

**The economic value of livestock
production in the EU
2003**

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'The economic value of livestock production in the EU'

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Preface

The **Farm Animal Industrial Platform (FAIP)** is an independent forum of European farm animal reproduction and selection organisations. These industries have combined because of their common interest in precompetitive research at the European level. Most of the organisations involved in animal breeding and selection are Small and Medium Enterprises.

The aim of the Platform is

- to stimulate research and research funding at the European level;
- to indicate the direction of research that is important for the industry to the European Commission and other interested bodies;
- to inform members about funding possibilities at European level;
- to stimulate participation of industries in research projects;
- to be a forum for the development and expression of opinions on research related topics (e.g. patent directive and new breeding technologies);
- to be a forum for farm animal industry interested in and/or related to reproduction and selection.

Special attention is paid to explaining farm animal breeding and reproduction to a wider audience. Transparency and a continuous dialogue with society are vital for mutual understanding of animal breeding and reproduction and animal products.

The economic value of farm animal production in Europe is of great importance, and at least comparable to crop production. In this publication, as an update of the issue FAIP has published in 1996, the economic value of farm animal production in Europe, the position of the European animal food industry, the changes in the world production market, and the role of farm animal breeding are presented.

Severe and growing competition from other continents already influences farm animal production in Europe. If the European industry does not invest more in research, development and new markets, within a few years milk, cheese, beef, pork, fish and poultry will be imported in large amounts into the EU from America and Asia owing to lower cost. This has significant repercussions for employment in the EU. Only a rapid improvement in the quality of European products will ensure the European consumer safe food, safeguard employment, and farmers that safeguard the environment.

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Summary

Livestock production technology is developing rapidly world-wide and has the potential to significantly increase production efficiency and so to reduce unit cost. The USA and Japan are actively supporting research in this technology. From 1995 to 2002, animal production increased faster in the USA than in the EU. In Asia, the combination of new technology and low production costs also provide a real competitive threat to the EU. This makes it vital to improve the competitiveness of the European farm animal industry. Animal production in the EU has been based on high-input, high-output price systems, but it will come under extreme economic pressure with the reform of GATT as product prices equilibrate with lower world market prices.

Livestock production in the EU can only remain competitive by ensuring the highest standard of both product quality and safety, and by efficient production methods that are both animal and environment friendly. It must be capable of responding quickly to solve problems relating to production processes, animal diseases and the environment. European consumers spend only 16% of their income on food, and this proportion is decreasing. It is now a challenge for the food industry to service and assure these consumers. The survival of primary producers and breeding organisations, the animal feed industry and the very large animal food processing industry depends on the ability of the industry to be innovative and to adapt to market changes. Currently, European farm animal reproduction and selection provide a major part of the breeding stock world wide. Development of improved technologies like genomics requires large amounts of capital, and, though it entails risks, the pay back can be very significant. Governments, research organisations, NGOs and commercial companies must work together. The EU must enhance its own expertise in this area and thus its own competitiveness, according to its own principles.

Production

The EU is currently the world's leading milk producer, accounting for one third of the world cheese and whole milk powder markets each, and the second largest beef producer in the world. The EU is also the second largest pork producer in the world after China. The USA is world market leader in poultry meat production. China is the second and the EU third. Aquaculture production in Europe has expanded by an average of more than 7.4% per

year in the last decade, and today it represents 31% of the total fishery production in the EU.

Although the number of farm animals kept in the EU has remained relatively constant, the number of holdings continues to decrease. Farms have to enlarge for survival, because their income is under constant pressure. The overall EU animal industry expects severe competition particularly from America and Australasia.

The EU farm animal reproduction and selection industry is a world leader but economically small. Despite this, its influence on livestock production is enormous and vital to the sector. Effective genetic improvement programmes are vital to the competitiveness of the EU livestock industry.

Value

Agriculture is responsible for 1.7% of the gross indigenous production of the EU. The value of livestock production in the EU is almost 125 billion Euro per year and accounts for 40% of total agricultural production. The contribution of animal production to the gross indigenous production is at least twice as high if the whole agribusiness sector is considered. Furthermore, three quarters of all the EU farm land is used for animal feed production. The animal feed industry is the main EU consumer of cereals.

Research

The EU must invest in R & D in this area to ensure high quality safe products that are produced in a responsible way. For this, precompetitive research at a European level is necessary. Therefore, the support of EC Framework programmes for transparent animal breeding research, taking into account consumer demands, is vital to provide the necessary critical mass, and to avoid duplication of efforts.

1. Introduction

Since 1994, the GATT agreement includes agriculture. Livestock production has to face the reality of free world trade and the removal of import barriers. In Europe food prices are artificially high. Other world economic areas pose a threat to the competitiveness of European livestock production because of their lower costs, the size of their industries, the land they have available, less restrictive regulations, and their research efforts. Should, in the future, animal welfare and production circumstances be included in WTO agreements, and European governments support sustainable and animal welfare production with their policies, then there will be space for a reasonable share of European special, local and organic animal production.

Threats

The economic blocks outside the EU are expected to expand their livestock production. Consequently, competition will become harder both within the EU and in the traditional export markets of the EU.

- Investment in farm animal reproduction and selection technology is at a higher level in the United States and Japan than in the EU.
- The Americas have several competitive advantages: a) large areas of available agricultural land and very large farm sizes, and b) less restrictive regulations for animal welfare and the environment. There have been setbacks in government research funding in most European countries, which traditionally would have subsidised precompetitive biotechnology research.
- In Asia new technologies are developing quickly and production costs are very low.

Internal influences

The European market has completed the transition from being production-led to being driven by consumer demands:

- The influence of retailers and food industries is growing.
- Consumers are paying more attention to environmental and animal friendly products, to regional specialties, and to guaranteed quality (brand names, guaranteed production process).

The European Community is presently the major source of the breeds of farm animals in the world.

External influences on livestock production

External factors influence agricultural production too. Apart from food supply, agriculture is vital for the dynamics of rural areas. External factors like tourism, recreation, and environmental and ecological aspects influence both production

and the green environment. According to Hofreither and Vogel (ed., 1995), they justify some protection and subsidy of agricultural production.

Global changes

Economists have made several scenarios describing the economic consequences of changing positions in the world market and world production.

De Groot *et al.* (ed., 1994) described the following three scenarios: (1) a scenario of Balanced Growth, where the world economy is strong and liberalised and world trade is very important; (2) Global Shift, where the world economy is strong and Europe declines in importance; and (3) European Renaissance, where Europe is an important partner in the global economy.

In the first situation, products of high quality, regional specialties and specialisation in environmental production methods are the best option to stay competitive. In the case of Global Shift, cost price is more important than quality. This scenario is more damaging for European countries, and high environmental costs increase this tendency. In the case of European Renaissance, both the chances of Balanced Growth and the threats of Global Shift are active.

Safety and quality

European livestock production can keep up its competitiveness and - compared to other economic blocks - its emphasis on safety (e.g. no growth promoters or hormones) and quality by having:

- a high standard of quality of products and production methods (guaranteed, animal welfare friendly, ecologically sensitive, regional specialties);
- more efficient production methods, and
- being earlier and better than others in solving problems regarding the production process and the environment.

Research

The innovative power of European livestock production in developing, distributing and using Research and Development will be important. Livestock companies and cooperatives need precompetitive research in order to

- develop good products in time;
- stay innovative, and
- be able to adapt to the market changes.

The most effective (and in some cases the only acceptable) way to improve animal production is through improved breeding and reproduction technology. The European farm animal breeding industry has established a strong leading position in the world market, despite being composed almost exclusively of SMEs. However, in the coming years the main concern of most European breeding companies will be economic survival in an open world market. Only a rapid improvement of quality and cost price of European products will ensure the European consumers safe and affordable food and farmers that take care of the green environment.

Importing patents and breeding animals

If Europe fails to invest in livestock reproduction and selection research, improved breeding animals and licensed technology may then become available from elsewhere. But it will always be at a competitive loss, and at a price. Imported breeding animals and patent licenses use money that becomes unavailable for research in Europe. If the European livestock industry fails to meet the challenge, within a few years milk, cheese, beef, pork, fish and poultry are expected to come in large amounts into the

The role of animal reproduction and selection

The size of the farm animal reproduction and selection industry is small.

Despite this, its influence on livestock production is enormous and vital to the sector. The cost-benefit returns from genetic improvement are very high:

How is this possible?

because genetic improvement is

- cumulative;
- permanent, and
- disseminated widely.

For more information on economic returns of breeding, see chapter 8.

European Union from America and Asia owing to their low cost prices. EU consumers may be provided with cheaper food - but we will have little say in how it is produced.

Capital and specialized skills

Developing new techniques and technologies requires serious capital input and specialised skills, and presents risks for small companies. Therefore, European governments, researchers and companies must work together in this area.

Governments are expected to maintain an adequate system for research and development, and the current aim of the European Union to spend 3% of its GDP on research and technology development is promising. The needs of individual companies, concerted actions, associations and platforms of companies will add extra value to research, e.g. in setting priorities which are vital for the livestock sector and in improving the applicability of research results. European animal reproduction and selection companies are prepared to take responsibilities: in their companies, their sector or their region and in working together with both research and (national and European) government, in being transparent, and in having a dialogue with society when developing improvements.

This publication

In this publication, the economic value of livestock production is worked out:

1. The size of the main agricultural blocks (chapter 2).
2. The size of EU livestock industry (chapter 3)
 - supply and demand;
 - livestock industry compared with other agricultural commodities.
4. The size and developments of the most important livestock species (chapters 4 to 7), and
5. The size and value of farm animal breeding and reproduction industry (chapter 8).

Sustainable animal reproduction and selection

Sustainable farm animal breeding and selection means the extent to which animal breeding and reproduction, as managed by professional organisations, generate competitive rates of genetic progress over a long period of time while maintaining good care of animal genetic resources for present and future generations (www.sefabar.org).

Challenges for animal reproduction and selection

Taking into account

animal health, animal welfare, product quality, consumer health, optimum production circumstances, the protection of the environment, and biodiversity:

New methods for selecting farm animals, especially for quality traits.

Many of these traits cannot be met by traditional ways of selection and breeding, but could be by genomics included in current selection programmes.

Increasing reproductive qualities of farm animals.

There is a need for fundamental research to improve aspects of reproduction: semen, oocytes and embryo production, and research on new methods to improve fertilisation.

New methods to improve disease resistance.

Genetic improvement of disease resistance, and extended research on immune response, endogenous viral genes and enteric disorders, has great potential to improve animal health without medicines. Furthermore, there is a need to investigate the genetic basis for susceptibility to diseases, e.g. variation in disease resistance, and interaction between genotype and disease. Research should be able to indicate potential risks and find solutions before zoonoses can affect animal populations or animal-human interactions (e.g. BSE, scrapie).

Efficient use of animal feed, especially by-products of human food.

Feed is the major cost item for animal production. Growth and feed-efficiency traits, endogenous growth factors influencing eating quality, and the improvement of possibilities to use by-products of human food are important.

Transparency and dialogue with society.

Transparency and dialogue with society while developing new technologies and products are of utmost importance to improve mutual understanding of animal breeding and reproduction and animal products. It is worth mentioning that none of the techniques involve genetic engineering or transgenesis.

2. Livestock production in the world

World animal production is continuously growing. Between 1995 and 2002, the world total meat production increased by 19%, the total milk production by 11%, and the egg production by 23% (Table 2.1).

Europe and North & Central America

In Europe, animal production has remained mostly constant during the last decade (Table 2.1.) This means that the average production level of the animals has continued to increase in the period as the number of livestock has decreased in Europe at the same time (Table 2.2).

Table 2.1. World livestock production (billion MT)

Country	Meat, Total		Milk, Total		Eggs Primary	
	1995	2002	1995	2002	1995	2002
World	205	243	539	598	47	58
Africa	10	11	23	26	2	2
Asia	75	98	142	186	26	35
❖ <i>China</i>	48	67	9	15	17	24
Europe	52	52	227	216	10	10
❖ <i>European Union (15)</i>	34	36	126	125	5	5
❖ <i>Candidate countries (13)</i>	2	2	9	9	2	2
North & Central America	42	50	90	97	6	8
❖ <i>United States of America</i>	34	39	70	75	4	5
South America	21	26	39	46	3	3
Oceania	5	5	18	26	0.2	0.2

Source: FAO, 2003b

Table 2.2. Numbers of livestock (million)

Country	Cattle		Chickens		Pigs		Sheep	
	1995	2002	1995	2002	1995	2002	1995	2002
World	1332	1360	13033	15420	901	939	1082	1044
Africa	203	233	1093	1293	18	19	220	251
Asia	456	472	6405	7660	512	564	411	406
❖ <i>China</i>	101	106	3137	3924	425	465	117	137
Europe	178	143	1883	1830	215	194	180	138
❖ <i>European Union (15)</i>	84	82	935	1015	119	123	113	102
❖ <i>Candidate countries (13)</i>	30	24	415	443	44	36	53	39
North & Central America	165	161	2277	2711	94	100	17	15
❖ <i>United States of America</i>	103	97	1611	1830	60	59	9	7
South America	294	313	1287	1810	58	56	85	76
Oceania	36	39	88	116	5	6	170	157

Source: FAO, 2003b

Asia

In Asia, meat, milk and egg production is growing fast, approximately by one third in the last decade (Table 2.1). The growth in livestock production has been even stronger in China which already produces 70% of the meat and eggs in Asia. This growth is also expected to continue in the future. The position of Asia in world animal production is changing too. While Asia produced a quarter of the meat in the world in 1988, by 2002 it produced 40%. Milk production increased from one fifth to one third over the same period. Also egg production is increasing very fast, and in 2002 Asia produced 60% of the eggs in world.

The increase in production was mostly due to the increased production level of the animals. However, the number of cattle, pigs and especially chicken also grew from 1995-2002 (Table 2.2).

Africa

The growth of animal production in Africa was moderate to low in the last decade (Table 1). The average animal output grew slightly, but so also did the number of animals, especially sheep (Table 2.2).

South America and Oceania

In South America, the production of both meat and milk increased in the last decade by 20% (Table 2.1). The increase was most remarked in the poultry industry, as the number of chicken in the continent increased by 40% from 1995 to 2002 (Table 2.2).

In Oceania, milk is the most important animal product and its production levels continued to increase strongly, by 44% in the last decade (Table 2.1).

Land use and population density

Over half of the world's agricultural land and permanent pasture is in Asia (one third) and in Africa (one quarter) (Table 2.3). However, while Asia produces between one third and two thirds of world's meat, milk and egg production, Africa only produces 3 to 5 %. Less than ten percent of the world's agricultural area and permanent pasture is situated in Europe, with only two percent of it being within the EU area. Owing to the intensity of production, the EU produces nonetheless 15% of the world's meat, 21 % of its milk and 8 % of its eggs. North and Central America, South America and Oceania each possess about 10% of the world's agricultural land and permanent pasture. The livestock production levels in North America, especially the USA, are as high as in Europe, but lower in South America and Oceania.

Asia is very densely populated compared with the other continents, with 60 % of the world's population living there (Table 2.4). Europe, especially the EU countries, is also relatively densely populated, and about 12% percent of the world population lives in Europe. The other continents are much more sparsely populated. In both Asia and Africa, the proportion of the population working in agriculture is still over 50%, but in the other parts of the world it is much lower and decreasing all the time. In the EU, only four percent of the population is working in agriculture, as compared with one fifth in the candidate countries.

Table 2.3. World agricultural area (million ha)

Country	Land Area	Agricultural Area	Permanent Pasture
World	13060	4974	3477
Africa	2963	1101	896
Asia	3098	1656	1110
❖ <i>China</i>	933	535	400
Europe	2261	489	182
❖ <i>European Union (15)</i>	314	141	56
❖ <i>Candidate countries (13)</i>	183	99	28
North & Central America	2137	635	367
❖ <i>USA</i>	916	418	239
South America	1753	619	503
Oceania	849	474	419

Source: FAO, 2003b

Table 2.4. World total and agricultural population

	Total (billion)		Agr. Pop. %	
	1995	2001	1995	2001
World	5.66	6.13	44.39	41.98
Africa	0.70	0.81	58.13	55.10
Asia	3.42	3.72	55.62	52.36
❖ <i>China</i>	1.23	1.29	69.29	66.01
Europe	0.73	0.73	10.14	8.17
❖ <i>European Union (15)</i>	0.37	0.38	5.35	4.15
❖ <i>Candidate countries (13)</i>	0.17	0.17	22.87	19.99
North & Central America	0.46	0.49	11.87	10.55
❖ <i>USA</i>	0.27	0.29	2.59	2.16
South America	0.32	0.35	20.73	17.71
Oceania	0.03	0.03	20.20	19.84

Source: FAO, 2003b

3. Livestock production in the EU

Apart from being important to the vitality of the countryside, farmers are responsible for the food supply. About 16% of the consumers' budget in the EU is spent on food (European Commission, 2002a).

Agriculture in the EU

Agriculture was responsible for 1.7% of the gross indigenous production in the EU in 2001 (Table 3.1).

Agriculture adds 6 % to the imports from and the exports to the world market (in 1995 this was 12 and 8% respectively, European Commission, 1996).

Livestock in the EU

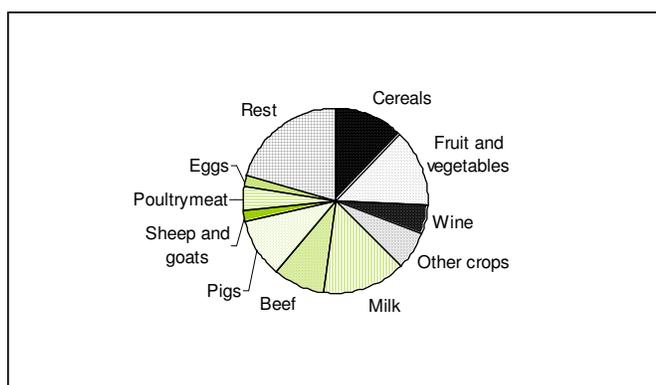
Livestock production added 122 874 million Euro to the EU agricultural production value in 2001, while the EU crops including animal fodder were responsible for 150 360 million Euro (Figure 3.1). The EU aquaculture sector adds a further 2 493 million Euro to these figures (FAO, 2003a). While the absolute value of livestock output is increasing yearly, the relative share of the animal output in the agricultural production value has decreased somewhat in the last years and is now a little over 40% (Figure 3.2.).

Table 3.1. Agriculture in the EU

	1998	2001	% change
Area farm land (*1000 ha)	128 691	128 305	-3.0
Jobs in agriculture (*1000)	7 083	6 701	-5.4
% of total jobs	4.7	4.2	-0.5
Agricultural output (million Euro)	213 467	287 886	+31.2
% Agriculture in:			
Gross ind. Product	1.5	1.7	+0.2
Investments	3.2 ¹	2.5	-0.7
Import	7.7	6.0	-1.7
Export	7.0	6.1	-0.9
Balance external agr. Trade (million Euro)	-3 384	-199	+94.1

¹1997 Source: European Commission, 1999 and 2002a

Figure 3.1. Agricultural output in the EU in 2001 (total 282 408 million Euro)



Source: European Commission, 2002a

Figure 3.2. Development of agricultural Output in the EU in 1997 – 2001 (million Euro)

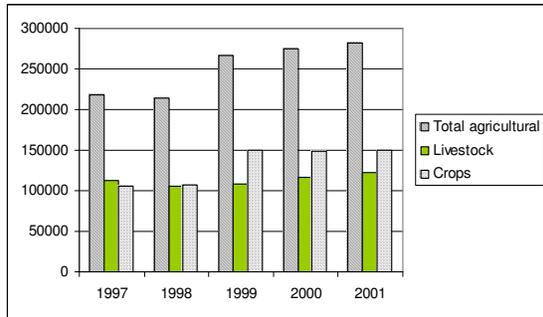
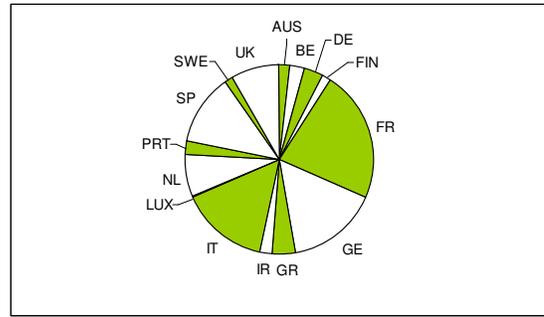


Figure 3.3. Share of agricultural production value of the EU in 2001 by member state



Source: European Commission, 1999 and 2002a

Animal production in EU member states

Animal production as a part of total agricultural production varies between the EU member states. In Ireland over 70% of agricultural production is due to the farm animal sector (European Commission, 2002a). In Belgium, Denmark, Luxembourg and the UK, animal production is responsible for 50-65%. In Austria, Finland, France, Italy, Netherlands, Germany, Portugal, Spain and Sweden this percentage is 30-50%, while in Greece it is 20%. Figure 3.3. shows the contribution of the individual member states to the total agricultural production value of the EU.

Agribusiness sector

The contribution of animal production to the gross indigenous production is at least twice as high if the whole agribusiness sector is considered. For example, in Denmark and the Netherlands, where direct agricultural production added 4 % to the national gross production, the agribusiness sector was responsible for 12 and 10 % of the national

Source: European Commission, 2002a

gross production respectively (European Commission, 1993; Ten Pas and Van der Ploeg, 1990).

In several countries the agricultural contribution to export is five to ten times as high as the direct agricultural contribution to the gross indigenous production (European Commission, 2002a). The net share of the EU in world trade is especially high in animal products: 14 % in eggs, 24% in cheese and 29% in milk powder, and 9% in total meat products (with 39% of the pig meat trade).

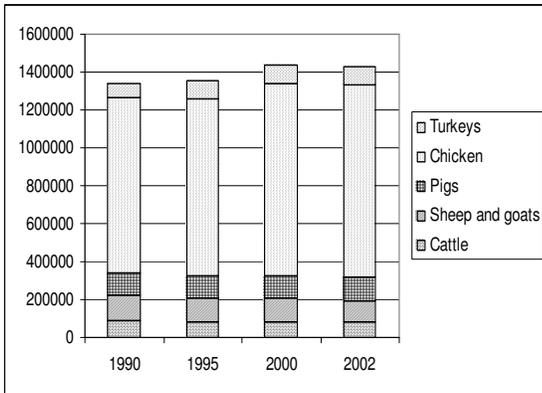
Area farm land

The area of (good) farm land continues to decrease in the EU (Table 3.1). There is a continuing, intensive pressure in Europe on all the available land from several sources.

Number of farms, number of animals

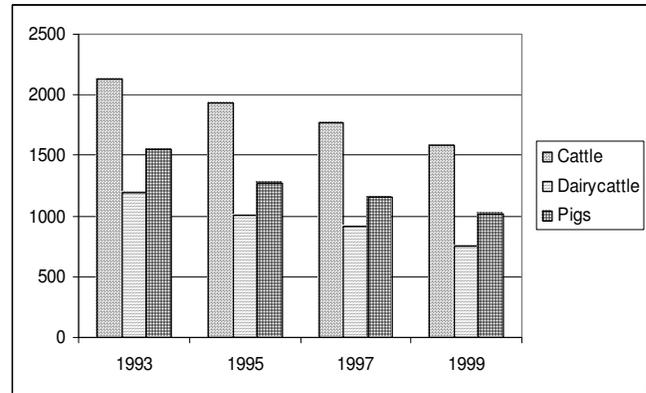
Although the number of farm animals kept in the EU has remained relatively constant, the number of holdings continues to decrease (Figures 3.4 and 3.5).

Figure 3.4. Number of livestock in the EU in 1990 – 2002 (*1000)



Source: FAO, 2003b

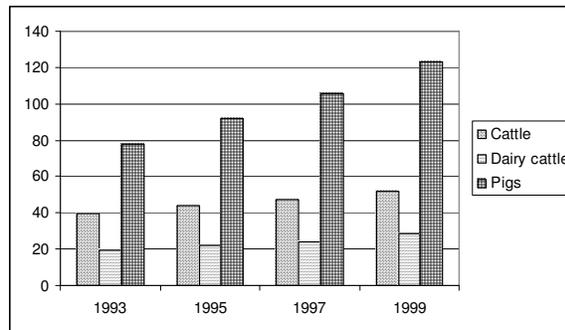
Figure 3.5. Number of livestock holdings in the EU in 1993 – 1999 (*1000)



Source: European Commission, 1999 and 2002a

The average size of livestock farms is growing rapidly, mainly for one reason: the income per each animal is decreasing every year (Figure 3.6).

Figure 3.6. Average number of livestock per holding in the EU in 1993 - 1999



Source: European Commission, 1999 and 2002a

Jobs in agriculture

A considerable proportion of the population in the EU is still involved in direct agricultural production (4.2 % in 2001) (European Commission, 2002a). In Spain, Ireland, Portugal and Greece, this proportion is 7, 7,

Animal output

Animal output can be divided into animals and animal products. The value of output due to animals in 2001 was 72 300 million Euro (European Commission, 2002a). Pigs and cattle were both responsible for 35 to 40% share of the output, poultry for 17% and sheep and goats for 8%. Animal product output value in the same year was 46 000 million Euro of

13, and 16 %, respectively. Aquaculture provides a substantial positive contribution to the socio-economic development of many coastal and rural regions in Europe, where alternative employment opportunities are limited and employment in capture fisheries is in decline due to restructuring of the sector.

which 41 000 million Euro was due to milk and milk products and 0.5 million Euro due to eggs. The pig, poultry and milk output value are on the rise since 1999, whereas the beef output value is on a slight decrease (Figure 3.7).

Animal feed

Almost three quarters of the 130 million hectares of farm land in the EU is used for the production of animal feed (European

Commission, 2002a). The animal feed industry is the main EU consumer of cereals (FEFAC, 2002).

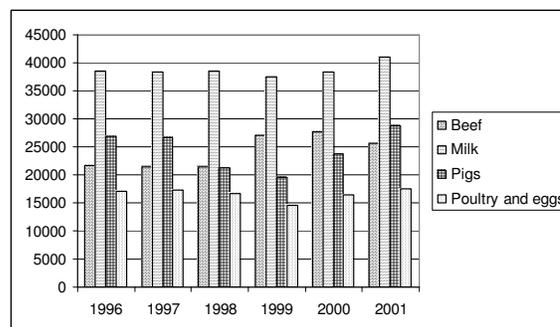
On average, 41% of all farm inputs in the EU member states are related to animal feed, compared with, for example, seeds 5%, energy 10%, fertilisers 7%, pesticides 6%, veterinary services 3% and maintenance of buildings and machines 9% (European Commission, 2002a). Seventy percent or more of the production costs for pork and chicken are due to feed costs (FEFAC, 2002).

Animal feed is often produced in areas that are not fit for crop production: too poor, too wet, too hilly or lands that are best fit for grassland, e.g. lowlands and mountain areas. The EU farm animals are fed annually with approximately 400 million tons of feedstuffs, of which half are roughages produced on-farm, 10% grains produced on-farm, 10% are purchased feed materials and 30% industrial compound feed (FEFAC, 2002).

Consumption

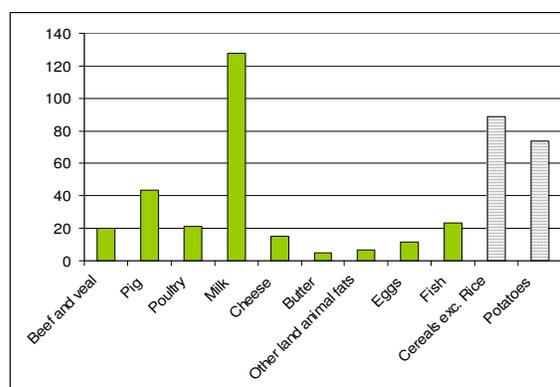
Most European citizens consume meat, milk and eggs. In 2001, the average European citizen consumed 96.7 kg meat (92.4 kg in 1989), of which 45 % was pork, 22% poultry and 21 % beef and veal (Figure 3.8). This is an increase, if compared with 1995 (93.4 kg) and 1989 (92.4 kg) (Animal Production, 1993), mainly owing to increased pork and poultry consumption. The egg and milk consumption in the same year were 12 and 128 kg per person, respectively. In addition, EU citizens consume on average 23.4 kg fisheries products per capita per year, of which 31% come from aquaculture (European Commission, 2001b).

Figure 3.7. Animal and animal products output in the EU in 1996 – 2001 (million Euro)



Source: European Commission, 1999 and 2001a

Figure 3.8. Average consumption kg per capita of animal products and some other major food items in the EU in 2001



Source: European Commission, 2001b and 2002a

Self sufficiency

The EU is currently self sufficient for most animal products, except for sheep and goat meat (Table 3.2). However, the EU has a considerable trade deficit in fishery products, and, while the quantities imported have remained relatively stable over the last decade, the deficit in terms of value continues to grow (European Commission 2001b)

Table 3.2. Supply balance sheets of animal products in the EU in 1995 - 2001

	Beef	Pigs	Sheep/goats	Poultry	Eggs	Milk ¹
Production (*1000 t)						
1995	8 115	16 105	1 164	8 042	5 257	978
1998	7 682	17 663	1 150	8 823	5 347	1 265
2000	7 464	17 564	1 150	8 734	5 236	1 382
Self sufficiency %						
1995	108.5	106.0	82.4	108.3	102.9	101.8
1998	103.3	108.8	81.3	109.1	103.5	99.2
2000	102.5	107.2	80.8	105.5	103.2	101.0

¹Skimmed milk powder; production excl. change in stocks

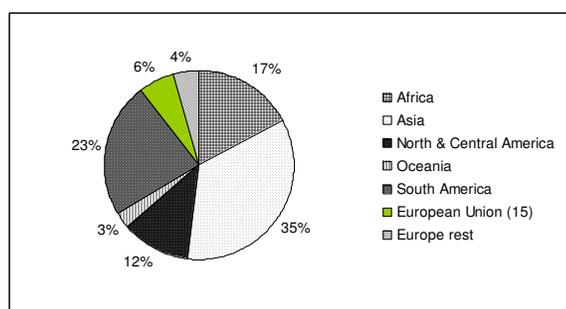
Source: European Commission, 1999 and 2001a

4. Cattle production

In 2002 there were altogether 1 360 million head of cattle in the world, 6% of which were living in the EU and a further 4% in the rest of Europe (Figure 4.1). The majority of the cattle in the world can be found in Asia (35%), South America (23%) and Africa (17%).

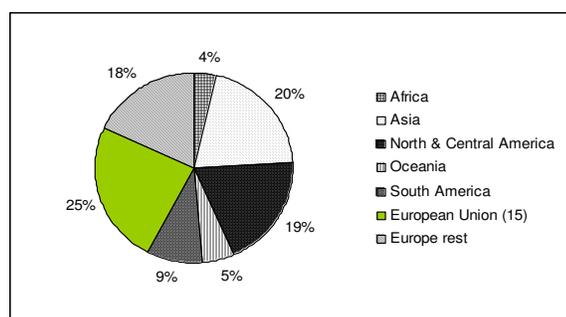
In all EU countries, except for Sweden, the number of cattle decreased from 1996 to 2001 (Danish Dairy Board, 1996, European Commission, 2002a). From 2001-2002 the number of cattle decreased further in all EU countries, except for Spain, France and Ireland. The reduction was due both to a decreasing number of adult cattle and calves for fattening as well as dairy cows.

Figure 4.1. Cattle population in the world in 2002



Source: FAO, 2003b

Figure 4.2. Milk production in the world in 2002



Source: FAO, 2003b

Milk production

In spite of the decreasing cattle numbers, the EU is the number one milk producer in the world with 122 million tons of milk per year in 2001 (Figure 4.2). This is one quarter of all the milk produced in the world. The second largest milk producer is the USA with 15% of the world milk production. Although the majority of the world's cattle live in the developing countries, only one third of the

world's milk is produced there. However, the milk production is expected to grow in the developing countries in the future, especially in India.

Milk production per cow per year is very variable over countries. The average milk production per cow in Africa was only 487 kg in 2002, whereas in North and Central America it was 4 684 kg and in the EU 5 903 kg milk per cow per year (FAO, 2003). The average milk yield per cow in the world in 2002 was 2 237 kg.

Within the EU, Germany (23% of total EU milk production) and France (20%) are the largest milk producers (Table 4.1). Production figures of dairy cattle in the EU vary from 4 400 to 7 838 kg milk per cow per year. The milk production level per cow per year continues to rise steadily in all EU countries, with the average increase of 4% from 2000 to 2001.

The overall milk supplies have levelled in the EU countries from the 1980s onwards, but in the USA the milk production is increasing at 0.5 to 1.5 % per year and an increase is expected in New Zealand and Australia as well. The reason for the levelling of the milk production in the EU is the imposition of milk quotas since 1985 (European Commission, 2002c).

The largest players in the world market of milk and milk products are the EU, New Zealand and Australia. In 2001, the EU had a 32 % share of the world cheese export market, 23% share of the butter export market, a 31% share of the whole milk powder export market and a 55% share of the condensed milk export market (European Commission, 2002a).

Beef and veal production

In 2001, 57 million tons of beef were produced world wide (European Commission, 2002a). The EU produced 7.3 tonnes of beef and veal in 2001, which makes it the second largest beef producer in the world (13 % of the world production), after the USA (21 %) and in front of Brazil (12 %) (Figure 4.3). Within the EU, the largest producers are France (22%), Germany (19%) and Italy (16%).

The beef and veal production has been in decline in the last years in the EU. In contrast, cattle numbers are growing slowly again in North America and as a consequence both beef and milk production is increasing there. This means that increasing amounts of beef are available for export, especially to Japan. Beef production is growing considerably also in Brazil: from 5.8 million tonnes in 1998 to 6.7 million tonnes in 2001.

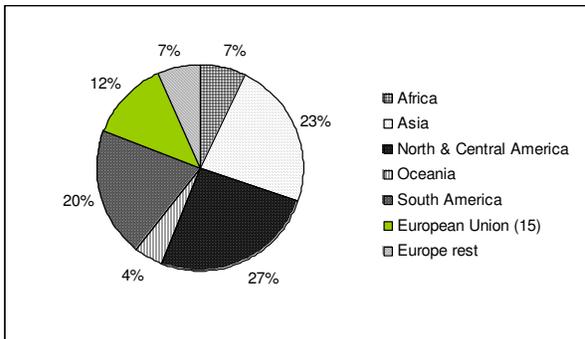
Research

European cattle farmers need help from research to maintain their competitive position in the world market in the future.

New technologies, e.g. in vitro fertilisation and genomics, will enable better utilisation of the

genetics of females in selection or selection for traits that could not be selected for before. It is important that new developments are accompanied by transparency and dialogue with society.

Figure 4.3. Beef production in the world in 2002



Source: FAO, 2003b

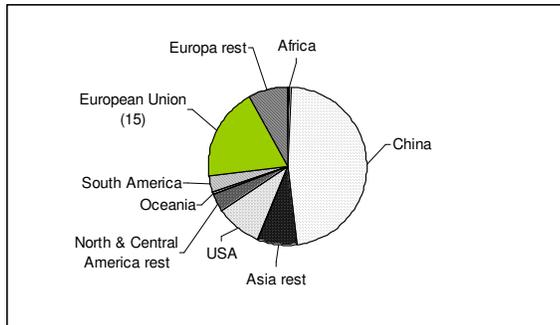
Table 4.1. Milk supplies in the EU in 2001 (1994 between brackets)

Country	No. cows (*1000)		Kg milk (*1000)	Milk kg/head
Germany	4448	(5192)	28191	6211(5237)
France	4195	(4428)	24767	5964(5396)
United Kingdom	2203	(2715)	14717	6292(5383)
Italy	2169	(2275)	11004	5066(4489)
Netherlands	1551	(1752)	11291	7370(6014)
Ireland	1233	(1292)	5447	4400(4208)
Spain	1190	(1369)	6624	5805(4167)
Denmark	628	(699)	4618	7171(6583)
Belgium	611	(673)	3395	5397(4493)
Austria	598	(817)	3300	5314
Sweden	425	(410)	3339	7838
Finland	352	(417)	2530	7067
Portugal	338	(372)	1982	5583(4344)
Greece	172	(206)	815	4528(3668)
Luxembourg	44	(49)	269	6114(5255)
EU-15 total/average	20156	22766	122288	6003(5132)

Source: European Commission, 2002a, Danish Dairy Board, 1996

5. Pig production

Figure 5.1. World pork production in 2002



Source: FAO, 2003b

China produces almost half of the pig meat in the world (47%). The EU is the second largest pork producer (19%), in front of the USA (10%) (Figure 5.1). Since 1995 there have been major changes. China's share of global production has increased from 38 to 47% and the EU's and USA's shares have dropped to 5 and 3% respectively (European Commission, 1993, 2003b).

World pork consumption and production

From 1995 to 2002, world pork production increased from 78.7 million tons to 93.6 million tons (FAO, 2003b). This increase from 42.5 to 55.7 million tons was mainly due to the increased production in the developing countries, especially Asia (Figure 5.2). The production in the developed countries including the EU hardly changed in this period, although pork consumption in the EU continued to increase (European Commission, 2001 and 2002a).

From 1995 to 2000, world pork consumption increased by 15%, both owing to the growing world population and the growing consumption per head (7%). Consumption has increased especially in China, Taiwan, and Brazil (FAO, 2003b). Within the EU, pork consumption has mostly stabilised in the North, while in the South the consumption is expected to grow (Spain, Portugal, and Greece) (Van Gaasbeek *et al*, 1993; FAO, 2003b). Competition from poultry could influence pork production and consumption as well.

The situation in the EU

The main exporting countries within the EU are Denmark (25% of pork export of the EU in 2000) and the Netherlands (17%).

Although the number of pigs is slightly increasing, the number of holdings is decreasing rapidly (Table 5.1). The variation in the average size of pig farm is still large within the EU: the smallest pig farms are in Portugal (average 18.1 pigs per holding in 1999) and the largest farms in Ireland (1 763 pigs per holding). A lot of pigs are still held on very small farms. However, it is getting more and more difficult to get an income from small farms. Farms simply have to grow in order to survive, because their income is constantly under pressure (European Commission, 2002a).

Severe competition from USA and Asia

EU pig producers expect very severe competition from other continents in the future, especially America and Asia.

In North America huge farms - 1 million pigs per farm - are coming on stream and research is stimulated by the government. Owing to the farm sizes and production methods such as growth promoters and hormones which are not allowed in the EU, cost prices are reducing rapidly.

In Asia, rapidly developing technologies together with low man power costs are responsible for increasingly cheap pig production. Taiwan has low man power costs, a good infrastructure and it is situated near to the important market of Japan. Pig production is growing in China and the country is expected, in time, to become an important exporting country.

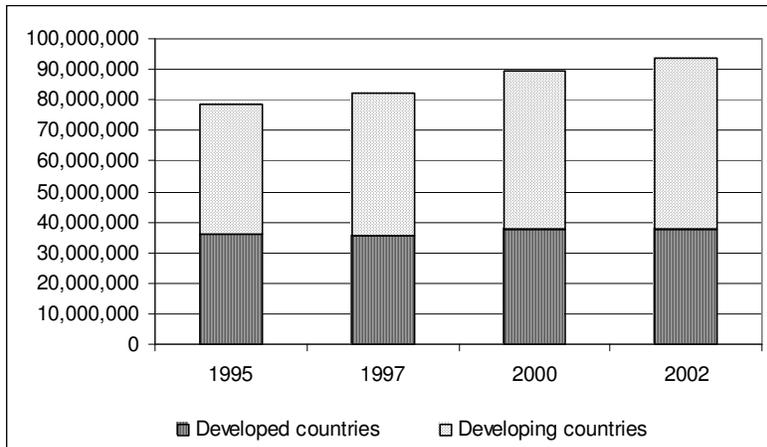
Within Europe, Hungary could be a successful competitor in the world market (Van Gaasbeek *et al*, 1993).

Research

European pig farmers produce high quality products and they work very efficiently. They can stay competitive in the future by improving pork products and pig rearing production methods. The EU should invest in research and development, advance its technologies, and produce high quality products in a responsible way. The pig-rearing sector is known for its ability to work together closely.

For these ends, precompetitive research on a European level is necessary: e.g. further development of genomics and its application in breeding programmes, and development of methods for improved reproduction of pigs on a farm level.

Figure 5.2. Pork production in the world 1995 – 2002



Source: FAO, 2003b

Table 5.1. Changing structure of pig farms in the EU

	1993	1999	% change
No. pigs (*1000)	121 227	125 045	+0.5
No. holdings (*1000)	1 552	1 014	-7.1
Average no. animals per holding	78.1	123.3	+57.9

Source: European Commission, 2002a

6. Poultry production

Meat

In the world poultry meat market in 2002, the USA was the market leader with 24 % of the market (Figure 6.1). China, since the early 1990s, has become the second largest producer (19 %), overtaking the EU (12%) and Brazil (9%). Since 1995, the total poultry meat production in the world has increased by one third from 54.7 to 72.2 million tons in 2002 (FAO, 2003b). In the same period, the production increased by 50% in China (from 8.7 to 13.5 million tons), and by 65% in Brazil (from 4.2 to 6.8 million tons).

Eggs

China produces 42% of the eggs in the world (Figure 6.2) (this was 40% in 1994, European Commission, 1995). Next are the EU and the USA (both 9 % share of the world egg production; this was 15 and 13 % respectively in 1994). The world total egg production increased from 47.0 million tonnes in 1995 to 57.8 million tonnes in 2002. In this period, the production in the EU however decreased slightly, while the production in the USA increased by 16%. In the same period, the egg production in China increased by 42% from 17.1 to 24.2 million tonnes.

Characteristics of the market

Poultry meat refers primarily to broiler (86%) and turkey meat (7%) and to meat from duck, pheasant, geese and other farm kept birds (Verheyen and Kok, 1993; FAO, 2003b). Poultry eggs are primarily hen eggs (93%).

Most poultry products are still produced for domestic consumption. There is a trend towards more fresh poultry products. The limited dependence of poultry production on land goes some way to explaining the low percentage of total production volume which is traded internationally.

Breeding companies

The genetic improvement of specialised lines of poultry for egg and meat production is provided by world wide operating breeding companies, situated in Europe and North America. Because of the regional character of poultry production they have also a local emphasis to their work and provide local employment.

Increasing demand

Poultry meat covers one third of the world meat consumption (FAO, 2003b). In the USA the poultry meat consumption is already very high (47.6 kg per head per year in 2000) and has grown by 8 kg since 1994. In comparison, the poultry meat consumption in the EU was 20.6 kg per head per year in 2000, and in Asia it was on average only 6.6 kg per head. Growth is expected in the high income Asian countries: for example in China the consumption has grown by 44% since 1995 to 10.5 kg per head in 2000. In Europe, consumption is also increasing, although the growth is expected to be lower in the future than the current growth of 2-3% yearly. Also South America, a few African countries, and the Middle East are potential growers. The growing consumption is related to the increasing income of the population. (Verheyen and Kok, 1993)

World poultry production will have to increase in the coming years to meet demand. Production is growing in most of the important production areas: USA, China and Brazil (FAO, 2003b). In the EU the production growth has slowed down. Mexico, Argentina and Brazil have increased their production fast in the last years and are expected to continue to do so in the coming years. The same goes for most Asian countries - especially Thailand - , but not Japan and Hong Kong.

Production in the Russian Federation, Japan and Eastern Europe has been decreasing (Verheyen and Kok, 1993; FAO, 2003b). Hungary, once number five producer on the world market, has a sharply decreased poultry sector. However, when economic reforms bear fruit, production is expected to go up again in these countries (Verheyen and Kok, 1993).

Poultry in the EU

EU poultry meat consumption grew from 12 kg per head in 1975 to 21.4 kg per head in 2001, of which up to one third was turkey depending on country (USDAFAS, 2002). Consumption of turkey in the EU tripled between 1975 and 1992, but the increase has slowed down since. The total poultry meat production in the EU amounted to 9.0 million tonnes in 2002, 75% of which was chicken and 21% turkey meat (FAO, 2003b). Furthermore, 5.2 million tonnes of eggs were produced in the EU in 2002. There are important differences in the types of poultry meat production in the different member states. In most countries production is concentrated

The economic value of livestock production in the EU 2003 in certain regions, which sometimes causes local environmental problems. The most important poultry producers in the EU are France, Italy, the UK, Germany, Spain, and the Netherlands.

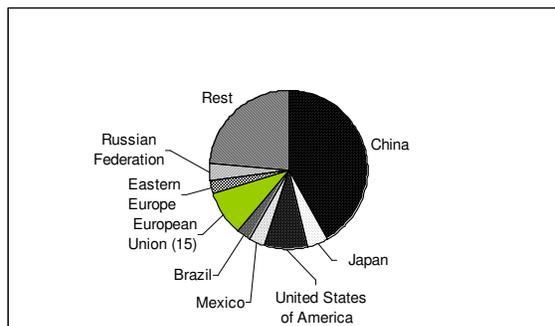
inevitable when high populations are involved, must therefore be sought.

Research

For the poultry industry in Europe it will be important to find alternative methods against disease challenge, to continue genomic research, and to improve research on endogenous viral genes on the genome.

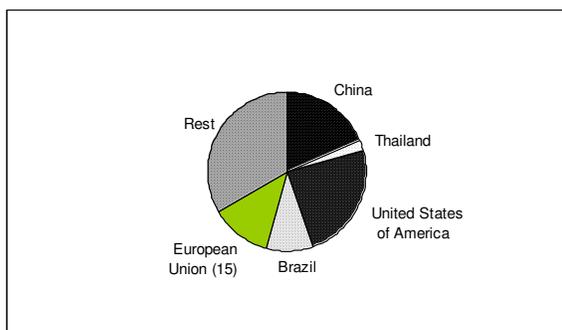
The development of the modern poultry industry has been reliant on vaccines, antibiotics and medicines to provide protection against e.g. coccidiosis and blackhead diseases. These will become less readily available in the future because of possible legal restrictions and the high costs of registering medicines with a low market potential relative to the cost. The development of alternative methods for disease challenge in Europe, e.g. by means of genomics related to host-pathogen relationships, which is

Figure 6.2. World egg production in 2002



Source: FAO, 2003b

Figure 6.1. World poultry meat production in 2002



Source: FAO, 2003b

7. Aquaculture

Aquaculture production in Europe expanded by an average of more than 7.4% per year between the years 1994 and 2000 (New, 2001). Today it represents 31% of the total fishery production in the EU (European Commission, 2001b). It was estimated that the total annual production of finfish, would exceed 1.3 million tonnes by the year 2000 in Europe (New, 2001). The largest producer is Norway, which produced 498 000 T, 38% of the European total. The second most important producer is the United Kingdom (143 000 T). France, Italy, and Greece each produced between 60 000 and 70 000 T of farmed fish in 2000, while Spain, the Faeroe Islands, Denmark, Turkey and Germany each produced between 35 000 and 45 000 T. The dominant species reared in Europe are Atlantic salmon (48%), other salmonids (26%), cyprinids (15%), seabreams (5%), and seabass (4%).

Many complex factors will determine the scale and characteristics of European aquaculture in the future (New, 2001). These will depend on macro global and regional economic and political factors, including the development of trade in aquaculture commodities. It is expected that the total European aquaculture production will be between 2.2 and 2.3 million T by the year 2010, with largely the same dominant species as now. In addition, farming of marine fish such as cod and flatfishes will likely become very much more important in European aquaculture in this decade.

Demand and supply

At the beginning of the eighties the EU was still self sufficient for fish and fish products. Since then demand has been growing fast as the average consumption of fish in the EU has increased from 19.2 kg per person per year in 1980 to 26.2 kg per person per year in 2000 (FAO, 2003b). However, at the same time the amount of fish supplied by traditional fisheries has stayed the same. The result is that nowadays the EU is no longer self sufficient for fish products.

The demand for fish which cannot be supplied by traditional fisheries in Europe will be partially

supplied by aquaculture. Many species such as cod, which were only kept on a laboratory scale until recently, can either already be reared on a commercial scale or will be in the near future. Some of the advantages of aquaculture products compared with the traditional fisheries products are their availability throughout the year and their image of high quality fresh products.

Characteristics of the market

The market for aquaculture products is growing. It is a special market with special characteristics. Only one percent of all the fish species is cultured in some way (about 300 species), and of these species 30 to 40 are kept under more or less controlled production circumstances. Of these species, 10 to 15 are commercially interesting. The danger is that on one hand not enough different species will be adopted world wide for commercial aquaculture, and on the other hand there will be over production for those species that are easy to manage.

In Europe, the market is very fragmented, with a strong regional character and a good distribution network. The European consumer for aquatic food products is quality minded, wealthy and health-caring.

Several species

Examples of commercially produced fish species in Europe are Atlantic salmon, rainbow trout, European seabass, several seabream species, and turbot. In addition, many other aquatic species such as blue mussel and oysters are cultured.

Atlantic salmon

The world wide salmon aquaculture production continued to increase strongly in the last years, from 465 245 T in 1995 to 1 025 287 T in 2001 (FAO, 2003a). Norway is the world's foremost aquaculture salmon producer (43% in 2001), followed by Chile (25%), United Kingdom (14%), Canada (9%), and Faeroe Islands (4%). Aquaculture salmon represents one third of the world's total salmon production (EAOBC, 1995).

In 2001, 18% of the total production value of aquaculture in EU was due to salmon. The salmon production is still expected to more than double within the current decade (New, 2001). The per capita consumption of salmon has been forecast to rise in the UK by 54% between 1999 and 2005, and increased consumption is also expected in Germany (39%), France (34%) and Spain (30%).

However, any expansion in the farming of carnivorous species such as the Atlantic salmon and trout will be highly dependent on the future availability of fish oil and fish meal for the production of feed (New, 2001). Another option is the development of diets based on proteins and oils from other animal and from plant sources.

Rainbow trout

The world wide rainbow trout production increased moderately from 365 240 tons in 1995 to 510 055 tons in 2001 (FAO, 2003a). However, the rainbow trout production in the EU is on a slight decline (Table 7.1). The world's largest rainbow trout producer is currently Chile (22% in 2001), followed by Norway (14%), Italy (9%), France (8%), Denmark (8%) and Spain (7%).

The value of rainbow trout per kg has decreased somewhat in the EU during the last few years. Nevertheless, rainbow trout is still the economically most valuable aquaculture species in production in the EU, bringing in one fifth of the total production value of aquaculture in 2001.

Seabass, seabreams and turbot

The culture of seabass, seabreams and turbot is mainly a European activity and the sector continues to increase. The growth was especially strong in the seabreams, where production increased from 16 695 tons in 1995 to 61 762 tons in 2001 (Table 7.1). The major producers of seabass, seabreams and turbot in the EU are Greece, Italy, Spain and France. Of the non-EU countries, the most important producers are Turkey (seabreams) and Croatia (seabass).

Although the EU production figures of seabass, seabreams and turbot represent only 8 % of the expected fish production from aquaculture in terms of volume, they amount to one fifth in terms of production value, owing to the relatively high prices per kg in these species (Table 7.1).

Blue mussel and oysters

Blue mussel is cultured mainly in Europe, and in 2001 almost 60% of the blue mussels in the world were produced in Spain. Other major producers are France, the Netherlands and Ireland. In oyster production, France is the world's fourth largest producer (3% in 2001) after China, Japan and the Republic of Korea who dominate the world market.

In 2001, one fifth of the value of the aquaculture in EU was due to the blue mussel and oyster production.

Future species

It is unlikely that expansion of the aquaculture industry will take place in the future by a large scale introduction of new species. Introducing new species into culture implies long term research which is expensive and without any guarantee of positive consequences for aquaculture activities. Nonetheless, currently for example cod is expected to progress from trials into commercial farming within a few years (New, 2001). Other species such as wolffishes are also being considered for commercial aquaculture.

Selection

Much work has already been done on zootechnology, pathology and nutrition of aquaculture species, which has resulted in considerable progress in farming technology. At present, the domain in which the most significant progress can be expected is that of genetics and selection. For new aquaculture species, the control of reproduction, improvement of spawning synchronisation, characterisation of food requirements for breeders and gamete preservation are subjects for intensive research.

Table 7.1. Estimate of fish farming production in the EU

	Production (tonnes)		Value (1000 Euro)	
	1995	2001	1995	2001
Atlantic salmon	83 748	162 267	233 864	447 141
Blue mussel	347 700	402 072	200 735	258 533
Seabass	16 521	40 805	128 781	199 802
Seabreams ¹	16 695	61 762	121 178	259 845
Rainbow trout	235 173	226 549	658 425	565 431
Oysters ²	154 577	140 140	349 300	218 219
Turbot	2 977	4 829	24 925	37 901
Total³	1 099 754	1 296 636	2 196 206	2 493 431

¹Gilthead, sharpsnout, and white seabream

²European flat and Pacific cupped oyster

³Total of all aquaculture in European Union

Source: FAO, 2003a

8. Returns from genetic improvement programmes

Genetic improvement is permanent, cumulative, and usually both sustainable and highly cost effective (Simm *et al.*, 1997). It is permanent, since it influences the performance of the affected animals for life, and also because improvements made in one generation get passed on to the next. Consequently, when selection is continuous, its benefits are cumulative across generations. Providing that selection is for an appropriate breeding goal, and right steps are taken to limit the loss of genetic variation in the population, selection can lead to sustainable improvements in animal performance. Past selection is usually beneficial even when the breeding goals are later revised because of changing demands and constraints for animal production.

Investing in selection can be highly profitable for livestock producers. For example in pigs, it is possible genetically to improve economically important traits at the rate of about 2 to 3% per year using proven selection techniques (Schinckel *et al.*, 1999). The long term improvement of commercial producers' herds especially is dependent upon the implementation of efficient genetic improvement programmes in the nucleus, or seedstock herds.

Impact of nucleus selection on commercial livestock production

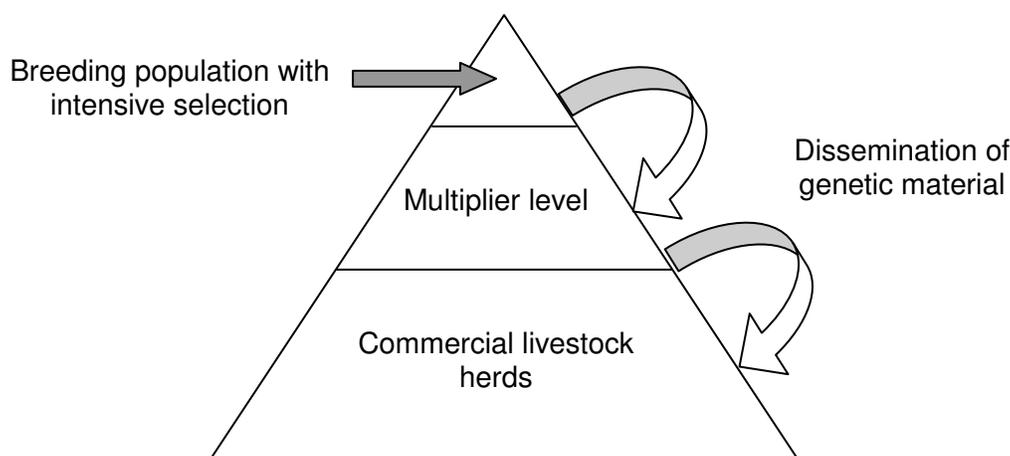
The structure of livestock breeding industries in most industrialised countries can be described as a pyramid with the elite breeders at the top, one

or more middle tiers of purebred or crossbred multipliers in the middle, and a final tier of commercial herds below (Figure 8.1). The elite herds are the main focus for genetic improvement. The main role of multipliers is, as the name implies, to take improved stock from the elite tier and to create from them more high genetic merit animals for sale to the commercial tier. As a result, genetic improvement flows down the pyramid from the nucleus to the commercial tier. Consequently, an efficient genetic improvement programme of a relatively small population of animals at the top of the pyramid can have a dramatic effect on the performance of a large number of animals in the tiers below. The European farm animal breeding industry has established a strong leading position in the world market (Farm Animal Industrial Platform, 2003 a, b).

Costs of investment into breeding and reproduction

Investments that need to be made in the elite or nucleus herds can include, for example, measurement and recording costs of economically important traits; genetic evaluation and selection costs; importation of breeding animals from other populations, and research to support and develop the breeding programme. Later on, the dissemination of the genetic improvement from the nucleus to the lower tiers incurs further costs related to the use of reproduction technologies. As a consequence, the commercial producers must be willing to pay a premium for obtaining genetically improved stock, to offset the costs incurred in the earlier tiers of the pyramid.

Figure 8.1. Pyramidal structure of for example pig or poultry breeding programmes



Returns of investment into breeding and reproduction

Genetic improvement can lead to increased production value, reduced costs of production, or both (Simm *et al.*, 1997). Benefits go to producers when cost reductions do not result in a reduction in retail prices or when quality improvements mean that they receive a higher price for their produce. With international trade, improved quality relative to competitors will mean that higher demand will result in higher quantities sold compared with a situation without genetic improvement. On the other hand, in domestic markets the local consumers tend to get the benefits from improvements in both cost and quality owing to competition forcing prices back down to a certain margin over production costs.

Effective genetic improvement programmes are vital to the competitiveness of any livestock industry.

It is not straightforward to estimate the returns relative to the costs of a breeding programme. Nevertheless, return to cost ratios from implementation of genetic selection programmes in nucleus breeding herds have been estimated to be in the range of from 9:1 to 118:1, depending on the species and the time scale of evaluation (Table 8.1). In any case, the cumulative value of selection programmes to commercial livestock producers and consumers has been, and will continue in the future to be substantial.

Table 8.1. Returns from livestock genetic selection programmes

Species	Time line	Return to cost ration	Source
Beef cattle	6 – 7 yr	10:1	Simm <i>et al.</i> , 1997
Beef cattle	30 yr	46:1	Farquharson <i>et al.</i> , 2002
Pigs	5 yr	23.0 : 1	Schinckel <i>et al.</i> , 1999
	10 yr	70.3 : 1	
	15 yr	118.3 : 1	
Sheep	30 yr	10 - 17 : 1	Banks, 1994
Sheep	10 yr	9:1	Simm <i>et al.</i> , 1997

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10. FAIP Members

Farm animals (several species)

Progenus, Belgium. Cattle, sheep, pigs
Finnish Animal Breeding Association (FABA), Finland. Cattle, pigs
SYSAAF, Nouzilly, France. Fish and poultry
U.N.C.E.I.A. (Union of French A.I. Cooperatives), France. Cattle, pigs
Semenitaly S.r.l., Saliceta S. Giuliano, Italy. Cattle, pigs
Intervet, The Netherlands. Farm animals
Nutreco, The Netherlands. Pigs, poultry, aquaculture
Team Semin, Norway. Ruminants, pigs, aquaculture
Meat and Livestock Commission, UK. Meat cattle, pigs
Faraday partnership, UK. Ruminants, pigs, poultry

Cattle and other ruminant selection and reproduction

Federation of Danish A.I. Societies, Denmark
Arbeitsgemeinschaft Deutscher Rinderzüchter, Germany
Alta Europe, The Netherlands
CR-Delta - Holland Genetics V.O.F., The Netherlands
Svensk Avel, Sweden
Genus, UK
Meat and Livestock Commission, UK

Aquaculture selection and reproduction

Akvaforsk Genetics Center, Sunndalsora, Norway
Aqua Gen, Kyrksaeterora, Norway

Pig selection and reproduction

GENTEC, Belgium
Federation of Danish Pig Producers and Slaughterhouses, Denmark
France Hybrides, France
Zentralverband der Deutschen Schweineproduktion e.V., Germany
Associazione Nazionale Allevatori Suini, Italy
IPG - Institute for Pig Genetics, The Netherlands
Asociacion nacional de criadores de ganado porcino selecto - ANPS, Spain
Sygen/PIC Group, UK

Poultry selection and reproduction

ISA, France.
Lohmann Tierzucht, Germany
Hendrix Poultry Breeders, The Netherlands
British Poultry Council, UK
BUT - British United Turkeys, UK.
Aviagen, UK

