

Plant reproduction materials

A Dutch motor for export and innovation



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Plant reproduction materials

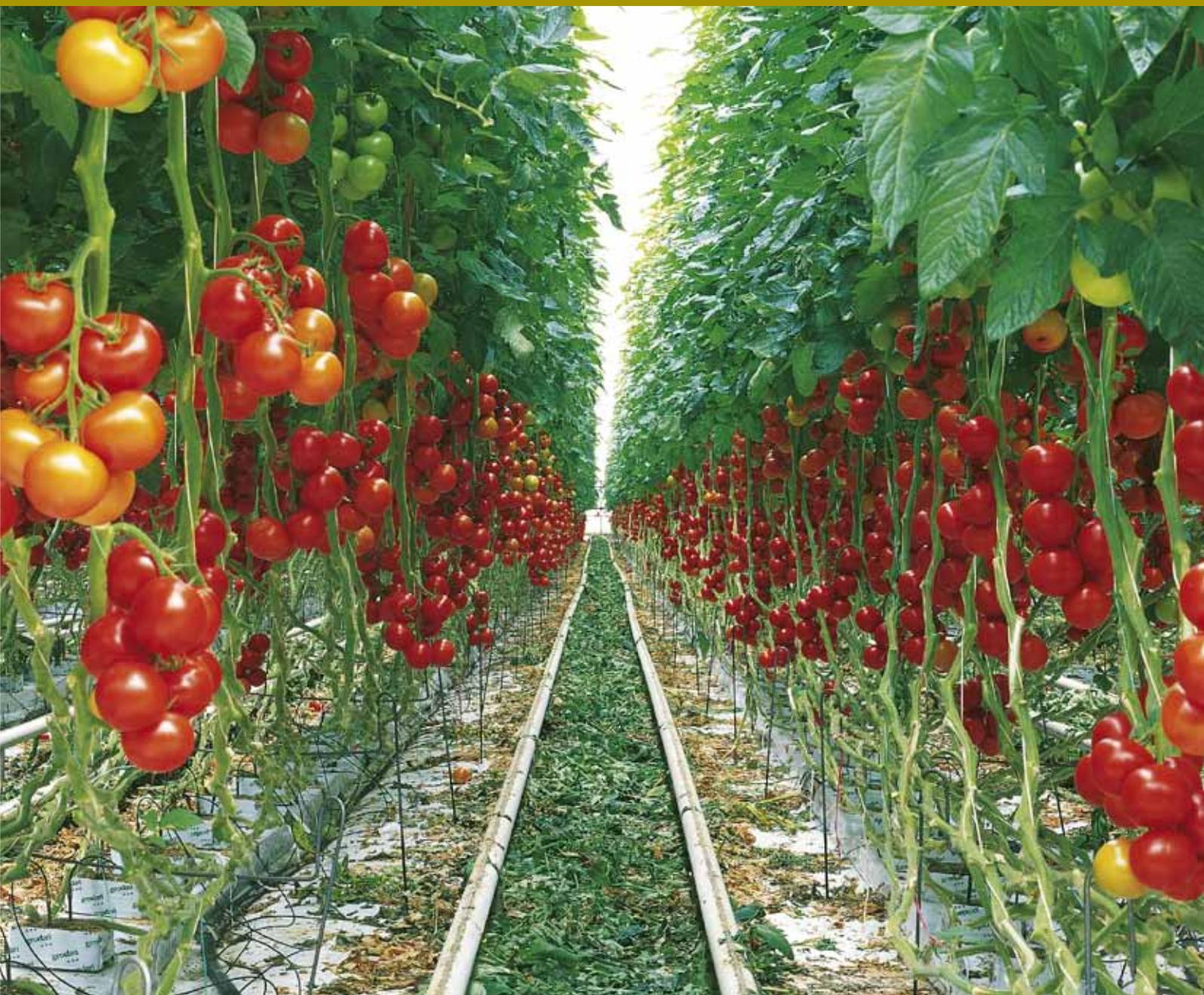
A Dutch motor for export and innovation

The Dutch plant breeding and propagation industry produces seeds and young plants for the agricultural and horticultural sectors. Dutch plant breeding and propagating companies are among the best in the world and many of the largest producers of plant reproduction materials are based in the Netherlands. The contribution to Dutch exports is large: almost 40% of the world's seed trade for horticulture and arable farming originates from the Netherlands. For seed potatoes, the share is even larger at almost 60%. These companies also create value for the rest of the chain through their innovative products. The considerable investments in Research & Development (R&D) also contribute to the Dutch knowledge infrastructure. The sector invests 15% of the turnover, on average in R&D. That is more than is the case in many other knowledge-intensive sectors, such as the pharmaceutical industry.

This brochure provides insight into the economic significance of the plant breeding and propagation industry for the Dutch economy. The results were gained by means of a questionnaire distributed among members of Plantum, supplemented by desk research.

An overview of the facts

In 2010, the plant breeding and propagation industry consisted of around 300 specialised breeding and propagation companies. Between 8,000 and 10,000 people are estimated to work in this sector. The total turnover is estimated at more than two billion euros (Table 1.1). The plant reproduction materials industry comprises three sub-sectors, namely for agriculture, vegetable horticulture, and ornamental horticulture.¹ The average return on the equity capital makes it one of the sectors in the Dutch agricultural chain with the best returns. The impact on the rest of the agricultural chain is also considerable: one euro's-worth of seed results in a value of around 100 euros in a retail chain store. The total export value of plant reproduction materials amounts to around 1.5 billion euros. Since 2001, the export value of plant reproduction materials has increased by about 75%. The share of plant reproduction materials in the Netherlands' total exports is 0.5%.





Constant innovation

The Dutch plant breeding and propagating sector has gained a leading international position by means of constant product and process innovation. The sector invests a great deal in innovation and R&D: approximately 15% of the turnover (Table S.1). Where vegetable horticulture is concerned, R&D expenditure increases in step with a company's increasing turnover. However, expressed as a percentage of the turnover, R&D expenditure remains the same, both for larger and smaller companies. R&D expenditure is used for the development of new products and processes. At a rough estimate, around 85% of R&D expenditure goes towards product innovations. 15% of this expenditure goes towards process innovation.

Companies within the sector follow a variety of innovation strategies: chiefly taking care of their own R&D, buying licences and entering into mergers and takeovers. Many companies have their own R&D facilities, particularly the major players in the vegetables sector. Although the breeders are active virtually all over the world, new products and processes still tend to be developed in Europe.

Companies in the plant breeding and propagation industry work alongside many different chain partners in the development of their products. This takes place both in the Netherlands and with partners abroad. Around three-quarters of the producers of plant reproduction materials work regularly within international collaborative ventures. The sector also frequently works together with research institutes and universities. These institutes and universities play an important role in innovation; almost all the producers of plant reproduction materials that participated in this study have been involved in a long-term joint venture with a research institute or university.

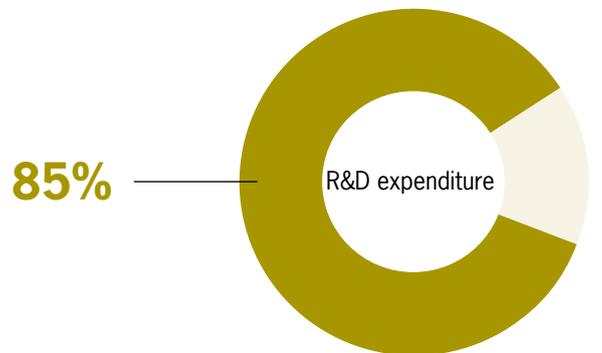
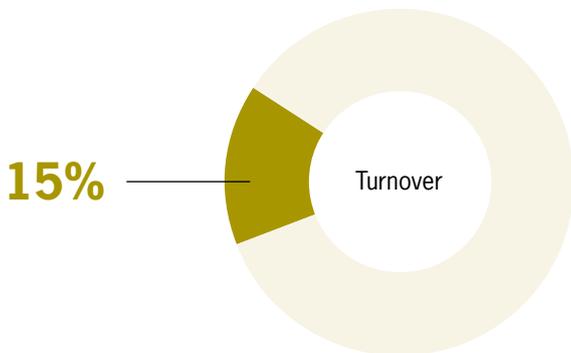
One of the most important indicators for innovation within the plant breeding and propagating industry is the number of applications for plant breeders' rights. The Netherlands has been leading the way in this regard for many years. More than 30% of the applications for plant breeders' rights originate from Dutch producers of plant reproduction materials, which indicate that they belong to the world's top in this field.



Table S.1 Key figures for innovation in the plant breeding and propagation industry

High R&D expenditure on innovation

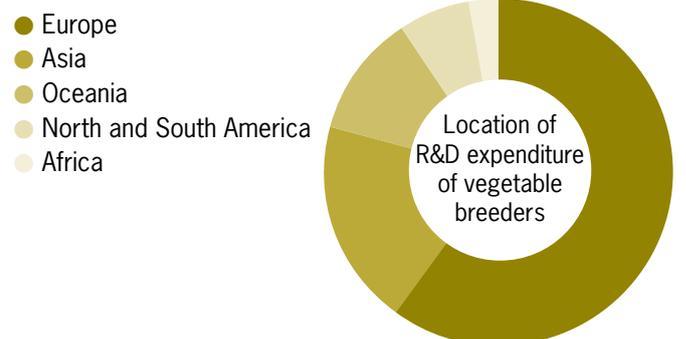
Product innovation is a spearhead



Top ten applications for plant breeders' rights in 2010

1	Rijk Zwaan Zaahteelt en Zaadhandel BV	89
2	Enza Zaden Beheer BV	49
3	Anthura BV	48
4	Nunhems BV	43
5	Dekker Breeding BV	43
6	Fides BV	32
7	Testcentrum voor Siergewassen BV	25
8	RijnPlant BV	22
9	Piet Schreurs Holding BV	21
10	Bejo Zaden BV	20

The largest share of innovation takes place in Europe



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Economics and trade

In 2010, the sector consisted of more than 300 specialised breeding and propagation companies.² Around 100 companies are active within vegetable horticulture, and the same number is active within plant reproduction materials for arable crops. The subsector of plant reproduction materials for ornamentals counts around 130 companies. Between 8,000 and 10,000 employees are estimated to work in the plant breeding and propagation industry. On the basis of various sources, it is estimated that around 1,000 to 1,500 people work in the subsector of plant reproduction materials for arable crops, between 4,000 and 4,500 in the subsector for vegetables, and 3,000 to 3,500 in the subsector for ornamentals.



Table 1.1 Key figures of structure of plant breeding and propagation industry, 2009

	Number of farms	Number of employees	Turnover in millions ^{a)}
Arable crops	100-110	1,000-1,500	240
Vegetables	100-110	4,000-4,500	1,460
Ornamentals	100-130	3,000-3,500	390
Total	300-350	8,000-10,000	2,100

a) Based on members of Plantum Source: Plantum, CBS, LISA, Hillenraad-100, LEI calculations.

A number of very large companies are active within the sector. The largest producers of plant reproduction materials in the Netherlands have more than 1,000 employees. Table 1.2 shows five important players for each subsector in random order. Syngenta, Nunhems, Rijk Zwaan, Enza Zaden and Monsanto are the largest breeding companies in the Netherlands. A number of these companies combine the breeding and propagation of a number of different varieties with the production and trade of crop protection products and fertilisers, amongst other things.

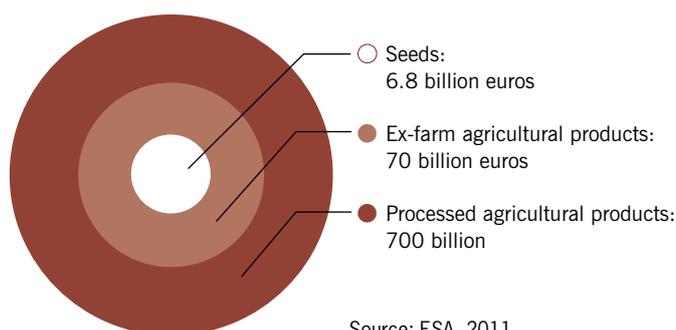
Table 1.2 Important players per subsector within the plant breeding and propagation industry, in 2010

Arable crops:	Seed potatoes:	Grass seed:	Vegetables:	Ornamentals:
Syngenta	HZPC	DLF-Trifolium	Monsanto	Royal Van Zanten
Dupont	Agrico	Barenbrug	Syngenta	Florensis
Limagrain	Europlant	Eurograss	Nunhems	Anthura
KWS	Solana	Innoseeds	Rijk Zwaan	Fides Group BV
Monsanto	Meijer	Ragt	Enza zaden	Beekenkamp

Importance within agricultural chain

The impact of the plant breeding and propagation sector on the rest of the chain is considerable. Figure 1.1 shows the market value of seeds in the EU as an example. This is approximately 6.8 billion euros. Ultimately, this leads to a value of around 700 billion euros at the retail chain store, meaning a multiplication factor of about 100 (ESA, 2011). The multiplication factor was confirmed by means of the questionnaire distributed among members of Plantum.

Figure 1.1 Importance in EU agricultural chain



Source: ESA, 2011.

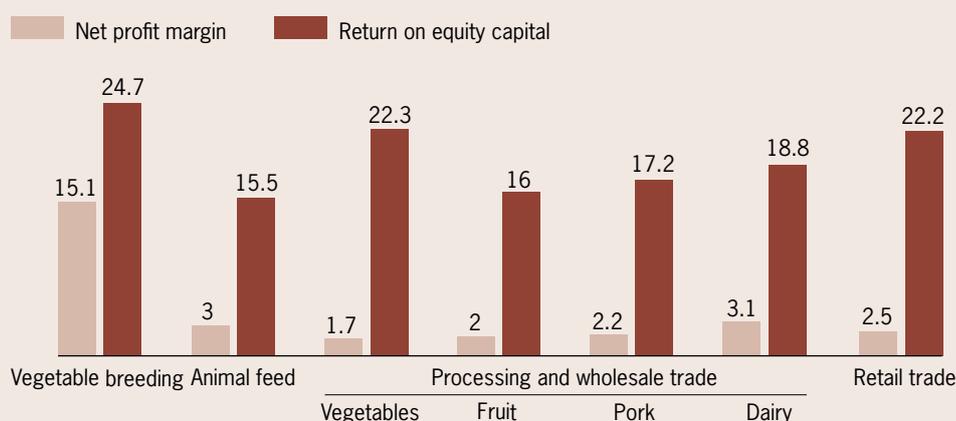
Turnover and exports

On the basis of the turnover of the members of the Dutch association Plantum, the total turnover of the sector is estimated at more than two billion euros. This relates to the turnover of the companies on both the Dutch and international markets. The Dutch plant breeding and propagation industry is to a great extent dependent on exports. However, between the subsectors there is a considerable difference in export dependence. Between 15 and 20% of the turnover of plant reproduction materials for ornamentals consists of exports, while producers of plant reproduction materials for vegetables and arable crops gain 65-70% of their turnover from exports³

Returns

The plant breeding and propagation sector is one of the sectors in the Dutch agricultural chain with the best returns. Previous research by Backus et al. (2011) into the economic performance of vegetable breeders, amongst others, estimated the return at around 25% in the period 2005-2009 (see figure 1.2). It also emerged that these companies achieved an average net profit margin of 15%. In comparison with other companies in the agricultural chain, this is considerably higher.⁴ The global interest in good reproduction materials is expressed in the high profit margin.

Figure 1.2 Net profit margin and returns in various agricultural sectors and the retail trade, averaged over the period 2005-2009



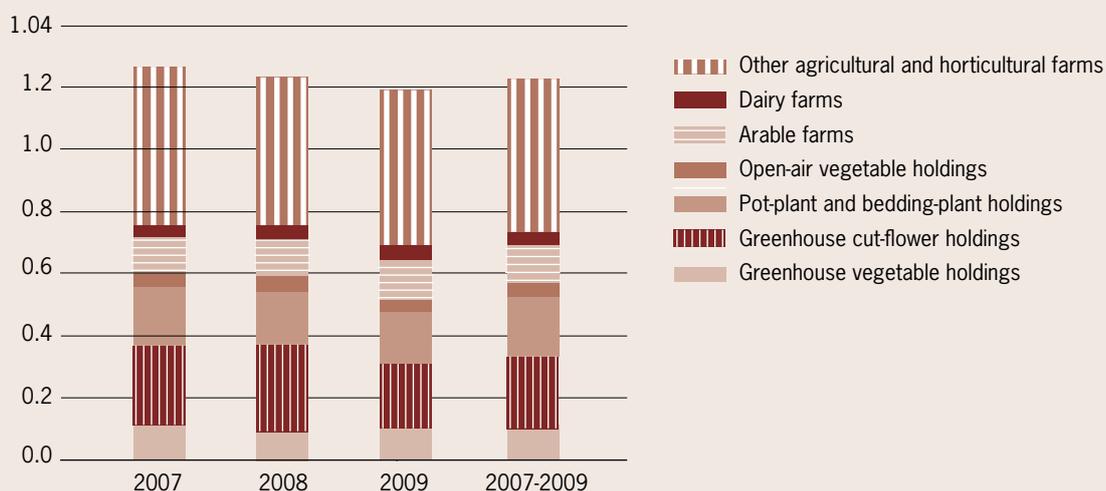
Source: Backus et al., 2011.

The plant breeding and propagating industry is strongly focused on knowledge and technology. Entry into the sector requires major investments in R&D and the protection of intellectual property. In recent years, the sector has become even more concentrated as a result of mergers and takeovers. Many companies are active in differentiated niche markets.

Dutch market for plant reproduction materials

On the basis of the LEI Farm Accountancy Data Network, an estimate was made of the total size of the market for plant reproduction materials in Dutch agriculture and horticulture. Expenditure on plant reproduction materials by Dutch farmers and growers is estimated at more than 1.2 billion euros per annum in the period 2007-2009. In figure 1.3, the expenditure of primary businesses on plant reproduction materials has been broken down into different sectors. The ratio of the market size of the various sectors has remained reasonably stable in recent years, although fluctuations do occur in the market size as a result of temporary price effects and weather conditions, for example. Greenhouse horticultural holdings account for a large share of the market, particularly the cut-flower holdings and the pot-plant and bedding-plant holdings.

Figure 1.3 Estimate of the size of the market for plant reproduction materials in Dutch agriculture and horticulture in the period 2007-2009, in billions of euros ^{a)}

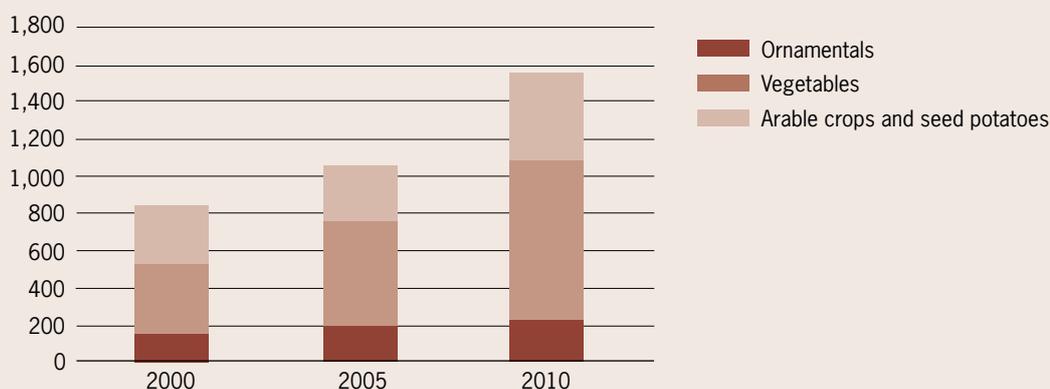


a) Other agricultural and horticultural farms are primarily mixed farms and fruit farms.
 Source: LEI's Farm Accountancy Data Network; excluding self-grown starch potatoes; purchase value at VAT percentage actually paid; this means that the figures are the best expression of the situation excluding VAT. Excluding bulb-growing farms and tree nursery farms.

Foreign market is growing

The total export value of plant reproduction materials amounts to around 1.5 billion euros. Figure 1.4 shows the development in the value of exports from the Netherlands during the period from 2001 to 2010 inclusive. Exports of plant reproduction materials have increased by around 75% since 2001, from approximately 860 million euros to 1.56 billion euros in 2010. The value of plant reproduction materials for the ornamentals subsector amounts to around 15% of the exports and is around 227 million euros. The value of plant reproduction materials for vegetables represents 55%. The value of plant reproduction materials for arable crops amounts to about 30%; around 60% of this is due to exports of seed potatoes.

Figure 1.4 Export value of propagation materials in the Netherlands 2000-2010 (x 1000 euros)



Source: Eurostat, including re-export. Excluding flower bulbs, fruit and trees.

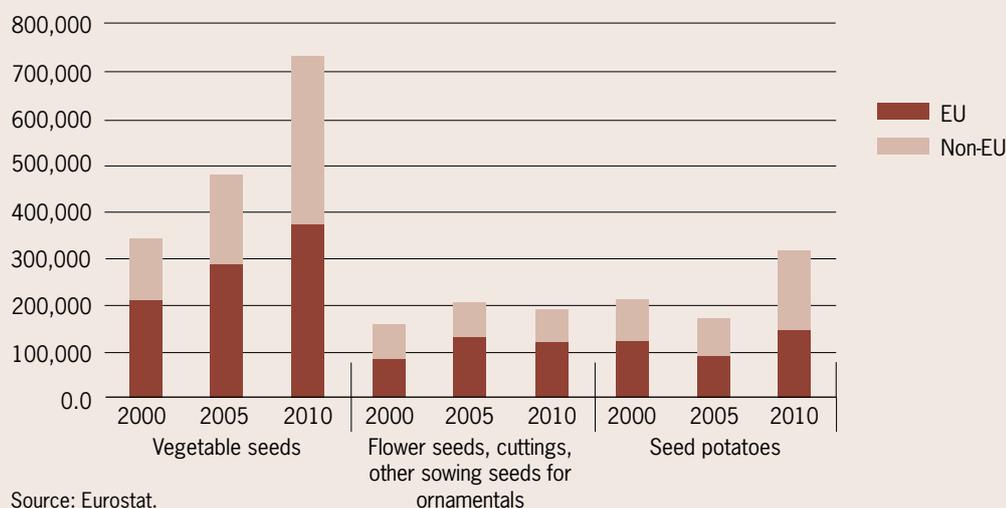


Export destinations

Figure 1.5 shows the ratio between the EU market and non-EU market as export destinations for a number of subsectors. With regard to plant reproduction materials for vegetables, it is striking that the value of the exports to non-EU countries has tripled since 2000. Exports to non-EU countries now have a value comparable to that of the EU market (360 million euros). The export market for plant reproduction materials for ornamentals is dominated by five countries that jointly account for half of the export value. The most important countries within this subsector in 2009 were: Germany (15%), United Kingdom (10%), United States (9%), Italy (8%) and France (6%). Exports of plant reproduction materials for agricultural crops are destined primarily for countries such as France, Belgium and Germany. The most important export destinations for seed potatoes in 2009 were Algeria, Egypt and Germany. In 2009, Algeria bought more than 30 million euros' worth of seed potatoes.

‘Approximately 60% of the global trade in seed potatoes originates in the Netherlands’

Figure 1.5 Exports of plant reproduction materials per region 2000-2010 (x 1,000 euros)



Source: Eurostat.

Share of plant reproduction materials in total exports

The share of plant reproduction materials in the Netherlands' total exports is 0.5%. The value of Dutch exports as a whole has increased by almost 72% since 2000. In comparison with this, the export value of propagation materials has developed faster than average: an increase of approximately 86%.

Share within the world market

The Netherlands has a strong position within the world market for plant reproduction materials. Compared with the total Dutch share in the world market (approximately 35%), the share of a few products in the category of plant reproduction materials is markedly greater. This can be illustrated using the example of the world trade in vegetable seeds. The world trade in vegetable seeds amounted to almost two billion euros in 2009. Approximately 35% of this originated from the Netherlands in 2009 (table 1.3). The Dutch share of seed potatoes on the world market was even greater, amounting to around 60% (table 1.4). Due to the limited availability of very detailed trading data for plant reproduction materials for ornamentals, it is not possible to make a comparison on a global scale. A comparison on a European scale has therefore been drawn up instead (table 1.5).

Table 1.3 The Netherlands' share in the global trade in vegetable seeds (in millions of euros)

	2000	2005	2010
Ratio between global trade and the Netherlands	29%	35%	35%

Source: Comtrade.

Table 1.4 The Netherlands' share in the global trade in seed potatoes (in millions of euros)

	2000	2005	2010
Ratio between global trade and the Netherlands	56%	53%	60%

Source: Comtrade.

Table 1.5 The Netherlands' share in the European trade in propagation materials for ornamentals (in millions of euros)

	2000	2005	2010
Ratio between EU trade and the Netherlands	56%	42%	43%

Source: Eurostat.

Imports

As is the case in many other sectors, business activities in the plant breeding and propagation industry are also increasingly being subcontracted abroad. The subcontracting of often labour-intensive activities, such as plant propagation, to low-wage countries brings about a considerable reduction in costs. A large proportion of this local production is then imported back into the Netherlands, after which the cuttings are further cultivated and the seeds are traded. This form of internationalisation has been one factor in the strong increase in imports of plant reproduction materials.

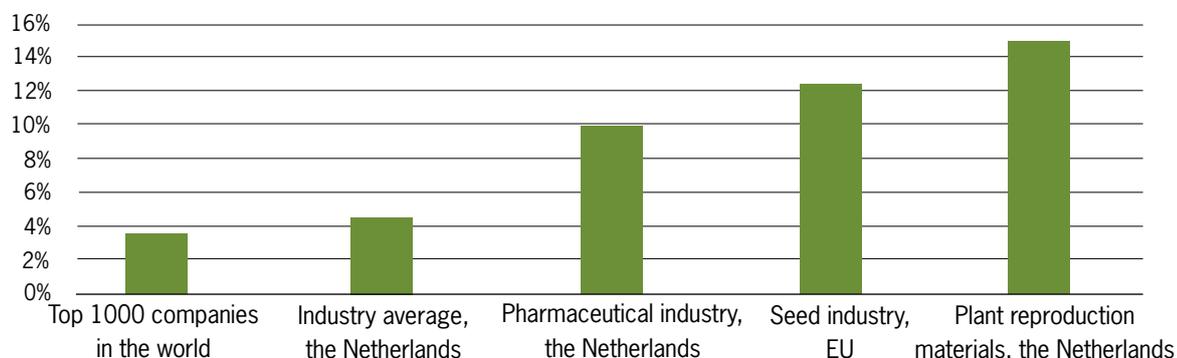
The import value of plant reproduction materials for the ornamentals subsector has increased by around 75% compared to 2000, and currently amounts to 222 million euros. Imports from Eastern Africa have increased particularly strongly and amount to 24% of the total. Imports of plant reproduction materials for the vegetable horticulture subsector have almost doubled compared to 2000, with a current value of 230 million euros. This relates primarily to imports from countries such as France, the US, Chile and Denmark.

Research, development and innovation

The plant breeding and propagation industry spends a lot of money on innovation and R&D: approximately 15% of the turnover.⁵ Compared with other sectors this percentage is still high: the EU average for R&D expenditure in the seed industry is around 12.5% (see figure 2.1). The R&D expenditure as a percentage of turnover is also high compared with other knowledge-intensive sectors. For instance, the pharmaceutical industry in the Netherlands spends an average of 10% of its turnover on R&D, while for the 1,000 largest companies in the world that figure is about 3.75%. The difference compared with other sectors in the Netherlands is huge: the Dutch average in industry is approximately 4.7%. The plant breeding and propagation industry therefore makes an above-average contribution to the Dutch knowledge infrastructure.



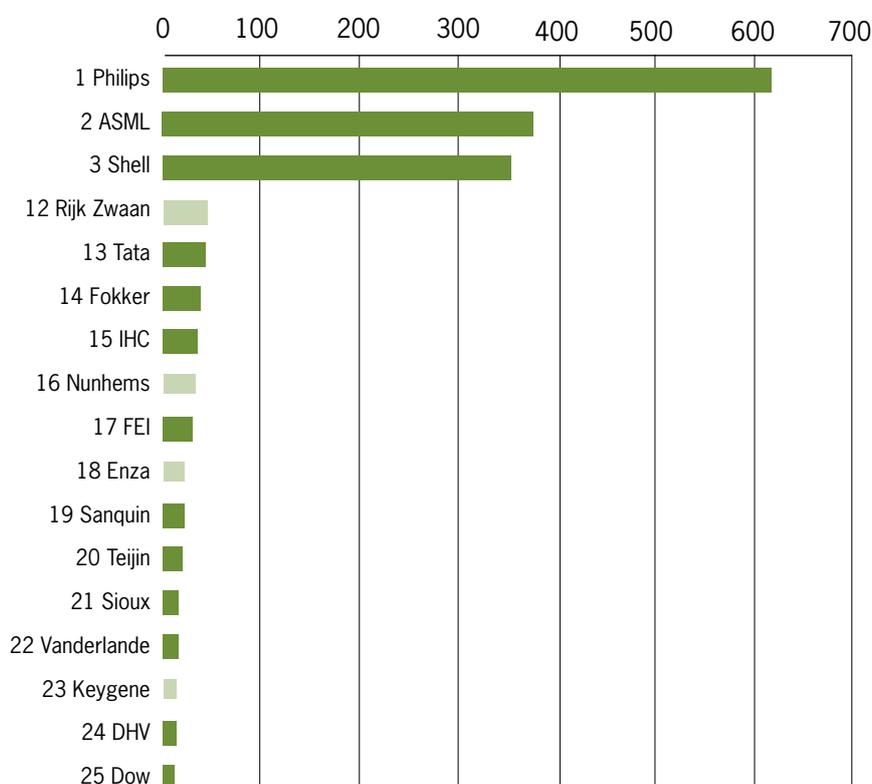
Figure 2.1 R&D expenditure as a percentage of the turnover, 2009



Source: CBS StatLine, BOOZ & Co. (2011), ESA (2011), Topsectorplan Life Sciences & Health (2011) and Jansen et al. (2008).⁶

The percentage of R&D expenditure can however differ greatly between businesses. While strongly internationally-oriented businesses sometimes devote 30% of their turnover to R&D, smaller businesses and businesses focused on the domestic market sometimes spend only a small fraction of their turnover on R&D. This can be explained by the fact that internationally-oriented companies have to respond to local consumer preferences in many different markets and are increasingly exposed to greater competition. The top 25 Dutch companies, with the greatest R&D expenditure, features as many as four companies from the plant breeding and propagation industry⁷: Rijk Zwaan, Nunhems, Enza Zaden and KeyGene (see figure 2.2).

Figure 2.2 Top 25 companies, R&D expenditure 2010 (in millions of euros)



Source: Topsectoradvies Tuinbouw en Uitgangsmaterialen.

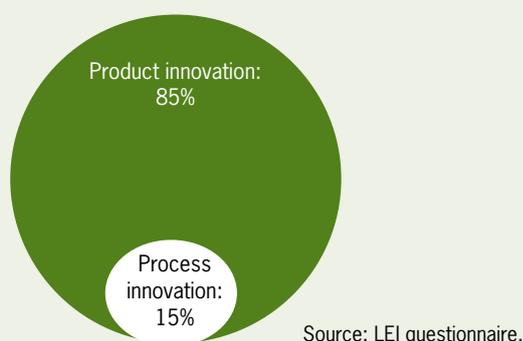
The relationship between R&D expenditure and turnover has been analysed for the vegetable breeding and propagation sector. The survey revealed that R&D expenditure within vegetable breeding and propagation remains relatively constant, regardless of the company's turnover. Both large and small businesses spend around 15% of their turnover on R&D. This phenomenon could possibly be explained by the fact that businesses are active within an international market, with strong competition from abroad. Innovation is a hard-and-fast condition for surviving within the competitive arena.

‘On average the R&D expenditure of producers of plant reproduction materials amounts to 15% of the turnover’

Product and process innovation

R&D expenditure is used for the development of new products and processes. Companies active within the plant breeding and propagation industry spend more on product innovation than on process innovation. A rough estimate suggests that around 85% of R&D expenditure goes towards product innovation. Just 15% of the money spent goes towards process innovation. That is not surprising, as new varieties constantly need to be brought onto the market in order to respond to new consumer preferences and innovations by rivals.

Figure 2.3 Ratio of product innovation to process innovation



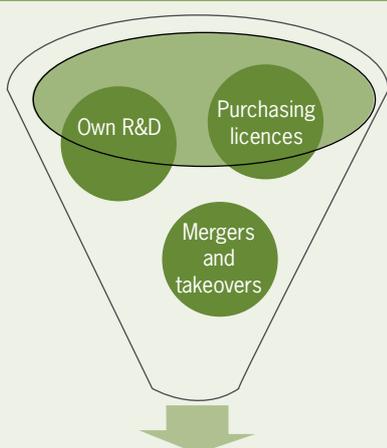
The high levels of spending on product innovation result in a very diverse range of new products each year. There are major differences between subsectors. In the case of plant reproduction materials for arable crops, this can mean five new varieties in a year, whereas more than a hundred new varieties produced by a company in a year is not unusual in the vegetable subsector. However, there are also differences within a subsector. In the period between 2008 and 2010, producers of plant reproduction materials launched an average of around 190 new products per company within the market for vegetables. There was however great variation: some producers introduced around 240 new products while others introduced only around 15 product innovations.

Strategies for innovation

Businesses within the plant breeding and propagation industry make use of a variety of innovation strategies, as shown in figure 2.4. Many companies have their own R&D facilities, particularly the larger players in the sector. In this case, companies develop new products and/or processes autonomously. A number of large companies also make use of two further innovation strategies, namely purchasing licences and entering into mergers and takeovers. Mergers and takeovers have resulted in consolidation within the sector. Innovation and globalisation of the sector are the driving forces behind this development.⁸

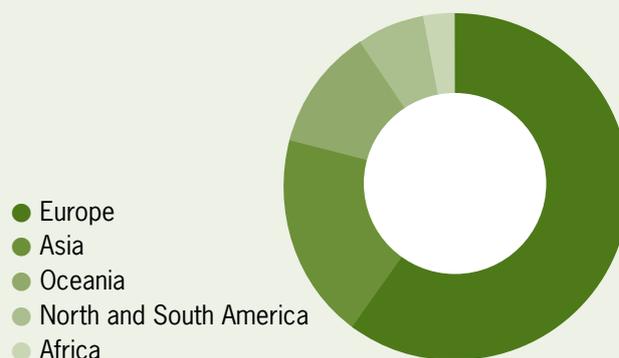


Figure 2.4 Innovation strategies within the plant breeding and propagation industry



Source: LEI questionnaire.

Figure 2.5 R&D expenditure by Dutch vegetable breeders in 2010 by region, in %



Source: LEI questionnaire.

‘Breeders are active all over the world, but the fundamental research takes place in Europe’

Location of R&D expenditure

The R&D activities take place not only in the Netherlands; producers of plant reproduction materials also develop new products and processes in other countries. This is illustrated in figure 2.5, showing where the R&D activities of producers of plant reproduction materials for vegetables take place. Most of the producers who took part in this study indicated that they still spent around 60% of their R&D budget in Europe. At the same time, producers now also spend a significant sum on R&D in Asia. Although the producers are active virtually all over the world, new products and processes are still developed in Europe. This primarily concerns fundamental research. Outside Europe, specific varieties are bred to suit local conditions. Propagation also takes place abroad.

Cooperation within the value chain

When developing innovations, companies within the sector work alongside many different chain partners (see figure 2.6). It is striking that irrespective of the subsector concerned, producers of plant reproduction materials work with growers, without exception. This is not entirely unexpected, as growers are the buyers of the reproduction materials produced by breeders and propagators. Although producers of plant reproduction materials form the basis of Agro & Food, cooperation also takes place with parties lower down in the chain during the development of innovations. Companies within the vegetable subsector in particular tend to work alongside foodstuffs manufacturers and retailers. In this way, companies are constantly updated on new market developments and consumer preferences.

Figure 2.6 Most important chain partners in innovation within the plant breeding and propagation industry



Source: LEI questionnaire.

According to the producers of plant reproduction materials, product development is the most important reason for cooperation. One example of product development is the development of a new variety. The second reason for entering into a cooperative arrangement is market development. Cooperation offers the parties access to and knowledge of local markets. An example of this is cooperation for the purposes of accessing the Chinese market. A smaller number of producers of plant reproduction materials indicate that they cooperate with other parties in the field of process innovations. Process innovations often relate to increasing the efficiency of the breeding or propagation process. Lastly, there are producers that enter into cooperative arrangements in all three areas.

Figure 2.7 The three most important reasons for cooperation



Source: LEI questionnaire.

The nature of the cooperative arrangement between companies is also very varied and may be focused on the different types of innovation. Some cooperative arrangements have a broad set-up and relate to both the development and exchange of new technologies on the one hand and marketing on the other. Other cooperative arrangements have a narrower set-up and focus on specific research and development processes. For the subsector of plant reproduction materials for vegetables, it appears that around 75% of the producers regularly or frequently cooperate with other parties on innovations, while 25% apparently engage in little or no cooperation with other parties.

Figure 2.8 International cooperation in product innovation in the subsector of plant reproduction materials for vegetables



Source: LEI questionnaire.

Public-private cooperation

Besides cooperation with chain partners both within the Netherlands and further afield, the plant breeding and propagation industry also works with research institutes and universities. Dutch research institutes and universities take on a leading role in these cooperative arrangements. For instance, Wageningen UR (University & Research centre) submits the most patent applications in the Netherlands in the subsector of breeding (see table 2.2). Other organisations submitting numerous patent applications include Technology Foundation STW, Leiden University and TNO. In total, research institutes and universities submit around 28% of all patent applications.⁹ Only large companies (with more than 250 employees) had more patent applications.

Table 2.2 Top 5 research institutes and universities, based on patent applications in the breeding sector, 1999-2008

Applicant	Number of applications
1 Wageningen UR	35
2 Technology Foundation STW	5
3 Leiden University	4
4 TNO (Netherlands Organisation for Applied Scientific Research)	3
5 Utrecht University	3



The public-private cooperative projects that are developed within the Technological Top Institute Green Genetics (TTI GG) make a major contribution to the flow of knowledge from Dutch public research institutes and universities to businesses and vice versa. Before genomics technology was introduced in plant research in the mid 1990s, the development of new tomato varieties took at least nine years. Thanks to the use of such technologies in breeding programmes, this development time has now been more than halved. New technologies developed by the research institutes and universities actually give rise to valuable applications in research laboratories within breeding companies via this public-private cooperation. This in turn creates value, accelerates the breeding process and at the same time strengthens the knowledge base in the Netherlands. The expectation is that the introduction of new techniques such as reverse breeding and next generation sequencing will accelerate developments in plant breeding still further, as a result of which new varieties will be tailored even more closely to the wishes of the market and society. In this way, the competitiveness of companies is reinforced, the world's food supply becomes more secure, and the loss of quality in the chain as a result of diseases, pests and limited shelf life is considerably reduced.

High innovation output

In the plant breeding and propagation industry, intellectual property is protected by plant breeders' rights and patent law.¹⁰ Applications relating to these are often seen as an indicator of what R&D expenditure will deliver, or in other words: the innovation output. Where applications for plant breeders' rights are concerned, the Netherlands has been leading the way internationally for many years (see figures 2.9 and 2.10). More than 30% of the applications are from Dutch plant reproduction materials producers, which underlines the important position of the Netherlands in this field.¹¹ Besides the Netherlands, other important countries include France, Germany, the USA and Switzerland.

'The Netherlands has been leading the way in plant breeders' rights applications for many years'

Figure 2.9 Applications for plant breeders' rights received by CPVO, 2010

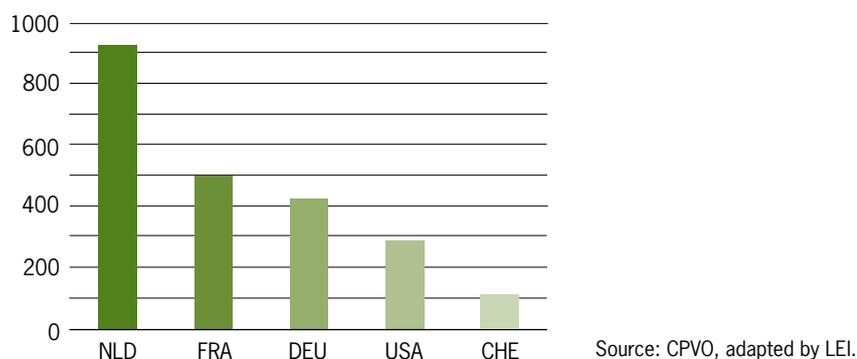


Figure 2.10 Applications for plant breeders' rights submitted by Dutch producers of plant reproduction materials to CPVO, 1996-2010

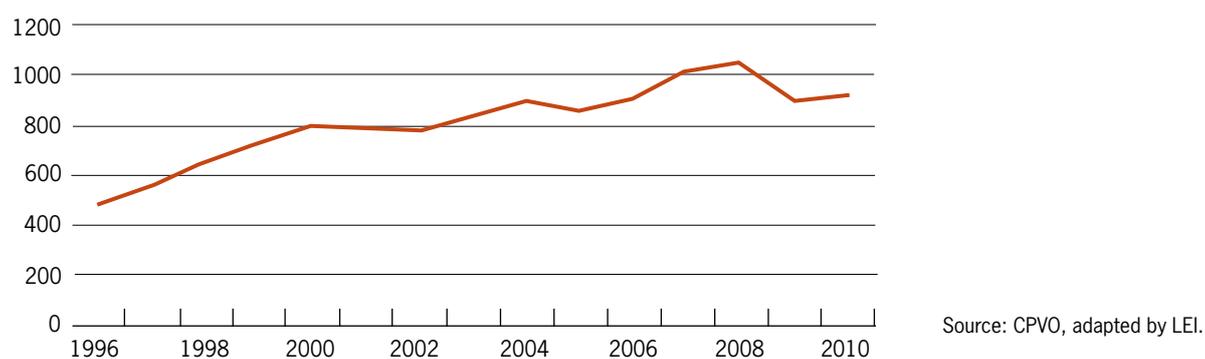


Table 2.3 shows the largest Dutch applicants for plant breeders' rights. Rijk Zwaan tops the list. The top ten comprises producers of plant reproduction materials in the subsectors of both vegetable horticulture and ornamentals. Both subsectors therefore contribute to the development of innovative products.

Table 2.3 Top ten Dutch companies producing plant reproduction materials arranged by number of applications for plant breeders' rights received by CPVO, 2010

Company	Number of applications
1 Rijk Zwaan Zaaideelt en Zaadhandel BV	89
2 Enza Zaden Beheer BV	49
3 Anthura BV	48
4 Nunhems BV	43
5 Dekker Breeding BV	43
6 Fides BV	32
7 Testcentrum voor Siergewassen BV	25
8 RijnPlant BV	22
9 Piet Schreurs Holding BV	21
10 Bejo Zaden BV	20

Source: CPVO Annual Report, 2010.



The Netherlands also scores highly compared to other European countries with regard to patent applications. The Dutch vegetable seed sector applies for an average of three or four patents per million inhabitants each year. The European average in the period from 1999 to 2008 was less than one application per million inhabitants.¹² In total, in the period between 1999 and 2008, 195 patent applications were submitted by Dutch producers of plant reproduction materials and by research institutes and universities. The most applications (48%) were submitted by large companies (with more than 250 employees), followed by research institutes and universities (28%) and small and medium-sized enterprises (22%). The remainder of the applications (2%) were submitted by private individuals.¹³

Rijk Zwaan and Monsanto/De Ruiter Seeds jointly top the list in terms of the number of patent applications (see table 2.4). It is striking that the top ten patent applicants consist primarily of companies in the subsectors of plant reproduction materials for vegetables and for arable crops. This is in contrast with the applications for plant breeders' rights, in which regard the ornamentals subsector is also represented in the rankings.

Table 2.4 Top ten Dutch patent applicants in the field of plant breeding, 1999-2008

Company	Number of applications
1 Rijk Zwaan Zaadteelt en Zaadhandel BV	19
2 Monsanto /De Ruiter Seeds	19
3 Keygene NV	10
4 Enza Zaden	9
5 Avebe NV	8
6 Syngenta	7
7 Advanta Seeds	5
8 Bejo Zaden BV	5
9 Expressive Research BV	5
10 Nunhems BV	4

Source: CPVO Annual Report, 2010.



In conclusion

The focus on innovation and the international character and image mean the Dutch plant breeding and propagation industry can justifiably claim to be a top-ranking sector. The Dutch plant breeding and propagation industry offers solutions from which the rest of the agricultural chain can benefit. It also contributes to devising solutions for problems in society, such as food security and sustainability within the agricultural sector. Over the course of the years, the sector has gained a very competitive position, with global influence and a major contribution to the Dutch knowledge economy. The prospects for further reinforcing and expanding the sector's position in the future are therefore favourable.

'The Dutch plant breeding and propagation industry contributes to food security and a sustainable agricultural sector'

Endnotes

- 1 The following definitions of the subsectors have been applied in this study. These definitions have been used in this brochure unless explicitly indicated otherwise.
 - Arable crops: seed potatoes and agricultural sowing seed
 - Ornamentals: flower seeds and propagation material for ornamental cultivation
 - Vegetables : vegetable seeds and propagation material for vegetable cultivationPropagation materials for fruit cultivation, flower bulbs and tree farming are not covered within this study.
- 2 Based on the Plantum membership list and the agricultural censuses carried out by Statistics Netherlands (CBS), adapted by LEI.
- 3 Based on LEI questionnaire.
- 4 Based on a random sample of companies in the Amadeus database.
- 5 Based on: LEI calculations.
- 6 Figures relating to industry average for the Netherlands date from 2006.
- 7 Expressed in terms of absolute R&D expenditure.
Source: *Topsectoradvies Tuinbouw & Uitgangsmaterialen*
- 8 Source: *Veredelde Zaken; De toekomst van de plantenveredeling in het licht van de ontwikkelingen in het octrooirecht en het kwekersrecht, 2009.*
- 9 Source: *Octrooitoppers; Topgebieden vanuit octrooiperspectief, 2011.*
- 10 Source: *Veredelde Zaken; De toekomst van de plantenveredeling in het licht van de ontwikkelingen in het octrooirecht en het kwekersrecht, 2009.*
- 11 Source: *CPVO, Annual Report, 2010*
- 12 Source: *Octrooitoppers; Topgebieden vanuit octrooiperspectief, 2011.*
- 13 Source: *Octrooitoppers; Topgebieden vanuit octrooiperspectief, 2011.*

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This brochure provides insight into the economic significance of the Dutch plant breeding and propagation industry for the Dutch economy. In addition to information about the structure and trade, this brochure focuses on an important aspect of the sector, namely that of research, development and innovation. Efforts in the field of innovation have led to a high-quality, internationally competitive sector. A top-ranking sector for the Dutch economy.

