Country Pasture/Forage Resource Profiles

ESTONIA

by

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CONTENTS

1. INTRODUCTION

The Republic of Estonia (Eesti Vabariik) is a parliamentary republic where the President is elected for a period of five years. The State's governing body is a parliament with 101 members, elected for a term of four years. The capital city is Tallinn (on 1 January 2000, it had 408 000 inhabitants or 28% of the total population) and Estonia is divided into 15 counties, 42 towns and 205 municipalities. The population was 1 439 197 (on 1 January 2000) with a density of 32 inhabitants/km^2. According to the World Factbook it was 1 324 333 in July 2006 with a growth rate of –0.64%. The population is mainly Estonian with a considerable Russian minority: Estonians 65%, Russians 28%, Ukrainians 3%, Belorussians 1%, Finns 1%, other 2% (on 1 January 2000). The official language is Estonian (belonging to the Finno-Ugric branch of the Uralic language) and the national currency is the Estonian kroon (1 kroon = 100 sents) which was introduced on 20 June 1992 at a rate of 1 EUR = 15.65 EEK.

The land area is 45 227 km^2; Estonia consists of a mainland and some 1 500 islands and islets in the Baltic Sea. It is bounded on the north by the Gulf of Finland (an inlet of the Baltic Sea), on the east by the Russian Federation, on the south by Latvia, and on the west by the Baltic Sea.

There are many lakes: Peipsi - total area 3 555 km^2 (area in Estonia 1 529 km^2), Võrtsjärv, 271 km^2, Narva artificial lake - total area 191 km^2 (area in Estonia 38 km^2). The "highest" point is Suur Munamägi at 318 m.

Estonia has been dominated by foreign powers through much of its history. In 1940 it was incorporated into the USSR as a constituent republic. Estonia remained a Soviet republic until 1991 when it declared its independence. The USSR. agreed to independence for Estonia and the other Baltic states on 6 September 1991; United Nations membership followed shortly thereafter.

Location, natural conditions and land

Estonia is in the northern part of the temperate zone in a transition between maritime and continental climates. Thanks to the warm North Atlantic Stream, all Northern Europe (including Estonia) has a considerably milder climate than, for instance, similar latitudes in North America. The Baltic Sea causes significant differences between the climate of coastal and inland areas.

Estonia, a tiny country, is the most northerly and the smallest of the Baltic states. Its area (45 227 km^2) is similar to that of the Netherlands, but the population is ten times smaller. Over 1 500 offshore islands make up 9.2% of Estonia's territory.

From the aspect of economic geography, Estonia's location on the Baltic provides a sea connection with many countries, in particular the Baltic countries. Also, Estonia constitutes a part of the northeastern coast of Europe, through which northern Russia communicates with the rest of the world. The economic-geographic position of Estonia has changed with the times. Estonia is now striving for membership of the European Union and its main economic partners are the member states of the Union http://www.estonica.org/)

Structure of agriculture and its role in national economy

(from *Agriculture and Rural Development. Overview 2000/2001*)

Agriculture has traditionally been an important area of activity and a source of income for Estonia. Transition to a market economy, privatization and restitution of the assets of former collective farms to their lawful owners, as well as the collapse of East European markets have altered the share of agriculture in rural and national development.

The percentage of rural population has increased since 1992 (28.9% in

Figure 1. Map of Estonia

1992, 30.9% in 2000), but the relative share of agriculture in the employment of rural population has decreased. In 1992, 51% of rural working-age population was in agriculture, but in 2000 only 18%.

According to the estimates of the Ministry of Agriculture, the gross agricultural product in 2000 amounted to EEK 6.38 billion (see Table 1). Gross output increased by 24% when compared to the previous year, but the 1998 level was only exceeded by 2%. The estimated income of people employed in agricultural production was EEK 2.34 billion and increased by nearly one-third when compared with the previous year. Despite the relatively large growth, the level of income was 8% lower when compared to 1998.

Table 1. Economic results in agriculture (EEK million)

	1998	1999	2000
Plant production	1 903	1 648	2 136
Livestock production	3 571	2 701	3 455
Output of agricultural holdings	6 261	5 139	6 381
Total intermediate consumption	3 574	2 968	3 524
Gross added value in production price	2 687	2 171	2 857
Depreciation	732	804	788
Net added value in production price	1 955	1 367	2 069
Other taxes	30	30	30
Other support	602	424	299
Agricultural income	2 527	1 761	2 338

Source: 1998 and 1999 - ESO (Estonian Statistical Office); 2000 - estimation of Ministry of Agriculture based on EUROSTAT methods, according to which seeds and feeding stuffs used in holdings and sold between holdings are not included in gross output.

There were 1 433 100 ha of agricultural land, 2 015 500 ha of land under forest and 283 300 ha of land under water in Estonia in 2000. Of the total agricultural land, arable land constitutes 1 119 780 ha (78%) and natural grasslands 298 700 ha (21%) (Chart 1).

Table 2 details land stock structure changes from 1990 to 2000, and especially the agricultural land decrease.

According to the Agricultural Census of 15 July 2001 there were 85 300 agricultural holdings and 176 400 agricultural household plots in Estonia. [* Agricultural holding (hereinafter: holding) is a

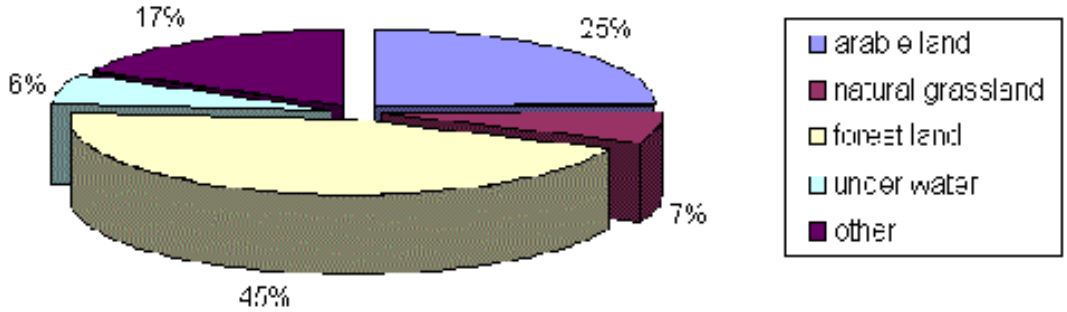

Chart 1. Land use (%) as at 1 January 2000

Table 2. Land stock, 1990–2000 at end-year, thousand hectares

Year	Total Land	Agricultural land				Forest and woodland	Under inland waters	Other lands
		Total agric. land	Arable land	Orchards	Natural grassland			
1990	4 522.6	1 458.4	1 131.9	14.9	311.6	1 920.1	283.3	860.8
1991	4 522.6	1 458.2	1 131.9	14.8	311.5	2 015.6	283.3	765.5
1992	4 522.7	1 455.0	1 127.6	14.9	312.5	2 021.8	283.3	762.6
1993	4 522.7	1 454.1	1 128.9	14.9	310.3	2 016.6	283.3	768.7
1994	4 522.7	1 449.5	1 127.8	14.8	306.9	2 016.2	283.3	773.7
1995	4 522.7	1 449.5	1 127.8	14.8	306.9	2 016.2	283.3	773.7
1996	4 522.7	1 449.5	1 127.8	14.8	306.9	2 016.2	283.3	773.7
1997	4 522.7	1 433.1	1 119.8	14.6	298.7	2 015.5	283.3	790.8
1998	4 522.7	1 433.1	1 119.8	14.6	298.7	2 015.5	283.3	790.8
1999	4 522.7	1 433.1	1 119.8	14.6	298.7	2 015.5	283.3	790.8
2000	4 522.7	1 433.1	1 119.8	14.6	298.7	2 015.5	283.3	790.8

production unit with single economic and technical management where there is at least one hectare of agricultural or forest land or at least 0.3 ha of fish ponds or where agricultural products are produced mainly for sale (irrespective of the size of land or fish pond). Agricultural household plot (hereinafter: household plot) is an economic unit where there is less than one hectare of agricultural or forest land or no agricultural or forest land and where agricultural products are produced mainly for own consumption, but where there are at least 50 m^2 of kitchen garden or three fruit trees or six berry bushes or 10 rabbits, 10 domestic fowls or other farm animals or three beehives.]

The average holding size was 20 ha and the average size of a household plot 0.2 ha.

Holdings and household plots together had 1 747 000 ha of land, of which the area used as agricultural land amounted to 891 300 ha; 98% of the used agricultural land was in the holdings and 2% in household plots. 69 810 holdings had agricultural land, the average size of land in the possession of a holding was 13 ha.

Cultivated agricultural land accounted for 51%, forest land for 32% and other land (agricultural land not used, land under buildings, flower gardens, roads, quarries, water bodies, etc.) accounted for 17% of the land in the possession of holdings. 44% of the land of household plots was used for growing field and garden crops.

All data on the last Agricultural Census (2001) will be released in the statistical database on the following website < www.stat.ee > under the heading “statistics”.

2. SOILS AND TOPOGRAPHY

As part of the East-European Plain, Estonia has a flat topography: over 60% of the country’s territory lies at an absolute height of 0 to 50 m and only one tenth has an elevation over 100 m above sea level *(Estonia Information Page*). The uplands and plateau-like areas alternate with lowlands, depressions and valley. These land forms, alongside the coastal cliffs in the north and west, are the largest features of Estonian topography.

The bases of the uplands of Estonia are usually 75–100 m above sea level. The highest point (318.1 m) in Estonia and the Baltic States, Suur Munamägi Hill, is located in the middle part of the Haanja Upland. Erosional and accumulative uplands can be distinguished:

- Erosional uplands are mostly flat. Their appearance depends largely on the bedrock topography. The two erosional uplands in Estonia are The Pandivere Upland and The Sakala Upland.
- The accumulative uplands have hilly topography. Their appearance is not dependent on the bedrock topography. The three accumulative uplands in Estonia are The Haanja Upland, The Otepää Upland and The Karula Upland.

Higher areas include also the plateaux. The Harju and Viru plateaux (about 30–70 m above sea level.) are in northern Estonia and the Ugandi Plateau (40–100 m above sea level) in southern Estonia. Other relatively high areas are the Central-Estonian Plain (60–80 m above sea level) and Kõrvemaa (50–90 m above sea level).

The Lowlands are plains reaching less than 50 m above sea level that have been flooded by the Baltic Sea, ancient Lake Peipsi and ancient Lake Võrtsjärv. Lowlands cover nearly half of Estonia. The largest lowlands are located in western Estonia.

There are some 165 000 marshes greater than one hectare in area, of which 132 peatlands are larger than 1 000 ha. The total area of marshes and swamp forests is 1 009 101 ha, which is over one-fifth (22.3%) of the country’s territory. Only Estonia’s northern neighbour, Finland, has a higher percentage (31) of peatland. The total protected area in Estonia is 533 000 ha (See Table 3 and Photo 1).

Table 3. Protected areas in Estonia, 1999

Type of protected area	Number	Territory, thousand ha
National park	4	144.0
Nature reserve	31	142.0
Landscape reserve	68	124.0
Protected areas with unrenewed protection procedure	210	123.0
TOTAL	313	533.0

Photo 1. The Endla Nature Reserve, autumn 1999
(Photo taken by A. Selge)

Major soil types. The soil cover of Estonia is characterized by high diversity due to the varied composition of parent material and diverse water conditions, a large share of peatland and peaty soils (about half), abundance of calcareous soils (especially in the north and west), and the high rock content of soils. Taking the total complex of genetic, ecological and productive characteristics of soils into account it is possible to diagnose and delimit the following types of soils identified by FAO (1994) terminology (Reintam, 1995; Reintam *et al.* 2000):

Rendzinas (*Rendzic Leptosols; Calcaric Regosols*) larger expanses occur in the north and northwest Estonia, but also in the Pandivere Upland. These soils have a high humus and nutrient content but are very stony and sensitive to drought.

Calcaric Cambisols and **Luvisols** are the best agricultural and forest soils. Their large expanses are characteristic of Central Estonia, but their combinations with rendzinas and *Gleysols* also occur in the northern and western parts of the republic. The complexes of these soils with Stagnic Luvisols have largely been described in the south of Estonia.

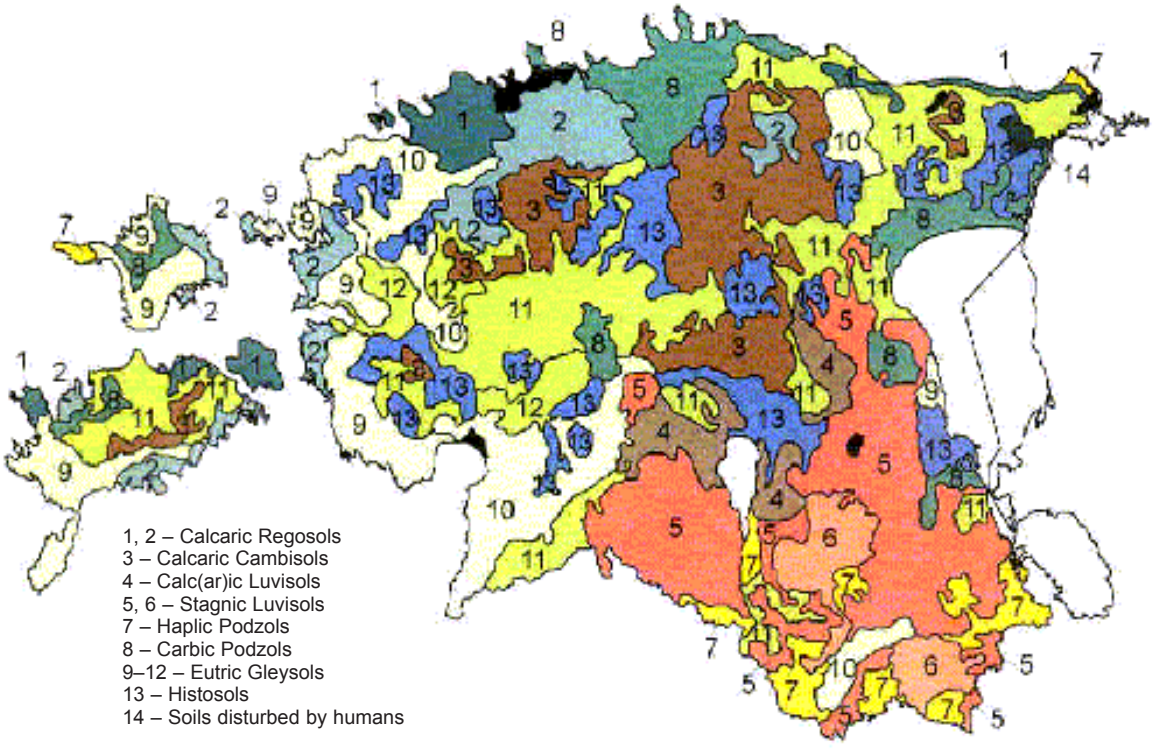

Figure 2. Soil map of Estonia (1:2 500 000)
(Reintam, L., Rooma, I. and Kull, A. 2000)

loosening combined with drainage is necessary for their improvement as arable lands. They have large expanses in the south of Estonia in combinations with Luvisols and/or Podzoluvisols (Albeluvisols).

Podzoluvisols (Albeluvisols) usually have a small area on microrelief hillocks in combination with the Stagnic Luvisols on the other topography in the south of Estonia.

Podsols (*Carbic, Ferric, Cambic)* are forest soils and unsuitable for agriculture; they occur in the Peipsi Lowland, but also on the western edge on the Pandivere Upland and on the island of Hiiumaa. *Gleyic and Histic Podzols* occur in wet pine stands, some of those have a humus horizon and may be suitable for agriculture.

Rendzic Gleysols and Calcaric Gleysols are formed on calcareous till occurring in the north and Central Estonia. They represent a good resource for grassland husbandry.

Eutric and Dystric Gleysols on different Holocene sediments have large expanses in the western and northern depression of Estonia. All Gleysols together predominate in the soil cover of Estonia.

Histosols (*lowland and transitional mires and high bogs)*) occupy 23% of the Estonian territory and their large expanses occur mainly in the West-Estonian and Peipsi depressions.

Fluvisols (*Eutric, Dystric*) occupy small areas on narrow valley plains where the seasonal inundations and accumulation of alluvial suspensions take place.

Salic Fluvisols are young soils on low coastal territories of the Baltic Sea and contain comparatively high amount of soluble salts.

3. CLIMATE AND AGRO-ECOLOGICAL ZONES

General climate - effects of topography. Estonia is in the northwest of the East-European Plain, i.e. in a transition zone from maritime to continental climate. The main factor influencing the climate of Estonia is the Atlantic Ocean (in particular the North Atlantic Stream). The climate is characterized by July–August more rainy) and long rainy autumn but with strong variability between and within years. The annual average temperature is considerably higher than in more eastern areas lying on the same latitudes but having a more continental climate.

The annual amount of sunshine hours varies between 1 600 and 1 900, being higher on the coast and on the islands, and lower on the uplands. The main factor shaping the differences in air temperatures between different regions in Estonia is the Baltic Sea. In winter it keeps the coastal areas much warmer than inland. At this time, the isotherms run from the north to south; during this period it is warmer in the west and colder in the east. The average air temperature in January is –6º to –7 ºC in Central and East Estonia and –2º to –4 ºC in the West-Estonian Archipelago. The coldest month is February (mean in Estonia –4º to –7 ºC) (*http://estonica.org*). The annual average temperature in Estonia is between 4.3 ºC and 6.5 ºC, being lower in the uplands and higher on the western coast of the islands. The warmest month is July (mean 16–17,5 ºC). The growing season lasts for 180–195 days and the frost-free period 110–190 days. Both are longer on the coast.

Estonia has a humid climate. The annual average of the relative air humidity is 80–83%. Annual rainfall (600–700 mm) exceeds the evaporation (350–450 mm). The mean rainfall for the growing season is 320–380 mm (in drought years: 200–300 mm). Rainfall is heaviest at the end of summer and least in the spring. The snow cover is characterized by large territorial and temporal variations. The average duration of snow cover in winter is 75–135 days: from the beginning of January to the end of March. In mild winters, however, much of Estonia has no lasting snow cover.

Agro-ecological zones based on climate and topography. Agro-ecological zones are based on the active plant growing periods (the mean overnight air temperature is over 10 °C), on temperature and moisture contents; also the conditions during winter for over- winter cultures are taken into consideration.

According to temperature conditions, Estonia is divided into the following two zones, of almost equal size, (*Eesti NSV agroklimaatilised ressursid*):

– Zone I – the northern and the middle regions; comparatively cool. The sum of active temperatures is 1 650 °–1 750°
– Zone II – the southern and western regions and islands; moderately warm. The sum of active temperatures is 1 750–1 900°

Agro-ecological characteristics inside a zone are variable due to the fact that the distance from the sea and other bigger waters differ as do the soil and the relief. Therefore, taking into consideration the dominant soil temperature, moisture conditions and the distance from the seacoast, the zones are additionally divided into subzones.

4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS

Cattle numbers and production. The number of animals and the output of livestock products have decreased in 1993–1999. The reasons are the low purchasing prices and the effects of agricultural restructuring. The domestic prices in 1997–1999 were influenced by the sharp decline of world market prices on average by 35% below the last 15 years' average. The number of bovines fell by 65% in ten years. The number of sheep has fallen about 78% (Table 4).

Table 4. Number of animals 1992–2005 ('000)

Year	Cattle	Pigs	Sheep	Horses	Poultry
1992	708.3	798.6	141.9	7.8	5 704
1993	614.6	541.1	124.2	6.6	3 500
1994	463.2	424.3	83.3	5.2	3 272
1995	419.5	459.8	61.5	5.0	3 178
1996	370.4	448.8	49.8	4.6	2 962
1997	343.0	298.4	39.2	4.2	2 380
1998	325.6	306.3	33.9	4.2	2 650
1999	307.5	326.4	28.7	3.9	2 684
2000	267.3	285.7	28.2	3.9	2 462
2001	252.8	300.2	29.0	4.2	2 366
2002	260.5	345.0	28.8	5.5	2 294
2003	253.9	340.8	29.9	5.3	2 096
2004	257.2	344.6	30.8	5.8	1 945
2005	249.8	340.1	38.8	5.1	2 183

Source: ESO and FAOSTAT 2006

Dairying is the main source of income of agricultural holdings despite the fact that total milk production has fallen in the last ten years from 1 200 000 tonnes in 1990 to 629 600 tonnes in 2000 (Chart 3) and rising slightly to 651 885 in 2004.

The decrease is due to a reduced number of animals, caused by the sharp decrease in the purchasing power of the Eastern market, the reduction of exports and low producer prices. Because of restructuring of production units, the lower profitability of production and the impairment of feeding conditions, the productivity of cows fell in 1990–1993. The yield per cow began to rise again from 1994. In 2000, the yield per cow was 12% higher than in 1990. The production of milk increased in Estonia in the 9 months of 2001, the production of milk increased 9% compared with the same period of the previous year.

Table 5. Number of cows under performance testing, and the size of herd

Herd size groups	Number of herds	%	Number of cows	%
… –4	1 246	38.8	2 859	2.8
5–10	934	29.1	6 573	6.4
1 –50	691	21.5	13 853	13.5
51–100	94	2.9	6 923	6.8
101– 300	169	5.3	29 755	29.1
300–900	70	2.2	32 249	31.5
900– …	7	0.2	10 181	9.9
TOTAL	3 211	100.0	102 393	100.0

Source: Agricultural Register and Information Board (ARIB)

Producers. The number of livestock producers is the largest (67.9%) in the herd size group of up to 10 cows and the smallest (7.7%) in the size group of over 100 cows. Nearly 70% of all cows is in herds of over 100 animals.

The number of dairy producers has decreased due to the closing of milk collection

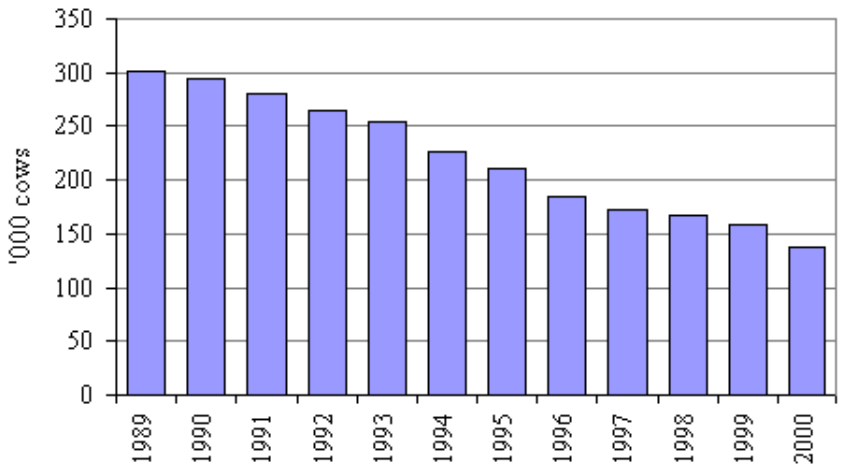

Chart 2. Number of cows as of 31 December 2000

services and due to termination of production during periods of unfavourable market conditions. As requirements for both purchased milk and milk production become stricter, the number of such producers will further decrease in the near future, because they are unable to keep pace with today's efficient production conditions. The decrease of herds of over 100 animals in recent years is due to the bankruptcy of several large-scale agricultural holdings or the re-orientation of such holdings to other areas of production. The number of herds of 11–50 animals has increased.

Number of cows. In 2000, the number of cows in Estonia decreased by 7 700 animals or 5.6% compared to 1999; the number of cows as of 1 January 2001 was 130 700 (Chart 2) falling to 116 800 in 2004. The liquidation of herds caused by the unfavourable market conditions of 1998/1999 has stopped; more powerful and competitive producers continue their activities. No substantial decrease in the number of cows is foreseen in the near future but, rather, a slight rise can be expected.

As to the structure of herds, most cows (71.4%) are of the Estonian Holstein breed and their percentage has increased since the year 2000 by 2.6%. The increased percentage of Holstein cattle is due to their higher genetic potential when compared to Estonian red cattle and the Estonian cattle breeds. The share of Estonian cattle has increased by 0.4% to 0.5% thanks to the state support given to them as an endangered breed. The share of Estonian red cattle is 28.1% and has decreased by 2.7% since the year 2000.

Milk production. According to a preliminary estimation, total milk production in 2000 was 628 663 tonnes, which is 0.4%, i.e. 2 577 tonnes more than in 1999 (Chart 3). The milk industry was sold 408 677 tonnes of milk, which is 1.1% more than in 1999. The quality of milk improved when compared to the last year. While in 1999, elite or top grade milk accounted for 79.4% of all purchased milk, in 2000 its share was 83.3%. The relative share of first grade milk decreased from 16.8% to 14.2%. The fat content of purchased milk was on average 3.9% in 2000, which is 0.1% higher than in 1999. Milk production in 2004 was 651 885 tonnes.

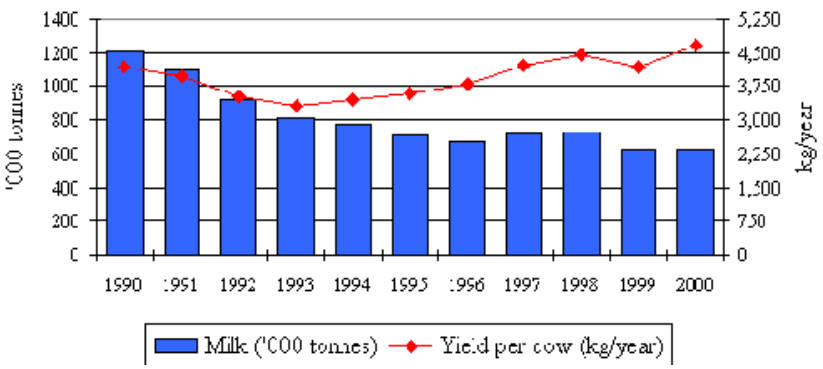

Chart 3. Total milk production and average annual yield per cow

Beef production. The number of cattle has gradually fallen in Estonia. As of 2001, the number of cattle was 252 800, which is nearly 10% less than the previous year. As the number of dairy cattle decreased and beef production depends on the number of cows, beef production decreased to 15 383 tonnes in 2000 and 15 242 tonnes in 2004. The number of cattle in 2004 was 257 200.

Foot-and-mouth disease outbreaks and cases of BSE influenced the world beef market in 2000. The effect of BSE on beef production will probably be more apparent in 2001. The current beef prices in the world are relatively high, although prices in the European Union fell at the end of the year due to decreased demand. Because of BSE outbreaks, import of beef from ten European countries to Estonia is restricted and this creates the need to expand local beef production.

Purchase prices for beef have been low in recent years due to little interest of producers in fattening bovines. Most bull calves have therefore been killed at less than one month old. From the second half of 2000, purchase prices increased and the December average was 8.31 EEK/kg. The quantities of beef purchased, however, were lower than earlier and the sales of beef animals to slaughterhouses were modest despite the high price even at the end of the year. It can thus be concluded that the decrease in the number of beef animals has reached the bottom and is expected to slowly increase in future.

The rearing of beef cattle is expanding. The Estonian Beef Cattle Association was founded on 21 July 2000 and beef cattle will be subjected to performance testing from 2001. The animal breeding society "Estonian Red Cattle" is responsible for co-coordinating meat cattle breeding. Beef cattle are reared in 14 counties; more than 50% of the herds are concentrated in Hiiu, Saare and Lääne counties. The total number of beef cattle herds is 76. More than a half of beef cattle farmers have relatively small herds (up to ten animals).

Research carried out by the specialists of Jäneda Training and Advisory Centre in 2000 gave an overview of the situation of beef cattle. Beef cattle presently accounts for only 0.5% (1 220) of the total number of bovine animals in Estonia. The majority of beef cattle are Hereford (72%), smaller numbers of Aberdeen-Angus, Limousine, Charollais and Scottish Highland animals are also kept. Relatively many hybrids are also reared for meat production. The above cattle breeds are equal for their meat qualities, with the exception of the Scotch breed that yields less meat and is mainly reared in Estonia for its exotic appearance.

Sheep production. The number of sheep in Estonia has started to increase. Compared with 1999, the number of sheep increased by 500, i.e. 2% (according to the Statistical Office data). Therefore the number of sheep at the end of 2000 was 29 000 and at the end of 2004 some 30 800 head. Sheep rearing is becoming more common in rural households. The total sheep meat production in the world has also increased during the last years and the demand for both lamb and mutton is presently high, which is why sheep meat prices are also relatively high.

The ewe support introduced in 1999 has influenced Estonian mutton production in the recent years. The marking and registering of sheep has increased, as it is a precondition for receiving ewe support. The recent years' development can be seen in the growing size of sheep herds. Owing to the scarce supply of sheep meat on the market and the relatively favourable prices, producers' interest in sheep rearing is high. Rapid growth is hindered by the fact that demands for purebred sheep exceeds supply. Detection of the Maedi-Visna virus in Estonian sheep also limits the purchasing opportunities. Marketing has been a problem for producers up to now. The Estonian Sheep Breeders Association with the support from cooperative activities has initiated the creation of a marketing group and preparation of a marketing strategy.

Estonian dark-headed and the Estonian white-headed sheep are reared for meat. The dark-headed breed currently prevails while the share of white-headed sheep is increasing. Out of the sheep entered in the farm animal's register, 69% are dark-headed and 31% white-headed. Of the ewes recorded by the Estonian Sheep Breeders Society, dark-headed sheep have only a slight majority. Oxford-Down, Texel and Dala sheep have been used to improve breed qualities.

Animal health. Estonia was free from all the extremely dangerous infectious animal diseases (A-list diseases) in 2000. Due to the stable disease-free status, livestock producers did not suffer from any economic loss due to animal diseases; neither was there any restrictions imposed on trade in animals

and animal products. Consumers were also protected from any danger of zoonoses. A framework of infectious animal disease control measures was established in 2000 by the Infectious Animal Disease Control Act. The Government of Estonia set up an inter-ministerial committee for bovine spongiform encephalopathy because of the country's European Union member status and the need to prevent the spread of the disease in Estonia as well as to identify the situation in Estonia.

5. THE PASTURE RESOURCE

The use of agricultural land. The use of the main agricultural production resource, agricultural land, which decreased at the beginning of the 1990s, stabilized by the turn of the century. The total size and the use of agricultural land have remained on the same level since 1997 (see Table 6). In the year 2000, the total area under field crops was nearly 813 000 ha, including 420 000 ha of grasslands, which forms 52% of the total area under crops. The area of unused lands was 270 000 ha. Only a half of this can be put to use again as pasture, because the unused lands are overgrown with bushes or have become wetlands in 3–4 years, as the drainage system was not maintained .

Forage crops According to the data of the Estonian Statistical Office in 2000:

- the average green yield of red clover and timothy mixture for silage was 11 980 kg/ha;
- for silage making and green fodder, crops cut totalled 136 874 ha, the average green yield of which was 12 758 kg/ha
- for haymaking 168,395 ha was mown and the average hay yield was 2 228 kg/ha. Haymakers were mainly small farmers and householders; bigger agricultural enterprises made hay from 23 633 ha (14%).

Traditional seed mixtures for pasture include grasses timothy (*Phleum pratense*), meadow fescue (*Festuca pratensis*), Kentucky bluegrass (*Poa pratensis*) , perennial ryegrass (*Lolium perenne*)and white clover (*Trifolium repens*). Perennial ryegrass winter survival is the main restricting factor in decreasing its area. Nevertheless, the perennial ryegrass popularity is increasing year by year. The new local cultivars Raidi (diploid), Raite (tetraploid) and the mainly imported Dutch and Danish cultivars in a proper management and choosing the right sowing area (well drained soils) have made success.

Farmers rarely establish pastures without white clover, which is the most important and common legume for permanent pastures in Estonia. Although we have native lucerne (*Medicago varia*) cultivars for pasture, 'Karlu' and 'Juurlu', this legume has not spread widely. In Estonia the importance of legumes has never been underestimated. Due to a continuous rise in the price of mineral N fertilizers in recent years, legumes again have an indispensable role as a source of N for grassland to improve soil fertility and increase the protein content of herbage.

Other grasses like cocksfoot (*Dactylis glomerata*), tall fescue (*Festuca arundinacea*), red fescue (*Festuca rubra*), meadow foxtail (*Alopecurus pratensis*) are used for establishing pastures depending on the growth area and soil. Traditionally the multi-species mixtures (5-6 grass species) with the seeding rate around 30 kg/ha are used in establishing the Estonian pastures. The tendency is to use pasture mixtures with fewer grass species and lower seed rates. On well-drained mineral soils the following seed mixture is recommended: timothy 7 kg/ha, perennial ryegrass 7 kg/ha and white clover 4 kg/ha.

There are two optimal periods for sowing grassland under Estonian conditions: early spring (up to 20 May) and midsummer (1–15 July), since normally the rainfall in June is insufficient for the seedlings. Grass/clover mixtures are best sown without a cover crop (highly recommended) as white clover is very sensitive to shading.

Table 6. Land resources ('000 ha)

Year	Territory	Agricultural land			
		Total	Arable land	Orchards and berry gardens	Natural grassland
1990	4 523	1 458	1 132	14.9	312
1995	4 523	1 450	1 128	14.8	307
2000	4 523	1 433	1 120	14.6	299

Source: ESO

The most intensive method of pasture utilization is portion (strip) grazing (2–3 portions per day by electric fence) when the grass utilization by cattle is the best. More and more the pasture is established for both grazing and silage-making.

In Estonia the commonest and traditional seed mixture for silage is red clover (15 kg/ha) and timothy (6 kg/ha). This is a short-term pasture, which can be used for three years as a rule. In 2001 red-clover-rich (around 75% of red clover) grass swards were sown on 100 141 ha, i.e. 23% more than in 2000.

Table 7. Grasses and grasses mixtures average dry matter yields in Estonia, kg/ha

Dominant grasses	Average dry matter yield, kg/ha	
	Optimum conditions	Poor conditions
Red clover (over 50%) + timothy	7 000	4 000
Lucerne (pure stand)	7 000	3 000
White clover (over 30%) + grass	5 500	3 000
White clover (below 30%) + grass	5 000	3 300
Goat's-rue/fodder galega	10 000	4 000
Italian ryegrass	10 000	6 000
Westerwold grass	6 000	3 000
Grass mixture	7 000	2 000

Source: The Estonian Chamber of Agriculture and Commerce 2001

Lucerne was grown in 2001 on 14 752 ha, i.e. 1 930 ha more than in 2000. A growth of the area of lucerne can be foreseen also in the next years. Due to the local climatic conditions, seed production in Estonia is complicated and the seeds are imported, mainly from the USA. The high-productive fodder Galega *(Galega orientalis*) cultivar Gale (bred in Estonia 1987) is a well-known legume for Estonian farmers. The scientists specified that fodder galega (*Galega orientalis*) as against *Galega officinalis* has a good edibility and does not contain alkaloids or contains them only in small quantities, and is not toxic. Galega fields have spread all over Estonia and arable lands under fodder galega in the republic in 2000 totalled 5 000–6 000 ha. Fodder galega is used mainly for silage making. The fodder galega sowing area has become stable because of the fact that its usage is restricted by comparatively low dry matter digestibility.

Among the hay grasses, the sown areas of Italian ryegrass and Westerwold grass show a tendency to increase. In recent years maize is grown for silage in some agricultural enterprises and dairy farms. In experimental stations the experiments continue with early maizes from the USA.

Problems. The decrease in the number of animals, which started at the beginning of the 1990s, has caused the abandonment of pastures and grasslands, which by now are infested with weed and shrubs. Small farms especially lack money to invest in improving (re-establishing and fertilizing) grasslands. As a result the botanical composition in grasslands is poor and grass quality low.

As the market of grass seeds and the financial situation of dairy farmers has improved during the last years, then the re-establishing and fertilizing of grasslands in the republic has also improved.

The main problems in grassland management are the following:

- unbalanced fertilizers use on the grasslands;
- old grass swards with poor floristic composition;
- grazing and cutting the grasses at too late a vegetative stage.

Land improvement is a separate problem. Drained lands cover 730 000 ha in Estonia, including 649 000 ha with drainage systems and 81 000 ha with ditch systems, polders cover 7 900 ha. The polders and drained lands are used mainly as grasslands. According to estimations, poorly maintained systems may cause a reduction in the quality of field land in 6–10 years from now and make the land impossible to use for agriculture within 25–30 years. Land owners are unable to carry out land improvement works by their own means. State support and the involvement of foreign projects are necessary, provided that responsibility for further maintenance is transferred to associations.

The obstacle to enlarging the sown area of pasture, especially of legumes, is because soils have become more acid. The scope for liming operations of acidic soils decreased from 1992 to 1998, which has caused re-acidification of agricultural lands. The acidity of soils has therefore increased in recent years. The estimated area of soils which need liming is 200 000–300 000 ha. Acid soils should be limed every five years. In order to improve the quality of lime-spreading operations, a joint project was launched in 1998 between the Ministry of the Environment of Finland and the Ministry of Agriculture of Estonia for the production of lime materials and spreading machines. Additional funds were acquired for performing the work and for supporting farmers.

Silage production In the case of successful milk producers, silage is the main fodder and the part of hay in the ration is not big. Big bale silage technology is very popular and widely used. Bigger dairy farms also use outdoors clamp silos (around ¾ of all silage). According to expert opinion, the necessary equipment will not be an obstacle in making silage, but smaller farms cannot buy equipment and have to hire it. Very often problems arise as the cutting of grasses tends to be late and the quality of silage decreases remarkably.

The main reasons for poor silage quality are the following:

- late harvest (even in a flowering stage);
- different quality of the grass swards from which silage is made;
- the low level and unbalanced use of fertilizers in grasslands;
- not wilted (too wet) or over dried silage material is baled or stored in clamps.

During recent years much attention has been paid to silage quality improvement by the Estonian scientific institutions in cooperation with foreign researchers in the framework of several projects. Producers have paid much attention to silage quality and it has improved significantly year by year.

Seed production Lack of seeds was a problem for renewing grasslands in the 90s. In recent years the situation has improved due to seed importation, mainly from Holland, Denmark and the USA. The foundation for the local seed breeding is Jõgeva Plant Breeding Institute. Jõgeva Plant Breeding Institute is a leading seed company in seed production and marketing of cereals, potatoes and forage grasses and legumes in Estonia.

Forage grasses and legumes. Altogether 114 seed fields were certified in Estonia in 1999 - timothy (*Phleum pratense*) 92.6 ha, meadow fescue (*Festuca pratensis)* 52.9 ha, Kentucky bluegrass (*Poa pratensis*) 22.6 ha, red fescue (*Festuca rubra)* 12.5 ha, perennial ryegrass (*Lolium perenne)* 10.0 ha, red clover (*Trifolium sativum*) 100.5 ha and alfalfa (*Medicago varia*)55.7 ha. Major varieties were meadow fescue Arni (52.8 ha), timothy Tika (51.3 ha) and Jõgeva 54 (40.9 ha), red clover Jõgeva 433 (47.1 ha) and alfalfa Jõgeva 118 (46.1 ha). In the favourable climatic conditions of 1999 comparatively high seed yields of legumes were obtained at Jõgeva. A total of 1 695 kg of legumes and 623 kg of forage grass seeds were produced by Jõgeva PBI.

The following grass/legume cultivars of Jõgeva Plant Breeding Institute have been recognized internationally: white clover (*Trifolium repens*) Tooma (Canada) and Jõgeva 4 (Finland), red fescue Kauni, red clover Ilte and Kentucky bluegrass Esto (Finland). Several varieties are undergoing DUS and VCU tests in Finland, Russia, Germany, Sweden, Latvia and Canada.

Main strategic goals of development

During recent years essential socio-economic changes have taken place in Estonia. Both internal and external environment has changed. Strategy plans on different levels have been worked out to determine priorities and develop in the changing world. The Estonian Government has looked through and approved some different strategies of development, which in direct or indirect ways also influence Jõgeva Plant Breeding Institute. In June 2000 the development strategy of agriculture was approved.

The main strategic goals are the following:

- to improve the efficiency and competitiveness of agricultural production and bring it into compliance with EU requirements;
- to guarantee stability of domestic market price level;
- to ensure supply the main domestic foodstuffs to the population;
- to maximize the agricultural sectors' contribution to national economic and social well-being on a sustainable basis (*http://www.jpbi.ee/index.php/288/*).

6. OPPORTUNITIES FOR IMPROVEMENT OF FODDER RESOURCES

Several state and international cooperation programmes of different countries (namely Holland, the USA) have played an important part in the development of grasslands. Grassland management has remained a priority within the following projects:

- **Project on Dairy Farming Improvement**: The project, supported by the Dutch Government, concentrated on pilot farms and advice based mainly on the experiences gained in the Netherlands. A number of farms were selected and advisers were given on the job training on farms. The activities concentrated more on farm trials and grassland management.
- **Project 'Milk'**. By applied research, the adjusting of growing technologies of different varieties to managing conditions of the region (the selection of varieties, establishing grasslands and re-establishing, the durability of grass plants; yield and nutritive value) was explained. On cultural pastures the influence of the beginning of spring grazing on the pasture grass mass distribution during the grazing period was studied. The wet and dry silage, made from red clover was used in feeding trials to find out their efficiency in milk production. Silage making technologies for red clover as well as norms for feeding red clover-rich grass silage were worked out. The efficiencies of different silage making technologies (clamp silage, bales of silage, different species composition) were compared on the bases of silage quality, the loss of nutrients and the profitability. Research was continued to find cheaper silage additives for dried feeds, which, due to biological additives, enable the reduction of losses in making silage and improvement of the quality of silage and milk.
- At the present moment the state-ordered projects (by Ministry of Agriculture) have an important role. Through these projects it is possible to study problems which are important to producers as well as to the state. The topics and results of this applied research will be analysed every year.
- Control Centre of Plant Production deals with testing new and foreign seed varieties. Since the year 1997, Estonia has been admitted to the OECD Cereal, Oil and Fibre Plants and Herbage Seed Schemes and is participating as an observer in the Vegetable Seed Scheme. In 2001, it was planned to submit an application for the EU equivalence on seeds and this process is ongoing. Re-accreditation of ISTA seed control laboratory was started in 2000, and completed at the beginning of year 2001.

Extension and advisory services in Estonia have an important role in spreading scientific research results to producers. Several achievements reflect the following strong points and unique features of the advisory system development in Estonia:

- The governmental advisory service programme and public competition of projects for funding has been initiated. The national advisory programme has been financed increasingly from the government budget. The funds provided by the advisory programme are used for project financing on the basis of open competition. The programme is aimed at supporting individual advice as well as group and mass activities. An impressive number of extension materials have been developed, and the materials in general seem to be of practical value to the farmers as reflected by their high sale.
- A system for certification of advisors has been introduced. A registry for advisors has been created and eligibility criteria have been developed.
- The Estonian Association of Rural Consultants and Advisors has been established, which continues to grow. Currently, it enjoys membership of about 100 very dynamic advisors in the country. The association prints a newsletter for advisors and makes use of modern technology.
- The demand for advice, especially that related to milk quality advice, is increasing very rapidly. Dairy farmers become more and more aware of the importance of producing high quality milk as a major factor influencing their income. As for the future, meeting EU standards is vital for producers who want to stay in business.

Aspects needing strengthening

- Cooperation between research and extension is inadequate. Not only are the definition of roles and distribution of tasks among different institutions and organisations belonging to the extension complex vague, but co-operation among these institutions and organisations is also inadequate.

- The relationship between the organizations producing the information (research institutions) and those applying it (advisors) is still weak.

7. RESEARCH AND DEVELOPMENT ORGANIZATIONS AND PERSONNEL

The grassland research in Estonia is concentrated at Estonian Agricultural University, Jõgeva Plant Breeding Institute and Estonian Research Institute of Agriculture. All research institutions are also engaged in implementing research work in practice as well as in development activities. The Estonian Grassland Society has an important role in introducing results of research work, in providing feedback from producers, in organizing training sessions, etc.

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8. REFERENCES

Agriculture and Rural Development (Editor Laansalu, A) (2001). Overview 2000/2001. Ministry of Agriculture. Tallinn. 188 p.

Eesti NSV agroklimaatilised ressursid. (Edited by k.Kivi). Tallinn 1976. 141 p.

Estonian Statistical Office Database 2000 (*website*)

FAO-UNESCO, 1994. Soil map of the World. Revised legend with corrections. Published by ISRIC. Wageningen. 140 p.

Older H., Viiralt R., Laidna T., Parol A., Selge A. (1994) Recent white clover research and development in Estonia. - "HERBA": Information Bulletin of the FAO European research co-operative network on pastures and fodder crops. Rome, No. 7; p. 35-40.

Piimafoorum 2001. Eesti Põllumajandus-kaubanduskoda. Tallinn. 40 p.

Piimafoorum 2001. Eesti Põllumajandus-Kaubanduskoda/The Estonian Chamber of Agriculture and Commerce. Tallinn 2001, p12.

Reintam L. 1995. Soils in Estonia. Soil and fertilization. Transactions of the International working group of soil fertility. International Society of Soil Science. Tartu 1995, pp. 122-131

Reintam, L., Rooma, I. and Kull, A. 2000. Estonia. Soil and Terrain Database, Land Degradation Status and Soil Vulnerability Assessment for Central and Eastern Europe. Version 1.0. Land and Water Digital Media Series, 10. FAO. CD-ROM.

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Acknowledgement:
As a great deal of the statistical information in the report as well as the information characterising Estonian agriculture in 2000 is given in the annual report of the Ministry of Agriculture (Agriculture and Rural Development Overview 2000/2001), I would like to thank Mr. Ants Laansalu for his help and assistance. I am also very thankful to Prof. Rein Viiral from the Estonian Agricultural University, whose useful remarks were of great help in writing this report.

[The profile was edited by J.M. Suttie and S.G. Reynolds in January/February, 2002 and modified by S.G. Reynolds in October 2006.]