose of provender and forage. In the last trimester of pregnancy the fetus, due to take the risks involved in feed absorption capacity, which is only in the assembly after three to four weeks to reach the previous value.

4. Wool production trait

The importance of wool production due to low sales decreased significantly. In particular, consideration should be given to the evolution of other traits that affect wool production traits of their role in defining the breeding objectives. Fineness of the wool, clean wool yield, wrinkling to take into account in the selection of our work has influenced the development of other properties. Such as for example the subtleties of organizational strength, the ability is negatively related to sales of feed, the vitality and the ability to adversely affect milk production. The wool yield increase of available selection options are divided into two groups. The area is one of the wool production agriculture through increasing the body weight increase, belong. The first economic limitations, the latter two of the above described disadvantages in addition to the "imbalance" increases, which is also undesirable. Another possibility to increase the yield of cotton end component group and cluster fleece density increasing the height of the fall. Both owner tributes for a number of other measures of value change can be expected. The decrease was acceptable, the fiber roughening of the two most important qualities of wool production, which is expected to be unfavorable volume as a result of selection.

5. Appearance

Many people are fetishized the importance of appearance. Others are not any significance to the looks like. The types of stamps and the preservation of the breed today too conformation of the importance to be attributed to errors that affect the production and indications of the production capacity. In this approach, it is also fit to the rams selection index score plays a role in the appearance, for many countries, the state scores (index scores) price determinants. The chromatic aberrations are associated with the utilization of the animals and the breed standards contain.

This type of error can be the formation of the horn, as is usually the typical properties. The the formation of the horn also providing a reference point to assess the temperament of the animal. The smaller space allowances, for your convenience, the ungainly animals and breeding of varieties favored.

6. Population (potential) ability to produce meat

In recent years, the efficacy of indicators forget that the animals relative to 1000 kg per producing ability is shown. The relative ability to produce a significant indicator of the economy. A population or potential meat producing ability is a measure of a unit of government arms t-complex can be obtained about the amount of meat. The value of the animals' body weight, prolificacy, feed demand is determined. These different types of indicators, the utility sequence varies considerably in relation to an individual capacity for production of meat. The population most commonly used indicator of meat production potential of 100 hectares of forage area and for the population quantity of meat can be produced.

7. Reproduction properties

In females, the attribute of many reproductive traits are composed. Some of them prolificity affected and some of them do not even appear directly measurable in maternal performance. The one depends on the number of lambs per parturition ovulatory quota, the engraftment rate of abortions and that the stock level, the operating conditions are difficult to identify. The potential increase in prolificacy and the choice is well-fed and well cared for animals can be 30-40% of the difference. The genetic potential for prolificacy in addition to significantly depend on the environmental conditions, low heritability (0.1-0.3). Exceptions include the varieties (booroola, olkuszka, prolific merino etc.), for which a special way in the genetic control of prolificacy.

The increase in yield for the same prolificacy plays the most important role, but now the economic interests along a significant role in the early breeding reception, the useful life of the seasonality and compressed result of parturition. Take advantage of these properties of genetic and phenotypic correlations are working to improve the production efficiency. The more varieties of parturient parturition concentrating the calving per litter - the prolificacy - reduction can be expected.

The males will affect their children's performance at prolificity. In their case, the available population-level indicators of the genetic factors increase the search activity, libido, sperm quality, and seasonal influences. Enforces these properties can result in significant environmental effects should be expected.

8. Feed utilization capacity

The sheep species can significantly affect the ability to sell the type of feed, sex and age.The transformation of milk suckling animals under 5 liters of milk - milk 1 kg of dry matter - produced by 1 kg of gain. The aging of sheep, their weight increases and the degree of recovery is deteriorating. During the fattening period, the initial 2-3 kg to 6-7 kg for the growing needs of the fattening unit. An average of 4-6 kg of feed conversion ratio of sales, 3-9 kg / kg of extreme values. The feed rate of the specific use of adult body weight of 50-55% is reached, deteriorates significantly.

Because sexual dimorphism is significant, it may take longer for fattening rams, and the efficiency is better. The males are sold 10-30% more feed. In Hungary you can find significant differences between varieties can be found. The extensive varieties available daily gain from 100 to 120 grams while the meats are 400g reported significantly more weight gain-values, which are closely related to vendor's ability to feed. In this, our country is still found in the Suffolk breed, Texel and Charollais.

9. Milk production trait

The evaluation of the main parameters of milk producing ability of daily milk yield, lactation length, lactation milk yield and persistency. In addition, account should be taken of the quality of the milk that is gut contents (minerals, fat, protein, sugar) as well. The heritability values - properties at low volume, high-quality attributes of the value of h2 - the characteristics of the positive and negative correlations to determine the production potential and tasks by improving milk production. The long breeding history, different breeding objectives, production and type traits for polarized varieties. So it is also the ability to produce milk.

The indigenous breeds of sheep milk production is adjusted to the needs. The lactation length is more or less equal to the length of gestation, length (150 days), and the volume adjusted to increase lamb. A liter of milk production as a 200 gram responding allow to weight gain, such as traditional and primitive types in general, accordingly, the amount of milk produced per 1 liter below that of lambs up to 200 grams weight gain was possible responding. Between 100 to 150 days of lactation length kept develops. The dairy breeds of the daily milk production by increasing the number of days of lactation for breeding task. Accordingly, the stretched beyond 200 days of lactation, milking and improving persistence of importance. The daily milk production in dairy breeds in extensive 1 liter, better production than the degree of the intensity, the type and capacity, depending on the individual 1-5 liters. The increase in the quantity of milk than we can count the milk content values - fat, protein, solids, etc. - reduction.

In the case of intensive meats was necessary to increase the amount of milk a day, since a number of outstanding 3-5 cent litter daily gain for the genetic capability level. Achieve such a value is 5 liters of daily milk production is required. However, in this case, due to genotypes for milk production needs to maintain only choices - especially if it is compressed yean - so fast agalactia possibility of carrying themselves. A high level (2-3 liters) production, a short, 50-day maximum of 100, but a balanced lactation and fast, breaking free of the meat breeds diminution essential. The twin delivery milk production significantly (30-60%) in more than one product of farrowed. The weaker produced larger, high-yielding varieties with minor differences can be expected.

10. Milk protein variants and human nutrition – the human benefit

It is noteworthy that milk protein polymorphisms are involved in human nutrition in various ways. Three crucial aspects include the hypoallergenic properties of particular types of milk, the release of peptides with biological functions from milk proteins, and the coevolution of bovine milk protein variants and human lactose tolerance (Caroli et al. 2009). Since the aspects of milk protein allergies and the lactose intolerance are summarised and evaluated in separate chapters, the bioactive peptides are mainly presented here.

11. Hypoallergenic milk

Most milk proteins are potential allergens, especially as αs1-casein, αs2-casein, and β-lactoglobulin, which are missing in human milk (EFSA, 2004; Crittenden and Bennett, 2005). The occurrence of alleles associated with a null or low content of those proteins might be exploited for the production of milk with particular nutritional qualities; that is, hypoallergenic properties (Caroli et al. 2009).

Besides selecting for milk with a null or reduced content of a specific protein, another possibility for producing hypoallergenic milk could involve genetic differences among epitopes, which are short fragments widely spread throughout the hydrophobic parts of the protein molecules. Epitopes on milk proteins comprise highly conserved sequences responsible for IgE cross-reactivity with corresponding milk proteins of other mammals, including humans (Wal, 2004).

12. The biopeptides

The two major categories of milk proteins are the insoluble proteins (the casein family) and soluble proteins (whey proteins), found in lactoserum. The casein family of proteins consists of several types of caseins: αs1-, αs2-, β-, κ- and γ-, while the whey proteins are α-lactalbumin and β-lactoglobulin. Milk also contains important minor proteins, such as serum albumin, immunoglobulins, lactoferrin, transferrin, calcium-binding protein, prolactin, folate-binding protein and protease-peptone (Park et al., 2007).

In recent years, it has been recognised that dietary proteins provide a rich source of biologically active peptides. Biopeptides have been defined as specific protein fragments that have a positive effect on body functions or conditions and might ultimately influence health (Kitts and Weiler, 2003). Such peptides are inactive within the sequence of the parent protein and can be released from precursor proteins by enzymatic proteolysis during gastrointestinal digestion or food processing (Fitzgerald and Murray, 2006; Korhonen and Pihlanto, 2006; Korhonen, 2009). Caseins represent a reservoir for a wide variety of bioactive peptides, i.e. minor regulatory compounds with hormone-like activity, which could affect nutritional value of milk (Meisel 1998; Lorenzini et al., 2007; Korhonen, 2009).

El-Agamy (2007) reviewed cow milk protein allergy and found that about 0.3 – 7.5 % of population could be affected, determined by country and society, and ethnicity; this allergy occurs predominantly in children, because in adults this problem is rather small. Most of the summarised studies state that β-lactoglobulin is the most allergenic protein in bovine milk, as it is missing from human milk, but the αs1-casein, as well as β-casein, and α-lactalbumin, bovine serum albumin, IgG could cause allergy. Most of these proteins are the source of various peptids borne during digestion or during milk processing.

There have been several studies on the case of peptides originating from β-casein. Special attention has been given to the differences between the A1 and B as well as the A2 variants. An amino acid substitution occurs at position 67, where the first two have histidine, while the last one has proline, and is responsible for the production of beta-casomorphin 7, which is called a dangerous peptide. However, 8 different casomorphins have been detected so far. Many reports have stated that this difference could be blamed for several diseases, and the milk from cows with A1 or B variants is called "histidine carrier".

Elliott et al. (1999) have suggested that consumption of milk from His67-carrying cows is positively and significantly correlated with the incidence of diabetes. It has been stated in other works (Beaglehole and Jackson, 2003; Laugesen and Elliott, 2003) that the A1 allele increases the risk of diseases such as diabetes, coronary heart disease and ischaemic heart disease in people consuming such milk. On the other hand, they did not find any negative effect of the A2 allele.

According to Molkhou (2006), the αs1-casein is incriminated as being the major milk allergen. Similar results were published by Kost et al. (2009) who stated that the β-casein A1, B and C genetic variants definitely led to the abovementioned diseases, but influence was not detected with the digestion of β-casein A2 and A3. With almost the same results Nilsen et al. (2009) suggested to use selection in breeding for increasing the frequency of alleles or haplotypes coding for Pro67 at the β-casein locus.

13. The minor proteins

In general, more than 200 kinds of minor proteins are in the milk of which about 60 are indigenous enzymes. Most of the minor proteins have biological functions (Fox and McSweeney 1998) and probably play quite significant roles. Important minor proteins include immunoglobulins, lactoferrin, transferrin, ferritin, proteose peptone, calmodulin (calcium binding protein), prolactin (50 μg/ml in cow milk - Park et al. 2007) and folate-binding protein, etc. Whey proteins also include a long list of enzymes, hormones, growth factors, nutrient transporters, and disease resistance factors.

14. The NPN – non-protein nitrogen

While early reports (Davis 1952, Armstrong 1959) ignored the 5-6% of NPN content of milk (DePeters and Ferguson 1992), with strong breed and herd effects, Jenness and Patton (1959) reported a "notable resemblance" between the compounds found in the NPN fraction of milk and those found in the urine of cows, suggesting that most of the NPN compounds are end products of N metabolism within the cows. These end products (NPN) could be derived either from blood or from the result of the degradation of milk proteins (Kuzdzal-Savoie et al. 1980).

Several factors influence the NPN level in milk, including management, feeds and diets, feeding practices, the season, the herd and breed, as well as the stage of lactation (Packard 1984; Wood and Boettcher 2003; Mech et al. 2008, Meehl et al. 2010), or the time of the day (Meehl et al. 2010). However, the significance of this milk N fraction to energy and N metabolism in the dairy cow has not been well characterised. Blood urea N has been positively associated with the intake of ruminally degradable and undegradable protein and negatively associated with the intake of net energy (DePeters et al. 1993).

Non-protein nitrogen in milk is probably the least understood N fraction: it has little nutritional value and does not contribute to cheese yield (Packard 1984; DePeters et al. 1993, Barbano and Lynch 1999). Therefore, it does not have the same economic value as "true" milk protein to either the processor or the consumer (Barbano and Lynch 1999).

15. Urea

The dominant component of milk NPN is urea, accounting for 50% of the N content in general, but Kaufmann (1982) reported that urea may constitute from 20 to 75% of the NPN fraction, while Hojman et al. (2004) calculated 36.1– 38.4%. It is an important parameter of milk quality and is an indicator of the adequacy of herd nutritional practices. Large values of urea content indicate an unbalanced ratio of protein vs. energy in the feed and inefficient utilisation of protein. Additionally, the milk urea content affects reproduction (Godden et al. 2001, Mitchell et al. 2005). Recent studies on urea and casein contents indicate that variability among cows exists (Wood et al. 2003; Ikonen et al. 2004; Mitchell et al. 2005).

4. fejezet - 5-6. Reproduction of small ruminants (sheep and goat)

Animals live under the influence of seasonal fluctuations of environmental conditions, with variable amplitudes frequently more marked in the higher latitudes and altitudes. The daily photoperiod and the annual cycles in environmental temperature are the most striking examples in temperate regions while the annual cycle in rainfall, with the consequent cycles in food availability, are important variables in tropical regions (Vivien-Roels and Pévet, 1983). As these changes reach acute levels, the animal species may respond by developing a series of different strategies (e.g. changing feeding habits, laying down energy reserves in the form of fat tissue, lowering the basal metabolism, moulting skin, fur and plumage, hibernating

and migrating). Another mechanism is a reproductive strategy involving a 'natural contraceptive method' (Lincoln and Short, 1980) which restricts the reproductive activity to the best time of the year for assuring that births occur at a time that promotes maximal growth and development of the offspring and supports lactation in the mother (Wayne et al., 1989). In

cold and temperate regions, this period corresponds to spring or early summer while in hot arid climates it coincides with the rainy season.

In order to synchronise their fertile period, seasonal breeders rely on environmental cues. Of the many environmental variables available, photoperiod is the most commonly used synchronising agent (Karsch et al., 1984) because unlike other climatic variables such as temperature and rainfall, the seasonal cycle of day length is constant between years. Species that use photoperiod to synchronise breeding activity are commonly classified in two different categories; long-day breeders or short-day breeders. Species in the first group, which include the ferret, the hedgehog and the horse, enter their breeding season after the winter solstice when the day length increases. Species in the second group, such as deer, goats and sheep,

become sexually active in response to decreasing day length in the late summer to early autumn. It is important to stress that seasonal reproduction occurs mainly in wild species as a result of natural selection while animal domestication and artificial selection has contributed to minimise the effects of season on reproductive activity. This idea is supported by the study of Lincoln et al. (1990) who compared the reproductive seasonality of wild, feral and domesticated breeds of sheep kept under similar conditions at the same latitude and concluded that wild-type rams reached the peak of testicular activity later in the year than domesticated rams while the feral type followed an intermediate pattern. On the other hand, domestic species that breed throughout the year such as cattle and pigs, if left in the feral state for an extended period, gain a strong tendency for parturition to be seasonal (Ortavant et al., 1985).

It is clear from the literature that sheep breeds originating from temperate climates in mid or high latitudes are seasonal breeders and use the annual variation in daily photoperiod in timing the annual reproductive cycle. On the other hand, in tropical and sub-tropical environments ewes are either completely aseasonal or intermittently polyoestrus with the quality and availability of food dictating breeding activity.

Supported by the works of Hafez (1952), Goot (1969) and Dyrmundsson (1978), Robinson (1981) argues that breeds whose origins are located between 35◦N and 35◦S have the tendency to breed at all times of the year while at latitudes greater than 35 ◦ it is normal to find ewes that are seasonally polyoestrus and whose breeding seasons are initiated by declining day length. In general, the higher the latitude the greater the photodependence and the more restricted the period of breeding activity (Poulton, 1987). In this view, while tropical breeds are sexually active throughout the year, British breeds demonstrate a distinct seasonality with a long anoestrous period during which no ewes ovulate spontaneously. Breeds from intermediate latitudes, such as the Australian Merino and Mediterranean breeds, have a short anoestrus during which a proportion of ewes ovulate spontaneously (5% in Australian Merino; Martin et al., 1986).Within breeds there is also a large variation. As an example, some ewes of the breed Préalpes-du-Sud have a very short breeding season while others are almost aseasonal (Thimonier et al., 1986). The breeding season starts in most ovine breeds during summer or early autumn (Chemineau et al., 1992) and its length varies largely among breeds but in general it ends during the winter (Hafez, 1952).

1. Manifestation of seasonality in the ewe

Reproductive seasonality in the ewe is characterised by changes at behavioural, endocrine and ovulatory levels, in an absolute fashion, giving rise to an annual alternation between two distinct periods; a breeding season, characterised by the succession at regular intervals (mean of 17 days) of oestrous behaviour and ovulation, if a pregnancy does not develop, and an anoestrous season characterised by the cessation of sexual activity. The transition from anoestrous to breeding season is gradual, with the occurrence of short cycles, because the first corpus luteum (CL) often regresses prematurely 5–6 days after its formation.

Both ovulatory activity and oestrous behaviour show parallel seasonal variation but there are some discrepancies at the beginning and at the end of the sexual season when some ovulations are not accompanied by oestrus. It is only after the end of the first ovarian cycle that the behavioural oestrus is exhibited. Silent ovulations, not related either to the onset or the end

of the sexual season, may also occur in some breeds during mid-anoestrus (Land et al., 1973; Ortavant et al., 1988). At the endocrine level, it is known that during the anoestrous season, follicle growth and regression occur and follicles as large as those found during the luteal phase of the oestrous cycle may be present (Hutchinson and Robertson, 1966; Matton

et al., 1977; Webb and Gauld, 1985). Throughout seasonal anoestrus, the follicles produce steroids, and many of the positive and negative feedback effects of the steroids on secretion of luteinizing hormone (LH) continue as in the breeding season (Gordon, 1997). LH continues to be released, episodically, but with lower frequency than during the reproductive season (one pulse every 8–12 h against one pulse per 3–4 h in the mid-luteal phase, one pulse per 1–2 h immediately prior to the preovulatory LH surge and one pulse every 20 min during the preovulatory LH surge (Yuthasastrakosol et al., 1977; Karsch, 1984; Martin, 1984; I'Anson and Legan, 1988; Thiéry and Martin, 1991). A major difference occurs also in plasma progesterone concentration, which remains virtually at undetectable levels during anoestrus (Roche et al., 1970; Karsch, 1984; I'Anson and Legan, 1988).

Follicle-stimulating hormone (FSH) levels seems not to be significantly different from those found during the reproductive season (Goding et al., 1969; Roche et al., 1970; Walton et al., 1977).

2. Manifestation of seasonality in the ram

Rams exhibit seasonal fluctuations in sexual behaviour, hormonal activity, gametogenesis and also in testicular weight and volume (Schanbacher and Lunstra, 1976; Lincoln and Davidson, 1977; Ortavant et al., 1985). However, behavioural and physiological variations are less pronounced than in the ewe.

In fact, while ovulation and oestrus in the ewe is arrested, spermatogenesis and sexual activity in the ram never stop. Generally, all these parameters are high at the end of the summer and in autumn and low at the end of winter and in spring (Lincoln and Short, 1980; Haynes and Schanbacher, 1983; Pelletier and Almeida, 1987). Taking the Ile-de-France ram as an example and considering that similar tendencies have been observed in many other breeds, Ortavant et al. (1988) report that the testis weight can vary from 180–190 to 300–320 g and spermatozoa production per gram of testicular parenchyma can increase from 8.5 × 106 to 12.2 × 106, resulting in a daily sperm production variation per testis of 1×109 to 4.8×109.

In Soay rams, LH and FSH levels begin to increase 2–4 weeks after the decrease in photoperiod, followed almost immediately by a rise in plasma testosterone levels accompanied by growth of the testis (Lincoln and Davidson, 1977). Rams' sensitivity to photoperiod is different from ewes. Sexual activity is usually stimulated 1–1.5 months earlier in rams, allowing that when the cyclic period of the ewes starts, the rams have already achieved a high level of sexual activity (this advancement is important because while anoestrous ewes can ovulate within a few days after hormonal stimulation due to the ever present large-sized follicles, the rams need approximately 45 days to complete spermatogenesis).

3. Modulating factors of seasonal breeding

It is well established that seasonal reproduction in sheep is mainly regulated by photoperiod. However, other cues from the environment (temperature, nutrition and social relationships) are believed to modulate its effect. While in temperate regions the photoperiod is the decisive factor and other environmental factors can only influence the onset and the duration of the

anoestrous period, in tropical areas nutritional level is probably responsible for some seasonal acyclicity.

Environmental temperature cannot impose seasonality on reproductive activity of the ewe as was clearly demonstrated by Wodzicka-Tomaszewska et al. (1967). These authors found that in spite of dramatic changes in temperature, the annual rhythm of reproduction persisted in ewes kept under a constant photoperiodic schedule of 12 h of light–12 h of dark per day. However, temperature may modify the onset of sexual season. It has been shown that ewes maintained under low temperatures during the summer period began their reproductive season earlier than those kept under temperatures typical of that season (Dutt and Bush, 1955; Godley et al., 1966). Also, Lees (1966) found a positive correlation between mean temperature in July and the date of the onset of the breeding season in Clun ewes.

It is well known that nutrition affects many aspects of reproductive performance in sheep, e.g. age at puberty in both sexes, fertility, ovulation rate, embryo survival, parturition to re-breeding interval, testis growth and spermatozoa production (for details see Smith, 1991; Clarke and Tilbrook, 1992; Rhind, 1992; Robinson, 1996). Nutritional inadequacies can show their effects as short, middle and long-term.

Thus, while some studies indicated that ewes can lose body weight without any immediate detrimental effect on reproductive performance, the accumulated losses over several reproductive cycles increase the incidence of barrenness (Robinson, 1981). The nutritional level received by ewes during the winter and spring can influence the percentage of ewes showing oestrus the following autumn (Smith, 1966) but a sub-maintenance diet introduced before the onset did not delay the breeding season except in very young and very old ewes (Hafez, 1952). Forcada et al. (1992) found that the length of seasonal anoestrus was clearly reduced when Rasa Aragonesa ewes were maintained with low body condition score (2.5 as compared to 2.7) for two consecutive years. Thimonier et al. (1986) reported that the variations in the occurrence of births in regions where the rainfall is very variable can be explained by variations in food availability.

In contrast, Gordon (1997) concluded that both in temperate and tropical breeds, the nutritional level appears to have little effect on the onset and duration of the breeding season. Robinson (1981) suggested that some conflicting reports in this matter can be resolved on the basis that reductions in body weight at mating of up to 15% have little detrimental effects in

the short-term but reduce long-term production. In the ram, changes in nutrition lead to profound responses in testicular size and spermatogenic function (Martin and Walkden-Brown, 1995).

The mechanisms by which dietary nutrients regulate reproductive parameters are complex, not yet well understood and are the subject of speculation (Parr, 1987; Smith, 1991; Robinson, 1996). However, there are sound arguments to favour the hypotheses that feeding regimen affects the secretion or clearance of gonadotropins (effect on ovulation rate; Adams et al., 1997), the clearance of progesterone (effect on pregnancy rate; Parr, 1987) or the balance between FSH secretion and gonadal feedback by changing the responsiveness to the inhibitory effects of oestradiol and inhibin (effect on seasonality of reproduction; Boukhliq et al., 1996).

The reproductive season can also be influenced by lambing date. The onset and duration of the natural breeding season is affected by previous lambing date. An early lambing date is associated with an early onset of the subsequent breeding season (Haresign, 1992; Mitchell et al., 1997), but not with its cessation (Mitchell et al., 1997).

Lactation period is another factor that can affect the breeding season. Under normal conditions, in highly seasonal breeds, births occur during seasonal anoestrus and therefore in this situation lactational anoestrus cannot be identified. But when the ewes are induced to breed during seasonal anoestrus they lamb in the breeding season and in lactating animals the

resumption of ovarian activity is known to be delayed (Mallampati et al., 1971). Suckling has also a pronounced effect on the length of postpartum anoestrus in less seasonal breeds lambing naturally during the breeding season (Shevah et al., 1974; Pope et al., 1989). Denervation of the mammary gland has been proved to shorten the length of postpartum anoestrus (Kann and Martinet, 1975).

Social interactions can strongly affect the reproductive state of sheep. Relationships between and within sexes have been identified as influencing various parameters of reproduction in both the ewe and the ram. For details see the reviews of Thimonier et al. (2000) and Rosa and Bryant (2002).

4. The photoperiod as the determinant factor of seasonal reproduction in sheep

Experimental evidence

The role of day length as the deterministic factor in inducing and suppressing sexual activity in both the female and the male sheep has been clearly demonstrated in a variety of experiments. Artificial reversal of the annual rhythm of photoperiodic variations induces reversal of the period of ovulatory and oestrous activity in the ewe (Yates, 1949; Thwaites, 1965; Wodzicka-Tomaszewska et al., 1967) and of the periods of recrudescence and regression of testicular size (Alberio and Colas, 1976, reported by Ortavant et al., 1988) and sperm production in rams (Colas et al., 1985). The treatment of animals with a light regimen which mimics in 6 months the normal annual day length pattern, generate in the ewe two reproductive seasons (Ortavant and Thibault, 1956, reported by Pelletier and Almeida, 1987) and in the rams two cycles of testicular growth (Lindsay et al., 1984) and sperm production (Jackson and Williams, 1973) in 1 year. Finally, the alternation of 3- or 4-month periods of constant long (16 h of light–8 h of dark) and constant short (8 h of light–16 h of dark) days induces the alternation of periods of sexual activity and inactivity in the ewe (Legan and Karsch, 1980) and testicular growth in the ram (Lincoln and Davidson, 1977). If the periods of day length are alternated every month, rams show a progressive increase in testicular weight which finally remains steady close to the maximum level (Pelletier and Almeida, 1987). Different light protocol treatments which produced changes in reproductive activity in both sexes can also be seen in the review of Chemineau et al. (1992).

5. Neuroendocrine mechanisms involved in the photoperiodic control of reproduction

The answer to the intriguing question of what causes ovulation to cease during seasonal anoestrus requires a full understanding of the hormonal patterns and mechanisms involved in the governing of ovarian activity during not only the period of anoestrus but also the periods of transition to anoestrus and return to oestrus.

The present section will focus on these points and conclude with the presentation of the current model of the neuroendocrine regulation of seasonal anoestrus.

6. Hormonal pattern during the transition toseasonal anoestrus

One of the first attempts to characterise the hormonal changes during the period of transition from cyclicity to seasonal anoestrus in ewes was made by Rawlings et al. (1977). These authors did not detect any gradual changes in the concentrations of LH, oestradiol and progesterone, but noted that at the end of the last cycle some ewes experienced a subnormal rise in LH concentration after which both LH and oestradiol levels remained basal. In more elaborate studies Karsch et al. (1980) and Legan et al. (1981) found that the pattern of LH secretion following the regression of the last CL of the reproductive season is different from those of previous luteolyses. While during the breeding season the basal LH level increases in a sustained way for 48 h, during transition to anoestrus it starts to increase for the first 24 h but falls progressively in the next 24 h. In addition, there is no occurrence of oestradiol rise and LH surge.

7. Hormonal pattern during seasonal anoestrus

A brief description of the hormonal relationships during the non-breeding season and some bibliographic support has already been presented in Section 2. Throughout this period the levels of progesterone remain low and no gonadotrophins surges are observed. However, neither the ovary nor the LH pulse generating system are inactive. Follicular development does not stop, periods of early follicle growth and regression are taking place and mature follicles are present. The study of follicular dynamics by ultrasonography has shown the existence of waves of follicular development (Souza et al., 1997).

The follicles produce steroids, and are capable of ovulating. Gonadotrophin hormones are secreted and both positive and negative feedback effects of ovarian steroids on gonadotrophin secretion are readily demonstrable (Legan and Karsch, 1979). Oestradiol secretion is similar to the breeding season that is an oestradiol rise follows each LH pulse (Scaramuzzi and Baird, 1977). In fact, the follicles are responsive to gonadotrophin stimulation and ovulation can occur if anoestrous ewes are treated with exogenous gonadotrophin-releasing hormone (GnRH) (Haresign et al., 1975; Southee et al., 1988) or multiple injections of LH (McNeilly et al., 1982). However, the LH pulse generating system, although active, is compromised because both frequencies of GnRH (Barrell et al., 1992) and LH (Karsch, 1984) are extremely low, tending to be even less than during the luteal phase of the cycle and sustained increases in tonic LH secretion are not normally observed (Scaramuzzi and Baird, 1977). Barrell et al. (1992) found that in marked contrast with observations made during the breeding season, an increased pulse frequency of both GnRH and LH hormones is not observed in anoestrus, which leads to the conclusion that the switch from breeding to anoestrous season in the ewe is associated with a marked change in the GnRH neurosecretory system.

8. Hormonal pattern during the transition from anoestrous to the breeding season

Yuthasastrakosol et al. (1973) first reported data suggesting the occurrence of minor LH surges during late anoestrus and the existence of a rise in progesterone levels commencing 11–15 days before the first behavioural oestrus. In a more elaborate work, Yuthasastrakosol et al. (1975) determined the levels of oestrogen, progesterone and LH throughout anoestrus and the first oestrous cycle of the breeding season. Once again, exceptionally high levels of LH and progesterone levels before the first full-length luteal phase of the breeding season. In this study, 75% of the observed increases in LH pulse frequency occurred within 1 week after a low frequency pattern of secretion (full anoestrus) and within 1 week before a rise in progesterone. These results suggested that the breeding season commences with an increase in tonic LH secretion, which initiates the sequence of preovulatory events leading to the first LH surge and that these changes in LH secretion pattern occur rapidly within less than a week. According to the authors, the transient increments in progesterone may represent short luteal phases, which result from ovulation of immature follicles. Finally, I'Anson and Legan (1988) suggested that before the first oestrous cycle, a transition period of 1–4 weeks exists, during which one or more increases in LH pulse frequency and progesterone concentrations may occur.

9. Anatomical pathway

The photoneuroendocrine pathway whereby photic cues are picked up and relayed to the GnRH generating system has been extensively investigated and is now well-understood (Legan and Winans, 1981; Karsch, 1984; Karsch et al., 1984; Turek et al., 1984; Hansen, 1985; Lincoln, 1992). Based on evidence obtained mostly in hamsters, Legan and Winans (1981) first proposed the current model for the pathway in sheep, which since then has received much additional experimental support. According to this model, the photic stimuli are first received by the retina, which contains the photoreceptors necessary for the photoperiodic control of reproduction in this species. The photic information is then transmitted from these receptors to the suprachiasmatic nuclei (SCN) of the hypothalamus via a monosynaptic tract known as the retinohypothalamic tract. The SCN functions as an internal

biological clock regulating endogenous circadian rhythms. After receiving input from the circadian system, the photoperiodic message is transmitted to the pineal gland by way of its sympathetic innervation designated by superior cervical ganglia (SCG).

The pineal gland functions as a transducer converting neural information regarding the light-dark cycle into a hormonal signal, which take the form of a circadian rhythm of melatonin secretion. The pattern of this melatonin signal, which can be interpreted as inductive or suppressive, sets the frequency of the LH pulse generating system and determines its capacity to respond to the negative feedback action of oestradiol (Lincoln, 1992; Williams and Helliwell, 1993; Malpaux et al., 1996). Experimental evidence for the existence and functioning of the described retinohypothalamic tract has been provided by various studies, based mainly in the destruction of its components, which have shown that the interruption of this pathway renders the animals unresponsive to changes in day length and interferes with the secretion of melatonin. Legan and Karsch (1983) and Karsch et al. (1984) found that the photoperiodic control was lost in ewes following blinding, demonstrating the role of the photoreceptors located in the eyes. A monosynaptic tract, independent of the primary optic tract used for visual image perception, ulinking the retina to the SCN, previously identified in other species, has also been found in sheep by Legan and Winans (1981) using a technique involving the autoradiographic localisation of [3H] proline. The implication of the SCN has been shown by Przekop and Domanski (1980), Jackson et al. (1986) and more recently by Scott et al. (1995) after confirmation that the ewes would not respond to day length changes following the lesion of this section of the brain. Both the removal of the superior cervical ganglionectomy (SCG) or the pineal gland resulted in an inability of rams (Lincoln, 1979; Lincoln et al., 1989) and ewes (Bittman and Karsch, 1984) to respond to changes in photoperiod, confirming the indispensability of those anatomic structures.

10. The role of melatonin

Melatonin is the main hormone secreted by the pineal gland and is by far the most extensively studied pineal compound. In several species, melatonin can also be synthesised in other organs such as the retina, intestine and salivary glands (Vivien-Roels and Pévet, 1983) but in most mammals the pineal gland accounts for almost all the melatonin in circulation (Yellon et al., 1992). Numerous studies have provided evidence that the pattern of secretion of this hormone follows a circadian rhythm with significant secretion occurring only during the dark period of the day with the light acting as a supressor. Consequently, melatonin levels in both the pineal gland and the blood are high at night and low during the day. There is also experimental evidence to show that exposure of animals to light at night readily suppresses the secretion of melatonin (Lincoln, 1992). The question of which parameter of the nightly melatonin secretion is used to measure the day length (i. e. amplitude, duration or phase relative to the 24 h light/dark period) has been extensively discussed in the literature.

From the two major hypotheses that have emerged, the “phase hypothesis” and the “duration hypothesis”, it seems that the most convincing evidence to date supports the “duration hypothesis” because sheep have been shown to respond to the melatonin signal irrespective

of when it is received during the 24 h period (Wayne et al., 1988). Therefore, the duration of nocturnal elevation in melatonin level may constitute the message whereby the pineal mediates the photoperiodic regulation of hormonal secretion. Long days are characterised by a short duration of melatonin secretion while short days are characterised by a longer duration of secretion. However, the circadian rhythm persists in constant darkness, being eliminated in constant light (Rollag and Niswender, 1976) or when animals are submitted to pinealectomy or superior cervical ganglionectomy when melatonin is secreted in small or undetectable amounts (Deveson et al., 1992 for review). This indicates that the rhythm is generated endogenously, presumably under the control of the SCN. The definitive demonstration that melatonin influences the reproductive seasonality in sheep came from studies in which melatonin was infused into pinealectomised ewes in patterns mimicking long and short days and it was found that the reproductive response was similar to pineal-intact ewes experiencing those photoperiods (Bittman and Karsch, 1984; Karsch et al., 1984; Bittman et al., 1985).

The major question being addressed at this stage of the discussion relates to the way by which the melatonin secretion pattern operates to change the sensitivity of the GnRH pulse generator to the oestradiol negative feedback. The sites and mechanisms of action of melatonin have been extensively studied and reviewed in the literature (Kennaway and Hugel, 1992; Williams and Helliwell, 1993; Kennaway and Rowe, 1995; Malpaux et al., 1996; Goldman, 2001) and yet there is still no clear indication of where and how melatonin acts. Although melatonin may act at different levels of the reproductive system, the main action may be within the central nervous system. Indeed, a direct effect of melatonin on GnRH secretion was demonstrated by Viguié et al. (1995) who observed an increase in GnRH pulse frequency when ovariectomised oestradiol treated ewes exposed to long days received melatonin implants. The rise in GnRH pulse frequency occurred simultaneously with an increase in LH pulsatility 40–60 days after the beginning of melatonin treatment. However, according to Malpaux et al. (1996), a direct action of melatonin on GnRH neurones appears unlikely. One reason is because most of the GnRH neurones are located in the preoptic area (POA) of the hypothalamus which does not seem to be a site of action of melatonin and very few are located in the mediobasal hypothalamus (MBH) which is a putative site of action of this hormone. Also, the long delay in the GnRH and LH responses to the melatonin treatment suggests a more complex mechanism and several neurotransmitters have already been implicated in the process, such as dopamine, serotonin and excitatory amino acids (glutamate, aspartate, etc.) (Malpaux et al., 1996). The detection of the physiological sites of action of melatonin has been attempted using melatonin microimplants inserted into regions of the hypothalamo–hypophisial complex, which limits the delivery of this hormone to those sites, in animals maintained in a photoperiod of long days. Results from this sort of study have shown that microimplants positioned in the premammilary hypothalamic area (PMH) (Malpaux et al., 1998) and in the MBH but not in the POA induced an increase in LH secretion in ewes (Malpaux et al., 1993) and an increase in FSH secretion and testicular size in rams (Lincoln and Maeda, 1992). On the other hand, several studies have shown that the sheep pars tuberalis (PT) is also an important site of melatonin action (De Reviers et al., 1989; Morgan et al., 1989; Bittman and Weaver, 1990; Stankov et al., 1991) but it is not clear whether this is a crucial target for reproductive action. In fact, while Lincoln (1994) reported that the administration of melatonin in the PT affected the photoperiodically induced cycles of FSH and prolactin secretion in rams, other authors (Malpaux et al., 1994, 1995, 1998; Goldman, 2001) argue that melatonin in this site only regulates the seasonal variation in prolactin secretion and not the secretion of gonadotropins. But whatever the mechanism and site of action of melatonin, its administration either by daily dosing or through constant-release devices allows short days to be mimicked and therefore it can be used to control the seasonal reproduction in both the ram and the ewe. However, for the treatment to be effective the animals have to have pre-experienced a period of exposure to long days just before receiving the melatonin and the response takes 2–3 weeks in the ram (Chemineau et al., 1992) and 40–60 days in the ewe (Haresign, 1992; Viguié et al., 1995) to be achieved.

11. The role of thyroid hormones in seasonal reproduction

Thyroid hormones play an important role for reproductive seasonality in a large range of species including birds, rodents and mammals. The first evidence of the involvement of these hormones in seasonal reproduction of sheep was provided by Nicholls et al. (1989) who found that ewes thyroidectomised in late anoestrous season entered normally into the breeding season but continued to exhibit regular oestrous cycles throughout the following anoestrous season, remaining in this condition for more than 1 year. It is now well known that thyroid hormones do not influence transition into the breeding season but their presence is required for its termination. Therefore, in the absence of these hormones the seasonal reproductive rhythm is not expressed. The site and mechanism of action of thyroid hormones remain to be elucidated but according to Karsch et al. (1995) it may act within the brain to promote morphological changes in the GnRH neurosecretory system. Therefore, the way in which the thyroidectomy prevents the effect of season on reproduction does not appear to be due to an altered metabolism of steroid hormones, to a disruption of all seasonal processes or to a disturbance of the pathway responsible for the transduction of the photoperiodic stimuli. Rather, the effect of thyroidectomy seems to be more specific, being restricted to the seasonal increase of the oestradiol negative feedback on GnRH release (Dahl et al., 1994, 1995). More detailed information on the involvement of thyroid hormones in seasonal reproduction is provided by the reviews of Karsch et al. (1995) and Gerlach and Aurich (2000). The seasonal reproduction and the endocrine mechanisms involved can largely be influenced by behavioural stimuli released through the social relationships that an animal (both the ram and the ewe) establishes with others of the same species. This important aspect of the reproductive process in sheep was recently reviewed by Rosa and Bryant (2002).

5. fejezet - Artificial insemination of sheep and goats – possibilities, realities and techniquesat the farm level

1. History of artificial insemination over the last 50 years

The state of artificial insemination in the sheep and goat industries has developed differently in Europe over the last couple of decades. The number of artificial inseminations in the sheep industry and the ratio of inseminated ewes increased sharply in East Europe, especially in the eastern part of Mid-Europe, during the 1950s and 1960s. The main reason for this increase could be due to the planned economy and certain central pressure from the state. The presence and the ratio of use of this method were much lower in other parts of Europe, and its development was rather slower.

Because of unfavourable economical circumstances, the profitability of the sheep industry fell in the eastern part of Europe and the number of sheep kept on big state and cooperative farms declined during the 1970s and the second half of the 1980s. With the changing economy in the early 1990s, the decline in sheep number continued. In Hungary, in particular, during the preparation period prior to accession to the EU, there was a sharp increase in sheep number, with the increasing trend lasting until the end of 2005. The trend has reversed since then, with a gradual and intensive reduction.

As the consequences of the use of artificial insemination (AI) with semen from imported breeding rams, wool production traits (fibre diameter, shearing, greasy wool weight and staple length among others) have steadily and gradually increased in Hungarian Merino flock. Artificial insemination centres were founded by the state between early 1950s and the end of the 1970s. Some regional sub-stations belonging to each county AI centres were supplying flocks from state and cooperative farms. Over this period, the state helped improve sheep breeding with the operation of AI centres. The number of inseminated ewes reached its peak in the mid 1960s, when 63% of ewes in the national flock were artificially inseminated with a relatively wide range, but from the end of this decade, the use of AI started to go back. In the Hajdú-Bihar County (east of the country) for instance, the number of inseminated ewes exceeded 85%, even in mid 1970s' (Kukovics, 1974; Jávor et al., 2006; Kukovics & Gergátz, 2009). From the mid 1970s, the state-owned artificial insemination centres started to close down, the number of rams kept for semen collection was reduced and the breeding animals were sold to various farms.

After this period, privately-owned self-owned ram and artificial insemination units were established and took advantage of the sheep breeding state and cooperative farms.

Meanwhile, artificial insemination started to be more intensively used in Western Europe. The number of inseminated ewes and their ratio increased in breeding programmes where rapid genetic development was essential. One of these programmes was the French dairy Lacaune breeding system, where more than 82% of the nucleus part of the population (about 160 000 out of the 750 000 heads) were artificially inseminated by 1993 with semen mainly transported from several AI centres. During the previous thirty years, average milk production increased from 50 to 70 litres to 300 litres per ewe annually (Barillet et al., 1993). This trend did not change and the system expanded to other breeds in France, Spain and Italy (Jávor et al., 2006).

Since the beginning of the 1980s, the number of inseminated ewes has decreased noticeably in Hungary. As the whole economy of the country was reorganised and privatised from the early 1990s, the number of farms utilising AI as the breeding method has almost disappeared. Nowadays, less than 2 % of breeding ewes are inseminated artificially on about 15 to 20 farms out of the registered 6,900 sheep farms. Indeed, the relatively small size of flocks (about 150 heads of adult females) has an important role in the development of this situation. Almost twenty breeds are bred in the country, but AI is only used in limited numbers. The Merinos are the dominant breed in the country; however, very few farmers breeding Merino sheep use AI.

It was quite well known many years ago and even today that AI can not be carried out without special skills. Several hundred people were educated on artificial insemination (in the 1950s and 1960s up to the mid 1970s) in order to use this modern breeding method in the country.

The education of shepherds practically decreased in Hungary, and no one received even minimal skills in the AI of sheep and goats between 1986 and 1999. On behalf of the Hungarian Goat Breeders Association and the Hungarian Sheep Dairying Association, a series of indoor courses were organised for sheep and goat breeders in 1999 and 2000. The courses were carried out in the Biotechnical Research Station University of Western Hungary, in Mosonmagyaróvár. More than 60 people (shepherds and goat breeders) finished the three courses and took successful theoretical and practical examinations, receiving a certificate for their knowledge. Unfortunately, the organisation of further courses had to be stopped because of a shortage of funds needed to cover the costs of the courses. However, a couple of years later, special official courses were announced by the state in sheep and goat AI, but there was no interest until now.

At present, only a limited number of breeders are convinced about the importance and the value of AI. Most of the sheep and goat keepers have several numbers of breeding males for mating.

Until 2008, two officially certificated artificial insemination stations (Pharmagene-Farm Ltd, Mosonmagyaróvár, and Bakonszegi Awassi Corporation, Bakonszeg) were operating in the country; however, some research centres (universities and research institutes) had complete laboratories ready to offer services to various farms. In 2011, only one AI station remained active in Mosonmagyaróvár, and there was a new embryo transfer station officially certified in Budapest.

2. The main factors affecting AI

There are several factors that could modify the effectiveness of artificial insemination and some of them are mentioned below.

The breed

In many publications, the ewe breed has been found to have a large effect on the pregnancy rate after artificial insemination. According to Hill et al. (1998), the wool type (strong wool – 67.6%; fine wool – 71.7%; fine medium and medium 73%) of Australian Merino affected the average pregnancy rate. In a Greek study (Karagiannidis et al., 2001), the conception rate rank of ewes was Chios, Vlachiki and (Vlachiki x Chios), with a significant difference between them. The pregnancy rate of Suffolk ewes was much lower (12%) than that of Finnish landrace (65%) in Irish studies (Donovan et al., 2001 and 2004), while the breed of the ram also had a significant effect on prolificacy after AI (Perkins et al., 1996; Donovan et al., 2001 and 2004; Anel et al., 2005).

Age of the ewe

The fertility rate in laparoscopic insemination gradually decreases from the age of 1.5 to 2.5 years (Anel et al., 2005), while it increases until 3.5 to 4.5 years of age in vaginal insemination.

The season of insemination

The season of insemination could have a strong effect on the results. According to Hill et al. (1998), the month of insemination exerted highly significant differences: it was 71.5% in March, April, or May and 67.6% in November, December, January or February. In the study of Anel et al. (2005), the season modified the conception rate after both laparoscopic and vaginal insemination (September-January 46.88 vs. 35.53%; February-June 43.96 vs. 29.79 %; July-August 38.95 vs. 22.72%), but the data of the first one were always higher.

The use of fresh, cooled, chilled, frozen semen

It is generally stated that the fertility of the semen decreases with cooling temperature. The use of freshly diluted semen could give the best result: 70 to 82 % (Donovan et al., 2001 and 2004) and 82.2% (Hill et al., 1998; Ehling et al., 2003). A similar level could be reached with cooled and stored semen /74-76% (Gergátz&Gyökér, 1997) and 56.7% (Fernandez-Abella et al., 2003) as well as with chilled and stored semen /between 37.5% (Fernandez-Abella et al., 2003) and 64.2-73.33% (Stefanov et al., 2006)/. The conception rate frozen-thawed semen was the lowest in all of the publications: 38 to 46% (Gergátz & Gyökér, 1997), 69.5 to 71.6% (Hill et al., 1998), 29 to 52% (Donovan et al., 2001, 2004), and 42.86 to 53.33 % (Stefanov et al., 2006).

The labour

In the study of Anel et al. (2005), the results of laparoscopic (from 40.60 to 51.54%) and vaginal (from 23.85 to 43.16%) insemination highly depended on the technician who carried it out.

The year

Anel et al. (2005) reported that the level of pregnancy rate decreased for both techniques (from 62 to 44% for laparoscopic AI and from 38 to 31% for vaginal AI) between 1990 and 1997.

Time of insemination after oestrus synchronisation

The time of AI is especially important in the case of oestrus synchronisation. The best time of insemination could be 46 (Fernandez-Abella et al., 2003), 48 to 72 (Karagiannidis et al., 2001), and 58 to 63 (Donovan et al., 2001, 2004) hours after the pessary removal.

Dose of PMSG used

Hill et al. (1998) reported that the type and dosage of PMSG (Pregnant Mare Serum Globulin - 200 IU – 62.4%; 250 IU – 72.9%; 300 IU - 79.1%; 375 IU and above – 69.4%) had a significant effect on the conception rate in artificial insemination.

The extender used

The main aim of diluting is to enlarge the fertility and storing ability of ram semen (Mucsi, 1997; Sarlós, 1999; Gergátz, 2007) with additional energy. There are many kinds of extenders used for this reason (skimmed milk, Ivanov, Salamon, improved versions of them, etc. (Kukovics, 1974; Becze, 1982, Gergátz & Gyökér, 1997; Sarlós, 1999; Fernandez-Abella et al., 2003; Jávor et al., 2006), and most of the authors suggest materials. The semen used in any kind of artificial insemination is mainly diluted, and dilution is particularly important in the case of cooling, chilling and deep freezing of semen. The most common dilution rate is the 1:1 – 1:2 – 1:3 – 1:4, but in practice, a ratio higher than 1:8 is not really used (Fernandez-Abella et al., 2003; Gergátz, 2007).

Dose of inseminated semen

In general, the suggested dose of semen is 0.1 to 0.2 ml with about 50 to 100 million active spermatozoa. About 50 to 100 million spermatozoa is needed in one dose to vaginal insemination, but 25 to 50 million are suggested for cervical insemination and 15 to 20 million is enough for laparoscopic AI (Kukovics, 1974; Jávor et al., 2006; Gergátz, 2007). However, several scientists have used much higher numbers: 106 (Fernandez-Abella et al., 2003), 50 to 300 (Ehling et al., 2003) and 400 (King et al., 2004) million spermatozoa in one dose of semen.

The method (vaginal, cervical, cervico-uterinal or laparoscopic) used

The simplest method is vaginal insemination, which could result in the lowest conception rate. The use of cervical and trans-cervical methods could give much higher pregnancy rates, but laparoscopic AI is the most effective one. However, it is also the most expensive and complicated method. Apart from the general trends, the publications show quite a wide range of rates: 31.25% (Anel et al., 2005) in vaginal, 18 (Yamaki et al., 2003); 42 (King et al., 2004); and 65-75% (Salamon & Maxwell, 1995; Donovan et al., 2001, 2004; Stefanov et al., 2006) in cervical; 69.6 to 76.4% (Szabados, 2006) in cevico-uterinal; and 44.89 (Anel et al., 2005), 64 (Yamaki et al., 2003), and 69 % (King et al., 2004) in laparoscopic insemination. It should be noted that these results are affected according to the semen used (fresh, cooled, chilled or frozen (Perkins et al., 1996; Moses et al., 1997).

3. Detection of ewes on heat and the number on inseminations

One of the key questions of artificial insemination is the detection of ewes on heat, the time of insemination following the selection, and the number of inseminations made. The main detection systems could be summarised as follows (Kukovics, 1974; Jávor et al., 2006):

I. Selection once a day (24 hours) in the morning (or in the afternoon)

A. first insemination made immediately

a. insemination every 24 hours

i. no further insemination

ii. second insemination made without further selection

iii. second insemination only in the case of when heat is detected

iv. further insemination in the case that the ewe is still on heat

A. no more than three inseminations

B. further inseminations until the animal is on heat

b. insemination every 8 to 12 hours

sub-points are the same as in point (a)

B. the first insemination made 3 to 4 hours after selection or later

sub-points are the same as in point (A/a)

II. II. Selection every 8 to 12 hours

A. insemination made right after detection

a. no further insemination made

b. further inseminations every 8 to 12 hours

sub-points are the same as in point I. (A/a)

B. first insemination made 3 to 4 hours after detection or later

sub-points are the same as in point I. (A/a)

Since heat in ewes lasts 24 hours, in general, and is shorter in the case of yearlings, the first (I) method could have several limitations and so, the second (II) method is proposed and could be more effective.

Concerning the daily distribution of real heats, adjusted to the possibilities of practical life, the ewes on heat are detected between 6 and 7 hours in the morning as part of the so called “Mosonmagyaróvár insemination technique” (Gergátz, 2007). The first insemination is carried out between 10 and 11 am, and the second one between 3 and 4 pm. Because of the once daily detection, about 5% of the yearlings will be omitted from insemination at first, but 95% of them will be inseminated in the next heat.

Many opponents of artificial insemination declare that using this method, the level of pregnancy obtained naturally cannot be performed. The results of studies from the last decades have proved that the pregnancy rate of ewes selected and inseminated only once could reach 60 to 65%. The pregnancy rate of the ewes selected and inseminated twice during the same cycle could exceed 75% and reach 80 to 85%. With the use of three inseminations, 90 to 95% of pregnancy could be performed (Kukovics, 1974; Jávor et al., 2006; Gergátz, 2007).

5.1. ábra - Figure 8: Collection of semen at a farm (Photo: Németh, A.)

6. fejezet - Artificial Insemination of Goats

The history of artificial insemination (AI) in farm animals began in the 1300s with Arabian horses. In 1780, Italian biologist Lazzaro Spallanzani performed his first AI procedure in sheep. Then in 1907, the veterinarian Elias Ivanov proved the viability of AI in reproduction when he opened a testicle of a dead, snow-frozen sheep and found live spermatozoids. In goat production, this technique has been limited to mostly dairy goat herds. However, meat goat producers have shown interest in learning this technique to accelerate genetic gain in their herds.

1. Doe Reproductive Tract Anatomy and Physiology

The Doe's Estrous Cycle

The doe's estrous cycle is the interval between two estrus or heat periods that lasts an average of 21 days. The estrous cycle has four phases: estrus, metestrus, diestrus and proestrus.

The estrus or heat can last from 12 to 48 hours. During estrus does are receptive to being mounted by bucks. For artificial insemination, it is important to identify when a doe is in heat. Producers are encouraged to utilize teasers, usually a vasectomized buck to identify a doe in heat. The signs of a doe in heat are:

- Swelling of the vagina
- Seeking the buck
- Standing for mating by the buck, teaser, or by other does
- Frequent urination
- Flagging tail
- Vocalization
- Presents vagina with mucus discharge that appears crystalline at the beginning, but may have a cheesy appearance near ovulation time.

When a doe is in heat

- The heat is longer in does that have had multiple births (multiparous) than it is among yearlings or does that have never birthed (nulliparous). Ovulation occurs at the end of the heat phase or 30 to 36 hours after the onset of heat.
- A well-nourished doe has a shorter estrus period compared to an undernourished doe. On occasions, a pregnant doe can show heat with or without ovulation.
- A doe that expresses a prolonged heat may be experiencing problems such as ovarian cysts.
- Does may also experience silent heat, which has no visible signs. Silent heat can go undetected by a producer. Does can experience false heat without ovulation.
- The rate of ovulation increases with age. Does 2 to 5 years of age are more prolific than one-year-old does.

The metestrus phase lasts 2-3 days, occurring immediately after the estrus phase. Ovulation occurs 30-36 hours after the onset of heat. It is the period when luteinization occurs. Luteinization is the process of forming a corpus luteum, which is a yellow glandular mass in the ovary that secrets progesterone. During this phase, the doe is no longer receptive to the buck.

Diestrus is the longest phase of the estrous cycle. Characterized by the functional corpus lutea, there is no sexual activity. The corpus lutea remains active producing progesterone up to 14 to 16 days. The number of corpus lutea present corresponds with the ovulations. In a non-pregnant doe the corpus lutea will regress under the action of prostaglandin-PGF2a secreted in the uterus.

Proestrus is the preparatory phase that lasts 2-3 days. It occurs when new follicles begin to grow and develop in the ovaries as the non-pregnant doe is about to return to estrus.

2. Preparing Does for Artificial Insemination

Does must be in good health status and have good condition scores. Check body condition. If needed, provide a good energy supplement for a 30-day period such as 1/2 lb/day of a high energy supplement with minerals and fresh water. Determine if does will be bred on normal or synchronized heat.

3. Estrous synchronization or induction:

There are several hormone protocols that have been recommended for estrous synchronization in goats: progesterone or prostaglandins F2 alpha (PGF2a). The choice and efficacy of the method depend on the season or time of the year. Prostaglandins works only if does have functional corpus luteum in the ovary. The utilization of hormones in estrous synchronization protocols are recommended during out of season or anestrous period. Note that in the US, the use of hormones in goats are under veterinarian supervision except when using the controlled internal drug-releasing device (CIDR).

6.1. táblázat - Table 5. Protocols for Estrous Synchronization in Does Using CIDR

Days & Time	**Procedures**
PROTOCOL ONE Day 1	Insert CIDR in the vagina with device gun or applicator.
Day 7 or 17	Administer 1.5 cc (ml) of PGF2a intramuscularly.Administer 2.9 cc (ml) of PG 600 intramuscularly.*
Day 8 or 18	Remove CIDR. Introduce teaser in contact with the doe. Start checking heat, and inseminate doe once at 18 hours after the onset of heat, or inseminate 18 to 24 hours from onset of heat.Alternatively:Remove CIDR and do AI by appointment 54 hours after removal of the CIDR.
PROTOCOL TWO Day 1	Insert CIDR in the vagina with device gun or applicator.
Day 8 or 18	Remove CIDR. Administer 1.5 cc of PGF2a and 2 cc of PG 600 intramuscularly.* Introduce teaser in contact with the doe. Start checking heat, and inseminate doe once at 18 hours after the onset of heat, or inseminate 18 to 24 hours from onset of heat. AlternativelyRemove CIDR and do AI by appointment 54 hours after removal of the CIDR.
* NOTE: PG 600 is a combination drug of 400 IU of Pregnant Mare Serum Gonadotropin (PMSG) and 200 IU of Human Chorionic Ganadotropin (HCG).	

During the breeding season in the fall and winter, the CIDR can be applied to synchronize the heat of does without association to gonadotropin. For better efficacy of the method, keep doe in contact with the teaser from the moment of withdrawal of the CIDR until time of AI. This procedure will help the doe come in heat, increase ovulation rate, and help identify the moment of the onset of the heat.

4. The success of intrauterine AI in does depends on many variables:

- The doe's reproductive soundness, general condition, and nutritional status.
- The doe's cervix can facilitate the deposition of the semen in the uterus or transcervically. When frozen semen is applied, higher fertility rates occur when semen is deposited intrauterine.
- In nulliparous does, the difficulties of bypassing the cervical os with the insemination gun to deposit semen is a factor that will influence lower pregnancy rates.
- The method of estrous synchronization.
- Timing and the number of AIs performed. The identification of a doe in heat is the most important factor for the success of the AI. A doe must be inseminated at least once within the first 18 hours after the onset of the heat. Timing is critical because the insemination process must be performed when the doe is still in heat, although ovulation occurs during metestrus. The alternative to heat checking is to perform AI by appointment 54 hours from withdrawal of CIDR. Although very convenient and less labor intensive, if it involves the use of frozen semen and yields a pregnancy rate of 35 to 50 percent.
- The quality of the frozen, refrigerated, or fresh semen.
- The expertise of the technician.

Compared to intrauterine AI, vaginal insemination can be performed with less concentrated semen when stored at room temperature. Does can be inseminated once during heat. This procedure can result in a 75 percent conception rate. Thus, vaginal insemination with fresh semen can generally be considered an easier method to apply in goats on a large scale. This will only work with fresh semen, not frozen semen.

7. fejezet - 7. Sheep breeds, tendencies and breed groups

1. Groups of sheep breeds

Concerning domestic sheep breeds, several approaches could be used in order to list them in to various groups. Almost one thousand breeds are kept in the planet giving about 1,1 billion heads of sheep nowadays. The Merinos are creating the biggest group having about 500 million heads, and the Corriedale breed is having the second stage on the rank counting nearly 300 million heads kept mainly in the Southern hemisphere. Various number of animals are belong to the other kinds of breeds kept in different parts of the world.

Each country and region has and used to have its own breeds and local sheep, but at the same time the representative of certain breeds appeared in almost all sheep breeding continents and countries, partly pushing back the keeping of local sheep, and partly used for the improvements of them using various kinds of crossbreeding systems.

On the base of anatomy differences one could distinguish short tailed breeds („so called" rat tailed breeds) which are having less than 12 tail vertebras. The East–Friesian, the Romanov, the Finnish- and Swedish Landrace, the Wiltshire horn, etc. The long tailed group of breeds, which are having 13-35 tail vertebras, is consists of most of the domestic breeds bred all over the world, like various kinds of Merinos, Racka, Tsigai, and meat breads. The fat tailed sheep are mainly bred under the semi-desert-desert environments, depositing fat in the tail, The most well-known breeds are the Awassi, Chios, Karakul, etc. The members of last group are depositing fat around their rump (fat rumped sheep), and belonging to the ancient sheep breeds and kept mainly in mid East regions of Asia, and not known in Europe, or America.

The fineness or the diameter of the wool fibre produced is giving the other possibility to group sheep breeds. The so called fine wool sheep breeds could be found on several parts of the world. These are dominantly various kinds of Merinos, which are bred in Europe, USA, and the whole Southern hemisphere. Among them one could distinguish super fine (below 18 micron), fine (between 18-23 micron), medium (23-26 micron), and strong wool (between 26-29 micron) wool producing varieties.

The so called medium wool sheep group (between 26-30 microns) were dominantly developed via crossbreeding using the Merinos and the various breeds of long wool sheep (in Australia, Ne-Zealand, South Africa, South America, and even in USA). At the same time, the most of so called meat breeds are also listed into this group.

Most of the strong - course wool sheep are listed into the „crossbred" wool producing (between 30-38-42 microns) sheep group. The long wool sheep were giving the bases of several other newer breeds, mainly belonging to the medium wool sheep group. These breeds were mainly originated from United Kingdom, but some part of them were developed in other continents. In general, they are producing course and strong wool with about of 15-30 cm staple length, and this long wool fibre characteristics gave the opportunity to create them a separate group.

The so called mixed wool producing group is covering the ancient breeds (but even the Romanov could be listed here) of sheep growing wool with fibre diameter from 10 to even 60 microns within the same fleece.

The last group of sheep does not grow wool, just hair (hair sheep) which are dominantly was developed in Africa, and the Caribbean Islands.

According to the utilisation of the sheep breeds could also be grouped. The individual animals of the various breeds are producing meat, wool, milk as well as pelt in different order of importance. Among breed groups a special one is indigenous, native or local sheep breed group of sheep. In the case of Hungary, these sheep breeds are the Hortobágy Racka, Transylvanian Racka, Cikta, and Tsigai. Among others the following breeds could be listed as wool-meat breeds: Australian Merino (several strains), Spanish Merino, Soviet – Russian Merinos.

The meat-wool group is mainly covers the meat breeds, like Hungarian Merino, German Mutton Merino, Suffolk, etc. The milk breeds are creating a special group as well, because all breeds are producing milk (during lactation period until the weaning of lambs), but there are specialised milk breeds, like Awassi, Assaf, East-Friesian, Lacaune (milk type), Sarda, Chios, British Milksheep, Langhe, Milking Tsigai, etc.

There is an other special group of sheep which are having very high prolificacy (prolific breed), which are achieving an increasing importance as the high lambing capacity is being utilised in the improvements of other breeds. The most important members of this group are as follows: Finnish Landrace, Romanov, Booroola Merino, British Milksheep, Javanese sheep, Bálbolna Tetra, etc. The Karakul and the Gotland Island sheep are the most well known members of the pelt producing breeds, however, several other sheep could also produce top quality lamb pelt (like Hortobágy Racka, etc.).

The final group on the list is the hair sheep which are mainly meat producers, but because the special quality of their skin, they form a separate group. There are dominantly originated from Africa, but several breeds could be founded in other region of the planet. Over the last two decades a new fashion wave launched aiming to develop so-called composite breeds (combining the traits of different breeds), which are having good meat quality, mothering ability but do not grow wool (just hair), or producing only shading wool, which means the wool is losing in spring time without any necessity of shearing.

A new phenomenon – fashion was launched during the last twenty years, and a group of pet – accompanying breeds appeared. The most extreme example was developed in China, where one breed became a status symbol within the very wealthy people.

2. From indigenous breeds

Hungarian autochthonous sheep breeds

Hortobágyi racka (or Hungarian Racka)– The breed is used to get an important role in milk production, but nowadays it is kept as gene reserve, and sometimes as pet animal as well. It has two varieties with black and white depending on the colour of the fleece. The economy value of the breed in production is rather low. Its main characteristics are the corkscrew shape of horns, and the long mixed wool. The body weight of the adult rams is 50-70 kg, while that of the ewes is 40-50 kg. The average prolificacy is 110-130%.

Gyimesi racka (Transylvanian Racka) – While the breed is in the gene reserve in Hungary, however, several times of ten thousand heads are bred, there are some millions of heads available from the breed in West part of Romania (Transylvania). It is dominantly bred for milk (60-80 l/100 days) and meat production (110-140% lambing rate). The breed arrived back to Hungary in the beginning of 1990’s. The ewes are producing 3-4 kg of course wool with 15-25 cm staple length (this data are even higher in Romania 25-35 cm). The adult rams are 80-90 kg, while the ewes reach the 45-50 kg.

Cigája (Tsigai) – The breed arrived to the country in early part of XVIII century from Small Asia partly following the line of the Danube river, and partly from the Northern part of Black sea. It is mainly used for milk and meat production nowadays, however, the original idea to get this breed was to improve the wool production traits of Hungarian Racka, or replace it based on the better wool production abilities. It could produce 60-80 litres of milk during 90-120 days of milking, and 2-3 kg of course and sometimes mixed wool. The average prolificacy is 120-140%. The body weight of adult rams is 65-90 kg, while that of the ewes is 40-60 kg.

Milking Tsigai – This big bodied sheep was developed in the South part of Hungary in Bácska and Bánát counties, which regions are belonging to Serbia and Romania. The breed has some typical characteristics: long and wide leafy ears and big „Ramses” nose, long legs and high body. The breed was mainly developed for milk production (it could produce 140-180 kg of milk during 120-160 days), but its prolificacy also rather high (160-180%). It could produce 3-3.5 kg of course wool with 10-15 cm staple length. The adult weight of rams is 90-150 kg, while that of the ewes could reach the 80-120 kg.

Cikta – On the other name was the „Tolna - Baranya County Schwabian Sheep” arrived to Hungary in the XVII-XVIII centuries when the Turkish occupation was finished and German people were settled into the depopulated areas of Hungary. The breed has light bones, light body weight, and it is producing 2-3 kg of course mixed wool. The prolificacy is not too high – about 100-120%. The body weight of the adult rams is 40-60 kg, while that of the ewes is only 25-45kg. It is kept only for gene reserve.

From the Merinos

Hungarian Merino – I was used to be a multi purpose (wool-meat-milk) breed, and later on the values of wool and milk production became less important concerning this breed, and nowadays is a meat – wool breed. There were many breeds used in the development of this breed (Soviet Merinos, German Merinos, French Merinos, and even Australian – New-Zealander Merinos), and now the meat is the dominating product, however meat-wool and wool-meat variants could also be found in the country. It could produce 3-7 kg of fine wool with 21-26 micron of fibre diameter, and with 5-8 cm of staple length.

Its milk production (after weaning of the lambs) 35-50 litres during 90-100 days. Its average prolificacy is 120-130 %. The average body weight of the adult rams is 70-120 kg, while that of ewes is 40-60 kg.

German Mutton Merino – Up to 1992 there were two different varieties bred (East German and West German type), and both type were utilised in Hungary. Nowadays, only the West type remained in the breeding and kept in the breeding. It has a robust strong body with meat type and still producing 3-5 kg wool with 24-28 micron of fibre diameter and 4-7 cm of staple length. Its average prolificacy is 130-150%. The average body weight of adult rams is 90-130 kg, while that of the ewes is 70-80 kg.

Merinó landschaf /würtemberg merino/ - It is bred in Germany in two different varieties: In the smaller one the body weight of the adult rams is 120-140 kg, and that of the ewes is 60-80 kg. In the bigger variant these data are 160-280-, and 120-140 kg. Both variants are producing 3-5 kg of wool with 26-30 micron fibre diameter and 8-12 (15) cm staple length. Their prolificacy is 120-150%.

Australian Merinos – There is no uniform breed description available, several varieties are bred based on the fineness of the wool: super fine (below 18-), fine (18-21.5-), medium (21.5-25.5) and strong (25.5-29 micron) wool. The staple length is changing between 4 and 12 cm. As the consequence of the keeping technology the colour of the wool is pure white and the clean wool yield is above 50% (carrying only limited amount of dirt and dust comparing for example to Hungarian Merino). The body weight of the ewes is increasing with the fibred diameter (in general) from 35 to 60 kg. The rams adult body weight changed – similarly to the data of ewes – from 60 to 100 kg. Poll and horned varieties are almost equally bred. The Merinos consist the 60-70% of the Australian sheep industry. The average prolificacy is 110-150%. however, the Booroola Merino is originated from the Medium Wool Merino and having more than 200 prolificacy.

Booroola Merino – Originated from the Medium Wool Peppin Merino and its prolificacy (the average is 2.4 lambs per lambing) is determined by only one major gene (its ovulation rate is changing between 3 and 12). The body size of the animals is between small to medium, the adult weight of the ewes is 40-45 kg, while that of the rams is 55-65 kg.

Afrino – It was developed in South Africa in order to get better adaptation ability to the production circumstances there. It is a kind of composit breed, carrying 25% Merino, 25% Ronderib Afrikaner, and 50% South African Mutton Merino blood. The income of its breeders is coming 80% from meat and 20% from wool. The breed is producing 3-5 kg wool with 25-29 micron fibre diameter and 5-9 cm staple length. The average prolificacy is 130-150%. The adult body weight of the rams is 75-95 kg, and that of the ewes is 50-65 kg.

Cormo – It was developed in Tasmania Island of Australia by crossing the super fine wool Saxon Merino and the Corriedale sheep. It could produce 4-6 kg wool with 22-24 micron fibre diameter and 5-8 cm staple length. The adult weight of the rams is 65-75kg and that of the ewes is 45-55 kg.

Polish Merino – It was developed after the Second World War by crossing the Polish and German Merinos. It has a medium body size and producing fine wool (23-25 micron, 5-8 cm). Its average prolificacy is 130-150%. The adult weight of rams is 70-85, and that of the ewes is 45-55kg.

Rambouillet – It was developed as a fine wool sheep in the Paris region of France by crossing the British meat breeds and Spanish Merinos as well as local sheep. Its older name was Dishley Merino. It has only limited importance in Europe, while it has a successful carrier in USA. It is producing 3.6-8.1 kg of wool with 18.5-24.5 micron fibre diameter and 6-9 cm staple length. The adult weight of rams is 110-130 kg, while that of the ewes is 68-90 kg. Its prolificacy is 120-150%.

South African Meat Merino – It was developed on the bases of German Merinos as meat-wool dual purpose sheep breed. It could produce 3-5 kg medium-strong wool with 7-12 cm staple length. Its prolificacy is 130-140 %.

Spanish Merino – It is the breed from where all the various kinds of Merinos were inherited. It was developed between the VIII. and the XIII. centuries and started its carrier from XVI. century covering almost all of the planet. The present form of the breed could produce 3-5 kg wool with 22-24 micron fibre diameter and 5.5-7.5 cm staple length. The adult body weight of the rams is 75-90 kg, while that of the ewes is 45-55 kg. The average prolificacy is 120-140%.

Xinjiang Fine Wool Sheep – It was developed in China by crossing the Caucasian and Stavropolian (Soviet Merinos) and Merino Precoce (French breed) breed on the bases of local sheep, which was finally improved by Australian Merinos at the end of 1970's. It is a dual purpose sheep and it could produce 3.5-5.5 kg wool with 22-25 micron fibre diameter and 5-7 cm staple length. The adult body weight of the rams is 75-90 kg while that of the ewes is 45-55 kg.

From the crosses of fine wool and long wool sheep

Polworth – It was developed as medium wool sheep breed in Victoria State of Australia by crossing fine wool Merino (75%) and Lincoln (25%) sheep breeds. It could produce 3-5 kg wool with 22-25 micron fibre diameter and 6-9 cm staple length. The adult rams body weight is 65-85 kg, while that of the ewes is 45-55 kg. The average prolificacy is 120-140 %.

Columbia – It was developed in USA by crossing the Rambouillet and Lincoln sheep. It could produce 4.5-7.3 kg of wool with 24-31 micron fibre diameter and 8-13 cm staple length. The adult weight of rams is 100-135 kg while that of ewes is 68-100 kg.

Corriedale – It was developed in New Zealand (and partly in Australia) by crossing the Merinos and Lincoln sheep, which reached the great carrier in South America, where it is bred in biggest number. It is producing 4-6 kg wool with 25-30 micron fibre diameter and 8-13 cm staple length. Its prolificacy is 140-160%. The body weight of adult rams is 100-120 kg while that of the ewes is 60-70 kg.

Targhee – It was developed in USA by crossing the Rambouillet, Corriedale and the Columbia breeds of sheep at the beginning of the XX century. It is producing 4.5-6.5 kg wool with 21-25 micron fibre diameter and 7.5-11 cm staple length. Its prolificacy is 130-170%. The adult body weight of rams is 90-135 kg while that of the ewes is 55-90 kg.

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From long wool sheep breeds

Leicester long wool – This breed was called the base of the modern sheep breeding started by Robert Bakewel during the years 1700's. This breed was the starting point of the development several other breeds since then. By nowadays, it became a rare protected breed in several countries, like United Kingdom, Australia, USA, etc. It could produce 6—15 kg special curly wool with 32-38 micron fibre length and 22-33 cm staple length. The average prolificacy of the breed is 130-160%. The adult rams reached 150- while the bodies of the ewes 100 kg weight.

Lincoln long wool – One of the biggest bodied sheep breeds of United Kingdom, which was the base of the development of several other breeds. It could produce 6-10 kg special curly wool with 33-41 micron fibre diameter and 20-38 cm staple length. Its average prolificacy is 130-170 %. The body weight of adult rams is 110-170 kg, while that of the ewes is 90-100 kg.

Border Leicester – This breed was the first result of the „improvement" of Leicester Long Wool sheep, which was reached by the second half of the 1700's. During the last one hundred years, this breed was the „starting point" of the development of several other new breeds in Australia and New Zealand. One of the main phenotypic characteristics of the breed is the big „Ramses" nose along with the up rising ears and the form of head. It could produce 4-6 kg of wool with 29-32 micron of fibre diameter and 12-15 cm staple length. The breed has a long body with long length, and high prolificacy (150-190%). The adult body weight of the rams is 140-175 kg, while that of the ewes is 100-120 kg.

Romney – This breed was developed from the British Kent or Romney march in New Zealand about one hundred years ago, and one of the most popular breed in the country even today. It could produce 4-5 kg wool with 30-40 micron fibre diameter and 15-22 (25) cm staple length. Its prolificacy is 120-140 (170) %. The adult weight of rams is 100-120 kg, while that of the ewes is 70-80 kg.

From medium wool meat breeds

Beltex – It is the Belgian variety of the Holland Texel sheep breed carrying extra muscle on the rear part of the body (especially on the rump and leg). It could produce 2.5-3.5 kg of wool with 28-33 micron fibre diameter and 4-6 cm staple length. Its prolificacy is 130-180%. The adult weight of the rams is 65-80 kg while that of the ewes is 45-55 kg.

Berrichon du cher – Hard French breed with easy handling and lambing ability. It was the meat line of the French INRA crossbreeding program. It could produce 3-4 kg of wool with 26-30 micron fibre diameter and 4-6 cm staple length. Its prolificacy is 140-180%. The adult weight of the rams is 110-140 kg while that of the ewes is 70-90 kg.

Blanche du Massive Central – It is the determining meat breed of the Massive Central in France, which has got a wool cover on the body like in the case of Lacaune. It could produce 1.5-2.5 kg of wool with 25-28 micron fibre diameter and 3-4 cm staple length. Its prolificacy (140-200%) is rather high along with the good fattening ability. The adult weight of the rams is 90-140 kg while that of the ewes is 55-80 kg.

Charollais – It is almost an extreme meat breed of France with strong bones and body, characterised by low fat production, early maturing and big growth ability. It could produce 2.5-3.5 kg wool with 26-30 micron fibre diameter and 3-4 cm staple length. Its prolificacy is 160-180%. The adult weight of the rams is 120-170 kg while that of the ewes is 70-90 kg.

Dorset Horn and Poll Dorset – This British breed is characterised by very long breeding season (practically ready for two lambings per year), and short legs as well as good meat production abilities, as well as special curly horns. The polled version (Poll) was developed in Australia and was distributed from there. The breed could produce 2.5-4.5 kg wool with 27-30 micron fibre diameter and 6-10 cm staple length. It has a high speed growth with good meat conformation, and it is milked in several countries. It has a high prolificacy: 160-200%. The adult rams have 100-130 kg body weight and that of the ewes is 70-90 kg.

Hampshire down – The breed was developed in England by crossing the Hampshire, South down, Wiltshire down and the Berkshire nott breeds in the years of 1830's. It is a very popular breed giving terminal rams for meat production. The European variety has got shorter while the USA version has much longer legs. It could produce 2.7-4.5 kg wool with 25-33 micron fibre diameter and 5-9 cm staple length. The average prolificacy of the breed is 130-180%. The average adult body weight of the rams is 120-150 kg while that of the ewes is 70-85 kg.

Ile de france – It was developed by crossing the French Merino (Rambouillet) and the British Dishley meat sheep in the region of Paris, France. It has a well-developed body and good grazing and adapting ability. It could produce 3-5 kg wool with 25-30 micron fibre diameter and 6-8 cm staple length. Its prolificacy is 130-170%. The average adult weight of the rams is 100-130 kg while that of the ewes is 70-90 kg.

Lleyn – It is one of the local breeds of North Wales with very high prolificacy (200-210%) which has a very good mothering ability, and carrying desirable meat conformation as well. (Because of these traits, it was one of the basic breeds in the development of British Milksheep.) During the last decades the breed is became more and more popular using in the improvement of prolificacy in several breeds. It could produce 3.0.3.5 kg wool with 28-33 micron fibre diameter and 7-12 cm staple length. The adult weight of adult rams is 80-120 kg while that of the ewes is 60-70 kg.

German Blackheaded Mutton Sheep – It was developed by crossing British blackheaded and local German breeds in Saxony, Germany. It is a strong-bodied breed with medium body size. It could produce 4.5-5.5 kg wool with 29-33 micron fibre diameter and 6-10 cm staple length. Its prolificacy is 130-150 %. The adult body weight of rams is 100-120 kg while that of ewes is 60-80 kg.

Rouge de l'Quest – It was developed by crossing the Wenslydales, Blueface leicester, and local breeds in the Valle of Loir, in France, during the decade of 1950-1960. Very good French meat breed with long and wide body, and good conformation. It could produce only 1.5-2.5 kg wool with 26-30 micron fibre diameter and 4-5 cm staple length. Its average prolificacy is 180%. The adult body weight of rams is 95-120 kg while that of the ewes is 70-90 kg.

Suffolk – Very popular English breed which was developed in Suffolk county, and used all over the world now. The original version has a shorter while the version developed in USA has long legs and high body. It could produce 2.5-3.5 kg wool with 26-33 micron fibre diameter and 2.5-5.5 cm staple length. It prolificacy is 130-

180%. The adult body weight of the rams is 120-170 kg while that of the ewes 70-110 kg. The American version is bigger and heavier one.

Texel – It was originally developed as meat breed in Texel Island of the Netherlands and became a very popular breed in all over the world because of its desirable body conformation. Apart of white one, it has a recessive blue variety as well. Its body weight is differing by country to country, and comparing to the original size the body weight was increased. Its prolificacy is 130-180%. It could produce 3.5-5.5 kg wool with 30-35 micron fibre diameter and 5-7 cm staple length. The adult weight of the rams is 95—110-130 kg and that of the ewes is 55-65-90 kg.

From the milk breeds

There are several different breeds utilised for milk production as well in the world. Apart from indigenous breeds (like Merinos, Tsigai, Racka, Curcana, Walashian, etc.) some other breeds (like Dorset, etc.) was milked until the specialised milk type breeds were not arrived into the various parts of the world. These milk breeds have different utilisation in various countries and somewhere (for instance in Spain) these are totally replace the local milk breeds. At the same time, the old Spanish milk breeds are still playing an important role in Middle and South America.

Assaf – The breed was originally developed in Israel by crossing the Awassi and the East Friesian breeds but it became very popular in Spain where more than one million heads are bred nowadays. It has white fleece and higher prolificacy than Awassi, and its fat tail is only one fourth of the one grown by Awassi sheep. It is the breed for large flocks kept intensively indoors, in frequent lambing system. It could produce 3-4 kg wool with 33-40 micron fibre diameter and 8-10 (12) cm staple length. Its prolificacy is 160-180%, while its milk production is 300-700 litres during 201-230 milking days. The adult body weight of the rams is 90-110 kg while that of the ewes is 70-90 kg.

Awassi – However, this breed was and is kept in all over the Middle East, the modern variety of the Awassi was developed in Israel from early part of 1950’s. It is a fat tailed big-bodied sheep strong bones with high milking ability producing 300-600 litres of milk over 210-220 days. It could produce 3-4 kg wool with 30-40 micron fibre diameter and 15-25 cm staple length. Its prolificacy is only 110-130 %. The adult body weight of the rams is 90-140 kg while that of the ewes is 60-80 kg.

British Milksheep – It was developed in England by crossing the British Friesian, Blueface Leicester, Lleyn, Poll Dorset and other breeds from early 1960’s, and became accepted registered breed in early 1980’s. The high prolificacy, a significant milk production ability and the good meat production traits were combined in this breed. It could produce 4-5 kg wool with 26-30 micron fibre diameter and 8-12 cm staple length. Its prolificacy is 20-310 % (in first lambing 220-, in the second 268-, and in the third 310 according to the breed standard). Its milk production 200-400 litres during 160-200 days. The adult body weight of the rams is 80-130 kg and that of the ewes is 60-80 kg.

Chios – This semi-fat tailed sheep was originated from Chios Island (Greece) but also bred in Turkey. Its milk production is 120-300 litres during 150-180 days. Its prolificacy is 150-230%. The adult body weight of the rams is 65-90 kg while that of the ewes is 40-70 kg. It could produce 1.2-2.5 kg wool with 27-35 micron fibre diameter and 8-13 cm staple length.

East Friesian – It was developed in the German and Dutch islands of the North Sea. Along with the dominant white colour the recessive black variant is also bred. Its milking ability and high prolificacy was utilised in the improvement of several other breeds. It is a typical big bodied, robust milk type breed, which could not tolerate the big number of animals kept together. It is the breed of small flocks in Germany, and very sensitive for various diseases. Its milk production is 500-600 litres during 180-200 days. The average prolificacy is 200-230%. It could produce 4-5 kg wool with 28-33 micron fibre diameter and 12-18 cm staple length. The adult body weight of the rams is 80-120 kg while that of the ewes is 60-80 kg.

Lacaune – It was developed in the Massive Central in South of France, and its improvements for high milking ability was started in early 1950’s. Nowadays more than one million heads are bred with quite reasonable milk production capacity. Up to the 1990’s the quantity of milk production was in the target of the improvements and from the beginning of the 1990’s the fat + protein, and nowadays the fat + protein +protein is the main selection aim. This breed comparing to East-Friesian could tolerate well the big number of animal kept together. It has two varieties: milk and meat types, from among the first one is dominating (nearly 750 000 heads). It could produce wool mainly on the back (about 1.5-2.5 kg) with 26-29 micron fibre diameter and 3-5 cm staple length.

The milk variety of the breed could produce 190-350 litres during 150-180 days. Its prolificacy is 130-160%. The adult body weight of the rams is 80-110 kg, while that of the ewes is 50-70 kg.

Langhe – Delle langhe – It was developed and is bred in North part of Italy. It is a medium sized milk type sheep. It could produce 4-4 kg wool with 28-35 micron fibre diameter and 8-12 cm staple length. It has 140-160% prolificacy. Its milk production could reach the 200-300 litres during 160-190 days. The adult body weight of the rams is 80-90 kg, while that of ewes is 60-70 kg.

Manchega – It is one of the traditional milking sheep of Spain kept mainly in the middle of the country dominantly in white colour but recessive black variant is also bred. It could produce 3-4 kg wool with 28-33 micron fibre diameter and 6-10 cm staple length. Its prolificacy is 120-150%. The milk production of the ewes could reach the 100-150 litres during 150 days. The adult body weight of the rams is 80-100 kg, while that of ewes is 60-70 kg.

Sarda – It was developed in Sardinia Island as local dairy sheep breed but also kept in the main land of Italy (and Tunisia as well). It has got small to medium size body. It could produce 2-3 kg wool with 30-38 micron fibre diameter and 10-15 cm staple length. The prolificacy is not too high: 120-140%. Its milk production 160-240 litres during 150-170 days. The adult body weight of the rams is 55-65 kg, while that of ewes is 40-45 kg.

From the breeds with high prolificacy

The high fertile breeds are consist of relative small group of sheep and from among more breeds could be listed into other groups as well (like Booroola, British Milksheep, Chios, etc.) After discovering the FECB gene of Booroola sheep other genes were found in different breeds responsible for high prolificacy as well. From among high fertile sheep some will be presented below.

Finnish Landrace – It was developed in Finland as local breed of sheep, but its high fertility was utilised in almost all crossbreeding programs in the world (and it has got a Swedish variety called Swedish landrace as well). It could produce 2-3 kg of wool with 24-31 micron fibre diameter and 7-15 cm staple length. The adult rams have a body weight of 70-90 kg while that of ewes 50-70 kg. The prolificacy of the breed reach the 210-280%. Based on an improvement program about 12-155 of the ewes are having four active teats for suckling of the lambs.

Bábolna tetra – As the result of a long crossbreeding program lasted many years and used several breeds in it, a new breed with higher fertility as developed in Hungary using 5 lines of Finnish landrace and 3 lines of Romanov based on Hungarian Merino. It has a steady 170% prolificacy. It could produce 3.5-4.5 kg wool with 22-36 micron fibre diameter and 8-11 cm staple length. The adult body weight of rams is 70-80 kg, while that of ewes is 50-60 kg.

High Fertile Merino – Under this name two different breeds were developed. The first one was created in the 1970’s by crossing Hungarian Merino with Romanov and finished with German Mutton Merino from East Germany. The second one was developed from the beginning of 1980’s where the Hungarian Merino was crossed with Booroola Merino, and finished with other line of Booroola Merino. The latter one was registered as separate breed in 1992. It was carrying the major gene of Booroola sheep, but it had a smaller body than the Hungarian Merino. It could produce 3-4 kg of fine wool with 16-24 micron fibre diameter and 5-7 cm staple length. The adult weight of rams was 65-85 kg and that of ewes 40-50 kg. Its prolificacy reached the 200-230%, but on the contrary of high reproduction traits its breeding was stopped because of low level of milk production, slow growth and small body weight of lambs.

Romanov – This very prolific breed was developed in the Vally of Volga River (Russia) and utilised in several crossbreeding program (like INRA 401, etc.) during the years between 1980-2000. Its popularity was declined since then. It is producing 1-2 kg mixed wool with 20-75 micron fibre diameter and 5-8 cm staple length. The adult rams body weight is 50-70 kg and that of ewes is 40-50 kg. Its average prolificacy is 205-300%.

From hair and shedding wool sheep breeds

Barbados blackbelly – It is an African hair sheep which got the present long leg variety in Barbados Island. During the last couple of years, the breed was utilised in several crossbreeding programs in order to drive back the wool production. The body weight of adult rams is 55-75 kg while that of ewes is 45-50 kg. Its prolificacy is 150-200%. Its skin is a perfect material for clothing purpose.

Damara sheep – It is an African fat tailed hair sheep which has an increasing carrier in USA and in Australia as well. One of the interesting traits of the breed that it is mainly browsing like goats ,and grazing less grass than other sheep. The adult weight of the rams is 65-80 kg while that of the ewes is 55-60 kg. Its prolificacy is only 110-130%. Its skin could be used for clothing for humans and covering the inside of the motorcars.

Wiltshire horn – It is an old English hair sheep breed, which has an increasing carrier during the last fifteen years, as it was utilised in the developments of several new hair or shedded wool sheep breeds. Both sexes are wearing spiral horns. The adult weight of rams is 75-90 kg while that of ewes is 50-65 kg. Its prolificacy is 130-160%, and the dressing ratio of its carcass is 60%.

NOLANA sheep – About twenty years ago a new breeding program started in Germany in order to develop a sheep breed, which is not producing wool. Several kind of breeds (Wiltshire horn, Barbados blackbelly, etc.) were used in this crossbreeding program and two different varieties were developed: the first one (called landrace) is having a smaller body and covering by coloured hair and the second is a big bodied one covered by white hair. The body weight of the animals belonging to the first one is 45-55 kg while the others in the second one reach the 55-65 kg.

Easycare sheep – In order to combine the easy handling ability, with high prolificacy and the absence of shearing as well as the very good meat production characteristics a new breed was developed in United Kingdom based on Wilshire horn sheep. The adult body weight of adult rams is 80-100 kg while that of ewes is 60-70 kg. It has a prolificacy of 180% and 60% dressing ratio in slaughtering. Its growth rate is quite high the lambs could reach the 17 kg carcass weight by 12 weeks of age. Nowadays more new breeds could be listed into the „group of easycare" sheep.

Katahdin – It is a shedding wool composite breed developed in USA by crossing African hair sheep breeds, Tunis sheep, Hampshire down, Southdown, and Wiltshire horn. It is belonging to the „easycare" group. The adult weight of the rams is 90-120 kg, while that of ewes is 60-80 kg. Its prolificacy reached the 200%, and beside the good mothering ability, it could be bred all around the year.

Royal white sheep – It was developed in USA by crossing the Dorper and St. Croix breeds between 1994 and 2002), and this breed is also belonging to the „easycare" group. The adult weight of rams is 95-130 kg while that of the ewes is 75-95 kg. Its prolificacy is 150-180% and it could be bred every part of the year. The body conformation of the animals is very good, and its dressing ratio is 55-62% in slaughtering.

Wiltipol – It is a new breed developed in Australia (also belonging to the „easycare" group) by crossing the Wiltshire horn with Border Leicester, Perendale, Poll Dorset, Poll Merino. It is a shedding wool sheep with very good maternal abilities. It could be bred all over the year, and its prolificacy is 130-180%. The adult weight of rams is 100-1205 kg while that of the ewes is 75-85 kg.

Somalian blackheaded sheep – It is a small African fat tailed sheep breed originated from Somalia, but was intensively used in South Africa being one of the bases of the development in Dorper sheep. It has black and red headed varieties. The adult body weight of the rams is about 50-, while that of the ewes is 30 kg. Its prolificacy is 100-110 %. The lambs could reach the 13 kg live weight by 95 days.

Dorper and White Dorper – The development of Dorper and White Dorper sheep breeds started from the years of 1930's. The main aim was to work out breeds with shedding wool, good mothering ability, which could be bred all over the whole year. During the last 10-15 years the popularity of these breeds were increasing intensively and wide spreading in USA, Australia and even it in Europe as well. The body weight of adult rams is 90-120 kg, while that of the ewes is 50-80 kg. Its prolificacy is 150-190 %, dressing ratio of lambs reach the 55-62% in slaughtering. It is resistant for inner parasites.

From fat tailed and fat rumped breeds

Karakul – It is belonging to the fat tail sheep breeds kept on the semi-desert and desert areas of Asia and Africa as well. It is mainly kept for the skin of the lamb slaughtered in the age of couples of days. It has six main colours (white, black, brown, gray, pink and pearl) and several varieties having more colours on the same body. After the slaughtering the lambs the ewes are milked. The milk production could reach the 100 litres over 120-130 days. The adult weight of rams is 80-100 kg, while that of ewes is 45-70 kg. Its prolificacy is 110-120 %.

Large tail han sheep – This fat tail breed is kept on the semi-desert regions of Mongolia and China (Inner Mongolia). The bigger variety (large tail han sheep) could reach the 160-190%, while the smaller variety the 229-270 % prolificacy. The adult ewes in the smaller one reach only the 25-, while in the bigger one the 35-40 kg. They are having very big fat tail, sometimes pulling after themselves on the soil.

Turki – fat rumped sheep – It is the largest fat rumped sheep breed of Afghanistan. The adult rams body weight is 90-13 kg, while that of the ewes is 60-80 kg. The amount of fat deposited on the rump and fat could reach the 5-10 kg. Its prolificacy is 120-130 %.

From pet – accompanying breeds

However, the pet or accompanying sheep are not so common than in the case in goats, one example is worthwhile to mention.

Dolan – It is a rare breed of China. They have distinctive curved noses, long floppy ears and twin tails, but the thing that really makes them special is the number of them: about 1,000 of them left in the world. Dolan were originally bred from sheep in Kashgar, north-west China, to grow more quickly and yield more meat, the priced breed has since become purely ornamental. It reaches maturity and weights over 90 kg at just six months, but no one is thinking about sacrificing them for meat anymore. The lambs of this breed are buying and keeping the wealthiest Chinese people as status symbol. One weaned lamb could be valued about US$ 25,000, while an adult ram even more million US$.

8. fejezet - 8. Breeding systems of small ruminants

Animal breeding is a part of the animal science that aim is the evaluation and exploitation of the genetic value of domestic animals. A breed is a group of animals with a similar appearance, behavior, and other characteristics that distinguish it from other animals.Pure-breedingPure-breeding is the mating of individuals from the same breed or type. A purebred flock is kept as a single flock because all ewes and rams contains the typical character of its breed. The goal of purebred sheep production is to provide superior genetics to the commercial sheep industry.

1. Out-breeding

Pure breeding has several types of mating systems. During the out-breeding unrelated animals from the same breed are mated. Important that mated animals are not closer relationship than at least 4 to 6 generations. Outbreeding is the recommended breeding practice for most purebred sheep breeders.

2. Inbreeding

In the inbreeding system, animal breeders/keepers are mating closely related rams and ewes. It means that sire to daughter, son to dam, and brother to sister will be mated. Technically, inbreeding is defined as the mating of animals more closely related than the average relationship within the breed or population concerned. The primary genetic aims of inbreeding is to increase the frequency of similar genes.

Inbreeding is essential to the development of prepotent animals and used to uncover genes that produce abnormalities or death and stabilize important traits in flocks. As summary, inbreeding results in an overall lowering in performance: vigor, disease resistance, reproductive efficiency, and survivability.

3. Linebreeding

Linebreeding is a system of breeding in which the degree of relationship is less intense than in inbreeding and is usually directed towards keeping the offspring related to some highly prized ancestor. The degree of relationship is not closer than half-brother half-sister matings or cousin matings, etc. Line breeding is a mild form of inbreeding.

4. Crossbreeding

Crossbreeding is the mating of animals from different breed or types. However, it does not mean that mixing of breeds are permitted, but rather is a systematic utilization of different breed resources to produce crossbred progeny of a specific type. Crossbreeding is used extensively in the commercial sheep industry and the majority of slaughter lambs are crossbred. Crossbreeding has two main advantages: 1) heterosis; and 2) breed complementarity. Heterosis or hybrid vigor is the superiority of the crossbred offspring. Mathematically, heterosis is the difference in performance between the crossbred and the average performance of its purebred parents.

There are effects of heterosis in the crossbred offspring, crossbred dam, and crossbred ram. In general, crossbred individuals tend to be more vigorous, more fertile and grow faster than purebreds (Table 6.).

8.1. táblázat - Table 6.: Heterosis in the crossbred lamb (Nitter, 1978)

Trait	Percent heterosis
Birth weight	3.2
Weaning weight	5.0

Pre-weaning ADG	5.3
Post-weaning ADG	6.6
Yearling weight	5.2
Conception rate	2.6
Prolificacy of dam	2.8
Lamb survival	9.8
Carcass traits	0
Lambs born/ewe exposed	5.3
Lambs reared/ewe exposed	15.2
Weight of lamb weaned/ewe	17.8

Effects of heterosis is large for traits that are lowly heritable (e.g. reproduction) and small for traits that are highly heritable (e.g. growth, carcass, and wool). The effects of heterosis are cumulative.

5. Breed complementarity

The second major advantage of crossbreeding lies in the ability to utilize breed complementarity. All breeds have strength and weak characteritics. Thus, production can be optimized when mating systems place breeds in roles that maximize their strengths and minimize their weaknesses.

For example when Polypay ewes with Suffolk rams are mated, the complementary strengths of breeds are optimized efficiency of a production system. This cross takes advantage of the reproductive efficiency and moderate maintenance costs of Polypay ewes while producing Suffolk-sired lambs to meet market requirements for fast-growing, heavy muscled lambs. The efficiency of this cross would be much greater than the reciprocal mating of Suffolk ewes to Polypay rams.

6. Crossbreeding Systems

There are several crossbreeding systems as well. Terminal crossing makes maximum use of both heterosis and breed complementarity. It may utilize two, three, or four breeds, and can be as simple as crossing two pure breeds.

7. Terminal crossing

In terminal crossing, all of the crossbred offspring are sold and took in a slaughterhouse. In a three or four breed terminal crossbreeding system, crossbred ewes and crossbred rams can be utilized in the system to maximize heterosis.

8. Rotational crossing

Rotational crossing exploits high level of heterosis. Ewes are mated to rams of the breed which they are least related. It has the best efficiency when breeds, which function acceptably as both ram and ewe breeds, are utilized.

This chapter is done after: Susan Schoenian, 2011

9. fejezet - 9. Feed intake of small ruminants

Small ruminant production systems vary widely, from intensive feeding with zero-grazing to the utilisation of rangelands in arid areas. In all production systems, it is generally economically sensible to maximise the proportion of forage in the diet to minimise feeding costs. Furthermore, as people are becoming more and more sensitive to the image of animal products, maximising forage utilisation is an increasingly important tool in animal production. In extensive systems, grazing also contributes to resource preservation. However, efficient utilisation of forage resources and control of animal impact on vegetation need thorough knowledge of what determines feeding behaviour and dietary choices.

This feed factors that influence feeding behaviour, dietary choices and ultimately nutrient intake in sheep and goats are discussed. First, the main characteristics of feeding behaviour are described in terms of the satiation process and motivation to eat. Then, the ways in which vegetation characteristics influence ingestion of forage, feeding behaviour and foraging decisions are reviewed.

At grazing, two different situations are considered: (i) situations where animals are free to develop their own foraging strategy; and (ii) situations where shepherds' and animals' strategies interact. To conclude, the prediction of intake for small ruminants in different environments is briefly discussed.

1. Feeding behaviour and control of intake

Intake is influenced primarily by hunger, which is distressing, and by satiety, which is generally pleasurable. Recently, Forbes (1995) postulated that "ruminants eat that amount of food which leaves them with the most comfortable feelings". Regulation of feed intake and dietary choices combines short-term control of feeding behaviour related to the body homeostatic regulation, and long-term control that depends on nutritional requirements and body reserves (Faverdin et al., 1995). Feed factors act mainly on the short-term control.

Main characteristics of feeding behaviour Since the 50's the feeding behaviour of ruminants fed indoors or at pasture has been extensively studied (see review by Jarrige et al., 1995; Ungar, 1996). Ruminants fed forages ad libitum eat for 5 to 10 hours per day and spend a similar time ruminating. When fed indoors feeding behaviour is scheduled by the feed distribution, usually two per day. Sixty to eighty percent of daily intake is eaten during two main meals following distributions. Thus daily forage intake is closely related to the amount eaten during main meals (Jarrige et al., 1995).

During a main meal, the rate of intake is highest at the beginning and then decreases continuously as satiation proceeds until satiety. Simple exponential models accurately fit cumulative intake during meals in both cows (Faverdin, 1985) and sheep (Baumont et al., 1989). Initial rate of intake represents the motivation to eat, and the constant of deceleration of the exponential function the satiation process. Kinetics of intake were also modelled on fresh leafy branches offered indoors to goats (Meuret, 1989). Rate of intake, especially at the beginning of the meal, seems to be a key factor for understanding variations in voluntary intake between forages (Moseley and Antuna-Manendez, 1989). At the beginning of the meal, motivation to eat a given forage expresses sensory and nutritive properties of the feed that were learned from previous experience.

At pasture, the feeding pattern of ruminants is determined by the grazing periods that occur essentially during daylight. In a temperate climate, grazing time is organised into 6 to 8 periods with two main periods at sunrise and sunset. Rumination time is also divided into periods between meals during the day, and forms the principal activity during the night. At high temperatures (>25°C), animals adapt their activity to avoid grazing at the hottest times: they start grazing earlier in the morning, prolong the evening meal and may also graze at night.

The satiation process Post-ingestive signals coming from feed contribute to the satiation process. These feedback signals are mainly integrated in the control of intake to prevent excess.

2. Role of rumen fill

When fed indoors with two distributions and free access to forage, rumen fill, measured as the amount of digesta in the rumen, reaches a first maximum after the morning main meal and the daily maximum after the evening main meal (Baumont et al., 1988). In grazing sheep, Thomson et al. (1985) also observed a first maximum in the morning at 9 a.m. and the daily maximum at 8 p.m. in the evening after the main grazing period. That the capacity of the rumen is involved in the control of intake is supported by two types of physiological evidence: (i) stretch-and mechano-receptors are present in the rumen wall (Leek, 1977); and (ii) increasing rumen fill with indigestible material by the equivalent of 1 kg dry digesta decreases intake by 0.6 kg dry matter on average (review by Faverdin et al., 1995). When rumen fill is increased with indigestible material, animals increase the number of meals and the time spent ruminating per kg ingested (Baumont et al., 1990a). This stimulation of rumination behaviour, related to increased stimulation of tactile receptors in the rumen wall, speed up digesta outflow and tends to reduce rumen fill.

3. Role of nutrients

During the main meals rapid fermentation of the soluble fraction of feed increases osmotic pressure and volatile fatty acid (VFA) concentration of rumen fluid and lowers pH (Rémond et al., 1995). VFA infusion in the rumen decreases feed intake in the short term, more so as the molecular weight of the infused VFA is low (Faverdin et al., 1995). The influence of molecular weight indicates involvement of osmotic pressure (Carter and Grovum, 1990). Signals sensed by chemoreceptors in the rumen wall and/or in the liver enable the animal to avoid excess and nutritional disorders. This may explain the low duration of main meals with grass silages that contain large amounts of organic acids and ammonia, especially when they are poorly preserved (Van Os et al., 1995). In this case, satiation occurs before rumen fill reaches a maximum. The same kind of adaptive phenomena may explain the choice of the feeds lowest in salt when goats were given a diet rich in sodium chloride (Morand-Fehr et al., 1996). During a meal, the signals that contribute to the satiation process act simultaneously and probably additively as indicated by the effects of an increase of rumen fill and an acetate infusion, performed separately or at the same time (Adams and Forbes, 1981). The different signals that are sensed in the digestive tract and the liver are integrated in the central nervous system and balanced with other stimuli (Forbes, 1996).

Motivation to eat and feed preferences Satiation factors, mainly those related to rumen fill, have been favoured to explain forage intake. Because of prior learning, sensitive recognition of the feeds allows anticipation of nutritional and physiological consequences of intake. This is essential to determine motivation to eat and meal size when one feed is offered, and also feed preferences and foraging behaviour in more complex situations, such as heterogeneous swards and rangelands.

4. Learning the post-ingestive effects of feeds

The senses that are stimulated in the presence of feed enable the animal to anticipate the postingestive effects of feed. Provenza et al. (1992) proposed a schematic representation of the processes involved in the learning of feed preferences. The affective system integrates the taste of a feed with postingestive feedback and the cognitive system integrates the odour and appearance of the feed with its taste. Learned food aversions towards toxic plants or feeds experimentally laced with several compounds that cause malaise have been clearly established in ruminants (du Toit et al., 1991). Learned preferences based on positive nutritional postingestive feedback are undoubtedly also important for ruminants. After 10 days adaptation, lambs developed a strong preference for nonnutritive flavours paired with glucose over the same flavours paired with saccharin (Burrit and Provenza, 1992). Thus ruminants, like other mammals, develop preferences for feeds that are richer in energy (Provenza, 1995). However, in a free-choice situation, diet selection does not always maximise energy density in the diet. Sheep eat some straw to prevent rumen disorders, even when a more concentrated feed is also on offer (Cooper et al., 1995). Sheep fed with a "long-fibre-free" diet will eat 10 mm polyethylene fibre to restore normal rumination activity (Campion and Leek, 1997). It was even observed that dairy goats can buffer seasonal variations in available vegetation composition. For example, at turn out, goats seek herbage species relatively low in protein and rich in fibre; it is likely that animals select vegetation to reduce the variation in ingesta composition as far as possible in the face of large seasonal variations of vegetation composition (Fedele et al., 1993; Morand-Fehr, unpublished). Moreover, post-ingestive stimuli need to be periodically reinforced, and so the animal has regularly to re-evaluate the cost/benefit ratio of the different choices. Dietary experience, particularly early in life, modulate feeding behaviour and diet selection Processes of learning from the mother, from other animals of the same species and through trial and error have been reviewed by Provenza (1995). For example, naive sheep, cattle and goats may eat up to 40% less than experienced animals in the same environment (Provenza and Balph, 1987). When feeding, animals adapt to their environment by developing their ability to recognize plant species and their grazing skills (Flores et al., 1989), and by learning and memorising the distribution of resources (Dumont and Petit, 1998). Learning from the dam and social partners (Thorhallsdottir et al., 1990), and recognition of postingestive consequences of diet choices are important in this adaptation and in the acquisition of appropriate dietary habits. Lambs accustomed to graze either clover or grass with their dam have a stronger post-weaning preference for the species they had previously experienced (Ramos and Tennessen, 1992). After weaning, lambs reared by goats spent less time eating clover than those reared by ewes, consistent with the stronger preference for clover of ewes compared with goats (Orr et al., 1995). For adults, short-term neophilia may temporarily modulate preferences. Sheep that had grazed either clover or grass swards for 3 weeks subsequently showed a stronger preference for the species previously lacking in their diet; nevertheless, after 3 days, they reverted to a stronger preference for the species they had been previously accustomed to eating (Parsons et al., 1994). However, when an unknown feed is offered to goats, sensory evaluation can take a long time and intake begins at a low rate, which can limit the size of the first meal.

5. Hedonic behaviour

Mechanisms of brain reward can cause some extent induce hedonic feeding behaviour, which competes with physiological factors controlling intake. Sensory properties of the feed will stimulate hedonic behaviour to some extent. Total intake of sheep was only 0.4 kg/d when they ate straw and received grass in the rumen but rose to 0.9 kg/d in the reverse situation, although the digestibility of the total diet was similar (Greenhalgh and Reid, 1971). Unpleasant sensations when eating straw may explain its very low hedonic value. Hedonic behaviour can explain voluntary intakes greatly in excess of requirements in wethers fed good quality forages (Baumont et al., 1997). The sensory motivation induced by a second distribution of fresh hay will override the satiety signals associated with the first distribution (Baumont et al., 1990b). However, the size of the second meal depends on the relative palatability of the two hays distributed. Sheep satiated with low-quality meadow hay will eat 400 g of lucerne hay. However, they are reluctant to eat meadow hay when satiated with lucerne. In goats, hedonic behaviour may explain why they make refusals even when this selectivity prevents them meeting their energy requirements (Morand-Fehr et al., 1991b). At pasture, the pleasant experiences associated with the consumption of a new food have been suggested to explain preference for novelty or for rarity (Newman et al., 1992).

Hedonic behaviour, however, competes with the effort that has to be expended to earn the reward. In a test situation, when animals have to walk to obtain a good forage, the preference for the good forage depends on the amount offered the animals in reward (Dumont et al., 1998). In conclusion, Fig. 1 summarises the main relationships between forage characteristics, short-term control of intake, feeding behaviour and finally forage intake. Modelling intake behaviour is a good tool to test our knowledge of what controls intake. Forbes (1980) developed the first mechanistic model of intake in ruminants. More recently, Sauvant et al. (1996) proposed a mechanistic model of intake and chewing activities that integrates relationships between feeding behaviour and digestive processes. Decisions between eating, ruminating and resting are taken according to the relative values of the functions of motivation to eat and of satiety, which integrate the signals described above. The forage is characterised by the cell wall content and its potential digestibility, and by the proportion of large particles. A palatability index and a coefficient of heterogeneity take into account non-nutritional characteristics and selection possibility in the forage and are combined to estimate instantaneous palatability of the forage. This model accurately predicted intake kinetics of sheep fed different types of hay indoors.

6. Role of plant characteristics on forage ingestibility

Forage ingestibility is defined as the maximum quantity of the feed that can be eaten by the animal when this is supplied ad libitum as the sole feed. When given indoors, ingestibility of green forage depends mainly on its nutritive value and fill effect and on its sensory properties, assuming it does not contain toxic compounds (Fig. 1). Conservation of forage generally modifies ingestibility. Compared with the original green forage, making hay depresses the nutritive value and consequently ingestibility. Making silage does not alter the digestibility, but ingestibility is depressed if the quality of conservation is poor and the silage contains large amounts of fermentation end products.

7. Nutritive value and fill effect

For a given plant, ingestibility, like digestibility, is dependent on the vegetation stage and the number of the vegetation cycle. During the first vegetation cycle, ingestibility decreases with the age of the plant. Relationships between age, digestibility, chemical composition of forage and their ingestibility are linear or slightly curvilinear according to the species (Demarquilly et al., 1981). With the same digestibility, voluntary intake of legumes is about 20% higher than that of grasses due to a lower cell wall content. Also, for the same age and digestibility, voluntary intake differs among grasses. Taking into account the main variations in forage ingestibility allowed the development of the fill unit system to predict feed intake for ruminants fed indoors (Jarrige et al., 1986).

The decrease in ingestibility with age of forage is the consequence of the increase in its fill effect. As the plant ages, its morphological and histological development decreases the amount of cell content, which is soluble, rapidly degraded and has almost no fill effect, and increases the amount of cell walls. Consequently, forage retention time in the rumen and thus fill effect increases. In addition, tissue lignification increases the undegradable fraction of the cell walls and decreases the degradation rate of the degradable fraction (Grenet and Demarquilly, 1987). The time needed to reduce particle size before ruminal escape is also increased. Retention time in the rumen depends mainly on the degradation rate of the degradable fraction and on the proportion of the undegradable fraction, since its outflow rate does not vary widely among plant species (Baumont et al., 1997). Residence time of dry matter in the rumen is closely related to forage ingestibility (Baumont et al., 1996).

8. Physical characteristics

Since the work of Arnold (1966), it has been recognised that the sense of touch plays a role in the response of the animal to the feed. Physical characteristics of the forage such as dry matter content and particle size, and resistance to fracture are known to affect ease of prehension and thus intake rate (Inoué et al., 1994). With dried forages, relative preferences for mixtures with varying proportions of long and short particles were closely related to the differences in intake rates (Kenney and Black, 1984). Discrimination between the different mixtures decreases as intake rates of the feeds being compared increase.

Accordingly, preference for short particles is more pronounced in slowly ingested forage like straw than in rapidly ingested hay. Small ruminants are also sensitive to particle size ofconcentrates. Ground feeds with a large percentage of fine particles (<0.5 mm) are clearly less well accepted than coarse ground feeds, (Morand-Fehr et al., 1994). The preference for coarse particles may be due to greater ease of prehension. The water content in feed modifies dry matter intake very little except with ground cereals that can be changed into compact pastes with a high water content.

Nevertheless, high humidity can result in a better acceptability of dusty, finely ground feeds. Thus, choice of diets by animals can be affected by interactions between particle size and humidity.

9. Chemical characteristics

The effects of various odoriferous compounds naturally present in plants were analysed by Arnold et al. (1980) by sprinkling the chemicals onto cotton wool pads placed in the manger. Effects of odoriferous compounds are difficult to interpret because they can vary in amplitude and sometimes in sign according to whether the animals are in choice situations or not. Arnold et al. (1980) added to pelleted hay small quantities of several compounds recognised to decrease intake by their odour or decrease preference for a water solution by their taste. Over a three-day period, significant depressions in intake were obtained with coumarin, gramine, tannic acid, malonic acid and glycine.

However, sheep that were both anosmic and agustatory were affected in the same way as normal sheep. In vitro digestibility of the pelleted hay was drastically depressed by tannic acid and gramine, and slightly by coumarin and glycine, but was unaffected by the other compounds. Small ruminants can also be sensitive to flavours added to the diet (Morand-Fehr et al., 1991a) and to sugar, salt, urea and hydrochloric acid at various levels, which correspond to the four primary tastes: sweet, salty, bitter and sour (Morand-Fehr et al., 1993). However, animals in the same flock display a very wide range of response to the 4 taste components. Grovum and Chapman (1988) showed that animal response to added chemicals varies with feed management. Low intake of silage is often attributed to low palatability, since digestibility is only slightly different from that of green forage.

Effects of smell and taste on silage intake were studied with anosmic and agustatory sheep (Michalet-Doreau, 1975). The increase in silage intake by anosmic compared with normal sheep was more pronounced with poorly preserved (+33%) than with well-preserved silages (+6.4%). Silage intake by agustatory sheep was not modified. Acetic acid added to the silage had a clear negative effect on intake (Buchanan-Smith, 1990). Amines are suspected to decrease palatability, because in sheep initial eating rate at the beginning of the meal was depressed by addition of amines in silage (Van Os et al., 1995). Low palatability of silages probably results from learning the negative post-ingestive signals due to high amounts of fermentation end products. Like other ruminants, sheep and goats are very sensitive to concentrate palatability. Preference tests under standard conditions in goats showed that fats, rapeseed meal and urea can lower the palatability of compound concentrate feeds (Morand-Fehr et al., 1991b). Giger-Reverdin and Sauvant (1991) established a scale of palatability for concentrate feeds.

10. Role of vegetation characteristics on grazing behaviour

Behavioural constraints are different and more diversified at pasture than indoors. Animals have to search for feed (search constraint) and they have to harvest the plants (prehension constraint). Even so, animals are free at pasture to develop their own foraging strategy. They exploit environmental heterogeneity by grazing selectively. Prediction of intake and of the impact of animals on vegetation needs an understanding of their foraging decisions. When shepherds drive their flocks on grazing circuit, their strategy of resource utilisation influences the animal's behaviour and interacts with the foraging strategy of the flock.

11. Foraging strategy and diet selection

On homogeneous swards, the importance of prehension constraints first caused herbage intake tobe represented as the product of intake rate and grazing time (Allden and Whittaker, 1970), assuming spatio-temporal stability of intake rate. As this approach is inappropriate on heterogeneous swards, a hierarchical approach is now preferred, that organises the grazing process into different levels corresponding to animal decisions, which are then integrated over wider spatio-temporal levels (Bailey et al., 1996).

12. Representation of the grazing process and theoretical bases of foraging behaviour

When an animal begins to eat, it selects a feeding site and a patch within that site. Selection of bites within the patch continues so long as Instantaneous Intake Rate (IIR) remains above a certain threshold. When IIR falls below this threshold, the animal selects a new patch, and when acceptable patches in the feeding site become scarce, a new feeding site is selected. This representation of the grazing process proposed by Laca and Ortega (1995) enables foraging behaviour to be formalised in terms of a hierarchy of scales where animals make decisions and integrate these over different spatio-temporal levels. A patch is defined as a spatial aggregation of bites over which IIR remains relatively constant (Illius and Hodgson, 1996).

Thus, patch size can range from an area from which one bite is taken to a homogeneous paddock. Two approaches to foraging decisions have been proposed. Synthetic approaches assume animals organise their behaviour towards an objective, whereas analytical approaches assume that behaviours arise from cause-effect relationships. The basic axiom of the main synthetic approach, Optimal Foraging Theory (OFT), is that present-day animals forage optimally as a result of natural selection, because optimal foraging enables the animal to maximise its reproductive output ("fitness") (Krebs and McCleery, 1984).

Fitness maximisation has often been translated into efficiency of foraging, which, for practical reasons, has often been equated with short-term dry matter intake rate (Laca and Demment, 1996). The recent model of Newman et al. (1995) base foraging decisions on maximisation of fitness and include a simplified mechanistic sub-model of digestion. Another synthetic approach, the principle of "satisfying", hypotheses that a behavioural option may be taken, not only when it is optimal, but when it is of sufficient benefit to the animal (Ward, 1992). This raises the problem of defining a satisfaction threshold if predictions are to be made under this principle.

Analytical approaches explain foraging behaviour in a complementary manner. For example, patch choice may be motivated by sensory stimuli, by post-ingestive feedback resulting from previous choices, and by dietary experience. Synthetic and analytical approaches should be perceived as complementary rather than exclusive. Although OFT stresses the importance of natural selection in determining behaviour, it cannot exclude the importance of short-term dietary experiences.

Optimisation-based predictions should, therefore, include animals' dietary experiences. The difficulty in dissociating the different approaches is well illustrated by the question posed by Illius et al. (1998): do animals eat a plant species faster because they prefer it (sensory stimulus) or do they prefer it because they can eat it faster (optimisation of behaviour)?

Optimisation is an elegant approach because it is a functional synthesis of foraging behaviour and it allows quantitative predictions. However, it may be a simplified representation of reality and the basic theoretical axiom has generally been simplified. The few experimental tests of intake rate maximisation hypothesis have not completely validated it, and this has led to suggest different explanations, such as the search for a balance of nutrients and dilution of toxins (Newman et al., 1994; Parsons et al., 1994), necessity for the animal to sample its environment (Demment et al., 1993), and constraints on the animal's ability to evaluate the cost/benefit ratio of different behavioural options (Illius et al., 1998).

13. The ruminant stomach

Goats are ruminants, animals with a four-compartment stomach, as are cattle, sheep, and deer. The compartments are the reticulum, rumen, omasum, and abomasum (true stomach). Monogastric or simple-stomached animals such as humans, dogs, and cats consume food that undergoes acidic breakdown in the stomach and enzymatic digestion in the small intestine where most nutrients are absorbed. In ruminants, feed first undergoes microbial digestion in the reticulum and rumen (together often called the reticulo-rumen) prior to acidic digestion in the abomasum and enzymatic digestion and nutrient absorption in the small intestine. It is the microbial digestion in the reticulo-rumen that allows ruminants to consume and utilize grass, hay, leaves, browse, etc.

The reticulum and rumen form a large fermentation vat that contains microorganisms, mainly bacteria, that breakdown and digest feedstuffs, including the fibrous component of grass, forbs, and browse that cannot be digested by monogastric animals. Some of the breakdown products produced through digestion of feed by bacteria are absorbed by the animal through the rumen wall and can supply a large part of the energy needs. The rest of the byproducts of digestion, undigested feed, and ruminal microorganisms flow out of the reticulo-rumen into the omasum where large feed particles are trapped for further digestion and water is reabsorbed. Material then flows into the abomasum where acidic digestion takes place and then to the small intestine for further enzymatic digestion and nutrient absorption.

The rumen provides several advantages to the goat in addition to digestion of dietary fiber. The bacteria in the rumen are capable of synthesizing all B vitamins needed. Bacteria can also synthesize protein from nitrogen recycled in the body, which may be advantageous on low protein diets. For proper ruminal function, goats require a certain level of fiber (measured as crude fiber, acid detergent fiber, or neutral detergent fiber) in the diet. Goats have bacteria in the rumen that can detoxify antinutritional factors, such as tannins. This enables goats to better utilize feedstuffs containing high tannin levels such as those found in browse. There are very few situations in which a goat will not consume adequate fiber, but one is when a very high grain diet is being fed. Inadequate fiber consumption can then lead to several disease conditions. The most important disease condition is acidosis or an extremely low pH in the rumen, causing decreased feed consumption.

When ruminants are born, the first three compartments of the stomach are underdeveloped and the stomach functions similar to that of a monogastric animal. This enables absorption of antibodies in colostrum and efficient utilization of nutrients in milk. As the young ruminant consumes solid feed, especially high in fiber, and the microbial population is established, the rumen is stimulated to develop. The rumen must have an acceptable degree of development for successful weaning.

The greatest asset of goats is the ability and tendency to utilize woody plants and weeds, not typically consumed by other species of animals (e.g., cattle and sheep), converting them into a saleable product. Therefore, these plant species can be inexpensive sources of nutrients and make for a very profitable goat enterprise. Goats typically consume a number of different plant species in any one day and can utilize some poisonous plants because they do not consume enough to be toxic. Similarly, goats are believed to have a relatively high ability to detoxify absorbed anti-nutritional factors. Goats are more resistant to bloating than other ruminants, and after a brief adaptation may graze alfalfa without bloating.

10. fejezet - 10-11. Sheep feeding, nutrition

1. Lamb fattening

Diverse lamb fattening technology known, their feature, that primarily onto fodder your primer. May fatten only with fodder, or may feed beside the fodder minimal, daily 100-150 grams of hay, maybe the latter one the more favourable solution, since the lambs do not take a litter substance so, and according to single experiences their digestion better. The fodder has to be before the lambs continuously, in a full measure ad libitum feeding necessary. According to the experimental results it farage rich one needs energy to be, but moderate protein level enough, and successfully utilizable the urea. The body weight in terms of growth and the specific fodder use the optimal fodder mix energy and it raw protein concentration approximately the successor: NEm: 7,5 MJ, NEg: 5,1 MJ. Raw protein: 135-145 g/kg of dry matter. If less are the fodder implies energy, the weight gain decreases, the specific fodder a use increases though. The merino young rams with the feeding of the mix at which the above parameters are daily 270-330 gram/days of weight gain may be attained. The kind defines it significantly the getting fat lambs fattening its parameters: the daily weight growth, the specific nutriment use, the fattening end mass.

2. Flushing

The so-called one flushing not something else, than the pistillate individuals relatively abundant forage before the pair season and the aim of to increase it rutting it proportion and to repair the conception results. The essence that the mothers in this period positive energy let them be in balance, so growing. The question is not plain this much however in the mirror of the newer scientific results. Good, you are at medium one mothers with better condition did not receive a positive answer many times in it case this repaired forage. Is disappearing so, that the flushing primarily then applicable successfully, if the mothers' condition is weaker at medium one, their weight 5-10% smaller, than normal medium condition. Regularly the flushing they make 200-400 grams of corn fodder eat some of its aim at us, it is necessary to observe that the fodder feeding is not necessary inevitably however. Onto the preparation time being available 2-6 weeks. Many examples prove it, that in this period, after scanter supply, abundant, mass high quality and roughage with feeding, driving onto pasture with optimal vegetation favourable results just like that can be reached. In the state of the essence that the one with decreasing mass or energy are balances being mothers we put it in a position like that with the repaired forage, when their weight growing. The flushing in a period richly feed mothers do not respond to the repaired forage generally, indeed may be harmful. The relative deficiency of Vitamin A, the phosphorus, the manganese, the zinc, the selenium and the copper, the strong predominance of the calcium is effective unfavourably the conceiving.

3. Hormones

The hormones the fodder biologically his most efficient substances. The same hormones encourage single vital functions, other ones are hampered by them. The oestrogenes is one of the group like this. The oestrogenes in a little portion with a favourable effect onto the genital activity and the protein character onto production, but it is hampered by them the conceiving. The hormones they accumulate in the organization, because of this nutritive aim their application is prohibited from in many countries.

4. The forage of intensive milking sheep

The intensive dairy farmer in the case of sheep-farmings feature, that the lambs you are not altogether only until short time they suck. The lamb upbringing milksubstituting, leaks with the help of automatic watering ones usually. The lambs demanding the milksubstituting, concerned they opposite The concentration of a nutrient. Only the one with a best quality milksubstituting suitable. The usage of automatic watering ones on a case important factor the milksubstituting temperature; the 18-20 °C a liquid works well generally. If warmth miklsubstituting drink, the lambs take too much in many cases and they get sick. It intensively producer mothers - that his daily production 2-5 kgs - according to worthy similar principles to fee, than the dairy farmer cows. Our domestic circumstances it stabled keeping and with the complete mixes truth forage recommendable. It is necessary to translate a big trouble the mineral-, microelement and onto a vitamin replacement. This means it, that the milkingforage to contain a dairy is needed for mothers developed complete premix, a suitable amount of fodder salt and according to need fodder whitewash. Place may be received because of the first stomach digestion in the nutriment in the interest of the bigger milk production on the front of the lactation protected proteins and fatts, too. The most favourable one, if the fodders on one mixed up, as a complete mix and ad libitum we feed it with the mothers. This the most important device of the increase of the milk production, with what in case of feeding like this, it one for which thank you can be said to the suitable function of stomachs big fodder uptake can be reached. With this preventable the concentrated fodder digestive disorders occurring possibly as the consequence of his feeding. Onto the highest production level compiled portion, a complete mix may cover it above the 4 kgs concerned producer mothers the need of a nutrient. These the excellently producer individuals at the average one onto bigger fodder uptake capable, and the fodders are utilized more efficiently at the average one. Before the delivery the dairy it is necessary to prepare mothers for the delivery and the more concentrated forage following it.

5. Industrial fodders

The vegetal one and the industrial processing of animal products were produced on it row, onto the forage of animals suitable byproducts, wastes. Vegetal: the milling industry fodders, the seed cleaning wastes, the plant oil industry one, the sugar industry one, the canning industry byproducts, the distilling industry one, the brewery industry one, the starch industry fodders et cetera. With an animal origin (rich in protein, rostmentes, tall fodders containing vitamins) the fodders arising in the course of the milk processing, the meat industry wastes, the fish processing byproducts et cetera.

6. Flavourings

The flavourings used in the forage into two groups can be enumerated, there are natural and artificial or synthetic substances. With the natural flavourings, (treacle, fodder sugar et cetera) the complemented fodder especially, growing animals take it with pleasure, more fodder is absorbed. Their similar effect the synthetic aroma is for substances, but this is very important, that the flavouring to the given species and let it conform to its diet adequately. Single strong flavour, flavourings may appear in the manufactured product concerned.

7. Two-phase lamb being fattening

We may manufacture the fattening fodder mix more cheaply, if we apply two-phase feeding, and from the starter nutriment or from forage, in approximately 50-60 days ages fattening mix we switch to its feeding. It is necessary to execute the transition gradually. In a case for which reasons were given only suggestible, for example the timed one (retarded) being fattening, from the pasture conversion a reason may be given the two-phase one fattening onto the application of technology.

8. The forage of ram in a mating period

In a mating season and let us give mass fodders with a better quality before it with 7-8 weeks, than in a resting period. The pulses hay may be more effective at the meadow hay, and then the feeding of a more beneficial turnip instead of silage. From among the fodder crops the oat the most important one. If he does not stand for a provision, with rye, triticale, barley, with a sorghum can be substituted. We give from oat you would eat at most 1,5 kgs, energy from richer fodder less. The quantity of the fodder has to attain it in case of a medium strain it 1 kg.

9. The forage of ram apart from a mating period

The rams in the look of nourishment are much more demanding, than the mothers, because of the relax period, neither it is allowed to neglect their forage. Apart from the mating period expedient for the rams beside mass fodders fodder crops to give. Onto the combination of this not anymore so demanding the ram: mixed economic fodder suits. His daily portion from the weight of the ram depends on 0,4-0,6 kgs. The turnip may come into a word primarily from among the mass fodders, the case of it deficiency silage high-quality can be fed. For ram indispensable the hay high-quality, in a period resting instead pulses straw can be given. These let its quantity not be over the 1-1,5 kgs.

10. The basic principles of the forage of rams

In the forage of the rams it recourse, the energy we distinguish two periods in terms of a claim: the breeding one and the resting period. The traditional, in a seasonal period truth leap some six amount to a week the breeding season, continuous having it chased lags behind totally quasi though the relax period. Natural mating it maintenance causes the search activity of the rams a big problem. The success of fertilizing depends on with what kind of energy the rams are looking for it significantly and cover the mothers being on heat. It may be the consequence of the protracted fertile cycle, the big strain that the condition of the rams for service is deteriorating, their searching activity decreases, their semen is diluted. In terms of forage the earner rams (test rams) supply with an identical level is claimed near with that of the rams for service, since their tasks tally, indeed the strain of the test rams sometimes even bigger one. Artificial at the time of fertilizing important task, that from the sires with a distinguished ability at what more semen, let us win being due to a successor. This from time to time strain with a measure like that for the rams, than the natural one, free mating. In case of unsatisfying feeding this in a case the decreasing semen the semen is needed with the decay of a quality primarily beside a quantity to reckon.

11. Salts

The salt just it vital element like that for the forage of the sheep, than any of the foods, the form of his dosage but different. Is found rarely, that the salt (the basis of which the common salt prepared in the some kind of form) it is stirred in into the fodder portion of the sheep. With a lot rather pressed blocks (salt lick) the sheep secure it in its form. These may be plain pressed salt-, concerns vitamin and selenium salt artefacts.

12. Periodic grazing

Taking the lawn area into consideration in case of periodic grazing the flock the need of fodder, and the economy interests - a section with five-six suitable greatnesses is assigned it, that a fence separates from each other. While the animals graze one of the sections, on the others performable the nurture of the pasture, the pasture grass rests concerned, buds. The periodic grazing may be portioned you are striped portioned.

13. The forage of sucking lambs under breastfeeding

The birthweight 1,5 and 6 (7) may change between a kg, which the mother is primarily because of age, depends on it forage and the litter number. An any kind of reason brings it about, the reduced

natal mass entails the next circumstances:

the increase of the falling out, falling away

smaller increase vigour

Greasier bony meat production.

The lambs with smaller weight an existence maintainer's energy needs onto weight projected significantly bigger, since their body surface is bigger with a shock compared to their weight, than their more advanced companions', they come into the world with significantly less reserve energy at the same time. Their reserves are scooped out if these lambs do not secure energy through a suck quickly and they fall away. The mothers produce a colostrum, the role of which is double, in the first days, on the one hand the prevention, on the other hand the feeding. Important, that let the lambs take a suitable amount of colostrums on the first day, since the one with a largest rate is the absorption of the antibodies in the first 12-24 clocks, and their role deciding effect, onto the survival of the lambs, his resistance capacity. He has to make the colostrum of identical other mothers deriving from a flock drink the lamb if the mother does not have milk, that may be kept in readiness deep-frozen. If a sheep is not available the colostrum, a goat or a cow suits. The colostrum milked on the first day necessary onto this aim to store. Heavy to notice which disposals a suitable amount of colostrums are not at, these mostly not udderly. The triple or plural twins likewise demand plus colostrum. From a colostrum the unconditional necessary quantity lamb some 50-100 milliliter. It enough colostrum consumption and the good mother lamb in the interest of the fast development of a contact beneficial, if it keeps mothers on one separated until some days with their lambs. Any kind of accidenatal forage we may give the lambs, their electoral mass a share in forage primarily the mothers' milk production defines it. The milking mothers' milk production heavy to establish, it is considered a good estimate, that 1 kg of lamb the lambs use approximately 5 kg of milk for weight growth up. Well-known, that the lambs of the mothers with smaller milk production they get in the habit of the consumption of the firm fodders before and more are taken, than the lambs that secure milk more richly.

14. The forage of sucking lambs at the time of choice

The choice age forage of the lambs does not require special circumstances if they eat enough firm fodder already. There is a very important factor however: with the choice in a time and directly after the choice not make change in it till then fed on fodders, let us not feed new fodders. If the lamb is being fattening with different fodder happens, we start the conversion with 3-4 days gradually after the choice onto the new fodder.

15. The forage of nursing ewes

The nutrient before the lactation supply influences the mothers' milk production directly. The lactation first the mothers mobilize it early in 6-8 of his weeks recharged auxiliaries in the interest of the milk production, with the auxiliaries mothers not taking action produce less milk, taken into consideration, that after the delivery the fodder uptake usually smaller, than the need. The important factor of keeping the milk production on a level, that let the lamb or lambs consume that milk quantity, that the mother produces, in an opposite case the production decrease tooth. The sheep milk to production the milk big (4-7%) there is need for much energy through fat and the content of milk sugar. The other head limiting factor the protein. This from latter one reserves with a minimal measure are at the mothers', so disposal the need the daily nutrient substance from advission it is necessary to insure it. The dairy farmer increased attention at mothers it is necessary to translate the calcium and phosphorus onto supply. The meat producer in sheep-farmings the principal question it, that the pasture and the other mass fodders may cover it the nutrient need or if not, there is need for a kind of amount of his fodder feeding. The experiments and practical experiences show it, that with the pastures with a right quality, mass and for the production of a moderated with tall fodders amount of milk the need of the nutrient can be covered. A lot depend on the environmental, keeping circumstances. Beside favourable keeping conditions, and if it ad libitum fodder uptake without a limitation insurable, there is need less fodder onto a supplement. The fact that we have production with a what kind of level in our sight influences the intensity of the forage, how much the proportion of the twin lambs, when we intend to separate the lambs; there is an opportunity for the lambs, and when onto the dosage of accidenta forage, how much firm fodder the lambs eat, et cetera. Follows from this, that the needs to put a worthy calculation on in all cases with it purchase into attention, how given local fodders standing onto the provision between circumstances cover the need in a kind of measure. It is necessary to decide on the knowledge of this it to be fed from the quantity of fodders, and from that direction, that what kind of accidental- and additional forage necessary onto the mothers' supply.

16. Fodder uptake

The tongue of the sheep does not burn mobile, can be provided forward, because of this the fodder the lips play a deciding role in uptake, that exceptionally mobile, gently fussed, a deep lip furrow extends on their middle. The cheek expansive, makes diverse motions possible one, scissors because of this implement, with shifts being directed ahead, onto a back and onto a side. The sheep presses the grass against the hard, gap-toothed edge of the upper lip with his sharp incisor at the time of grazing. The final is the role of the lip in the fodder uptake. The time devoted to the fodder uptake all it stabled, the pasture all emerged at sheep from 24 of the clocks of the day 17-25% puts out. They help lose weight with 20-30 occasions under 4-6 clocks from the fodder. The chewing of the sheep the fodder burns at the time of uptake superficial. The chewing the quality of the fodder influences the number of motions. At the time of grazing 30-90, at the time of the feeding of tall fodder 55-40, 80-90 are the numbers of the minute chewing at the time of the consumption of fodder.

17. Stubble

The tillage plant growing after the harvest, the stubble affords the opportunity to the grazing of the animals before a break. For the sheep suitable the grain-, potato-, carrot-, seed pea-, horse bean-, lupin-, and corn stubble.

18. The forage of milking sheep

From a forage viewpoint after delivery the mothers onto three groups divisible: the nursing one, the milker one, it separated furthermore and reduced mothers' group. The nursing mothers' weight needs only 50-60 days under a breastfeeding period with his decrease to reckon. The measure of the monthly decrease may not be over the 4 kgs in this case. In an opposite case it conceiving again meets with difficulties.

19. Dairy mothers' forage after choice

The dairy in sheep-farmings iswhat they aim for early choice everywhere in the interest of bigger milk production. We have to tailor the forage to the expected production level after the choice. The one with smaller production (0,4-0,5 kg/days) mothers the need of a nutrient the usual stringy- and with mass fodder, and in the milker house fed we may cover it richly with 0,2-0,3 kg of fodder. The half intensively (1 kg/days) producer in case of mothers important, that pasture high-quality, concerned stringy- and mass let us insure fodders, beside which some 0,5-0,7 kg of fodder we have to feed that of a half. Beneficial, if it is fodder a part of it in the milker house, they have it other part liked about the one mixed with the mass fodder. According to the experiments, if the dairy is complete fodder used in your cowherd similarly to the feeding of a mix (mass fodder + the mix of fodder ad libitum) we relieve it the forage of the milking sheep, some increasable the fodder and energy uptake, as the result of which repairable the milk production. The quantity of the nutriment the function of the production and the fodders standing onto the provision, 0,5 kg fodder exceeding significantly milk production above only 1 kg justified to portion.

20. Young ewes’s forage

In the domestic practice, that the lambs intended as the breeding and being fattening are kept together until certain time and fee. This it justifiable, that the animals intended as breeding longer beneficial, if we take advantage of their increase vigour in their young age. A habit intended young animals as the breeding in 9-12 weekly ages to sort out, this selecting the pistillate one provides an opportunity animals onto it choosing. The twin lambs let us not regard his smaller mass as a negative factor usually the breeding selection, since it is a twin fall mothers giving repair it the flock productivity. After the selection of the breed it is necessary to keep the young animalsin a separate flock and to feed them. The young animals breed case to reduce the fodder is needed comparing the content of energy to that of your chin gaining weight. This available the fodder portion 50-70% it reduction. To the development of their digesting tract, they need hay. The mass high-quality fodder their necessary number, this is a wet and dry carrot with a slice though with grazing, in winter in summer we solve it by silage. The natural keeping, the proper motion are indispensable. The increase of the digesting tract aim it is necessary to increase it their fodder the content of a dry substance and a fibre, since the forage under the upbringing influences their digestive capacity in the later ones, fodder recorder their ability. Based on all these daily 0,5-1,5 kg of hay, 0,4-0,6 kg of mixed fodder, lamb forage we have to feed nutriment, 1 kg of silage or 2-3 kg of pasture grass, depends on an age and the quality of the fodder. Into the breeding the order of the deliveries influences the time of a purchase. A considerable interest is connected with it if the substance gives birth once annually, that the ewes in two monthly ages into breeding let them be purchasable. The ewes may be attached smoothly so into the order of the seasonal delivery. If condensed giving birth apply, into the later breeding a purchase extends the unproductive period of life by only some months. You are later in eight-nine monthly ages traditionally at us it is bought into breeding the ewes, but into the previous breeding over meat producer at substances anyway beneficial. Into the breeding the decision of a purchase the development the deciding factor, and not the age. Requirement, that the ewes have to get away at the time of a purchase into the breeding their full-grown age weight 65-70%. If you would eat smaller, cannot be had bought into breeding, considering that the mentioned living person mass is normal breeding condition to be understood. The optimal growth of the ewes depends on the kind and the breeding aim may change on a wide scale.

21. Empty mother the forage of sheep

Annually onetime giving birth it case the time span of looking emptily the manner of it computation: 365 of the days of the year - onto fertilizing truth preparation (4-6 weeks) - one after fertilizing 2-4 weeks - from the 85. day of the pregnancy - breastfeeding, milk production period 116-234 days (beside 28-60 days electoral, milk production periods). Its deciding proportion - legatee fall in case of a cycle - onto summer, the grazing one goes to a period concerned. In case of 1, 5 delivery whirls until 27-90 days consider from a forage viewpoint for empty one the mothers. In this period, the mass fodders: grazing grass, pastures, byproducts sowed, siloed fodders. Digesting beside the succulent fodders let us make a proper amount of tall fodder eat some of a physiological aim, mainly straw. It stabled, for empty sheep not going regularly to pasture 2-3 kg of succulent fodder (corn silage, grass silage, wet turnip), 1-1,5 kg of hay or straw satisfy the need of the nutrient. The mothers the straw corresponding hay it is taken in a value. The uneconomic field not justified by the mothers in the unproductive phase, an empty state cultivated fodders to feed.

22. The forage of pregnant ewes in the early stage of the pregnancy

Until some 40 days, while it is an embryo does not embed into the placenta, the placenta gains the supply of a nutrient substance from a liquid. If the mother in this period serious stress (for example nourishing below) vein, the foetus may be frequent as a result of this necrosis. In the interest of the avoidance of this the mothers the conception, concerned in the 1-1,5 months following the pair period so fee, that let energy be positive on their balance's salve. The overfeeding and the heat shock likewise deleterious effect. The pregnancy the first two third only they the young mother sheep demand forage above a life-maintaining level, that their full-grown weight or bad one was not attained yet their condition. For these monthly 2-4 kg of weight onto an increase enough producers we give fodder. It is necessary to avoid much of it pulses feeding, with what oestrogen the ferry of their content inducing they may be the foetus for necrosis. The mothers this- the supply of a vitamin and selenium likewise worthy to reexamine, to check, with what their deficiency the foetus may be the primer reason of necrosis likewise.

23. The forage of pregnant ewes on the middle of the pregnancy

In the middle of the pregnancy, the mothers we may base the supply of fodder on one grazing exclusively if it is proper in a quantity onto a chin provision. This period from the 40. day of the pregnancy, we calculate it until the 85. day. Favourable, if the mothers keep their weight, so their supply may be a nutrient substance close to the subsistence. The experiences indicate that it does not cause a demonstrable disadvantage, if 5-6% they lose from their weight, the overfeeding may entail serious dangers opposite this.

24. The forage of pregnant ewes on the end of the pregnancy

For the increase of the vehem, two thirds falls to the last 6-8 weeks of the pregnancy. For an equivalent can be considered, if it one, concerned twin with a lamb pregnant mothers 12-13, concerned 18-20% their weight is increased in this period. Fundamentally important the favourable energy and protein supply to the reserves' training, the building of the vehem and the colostrum -, concerned to the starting of milk production. If the pregnancy is the mothers' supply the first two third there was an equivalent, the good pasture you are the mass with a right quality and through the feeding of roughages, only in this period demand fodder with a limited measure supplement (0,2-0,3 kg/days). The protein is richer in the protrein of supply, which can be insured usually with tall fodders, it fed energy for fodder one primarily in this case it is necessary to get it. With the forage according to the need available, let their resistance capacity be good in order for the lambs with suitable weight to be born and let the mothers produce a suitable amount of milk. The incomplete nutrient substance supply is harmful for the performance of the flocks in this period since less and one of worse quality are a lamb can be manufactured. The overfeeding likewise harmful, the last three-four increase the incidence of the pregnancy toxaemia significantly in a week especially, primarily the two conditions, with more lambs at pregnant mothers.

In the last seven the mothers the uptake of fodder decreases significantly, this the nutrient substance brings a negative change in supply naturally. This reduced nutrient substance supply cooks for the development of the pregnancy toxaemia its factor. The defense quite heavy; first of all, it is necessary to avoid the mothers putting on weight.. The lack of appetite caused it nutrient substance we may help deficiency in such a way though that smaller terime concentrated fodders feed. The excessive increase of the fodder portions but the acidosis carries his danger alone. The practical forage in this period in case of an opportunity expedient to group the mothers, and in the forage tailored to their condition to give a share, like this for example the next groups can be developed:

1. young, mothers growing yet, skinny mothers (these demand an extra supplement),

2. one with suitable, medium condition individuals,

3. one with plus condition mothers (these very moderate, it concentrated with the coming of delivery with portions then expedient to feed).

The grouping it may be a fundamental viewpoint that the mother is pregnant with a single lamb or twins, if onto the statement of this opportunity yes.

25. Water consumption

The sheep drinks 2-6 litres of water five-six times daily. Onto 1 kg of dry substance 2-4 kgs the water consumption. The water consumption the fodder the temperature of the environment influences it apart from the content of a dry substance. Constant water it is all necessary to ensure uptake in the stable, all though on the pasture. Most favourable from the living water truth drinking. The sheep is exceptionally sensitive to the temperature of the water. He does not drink the cold water with pleasure. The sheep sucks up the drinking water, it orifice draws into the water or the fluent fodder without, that its nostril would reach down into it, and the tongue solves suction with his moving back and forth who.

11. fejezet - 12-13. Goat feedig, nutrition

Proper nutrition is essential for the health and productivity of all animals and is the basis of successful production systems. A well planned and executed preventive health program cannot overcome problems that are created by poor nutrition. Nor can advanced reproductive technologies overcome nutritional limitations of reproduction. Therefore, nutrition of the goat is of paramount importance for successful goat production. Nutrition is the science of providing nutrients to animals in adequate amounts and in forms that the animals will consume. For sustainable and profitable production, these nutrients must also be provided in a cost-effective manner.

1. Nutrients

Nutrients are defined as substances that aid in the support of life. The six classes of nutrients include protein, carbohydrate, fat, vitamins, minerals, and water. Nutrients are often classified as organic (carbon-containing) or inorganic (minerals).

Energy is not considered a nutrient, but can be derived from the breakdown of several nutrients including fat, protein, and both simple and complex carbohydrates. Energy is required to propel the biochemical processes that are necessary to sustain life. A deficiency of energy will cause weight loss, low productivity, and ultimate death of an animal. An oversupply of energy will usually result in excessive fatness, which is also unhealthy. A simple unit of measurement of energy is pounds of total digestible nutrients (TDN). A 0.453592 kg of TDN, equivalent to a pound of digested carbohydrate, equals 2,000 Kilocalories (or Calories as used in human nutrition) of digestible energy. There are a number of other measures of energy used, but they are less easily understood.

2. Water

Water is an essential nutrient for all animals and is sometimes overlooked. While goats require less water than cattle, they do need water and require additional supplies when lactating or coping with hot weather. A 50 kg goat will require 5-10 litres of water per day depending upon diet, intake, and weather, toward the lower range in winter and toward the upper range in the hottest days of summer. A lactating goat will require an additional 1 quart of water for every 0.5 litre of milk produced. If a goat is producing 2.4 litres of milk at peak lactation while raising twins, 9.5 litres of water are required each day. If goats are eating green material, a substantial part of their water requirement can be met by water contained in the plant material. However, if dry feed such as hay is consumed, water must be supplied to meet the requirement.

Water should be kept clean to encourage intake. This usually involves regular cleaning of the troughs. It is important that the area around the trough not be muddy, as this is a good environment to spread foot rot and internal parasites. Placing some rock or gravel around the troughs can help keep feet dry and reduce disease problems. Water cleanliness is especially important for bucks on high grain diets. Their water needs to be shaded in summer and warm in the winter to encourage intake and reduce the risk of urinary calculi.

3. Carbohydrates

Carbohydrates usually provide the majority of energy to goats. Carbohydrates can be classified as simple, such as sugars (easily identified by their sweet taste; maybe 1, 2, or 3 sugar molecules ulinked together), or complex, such as starch (found in grains) or cellulose (i.e., fiber). Grass, forb, and browse plant species generally contain high levels of cellulose, which must be digested by rumen bacteria to provide energy.

Cellulose is often referred to as fiber, although the term fiber also pertains to other substances such as hemicellulose and lignin. Fiber in young plants may be highly digestible and provide a high level of energy, but fiber in older, mature plants is often poorly digested and may only provide half the energy of other carbohydrates. Fiber in the diet may be characterized chemically in several ways, such as crude fiber (CF), acid detergent fiber (ADF), and neutral detergent fiber (NDF). These abbreviations are used in hay analysis and may appear on feed tags. In general, the lower the fiber level, the higher the level of digestible energy. However, a certain minimum fiber level is required for healthy rumen function.

Goats do not adapt as easily to high concentrate diets as cattle and sheep and are more likely to get acidosis, founder, urinary calculi, and enterotoxemia. To avoid these problems, very gradually increase the concentrate level in the diet when placing goats on high concentrate diets and maintain a minimum of 12% crude fiber in the diet or about half of the diet as grass, browse, or hay. Goats are typically not feed efficient, except for some rapidly growing Boer goats, and may require 7 lbs or more of feed per pound of gain. Also, one must be very alert for health problems with goats on high grain diets.

4. Fats

Fats, also called lipids, are very high in energy, providing more than twice the energy of carbohydrate on a weight basis. The fat content of ruminant diets is generally low, as plants have a low fat content. Plant waxes are fats that goats consume as they graze and browse, but they are not digested. Fat may be added to diets to increase the energy content. However, high levels of added fat depress fiber digestion unless treated to be inactive in the rumen. These fat sources are termed “bypass” and may be used in dairy goat diets but are generally not used in meat goat diets.

5. Protein

Protein is composed of building blocks called amino acids that the body uses to produce all of the different proteins required for growth, production, and maintenance. Protein is required in the diet for accumulation of new body mass (growth) and for replacing protein lost by normal wear and tear.

Ruminant animals are usually fed supplemental protein to make up for dietary shortfalls. In the rumen, bacteria degrade much of the consumed protein and use the amino acids to form bacterial protein. Bacteria can also form protein from nonprotein sources such as urea and, if provided with sufficient energy, can form significant quantities of protein. To prevent breakdown and digestion by ruminal bacteria, some protein sources are protected from degradation by coating or other means. Some natural proteins are also resistant to ruminal degradation by bacteria. These types of proteins are referred to as “bypass protein” as they bypass digestion in the rumen. Other common terms for bypass protein are “ruminal escape” and “rumen undegraded.” Bypass protein sources are very important in dairy cow nutrition, but have lesser significance in most meat goat production systems.

6. Vitamins

Vitamins function as critical chemicals in the body’s metabolic machinery and function as co-factors in many metabolic processes. A deficiency of a vitamin will slow or block the metabolic process in which that vitamin is involved, resulting in deficiency symptoms. Vitamins are divided into those that are fat soluble (i.e., A, D, E, and K) and those that are water soluble (i.e., B vitamins and C).

Vitamin A can be synthesized from carotene, the pigment that gives grass and hay their green color. As long as sufficient green feed is consumed, vitamin A intake will be adequate. Vitamin A is necessary for normal epithelium (skin) development and vision. A deficiency causes many symptoms, including tearing of the eyes, diarrhea, susceptibility to respiratory infection, and reproduction problems. Vitamin A is often supplied to animals not consuming green forage such as in winter months. Many mineral and vitamin supplements contain vitamin A.

Vitamin D is called the sunshine vitamin because animals can synthesize the vitamin with the help of the sun. Ultraviolet light in sunshine converts pre-vitamin D found in the skin to a pro-vitamin D form that is used by the animals. Usually, even limited sunlight exposure is adequate to provide a days’ supply of vitamin D. Sun-cured hay contains Vitamin D. Vitamin D is necessary for calcium absorption and metabolism by the body. A deficiency of vitamin D, called rickets, results in lameness, weak bones, and bowed and crooked legs. The liver is the main Vitamin D storage site in the body. Vitamin D is normally present in mineral supplements and often added to complete feeds.

Vitamin E functions as an antioxidant in conjunction with the mineral selenium. The requirements for one can be partially met by the other. Thus, vitamin E is very important in areas with marginal or deficient levels of selenium. A common vitamin E deficiency disease, particularly in newborn or young animals, is white muscle disease, where white spots are seen in the heart and skeletal muscle due to oxidation damage. A marginal deficiency of vitamin E can depress the immune system and cause reproductive failure. Green grass and green sun-cured hay have high levels of vitamin E. Most mineral supplements and complete feeds contain vitamin E, especially in areas that are deficient in selenium. Vitamin E is expensive and minimal supplemental levels are used in contrast to vitamins A and D that are less expensive and often included at generous levels.

Vitamin K is technically required by animals and functions in the clotting of blood. Vitamin K is produced by bacteria in the digestive tract and absorbed. Generally, goats do not need to be supplemented with vitamin K.

7. Minerals

The inorganic nutrients are called minerals. Minerals are further subdivided into macrominerals, those required at 0.1% or more in the diet (macro means large), and microminerals, those required at the part per million (ppm) level (micro means small). A ppm is the weight of a paperclip in a thousand pounds of feed. A hundred ppm is equal to 1.5 ounces in a thousand pounds of feed. Macrominerals include calcium, phosphorus, sodium, potassium, chloride, sulfur, and magnesium. Microminerals include iron, copper, cobalt, manganese, zinc, iodine, selenium, molybdenum, and others. Minerals function in many ways in the body. Some such as calcium and phosphorus are major structural components of bones and teeth, as well as having other functions. Other minerals facilitate nerve functioning or fulfill a role as electrolytes. The mineral requirements for goats are not as well-known as they are for other livestock species and have often been extrapolated from sheep or cattle requirements due to a lack of studies in goats. As such, mineral recommendations for goats often have a wide range because of lack of accurate goat-specific information.

8. Macrominerals

The macrominerals are listed below, followed by the abbreviation, normal dietary range, function, deficiency symptoms, and major dietary sources.

Calcium (Ca) 0 .3 - 0.8%

The major biological function of calcium is for bones. Bones contain 99% of the calcium in body. Calcium is also necessary for muscle contraction, nerve conduction, and blood clotting. The main deficiency symptoms are seen in the skeletal system. Bones become soft and weak and may be deformed. Lameness can result. This condition is called rickets or osteomalacia. Vitamin D deficiency causes similar symptoms due to the role of vitamin D in the absorption and metabolism of calcium. Calcium is relatively high in milk and lactating goats need adequate levels of calcium for milk production. Does can get hypocalcemia (milk fever) while lactating due to a metabolic disorder which results in a shortage of calcium in the blood due to calcium being used for milk production. Urinary calculi is a condition brought about in part by an imbalance in the calcium to phosphorus ratio in the diet. Generally, twice as much calcium as phosphorus should be in the diet of ruminant animals. An excess of calcium can cause abnormal bone growth. Major common dietary sources of calcium include limestone and dicalcium phosphate.

Phosphorus (P) 0.25 - 0.4%

Approximately 80% of the body’s phosphorus is found in bones, with the remainder in the blood and other tissues. In addition to skeletal structural functions, phosphorus is essential in energy metabolism, acid-base balance, and is a constituent of enzymes and genetic material. The major symptoms of phosphorus deficiency include reduced growth, listlessness, unkempt appearance, depressed fertility, pica (depraved appetite-eating wood, rocks and bones), and decreased serum phosphorus. Phosphorus is the most commonly encountered mineral deficiency and also the most expensive macromineral. Sources of phosphorus include protein supplements, cereal byproducts, mineral supplements, and dicalcium phosphate.

Sodium (Na) 0.2%

Potassium (K) 0.8 - 2.0%

Chloride (Cl) 0.2%

All three of these minerals function as electrolytes in the body. Electrolytes are mineral ions, carrying a positive or negative charge that the body uses for osmotic balance, pH balance, and water movement. They are also essential in transmission of nerve impulses. These minerals are highly water soluble and are easily lost with diarrhea. Electrolyte solutions used to treat animals with diarrhea contain all three of these minerals. A deficiency of potassium could occur on high concentrate diets, with symptoms including poor appetite, urinary calculi, body stiffness progressing from front to rear, and pica (depraved appetite as described above). A deficiency of chloride depresses growth. A deficiency of sodium causes reduced growth and feed efficiency. Salt provides both sodium and chloride. Most forages have adequate levels of potassium.

Sulfur (S) 0.2 - 0.32%

The major biological function of sulfur is as a component of sulfur-containing amino acids. Therefore, sulfur is important in protein synthesis, milk and hair production, enzymes, hormones, hemoglobin, and connective tissue, and is a component of the vitamins biotin and thiamine. The major deficiency symptoms include poor animal performance, hair loss, excessive salivation, tearing of eyes, and weakness. Major source of sulfur is protein, which contains sulfur as a component of some of the amino acids. Therefore, sulfur is important in diets where nonprotein nitrogen (e.g., urea) is used to substitute for some protein. Sulfur-containing mineral blocks are often used for control of external parasites in goats. Excessive sulfur in high concentrate diets can contribute to polioencephalomalacia as discussed for the water soluble vitamin thiamine.

Magnesium (Mg) 0.18 - 0.4%

Magnesium is found in bones (60 – 70% of that in the body), liver, muscle, and blood. It is required for normal skeletal development, and nervous and muscular system functions, as well as for enzyme systems. It is also closely associated with metabolism of calcium and phosphorus. In ruminants, a major magnesium deficiency disease is grass tetany, often seen on fast-growing, lush, cool season pastures. Affected animals have low blood magnesium levels, exhibit a loss of appetite, are excitable, stagger, have convulsions, and may die. High fertilization rates, cool temperatures, and high levels of plant potassium and(or) rumen ammonia may contribute to the disease. A major supplemental source of magnesium is magnesium oxide. It is often supplemented on winter wheat pasture and mixed with a protein source to encourage consumption.

9. Micro or trace elements

The first level after the mineral name is what is thought to be the minimum requirement in the diet, while the second is the value above which the element can become toxic. Most supplemental trace minerals are provided by trace mineralized salt or mineral mixes that are designed to provide 25 to 50% of requirements. This is adequate if the animal's diet is marginal in a mineral but inadequate if that mineral is severely deficient. Unless a documented deficiency exists, it is best not to provide 100% of a trace mineral, because an excess of one mineral may depress the absorption of another creating a deficiency. Excess supplementation of some minerals can cause toxicity problems, especially with copper and selenium.

Iron (Fe) 50 – 1000 ppm

The major function of iron is as a component of hemoglobin, required for oxygen transport. It is also a component of certain enzymes. The major iron deficiency symptom is anemia. Anemia can also be caused by blood loss due to several factors, including injury, internal parasites (barber pole worm or liver fluke), and a bad case of external parasites such as lice. Iron is stored in the liver, spleen, and bone marrow. Milk is very low in iron; therefore, kids raised for a long time on milk alone will develop anemia. Soil contamination on forages can provide significant levels of dietary iron. Iron sulfate is a common means of adding iron to the diet. Forages in some areas have excessively high levels of iron that suppress utilization of other trace minerals

Copper (Cu) 10 - 80 ppm

Copper is essential in formation of red blood cells, hair pigmentation, connective tissue, and enzymes. It is also important in normal immune system function and nerve conduction. Deficiency symptoms include anemia, "bleached" looking (lighter color) and rough hair coat, diarrhea, and weight loss. Young goats may experience progressive incoordination and paralysis, especially in the rear legs. High dietary molybdenum can depress absorption of copper and cause a deficiency. There should be at least four times as much copper as molybdenum in the diet.

Cobalt (Co) 0.1 - 10 ppm

The only well accepted biological function of cobalt is as a component of vitamin B12. Rumen microbes utilize cobalt for growth and produce vitamin B12. Cobalt deficiency symptoms include loss of appetite, anemia, decreased production, and weakness. Most natural feedstuffs contain adequate levels of cobalt.

Zinc (Zn) 40 – 500 ppm

Zinc is found in all animal tissue and required by the immune system and for normal skin growth. Zinc is also essential for male reproduction. Deficiency symptoms include dermatitis (thick, dry patches of skin), hair loss, skin lesions, swollen feet, and poor hair growth. The bran and germ of cereals contain high levels of zinc.

Manganese (Mn) 40 – 1000 ppm

Manganese is important for bone formation, reproduction, and enzyme functioning. Deficiency symptoms include a reluctance to walk, deformity of forelegs, delayed onset of estrus, poor conception rate, and low birth weight. It is unusual to have a manganese deficiency.

Selenium (Se) 0.1 – 3 ppm

Selenium functions with vitamin E as an antioxidant, protecting cell membranes from oxidation. Selenium also affects reproduction, metabolism of copper, cadmium, mercury, sulfur, and vitamin E. Deficiency symptoms include poor growth rate, kids being unable to suckle, white muscle disease (cardiac and skeletal muscles have white spots), sudden death by heart attack, progressive paralysis, and retained afterbirth. Selenium is deficient in many areas because of low soil levels (geological factors); however, there are a few regions of high selenium soils leading to high the toxic levels in plants. Toxic levels of selenium cause shedding of hair, diarrhea, and lameness. Most plants that are not grown in selenium deficient soils will have adequate selenium levels. It is more effective to provide selenium supplementation through feed than by injection.

Molybdenum (Mo) 0.1 – 3 ppm

Molybdenum deficiencies are very rare. Toxicity occurs above 3 ppm due to reduced copper absorption, resulting in a copper deficiency. The copper level must be four times the molybdenum level to overcome this effect. High dietary levels of molybdenum are usually related to soil content. Molybdenum (as ammonium tetrathiomolybdate) is often used to treat copper toxicity in animals.

Iodine (I) 0.5 – 50 ppm

The only proven biological function of iodine is as a component of thyroid hormones that regulate energy metabolism and reproductive function. The major iodine deficiency symptom is goiter - a swelled or enlarged thyroid gland in the neck. This should not be confused with the thymus gland in the neck on young animals (the thymus gland is especially pronounced in Nubian kids, but shrinks after several months of age). Also, iodine deficiency causes reduced growth and milk yield, pregnancy toxemia, and reproductive problems such as late term abortion, hairless fetus, retained placenta, and weak kids.

The energy and protein requirements of goats according to Australian standards

Information for these tables was sourced from: McGregor, B. (2003). Nutrition of goats during drought. Rural Industries Research and Development Corporation. Greenwood, P. (1992). Dairy Goats: Nutrition. Agfact 7.5.5. New South Wales Agriculture.

11.1. ábra - Table 7: Maintenance requirements

Live weight (kg)	Energy requirement (MJME/day)	Protein (g/day)
10	2.27	33.00
20	3.82	55.00
30	5.18	74.00
40	6.43	93.00
50	7.60	110.00
60	8.71	126.00
70	9.78	141.00
80	10.81	156.00
90	11.80	170.00
100	12.78	184.00

NB: the above figures are for goats in confined areas ie. minimal activity.

Assuming an average lactation length of 12 weeks, with a doe producing an average of 1.5 kg milk/day with a milk solids test of 9.5%. If you are a dairy producer, you may require figures for a range of production scenarios.

10. Dairy Goat Nutrition

Feed costs account for more than 55% of dairy goat production costs. As a result, many producers have become engrossed in reducing costs to feed a goat per day rather than optimizing their feeding efficiency. The cheapest ration is not usually the most production-efficient ration. This statement may sound like a contradiction, but relates to the understanding of how the goat and her rumen interact from a nutrient requirement perspective. The dairy goat, like other ruminant animals including the cow and sheep, has a unique digestive tract that allows the animal to consume and utilize fibrous foods which otherwise would be unavailable to nonruminant animals. This ability is the result of a symbiotic (i.e., mutually beneficial) relationship between the goat and billions of microorganisms that inhabit the rumen or pregastric compartment. Bacteria and protozoa that inhabit the rumen have the capability to ferment material, which would be indigestible to the goat alone, and produce end products used to produce high quality products such as meat, milk and mohair. Dairy goat producers need to take full advantage of this goat-rumen interrelationship in order to produce milk most efficiently. In addition, feeding both the goat and rumen properly will result in a healthier animal overall. If you are not taking advantage of the rumen, then you might as well be feeding pigs! The focus of this presentation is to acquaint you with a conceptual approach to nutrient requirements of the dairy goat and her rumen and how they are appropriately met in an effort to produce milk as efficiently as possible.

12. fejezet - 14. Behaviour and treatment of sheep

The basic movements of the sheep are the following:

- movement,
- position,
- location

Experience has shown that human activities within the stables can decisively manifestations of the animal, for example: eating animals is not possible, but time is crucial to the fodder of motion.

1. Mother-lamb relationship

In today's varieties twin calving rate while increasing the possibility of a relationship with the mother of the lamb is not formed. The ethology of the mother-lamb relationship formation introduced the concept of the critical period. The mother-sheep relationship development and communication takes place through the senses. Some authors of the smell, the sight of others, and still others emphasize the role of the hearing. The formation of the first mother-lamb relationship, the key elements of the licking of the foetal coating the mother of the lamb's head start. It usually gets up at the end of the lamb, and the first attempt to breastfeed. If the mother licking off the lamb and allow at least 20 minutes to suck, you will not allow yourself to strangers lamb. The first breastfeed should be done within 12 hours. If omitted, "the lamb's mouth gets cold." Mothers have a couple of days after calving is about 10m lambs also recognize his voice.

It is to be expected, however, that even make 20's group also intended to be a mother-lamb pairs, which do not develop a relationship. These are the number of twin-calving rate of growth increases. The age of the mothers and lambs in natural condiloosen the connection is secure. The "nursery rearing", reducing the number of nursing opportunities can accelerate the process. The maternal behavior of sheep and analysis of the interactions between age and closeness of the relationship between negative relationship has been established.

2. Sleeping

The sheep does not have deep sleep. Arrested during sleep eyes, relax muscles supporting the head, the head and the ears are drooping. Sleeping is divided into two sections, deep sleep – it is all 10% of sleep time - sleep and superficial. The absolute time is of the deep sleep 1-1.5 hours.

3. Position

The adult sheep is standing in the pasture or in the barn half of the day as well. Food intake is mostly done while standing, it is particularly characteristic of pasture grass recording. Healthy animals (except foot fault, mouth, smelly lameness) during the intensive grazing always available. If you are not feeding the sheep while recording, you will definitely sick.

4. Learning Support

The sheep in the most professional hands-on experience during the treatment. Maybe this is too simple for many people, but the sheep is much more tiring mistreatment of people as a working professional. Many times arthritis and other aches and pains of improper work, which is the job of the shepherd can force people to leave.

5. Defecation

The sheep faeces emptied 6-8 times per day, peak to be held for two hours after eating, and after 3-4 hours reduces the rate of excretion.

6. Calving behaviour

Parturition in sheep falls mostly in the early hours, but in terms of the frequency of the second peak between 15 to 20 hours talk time too. Parturition approached, the sheep belly down, the stern sinks, redness and swelling of the vulva, udders stretched and becomes plump. Typically, the animal's behavior has change. Moving more cautiously, but less than staying in one place, constantly seek. The preparatory pain will begin when the vaginal mucus leaves. The preparatory contractions began, the mother is nervous, get up, lying down, looking. The siting of the sense of smell and vision is to help; favors - if not calved boxing, going to the lake was littered - the smooth, low lit places. The selected location is not farther than 1-2 meters away. May push for 10-30 minutes of pain, their length greatly influence the animal's age. The age of the animal can greatly pains, giving voice, giving birth rate during standing and lying down too. Expulsives of the dam before the beginning of his fellows, and is separated from the first leg of arranging the stage, and then the selected area from different directions several times lying down, is located. Twins born between 1/2-1 hours apart. In this case, open the birth canal due to increased hygienic requirements. The after-pains section, which makes up 1.5 to 2.5 hours, you spend your other life activities in order sheep. One minute after birth the mother gets up and starts cleaned the lamb. The sweepers, licking the head always moves backwards and start moving. It is very important for maternal behavior, because it was poor in 15-20% of causes of mortality in lambs. The lack of lambs up about 20-25% of the responsibility for caducity. The longer gestation period is usually the mother and lamb depletion, therefore, lead to unnatural behavior.The modern varieties are generally poor maternal behavior and poor parental care instinct characteristic of hours and this technology should be considered. The mother's postpartum behavior of the primary water intake and frequent, but short-term feeding-stage process.Powerful immobility (hypnotic state) is reached. This condition is often caused by when the animal is implanted in the rump, or turn the page on earth. Many methods have been studied in relation to how this situation could cause and how we can provide. Until now, the most effective is the method that has proven to turn the animal on its side, slightly wrapped his ears, and his eyes were covered as well. In such cases, the animal will remain lying on its side for a few minutes. Behavioral parameters of traditional and industrial conditions. Farm animals are the sheep of the species, which mostly lives in the original living conditions, produce. Crucial part of the life of the sheep in the pasture, or even a traditional barn filled. No other species, wherein the sexual behavior (due to conventional) would be a significant, such as a sheep. Large group of key factor keeping the mother-sheep, ram, the relationship between the mother and the development - natural conditions, the possibility of a smooth - provide. However, the sheep breeding evolved the industrial commission forms of production stages, such calving of the sheep rearing and fattening. The same change in housing technology element to be considered in grazing conditions change, the mechanization of milking.

7. Feeding

The sheep feed intake during chewing is usually superficial, and the number of chewing movements depends on the quality of the feed. Forage feeding for 55, 80 intake of grains, grazing on grass type and size varies from 30 to 90 depending on the number of minutes of chewing.Time for feeding sheep breeding in the barn for 24 clock of 17-25%. The 4-6 hours consumes 20 to 30 times the feed. It was observed also that the dose had a positive effect for the duration of eating and speed of the recording even more so symbol rate and duration as well.Poor pasture additionally fed fodder for a minimum of 16 cm food tray length required to be made available to all the sheep to feed. If no adverse dominant fight shorter trough, but the non-dominant individuals gradually become non-eaters. The fat lamb with the current technology, only concentrated fodder consumed by different eating habits. The number of participants (29 to 52) and the size of the space (0.4 to 0.7) 50 to 80 days, depending on the changes between 11.8 to 17.7% of the time spent eating, and this value is between 80 to 120 days 7, ranged from 9 to 14.9%, but there was no correlation between food intake and the duration of the fattening results. The lambs are housed in medium and high quality nutrition for 30 and 28% individually outperformed their counterparts on fattening performance of position. Presumably, the candidates imitative skill group on hold due to multiple food intake and thus the greater weight gain. The group size, capacity, size of the feed, the feed structure, other environmental factors may influence the time of food intake. The optimum effect under the cold at 5 ° C increases the speed of feeding the same time reference, and then decreases, however, the time and the speed as well. The 30 °C hot decreases the like eating, appetite, such as sheep performance.

Race preservation of forms of action

1. sexual behavior,

2. calving behavior,

3. maternal care, and the mother's relationship with the lamb,

4. the lamb for mother's insistence.

8. Milking behaviour

The sheep can milking with hand and machine milking. In many cases, the milking mothers voluntarily move towards the milking, but more often is needed to drive the animals are dogs. This has a negative impact on the delivered milk: dairy animals the nervous release of neurohormonal regulation is impaired, the amount of milk decreases. It is also a negative role in the behavior during milking, because the animals are disturbed milking harder, more moving.

The machine milking behavior of the two major advantages compared handstripped:

1. milking space voluntary movement of the sheep,

2. the individualized feed consumption calms the mother's responses during milking.

The parallel milking stall every point of view improvement was the carousel machines. The sheep for two or three days to get used to the machine, milking machine and 48-station even if only two or three individuals can not find a place in the milking space. These milker must be individually set into place. The carousel machines, changing the order of better care for mothers, which cast a negative impact on the quantities of milk. The rotary motion of the motor can interfere with mothers, and milking potential is greater.

9. Watch

The sheep stimuli from the environment is always looking in the direction from which the stimuli are detected. The visual observation while hearing a very significant role, which is the primary stimulus localization enjoys. The monitor is always a group activity, a single indicator of an animal you move the others take up position monitoring.

10. Paddock

The lower body is controlled by the movement of sheep, animals on the basis shoulders moved forward or backward. If you move back and your knee tightened, the animal moves forward. The tail can also induce twisting to move on the front. Larger mammals move forward you can prevent that we will hold your hand under the chin, and if necessary, turning his head and feet neck. On the hind leg set, we can paddock backwards the sheep. Once in the hind legs, the first reason, the chests clamping legs (Fig. 76).

11. Game

In general, the lambs occurring behaviors. That included player running in the barn, fighting, breaking the front. Running on the grass is an economic problems for lambs (high energy loss), so the lambs, if the mother can not be released into the pasture, each case must be taught to older control animals for grazing. There are many problems in fattening lambs, feed intake and rumination time shortening - the concentrated, poor nutrition due to the liberation of fiber spend time playing. The playing with the feeding apparatus is 20-25% rate. By the adult sheep player behavior is usually not seen.

12. Signal – alarm

The audio signals are different. Characteristics are summarized as follows:

M-m-m-m-m = mother called lamb.

Bé-é-é (crying sound) = sheep looking for his mother.

Growling, deep, choppy voice call = sex.

“Möszögő” volume of the head at the same time moving the indicator = danger.

13. Sheep vision

The sheep do not perceive their environment as well as humans. Her eyes are located on the side of the head, so nearly realizes the whole space around them without having to turn his head. Rear approx. 30 ° "blind spot" is. A sheep narrower depth perception to facilitate three-dimensional field of vision than humans. Flanked not deep detection, there is only one eye perceive. This explains why when lateral viewing area in a sudden strange objects appear, they are frightened they. Origin by definition, the sheep prey species, constantly monitors the environment for threats on see so wide-angle vision is very important. Whilst the moving dog is up to 1000 m distance, response, while a move lute not notice because you do not see any detail, as humans.

14. Catching Sheep

It is easier and safer for the sheep to catch if from behind a "blind spot" from approaching. Easiest is a small, enclosed area to catch the animal, with just enough space to the shepherd to move freely, but not enough to make the sheep the same post. If this area is too large, it is to be kept to the animal. the set must many ways as possible, but the most effective and the state of the safest, if the head inherently obtained the under the chin, two hands or hook-like cane which Western Europe has also adopted methods. The habit of the animal's skin, woolen grip because the skin can cause injuries (wool descend), which could reduce the carcass quality and lower quality category. Especially immediately before slaughter causes this is a big problem. Animals, which have horn are more difficult and dangerous under the chin with two hands. In this case, the hook-like cane can be used. Alternatively, it may be the sheep back foot catch and raise, but of larger animals, a strong physique and feet is required. If the sheep have stopped the fight, first in one then it will be the other horn. Hook-like cane of, which should catch the sheep leg, in many cases, mastitis and leg injuries.

15. Sheep movement

The movement of sheep, characterized in that

- move faster on the flat than uphill, uphill and moving faster than leaving it,
- • usually stop and assess changes in the environment, when a group in front of a moving vessel,• stop immediately after looking down at the ground, if there is enough space to move the head,• turn back from the edge of the pocket,
- rears, when he sees the pit below,
- dead-end street stops, turns around and around. 3 m fromtheend ofretreats,
- water is not willing to go that deep, or the animal does not know the depth of
- while trying to escape squeeze oneself into gaps with their body.

16. Contact modes

The sheep interact with one of the characteristics of collective behavior. This is most important of the mother-sheep relationship. The larger group of adult animals (cattle), smaller units may occur, but they are loose and often temporary groups (some of pasture grazing animals separately). The connection between the visual and the audio signals to be held. The first-time mother after giving birth to lambs by smelling the field.

17. Rumination

The rumination before the animal stretches out his neck, and swallow a little saliva. This makes esophagus scabrate. Then a closed glottis inspiratory movement performed under deep, chest expansion in creases the negative pressure in the chest cavity. Expansion of the esophagus, and then get a piece of the esophagus, the stomach and then closes the mouth. The coarse feed stimulates parts of the esophagus lining.

Then, with about 100 cm/sec speed the wall antiperistalsis means at the mouth of the hopper reaches. Then the choice of the animal bite to 15-20 g 80-100 chewing motion 40-60 seconds again chews, and then swallow it.

This came back to bite harder, deeper parts of the rumen is why, while the food on the reticulum by another dose into the stomach.

The rumination is usually 0.5 to 1.5 hours after eating to begin with, but there are large individual differences. Of rumination between 6-10 seconds between cycles. Of rumination periods of 20-25 minutes. Daily rumination 10-12 period can be calculated one day. The rumination usually takes longer than the time of food intake, usually a quarter of the day.Should be designed to feeding technology, the feed structure that rumination, feed intake, rest ratio is correct. The roast lamb fattening technologies examination, it was found that the time spent ruminating was not more than a case of 4%. The lack of function of the rumen rumination led acidify.

18. "Tracking" behavior

The sheep "tracking" type of social species. After birth the first hour when walking begin the lambs, large moving object - usually the mother - move towards, and follow the recommendations. Yet adult animals will follow those people who are sheep when they fed them.

19. Critical period after birth

The length of the critical period in relation to the literature gives very different opinions. Some scholars believe that the first ten minutes of the final period smell round, otherwise it can not accept a female lamb. Other authors from 1.5 to 2 hours is needed in the relationship development. 30-40% of twin-calving rate in the group of 12-24 hours should barn lambing the "drift" without a relationship.

20. Effect of the presence of the dog

The area was fenced sheep learn how to respond to the dog. In contrast, technology is not acclimated animals disperse when they are trying to dog gatherings. The group reflected a sheep trying to minimum distance (escape distance) to keep the dog, and respond accordingly approached. The distance between one sheep escape and keeps the group together. When you can not get away, can be expected to turn to face the dog next to him or run away to avoid the fenced. The domestic sheep dog and human proximity effect of group reflected. Once this is done, it is easier for herding. It is much easier to move in a flock like sheep from a few isolated. However, a well-trained dog or two persons to facilitate segregation. Easier to corral the entire flock herd, even when only a few sheep we require.

The dog or the human situation, posture, movement and sound of these affect the response of sheep.

In order to provide dogs with the best performance, the best work is done with new tricks, develop a regular printing, and they must be constantly managed.

21. Bondage

The sheep in the supine position may be maintained if the front or rear legs fixed. As an effective and inexpensive method if a rope is fixed to the rear legs. The sedentary sheep, we impose the rope above the hock create a loop in the other end of the rope on the neck we take. In this situation, the sheep lay down the ground. In some cases, you will also need to adjust the rope so that the animal is resting comfortably. The slope of the head should be facing upward toward the rumen gas can leave.

22. Shear during treatment

The sheep shearing forces must be reduced or completely between each shear technologies must be disconnected. The sheep are possible, a position to be clipped, which is the most convenient and sheep, and for the shear. I always had very squeeze-track feet, but constantly changing body position must be maintained, however, that care must be taken that the Bondage of suppressed blood flow to parts of the body undisturbed. Otherwise, the sheep restless, nervous and constantly moving. During movement of the hand and machine shearing of the damage is also common. The damage done by growing at a false-insignificant wool fiber is worth the wool industry. After shearing, the sheep are separated clipped "coat" of their peers.

23. Anxiety-reducing factors

Be reduced by the unrest: the proximity of the other sheep, low-frequency sounds, such as the mother's voice or the rams' courtyard located in "low intensity lighting. Note that the only peaceful rumination circumstances.

24. Sexual behaviour

The ram is a 20-40 minute walk around the small group of ewes, practically under control keep their sexual status. The ready for servicer explicitly recognized by the pheromone. The semantics of the salivary sheath ready for servicer not be attractive for. The smell, the blind rams are very well informed. The initiative, however, rather female starts. These are in addition to looking for the rams, and actively stimulate also typically bumping his head or the stern. The hedged waiting the ready for servicer the specific behavior of sheep, a ram as a ram's head while standing over shoulder standing stretch.

The ram is the preparing genital mating control (sense of smell, lick) begins. Continuation: step with the front leg, shoulder and breast to jostle shoulder. Possibly the head of the ram in the wrong drive along the shoulder of the nut is jostle. All of these sounds are heard during a typical. The ready for servicer mother sniffs the urine stream, according to tasted, and the strong reaction smell reflex tucked upper lip grimace. The following features, the jump in front of the ram, one front leg taken over the three ready for service maybe then jump follows the movement of the trunk cover, but also intro mission (the introduction of the penis) without. Intro mission the next jump is created only when some lightning-fast barely visible after the scrubbing action of the strong body bending (shock, escape) the ejaculation happens.

The game can only be described pre-mating event occurs when semen is collected and hand mating is generally lacking. In this case, the ram is "ado" without jumps, and push off very quickly. Estrous the average time is usually six mating occurs.

The timing of insemination in sheep does not seem to be relevant. The sperm capacity of living of sexual roads make for example is 24 hours. The conception about the same result if the start of oestrus insemination after 4 and 36 hours. Only the earlier and later reduced to conception after insemination, 48 hours after the onset of estrus and insemination has no meaning.

25. Sucking

The newborn lambs, as it can stand, turning his head toward the mother. Finding the udder is a difficult task, usually only the mother can take place. The mother sheep facing stern, rear lifted his head upward to help sheep. The experiments of the sucking are 60-65% successful. The successful expansion of the dairy sheep under tail-wag we experience. The twin lamb suckling characterized in that the selected from a half-udder occurs in 85-90% of cases. The number of the sucklings that the sheep need the correct amount of food intake, but this is in cattle guaranteed. The first 24-hour clock of 20 use 24 to 28 times the sucking lamb. Make within the first day of the birth weight and the daily temperature from 80 to 100 per day depending on the occasion also gives some nursing literature. It can be concluded that 28 have a few days of breastfeeding for the number corresponding to educate, feeding when it is not worth delaying weaning.

The great different of the ages simultaneous rearing of lambs caused great concern for "theft of milk." Lambs of 6-7 weeks, which weighs 16 to 18 kg of milk suckling from the younger lambs. "Milk theft" always takes place from the back. The dairy sheep stealer droppings brow always will be identified. The mother can hardly protect herself from theft. The breast are highly dependent on the number of lambs suckling activity. It can be observed that hunger can only be a positive for some time sucking activity, later in the suckling lamb and suckling finding the udder activity decreases rapidly. If the first blow job is not done within 12 hours, you can "cool down the lamb's mouth," and dies.

26. Social ranking

Sheep can not be experienced competition, if the environmental conditions (feed, land) are sufficient. However, the sheep also develop dominant lines, but these are not great economic importance. The development of social ranking on body weight and height of the hock joint is involved. Other observations that only affects the aggressiveness of the individuals in the group. The individuals, who have horn are well ahead in the social ranking. The feeding is insufficient, the dominance of individuals in order not to fight back in their place, but gradually become hunger. A new unique behavioral characteristic of social inclusion is not too difficult, but the mixing of different breeds in a pasture of flocks is very long process.

13. fejezet - 15. Grazing Management for Sheep Production

1. Sheep behaviour in grazing

Ruminant animals graze wherever and whenever forage is available, therefore, a producer can say that he does practice "grazing management". Grazing occurs either by design, when controlled by a knowledgeable manager, or by default, when animals are allowed to graze on their own without regard for plant and animal requirements. A livestock producer must visit his pastures frequently, not only to check the animals, but also to check the forage. This allows the producer to monitor what is happening with the pasture and to anticipate and correct any potential problem before it results in reduced livestock performance.

A grazing management plan must be designed with both plant growth and animal performance in mind. For long-term sustainability, there must be a balance between plant and animal requirements.

Plant growth is maximized when they are "harvested" (or grazed) at maturity, but at that point the forage quality is low and animal performance may suffer because the nutritional needs of the animal are not met.

Animal performance is maximized if the plant is grazed while it is actively growing (i.e. producing high-quality feed), but repeated, uncontrolled grazing will result in animals selectively consuming the highly nutritious and palatable plants while leaving the unpalatable ones. Over time, this will cause the disappearance of desirable plants (called decreasers) and the predominance of less desirable and undesirable ones (called increasers and invaders).

2. Sheep Grazing Patterns and Behaviour

Grazing animals are looking for green plant material. Their first preference is new green leaves. When new green leaves are not present, the animals will eat older green leaves, followed by green stems, then dry leaves, and finally dry stems. Grazing animals are also looking for plants that they consider palatable. Sheep have narrower mouths and more flexible lips than cattle; therefore, they can be more selective in their grazing by taking individual bites. Ruminants swallow their food as soon as it is lubricated and after they have consumed a certain amount, they ruminate. Cattle usually graze for four to nine hours a day, and sheep and goats for nine to 11 hours a day. Animals usually graze, then rest and ruminate. Sheep rest and ruminate more than cattle: seven to 10 hours a day as opposed to four to nine hours a day for cattle.

- Sheep can graze rugged terrain more easily than cattle.
- Sheep are reluctant to graze areas that have natural predator cover.
- Sheep may walk from three to five kilometres for water (depending on topography). The distance they have to travel has a significant influence on production. The greater the distance to water, the more energy and time is needed to satisfy the sheep's requirements.
- Sheep need from 7.5 to 10 litres of water per day.
- Livestock seek shade and cool locations during hot summer periods, which may result in excessive grazing under trees and in riparian areas.
- Livestock usually overuse dry southern exposures early in spring and then switch to riparian and shaded areas during hotter times of the year. North facing slopes usually remain underused.
- Sheep have a strong flocking instinct and maintain social spacing and orientation in pens as well as pasture. Breed, stocking rate, topography, vegetation, shelter and distance to water may influence this instinct, but isolation of individual sheep usually brings about signs of anxiety and may cause the sheep to try to escape.
- Sheep tend to "follow" one another even in activities such as grazing, bedding down, reacting to obstacles and feeding.

Some pasture characteristics that influence how close actual intake gets to potential intake are listed below.

- Forage Selection. Grazing animals are very selective in what they eat. Their choices are influenced by the presence of secondary compounds (phenolics, volatile oils), plant morphology (such as thorns and thick cuticles, dried "stemmy" material) and past grazing experience. Sheep tend to avoid the older seedstalks or "stemmy" grass. An increase in the number of seedstalks in a pasture will reduce the sheep's grazing intensity; however, when seedstalks are removed (such as by cutting during the previous fall), sheep's preference for the non-stemmy forage increases.

- Preference. An animal's forage selection is more a function of its past experience than its breed. Grazing is an acquired skill, which is learned at an early age. This means it is possible to train an animal to consume certain plants, such as leafy spurge, for vegetation control.

- Palatability. Livestock select food that has the most pleasing texture. They also choose familiar foods. Green material is preferred over dry material, and leaves over stems. Palatability is affected by fibre content, bitterness or sweetness, water content and plant abundance.

3. Understand Forage Growth

Plants obtain their energy from sunlight by producing carbohydrates through photosynthesis. In order for pasture to remain productive and provide a steady source of grazing year after year, the grass must feed itself first before providing feed for animals.

Photosynthesis produces carbohydrates, which the plant uses for growth, maintenance, storage and reproduction, in that order. In plants, growth is the first priority for any available carbohydrates. If the green leafy areas of actively growing plants are repeatedly removed or consumed (grazed, clipped or mowed), the plant will use its energy (mostly stored from previous production) to continually replace the leaves. If the plant produces more than enough carbohydrates to meet its growth and maintenance demands, then the excess is stored for later use. Since growth takes priority over storage, repeated defoliation (e.g. heavy uncontrolled grazing) during the growing season will seriously deplete a plant's stored carbohydrates, leaving very little or no energy for reproduction. This gradual weakening of the plant is the basis for using grazing or mowing as a tool for weed control or vegetation management.

It is important to note that carbohydrate storage increases when the growth slows and the leaf area is large. Conversely, storage decreases when leaf area is small and growth is fast. Perennial plants must have sufficient stored energy to survive the winter, initiate growth in the following spring and recover after complete defoliation. Defoliation occurs as a result of grazing but also as a result of clipping and mowing, disease and insect outbreaks, and frost and hail. In order to maintain a long-lived and vigorous perennial forage stand, adequate levels of carbohydrates must be maintained. This can be done by:

1. Delaying defoliation or keeping early defoliation periods short;

2. Allowing adequate leaf area to remain after defoliation;

3. Allowing adequate time between defoliations to permit the leaf area to regenerate and carbohydrate reserves to build; and

4. Leaving adequate residual leaf area and time late in the season to permit carbohydrate build-up and bud development.

Rotational grazing is most necessary on perennial pastures, especially if several forage species are mixed together in the pasture. Without rotational grazing, sheep can selectively graze the plants they prefer and avoid others. Over-grazing soon weakens the preferred species and they are soon crowded out, leaving only the less desirable plants for future grazing. Rotational grazing forces sheep to consume all species more or less equally, and gives all grazed plants time to recover and regrow while sheep graze other pastures.

4. Grazing Management Principles and Planned Grazing Systems

The traditional herded system (where the flock is herded and bedded in an open area near the shepherd's mobile camp) is most suited to large tracts of land that are grazed only once per season for a short time. Herding is not often used in Saskatchewan. The system of choice for Saskatchewan sheep producers is confined (fenced) grazing, which requires planning to manage and control the areas where the sheep are permitted to graze.

Fences, water developments, the strategic placement of salt or mineral supplement and herding can result in more uniform livestock distribution on a pasture. Grazing systems are designed to control the timing, intensity and frequency of grazing.

Over the long-term, a successful grazing system the followings should do:

- Balances livestock numbers with the forage supply;
- Uniformly distributes livestock over the pasture and reduces selective grazing;
- Alternates periods of grazing with periods of regrowth. (Regrowth must occur during active growing periods to be effective.);
- Maintains a healthy plant community with a desirable distribution of species and plant age classes;
- Avoids damage to grazed plants when they are most susceptible;
- Maintains healthy watersheds and soil;
- Meets the physiological needs of grazing animals;
- Maximizes livestock gain per acre;
- Uses methods that are environmentally sound, practical to implement, simple to operate and flexible in case of unforeseen circumstances; and
- Addresses the needs of the entire ecosystem, including plants, wildlife, domestic livestock and soil.

Range improvements and grazing systems attempt to control livestock behaviour. Range management can be defined as the art and science of manipulating, using and conserving grazing land resources, while maintaining ecosystem integrity. The four basic principles of range or pasture management lead to increased livestock production, improved watershed and ecosystem stability, and long-term sustainability. They are:

1. Graze range or pasture at the right time of year and to the right degree;
2. Leave adequate leaf area for regrowth to ensure the restoration of individual plant vigour;
3. Allow adequate "rest" for the forage in your pastures. Livestock should be kept off the range for a period during the active growing season to allow adequate regrowth for next year; and
4. Control livestock distribution and access to minimize selective grazing and prevent excessive regrazing of plants.

These principles are fundamental to the wise management of grazing resources, and are applicable to both tame and native pastures. Grazing can cause long-term harm if these principles are not followed. Poor management will lead initially to reduced plant vigour. Continued poor management will cause the loss of valuable forage plants, drought resistance, ground cover and range productivity. Ultimately, the condition or health of the range will deteriorate to such an extent that animal weight gains and productivity are affected.

5. Multi-species Grazing

Grazing a variety of species on the pasture, either simultaneously or in sequence, can be used to distribute grazing pressure, maintain or improve plant diversity and diet quality and spread economic risk. Also, the effects of multi-species grazing can be duplicated by grazing two groups of the same species, which have different nutritional requirements, as determined by their class and stage of production. For example, lactating ewes with lambs should be placed on the highest quality pasture available to promote desired levels of milk production and lamb growth. Dry, non-pregnant ewes or ewes in early to mid-gestation should be placed on lower quality forages or serve as second grazers behind young, growing lambs. Strategies that match stage of animal production with type and quality of forage improves overall forage utilization while maintaining optimum animal performance.

Producers should keep in mind that different animals prefer different forages, as shown in Table 17 (Taylor, 1981): According to his observations, the cattle diets consist primarily of grass. The sheep tend to prefer forbs to grass and browse. Goat diets contain large amounts of browse compared to cattle and sheep diets.

13.1. táblázat - Table 17: Relative proportions of grass, forbs and browse in the diets of cattle, sheep and goats

Kind of Forage	**Cattle**	**Sheep**	**Goats**
Grass	60%	40%	20%
Forbs	20%	40&	30%
Browse	20%	20%	50%

Source: Taylor, C. A. Jr. 1981. Optimal use of range with mixtures of livestock . pp. 166.175. In White, L. D. and Hoermann, L. A. (eds.). Proceedings of the International Ranchers Roundup, Del Rio, TX. Texas Ag. Ext. Serv., Uvalde, TX 434 pp.

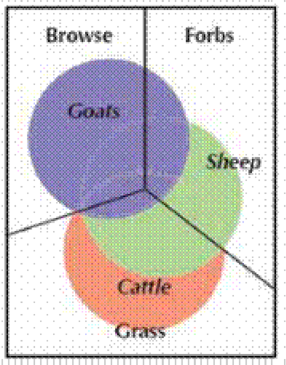
Because of the different dietary preference, mixing kinds of livestock under certain conditions is possible. However, the forage source must have the necessary diversity and production for the animals to meet their dietary preferences. For example, cattle and sheep will compete if grazed together in a predominately grass pasture. However, they will complement each other if grazed in a pasture with a high proportion of forbs and browse. Whatever the forage source, grazing cattle and sheep together will place increased management requirements on the operator. The fencing and other infrastructures needed to handle the two kinds of livestock are different. The herd health issues (recognizing, treating and dealing with sick animals) will also be different.

Making use of combinations of animal species in a grazing plan can benefit the range resource, the grazing animals and the producer:

- Small ruminants can control and utilize plants that cattle will not or should not eat.
- By grazing taller, courser forage, cattle can provide sheep better access to the short, tender regrowth.
- Multi-species grazing may spread the economic risk between the commodity prices - at any given time, one species may provide better returns while the other is not as profitable.

The disadvantages of multi-species grazing are the increased need for fencing, water distribution and storage troughs, handling facilities and management skills. Access to and knowledge of the markets for more than one species may also constrain multi-species grazing.

13.1. ábra - Figure 13.: Differences in grazing of cattle, sheep and goats



6. Bloat

Bloat occurs in ruminants when gas produced during fermentation becomes trapped inside the rumen rather than being expelled through eructation or belching. The resulting rumen distension can exert pressure on the animal's respiratory and circulatory systems to the point of death.

7. Management to lessen problems with bloat

Bloat can be reduced through the following pasture management methods:

- Plant pastures so that no more than 50 per cent of the forage mixture is alfalfa or clover.
- Consider planting non-bloating legumes such as birdsfoot trefoil, sainfoin and cicer milkvetch (AC Grazland is an alfalfa variety that can reduce but not eliminate bloating).
- Fill up animals on dry roughage or grass pastures before turning them out onto legume pastures. A hungry animal may overeat when given access to fresh pasture and develop bloat.
- Move the livestock onto alfalfa at mid-day instead of the prime grazing times of morning or evening.
- Minimize bloat by turning animals onto alfalfa that has reached the bloom stage or later. The more mature the alfalfa, the less the risk of bloat. Once alfalfa has flowered, the risk of bloat is greatly reduced.
- Bloat also appears to be more prevalent if the animals eat only the upper portion of the plant, which is high in rapidly degradable protein. Grazing animals at a high stocking rate will minimize this problem.
- Provide the animals with grass pasture, hay, crop residue or grain along with the legume on pasture to reduce their consumption of the legume.
- Graze in a rotation using different grass and legume pastures or strip-graze (with electric fencing) to force animals to eat most of the plant material rather than just the succulent top growth.

8. Weed/Vegetation Control Using Sheep

Sheep producers can use their animals for weed or vegetation control. Sheep grazing has been shown to be an effective method for controlling vegetation. Sheep can provide an alternative to chemical control; they can be used where herbicides cannot be applied, such as near environmentally sensitive areas and in terrain where it is difficult to conduct chemical spraying.

Sheep and goats definitely eat weeds, but these animals may not be a practical method of weed control for landowners who have only minor weed infestations or small patches. Alternative vegetation control may be more suited for such circumstances. As well, in more extensive infestations or large areas that require vegetation control, significant infrastructure (such as water and fencing) may need to be put in place.

A sheep producer must decide whether he is managing for maximum sheep production or vegetation management. Grazing will control top-growth of weeds and unwanted vegetation, but an exclusive diet of weeds may not result in optimum weight gain for the animals' production.

Grazing will control but not eliminate weeds. For adequate long-term weed control, grazing can be implemented as part of a larger, integrated weed-control strategy. The sheep will eat the undesirable plants, thus reducing competition for the desirable plants, which permits them to become more vigorous and increase.

9. Managing pastures for sheep

The pasture resource is often the most neglected part of the sheep enterprise, yet it usually provides the majority of nutrients to the stock. Well-managed pastures that are properly grazed have the potential to minimize feed costs and increase profits. Pasture is the most natural diet for sheep and other ruminant animals. Though pasture is not without its own risks, fewer digestive problems are usually encountered among grazing sheep and lambs.

10. Pasture plants

A pasture can be comprised of many different kinds of plants. Which species to plant depends upon the purpose of the pasture, the climate, and soil type. Soil survey maps can help with the latter. The best pastures usually contain a mixture of grasses and legumes. Selecting one or more grass and legume species is usually preferable to commercial pasture mixes, which may contain plant species, which are not adapted.

11. Cool season grasses

Cool season grasses form the basis of most sheep pastures. Cool season grasses are annual or perennial plants that begin growth during the fall or winter and grow to spring or early summer. Cool season grasses are not damaged by sub-freezing temperatures. However, they go dormant during hot weather. Common cool season grasses include orchardgrass, bluegrass, tall fescue, timothy, reed canarygrass, ryegrass, brome grasses, and wheat grasses.

12. Tall fescue

Tall fescue is the most important cool season grass. Most tall fescue is infected with a fungal endophyte that reduces performance in grazing animals and causes reproductive problems in horses. Sheep appear to be less affected by the endophyte than cattle and horses. Animal performance is superior on endophtye-free fescue, but plant persistance suffers. MaxQ™ tall fescue contains a non-toxic endophyte, which improves animal performance while maintaining plant performance.

Tall fescue is the most desirable grass to stockpile for late fall and winter grazing. Unlike the summer forage, fall-saved fescue is palatable and high in digestibility. Forage quality losses after frost are less for fescue than other forages. Endophyte toxicity of stockpiled fescue declines with time.

13. Warm season grasses

Warm season grasses are annual or perennial plants that begin growth during the spring, and grow to summer or autumn until frost. Common warm season grasses include bahiagrass, bermuda grass, crabgrass, eastern gamagrass, big bluestem, indiangrass, switchgrass, sudangrass, and pearl millet. Most native grasses are warm season grasses. Sheep have generally not performed as well on warm season grasses as cattle.

14. Annuals

An annual is a plant that completes its life cycle in one year. Annuals must be planted every year in order to produce forage for livestock feed. Summer annuals complete their life cycle between spring and fall. Summer annuals include crabgrass, pearl millet, sorghum, sudangrass, and sorghum x sudangrass. Winter annuals complete their life cycle between fall and spring. Winter annuals include wheat, barley, winter oats, rye, and triticale (rye x wheat).

15. Brassicas

Brassicas are annual crops, which can be grazed by sheep. They include rape, kale, swede, and turnips. They are most commonly used to extend the grazing season. Performance on brassicas is improved if dry hay is offered. Lamb performance on brassicas has varied.

16. Small grains

When properly managed, small grain crops can be used for grazing by sheep and other livestock. Small grains can provide excellent pasture in the fall and early spring. The effect of livestock grazing on small grain yields ranges from yield reductions to increases in yield.

17. Forbs

Forbs are non-grasslike, non-woody, flowering herbaceous plants. Forbs are commonly called weeds. They may be classified as annual or perennial, warm season or cool season. When grazing a mixed sward, sheep prefer forbs. Sheep's preference for forbs makes them well-suited to landscape management.

18. Browse

Browse includes buds, twigs, leaves, fruit and flowers of woody plants (trees and shrubs). While sheep will eat varous browse species, goats are best known for choosing these types of plants.

19. Crop residues

Crop residues are the materials left in a field after the crop has been harvested. Residues include stalks and stubble, leaves, and seed pods. Crop residues offer a low-cost feeding alternative for sheep, while sheep grazing helps to control pests by disrupting insect life cycles.

20. Pasture Establishment

Planning for a successful pasture establishment should begin months in advance. It can take years to correct severe soil acidity. If lime is needed, it should be applied six to 12 months prior to seeding.

Different seeding methods can be used to establish a pasture: drilling, cultipacking, and broadcasting. No-tillage involves using herbicides to kill the existing vegetation and then seeding directly into the residue. The seed bed is usually prepared by hay removal or hard grazing.

The best time to establish cool season grasses is in the late summer and early fall. Spring plantings have enough moisture for seed germination, but weed pressure is high. Warm season grasses should be planted in late spring to early summer after the soil temperature has reached 65°F or above. Seeding rates depend upon the plant species and seeding method. Certified seed is recommended.

Legume seed may need to be innoculated with the proper bacterial strain. New seedings should not be grazed until the plants have developed sufficient root systems. If you can easily pull a plant from the ground, its root system is not sufficiently developed.

21. Pasture Renovation

Pasture renovation is when you "renew" a pasture by introducing a desired forage species into the existing plant stand. It should be done on a regular basis, as most legumes tend to be short-lived in a pasture. Overgrazing, poor fertility, and other adverse conditions tend to favor grass plants over legumes.

Frost seeding is a common method of pasture renovation. This is when seed is broadcast into existing pastures during the late winter or early spring when the soil freezes at night, but thaws during the day.

22. Pasture Maintenance

Maintaining a pasture is similar to maintaining a car. If you want good, long-term performance of your pasture, you need to take steps to properly maintain it. Soil sampling a minimum of every three years is a must. Lime and fertilizer should be applied according to soil test results. Excess lime can cause mineral deficiencies. Excess fertilizer pollutes ground water.

Pastures which are composed of predominantly grass plants should receive nitrogen fertilizer every year. There are numerous sources of inorganic and organic nitrogen. Sheep grazing pastures fertilized with poultry litter or pig manure may be at increased risk for copper toxicity. Pasture which contain 30 percent or more legumes usually do not require nitrogen fertilization. Broadleaf weeds can be controlled with herbicides and mowing. Controlled grazing and proper soil pH will also help to surpress weed growth.

23. Poisonous plants

Numerous plants can be poisonous to sheep. Toxicity usually depends upon the growing conditions and stage, plant part, and amount consumed. As a general rule, sheep usually avoid poisonous plants. Problems arise when desirable forages are scarce and poisonous plants are abundant.

The effects produced by the ingestion of poisonous plants are extremely variable and depend upon the poison consumed in the plant. Some poisonous plants cause rapid death. Others produce gastro-enteritis or cause nervous symptoms or locomotion problems. Treatment is usually unrewarding.

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The project is supported by the European Union and co-financed by the European Social Fund.