

The World Seed Market

Developments and strategy

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1.1 Definition of terms

The agricultural seed sector comprises the breeding, propagating and trade of seed and seed products as propagating material in commercial agriculture. Agricultural seed is produced and sown in enormous quantities. The added value is limited compared to that of horticultural seed. Agricultural seed can be propagated vegetatively (seed potatoes) as well as generatively (with seed). Good seed is basic to agricultural production, because the quality of the seed is one of the factors determining the success of the harvest and the quality of the product.

1.2 The changing world of seed companies

In the production and sales of agricultural seed, much is changing in competitive position round the world. The establishment of the European Union (EU), restructuring of the Common Agricultural Policy (CAP), the political revolution in Eastern Europe and the liberalization of world trade via the GATT negotiations are bound to effect both agricultural producers and the suppliers of agricultural seed. Agriculture faces significant change. Attempts are being made to minimise the overproduction of various agricultural crops in the United States and Europe by letting fields lie fallow and converting to other crops. This results in a declining and shifting demand for agricultural seed in these parts of the world. In other regions (Africa, Asia & South America), production is going to have to increase to meet the continuing growth in population. We can also expect an increase in the demand for new, more productive varieties. Only a few countries have a large agricultural seed industry. If companies are to make the most of the many changes, a clear picture is needed of the position of these countries and their industries.

1.3 Background to the study

Our research is based on a thorough study of the available literature, and consultation with experts.

In the study, the following crops and crop groups are described, and the most significant countries analyzed.

Grains (wheat, barley, maize (corn), rice)

Oilseeds (soy, & other oilseeds)

Sugar-beet seed

Pulses (peas, beans)

Potatoes (seed potatoes)

Fodder crops (grasses, other fodder crops)

In the study 'maize' has been called 'corn' when specifically referring to the USA. We have included seed potatoes in our definition of agricultural seeds.

In chapter 2 a brief overview is given of developments at world market level, such as supply and demand. Trading aspects are dealt with in chapter 3. France, the Netherlands and the United States play an important international role in the agricultural sector, as covered in chapter 4. In chapter 5, important developments in the area of breeding and propagating are discussed. The seed industry is subject to external influences, which may be experienced either as new opportunities or as threats. We shall look into this in chapter 6. Chapter 7 reflects the outlook of the sector, and examines a range of strategic options.

Summaries are provided at the end of each chapter for quick reference.

This study has been published in line with the long term commitment of Rabobank to international food and agribusiness. For more information we refer you to the study 'International competitiveness in the propagating material sector' (1992, also written in cooperation with the Ministry of Agriculture, Nature Management and Fisheries) about developments in the area of breeding and propagating in horticulture, and to the studies 'The world grain market' and 'The oilseeds complex', published by Rabobank Nederland.

2 Development of demand

Developments in primary agriculture have direct consequences for the agricultural seed sector. Demand for agricultural seed is directly related to world acreage trends in the respective crops. Acreage development is in turn largely determined by agricultural policy, productivity, developments in human and animal consumption and by industrial applications.

2.1 Acreage development

The total acreage of cultivated land in the world stands at over 1.4 billion hectares (over 10% of total land area), and has increased by almost 2% over the last 10 years. In Africa increase has measured almost 5%, and in South America a little over 10%, whereas in Asia it has measured only 0.5%. In the industrialised nations there has been little or no increase, and in Europe there has been a significant decline.

The world acreage of **grain** has declined over the last 10 years. In 1980 a total of 718 million hectares was cultivated, and has stabilised at around 700 million hectares since then. Grain acreage has decreased in almost all EU countries as a result of changes in EU agricultural policy.

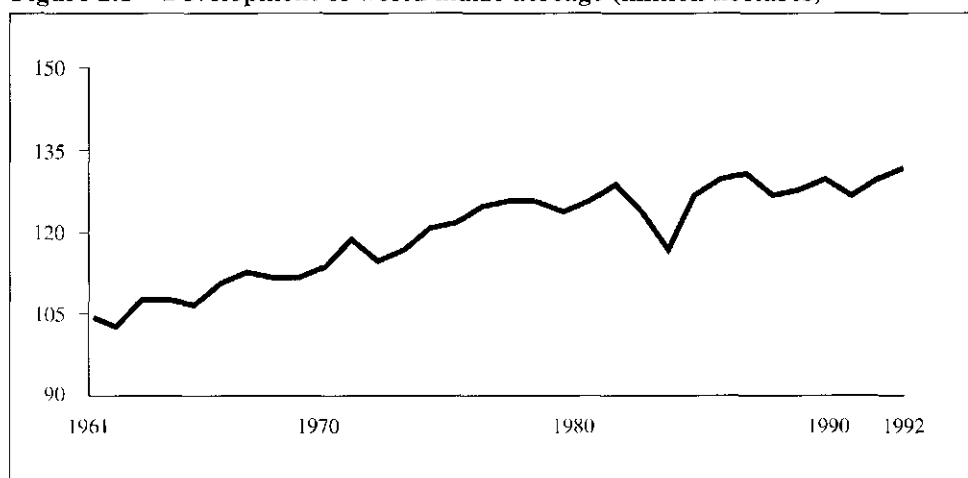
Wheat acreage in Europe has increased only slightly over the last 20 years, and fluctuates around 27 million hectares. In 1992 the figure fell to 25 million hectares. In North and Central America, wheat acreage increased from 27 million hectares in 1970 to almost 46 million hectares in 1982. Since then, the area has gone down again to around 40 million hectares. In Asia we see a gradual increase in acreage from a little under 70 million hectares in 1970 to around 85 million at the start of the 1990s. In Africa, acreage has increased in an irregular manner from 7 to 8.9 million hectares. Oceania also showed acreage growth, peaking at almost 20 million hectares in 1982-1983, since when it has declined steadily to around 9 million hectares.

Table 2.1 World surface of agricultural crops (million hectares)

	1970	1980	1991	1992
grains	674	718	696	700
roots/tubers	48	47	47	48
pulses	64	61	70	67
oil crops	82	107	124	127
sugar-beet	8	9	9	8

Source: FAO

Figure 2.1 Development of world maize acreage (million hectares)



Source: FAO

Over 90% of **rice** acreage is to be found in Asia, the major producer countries being China, India, Indonesia, Bangladesh and Thailand. In Asia, acreage increased from 122 million hectares in 1970 to 132 million hectares in 1990. At present world acreage appears to be stabilising.

Maize (corn) acreage in Asia shows a steady increase from 31 million hectares in 1970 to at least 40 million hectares in 1990, and therefore accounts for most of the world growth. Since 1990 acreage has stabilised. In North and Central America, acreage increased from 33 million to 39.2 million hectares in the same period, to recover to 1980 levels. The United States holds a 75% share. When production is measured in tons, however, North and Central America produce twice as much as Asia. Maize acreage in the EU has been on the increase again in recent years and totalled 3.7 million hectares in 1992 - just 3% of world acreage.

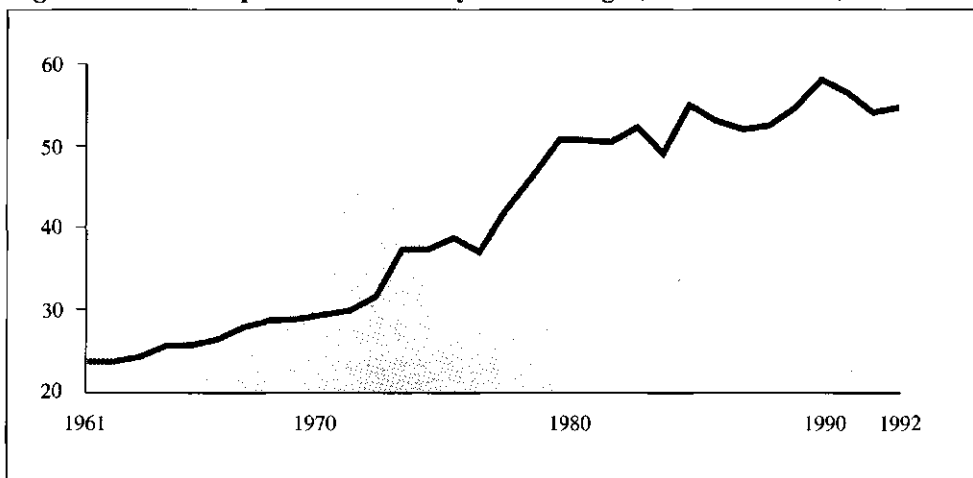
The world acreage of root and tuber crops increased by 3% between 1980 and 1992, to 48 million hectares. Potatoes and cassava are responsible for 38% and 33% respectively. World acreage of **potatoes** declined between 1981 and 1992 by 6% to 18 million hectares. Potato acreage in the EU has been halved in the last 20 years, falling from 3 million to 1.6 million hectares in 1992. The two main contributory factors were a change in consumption patterns within the EU and the disap-

pearance of feed potato production. An all-time low was reached in 1989, with an acreage of 1.4 million hectares. The increase in potato acreage in 1991 was largely the effect of the unification of Germany. In France, Germany and the Netherlands acreage has increased since 1990. Acreage declined in Spain, Italy and Portugal. The recent extension of potato acreage in the EU reflects not only relatively favourable prices in the period 1989-1991 but also the substantial drop in the grain price, which caused a number of arable farmers to move over to 'free' products, such as potatoes.

Between 1980 and 1992 the world acreage of **pulses** increased by 6% to 67 million hectares. Asia is the major producer of pulse crops, accounting for 51% of the world acreage. At the start of the 1980s pulse production and acreage increased significantly in the EU, a trend which is now being followed in world production as a whole. France accounts for much of this increase, and production is destined primarily for animal fodder. The increase came about as a result of EU policy to support these crops. Since 1990 the pulse acreage in Europe has tailed off slightly.

Among **oilseeds**, soybeans are by far the most significant on a world scale. Over the last 10 years the world acreage of soybeans has increased by 10% to 54 million hectares. It had risen steeply to 58 million hectares in 1989,

Figure 2.2 Development in world soybean acreage (million hectares)



Source: FAO

but then fell back to 54 million hectares. Major producers are the United States, Brazil, China and Argentina. Production in these countries has risen in response to the increase in international demand, particularly from the EU.

In the EU rapeseed and sunflowers are the major oilseeds, with an acreage of 2.4 and 2.7 million hectares respectively. The increase in production of these crops in Europe is a result both of an increased demand for vegetable oils and the EU agricultural policy.

In 1992 we find approximately half of the world's **sugar-beet** acreage in Europe. Sugar-beet is influenced strongly by EU agricultural policy, which includes a production quota and a system of guaranteed prices. Between 1990 and 1992, EU acreage went down by 6%, largely due to the decrease in acreage in Germany following unification.

The demand for **grass seeds** comes from two specialist market sectors: fodder grass and grass for recreational use. The market for fodder grass is stagnating. Following the introduction of milk quotas and the increase in cattle per hectare, **grassland** acreage in the EU has declined by 3% over the last 10 years, to stand at 48.4 million hectares; maize for silage has also replaced the use of grass in silage. Demand for grass seed is also dependent on weather conditions, as grassland frequently requires reseeded after frost or drought. The market for recreational use is reasonably stable now, but cyclically sensitive. Demand is affected by factors which include government expenditure on recreation facilities and private expenditure on gardening.

2.2 Productivity

The improvement of plant varieties, along with the use of natural or artificial fertilizer and pesticide, plays an important role in the increase of crop yields. In the US and EU wheat productivity has increased by an average 1% per year for many years, half of which is accounted for by the improved seed quality. Maize yield increases have largely been achieved through bree-

Table 2.2 Productivity of grain, rice and maize in 1992 (tons/hectare)

	Grain	Rice	Maize
World	2.6	3.6	4.0
Asia	2.5	3.7	3.3
Africa	1.6	1.9	1.3
USA	2.7	6.4	6.8
South America	2.0	2.6	2.5
Europe	4.5	5.6	4.7
Oceania	1.7	8.2	5.1
CIS	2.0	4.4	2.0

Source: FAO

ding. In Asia, as a result of the Green revolution and the use of much improved wheat and rice varieties, yield per hectare has increased significantly in the last ten years. Population growth, increased consumption and restricted acreage in Asia and South America point to the need for further improvements in production per hectare, and hence for new varieties and new technology.

In developed countries the productivity of certain crops is increasing. In addition to this aim for breeding seed companies increasingly include the internal and external quality of varieties and resistance in their research programmes.

2.3 Consumer trends

World consumption of grain and vegetable oils measured in kilograms per capita continues to rise; consumption of sugar and confectionary is stabilising but shows a shift towards confectionary; the consumption of sweets is 2 to 3 times as high in developed countries as in Asia and Africa but is declining slightly in per capita terms. Consumption of root and tuber crops is falling worldwide.

In developed countries, the consumption per capita of all major arable crops is either levelling off or falling, with the exception of vegetable oils. General prosperity has ensured that maximum food consumption has been reached, in terms of both kilograms and calorie intake; public health departments suggest that it has, in fact,

been exceeded. As prosperity increases still further, it stimulates the consumption of luxury and exotic vegetables and fruit, pushing aside such traditional staples as potatoes and grain products. The market in this part of the world is consequently showing clear signs of saturation, especially as population growth has slowed.

In developing countries consumption per capita of all categories is on the increase, with the exception of root and tuber crops. Population growth is high, leading to growth in total consumption of arable products. Asia in particular is significant: in both quantity and rate of growth, it is the most important consumer; it has a huge, growing population and some regions show significant economic growth. In countries which are developing rapidly, the basic food package is broadening with a shift towards wheat (alongside traditional rice), vegetables, fruit and meat.

World consumption of foodstuffs is expected to increase by 1.6% a year up to the year 2000. In developing countries, an increase in consumption of 3% a year is anticipated.

2.4 Animal consumption

Animal consumption is an important factor in the demand for arable products. In Europe, North and Central America and the CIS especially, most grain products are sold for cattle fodder. A compound feed industry exists in the US and the EU; heavy use is made of imported grain substitutes such as tapioca, corn, gluten and soya meal to mix compound feeds in northwest Europe. Alterations to European agricultural policy have led to a fall in grain prices. Lower grain prices may lead to more grain being sold as cattle feed in the EU, at the expense of imported grain substitutes.

On a world scale, animal consumption of arable crops is rising. In the EU, however, demand is stagnating as livestock levels fall in the face of manure problems, environmental pressure and the milk quota.

2.5 Industrial applications

The industrial non-food use of arable products is generally low. Less than 2% of total world grain production is processed. In North and Central America this figure stands at 3.5%, and is on the increase. In Brazil alcohol for fuel is produced from sugar on a large scale. In the EU starch is extracted from potatoes and maize for raw materials.

In the US and the EU extensive research is being carried out into new industrial uses for arable products. Attention is focused particularly on bioplastics, paper, cardboard and energy. However, high production costs involved in agricultural raw materials, uncertainty concerning delivery and fluctuating quality and price prevent arable products becoming a major source of industrial raw materials.

Some analysts expect EU non-food oilcrops for the production of bio-ethanol and bio-diesel to increase further from 200,000 hectares in 1993 to 700,000 hectares in a few years time. This would represent approximately 14% of EU oilseed production.

2.6 Agricultural policy

Almost all countries which are major arable crop producers use some form of protection or support for their own arable sector.

EU

EU agricultural policy focuses primarily on the development of the agricultural sector, and has a strong tendency to shield the internal market from world market influences. Falling prices and sales problems in the international market have, however, increased the costs of the policy and given rise to a number of policy changes. The MacSharry policy provides for a drastic reduction in guaranteed prices and overproduction by only offering income compensation to large farmers if they allow 15% of their acreage currently devoted to grain, protein-containing crops and oilseeds to lie fallow; grain production in the EU will decrease, as will acreages for sugar-beet, oilseed, fodder crops and rape. The fodder pea market will remain stable.

EU estimates for 1993 show an average fallow rate on agricultural land of 8%. Percentages vary from country to country because of differences in scale of farming. In the United Kingdom and France, fallow percentages stood at an estimated 14% and 11% respectively in 1993; in Germany and the Netherlands these are estimated at 5% and 2%. This will have short-term consequences for the agricultural seed sector, and a 5% reduction in grain seed is anticipated.

Lower sales prices will also force farmers to attempt to reduce production costs by decreasing the intensity of grain production. The lower grain prices resulting from the MacSharry policy will therefore lead to lower grain seed prices. In order to reduce cultivation costs, European farmers are increasingly propagating seed of wheat, barley, oats, rape seed and pulses for themselves from their own crops.

The common agricultural policy (CAP) also affects 'free' crops. Potatoes are a good example of this, facing 'push' side effects from the CAP. Restrictions on dairy, wheat and sugar-beet have resulted in an increase in potato production. Potato prices have fallen considerably as supply exceeds demand for both seed potatoes and potatoes for consumption.

The United States

US agricultural policy has also affected cultivation acreages. Farmers in the US and Canada are supported to the same extent as those in the EU. In order to limit production, the United States applies fallow regulations which vary according to the product and the forecast production level. A US grain producer only qualifies for subsidy if he complies with the acreage restrictions laid down by the government. The US is also planning a reduction in agricultural subsidies in order to reduce the federal deficit.

2.7 Summary and outlook

Total demand for agricultural seed is determined in part by the world acreage of arable crops. In most product groups, acreage is stabilising although

differences can be seen from region to region. The acreage of oil crops is still rising. The acreage of arable crops is determined by both government policy and the demand for end products. Demand for propagating material is increasingly determined by the factor of quality, whereby consumer demand is passed on to suppliers of propagating material via retailers, wholesalers, processors and farmers.

In Southeast Asia acreage is increasing only slightly, for lack of suitable farming land. Required increases in production will have to be achieved primarily through higher productivity.

World consumption of grain and vegetable oils (in kilograms per capita) continues to grow; consumption of sugars is stabilising, with a shift from natural sugars to sweeteners. Consumption of root and tuber crops is falling. In developed countries, the general trend for arable crops is towards falling or stabilising per capita consumption, with the exception of vegetable oils. Population growth is slow. The market in developed countries is therefore unlikely to increase.

In Asia, Africa and South America consumption of all major arable crops is growing, with the exception of root and tuber crops. The high rate of population growth in these regions, together with growing consumption, will of course cause demand for arable products to rise sharply.

The agricultural sector increasingly operates as a buyers' market rather than a sellers' market. Each link in the chain raises its own quality standards in an attempt to provide the increasingly discerning consumer with a high quality product. The market is gradually dividing into market segments each with its own specific quality standards. Mass produced goods are being replaced by products with higher added value or innovative images, with repercussions for the choice of propagating material. Apart from phytosanitary standards, buyers are becoming increasingly concerned about the cultivation methods employed, and are looking for a greater

choice of varieties. The increase in integrated and biological cultivation of arable crops will result in a limited demand for biologically cultivated seed for the time being.

World animal consumption of arable crops is rising. In the EU demand is stabilising because of restrictions imposed on the cattle breeding sector. Lower grain prices, resulting from amendments to EU agricultural policy, will lead to larger sales of grain as cattle fodder. Southeast Asia is a growth market; as a result of changing food patterns, meat consumption is increasing, and will in turn lead to a rise in animal consumption of arable crops.

Industrial use of arable products is generally low, and only in the long term is any wide-scale use as industrial raw material likely.

The influence of the government on arable farming is significant, both in the EU and in the US. Current agricultural policy affects not only selling prices but has also reduced cultivated acreage of crops. The EU requirement to let land lie fallow has led to an increased demand for set-aside cover crops. Demand for fodder grasses is stagnating because of the quota restrictions placed on cattle breeding in the EU. The market for grass for recreational use remains stable. Grain acreage has fallen following changes in the EU agricultural policy.

Agricultural policy will therefore have a number of short-term consequences for the agricultural seed sector. Lower sales prices will force farmers to attempt to reduce production costs by decreasing the intensity of grain production and to use more farm-saved seed, which they have produced themselves. At the same time, letting land lie fallow will also result in reduced sales of grain seed. Both developments will lead to a reduction in grain seed demand and, in turn, prices. A fall is also anticipated in the acreage of sugar-beet, maize, oilseeds and fodder crops in the EU. For all markets, the development of demand for certified seed in relation to levels of farm-saved seed is important.

Under current market conditions it will be difficult to demand higher prices for new high-quality varieties.

3 The agricultural seed market

3.1 The world seed market

World consumption of agricultural seed (including farm-saved seed) stabilised between 1980 and 1990 at 118 million tons. Trends in patterns of consumption have differed from region to region. In 1990 Asia was the largest consumer of agricultural seed, consumption rising by 18% to 38.4 million tons during the last decade. Rice accounts for thirty per cent of this. The increase in consumption in Asia has affected all crops. Barley seed consumption has risen by 24%, greater than the 16% increase in rice seed, because of the shift from rice to grain consumption in this region. The growing demand for arable crops, stimulated by increased prosperity and high population growth rates, necessitates higher productivity. Part of this may be achieved through the

use of more productive varieties. In developing countries, the increasing use of improved varieties primarily involves the three most important crops, namely wheat, rice and maize. Modern varieties with high yields are used widely in some developing countries. The demand for seed is still low, though, as annual refreshment of wheat and rice varieties is low. For rape, potatoes and pulses there are few good varieties available, because of the low priority given to improvement.

In 1980 the CIS was still the largest consumer in the world (35%), but consumption fell by over 10% between 1980 and 1990, to stand at 37.3 million tons. The falling production of agricultural crops in the CIS caused a reduction in the consumption of agricultural seeds, affecting all crops.

In terms of weight, wheat and root/tuber crops are by far the most important agricultural seeds in the world;

Table 3.1 Total world consumption of agricultural seed, by continent (million tons, including farm-saved seed)

	1980	1985	1990
CIS	41.7	37.7	37.3
South America	4.3	4.4	4.2
Europe	23.2	23.6	21.3
N & C America	10.9	10.4	11.0
Asia	32.6	35.0	38.4
Africa	3.9	4.3	4.6
Oceania	1.2	1.4	1.1
Total world	118.8	117.7	118.7

Source: FAO

Table 3.2 Total world consumption of agricultural seed, by crop (million tons)

	1980	1985	1990
wheat	34.0	33.2	35.0
barley	11.8	11.6	11.1
rice	11.5	12.2	13.0
maize	6.4	6.5	6.8
other grains	9.5	9.3	8.9
root/tuber crops	36.8	35.4	33.3
pulses	3.4	3.9	4.0
oilseeds	5.4	5.6	6.6
Total	118.8	117.7	118.7

Source: FAO

in value however maize may be considered the most important commercial seed. Since 1980 consumption of seed for wheat, rice, corn, pulses and oil-seeds has increased. In the 1990/91 season consumption of seed potatoes in the EU measured 3.2 million tons. Germany, with 784,000 tons, held the largest share, followed by the United Kingdom (537,000), the Netherlands (400,000) and Spain (385,000). The EU market for grass seed has a turnover of approximately 116,000 tons per year.

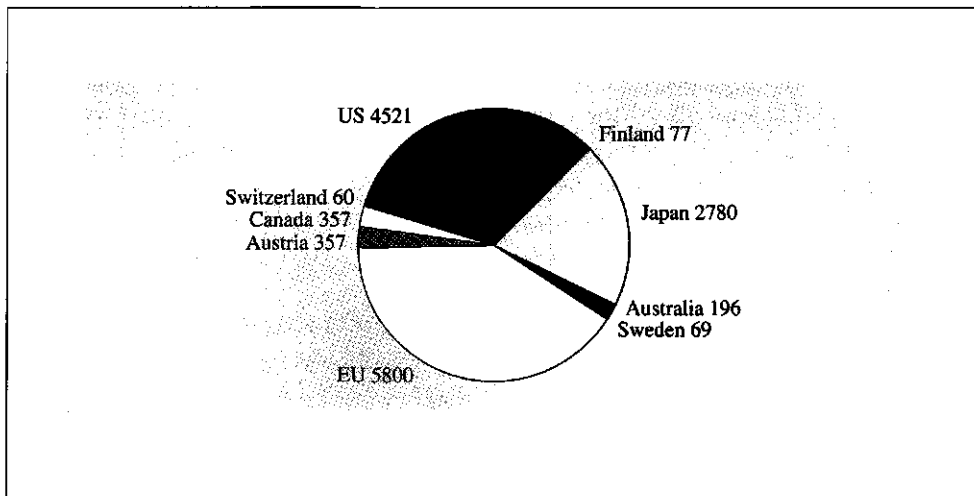
The value of world market

The world market for seed is valued at \$45 billion. It can be divided into 3 main categories, each accounting for roughly similar proportions of the total value: commercial seed, farm-saved seed and seed from government institu-

tions. The latter is particularly prominent in developing countries and planned economies. In more than 60% of African countries for example, governments have full control of the procurement and distribution of seeds, while in 28% of the countries both government and private sector are involved. The absence of competition leads to a lack of innovation and efficiency and a poor seed quality may lead to agricultural stagnation.

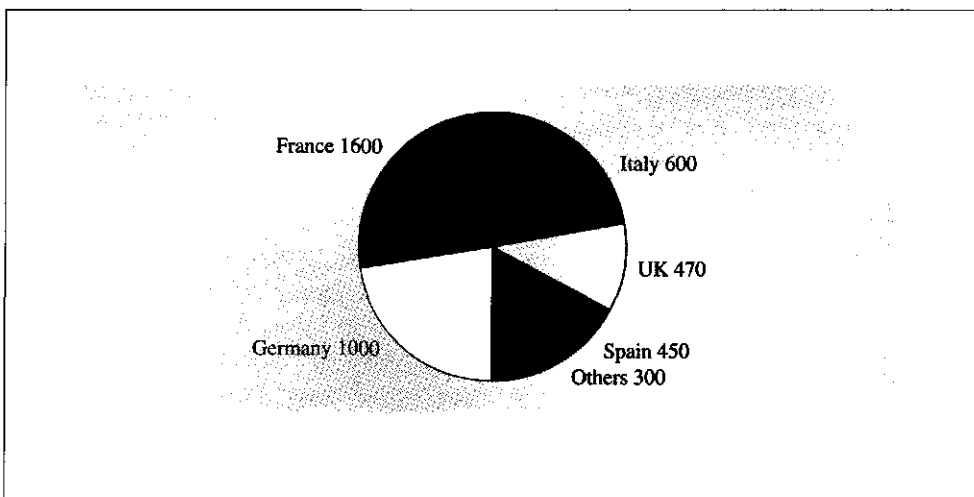
The total value of commercial seed for agriculture and horticulture in OECD countries measured \$13 billion in 1990. The largest markets are the EU, the US and Japan. Turkey, Argentina and Brazil also form important sales markets for commercial seed.

Figure 3.1 Certified seed consumption (agricultural and horticultural) in OECD countries in 1990 (\$ million)



Source: OECD, USDA

Figure 3.2 The EU agricultural seed market (\$ million, estimates, excluding horticultural seeds)



Source: Agrarbericht, Cultivar, estimates

For many farmers seed is too expensive. The development and production of new wheat and rice varieties is carried out primarily by government agencies. Some rice varieties are improved and produced by the International Rice Research Institute (IRRI) in the Philippines. The International Maize and Wheat Improvement Center (CIMMYT) improves maize and wheat varieties.

EU

Between 1983 and 1991 grass seed production in the EU increased by 66% to 162,000 hectares. Denmark supplies around 50% of total production, and the Netherlands around 25%. Between 1985 and 1991 stocks in the EU increased by 58% to 144,000 tons, 42,000 tons of which was Italian rye grass and 55,000 tons English rye grass. In 1992 the grass seed acreage fell to 150,000 hectares. Stocks remain high, due to the unfavourable sales market.

The land area devoted to seed potatoes between 1983 and 1991 increased by 25% to almost 124,000 hectares. In 1993 the land area for propagation fell back to 114,000 hectares. In Germany acreage fell sharply, from almost 29,000 hectares in 1992 to over 20,000 hectares in 1993. In the Netherlands acreage remained stable at 36,000 hectares.

3.3 Market structure of seed companies

Commercial agricultural seed companies operate within a very fragmented sector, and are primarily active in Europe and the United States.

There are around 1500 seed companies in the world, of which 600 are based in the USA and 400 in Europe. The 26 largest companies listed in table 3.7 have a combined turnover of about \$7.0 billion, representing nearly 50% of the commercial market for agricultural and horticultural seed. Their market share in a number of countries and in a number of products groups is even higher. The US company Pioneer, for example, holds around 40% of the US corn seed market.

The market share of these major seed companies can be expected to increase still further. A similar situation exists in poultry farming, nine large breeding companies alone supply approximately 90% of the total commercial world parent stocks for broilers; the remaining supply comes from local breeding companies.

Of the 26 largest seed companies, half are specialist seed companies and half are owned by larger corporations: all the parent companies are involved in supply to the agricultural sector, and include most notably producers of agrochemicals (fertilizers, pesticides). In Europe, in France and the Netherlands particularly, a number of cooperatives are involved in the seed business.

Of the 26 largest seed companies, six are located in the US, seventeen in Europe and two in Japan. Japanese companies concentrate on horticultural seed. Most of the major companies are clearly internationally oriented. Some companies specialise narrowly, holding high market shares with a small product

Table 3.6 EU seed production of major arable crops (1000 hectares)

	1983	1988	1991
Grains	759	728	793
Maize	42	37	59
Grasses	99	132	162
Other fodder crops	43	35	49
Pulses	51	117	59
Sugar-beet	8	5	7
Seed potatoes	95	99	124
Oilseeds	29	42	49
Total	1.126	1.195	1.302

Source: GNIS

Table 3.7 The world's largest seed companies (turnover refers to seed sales only)

company	main activity	country	main subsidiaries/countries	seed turn-over \$ mln	core seed products
Pioneer	seeds	USA	more than 40 countries	1.260	corn, soybeans
Sandoz	chem	Switzerland	Northrop King, Rogers, Zaadunie, Hilleshög	625	hort. seeds, oilseeds, corn, sugar-beet
Limagrain*	seeds	France	Force Limagrain, Nickerson, Tézier, Vilmorin	440	corn, oilseeds, forage hort. seeds
Takii	seeds	Japan	Japan, USA, Europe	360	hort. seeds
Upjohn	chem.	USA	Asgrow, Bruinsma	300 **	corn, soybeans
Sakata	seeds	Japan	Japan, USA, Europe	300	hort. seeds
Cargill	ag.trader	USA	Cargill hybrid seeds	275 **	oilseeds, corn
Amylum	starch	Belgium	Orsan	275	corn
Cebeco*	coop	NL	Europe, USA	260	hort. seeds
ICI	chem.	UK	ICI Seeds, SES, Zeneca	250	corn, sugar-beet
KWS	seeds	Germany	Betaseed, Vanwaveren	247	sugar-beet
Dekalb	seeds	USA	Europe, S.America	225	corn
Maisadour	seeds	France	Sunflor, Orsem	225	corn, sunflower, soybeans
Coop de Pau*	seeds	France	Rustica	220	corn, cereals, sunflowers
Suiker Unie	sugar	NL	Van der Have, Mommersteeg	215	sugar-beet, forage
RAGT	seeds	France		210	corn, sunflower, forage
Pioneer	seeds	France		200 **	corn, sunflower
France Mais					
Ciba Geigy	chem.	Switzerland	Ciba seeds, Funk seeds	175	corn, oilseeds, cereals
Sigma*	seeds	France	Semences de France	170	small grain cereals
Rhône Poulenc /Orsan	chem.	France	Clause, Ceres, Harris Moran	155	hort. seeds, seed potatoes
Geo. J. Ball, Inc	seeds	USA	Petoseeds, Pan American seed, Ball seed, Burpee	150 **	hort. seeds
DLF*	seeds	Denmark	Trifolium, Eurosemences	135	forage
Royal Sluis	seeds	NL	France, USA, Italy	130	hort. seeds
Mycogen	biotech.	USA	Agrigentic	125	corn, oilseeds
SLR*	coop	Sweden	Svalöf/Weibull	122	oilseeds
Rhône Poulenc	chem.	France	Rhône P. Agrochimie	100	oilseeds, corn, wheat hybrids
Total	26			± 7,000	

Sources: Cultivar, annual reports

* coop ** estimate

package, whilst other companies offer a very broad package. Both options have their advantages and disadvantages.

In addition to the companies mentioned, there are a further ten companies with a turnover of around hundred million dollars. These include:

- DanESCO (Maribo, sugar-beet),
- Land o'Lakes (forage, soybeans, corn),
- Delta and Pineland (cotton),
- Barenbrug (grass seeds),
- Goldsmith (flowers),
- Agrico (seed potatoes),

ZPC (seed potatoes),
Pennington seeds (hort. seeds, forage),

This indicates that the 35 largest seed companies have a combined market share of about 53% of the commercial seed market.

A number of medium-sized companies also exist together with a very large number of small companies. The smaller companies tend to function as regional traders (retailers), sometimes offering only a limited range of varieties.

The large number of seed companies means that more and more varieties are coming onto the market which, in terms of technical value, are no great improvement on varieties already available. This makes it difficult for buyers to have a clear view of the market and to identify seeds of higher quality which really merit higher prices. The number of varieties available can be expected to grow still further. One benefit this brings is that more and more value is added to seed, which increases its gap over farm-saved seed. Hence pre-treatment of seed with agro-chemicals, for example, can significantly reduce total use of pesticides.

3.4 Concentration

Concentration in the sector is on the increase. A number of factors have encouraged this process, including replacement of old management with family enterprises, increased demand for knowledge and capital, and the need to access new sales markets.

The outcome of acquisitions of seed companies by multinationals involved in the petrochemical, agrochemical and pharmaceutical industries have been mixed. On the one hand, seed industries showed attractive growth and earnings potential, making purchase an attractive option as part of a diversification strategy. Seed companies also hold a strategic position at the beginning of the food production chain. With hindsight, however, takeover by companies unrelated to the sector is problematic given that the seed business is highly specialized, with long payback times for R&D and changing sales opportunities. A number of petrochemical industries have since resold their interests in the industry.

For a number of companies a link exists between the breeding activities and their own research. Some knowledge in the area of biotechnology and gene-technology available from the pharmaceutical and food industries can be applied to the breeding of plants. Existing distribution networks of other agricultural inputs, such as fertilizer and pesticides, can also be used for seed. The potential for synergy, however, has been limited. Major phar-

maceutical and agrochemical industries nevertheless remain active in the seed sector, and have made seed into a strategic activity, investing in companies and the development of new biotechnological techniques.

The development of disease resistant plant varieties may also have played a part in the acquisition process. From a strategic point of view suppliers of chemical inputs may involve themselves in the sector to be able to compensate falling herbicide demand with the increasing demand for expensive seed. Moreover, knowledge about plant disease and the existing distribution apparatus for inputs can be put to better use.

The wave of concentration seems to have subsided for the time being, given to the current unsecured market outlook for seeds. On the whole, existing companies are already strongly committed and are engaged in further strengthening their position in both distribution and in their product package. The accent is currently on restructuring and reorganisation, rather than on growth and investment in new activities.

In addition, seed companies are looking for opportunities to cooperate with each other through joint ventures in research and sales. Limagrain, for example, has established joint activities with both Rhône Poulenc and DLF.

The **seed treatment companies** are a distinct group. Many are subsidiaries of the major seed companies, but some are independent. Other companies specialise in the **distribution** of seeds, though many seed companies have their own sales organisations which sell directly to farmers. In Europe, and particularly in France, distribution is in the hands of cooperatives.

With the introduction of biotechnology for the improvement of plants, new specialised **biotechnology companies** have sprung up in the United States and in Europe. These companies focus particularly on the development and licensed sale of biotechnological methods and techniques, or themselves apply

these techniques to the development of new varieties.

The major agricultural seed companies direct their energies towards the breeding of hybrids in particular. Most breeding of non-hybrid varieties is carried out by public bodies. Investment by private seed companies in these crops depends very much on the extent of protection given to the varieties developed. If varieties are not offered adequate protection, it is unprofitable for private seed companies to make large investments, and they will be increasingly inclined to concentrate on the breeding of hybrid crops.

3.5 Financial position

Table 3.8 provides some financial ratios pertaining to groups of seed companies. They represent the average of a large group of internationally operating seed companies; any significant deviations from the average are not included. Margins however may vary considerably and can depend on whether seed production is contracted out or grown by the seed company itself. US seed companies usually have higher margins, focusing more on hybrid seed.

In general, separate figures are not available for the seed interests of **agro-chemical companies**. Consolidated figures show that these companies tend to be relatively strong, while both solvency and net profit are generally higher than within the group of large specialised seed companies. Assuming profit levels matched those of these large independent seed specialists, the seed divisions of chemical companies would appear to contribute profits which are lower than those made in core activities. This would put some pres-

sure on the chemical industries with regard to their commitment to maintain their presence in the seed industry.

It is worth noting that the performance of the large **specialised agricultural seed companies** is more or less comparable with that of the large **horticultural seed companies**. Gross margins of European horticultural seed companies are generally higher -round 70%- than with other seed companies, being more R&D oriented.

Many agricultural seed companies have a limited product range only, whilst the large horticultural companies stock a wide range of varieties, sometimes running into thousands. To maintain a range of this extent is extremely expensive. Average net profit margins seem satisfactory, compared to other sectors, but have to be viewed in the light of the considerable investments required. R&D activities in these companies account for 5-15% of turnover. In addition to that an average of more than 10% of turnover is spent on distribution and marketing.

Poor results for specialised international **grass-seed companies** are the result of a weak sales market. The seed potato sector shows comparable figures, although these companies hold no stocks at the date of balance sheet. Specialised companies should produce satisfactory profits in the long term and must create sufficient financial strength to survive difficult periods.

3.6 Summary and outlook

The world market for certified seed is estimated at around \$15 billion, \$13 billion is accounted for by OECD countries. The most important markets are

Table 3.8 Financial position of categories of seed companies (average 1990- 92)

	equity % balance total	gross margin %turnover	net profit %turnover	days stock
agro chemicals	50-60%	70%	5-15%	70
large spec. seed companies	40-50%	50%	6.5%	100
hortic. seed companies	60%	50-70%	6.5%	100
spec. grass-seed companies	15-25%	30%	1.5-2.5%	125

the US and the EU. In addition to commercial seed, seed is supplied by government institutions and other seed is farm-saved; the value of both segments is comparable on a world scale to the market for commercial seed. The relationship between commercial and farm saved seed is important to seed companies, particularly in OECD countries.

There are around 1500 seed companies in the world, 25 of which hold a combined market share in commercial seed of more than 50%. The major seed companies, with a wide range of products, are generally in a strong position financially, and under present market conditions tend to yield better profits than smaller specialists. The concentration of seed companies is expected to increase further, but mergers and acquisitions will be more precisely targeted than in the past.

Developments in agricultural seed production depend to a large extent on developments in primary agriculture in the region concerned. Consumption of seed has stabilised in the markets, but is expected to fall in some under the influence of the government policy on primary agriculture. The production of grain seed in the EU will fall by 5% as a result of set aside and expanding cultivation. Acreage reduction programmes may result in increased demand for grass seed to improve nitrogen fixation of set aside land. Between 1980 and 1990 the costs of seed for farmers in the EU rose by 10%. The reforms within agriculture in Europe are stimulating farmers to produce at the lowest possible cost price. To achieve this, grain cultivation will have to be extensified, and, because of competition with farm-saved seed, the price of certified grain seed will fall.

Seed consumption amongst farmers in the United States is expected to remain more stable, including the consumption of corn seed. The turnover of US companies will increase as new markets develop abroad.

In Asia, production of agricultural seed will increase further in response to

rising demand for arable crops. The share of farm-saved seed, which has always been high in this region, will fall. It will be necessary to make more use of modern commercial varieties if production is to be increased sufficiently. This will require good protection of non-hybrid varieties. Without adequate protection, private agricultural seed companies will not invest in the development and production of non-hybrid varieties in this region.

The market conditions described will put seed company margins under pressure.

The use of certified seed is increasing worldwide. Because of this, and because various countries have specialised in the breeding of certain crops, international trade has increased in importance. Trade in agricultural seed takes place primarily between industrialised nations. In 1992 8% of total EU exports in agricultural seed went to developing countries. For the United States, exports to developing countries, measuring 24%, are considerably greater. There is relatively little international trade in wheat, barley and rice. International trade in agricultural seed is restricted by, amongst other things, large differences in climate between the world regions, and relatively high transport costs compared to the low added

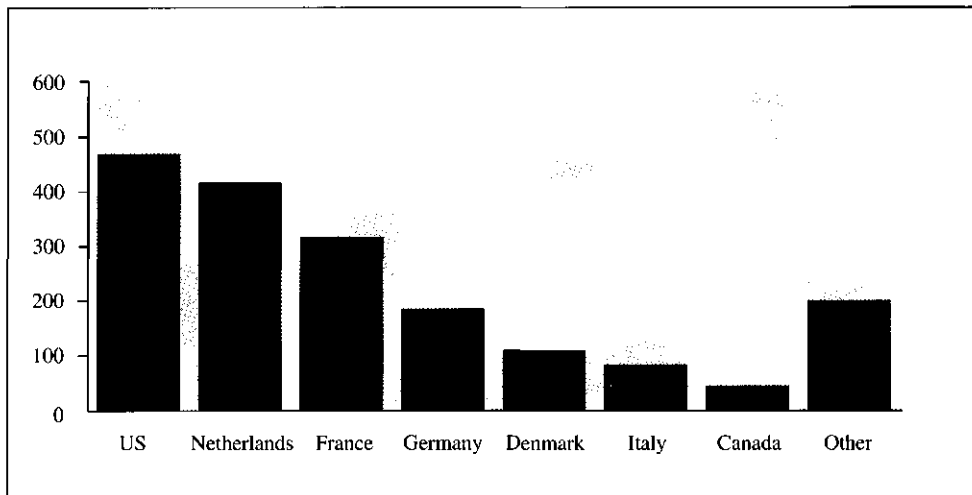
value of many crops. Agricultural seed companies therefore tend to breed and produce in the sales region, or have varieties propagated under licence.

4.1 Export

Total world exports of agricultural seed (grass, sugar-beet, wheat, maize and seed potatoes) measured \$1.9 billion in 1991. This is about 14% of the total market value of commercial seed. Compared to agricultural seeds, the export of horticultural propagating materials is far more significant; exports from OECD countries amounting to \$1.0 billion, represent about one-third of total market value. Transport costs relative to weight and added value are less of a problem.

The US is the largest seed exporter and will be discussed in chapter 5.1. Countries within the EU have a 60% share in the world export of agricultural seed.

Figure 4.1 Major exporting countries, agricultural seed exports only 1992, (\$ million)



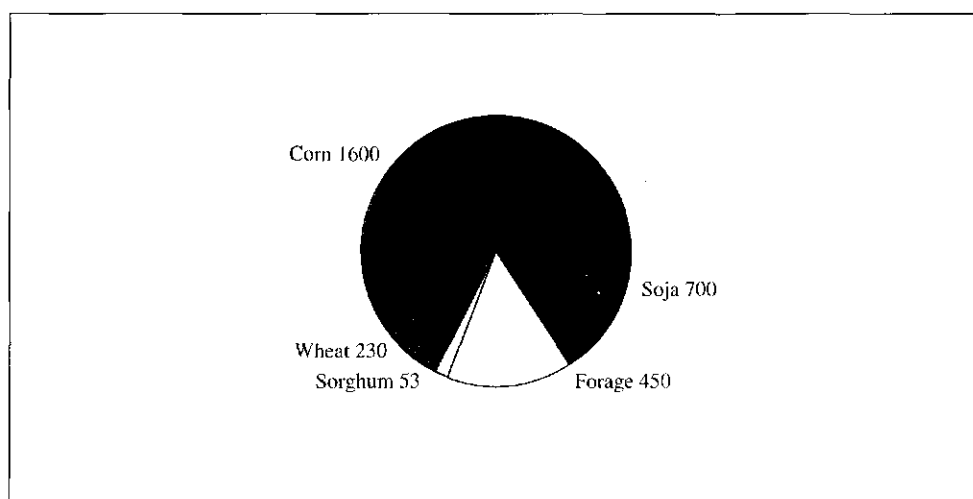
Source: EXMIS, USDA

Table 4.1 EU exports of various agricultural seeds, 1992

	\$million	%	1000 ton	%
Maize	209	16	61	4
Wheat	38	3	98	7
Other grains	48	4	117	8
Pulses	69	5	42	3
Sugar-beet seed	295	23	25	2
Oilseeds	67	5	30	2
Grasses	203	16	166	12
Seed potatoes	361	28	836	61
Total	1.290	100	1.376	100

Source: EXMIS

Figure 5.1 Estimated market value of agricultural seed in the United States (\$ million)



Source: SEED WORLD, June 1993. Cultivar seed business. USDA

Table 5.2 Total seed consumption of major crops in the United States (1,000 tons)

	1987/88	1990/91	% growth 87/88-91
Wheat	2,550	2,670	+ 5%
Barley	377	350	- 7%
Oats	506	306	- 40%
Rice	150	160	+ 7%
Corn	482	540	+ 12%
Sorghum	36	36	0%
Soybeans	1,684	1,722	+ 2%

Source: USDA

lion of which is accounted for by home gardening and \$500 million by the professional market.

The use of commercial seed differs significantly from state to state. In Kansas, the state with the highest winter wheat acreage, only 27% of seed requirements are met by purchase, whilst in the state with the lowest winter wheat acreage, 70% of seed requirements are purchased. In Colorado, only 45% of seed potato requirements were bought in, the lowest percentage in the United States. In the largest potato production

areas, around 90% of seed potato requirements are purchased.

In the last twenty years, there has been a fall in the number of varieties used for each crop in the United States. The need to improve productivity has stimulated the rapid spread of new, genetically uniform varieties. Modern varieties are also more suited to mechanical harvesting, enabling extensive agricultural production.

The cost of seed makes up only a small fraction (approximately 3%) of total production costs incurred by American farming companies. Expenditure on agricultural seed in the United States measured \$3 billion in 1991. The cost of seed varies considerably from crop to crop. The percentage of variable cost per crop accounted for by seed is as follows: rice 8%, sorghum 7%, wheat 11%, corn 17% and soya 21%.

Table 5.3 Use of commercial seed in the US (%)

Winter wheat	36%
Seed potatoes	84%
Soya	77%
Corn, sorghum, beans, grasses, sugar-beet	> 95%

The breeding of agricultural crops is carried out in both private seed companies and the public sector. Seed companies focus on the breeding of hybrid varieties, whilst public research bodies breed non-hybrid varieties, including wheat. Those varieties developed by public bodies (universities, USDA and Agricultural Research Services) are often put on the market by private seed companies. As a result of far-reaching cuts imposed by both federal and state governments, basic and applied research into seed breeding carried out by universities and institutes has decreased drastically. Private seed companies work in close cooperation with universities in the area of fundamental research.

At present in the United States there are almost 600 companies involved in breeding. Of these, more than 200 are active in the production, sale and distribution of corn seed. Most of these companies sell seed for other crops alongside their corn seed range. There is a wide diversity in the type of company to be found in the United States. Companies operating nationally and/or internationally distribute their seed throughout America, and some have subsidiaries or joint ventures in Europe, South America and Asia. The regional, medium-sized seed companies focus on one or more states. The hundreds of local seed companies sell a wide assortment within a small geographical area. Small local companies are often family businesses, focused primarily on providing extra service.

Given the large distances involved, dealers are very important in the USA. A decline in the number of traditional dealers with little added value may be expected as a result of the declining number of traditional farmers, while dealers that support their customers with information, through which they can improve their yields will have better opportunities. At the same time large farmers may choose to buy directly from the seed company. Highly-developed distribution networks are forming for corn, and, increasingly, for soya. What is more, the sale of these two crops is well supported by adverti-

sing, service and regional crop demonstration fields.

Trade

For seed companies in the United States, the sale of corn seed abroad forms only a relatively small part of the total sales (10-30%), though it is increasing. Most of their production is sold on the huge domestic market. Sixty-five per cent of US corn exports go to the EU, with Italy, France and the Netherlands as the largest markets. Exports to Italy tripled between 1988 and 1992 to \$52 million, 98% of which consisting of corn hybrids. After an initial fall from \$24 million in 1990 to \$3.5 million in 1991/92, US exports to former Comecon nations recovered to \$29 million in 1992/93. Exports to the value of \$27 million went to the Ukraine. Exports to central Europe have all but ceased as American companies nowadays cultivate corn seed locally themselves. In 1992/93, wheat seed made up 34% of total US agricultural seed exports; in value terms however it made up only 10%, namely \$50 million. Saudi Arabia is the largest sales market, accounting for 95%, which makes the wheat seed export rather vulnerable.

The value of agricultural seed exports to the EU in the 1992/93 season measured \$223 million. Of this, corn hybrids took a 46% share. The most important sales markets for grass seed are Japan, Canada and Mexico.

In the 1992/93 season the United States imported agricultural seed to the value of \$98 million, most of this being made up of grasses, pulses and corn. Canada is the largest supplier. Imports of agricultural seeds from the European

Figure 5.2 US agricultural seed exports (\$ million)

	1986/87	1992/93
Wheat	18	50
Corn	59	190
Sorghum	18	31
Pulses	34	39
Oilseeds	27	38
Grasses, other forages	82	122
Total	238	470

Source: USDA

tries the government has a direct relationship with seed companies. The location of seed company headquarters is partly determined by the presence of a number of specific factors, including highly qualified labour and basic research, and secondary conditions such as distribution, financial infrastructure, taxation and the regulatory environment. The seed industry is an extremely know-how intensive industry, highly dependent on the quality of its personnel. In this area particularly the government is able to exercise influence on the establishment or retention of the seed industry. It can create an attractive climate through the provision of education and research opportunities, thereby ensuring the availability of appropriate labour and research. While government subsidies are generally on the decrease, involvement is increasing through environmental policy, quality control, and the protection of intellectual property.

Subsidies

Within the EU, policy on subsidies is gradually being harmonized. The EU itself also grants subsidies, to stimulate the development of innovative plant biotechnology and to encourage the cross-border cooperation of companies and research bodies.

The national governments of the United States, France and Japan attach great value to the development of biotechnology. The American government has formulated liberal policy concerning the introduction of biotechnological products onto the market. In 1992 government expenditure on agricultural technology measured \$190.5 million. In France, larger companies are given particular support. A number of government institutes are engaged in fundamental and applied research. The German government, through its 'Biotechnology 2000' research programme, provides considerable financial support to the development of biotechnological techniques in the breeding of plants. In the United Kingdom, investment in agricultural technology measures around \$53 million. Most research is carried out in the public sector. The transfer of biotechnological knowledge to private companies gene-

rally runs smoothly in the United Kingdom.

Dutch government policy highlights three major areas: knowledge infrastructure, education and regulation. Partly thanks to the high standard of research and university education, Dutch agricultural seed companies have managed to establish a strong position in techniques for breeding and propagating.

The Dutch government is currently working to expand measures to stimulate the sector through fiscal R&D concessions in order to reduce R&D costs within companies. At present around \$53 million a year is being invested in publicly financed research into agricultural biotechnology. This is comparable to the contributions made by the governments of the United Kingdom and Japan into plant biotechnology research.

Environment policy

The methods by which various national governments attempt to reduce environmental effects varies from country to country. In the United States regulations range from subsidies for crop tests to imposing extra tax on fertilizers. In the US a new law proposal is under discussion which will result in further restrictions on the use of pesticides. The health of farmers and consumers is central and is given a higher value than agricultural needs.

EU member states have set up various programmes to restrict the use of fertilizers and chemical pesticides. There are guidelines which apply to the EU as a whole concerning the concentration of fertilizers and pesticides in ground water and surface water, with which all member countries have to comply by the year 2000. The way in which the policy is implemented is left to the individual member states.

The Dutch government has a crop protection plan to be implemented over a number of years which aims to halve the use of chemical crop protection by the year 2000. Seed companies contribute to this through the development of

resistant varieties and seed coating treatments.

Quality policy

Quality research in breeding focuses on the development of resistance, vitality and purity. Phytosanitary quality is also of importance.

New varieties are tested for quality before being released onto the European market. At the EU level quality is regulated through commercial guidelines, setting standards for the product before it can be sold. Crop varieties traded within Europe have to be checked for registration and plant breeders rights, and for value for cultivation and use (vcu). The purpose of vcu standards is to provide users with information about the features of new varieties, and field cultivation tests are a prerequisite to appearing on the list of varieties. By making such tests compulsory, 2 or 3 years is added to the time it takes for a new variety to appear on the market. This is an important barrier in the current market climate in which ever higher production standards have to be met. On the other hand, once a product has been approved in one country, it can be released onto the market throughout the EU. The implementation of this regulation has not yet been fully harmonised, and arrival of the internal market within the EU has not yet, in the case of seed potatoes, led to a complete removal of trade barriers.

In the United States there is no national list of varieties for agricultural seed, and no tests are carried out on vcu.

Intellectual property

In many countries, new varieties are protected by national law, often based on the 1961 UPOV Agreement (Union Internationale pour la Protection des Obtentions Vegetables). The updated version of this agreement, dated 1991, provides for increased **plant breeders rights**.

This change in the law has given rise to much discussion, centring on farmers' privilege. Considerable quantities of seed are retained by farmers, particularly from harvests of certain grains

(wheat, barley, oats) and of potatoes, cabbages and pulses, for which the breeder receives no reimbursement. In the revised UPOV agreement (1991) it is left to individual members to decide to what extent they make room for farmers' privilege in national law.

Rising R&D costs in breeding make it necessary to improve the legal protection of propagating material. Without adequate protection of nursery products it is virtually impossible for private companies to invest in costly biotechnological research. Governments recognise the social importance of this question. In Europe and the United States, legal protection of varieties has led to the stimulation of breeding activities by private seed companies, as a result of which the quality of seed has greatly improved.

As part of the internal market 1992, the European Community is formulating **community plant breeders rights**. This means that if a breeder applies for, and is granted, breeders rights in one member state, he is automatically entitled to breeders rights protection in all 12 member states. In general the UPOV recommendations have been followed. At the end of 1993, the EU agricultural council reached political agreement (with the exception of Denmark) concerning the agricultural aspects of community plant breeders rights, including the farmers' privilege.

Under the agreements, farmers' privilege is rooted in the regulations. This exception to the principle of plant breeders rights effectively allows farmers to use legally protected varieties which they themselves have harvested for their own cultivation in the following season without having to obtain permission from the breeder. This allowance applies to a number of fodder crops, certain grains, potatoes and a few oil crops and fibre plants.

To be able to exercise farmers' privilege, farmers have to pay a token sum to the breeder, which is considerably less than the amount normally charged for licences.