

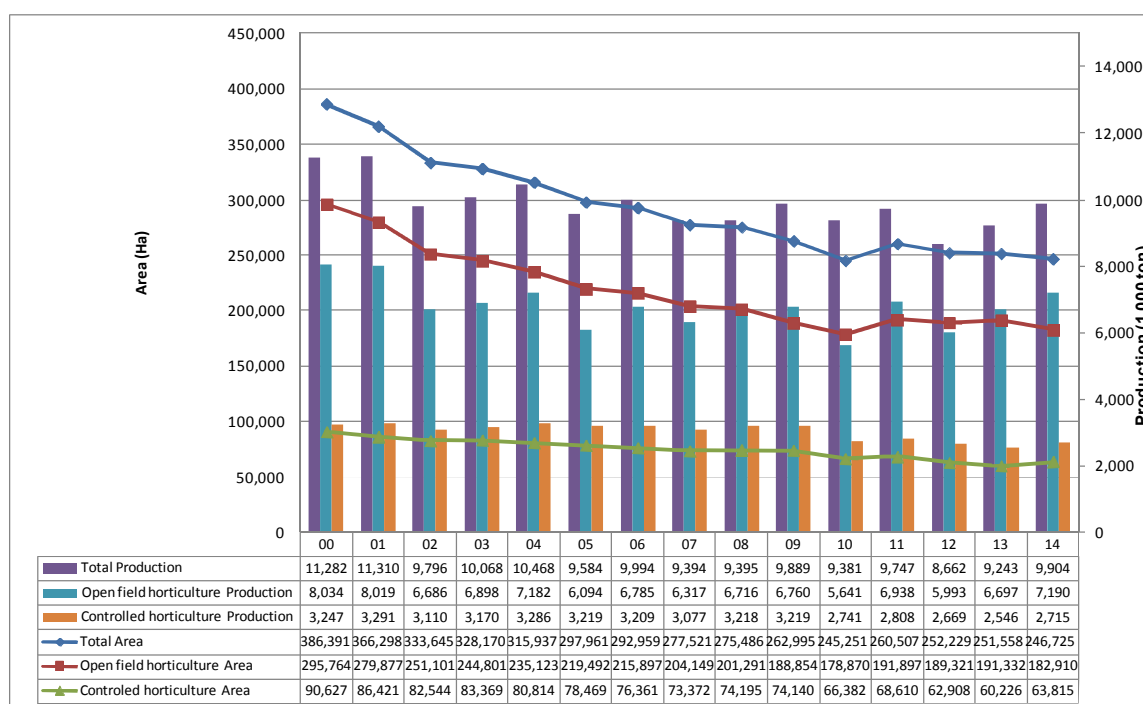
# Greenhouse Horticulture in Korea

June, 2016  
LAN Seoul

## 1. Overview of Korean horticulture

### 1) Vegetable

Figure 1. Vegetable production and farming area by open field and controlled horticulture by year



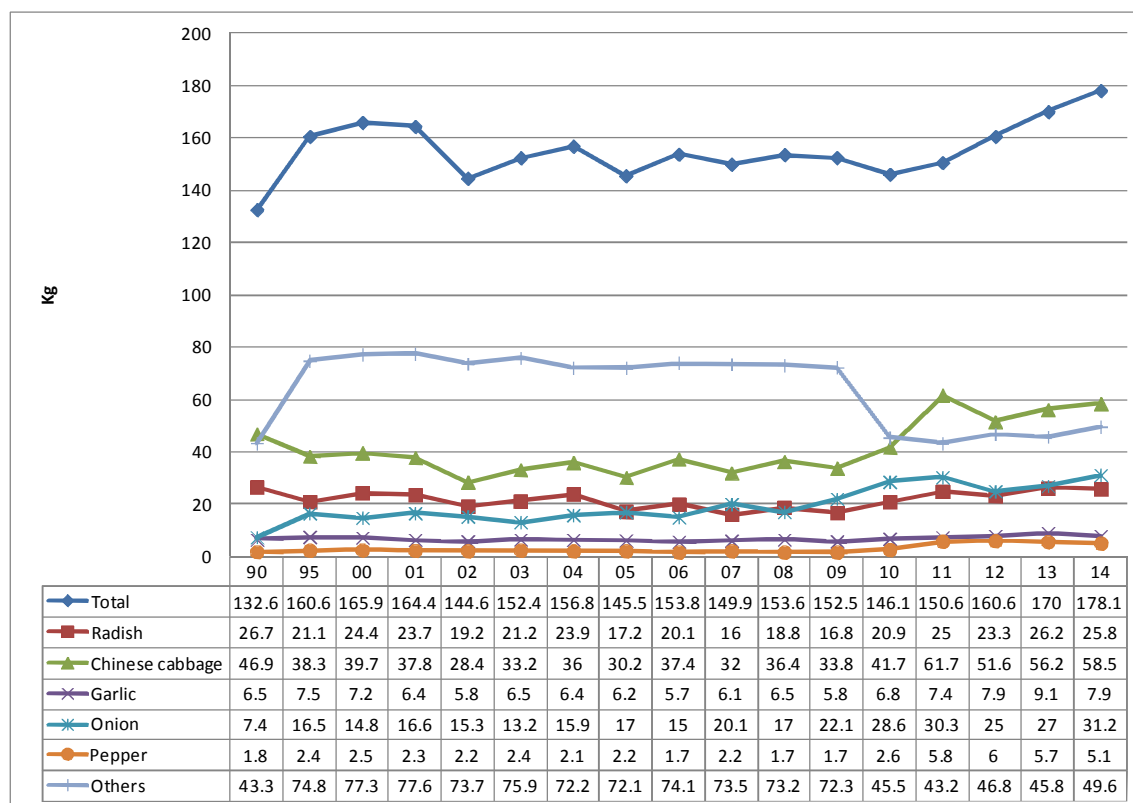
\* Controlled horticulture: greenhouse and other controlling facilities

Total vegetable production was estimated at 9.9 million ton produced in 246,725 ha in 2014. Since vegetables are mostly consumed fresh as Kimchi (fermented lettuce and cabbage), leaf vegetables going with BBQ or vegetable side dishes, the impact of imported and refrigerated vegetables on the local vegetable production has been limited.

Table. 1. Vegetable production by year by kind (Unit: 1,000 ton)

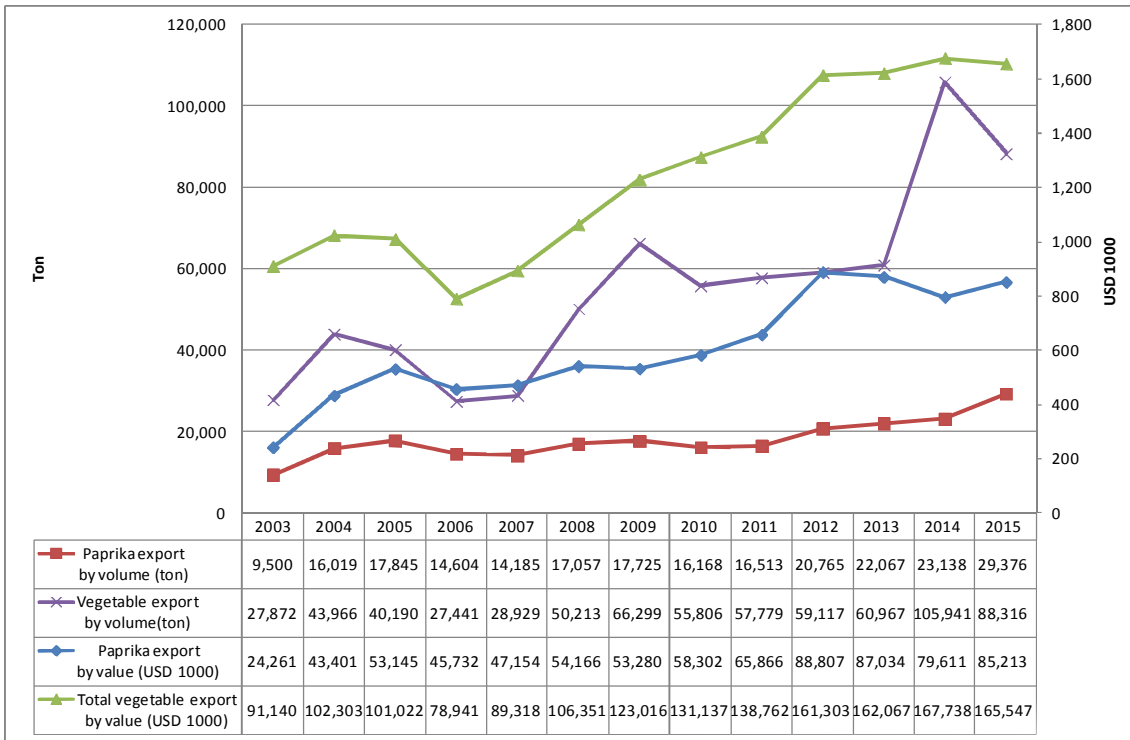
Year	Fruit-bearing	Leaf	Root	Condiment	Total
2006	2,694	3,531	1,648	1,904	9,994
2007	2,667	2,956	1,300	2,239	9,394
2008	2,777	3,134	1,531	2,057	9,395
2009	2,708	3,237	1,386	2,310	9,889
2010	2,639	2,411	1,160	2,221	9,381
2011	2,232	3,456	1,348	2,401	9,747
2012	2,075	2,839	1,222	1,017	8,662
2013	2,353	3,013	1,396	2,279	9,243
2014	2,508	3,239	1,400	2,524	9,904

Figure 2. Per capita vegetable consumption by year (Unit: Kg)



Korea is one of the largest countries in per-capita vegetable consumption as shown in Figure 2. The self sufficiency rate of vegetable of Korea in 2014 was 85%. Since the per-capita vegetable consumption is increasing continuously and the main vegetable crops/varieties in Korea are mostly different from those of vegetables which are largely produced in Europe or America, it is expected the local production will continue to be stable. Furthermore as shown in Figure 3, the export of vegetables is increasing continuously. Around half of the export value in 2015 came from the export of Paprika into Japan.

Figure 3. Export of vegetables from Korea by year



2) Ornamental plants

Figure 4. The number farmers and farming area by year

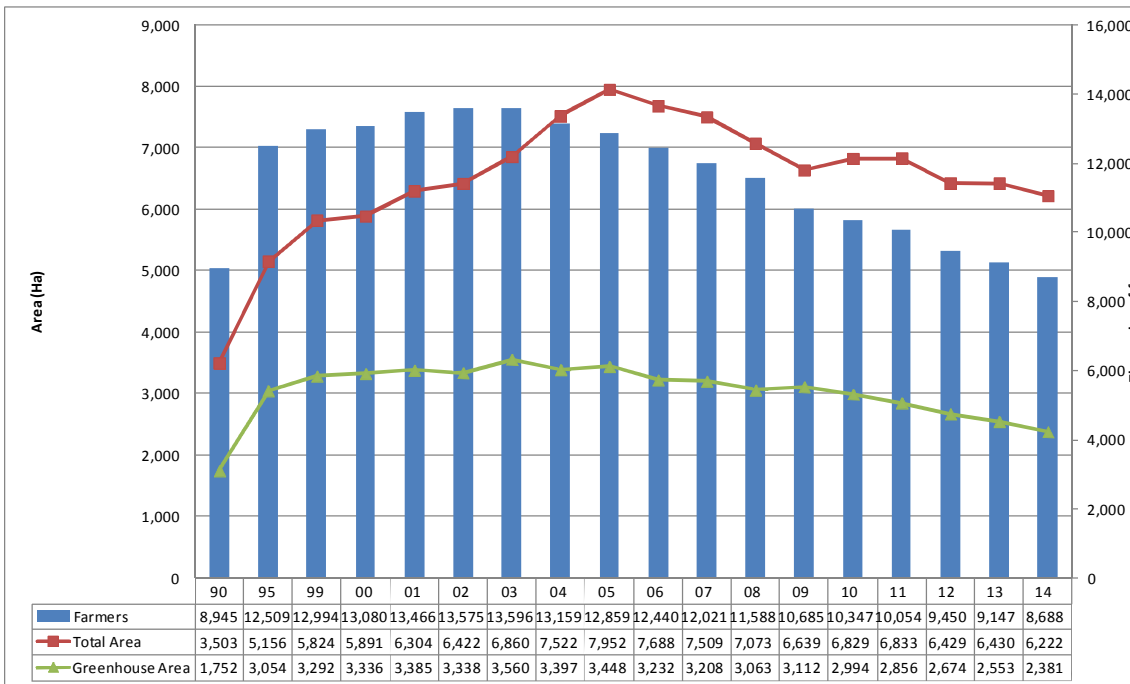
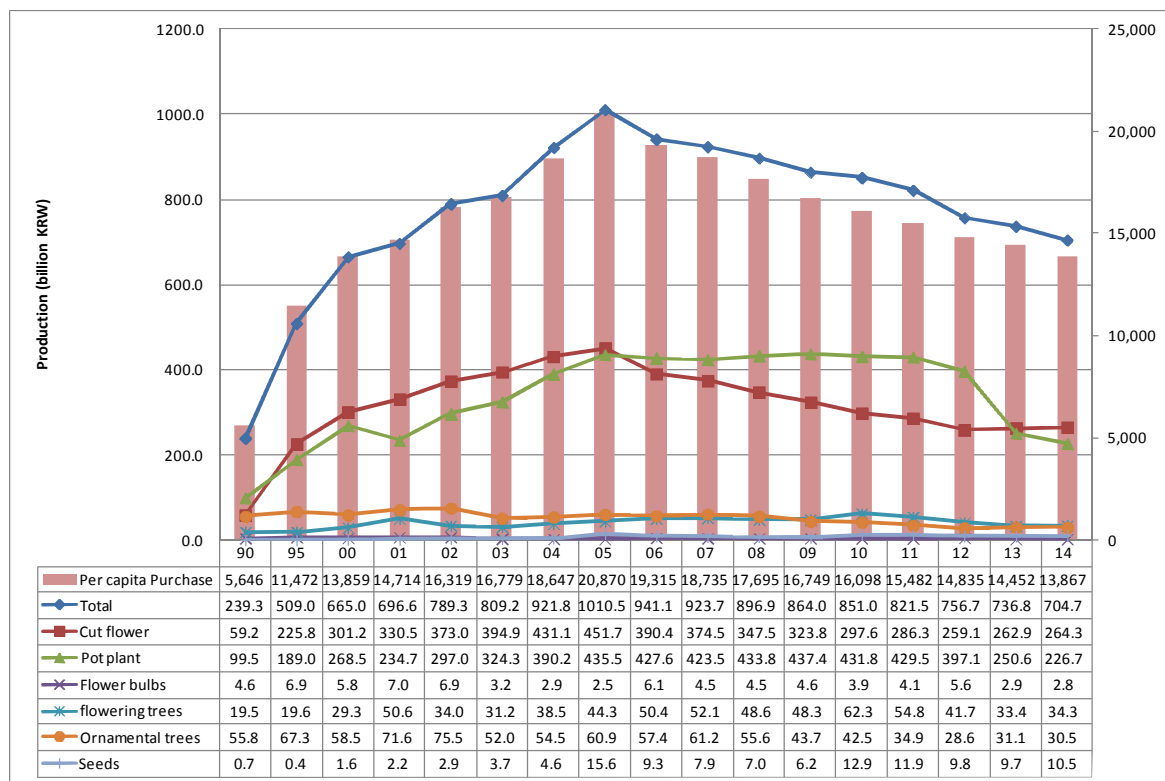


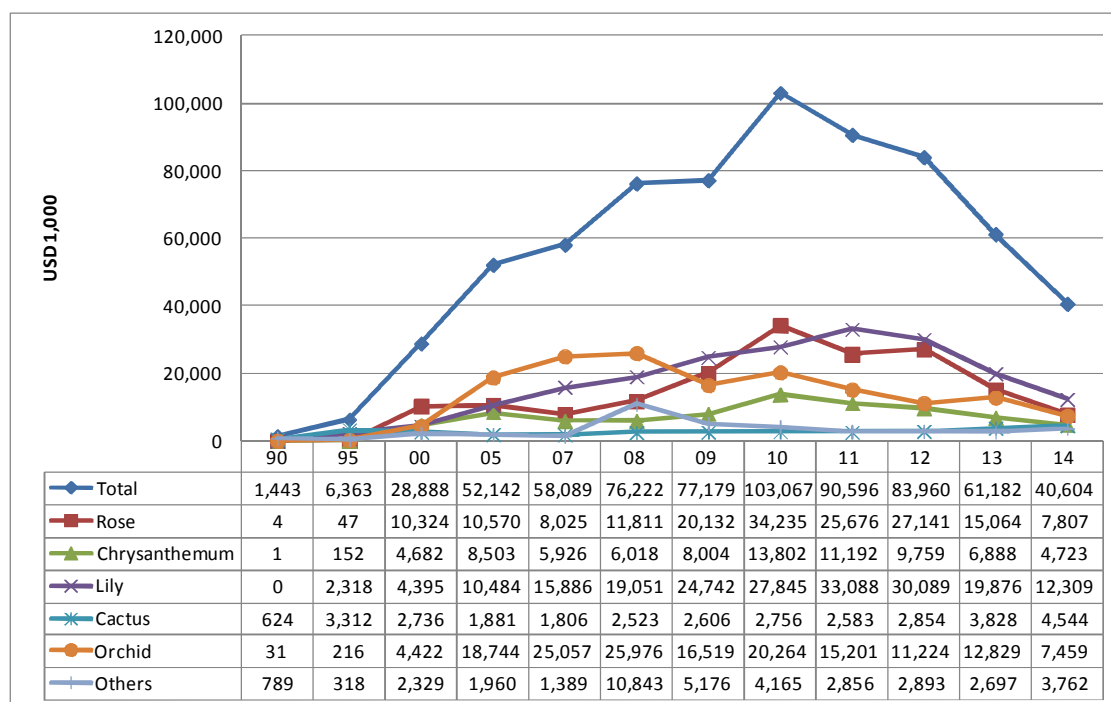
Figure 5. Production and per capita purchase amount of ornamental plants by year



\* 1 EUR = around KRW 1,328 as of 1 June 2016

Total ornamental plant area increased until 2005 as the purchase amount was growing. Since 2005, the area has diminished drastically due to the shrink of flower purchase caused by the world economic downturn. The purchase amount is not recovering even after the economy is turned around. Korea's flower purchase derives mainly from business concerns that handle ceremonial occasions and from floral decorations in hotels. Individual purchase is still very low compared to other developed countries. The export of ornamental plants is also shrinking as shown in the Figure 6. In terms of greenhouse business, the Korean ornamental plant sector seems to be not that promising.

Figure 6. Export of ornamental plants from Korea



### 3. Greenhouse horticulture in Korea

#### 1) Greenhouse for vegetables

Table 2. The area of vegetable greenhouse by type by year (unit: Ha)

Year	Total	Plastic greenhouse	Hard board greenhouse	Glass greenhouse
2005	46,354	46,094	45	215
2007	50,157	49,828	104	225
2008	50,297	49,990	55	252
2009	50,024	49,605	133	286
2010	48,835	48,465	98	272
2011	49,537	49,175	88	274
2012	47,924	47,556	90	278
2013	51,058	50,686	67	306
2014	51,787	51,382	76	329

Korean greenhouse production has shown expansion consistently since 1995 whereas open-field production has decreased. This boosted the productivity and quality in the vegetable sector. In 2014, total greenhouse area for vegetables was 51,787 ha, of which 51,382 ha was under plastic and 329

ha was under glass. Glass greenhouse area has increased consistently over the last years for the production of high-value vegetables such as paprika and tomatoes.

Table 3. The area of greenhouse by greenhouse type (2014, unit: Ha)

Plastic greenhouse						Hard board greenhouse				Glass greenhouse			
Single			Linked			Single		Linked		Single	Linked		
Tunnel	Arch	Others	Tunnel	Arch	Others	Roof	Arch	Roof	Arch		Roof	Venlo	Others
23,894	19,992	291	2,236	3,565	96	5	29	29	12	2	139	183	5

Table 4. The area of greenhouse by nutrition (2014, unit: Ha)

Solid medium				Water			
Pearlite	Rock wool	Coco peat	Others	DFT	NFT	Spray	Others
633	255	821	462	64	47	227	472

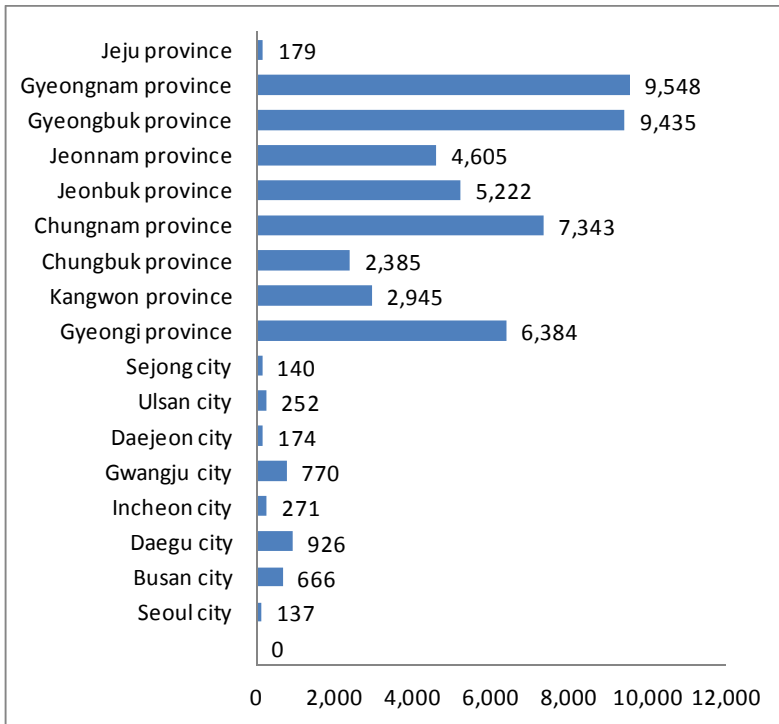
Table 5. The area of greenhouse by energy source (2014, unit: Ha)

No heating	Heating													
	Solid fuel							Oil				gas	electricity	Geothermal
	Waste wood	briquette	Coal coke	Waste tire	Wood pellet	Others	Diesel	Heavy oil	kerosene	Others				
36,904	45	285	40	1	542	166	8,840	1,451	1,949	462	36	930	136	

Around 71% of the total greenhouse area is not heated in the greenhouse. More than 85% of the heated greenhouse area is using oil. Unlike the Netherlands, Korea has little gas pipeline to countryside. Gas lines are connected mainly to residential areas. Therefore Korean farmers have difficulty in securing cheap and convenient energy sources. The Korean government has promoted geothermal energy with a subsidy program since 2010.

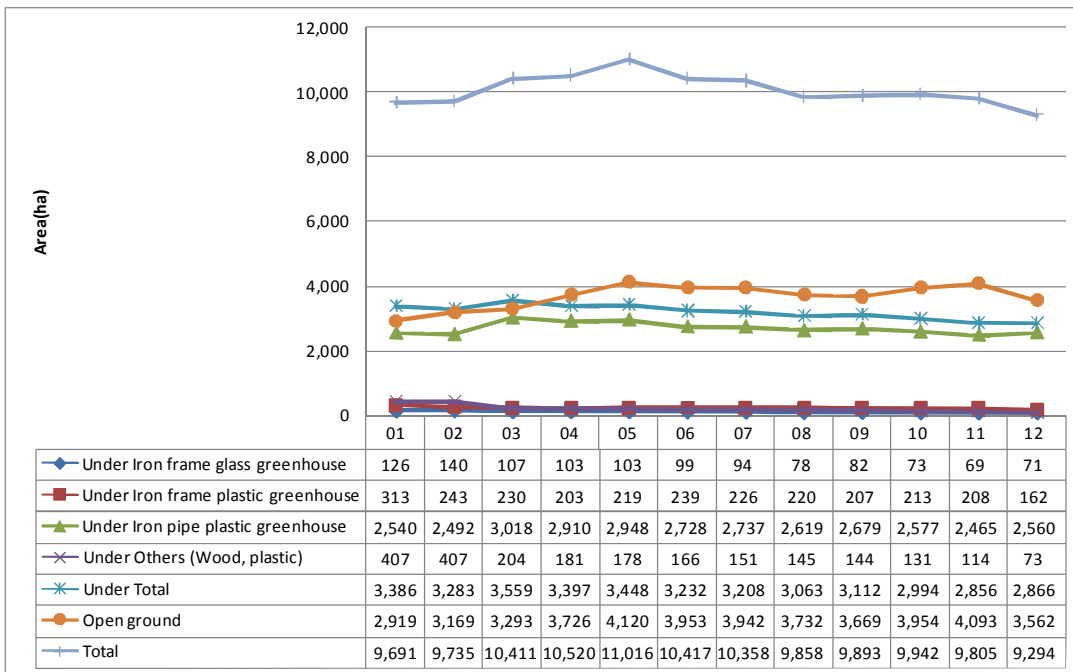
Gyeongsangbuk and Gyeongsangnam provinces in the south-east are the main vegetable greenhouse districts in Korea, which have the geographic advantages for transportation of vegetables in fresh to Japan. According to 2014 statistics, around 37% of greenhouses were located in these provinces. The most fast-growing greenhouse area in Korea is the south-west (Jeonbuk, Jeonnam and Chungnam provinces) because several reclaimed land projects are being completed over there. Vegetables produced most extensively under cover are watermelon, tomato, pepper and melon. Korean vegetable production is mostly a family business. Korean government and farmers are trying to improve the productivity by learning Dutch skills and building Dutch hi-tech greenhouses.

Figure 7. The area of vegetable greenhouses by province (2014, unit: ha)



## 2) Greenhouse for ornamental plants

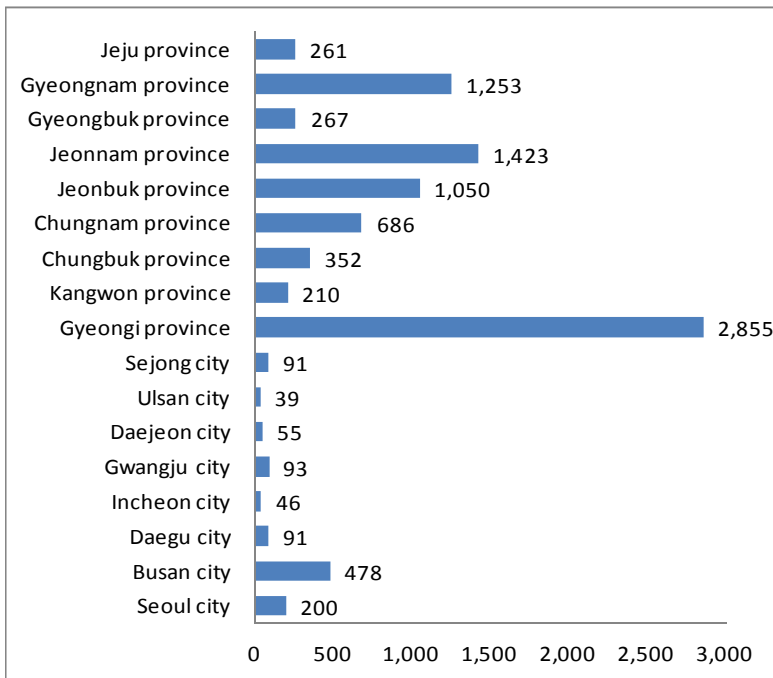
Figure 8. The area of ornamental plants greenhouses by year (unit: Ha)



Total greenhouse area for ornamental plants was 2,866 ha in 2012, of which 2,722 ha was under plastic and 71 ha was under glass. Ornamental plant growers are less positive about high-tech

greenhouses than vegetable growers who are aware of the necessity of high-tech greenhouses for the production of high-value vegetables for export. This is the reason of the 10-year consecutive decrease of the glasshouse for ornamental plants(140→71ha) since 2002.

Figure 9. The area of ornamental plant greenhouses by province (2012, unit: ha)



Ornamental plants farms are mostly located in Gyeonggi and Gyeongnam provinces which are close to big cities such as Seoul and Busan city. 51% of greenhouses were located in these provinces in 2012.

Ornamental plants produced most extensively under cover are rose, chrysanthemum and lily. Ornamental plants production is also a family business and the productivity is relatively low.

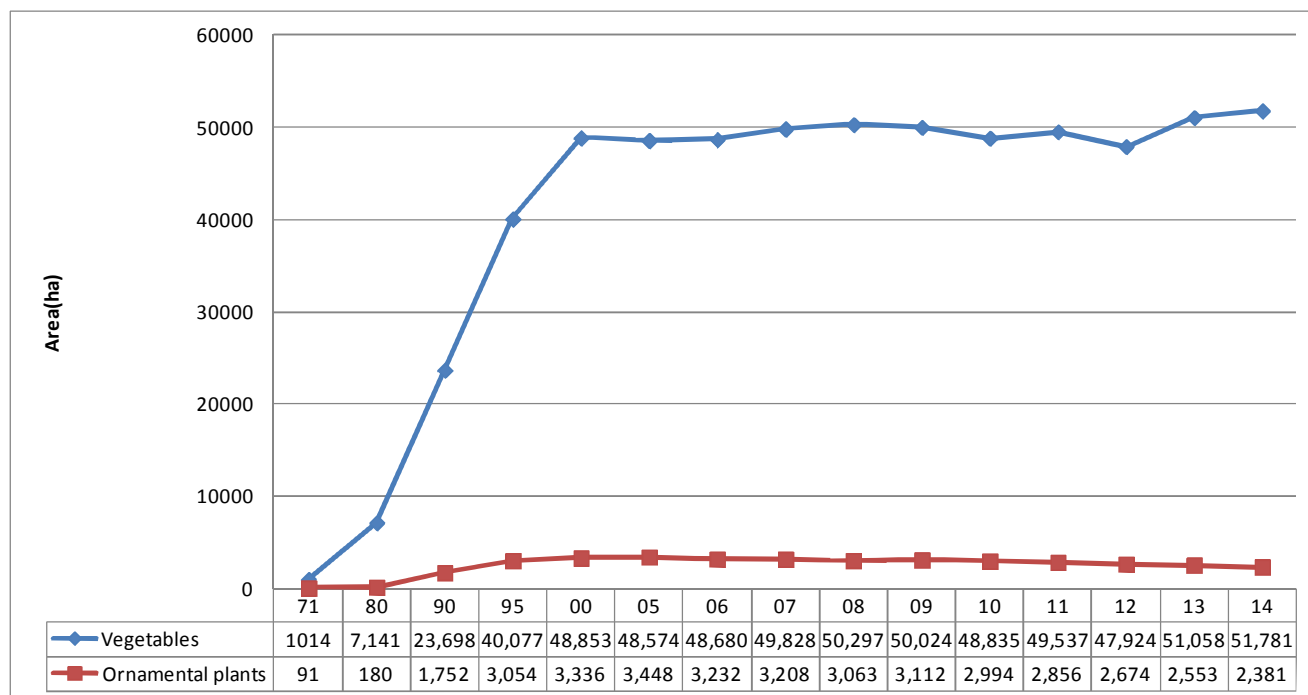
### 3. History of Korean greenhouse horticulture and lessons learned

#### 1) before 1990: development of plastic greenhouse

Korea has a very extreme weather; summer is hot and humid, and winter is cold and dry. Korean farmers started growing some vegetables in plastic greenhouses in the winter to avoid hot summer. Korean farmers were small and couldn't afford to pay for modern glasshouses. Instead, Korea developed cheaper plastic greenhouses without sophisticated system. The amount of sunshine in Korea is much more than in the Netherlands (Korea: 2,420 hrs, The Netherlands: 1,480 hrs), and Koreans believed that plastic was enough for growing horticultural crops.



Figure 10. Greenhouse area by year



## 2) 1990~1999 – Start of subsidy program for glasshouses

In 1990s, Korean greenhouse horticulture continued to grow. In order to make the greenhouses more efficient and modernized, the Korean ministry of agriculture made a subsidy program for hi-tech greenhouses. Many vegetable and flower farmers applied for the subsidy program and hi-tech greenhouses were largely built on the basis of the program. Most of greenhouses were built by Dutch greenhouse builders on a turnkey basis because local (plastic) greenhouse builders had little knowledge or technology for hi-tech greenhouse. There were two requirements for those who want to receive the subsidy: 1) more than two farmers should work together for the greenhouse 2) the products should be exported.

### \* Lessons learned in the cooperation between Korea and the Netherlands in 1990s

- By working together between the two countries, several success cases were made: Korea became the largest exporter of paprika into Japan. Most of leading vegetable exporters in Korea were established in this period.
- The requirement for the partnership of more than two farmers was an obstacle to success: farmers often conflicted due to lack of the spirit of cooperation.
- Most of greenhouses for ornamental plants were failed. Korean flower farmers are now saying that expensive glasshouses are not necessary for flowers because Koreans don't have an eye for high-quality flowers produced in hi-tech glasshouses. Therefore most of recent state-of-the-art greenhouses are concentrated on vegetable farming.

- It is important to have a good local English-speaking middleman in Korea. He or she can support for greenhouse building with a local license, find customers and can cover demanding customers which frequently ask after-sales service.

### 3) 2000~2008– Stagnation

After the subsidy program was finished, there was almost no large scale glasshouse project in Korea. As local farmers are not big enough to pay for hi-tech greenhouses, no one could invest in new hi-tech greenhouse projects without a subsidy of the government. Many Dutch greenhouse builders and their local partners left the sector in Korea.

### 4) 2009~ 2013 – Efforts to revive the sector but frustration

Korean Ministry of agriculture (MAFRA) announced a large scale Agro-food complex project in 2009. The plan was to lease reclaimed lands such as Saemangeum, Youngsan river and Hwaong (find the locations in Figure 11) to large-scale companies and support for infrastructure and fund. The Korean government promoted hi-tech greenhouses for these areas because they believed hi-tech greenhouse horticulture can promote agricultural export.

Around 114 ha in Saemangeum, 200 ha in Youngsan River and 100 ha in Hwaong were assigned to agro-companies. One of leading companies was Dongbu group, the largest fertilizer maker in Korea, which secured 50 ha in Saemangeum and 100 ha in Hwaong for vegetable farming. 50 ha in Youngsan-river was assigned to Hanbetall, a new company established by Paprika farmers near Youngsan-river area. Nongsan trading which had been successful in exporting paprika to Japan since 1990s also received 64 ha in Saemangeum. In this trend, many other non-agricultural companies were also interested in vegetable farming in hi-tech greenhouses.

However the projects ended all failed or halted. Dongbu group had begun building the Asia's largest, cutting-edge glass greenhouse of 12 ha in size, with an investment of KRW 57 billion (EUR 43 million) in Hwaong in February 2011. Dongbu fully constructed the greenhouse late 2012 and began growing tomatoes, with harvest and exports scheduled in March 2013. Right after the completion of the greenhouse, Dongbu decided to halt its massive glass greenhouse business at Hwaong. The decision was reached as the nation's agricultural community vehemently protested against the business, saying the Dongbu's entry into the large-scale farming sector threatens their livelihoods.

Dongbu group stopped all the on-going projects and plans on horticulture not only in Hwaong but also in Saemangeum. After a long controversy, the greenhouse in Hwaong was sold to a company called Wooil farm. This case impacted on all the discussions to develop Korean horticulture and the government also stopped supporting agro-companies for greenhouse projects. Hanbetall was basically weak in the finance and couldn't continue the project without financial supports by the government. Nongsan Trading also decided not to progress the project.

In this period, Korean farmers learned Dutch greenhouse horticulture through Dutch practical training companies or institutes and tried to plan greenhouse building by themselves not on a turnkey basis. Many greenhouses were built with a combination of Dutch climate control system, Dutch interior automation system, local frame/aluminum/ glasses (copied by local companies) and other possible local products. Dongbu greenhouse in Hwaong was also built in this way. However, farmers are facing several troubles after the completion of greenhouses, for instance; mis-match between systems and water leakage.

Figure 11. Reclaimed lands for greenhouses in Korea



### Lessons learned in the projects between 2009 and 2013

- Opposition by local farmers is an obstacle in greenhouse horticulture business in Korea. For large-scale companies who want to start horticultural business in Korea, they should not receive any subsidy from the Korean government. Otherwise they will confront troubles with Korean farmers.
- Small companies or cooperations of small farmers are usually very weak in the finance. It is generally not easy to receive subsidy from the central or regional government. They are likely to give up their projects or plans if they fail to secure subsidies from the central or regional government.

- There are several local greenhouse builders. They are very strong in lobbying to get greenhouse building projects. However, their technology level is not stable because most of their products are developed through a simple copy of Dutch products. Local farmers are recently coming back to Turnkey by Dutch greenhouse builders.
- In relation to ambitious governmental greenhouse projects, many regional or central government officials or researchers visited the Netherlands to learn Dutch horticulture. However most of these visits have not resulted in actual cooperation or business. The actual purpose of the visits should be checked more carefully.

#### 5) 2014~ now – still a difficult market but some positive changes

After the symbolic case of Dongbu, all the discussions to make large modern greenhouse districts were canceled or suspended. Conglomerates which were considering investing in agriculture also withdrew their plans. Many Dutch greenhouse builders stopped the business in Korea.

After some time, some opportunities to develop Korean horticulture are coming up. Some regional governments are trying to make greenhouses using waste heat from power plants. A livestock company made a state-of-the-art greenhouse on a turnkey basis by a Dutch greenhouse builder. Dutch climate control system for greenhouse is still very popular among Korean researchers and universities. The Saemangeum project is still going on even though it is much delayed. Some conglomerates are trying to make large scale greenhouses. They are aware of the Dongbu case and are carefully preparing their projects. There are still a lot of obstacles but the sector is developing in a positive way.

#### **4. Summary of opportunities and obstacles for Dutch greenhouse builders**

- The policy of the Korean government is to promote more added-value agriculture and export of agrofood products. Therefore Korea will focus on hi-tech greenhouse horticulture for new (reclaimed) lands. Some of greenhouse projects in reclaimed lands have already been canceled or delayed. But there is no doubt that some of them will be developed as a large greenhouse district in the end.
- If the customer is a conglomerate, opposition by local farmers may be an obstacle in greenhouse projects.
- If the customer is a small farmer/company, Dutch greenhouse builders should check first if the customer already secured the budget. Small companies rely very much on governmental supports and it is not always successful to receive subsidies from the government.
- There are several local greenhouse builders and the technology level is not that high. From lessons learned over the last 10 years, Korean farmers recognize that there are troubles such as leakage in greenhouses built by local builders. In spite of that, local builders would win projects because they are strong in lobbying.

- Korean customers ask Dutch greenhouse builders a lot of questions and information on greenhouse when they start a greenhouse project. But they often choose somebody else when they select a builder in the end. Koreans are generally more precise and demanding for the details. Therefore Dutch builders have no choice but to provide relevant information when requested. It is recommended to have a close conversation with Korean customers from the beginning on a trust basis to prevent such unfair cases.

- It is not always easy to start business in Korea. Two main obstacles are language (Korean cannot speak English well) and license (For greenhouse building, it needs a construction license owned by a Korean). Therefore it is critically important to find suitable Korean partners who can speak English and arrange the license.

## **5. Relevant fairs & magazines**

### 1) Fair

TAMAS: Agricultural machinery and Seeds show, covering various agricultural items such as machinery, greenhouse, seed, fertilizer and etc.

The website is <http://www.tamas.or.kr/english/index.html>. This show is held in November every other year, and the next will be in 2015.

KIEMSTA: Korean International Exhibition of Machinery, Equipment, Science and Technology for Agriculture.

The website is <http://www.kiemsta.co.kr/e-main.html>. This show is held in October every other year, and the next will be in 2014.

### 2) Magazine

The Monthly Horticulture (<http://www.hortitimes.com/>) will be the most read magazines among horticulture stake holders. But it is in Korean language.