

THE HORTICULTURAL SECTOR IN THE REPUBLIC OF KOREA



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FOREWORD

The industrial activities are growing very strong in the Republic of Korea, resulting in a strong increase of the income. Agriculture is not following these developments. Korean government considers the modern horticultural production with emphasis on modern glasshouse production and especially flower growing, as a great potential to improve the welfare in the country. Korean government has far developed plans to import hundreds of hectares of modern glasshouses with modern equipment. The Dutch greenhouse industry could possibly give support to these developments.

On request of the Ministry of Agriculture, Nature Management and Fisheries, Department for Trade and Industry, Ir. A.P. Verhaegh of the Agricultural Economics Research Institute (AERI) visited Korea from March 30, 1992 till April 12, 1992 to study the Korean horticultural sector. Findings are published in this report. The aim of the study was to analyze the Korean horticultural sector to give more insight in possible cooperation.

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Ir. A.P. Verhaegh

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CHAPTER 1. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The agricultural sector has been neglected in the past, while the industrial activities were growing very fast. In a short period many Koreans moved from the country to the cities to find employment in the industry and the service sector. Most people living in the cities have still strong connections with people in the rural areas. Korean people are now aware of the position of the farmers. In the whole of Korea there exists a very strong feeling to improve the position of the farmers. This is an unique situation and will be a strong force behind new developments in the rural areas.

The agricultural farms in Korea are of a very small scale. The average ^{size} is only 1.19 hectare. This size is a strong barrier in creating a modern agriculture sector. The position of the farmers will grow even worse by the international developments of open markets. The income of the agricultural sector depends very strongly on the results of the rice crop. The cultivated rice acreage amounts to 59 percent of the total cultivated land. Korean rice is five to seven times more expensive than foreign rice. The only way for Korean farmers to survive is to switch from rice to other crops.

Especially greenhouse crops and also fruit cultures are two types of farming which profit from the economic development of the Republic of Korea. During the last twenty years the increase in production to answer the growing demand was orientated on out-of-season products and a larger assortment. Quality awareness is still at a low level in Korea. To be able to offer produce all the year round the growers enlarged the cultivated area spectacularly with protected crops offering at the same time to the Korean public new types of vegetables, fruit and flowers. The same consumers will ask for more in the near future, especially in the winter period. Consumers will also ask for better quality as the quality of their life keeps on improving. Producers will only be capable to fulfil these wishes by a higher production technology.

The Korean government launched recently a ambitious master plan to restructure the agriculture sector and to strengthen the international competitive power of Korean farmers. Priority is given a.o. to horticulture and especially the greenhouse sector. The Korean government is interested to develop a modern glasshouse sector and for this purpose growers can get very interesting subsidies.

This study has primarily been composed for Dutch companies wanting to set up commercial horticultural activities with Korea, however also for Korea organizations and companies interested in a modern greenhouse industry. Because two parties are involved here, some parts are more interesting to Korean companies. To support these groups and other parties involved with summarized information and understanding of the Korean commercial horticultural sector its complexity can be best analyzed by dividing it into independent aspects.

Climatic characteristics play a major role in the intensive crop economics of the production of glasshouse crops. It is easily to understand that the first aspect has to be related to the climatical conditions. This aspect will be examined on its technical and economic possibilities in view of the policy of the Korean government which considers modern glasshouse production as a great potential.

The next aspect treated will be the technological level of production, because modern glasshouses go together with high investments and high running costs. The business of modern glasshouse production will only be profitable by adapted cultivation techniques.

The third aspect is the parties, which have to be taken into consideration when developing a modern horticultural sector in Korea.

The fourth aspect is the marketing.

The fifth aspect is related to some sociological and psychological topics, of which experiences in the Netherlands show the importance. Last but not least possibilities will be summed up how to transfer knowledge and a general conclusion will finish this chapter.

Climatical conditions

The Korean climate has four seasons annually, just like the Dutch one. The most significant differences are that Korea has in winter more days with frost and lower temperatures, but in summer higher temperatures during the day and at night. Other differences in the climate of both countries are the daily pattern of the temperature courses with greater differences in temperature, and a higher humidity in summer and a lower one in winter. Dutch farmers may have some problems in autumn when they have to cope with a relatively high humidity. The radiation, the most important growing factor, is in the winter much higher in Korea than in The Netherlands. It is even impossible in The Netherlands to grow fruit vegetables like tomatoes in wintertime, because of the absence of sufficient sunlight. The same causes in Holland a decline in the quantity and quality of roses during the winter. The climate of Korea compared with the Dutch one is on balance less mild for growing flowers and vegetables of a high quality and a large productivity, and can be compared with the more continental climate in central Europe. The Netherlands have technically and economically a weak production period in the winter because of the light shortage, Korea has the same limitation in the summer because of the high temperatures. Korea must develop first the technology of its production in its best season, like the Dutch have done and are still doing.

The total area in Korea covered with walk-in greenhouses amounts to 24 470 hectares. These houses are all covered with vinyl, a layer of thin plastic. Of the total area 30 percent is of the permanent type and in use for several years. The other part, 70 percent, is temporary and removed yearly. The average size of a greenhouse farm is approximately 2500 m² with plastic covering. Vegetable growing is the most important cultivation in temporary as well as in permanent greenhouses. Cut-flowers are much more cultivated in the more developed permanent multispan greenhouses. Many of the greenhouses have a tunnel structure or a multispan with two or more spans. The height of the greenhouses is different. Heating and ventilation systems are not to be found or on a low level of technology, and only installed in permanent greenhouses. In many permanent as well as in temporary greenhouses permanent or manual moved screens and other material are used to protect the plants against frost. Sometimes two independently functioning energy screens are installed, not with the idea to save energy but to get the right minimum temperature when there is severe frost.

The conclusion has to be that Korean farmers show a great and flexibel attitude towards new developments in their country and have built up a protected crop industry of nearly 25 000 hectares of walk-in greenhouses in a very short period. For a modern glasshouse industry however this set up is insufficient.

Light, as already mentioned, is the most important climatic factor in modern glasshouse crop production. Even in Korea farmers have to be careful with light, the level of radiation in winter is much lower than in summer. Light as a production factor is especially important in Korea in winter as the winter is an important production season, because of the high prices and the export possibilities. Korean farmers, therefore, need the best covering material on their modern greenhouses, glasshouses well equiped with modern

ventilation and heating systems, movable screens to save energy and movable screens to protect the plants against to high direct radiation of the sun. The Venlo-type is a very high developed and for farmers economically most attractive glasshouse. The well-known Dutch suppliers of greenhouses and greenhouse equipment can play an important role in supporting the construction of a Korean modern glasshouse industry.

Production technology

A modern glasshouse is high tech, which implies high investments, not only because of the construction costs and the price of glass instead of plastic, but also because of the equipment needed as e.g. improved systems for heating, ventilation, sreens, water-supply, fertilizing, disease control and modern internal transport. All is needed to obtain better results and to save on labour costs. High technology demands also a high technique of production to be able to meet the high costs. In 1990 Dutch farmers achieved a yield of 433,000 kilogrammes of tomatoes on average per hectare of greenhouses, 97 percent of which were of export quality. This high level of production was gradually reached in 40 years. In the fifties the yield was only 70,000 kg per hectare. The harvest increased more than 6 times in this period.

What The Netherlands has achieved in 40 years, Korea likes to do in 10 years or less. This is a problem in Korea, where the farmers have no experience and the necessary knowledge is not yet available how to use a modern glasshouse and how to cultivate in such a glasshouse. The recent research in Korea is more basic and less applied research. By applied research it is oriented on the traditional way of farming in greenhouses. Only very little research is done into the direct needs of the farmer with high tech aspects. The following problem in their research will be how to reach farmers by transferring the research findings. Transfer of knowledge is a neglected field at the moment by lack of specialized training, specialized extension and developed horticultural magazines. At this moment suppliers of seed and plant material of modern cut-flowers are the main source for farmers to obtain knowledge about cultivation techniques.

In the last twenty years the Korean farmers switched from cultivation on the open field to cultivation in plastic covered greenhouses, but they kept on using the old cultivation methods. This way the results did not improve as is illustrated by the very low yields of the fruit vegetables in the greenhouses. Knowledge is generated by more information about and insight in the influence of the climatical factors, plant behaviour, watering, fertilizing and the interactions between these factors. Many Korean parties have to be involved to activate this process.

The generating of knowledge will receive a strong boost by better farm inputs like seed, cuttings, fertilizers and remedies against diseases and varieties accepted on the modern market. The Korean farmers should be given the opportunity to obtain such inputs. These inputs are not available on the local market. These materials have to be imported, otherwise the establishing of a modern glasshouse industry will stagnate. The Korean government should acknowledge the international patent laws about plants to be able to introduce newly developed varieties by paying royalties. By accepting the international rules Korea will offer a great potential for Dutch suppliers of such materials. These suppliers have to realise that optimum service and support will be the basis for a great and durable success.

The parties concerned

The Korean government, the national and local government, took an excellent decision with a new master plan to build a large number of modern glass greenhouses on private farms in the nineties, to set up new research institutes at the same time, to increase the research capacity on the experimental stations, and to establish on RDC a new department called "Controlled farming" with a great number of employees. This master plan is called "10-Year Farm Restructuring Program".

The Ministry of Agriculture, Forestry and Fisheries (MAFF) dominates in the making and steering of the new developments. On the MAFF two departments are involved in protected crop production, the Vegetable Division and the Fruit and Flower Division. Two organizations, the Rural Development Administration (RDA) and the Korea Rural Economics Institute (KREI) are doing research to support the decisions of the MAFF. All research stations are under direction of RDA. The Rural Development Corporation (RDC) is very important in the execution of policy measures of the MAFF on the production side while the Agriculture and Fishery Marketing Corporation (AFMC) has the same main task on the market side. The National Agricultural Cooperative Federation (NACF) is also an important organization in horticulture, i.e. in banking, supply of farm inputs and in marketing.

Decisions like these, however, are not taken independently from other developments in the country and they have always a spinn-off influencing developments in other organizations in the country. Ever more Koreans play their part in the development of a modern greenhouse industry, some of them try to improve the situation on the home market, others try to organize the export. The market side may be covered by these activities, the production side, however has not seen any actions except may be a few which are only in an initial stage. Production technology is still traditional and have to be changed into a high-tech technology adapted to a modern glasshouse.

The organization to improve production techniques to a high technology is not developed at farmers' level, not enough greenhouse farmers have access to sources of information. Korea has a great potential to develop such an organization. The generous policy of the government to pay an substantial part of the investments needed for a modern private glasshouse industry can only be found in Korea and nowhere else. Moreover different Korean organizations as universities, institutes, federations, administrations and corporations are all parties with certain tasks and with a strong interest to support the agricultural sector. To create a modern glasshouse industry in a short period cooperation among all these organizations is highly necessary and have to be aligned in the same direction. During the visits of organizations deviating opinions were also expressed, mainly based on a lack of the right information. For the development of the sector the correct information on all the glasshouse aspects is a main issue to convince the people. An important task also for Dutch suppliers of greenhouses and production inputs is to inform adequately all parties concerned.

Specialized extension of glasshouse crops, on farmers orientated research and direct transfer of knowledge among greenhouse farmers are items to develop. Together they constitute together a good basis to introduce new production techniques.

Organizations as the Korean Florist Association are in direct contact with most of the flower growers. Their monthly magazine is an ideal instrument to bring information straight to the farmer. Besides market information this magazine should also be used for dissemination of knowledge about growing techniques, technical and economic performances of glasshouses and so on. In

principle organizations as the Korean Florist Association should receive all possible support from other parties concerned in Korea. Specialist journals are very important for the transfer of knowledge.

In The Netherlands the transfer of knowledge on farmers level is achieved by a very intensive and specialized extension network and by the organization of the NTS (Nederlandse Tuinbouw Studieclubs). The NTS is a farmers' organization, which has as its main task the improvement of cultivation on the individual farm. A farmer faces many problems and limiting factors of which a great number may be solved by the exchange of know-how among farmers with the same interests. The Dutch extension has an important task in organizing these contacts. Glasshouse crop production is a knowledge intensive activity, Korea should create also a farmers' network to facilitate the exchange of experience among farmers.

A special way of knowledge transference are the DEMO-projects, which are very important in case of calamities. A DEMO-project is a demonstration project focused on development and not on research. The DENAR-project at Rijswijk, near The Hague, was started during the energy crises to show farmers how to save energy by various techniques and to make farmers try out of promising new techniques. The project is nowadays successfully used to tackle environmental problems of soil, water and air pollution. The present situation in Korea, which tries to create a modern greenhouse sector in a relatively short period of ten years, can be compared to this situation. DEMO-projects will also have a positive influence on the developments in Korea.

The private sector supplying farm inputs for modern crops is still weakly developed and needs support.

All these activities have to be developed by Koreans. Some of them like trade journals and Demo-projects can be supported by Dutch workmanship and Dutch know-how. Dutch suppliers of horticultural technology and materials can optimize their services by introducing this in Korea.

The market

The demand in Korea for fresh horticultural produce, especially quality products, will increase very strongly over the next ten years as the population will grow and at the same time acquire a substantially higher living standard caused by the economic growth of the country.

However consumers will have to learn how to handle flowers, which will become readily available to them when the system of the outlets will have been modernized. Greenhouses also have the advantage that the supply to the market shows less fluctuation than the supply derived from the open field. The supply will become even more stable when the production side will be kept better in hand, which can more easily be achieved in a modern glasshouse. A stable supply is very attractive to consumers, who will make the efforts of the Korean farmers worthwhile by buying these more expensive products.

The distribution channels for fresh vegetables, cut-flowers and potted plants are significantly different in Korea. There are many wholesale markets nationwide, most of them are in Seoul. In general the market facilities are outdated, market space is inadequate for both buyers and individual wholesaler and the post harvest handling is very poor. The new and beautiful "Flower Marketing Center" in the area Seocho-Ku in the south of Seoul is a good example of the way the government is interested to improve the whole market system. The management of this center is done by AFMC. The staff is interested in activities to improve the quality of the supply.

Korea intends to export flowers and fresh vegetables. Up till now all horticultural activities have been orientated on the domestic market only with few influences from abroad. An open market will mean competition from

foreign suppliers. In such a situation international standards of quality, cost pricing and packing will be the first items to pay attention to. Not only the Korean market is promising, also the international market has many possibilities. The flower market of the USA is also underdeveloped. Experts call the USA: "the largest underdeveloped market for flowers in the world ". Japan is also a promising market. If these markets would really develop the exporters will get a gigantic market to sell their flowers. Korea has the potential to play its part among the other suppliers. If Korea does not use its potential, it will meet in the future with competition of foreign suppliers on its home market in an open international market system.

Dutch growers fear increasing competition on the international market by the creation of new horticultural production centers in other parts of the world supported by Dutch workmanship and know-how. With reference to Korea this fear isn't justified. There are two main reasons for this statement. Dutch produce sold on markets far from home is only additional to the local assortment. The second reason is that markets have to be developed by the main suppliers. By promotion and with the help of an excellent network of retail selling points the Dutch flower and vegetable industry brought consumption in the western European countries on a very high level. The flower industries of the USA themselves and other main suppliers as Columbia and Mexico are the parties concerned in the promotion of the flower consumption in the USA. Several Korean organizations are conscious of the importance to make the people more familiar with flowers, and organize different activities to promote the consumption of flowers. To the Dutch glasshouse industry the possibilities of supplying flowers and vegetables of a superb quality to a developed market located on a long distance from the site of their production will be much larger than to a similar underdeveloped market.

Sociological and psychological aspects

There is a growing awareness that the development of a modern greenhouse industry is a human activity. Universities, institutes and experimental stations do not execute it, but they support it in their specialist ways. In the middle of the development stands the farmer, who is the one to take the decisions. He must be like a spider in its web. The quality of the decisions depends on how the web, a network of relations around the farmer, has been developed. In The Netherlands we call this the "Centre function". Farmers, who occupy the centre, profit in equal ways from this advantage, whether they are big or small. Of those outside a centre only the big farms can make profit by it. It is known that to create a centre function it is necessary to have a cluster of greenhouse farms in a small area. For the location of flower production two areas are most important in Korea. The area covering the cities of Seoul and Incheon and the province Kyonggi, is by far the most important area for potted plants, 72 percent of the total area cultivated with potted plants in Korea lies in this region. The south dominates in cut flowers with 47 percent of the total area in the cities of Pusan and Kwangju and the two provinces, Kyongnam and Chollanam. In both areas concentrations of greenhouse farms can be found. Most of the innovating developments are going on in the cut flower industry in the south. In Korea there are possibilities to interconnect already existing areas with a concentration of greenhouses and so to develop the centre function. We, in The Netherlands, know by experience that the NTS functions at its best in such areas of concentration.

Possibilities to transfer knowledge

Next to creating optimal conditions for production, building a modern greenhouse full of modern equipment and having the disposition of the right inputs, the Korean must all have the expertise to exploit them. As we already have discussed this is the weak spot and will be the biggest bottle-neck in the future for the development of a Korean glasshouse sector. The knowledge is available in The Netherlands and can be used in Korea after adaptation to the circumstances there. Korean, Dutch suppliers and others ones, who are interested, should meet to exchange the knowledge. Some possibilities how to manage this already have mentioned before, other possibilities are, irrespective of their importance:

- To give demonstrations, training projects and to organize exhibitions.
- To organize Dutch support.
- To invite foreign specialist to deliver lectures.
- To follow courses like the International Course on Glass-greenhouses, which is organized annually by the International Agricultural Center (IAC) at Wageningen, Holland.
- To exchange researchers on the level of experimental stations.
- To organize courses in Korea with foreign instructors.
- To work a short term in Dutch greenhouses (the individual programme of IAC).
- To translate and to circulate more international literature and trade journals.
- To improve the skill in reading and speaking English.
- To bring in foreign experts and bureaus of consultancy and management.
- To appoint more extension officers provided with the necessary facilities.
- To organize farmers study groups.

The Korean glasshouse market is a promising one on the short term as well as on the long term. Korea has no glasshouse manufacturers at this moment. Hundreds of hectares of modern glasshouses with modern equipment can be sold on this market, however only by a good guidance of the development. Dutch suppliers should realise that. The Korean organizations involved in the development of a modern horticulture sector have to be well informed to be able to form an opinion about the economic possibilities of modern glasshouses. Repeatedly a lack of information could be determined with the result of different opinions about modern developments. For the Dutch an important task to give attention to.

The Dutch suppliers are specialized enterprises, which means also a limitation. The whole Dutch glasshouse industry is divided into highly specialized enterprises in the fields of technique, culture, credit, extension, market, etc. All these specialized enterprises together with the Dutch growers create the modern glasshouse industry of the Netherlands. Korea also has to develop such a structure to be successful.

CHAPTER 2. GENERAL GEOGRAPHICAL, SOCIOLOGICAL AND ECONOMICAL ASPECTS

The Republic of Korea is situated between the 34 and 38 northern latitude and measures about 500 Km from north to south and 250 Km from east to west. The country is a mountainous peninsula, surrounded by 3,579 small islands of which only the island of Cheju has any economic and cultural significance. The highest mountain in the country is the extinct volcano of Halla San on the island of Cheju, which is 1950 m high.

The Republic of Korea is half the size of Great Britain with an area of 98,955 Km². When traveling across Korea one is never out of sight of the mountains, because they form appr. 80 percent of all the area; only slightly more than 20 percent of the country is arable land. Vegetables are grown on the plains, but the main crop is rice. Most of the flat area lies in the west and the south of the country. The transport and communications systems are well developed. There is a network of highways between the big towns and even more are going to be build. Trains and aircrafts provide an easy way of local transport.

The total population of the Republic of Korea was 38.7 million in 1981 and 43.5 million in 1990. The population increases with 1.5 percent every year. In 1990 24 percent was living in the city of Seoul and 14 percent in the province of Kyonggi, the province which surrounds the city of Seoul. In the same province another big city is situated, Inchon with 1.8 million inhabitants. This part of Korea is economically most powerful. The second largest city of the Republic of Korea is Pusan with 3.8 million inhabitants. Other million cities are Taegu with 2.2 million, Kwangju with 1.1 million and Taejon with 1.1 million inhabitants. 72 percent of the total population is living in urban areas nowadays. Most of the people still have their roots in the rural areas. There has been a notable urbanization in the last decennia. For the location of the cities and population density see appendix 1.

The climate of the Republic of Korea is mainly influenced by the continental climate of East. There are four quite distinct seasons. Although the latitude is the same as the one of southern Spain and North Marocco the climate is completely different as is shown by the average temperatures in table 2.1. The Korean winters are cold and the summer fairly hot, they resemble in some way the winters and summers of a continental climate, which is important information for the cultivation of horticultural produce, especially of protected crops.

Table 2.1 Average season temperatures (degree Celsius) in different parts of the world.

	Latitude	Temp.	Winter	Spring	Summer	Autumn
	-----	-----	-----	-----	-----	-----
Seoul (Korea)	36.8	min.temp.	-7.6	4.6	19.6	7.4
		max.temp.	1.9	15.7	28.7	18.5
Almeria (Spain)	36.4	min.temp.	8.6	12.6	20.3	15.9
		max.temp.	16.1	19.9	27.8	23.1
Rabat (Marocco)	34	min.temp.	9.0	11.7	17.0	14.0
		max.temp.	17.3	20.7	26.3	23.3
De Bilt (The Netherlands)	52	min.temp.	-0.3	3.8	11.1	6.2
		max.temp.	5.2	12.7	20.8	13.9

When looking at the data of table 2.2 the conclusion is evident that an economic miracle is taking place in the Republic of Korea. Between 1985 and

1991 the GNP (Gross National Product) has increased nearly 3 times per head from US\$ 2194 to US\$ 6316.

Table 2.2 Some major economic indicators of the Republic of Korea.

	1986	1987	1989	1990	1991 1)
	----	----	----	----	-----
- Gross National Product (GNP)					
per capita, US\$ current	2503	3098	4994	5569	6316
1985 = 100	114	141	228	254	288
- Consumer prices 1985=100	103	106	120	130	-
- Monthly industrial wages,					
* 1000 won	351	387	541	642	-
- Balance of payments of trade					
balance, US\$ million	4206	7659	4597	-2004	-
- Basis exchange rate,					
Won per 1 US\$	861	792	680	716	-

1) 1991 estimated.

Source: National Bureau of Statistics, Economic Planning Board

The GNP in 1989 in The Netherlands was US\$ 15,920 per head. Between 1980 and 1989 the average annual rate of inflation was in The Netherlands 1.9 percent and in Korea 5 percent. The annual growth of the GNP came in Korea to 7 percent and in The Netherlands to 1.8 percent, more or less the same rates are expected in the future. In 1990 the balance of trade showed a deficit for the first time after many years. In this year the export came to US\$ 71.9 billion, an increase of 10.5 percent on the previous year and a considerable growth compared with previous years. Although the exports of toys and footwear dropped with 13.7 percent and 11.1 percent respectively, the shipping and chemical sectors maintained their growth with 47.7 and 35.1 percent respectively. The imports in 1990 had a value of US\$ 82.5 billion, 16.7 percent above the figure of the year before. Despite the government's efforts to restrict imports the imports of durable consumer goods rose with 19.8 percent and of commercial goods and machinery with 18.2 and 18.9 percent. The commercial goods and machinery were mostly bought to automatize the industrial process. The import of oil products rose with 27.4 percent mainly as a result of the expansion of the Korean oil industry. The import of steel was 39.7 percent higher to meet the demand of construction projects in the new satellite towns.

The Korean economy is dominated by a small number of industrial conglomerates, known as "chaebol", which means in English "group". They are huge companies, owned and controlled by one family. They are active in many fields from electricity, shipbuilding, automobile industry, insurance and hotels to the food industry. The ten largest chaebols share between them 30 percent of all sales of manufactured goods. The best known chaebols are: Samsung, Daewoo, Hyundai and Lucky Goldstar. The Korean government tries to curb the influence of the chaebols.

The Korean people work hard, six long days a week. In 1989 the working week was reduced with 3 hours compared with 1981, from 53.7 to 50.7 hours weekly. It is, however, still very long in comparison with other industrial nations.

CHAPTER 3. AGRICULTURAL SECTOR

3.1 Agricultural population

In the eighties the total population increased, but the agricultural population decreased with 3.3 million. In 1981 one fourth of the population lived in the country, in 1990 less than one sixth.

Table 3.1 Population in million

	Total	Farm Population		Economically active				
				total	agric.	fishery	industry	others
1981	38,723	9,999	25.8	14,023	4,556	245	2,983	6,239
1990	43,520	6,660	15.3	18,036	3,152	140	4,928	9,816

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

The decrease in agricultural population is caused by a decreasing number of households and a decreasing number of the household members. From 1981-1990 the number of household members in the country decreased from 4.9 to 3.8 members, and the number of households from 2.0 to 1.8 million.

The economic boom of the Republic of Korea is also caused by a strong increase in the number of labour places, 4 million more in 1990 compared with 1981. The share of the agriculture in the total supply of labour places over the whole country declined from 34 percent to 18 percent in 1990. Because of the strong economic growth the unemployment rate has decreased from 4.5 in 1981 to 2.4 percent in 1990.

Besides the decrease in the agricultural population the population is also ageing. The number of active people in the ages of 20 to 40 years decreased the most in the period from 1981 - 1990, nearly with one million. The share of this group in the total of the people active in agriculture decreased from 34 to 22 percent. These percentage are 28 respectively 22

Table 3.2 Agriculturally employed persons per age group (*1000).

	Total	15-19	20-40	40-50	50-60	60 and over
1981	4,801	196	1,632	1,364	1,034	575
1990	3,292	20	709	711	1,074	779

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

for the group in the ages of 40 to 50 years. The total of the group with the age of 50-60 years increased from 1,034,000 in 1981 to 1,074,000 in 1990.

3.2 Use of land

The total area of the Republic of Korea amounts to 9.9 million hectares. Of this area only 2.1 million or 21 percent is cultivated land. For

the Netherlands these figures are a total area of 3.7 million hectare of which 2.0 million or 54 percent is cultivated. While The Netherlands is completely flat Korea has many mountains and is also hilly in the fertile areas. For the cultivated land per province see appendix 1.

Table 3.3 Use of land in hectares.

	Total	Cultivated land	Forest	Other
1990	9,926,262	2,108,812	6,476,030	1,341,420
%	100	21.2	65.3	13.5

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

3.3 Number and sizes of the farms

To develop a modern agricultural sector the size of the farms is important. The average size is only 1.19 hectare. This size is a strong barrier in creating a modern agricultural sector. In The Netherlands the size of the average farm amounts to 15.5 hectare.

Average farm size.

	Number of farm households	Total area in hectares	Area per household (ha.)
1981	2,029,626	2,188,268	1.08
1990	1,767,034	2,108,812	1.19

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

In 1989 75 percent of the farm households were occupied with full time farming, in 1983 this was 81 percent.

The changes in the country can be illustrated by the strong decreasing number of the small farmers with less than one hectare. Also in the class size of 1.0 to 2.0 hectares the number of farms is decreasing although less strong. The number of farms above 2.0 hectares is increasing, (table 3.5).

Table 3.5 Number of small and big farms.

	Total	Non-crop and under 0.1 ha.	0.1-0.5	0.5-1.0	1.0-2.0	2.0-3.0	3.0 and more
1979	2161821	84308	641169	764203	555630	89733	26778
	100	3.9	29.7	35.3	25.7	4.2	1.2
1989	1771856	35735	475290	594153	506437	101314	28927
	100	2.0	26.8	33.5	30.3	5.7	1.7

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

3.4 Type of farming

The most important crop is rice with 59 percent of the total area. The income of the agricultural sector depends very strongly on the results of the rice crop. The area of paddy is constant from 1985 till now. The area for grains and potatoes is decreasing, as well as for sweet and white potatoes. Of the various grains maize is the most important crop with 25,987 hectare in 1990. The area of pulses is also stable. The special crops including sesame and peanut are decreasing, but medicinal crops increased from 11,754 in 1985 to 16,885 hectare in 1990. Vegetables followed most agricultural crops in a declining trend. Fruit and greenhouse cultures are two types of farming which profit from the economic development of the Republic of Korea. The area of fruit increased with 21 percent and of greenhouse crops with 92 percent in the period of 1985 to 1990. Greenhouse crops include vegetables, flowers and some other crops.

Table 3.6 Type of farming, hectares.

	Total	Utilized land 1)	Food crops				
			Rice	Barley and wheat	Miscella- neous grains	Pulses	Potatoes
1985	2144415	2592014	1236768	241995	40176	195977	64590
1989	2126721	2484599	1256661	178979	34949	201754	53642
1990	2108812	2409360	1244341	159609	37030	187696	40060
	Special crops	Vegetables in the open field	Fruits	Mulberries	Other perman. crops	Greenhouse crops	Others
1985	132867	337230	108747	11737	14572	23182	184173
1989	144821	282766	126780	7714	13822	40690	142021
1990	130071	276610	131517	7532	15607	44613	134674

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991
MAFF.

1) multiple cropping

3.5 Vegetable crops in the open field

The total area of fruit vegetables (cucumber, melon, tomato, pumpkin, water melon and strawberry) was 39,333 hectares in 1986 and 32,329 hectares in 1990 a decrease of 18 percent. Of the different fruit vegetables only pumpkin shows a contrasting development, a limited increase. Of the leafy and stem vegetables (chinese cabbage, spinach, lettuce, and cabbage) the total area decreased also in the same period, with 6,945 hectare or 12 percent. All leafy and stem vegetable production decreased. Radish and carrots (root vegetables) show a decrease of 9 percent. The flavour vegetables decreased the most to 136 293 hectare in 1990 from 214,702 hectare in 1986, a decrease of 35 percent. Of this group red peppers decreased very strongly. Garlic, Welsh onion and onions occupied also a smaller area in 1990. Of the flavour vegetables only ginger increased its area. For some information about the total production see paragraph 3.8.

The attitude of the consumer have to be analysed over a longer period to understand the decreasing areas of vegetables produced in the open field in the period 1986 - 1990. The vegetable consumption increased from 60 kg per

capita in 1970 to 121 kg in 1980. People eat more vegetables when there is a move from an absolute low income to a relatively high income. After 1980 the consumption of vegetables per capita is stabilized. While the income per capita increased very strong in this period. The consumer can not eat more vegetables but will now transfer the wishes for better quality and other vegetables. It are the vegetables produced in the open field who are substituted by the vegetables produced in the greenhouses. These changes are caused through changes in the wishes of the Korean consumers. Consumers living more and more in cities and with an increasing income. This trend will be continued in relation to a further rise of the income per capita.

Table 3.7 Area of vegetables in the open field, hectares.

	1986	1989	1990		1986	1989	1990
Cucumber	3995	3419	3022	Pumpkin	2415	2386	2444
Melon	5040	4203	3951	Water melon	22625	19149	20277
Tomato	1117	521	493	Strawberry	4105	2203	2142
Chin.cab.sp. a)	21278	20082	20869	Spinach	5046	3702	3013
Chin.cab.au. b)	26853	19012	22953	Lettuce	2981	2292	2497
Cabbage	4052	3920	3933	Red pepper	128963	71672	62759
Radish spring	15878	15651	14590	Garlic	48240	38305	43643
Radish autumn	21805	20983	20052	Welsh Onion	24248	21743	18548
Onion	9806	10327	7602	Ginger	3445	3679	3741
Other vegetables	10941	14864	15811	Carrot	5105	4453	4270
Total general					367974	282766	276610

a) Chinese cabbage in spring; b) Chinese cabbage in autumn.

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

3.6 Fruit crops

The total area of fruiting trees increased with 16 percent in the past four years. The area increased for all fruits except for pears and plums.

Table 3.8 Area of fruits, hectares.

Fruiting trees	1986	1989	1990	Young trees	1986	1989	1990
Apple	23958	25451	26002	Apple	12485	21433	22831
Pear	7623	7203	7137	Pear	1394	1589	1921
Peach	8102	10350	10466	Peach	6354	2548	1867
Grape	11366	12934	12845	Grape	5671	2902	2117
Orange	14028	15743	17089	Orange	2745	3079	2198
Persimmon	5602	6766	7667	Persimmon	5210	5603	5914
Plum	2792	2614	2529	Plum	1200	641	662
Others	1715	2560	3244	Others	1935	5348	7023
Pineapple	42	16	5				
Total	75228	83637	86984		36994	43143	44533
	100	111	116		100	117	120

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

On the basis of the figures of the young orchards the conclusion can be made that the areas of apples and fruits included in the category "others" will grow fast in the near future.

The province of Kyongbuk is the most important fruit district with

52,840 hectares or 40 percent of the total area in the Republic of Korea. The province of Kyongbuk is by far the center for apples. Kyongbuk is followed by the Island Cheju with 19,538 hectares (mainly oranges) and the province of Kyongnam with 13,450 hectares.

3.7 Modernization

The number of modern equipment and machines in the agricultural sector of the Republic of Korea increases from year to year (table 3.9). More and more machines are bought to save labour. Modernization can also be recognized in the increase of direct farm inputs such as fertilizers. The consumption of elements of fertilizers (nitrogen, phosphorus, potash) increased from 762,297 metric tons in 1984 to 997,912 metric tons in 1990, an increase of 31 percent in six years.

Table 3.9 Equipment and machines, units.

Year	1985	1989	1990
Power tiller	588,962	739,098	751,236
Tractor	12,389	31,328	41,203
Rice transplanter	42,138	111,937	138,405
Binder	25,538	49,816	55,575
Combine	11,667	32,882	43,594
Sprayer	291,945	450,844	484,212
Speed sprayers	3,183	12,049	15,330
Mister & Duster	222,402	213,922	195,822
Water pump	286,298	326,471	341,548
Threshing machine	301,717	284,837	266,608
Dryer	5,437	13,813	17,749
Sowing machine	3,584	4,473	6,492

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF

The average size of the farm is still very small, but developments to establish a more modern agricultural sector are already in progress. The number of farms in the highest size categories (above 2 hectares) is increasing. Each year the number of modern equipment and agriculture machines also increases. The assortment of crops is changing rapidly. Very strikingly is the strong increase in the area of protected crops. A special chapter will be devoted to the greenhouse sector.

3.8 Total production and production level

For the famous traditional crops as chinese cabbage and radish the production level per hectare is high. A long experience in growing and cultivation techniques has brought this level about. The popularity with the consumers declines however as the population grows and the welfare increases. In the first half of the eighties the total production of chinese cabbage was always above three million metric tons, in the second half the total production was less in three of the five years. The average production of radish was 5 percent lower in the second period in comparison to the first half of the eighties.

The third famous vegetable in Korea is red pepper. The production per hectare was never so high as in the last three years. The total production increased in the eighties to a level of 208,973 metric tons in 1988 but

decreased sharply in 1989 and 1990 to 132,748 metric tons in 1990.

The total apple production in the Republic of Korea amounted to 628,947 metric tons in 1990. For a total area of 26,002 hectare fruiting trees this means an average production of 24,188 kilogrammes of apple per hectare.

Table 3.10 Production in kilogrammes per hectare of some vegetables produced in the open field

	1985	1986	1987	1988	1989	1990
Melon	16,670	16,680	16,930	17,190	17,540	17,570
Water melon	22,290	21,350	20,900	23,530	22,580	22,040
Cucumber	23,220	21,280	22,880	23,190	23,730	23,710
Pumpkin	17,490	16,290	16,640	17,380	16,880	17,550
Tomato	31,180	30,930	28,790	28,680	30,400	29,180
Strawberry	10,850	10,650	11,100	11,500	11,980	12,520
Chinese cabbage spring	32,720	32,470	31,830	33,860	33,320	33,160
Chinese cabbage autumn	91,800	101,220	98,740	94,170	106,510	111,050
Cabbage	35,180	34,940	36,130	35,700	36,740	36,700
Spinach	12,650	12,290	12,620	12,730	12,940	12,040
Lettuce	19,080	18,800	18,010	18,690	18,200	17,140
Radish spring	29,880	28,750	28,090	30,940	30,090	29,550
Radish autumn	50,370	57,270	55,110	51,140	6,260	62,590
Carrot	17,590	17,960	19,060	19,350	2,830	20,280
Red pepper	1,400	1,530	1,550	2,150	2,070	2,120
Garlic	6,570	7,670	8,150	8,200	9,270	9,550
Welsh onion	24,640	25,260	25,070	25,430	25,240	25,100
Onion	40,920	38,700	44,450	47,460	54,030	53,580
Ginger	9,480	9,740	8,550	9,120	9,260	9,180

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

In the eighties the area and the production per hectare increased, the total production, therefore, increased strongly. Apples are a favorite fruit for Korean consumers. This is also true for all fruits mentioned except plums.

Table 3.11 Production in kilogrammes per hectare of fruiting trees

	1986	1987	1988	1989	1990
Apple	22 445	22 471	25 485	26 561	24 188
Pear	17 719	20 556	26 805	27 607	22 325
Peach	17 114	14 331	13 623	12 851	10 948
Grape	14 558	12 247	12 222	12 429	10 224
Oranges	24 202	29 706	27 811	47 419	28 830
Persimmon	17 655	13 325	15 959	16 761	12 490
Plum	13 473	13 917	12 674	8 376	9 969

Source: Statistical Yearbook of Agriculture Forestry and Fisheries 1991 MAFF.

Table 4.3 Greenhouses and types of farming.

	Total area in hectares	Temporary		Permanent	
		number of farms	area in hectares	number of farms	area in hectares
Paddy	6,221(25)	34,270	5,321(31)	6,261	898(12)
Fruits a)	1,317(5)	1,891	322(2)	3,226	999(14)
Vegetables	14,59(60)	32,376	10,855(63)	10,419	3,807(52)
Flowering plants	1,586(7)	1,008	298(2)	4,041	1,286(18)
Others b)	685(3)	2,948	416(2)	1,371	272(4)
Total	24,468(100)		17,208(100)		7 262(100)

a) a.o. grapes b) o.a. sericulture.

Source: Agricultural Census 1990.

of flowers. In greenhouses some fruits as grapes are produced as well. The culture of bananas in greenhouses has completely collapsed after opening of the borders.

4.5 Location of the greenhouses

The big towns and provinces in which these towns are located have been taken for a further survey. The temporary greenhouses are mainly located in the south. Of the total area with temporary greenhouses 74 percent is situated in the four southern provinces. Of these provinces Great Pusan with 5,177 hectare is number one, directly followed by Great Taegu with 4,719 hectares. In both regions more than half (58 percent) of the Korean area of temporary greenhouses is located (table 4.4.). In Great Taejon 18 percent is located with 3,162 hectares temporary greenhouse. Great Seoul and the Island of Cheju are by far in the minority with their temporary greenhouses, which occupy only 4.4 and 0.3 percent of the national area. In both areas the permanent greenhouses are of importance. Great Seoul has 2,799 hectares or 38 percent of the total area in Korea with permanent greenhouses. In Cheju is this 1,149 hectares or 16 percent. The four southern provinces also have 38 percent of the total area in Korea with permanent greenhouses. Great Kwangju is here number one with 1,223 hectare or 17 percent of the national area, followed by Great Pusan with 1,046 hectare or 14 percent.

The provinces as well as the towns as well have many administrative districts. A town in Korea is always encircled by large stretches of land. The city of Seoul has 14 of such districts and the province of Kyonggi 44. In nearly each of these districts there are permanent greenhouses. Strong concentrations can be found in the district of Kangnam-gu with 145 hectares and in Kangdong-gu with 148 hectares, in the city of Seoul and in Koyang-gun with 529 hectares, in Kwangju-gun with 368 hectares, in Namyangju-gun with 211 and in Hanam-shi with 183 hectares in the provinces of Kyonggi. There are also concentrations of permanent greenhouses in the South with as most important districts: Kangso-gu with 269 hectares around the city of Pusan, Kwangsan-gu with 543 hectare around the city of Kwangju, Naju-gun with 289 hectares in the province of Chollanam, 107 hectares in Songju-gun in the province of Kyongbuk, Changnyong-gun with 151 hectares in the province of Kyongnam and two districts on Cheju. The district of Sogwipo-shi has 668 and the district of Namjeju-gun has 407 hectares of permanent greenhouses.

Table 4.4 Location of the greenhouses.

	Acreage (hectares)		
	temporary	permanent	total
- Great Seoul	747 (4) 1)	2,799(38)	3,546
o.w. city of Seoul	56	520	576
city of Incheon	17	61	78
prov. of Kyonggi	674	2,218	2,892
- Great Pusan	5,177(30)	1,046(14)	6,224
o.w. city of Pusan	539	352	891
prov. of Kyongnam	4,638	694	5,333
- Great Taegu	4,719(28)	343(5)	5,062
o.w. city of Taegu	117	67	185
prov. of Kyongbuk	4,602	276	4,877
- Great Kwangju	1,554 (9)	1,223(17)	2,777
o.w. city of Kwangju	89	586	675
prov. of Chollanam	1,465	637	2,102
- Great Taejon	3,162(18)	327 (4)	3,489
o.w. city of Taejon	189	57	246
prov. of Chungnam	2,973	270	3,243
- Province of Chollabuk	1,176 (7)	120 (2)	1,296
- Province of Chungbuk	370 (2)	130 (2)	500
- Province of Kangwon	254 (2)	125 (2)	379
- Cheju	49 (0)	1,149(16)	1,197
Total	17,208(100)	7,262(100)	24,470

1) between brackets percentage of total

Source: The Agricultural Census 1990.

4.6 Location of the crops

The national crop plan according to the Agricultural Census is illustrated in table 4.5. 1,610 hectares are tomatoes, 2,851 hectares cucumbers, 3,329 hectares strawberries, etc. A clear difference of their locations can be made concerning the vegetables who are sensitive to heat, such as peppers, melons, strawberries and fruit vegetables as tomatoes and cucumbers and vegetables which are extra perishable, like spinach and lettuce. Spinach and lettuce are mostly produced in Great Seoul, the largest concentration of consumers and also the most wealthy area of Korea. These sensitive to heat and less perishable crops are produced in the South, where it is warmer compared to the North. Pine apple, which is very heat sensitive, is mostly produced on the Island of Cheju.

Of the total area of 1891 hectares of flowering plants 934 hectares or 49 percent is situated in Great Seoul and 558 hectares or 30 percent in Great Pusan. These two great production concentrations are followed at a great distance by the Island of Cheju with 121 hectare or 6 percent of the total. In the city of Seoul the district of Socho-gu has the biggest concentration with 128 hectares. The district of So-gu with 40 hectares has a small concentration in the city of Incheon. In the province of Kyonggi there are concentrations in the districts of Koyang-gun with 235 hectares, Kwachon-shi

with 79 hectares, Yongin-gun with 66 hectares and Songnam with 63 hectares. Kangso-gu with 203 hectares is the biggest concentration of flowering plants in greenhouses. In the province of Kyongnam Kimhae-gun is the biggest concentration with 65 hectares followed by Changwon-shi with 49 hectares, Masan-shi with 47 hectares, Kimhae-shi and Changwon-gun with 46 hectares each. On the Island of Cheju we find concentrations of flowering plants in greenhouses in the districts of

Table 4.5 Location of the crops, hectares 1990

		Area of harvested crops in greenhouses							
		tomato	cucum- ber	straw- berry	water- melon	musk- melon	melon	pine- apple	
Total	Korea	1,610	2,851	3,329	3,684	3,889	354	412	
Great	Seoul	131	456	7	9	36	3	0	
Great	Pusan	406	588	972	1,832	276	100	88	
Great	Taegu	228	208	307	797	3,098	65	1	
Great	Kwangju	178	763	674	354	90	99	1	
Great	Taejon	425	344	1 062	527	203	52	1	
Prov.	Chollabuk	85	94	231	117	166	21	2	
Prov.	Chungbuk	69	124	61	40	11	7	-	
Prov.	Kangwon	44	247	10	4	8	6	0	
	Cheju	44	27	5	4	1	1	319	
		Spinach	Radish	Chinese	Let-	Red	Western	Other	Flower-
				cabbage	tuce	pepper	veg.	veg.	ing
									plants
Total	Korea	1859	1242	2851	2802	1967	301	2577	1891
Great	Seoul	1148	460	877	1607	125	59	972	934
Great	Pusan	83	211	663	147	835	107	649	558
Great	Taegu	116	61	218	153	75	5	195	42
Great	Kwangju	241	129	338	433	570	38	267	88
Great	Taejon	80	222	450	195	262	16	250	77
Prov.	of Chollabuk	29	106	187	119	53	59	114	38
Prov.	of Chungbuk	133	28	68	101	24	5	59	10
Prov.	of Kangwon	27	17	38	32	12	8	59	23
	Cheju	2	8	12	15	11	4	12	121

Source: Agricultural Census 1990.

Sogwipo-shi with 75 and Namjeju-gun with 27 hectares. In the other cities and provinces there is only a small concentration of 27 hectares in the district of Taeon-gun in the province of Chungnam.

4.7 Area and developments in the area per crop

In 1990 the total area planted in greenhouses with vegetables was 34,767 hectares with flowering plants 2,429 hectares and others 7,417 hectares, together 44,613 hectares. Of the vegetables most items show a strong increase in the planted area. Exceptions to the rule are red pepper

with a decreased area and tomatoes and strawberries with more or less a stabilized area. The area of some vegetables in the open has become smaller compared to the area in the greenhouses e.g. tomatoes, strawberries, melon, cucumber, others will be larger at short term by a same trend. It is remarkable that the area of vegetables in the open field is decreasing (367,974 hectares in 1986 to 276,610 hectares in 1990) but the area of vegetables cultivated in greenhouses is increasing more and more (23,358 hectares in 1986 and 34,767 hectares in 1990). In 1985 the area of open field vegetables was 16 times the area of vegetables cultivated in greenhouses, in 1990 this factor was 8 times.

Table 4.6 Crops cultivated in greenhouses, hectares.

	1986	1989	1990		1986	1989	1990
Watermelon	1529	3973	5404	Tomato	2006	2171	1992
Strawberry	5323	4200	4715	Chinese cabbage	2378	2828	3673
Spinach	307	1746	2224	Lettuce	1048	2403	2393
Radish	1711	2562	2485	Red pepper	2534	2166	2096
Melon	3068	4416	4209	Cucumber	2622	3429	3929
Pumpkin(squash)	832	1130	1647	Flowering plants	997	1718	2429
Others	3277	7948	7417				
Total general					23358	31024	34767

Source: Statistical Yearbook of Agriculture, Forestry and Fisheries 1991 MAFF.

4.8 Number of farms with flowers

The number of farms growing flowers increased by 2,840 in the period 1986-1990 from 6,105 farmers in the beginning to 8,945 farmers at the end of the period examined. It is a positive thing that the increase took place for 94 percent in the category of professionals. The category subsidiary stayed more or less at the same level.

Table 4.7 Number of farms with flowers in the Republic of Korea.

	1986	1987	1988	1989	1990
Holdings	6,105	6,737	7,195	7,820	8,945
o.w. professional	3,535	4,010	4,617	5,417	6,197
subsidiary	2,570	2,727	2,578	2,403	2,748

Source: Horticultural crop production in Korea 1991 HES/RDA Suwon.

4.9 Total value of the flower sector and of the subsectors

The total value of the flowers amounted to 88,157 million won in 1986 and increased to 239,348 million in 1990 (table 4.8). In 1986 ornamental trees had the biggest share with 40 percent of the total value. Pot plants took over this position with a share of 42 percent 4 years later in 1990. Cut-flowers were second in 1990 with 25 percent. Yearly increases of 60 to 90 percent in the total value show that the Korean consumer has a strong interest in potplants, cutflowers and bulbs. Flowering trees and ornamental

Table 4.8 Total production value (million won) of the flower sect.

	1986	1987	1988	1989	1990	*)
Total value	88157	97699	134914	231081	239348	(271)
o.w. cut flowers	16946	24668	35681	54220	59224	(349)
pot plants	21204	26456	42542	61643	99516	(469)
bulbs	1167	1498	1880	2877	4641	(398)
flowering trees	13588	12402	16872	16546	19487	(143)
ornamental trees	35065	32489	37878	77433	55779	(159)

*) 1990 in percentage of 1986.

Source: Horticultural Crop Production in Korea 1991 HES/RDA Suwon.

trees obtain also more interest however with a more modest growth of 10 to 12 percent yearly. In case of pot plants the growth in value exceeds the growth of the number of pots (table 4.9). The average price of a pot increased in the period 1986 - 1990. In cutflowers the opposite has happened, the growth in value was a little less than the growth in the number of cut flowers.

Table 4.9 Total production of the flower subsectors.

	1986	1987	1988	1989	1990	*)
Cut flowers						
* 1000 flowers	206396	294066	350586	398346	765233	(371)
Pot plants						
* 1000 pots	40198	85551	56356	51434	77288	(192)
Bulbs						
* 1000 bulbs	11723	14559	16061	19386	25536	(218)
Flowering shrubs						
* 1000 pl.	24530	28693	31373	17360	27104	(110)
Ornamental trees						
* 1000 pl.	15774	35085	70898	25940	20016	(127)

*) 1990 in percentages of 1986

Source: Horticultural Crop Production in Korea 1991 HES/RDA Suwon.

4.10 Composition of flower production in different areas

In paragraph 4.5 the location of flowers cultivated in greenhouses is described. In this paragraph information is given about the composition of the flower production in different areas, including the open field production of flowers. Great Seoul is by far the most important place for pot plants. 72 percent of the total area cultivated with pot plants lies in this region. Cheju ranks second with 7 percent of the total pot plant area.

The south dominates in cut flowers with 47 percent of the total area in Great Pusan and Great Kwangju. Great Seoul is also important for cut flowers with 267 hectares or 27 percent of the total area.

Great Seoul has also 40 percent of the total area of flowering trees and ornamental trees combined.

Table 4.10 Acreage of flower production per subsector in different areas, 1990, hectares (greenhouses and open field production)

	Total	Cut flowers	Pot plants	Bulbs trees	Flowering trees	Ornamental
Great Seoul	1,518	267	563	29	117	528
Great Pusan	595	366	36	11	63	119
Great Teagu	100	26	47	1	11	17
Great Kwangju	292	105	24	13	35	114
Great Taejon	320	73	30	5	32	180
Province Kangwon	42	33	3	2	2	2
Province Chungbuk	88	15	6	.	8	59
Province Chollabuk	301	33	22	4	60	180
Cheju	245	88	56	19	50	32
Total	3,503	1,006	787	85	377	1,230

Source: Horticultural Crop Production in Korea 1991 HES/RDA Suwon.

4.10 Total production of vegetables and the production level in greenhouses

The total production of vegetables in the Republic of Korea cultivated

Table 4.11 Total production and production per hectare in greenhouses (metric tons)

	1987		1990	
	total prod.	prod.per hectare	total prod.	prod.per hectare
Leaf vegetables:				
Chinese cabbage	70,374	36.3	132,377	36.0
Cabbage	1,820	28.0	2,542	32.6
Lettuce	25,116	18.7	45,773	19.1
Spinach	5,313	15.3	41,287	18.6
Edible Chrysanthemum	3,916	19.5	3,750	18.7
Welsh onion	1,575	16.9	1,654	20.2
Root vegetables:				
Radish	40,735	33.6	74,365	29.9
Fruit vegetables:				
Cucumber	95,197	38.3	144,480	36.8
Squash	17,639	25.3	39,381	23.9
Oriental melon	62,226	21.5	109,588	26.0
Watermelon	42,605	29.1	146,352	27.1
Tomato	63,745	33.5	63,337	31.8
Eggplant	1,785	17.0	1,211	29.1
Hot pepper	32,982	15.4	44,591	21.3
Strawberry	57,959	14.0	81,616	17.3
Melon	1,245	23.1	2,997	21.6
Other vegetables:	17,477		89,426	
Total	548,709		1,024,727	

Source: Horticultural Crop Production in Korea 1991 HES/RDA Suwon.

in greenhouses was 548,709 metric tons in 1987. In comparison to the year 1987 the total production increased by 39 percent in 1988, by 72 percent in 1989 and by 86 percent in 1990. In four years the quantity of vegetables produced in greenhouses almost doubled. In this period the leafy vegetables increased from 108,114 to 227,383 metric tons, an increase of 110 percent in four years. Fruit vegetables increased from 382,383 in 1987 to 633,553 metric tons in 1990, an increase of 66 percent. Root vegetables increased from 43,366 to 74,365 tons which is 71 percent more. The category "other vegetables" showed the strongest increase namely 602 percent.

In the four seasons climate of Korea greenhouses are introduced to extend the harvest season from the open field backwards to an earlier period, or forwards to delay the harvest or even to the winter period. In the beginning of such a development the farmers work in a simple way. They put covering material above the open field crop to take advantage of the so-called greenhouse effect, an increase in temperature. Moreover the crop is protected against the wind and other climatic factors. A step further is to keep the greenhouse free from frost. During this development the outside cultivation technique is still applied. This explains the extremely low yields by the fruit vegetables, e.g. tomatoes 4 kilogrammes per square meter. In The Netherlands farmers produced in their greenhouses 7 kilogrammes tomatoes on average per square meter annually in the fifties. Dutch growers also started with unheated greenhouses. The next step was to keep the greenhouse frost free. Nowadays tomato farmers produce 45 kilogrammes per square meter, 6.5 times the harvest of 40 years ago. This was realized by going through a whole learning process and strong improved greenhouses, to understand and to improve the greenhouse climate, by using better plant material, creating better conditions and improving the adaption of the plant to the new circumstances. Korean farmers have to follow the same path of development.

4.11 Area and production of the most important cutflowers

The area of cultivated carnations amounted 62.5 hectare in 1988 and two years later 70.7 hectare (table 4.12). The total produced flowers are 70,2 million in the first year and 67.9 million in the second year. By an increasing average price from 81 to 115 Won per flower the total turnover increased from 5,658 million in 1988 to 7,814 million in 1990. The area of roses also

Table 4.12 Cultivated area (ha), produced quantity (1000 pieces) and value (1000 Won) of cutflowers

	1988			1990		
	area	quantity	value	area	quantity	value
Chrysanthemum	278.5	113,577	11,197,256	287.4	139,325	12,484,409
Carnation	62.5	70,228	5,657,808	70.7	67,903	7,814,457
Gladiolus	37.4	9,327	1,501,293	49.8	11,213	1,968,616
Tulip	16.0	4,838	1,215,730	13.4	18,888	842,314
Rose	114.4	59,119	5,151,728	159.0	81,745	10,158,184
Lily	43.2	13,641	2,987,633	84.1	38,408	7,781,133
Gypsophila	74.0	48,395	3,749,051	177.0	107,785	8,117,617
Gerbera	-	-	-	35.3	26,609	4,650,222

Source: A Study on Policy Measures for Enhancing Foreign Market of Flower Crops, Studies on the Japanese Market, 1991. 12. 31.

increased, with 39 percent in two years. The figures illustrate a same increase in the production ,however a doubling in production value. The result must be a strong increase in price, 87 won per piece in 1988 and 124 won in 1990. Also strong growers were the lily with 95 percent, gypsophila with 139 percent, and the gladioli with 33 percent in two years. The average price in 1990 compared to 1988 is higher for gladiolus and for the other two flowers lower. For chrysanthemum the quantity of flowers increased with 22 percent, while the prices decreases with 10 percent from 98 to 90 won per stem.

Gerbera is a new comer in the top. Farmers received for gerbera an average price of 175 Won per flower in 1990.

By an increase of the total flower supply of 54 percent in 1990 in comparing with the supply in 1988 the average price increased with 11 percent. The conclusion is that The Korean flower market must be a promising one.

An indication about the number of flowers harvested per unit of area can be obtained by dividing the quantity supplied through the area produced. The production per square meter is 75 flowers by gerberas, 108 by carnations, 63 by gypsophila, 44 by chrysanthemum and 51 by roses.

5. VISITED ORGANIZATIONS

5.1 Ministry of Agriculture and Fishery (MAFF)

Mr. Cho Kyung-shik, Minister of Agriculture, Forestry and Fisheries (MAFF) launched recently a master plan, named "10-Year Farm Restructuring Program", to strengthen the international competitive power of the Korean farmers. To carry out the program, a total of 41,702 billion won will be invested in agriculture and fisheries in the period from 1992 till 2001. In particularly MAFF has an ambitious manpower developing program to educate 10,000 future farm and fishing leaders every year. Young people have been massively moved to urban regions due to the industrialization. Programs for rural leaders had produced good results over the past ten years. For example, farmland acreage of farm leaders increased 50 percent in 10 years, their livestock populations doubled and their machine holdings increased four to six fold. The leaders are screened from persons with the age of 35 years or younger. Too small size of the farms and the small narrow roads have been a major obstacle to mechanization. The permissible farmland ownership will be enhanced to 15-20 hectares from the current three hectares. The size of 15 - 20 hectares per household is the optimum scale to guarantee profit to farmers. The government also plans to increase investment in research and development from 0.2 percent of the total agricultural output last year to the 0.5 percent level by 1996. The R&D fund will be used to expand up-to-date facilities, to increase researchers and to set up research institutes. The government will also promote exports of farm products. For this purpose the state-run Korea Trade Promotion Corporation has set up a section on farm and fisheries products to support farm and fisheries exports.

On the MAFF the Vegetables Division and the Fruits & Flower Division are in charge of the interests of the horticultural sector.

The Vegetable Division will subsidize 9 glasshouse projects for vegetable growing in 1992, proceeded from the "10 Year Farm Restructuring Program". The total investment amounts to 13.3 billion Won with an average of 1.5 billion per project (1,000 Won = 2.4 DFL.). Of these projects 30 percent will be subsidized by the central government. They will recommend the local governments to do the same. 30 percent will be a bank loan at an attractive interest rate of 5 percent and 10 percent has to be paid by the farmer himself. The loan has to be repaid in 17 years to begin three years after the start of the project. The glasshouses will be imported from The Netherlands. Before the year 2,000 120 similar projects are planned. This number will be higher when results of the farms are sufficient and less if the results would be negative. Mr. Jin, the director, emphasized the need of technical assistance from The Netherlands.

Very recently the Vegetable Division promised AFMC to subsidize a new vegetable project of 3,000 pyung ($3.3 \times 3,000 \text{ m}^2$). MAFF will pay 1.8 billion and AFMC 1.2 billion, a total investment of 3 billion Won. The glass for this project will be made locally, the modern equipment will be imported from The Netherlands. AFMC will send some technician to The Netherlands. The main purpose of this AFMC project is to train the farmers.

The Fruit & Flower Division of MAFF has subsidized last seven years per year 20 semi-automatic greenhouse complexes for growing flowers covered with plastic. This year they plan 3 modern full-automatic complexes of which one will be imported from The Netherlands, the other two will be made locally. The three farmers involved in the projects are farmers with a very high education (university level) and these farmers already export flowers to Japan. The farmers have to set up a high technological greenhouse sector and to transfer the knowledge to other farmers.

The planning for 1993 will depend on the results of 1992. Mr. Hong Bum,

Kim told us there had suddenly been a strong increase in the number of Dutch greenhouse builders who visited MAFF to sell their greenhouses. For a long time they had contact with two, now there are 6. The price has meanwhile decreased from 600 to 350 thousand Won per pyung. He was rather confused. With the first greenhouse project built on the Horticultural Experiment Station in Suwon they have problems caused by the sometimes very strong wind in the summer. Mr. Bum like to be informed about quality related to the price of different greenhouses covered with glass. MAFF has two development programmes, one for simple facilities and one for technical highly developed facilities. Concerning horticulture technical highly developed projects are not only the glass greenhouses equipped with control systems by computer for the production of flowers and vegetables but also mushroom farms, tissue culture and nurseries propagating young plants.

5.2 Korea Rural Economic Institute (KREI)

This institute was established as an incorporated research foundation in April 1978 under the financial sponsorship of the Korean government. The institute is led by a board of 15 directors from government, universities and voluntary organizations concerned. The chairman of the board of directors is appointed by the government. It is a non-profit research institute which undertakes problem orientated research and policy studies in the field of national food policy and agricultural and rural development with a view to assist farmers, government and agri-business firms in their decision making.

Major activities of KREI are research, rural opinion polls, organizing seminars, conferences, etc. and training. KREI conducts both long-term and short-term research projects. KREI is active in numerous research fields: agricultural economics in general, production economics, marketing economics, resources economics, rural sociology and data system analysis. The rural opinion poll system, a monitoring system involving more than two thousand farmers nationwide gathers accurate opinions of farmers about farm policy and rural problems. The polls are carried out by way of on-the-spot interviews and mail surveys. KREI research staff is encouraged to meet farmers and farmers' leaders for mutual learning and understanding agricultural policy.

Research directly oriented on horticulture problems is not yet far developed. On account of the rapid transition of the Korean agriculture and the rural society and the priorities for horticulture in the near future specific horticultural projects are included in the new research programmes. Mr. Se - Ik OH has started a comparative research on the profitability and the optimum size of a greenhouse farm of the conventional greenhouse type covered with plastic and the modern type covered with glass. Growers will be interviewed and the data will be analyzed.

During the visit an intensive discussion was held on the advantages and disadvantages of the traditional plastic greenhouses and the modern greenhouse with computerized controlled climatic systems. Aspects were discussed of investments per m² in relation to the area to be build, investments in the glass greenhouse construction only and separate in equipment as pipe heating and a computerized ventilation system, the light reduction by different plastic types and by glass, cleaning costs of glass, differences in lifetime between a glasshouse and a plastic house, labour and energy efficiency possibilities by small and large scale houses, and experiences with plastic greenhouses in the Netherlands at large scale projects. Serious misunderstanding is caused by the direct translation of the price of a small glass greenhouse on a experimental station for research purposes to the investments of a large greenhouse for commercial use. The general opinion about the economic feasibility of a greenhouse covered with glass is low. The problem is that Korea has only theoretical possibilities of comparison by lack of

modern greenhouses covered with glass. The few glass greenhouses in use at this moment do not give any basis on account of the great differences among growers in similar circumstances. The new master plan of the government to build modern glasshouses for the growers in the near future is therefore very welcome.

In the period of 1992 till 1996 Korea will acquire experience with glass greenhouses and meanwhile set up an own greenhouse factory (joint-venture) by which the investments will be reduced considerably after 1996.

5.3 Rural Development Corporation (RDC)

The RDC main office is established in Seoul. The RDC has 9 provincial offices with many district offices and 6 project offices. RDC has approximately 3000 employees. RDC was started in 1938 and the last reorganization took place in 1990.

One of the main objectives of RDC is to improve the structure of the country by increasing the farm size and the infrastructure, if necessary by resettlement of whole villages; to develop agro industries, renovation of houses and so on; to help financing these improvements with attractive loans; to help very small farmers with additional income; to support small farmers who leave agriculture; to help key farmers with overseas studies; to bring the latter in contact with technology and capital intensive ways of agriculture. RDC has also overseas projects and provides overseas consulting services. RDC is working on a small scale but they also have large scale comprehensive developments projects.

In January 1992 a new department is added to the already existing departments, called "Controlled farming". Controlled farming includes tissue culture, nurseries for producing young plants, mushroom growing and greenhouses covered with plastic and glass. The "controlled farming" department has 72 employees. This high number of workers shows the importance the Korean government attaches to the introduction of these high technological ways of agriculture. RDC gives advice and does the implementation if necessary.

A farmer who is interested in controlled farming has to present a request to the county government. This request goes to the city or provincial government, then to the central government and finally it will arrive at the RDC. The RDC makes a feasibility study and gives advice. Greenhouse projects realized by this system will receive 40 to 50 percent subsidy from the central government and for the rest a loan at a special rate of 5 percent. The 40 percent is for a greenhouse project covered with plastic and the 50 percent for a greenhouse covered with glass. The repayment period for a plastic greenhouse is 7 years and for a glass greenhouse 17 years. The first 3 years only interest has to be paid. According to people of RDC this project is separate from the new plan of the government, named "10 Year Farm Restructuring Program"

RDC has given a positive advice for 10 glasshouse projects with an average size of 0.5 hectare at this moment. The glasshouse projects are spread over 6 provinces. Farmers will grow vegetables and flowers in these glasshouses. RDC will also recommend to import the complete glasshouse projects from The Netherlands before the end of this year.

The basic philosophy of RDC is to replace the present-day small greenhouses by large scale units to overcome the shortage of labour by mechanization. Large scale greenhouses covered with glass have a higher investment of 60 to 70 percent per unit of area compared to large greenhouses covered with plastic. In both greenhouses modern equipment is installed. The replacement of plastic every year and the higher risk by easier damage of the plastic resulting in possible damage to the crop is excluded from the comparison. RDC worries about the capability of the glasshouse farmers if they can handle the modern equipment and whether they can sufficiently manage the crop. RDC

will follow the economic results of the glasshouse projects during the first cropping year. They may change their opinion depending on the experience. RDC is convinced that Korea has to replace the plastic greenhouses by glass greenhouses, however slowly, and RDC is not entirely sure which type of greenhouse is the most suitable for the Korean climate, the Dutch Venlo type or the more expensive broad span from Japan. This restriction is mainly based on the ventilation possibilities in summer by high temperatures. RDC is of the opinion that a Korean farmer should have at his disposal high value varieties. A greenhouse covered with glass will be more profitable by these varieties.

5.4 Rural Development Administration (RDA)

All 15 governmental experimental stations are under the management of RDA. RDA is also controlling the experimental stations of the local governments. 11,000 people are employed at this organization, including the people active on the experimental stations of the local governments. The headquarter with 419 employees is established in Seoul. RDA is a 100 percent governmental organization which belongs to the MAFF. The level of the administrator of the RDA is a vice-minister.

In relation to the recently announced masterplan, named "10 Year Farm Restructuring Program" of the government ten specialized research institutes have been set up under the Rural Development Administration. They include a pear research institute in Naju, Cholla-namdo, and a tangerine research institute in Cheju-do. In Suwon a new experimental station will be created for flowers and vegetable research, while the old one will only be used for fruit research. The research capacity on these stations is strongly increased. By these changes the policy of the government becomes clear. The government has developed a new masterplan to improve energetically the horticultural production in Korea especially the greenhouse production in the next 10 years.

Mr. Chung, Hong Woo and Mr. Park, Pyung Sik, two researchers of the Farm Management Bureau on the headquarter of RDA in Seoul, have recently presented a paper at a symposium and published a study about the economic feasibility of different types of greenhouse as well: the greenhouse covered with vinyl, the greenhouse covered with PET and the greenhouse covered with glass. PET houses are not at all or only very little used by farmers but are nevertheless developed by research and strongly recommended. A problem is the dust.

In the table 6.1 on next page the investments belonging to the different types are shown. The total investments per unit of area of greenhouse covered with

glass are 4.6 time those of a vinyl house and 1.9 times those of a PET house.

Glass and PET house are fully automatic, vinyl houses semi automatic. To heat the greenhouse paraffin is used with a price of 196 Won per litre. For farmers the price of petrol is tax free. Calculated labour costs are 25,000

Won per day. The two researchers received the basic data from technician. They did not know if in the investment amount of 126.600 for the house structures and covering material of a glasshouse also was included the investment for a screen to save energy. At this moment Korea has no commercial glasshouses so yield figures for crops cultivated in glasshouses were derived from results in Japan and from experiments.

The analysis was done with different types of financing, from very attractive financing, farmers having to invest all by himself and in between. Many crops were analysed (red peppers, cucumbers, tomatoes, melons, lettuce, roses, carnation and chrysanthemum).

The calculated results were different. The vinyl house is the most profitable. The results in the glasshouses were not or less profitable. The results of a PET house are in between.

Table 6.1 Investments in won (x 1 000) per 1 000 m2 for different type of greenhouse.

	Vinyl houses	PET houses	Glass houses
Outside equipment like tractors	-	9,500	9,500
Simple outside equipment 6 HP	2,500	-	-
Sprayers	2,000	2,000	2,000
Air heater 125,000 kcal	3,500	3,500	-
Boiler and pipes heating systems	-	-	26,400
CO2-generator LPG	3,000	3,000	3,000
Vehicles	2,500	2,500	2,500
Irrigation systems	1,800	1,800	1,800
Climate control systems	12,000	12,000	12,000
House structures and covering material	12,300	35,500	126,600
Screen systems	-	7,200	-
Total investments per 1 000 m2	39,600	77,000	183,800
Lifetime of covering material in years	1	7	25

Modern greenhouses covered with glass and with computer controlled systems demand high investments. These high investments have to go together with high yields and high quality and with the use of inputs of a high standard. The high yields are only obtainable in the modern greenhouse covered with glass. The two investigators were very surprised to hear the yields achieved by the average glasshouse farmer in the Netherlands. This knowledge is not yet available in Korea nor in practice nor with the research organizations. The plan of the government to build modern greenhouses covered with glass over a period of 5 years has to be considered as an introduction period in which to learn to handle the equipment and to increase the yield and quality to the level on which the modern greenhouse will be profitable for most of the produce. To accent the low technology will harm the introduction of high technological greenhouses.

5.5 National Agricultural Cooperatives Federation (NACF)

The NACF celebrated its 30th anniversary in Seoul on August 14, 1991. In his congratulatory address at the ceremony, H.E.Roh, Tae-Woo, President of the Republic of Korea, said that the government would invest a total of 41,702 billion won in comprehensive projects to boost the agricultural industry in the next 10 years, starting next year. This announcement indicates clearly the importance of NACF in the agricultural society of Korea. The business activities of the agricultural cooperatives are banking, supply of fertilizers, pesticides, farm machinery and other farm inputs, insurance, providing farmers with consumer goods by chainstores, transportation with 2,352 trucks and 11 car-carrying ferries, processing, farm guidance by education and training of farmers and related supporting activities as public relations and research. NACF is represented in all the provinces. The marketing business of the agricultural cooperatives can be divided in two

stages; the assembling stage in the producing areas and the distribution stage in the consuming areas. Cooperative farming groups are organized among the farmers who live in neighbouring villages and cultivate the same kind of crop. The groups, numbering 12,380 nationwide, conduct joint shipment under marketing guidance and operating procedures of the NACF and its member cooperatives. A total of 201 assembling centres have been established, executing the functions of collecting, sorting, storing, inspection and for a part selling by auction. Besides, fruit sorting centres are operating at the 13 major fruit producing area for better standardization. In terms of functioning there are three types of cooperative marketing centres operated in the large cities by NACF: one is dealing in fruits and vegetables, another exclusively in grains and the third one in all kinds of agricultural commodities.

The total turnover of farm products marketed through the agricultural cooperative channels increased in 1990 by 11.6 percent over the previous year with a record of W3,008 billion. Out of the total, W920 billion came from sales by the NACF and W2,088 billion from sales by member cooperatives. Of the total turnover 31.1 percent, or W935 billion, came from the sale of food grains; 24.2 percent or W727 billion from vegetables; 21.4 percent or W644 billion from fresh fruit; 13.1 percent, or W306 billion from livestock and the rest from other products including processed foods and raw material crops such as silk cocoon, malting barley, sweet potato, etc. (1,000 Won equals 2.4 Dutch guilders). The conclusion is that NACF is very active in horticulture.

The NACF held the "Flower Festival 1991" in April 1991. The festival was held simultaneously around the country at the twelve flower marketing centres of the agricultural cooperatives. The NACF also launched the "Flower-loving Campaign" in Seoul in April 1991 in collaboration with MBC (Munhwa Broadcasting Corporation). The NACF and member cooperatives expect that the increased use of flowers generated through these activities will improve the income of the farmers. In Korea the consumption of cutflower per head is only 6,000 Won in value. Only 10 percent of the cutflowers is used in homes, 60 percent is used as floral decoration at marriages and funerals.

Agricultural cooperatives have established various marketing facilities to guarantee favourable prices both to farmers and consumers by reducing the marketing costs of farm products.

NACF established in 1990 the Korea COOP. Trading Co.. This organization has also been active in the development of high quality export items. The major items for export in 1990 were canned mushrooms, processed foods, salted vegetables, pressed rice, straw, flowers and fruits such as apples, tangerines and pears. The value of exports during 1990 was US\$7 million, showing a 13.2 percent decrease in total turnover, but a remarkable increase of 410 percent was recorded for the export of fruits.

A seminar on the development of the floricultural industry was held on the 19th September 1990 at the NACF conference hall. The seminar, which was organized by NACF to find ways to develop the floricultural industry in Korea, was attended by more than 128 specialists connected with floriculture. According to their papers, the specialists argued that to advance the floricultural industry it was necessary to develop new flower varieties aimed at international markets, to secure arable land for continuous supply, to maintain a stable price, and to implement a consistent governmental floricultural policy. It was also recommended that farmers should increase their efforts to produce higher quality flowers and that NACF should play an active role in helping floricultural farmers.

Approximately 60 percent of NACF's operations is banking business for farmers and the general public. Recently the NACF is making great efforts to diversify its business into marketing and processing of agricultural products. Rice farming should be replaced by a.o. horticultural or floricultural

farming. NACF leaders show great interest in The Netherlands. The Netherlands has successfully developed its horticultural and floricultural farming by the development of an efficient and mechanized farming system e.g. greenhouses in spite of small farmland sizes. The Netherlands has exported many varieties of flower and vegetable breeding materials to Korea and these have been used successfully for Korea's horticultural and floriculture farming.

In the discussion with the general manager of the horticultural department and the director of the vegetable section they said immediately at the start, that farmers had a great interest in greenhouses covered with glass. They wondered however, if growers would be able to manage these computerized houses and to pay back these expensive houses. The bank is only financing the need for short term capital, long term capital is financed by the government. From the point of view of economics of scale it would be much cheaper to build on a large scale. Perhaps a greenhouse complex of 1 hectare with about 6 units could be a possibility, however growers prefer to be independent. One has to cooperate by buying inputs and selling the harvest. The supply of credit is subject to general rules. NACF doesn't have something special for greenhouses. On the question "What about the greenhouse sector in 2000?" they were convinced that the sector at that time would be modernized with a large number of greenhouses covered with glass.

5.6 Horticultural Experimental Stations (HES's)

The research programmes of the experimental stations are under the supervision of the Rural Development Administration (RDA). The main experimental station is established in Suwon, named "Horticultural Experiment Station, RDA". Suwon lies 30 kilometers south of Seoul. There are also three substations. The biggest substation is the Pusan Branch. Pusan is located in south-east Korea. The Naju Branch is near the city of Kwangju in south west of Korea and there is a substation on the island of Namhae called "Namhae Substation". Namhae is situated in the south of Korea too.

Table 6.2 Facilities of the different stations

	Area of fields ha	Buildings m2	Glass houses m2	Net houses m2	Plastic houses m2
Suwon	46.3	14,599	4,386	1,766	4,907
Pusan	16.5	6,189	2,043	1,410	5,212
Naju	19.2	2,055	86	-	1,396
Namhae	12.5	1,932	100	764	1,196

HES-RDA Suwon.

As already told vegetable and flower research will get their own combined station. The construction of this new station will start within a year and will also be established in Suwon at the grounds of an early barley station. Fruit research will stay at the old station. The new station will have three departments. The vegetable, the flower and the potato department.

The functions of these stations are:

- Varietal improvement and genetic studies for vegetables, fruit trees, ornamental crops and potatoes.
- Development of cultivation practices concerning horticultural crops and related studies.
- Storage and processing of horticultural crops.

- Research to improve horticultural crop production in greenhouses.
- Seed testing.
- Potato research and seed production.

HES in Suwon has now a research capacity of 95 researchers of which 19 are vegetable breeders, 19 vegetable cultivation researchers, 17 people for research in greenhouses, 34 floriculture researchers and 8 people for potatoes. HES in Pusan has 18 researchers and Namhae 5. A total research capacity of 124 people, excluding some researchers in Naju. The number of researchers has very strongly increased. It almost doubled within a year. One of the directors of HES Suwon said that it is a strong recommendation of the government to the new vegetable and floriculture station to do more research to help the direct needs of the growers.

A problem for the new crew of the station is the great number of young researchers without experience.

HES-RDA Suwon

In Suwon a small modern greenhouse of the Venlo-type with modernized greenhouse equipment with an auto-environment control system by computer was built for research purposes by a Dutch company in 1990. In this greenhouse a sun-screen has been installed. The buildings include several laboratories. Among the many projects studies are done in the field of:

-hydroponics research for studies on fertilization management and for high quality production of crops like lettuce, tomatoes, strawberries and peppers.

-Labour shortage is a big problem with peppers. Studies are made into the mechanized possibilities of harvest in one go. Growers have now to harvest 4 to 5 times. Labour saving studies are made of raising of vegetables seed lings.

-Research is done into the light requirements for photosynthesis of new varieties.

-A model plastic house is strongly recommended to the practice for labour-saving and improved growing environment.

-A glasshouse experimenting in a one-line system for progressive lettuce production is tried out.

-A breeding programme and a programme on plant physiology is carried out. Houses with covering material of thick plastic material were not favourable for the development of the crop. Researchers were convinced that an optimal use has to be made of the available light. Light is also important in Korea.

-Experiments were done with cutflowers as roses, carnations, grafted cacti, gerbera, lilies, alstroemeria, foliage plants, year-round carnations production, gentian, chrysanthemums and gladioli. Also potted plants were under investigation like cyclamen, pelargonium, sinninga, achimenes, bonsoi, roses, gerbera and others.

HES-RDA Pusan

This station is situated close to Pusan in the Kimhae greenhouse area. The special tasks of this station are:

- breeding of fruit vegetables in vinyl houses, onions and the development of cultural practices and
- development of cultural practices for cut flowers.

The guidelines for the research are:

A. Improvement of quality and productivity of fruit vegetables, which are promising for export.

- breeding of strawberries with a high sugar content;
 - selection of cultivars and development of cultural practices for cucumber;
 - establishment of techniques to extend the harvest period to increase productivity;
 - consolidated control of facilities and computerization.
- B. Establishment of new cropping system and stabilized production techniques for year round production.
- off season production of strawberries by controlling flower bud differentiation;
 - study of cultivation techniques in alpina areas in relation to flat areas;
 - improvement of fruit vegetable quality by applying hormones.
- C. Development of cultural practices to decrease production costs.
- decreasing production costs by mechanization especially in onion;
 - development of labour saving techniques in nurseries.
- D. Development of new techniques for cut flowers to increase the export.
- study of water culture by hydroponic systems to promote quality;
 - development of manuring methods based on nutrition absorbing characteristics.

The number of researchers has recently been increased from 15 to 18. According to the director the number of 18 researchers is certainly the maximum this station should have. Most researchers are active in the field of breeding and in second place with cultivation. Only two researchers are on research for flowers. This number will be doubled this year. The biggest problem for the farmer is to continue with the crop to harvest enough flowers and their quality, the second problem is breeding and the third problem is to have more control of the environmental factors of the plant. Until recently the government neglected the flower production, vegetables were their only interest. The government is now also interested in flower production. They are highly interested in breeding new flower varieties. Other remarks made in the discussion were: there are differences in climate that's why material from abroad is not always suitable for Korea. Flower farmers are using a lot of planting material from abroad. Korea has special problems in the winter when it is too cold for flowers and vegetables. Vegetable growers do not heat the greenhouse. They are using insulation material to keep the heat in the greenhouse. The result is a shortage of light caused by this way of screening.

Research programme is set up by the staff. The individual researcher makes the proposal. The proposals are checked by a committee. The members of this committee are only RDA people. The research results are transferred to the extension. In each county there is an extension office.

In four of the seven small greenhouses covered with glass research is done on gerbera looking at rockwool and testing cheaper fertilizers; there was also a breeding programme for gerberas. The other glasshouses are used for research on strawberries and melons, breeding and disease resistance. Research is done to increase the production of cucumbers by continuation of the harvest by a.o. fertilizing. A small multispan greenhouse is used for research on watermelons to create seedless varieties. The area of watermelons cultivated in greenhouses increases every year. Melons in greenhouse are harvested from February till July. The watermelons harvested before the month of May are cultivated in multispan greenhouse and the later ones in tunnels. The watermelons from the open field are harvested in July and August. Greenhouses with watermelons are not heated. Research is also done on cabbage, tomatoes and table grapes. Tomatoes are

cultivated after the rice. Rice is cultivated from March till October and after the rice the tomatoes are produced in tunnels of 1.5 to 2 meters high. After the setting of 5 trusses the plant is topped. Only 3 to 4 tomatoes are acceptable per truss. The yield is low. The tunnels are not heated. Only one crop of tomatoes is possible in this cropping plan. On this station no research is done on potplants.

The station has excellent facilities, a well equipped laboratory to analyze the soil and a tissue culture laboratory. Sometimes farmers make use of the soil laboratory.

5.7 Dongguk University, Seoul

Prof. DR. Chong Hwan Chu of the Dongguk University has just published a study named "A Study on Policy Measures for Enhancing Foreign Market of Flower Crops -Studies on the Japanese Market-" The summary is literally quoted here under.

The objectives of this study are to research various ways to rear a floricultural industry, to enhance floricultural export through the comparative analysis of the floricultural industries in Korea and Japan, and to propose some political measures for the government.

The major conclusions are:

- (1) In case of Japan with a rapid growth of the floricultural industry, the import of flowering plants exceeds the export by 18 times and the import of cut-flowers is rapidly increasing in comparison to other kinds of flowering plants.
- (2) In case of Korea, with a rapid growth of the floricultural industry since 1970, the import of flowering plants exceeds the export remarkably.

The cutting flower plants and the cutting branches or leaves which showed only little surplus export, which meant a deficit situation in trading since 1989.

Government support is therefore very urgently needed to promote the export.

This study, therefore, proposes to the government as follows:

- (1) Introduction of new plants, development of cultivation technology, improvement of marketing systems, enlargement of facilities and supporting funds must be introduced to extend the export of flowering plants which are popular in Japan.
- (2) To solve the problems of marketing such as packing, transportation and storage. Government support, technical development and advertising will be necessary in case of the following aspects: use of chemical chrysal, triton as adhesive, refrigerated containers, atmosphere controlled storage facilities, public sorting systems with automatic lines and construction expenses.

So far the summary. Prof. Chong Hwan Chu told us that the strong decline since 1989 was caused by quality problems of the Korean flowers and that the flower business is underdeveloped in Korea. An other problem is the strong increase in labour costs in Korea. The domestic market shows a big demand at the moment and people do not worry about quality. Korea has to increase its quality consciousness. Korea has to become a member of the international organization to protect the rights of the growers. The developments in Korea are hampered by not being a member of this organization. He has found also that in Japan 80 percent of the growers have switched from greenhouses covered with plastic to greenhouses covered with glass. In Korea, however, greenhouses covered with glass are not profitable owing to the high investment.

5.8 Korean Florist Association

The Korea Florist Association was founded in 1969. The headquarter of the Korean Florist Association is established in the building of the new auction of the Agricultural and Fishery Marketing Corporation. The headquarter employs 7 people. Of the total of nearly 10,000 flower farmers in Korea 7,000 are members of the Korean Florist Association. The membership costs are 10,000 Won yearly. The Korea Florist Association has also offices in the country, 14 in the Seoul-Konggi area and 14 outside it. The organization is independent and the board of directors is chosen by the members. The activities are to give members market information, technical information, to promote the consumption of flowers by consumers, to supply members with information about the export of cutflowers and to protect the interest of the member farmers. Monthly a professional magazine named "Korean Florist Association Bulletin" with nearly 10,000 copies is published with prices of cutflowers sold at the auctions and with prices of cutflowers and potted plants sold at wholesale markets. It publishes prices per variety and further articles on the above mentioned activities and has all kind of advertisements about production inputs even on Dutch planting material.

Greenhouse farmers have a tremendous need of information about cultivation techniques, farm inputs and all kind of things on farmers level. More and more market information is accessible to the farmer in Korea, however on the production side there is still a big deficit. Extension is the work of the official extension organization (MAFF). The official extension organization is present all over the country. Each province has subdistricts and each subdistrict has its own extension bureau. All over Korea there are 175 subdistricts. Farmers can get information at these local bureaus. The local bureaus call the experimental stations in case of greater problems. These organizations have a great shortage of knowledge about greenhouse farming. Greenhouse farming is a complete new development in the Republic of Korea and especially growing new types of flowers for the market. The Korean Florist Association is one of the few organizations to help farmers producing flowers directly with information at the farmers level.

5.9 The Korean Horticulture Technique Association

This organization is similar to the Korean Florist Association but less specialized and orientated at vegetables, fruit and medicinal herbs. The interest in protected crops is still on a low level. Most activities are focused on courses for starters of a new crop for example when a grower of rice is interested to grow cabbage. Technical courses of six months with 600 till 700 participants are organized twice yearly.

5.10 Korea Flower Institute (KFI)

This institute is recently founded. Mr. Young Pyo, Hong is the president. The foundation was approved on 12 august 1991 by the Ministry of Agriculture. At the moment the foundation is also established at the new Flower Auction Market, room 105.

The purpose of this organization is to improve the development of flower growing techniques, research on new varieties of flowers and selection of varieties for commercial growing, education in flower growing for growers, students and citizens and exhibitions of flower varieties and glasshouse cultivation for trainees.

To develop these activities the foundation has a new complex built in Yaju between Suwon and Wonju. Here a greenhouse is built of 10,000 m² meter of

which 8,000 m² plastic and 2,000 m² glass covering. A guest house is also erected with a capacity of 60 persons. The total complex is 18 hectares to be planted with flowers and trees. The government will pay the fees for following the courses. Shortly the first short courses of one week will start. Students are the participants of the first course. A board of eleven members is leading the foundation. This project has also to be seen as a DEMO-project (Demonstration-project) for the growers demonstrating to manage new cultivation techniques, varieties, greenhouse types, etc. in practice.

One of the founders Mr. Dong-Chae Suh has recently written a thesis to obtain the degree of Master of Economics with the title "A study on the present status and demand forecasting with the development policy of flower industry in Korea". He interviewed 1,000 growers, wholesalers, retail shop owners and consumers to collect data. He found that flower growers are well educated. Of the total number of flower growers 12 percent are of university level, 18 percent have two years of university education, 41 percent high school and 29 percent secondary school. 12 percent of the flower growers are of an age between 20 and 30 years, 18 percent between 30 and 40, 35 percent between 40 and 50, 29 percent between 50 and 60 and 6 percent is older than 60 years. The Korean cutflower consumption pattern was also analysed, it consists of 70 percent usage at events including weddings, openings, churches, graduations and funeral ceremonies etc.. 20 percent is general consumption as office decoration and for gift purposes. Only 10 percent is bought for home consumption in Korea. In Japan this is 20 percent and in the Netherlands 40 percent of the total turnover of cut flowers. In the period of 1990-2000 the GNP should increase from 4,125 US Dollar to 12,217 US dollar. According to Suh the demand per head for potted plants and cut flowers will increase from 161,561 Won to 629,447 Won. The number of pieces of cut flowers consumed by households should increase from 34 in 1990 till 84 in 2000.

CHAPTER 6 MARKET AND TRADE

6.1 Introduction

The Korean consumers and the Korean market of fresh horticultural produce will be described in paragraphs 6.2 and 6.3. The imports and exports of horticultural produce and the import regulations will be analysed in paragraphs 6.4 and 6.5.

6.2 Korean consumers of fresh horticultural produce

Some decennia ago Korea was still a production economy, in which it depends on the producer what the consumer will find in the market. Nowadays the Korean fresh horticulture market is moving more and more into a consumer market. The consumer has certain wishes and will pay for it. The demand for fresh horticultural produce, especially quality products, will increase in Korea very strongly over the next ten years as the population will grow, and at the same time acquiring a substantially higher living standard by the economic growth of the country. Urbanization is a third factor with a positive effect on the demand for fresh horticultural produce. Seoul and its surroundings are the most economic powerful region of Korea. Of all flowers in Korea 75 percent are traded in Seoul and the neighbouring cities.

In the last twenty years the Korean farmers switched from cultivation on the open field to cultivation in plastic covered greenhouses. The increase in production to answer the growing demand was orientated on out-of-season products and a larger assortment, however quality awareness is still at a low level in Korea.

Korean producers showed a great flexibility to improve the assortment by including new fruits, vegetables and especially flowers. Korean farmers stretched the supply season by building more and more greenhouses and by heating a part of these houses. Korean farmers have to develop this producing system more and more so they can better meet the wishes of the consumers for some time to come. They can only do this in glasshouses with modern equipment.

As already mentioned a strong increasing in welfare is expected in the near future. This will change the attitude of the Korean consumers. They will ask for more highly valued fresh horticulture produce. Changes can be illustrated by income elasticities as showed in table 6.1. The Korean people

Table 6.1 Income elasticity of some products in Korea.

Rice	Maize	Beetroot	Milk	All flowers o.w.	Cutflowers
-0,10	1.06	1.48	2.15	2.37	3.96

will eat less rice but buy more flowers, especially cutflowers when their income increases. The conclusion is that for Korean consumers rice is an economically inferior product while flowers are a luxury product. In case of a higher income of 1 percent the consumer will increase the amount spent on cutflowers with 3.96 percent. With an increasing income the Korean consumer will spend more money on flowers.

On the "Presidential Council on Science and Technique" of Mr. Kim Hyeong Joon I received information about the future expectations of the buying of floriculture produce by Korean consumers (table 6.2). The demand for

floriculture produce will increase from 244,800 to 1361,000 million Won in the period from 1990 till 2001, an estimated increase of nearly 6 times. Korean farmers will be the main suppliers. The imports in 1990 came to 3 percent of the total demand, this percentage will decrease to 1.2 percent in 2001. The export will increase from 1,700 million Won in 1990 to 62,000 million in 2001.

Table 6.2. Future estimations about consumption of total floriculture produce in 100 million won.

	1990	1995	2001
Domestic demand	2,448	4,930	13,610
Export	17	100	620
Supply:			
locally produced	2,393	4,940	14,060
imported	72	90	170

The increase in consumption per capita illustrates very well the wishes of the consumer. The vegetable consumption increased from 55.9 kgs per capita in 1970 to 120.6 kgs in 1980. After that the consumption of vegetables stabilized. The consumer can not eat more but will change to wishes for better quality and a broader assortment. The fruit consumption increased from 10 kgs in 1970 to 29.5 kgs in 1988. A consumption of 29.5 kgs fruit per capita is still at a low level. The consumer will in the future ask for more fruit and will also be interested in other fruits.

Table 6.3 Annual consumption of vegetables and fruits in Korea in kg per capita.

	1970	1975	1980	1985	1986	1987	1988
Vegetables	55.9	62.5	120.6	98.6	114.6	112.2	117.3
Fruits	10.0	14.0	16.2	26.6	26.3	26.3	29.5

Source: KREI

Floriculture products include cutflowers, potted plants, bulbs, flowering plants and ornamental plants. The strongest growth is foreseen in cutflowers and potted plants.

Quality awareness is still at a low level in Korea. The consumption of flowers for household use is still very low. By advertising and promotion campaigns consumers have to become more familiar with flowers, they will have to learn how to handle flowers. For home consumption consumers buy flowers impulsively. For this reason the whole Korean outlet and market system have to be improved on their retail level.

6.3 Marketing systems

For several years already one of the priorities of the government is a gradual improvement of the market system for fresh horticultural produce by making the system more transparent, tuning the demand more to the supply, improving the trading position of the producers and creating facilities to improve the post harvest technology.

The new Flower Marketing Center, a beautiful complex situated in the south of

Seoul - Yangjai-Dong, Seocho-Ku - is a good example of the way which the government is interested to improve the whole market system.

6.3.1 Flower Marketing Center

The Flower Marketing Center is 89,000 m² in size. This center has an auction (Dutch system) with an auction room of 9,040 m². Only cutflowers are auctioned at three o'clock in the morning, six days per week. On average 55 merchants buy the products. The auction has a total capacity of 120 buyers. The turnover amounts to 55 million Won a day. 20-30 percent of the cutflowers destined for Seoul is sold through this auction, the target for the future is 50-60 percent. Among the staff there was a great interest to sell potted plants also by auction.

The auction costs for the supplier amount to 7 percent of which 5 percent is subsidized by the government. This subsidy will disappear after a short introduction period. The management is in hands of the Agriculture and Fisheries Marketing Cooperation (AFMC). All expenditure is born by the government. The total investments amount to 31 million dollars.

There is no membership, producers are free to bring their produce. A problem is still the quality of the supply. The staff is interested to be active on this point. They are also interested in export and to supply farmers with high breeding material and modern farm inputs. The developing of more auctions like this type in Korea depends on the results of this one.

In the same building several offices are housed which are in use by the staff of the auction and several private firms and organizations. Two greenhouses, with a total area of 11,670 m², are used for the sale of small and big potted plants and ornamental plants. Besides the building and the greenhouses a cutflower market is established in this center, open after the sale of the cutflowers at the auction. The fourth activity in the Flower Marketing Center is the trade in pots, boxes, packaging material and other horticultural equipment.

6.3.2 Other outlets

More than 90 percent of all cutflowers and about one half of the potted plants are sold on wholesale markets. Most of the flowering potted plants are sold directly to the retailers. The distribution channels for cutflowers and potted plants are significantly different. There are nationwide 49 wholesale markets of cutflowers and potted plants (1987). Most of them are located in Seoul (19). In general the market facilities are outdated and market space is inadequate for both buyers and individual wholesalers. I saw places with a maximum size of 5 to 12 buckets.

The cutflower trade is conducted on a consignment basis, with a commission charge of 15 to 20 percent. Regarding the potted plants there is an increasing trend among producers to cooperate, and to sell in a joint place also used as a display. The commission costs are the same as for cutflowers. Large potted plants (pot size over 20 cm) have a very high share of the market, 70 percent of the total market value.

The recent manner of packing and transportation of the flowers also has many constraints. To develop a modern Korean flower sector post harvest handling and market facilities have to be changed entirely. Adequate packing has not been developed. The normal practice is to wrap each plant separately in brown paper and to transport them in open or canvas covered trucks. The damage incurred during transport is very high. Flowers consigned from Pusan and Cheju Island to Seoul during winter season are packed in cartons and transported by air. Flowers from other regions are transported by train or

truck. Farm pre-cooling and refrigerated transport systems do not exist.

6.3.3 Flower prices

The wholesale prices of cutflower remain at a high level in the period from December to March, drop in April and are at their lowest level between June and September. Flower prices rise dramatically during the wedding season, around graduation days, New Year's Day and other special days. In the Korean Florist Association Bulletin market prices are published of the different cutflowers and potted plants. For the most important cutflowers the prices in Won are shown in table 6.4 for the period from 21 February till 20 March 1992.

Table 6.4 Average prices of some cutflowers sold on the wholesale markets in the period from 21 February till 20 March 1992 (Won).

	Average	Maximum	Minimum
Gerbera per 10 flowers	1480	3500	800
Gypsophyla per bunch	1850	4500	1000
Carnation per 20 flowers	1830	3500	1000
Rose per 10 flowers	3050	3500	2500
Tulip per 10 flowers	2050	3000	1500
Chrysanthemum	2730	5500	1500
Gladioli	4450	5500	3500

Differences in price are among other things due to by the daily supply, the quality and variety. The highest price for all flowers is realized on 21 February.

6.4 Import and export

Korean import of floriculture produce increased from about 1.1 million in 1980 to 9.7 million US dollar in 1991. The major import items are bulbs, young plants (nursery) and seeds.

Table 6.5 Trend of import and export of flowers in 1000 US Dollar.

	1980	1985	1986	1987	1988	1989	1990	1991
Export	1,055	560	885	1,228	1,417	2,104	2,485	2,204
Import	1,123	3,697	3,681	4,498	7,210	8,269	10,286	9,663

Source: Statistical Yearbook of Foreign Trade (Korean Customs Administration)

Of the total import in 1991 44 percent were young plants (orchids, gypsophila, carnation and some smaller supplies), 33 percent bulbs (tulips, gladiolus, lilium and some smaller supplies), 12 percent seeds and 10 percent cutflowers (including leaves). In 1986 these percentages were respectively 31, 36, 28 and 4 percent.

Imports of cutflowers increased very fast in the last two years it amounted to 210,000 US dollars in 1989, to 662,000 in 1990 and to 942,000 US dollars in 1991. Only small scale importers are active in importing cutflowers. Cymbidium, mainly imported from Thailand, is by far the most imported cutflower,

(627,245 US\$ in 1991). The present import tariff for cutflowers is 30 percent. This tariff is scheduled to be reduced to 25 percent in 1994. The imports of cutflowers are still very small mainly be caused of the limited market for high quality cutflowers, the high tariffs, the high transportation costs and a very negative attitude towards the import of cut flowers.

The import of flower seeds amounted to 1.1 million US dollars in 1990 and to 1.4 million in 1991. In both years Japan was the most important supplier with more than 60 percent of the total amount. The share of The Netherlands amounted to 8 percent in 1990 and 13 percent in 1991, of the USA to respectively 11 and 13 percent.

During the last few years the import of flowerbulbs has increased. About 90 percent of the bulbs is imported from The Netherlands. Lilium is the

Table 6.6 Total imports of flowerbulbs in Korea in US\$ *1000.

Year	1988	1989	1990	1991
Value	1,621	2,261	4,229	4,571

Source: Statistical Yearbook of Foreign Trade

main produce with 30 percent of the total import. Tulips have a share of about 21 percent, gladioli 9 percent and hyacinths 1 percent. The present import tariff on plant breeding material, such as flowerbulbs, young plants (nurseries), tree stock and ornamental crops is 11 percent. This tariff will be reduced to 9 percent in 1993 and 8 percent in 1994. There is no tariff on the import of vegetable seeds.

The imports of young plantmaterial for flower growing has increased with 40 percent, from 1.1 million in 1990 to 1.6 million US dollars in 1991. The Dutch share in the imports amounted to about 25 percent in both years. The imported young plantmaterial is not only used to produce cutflowers, it is also used to produce potted plants (guzmania), (table 6.7).

Table 6.7 Total imports of young plantmaterial for flower growing in Korea in US\$ * 1000

	1990	1991
Carnations:		
Total	201	210
Of which The Netherlands	99	95
Guzmania:		
Total	2	27
Of which The Netherlands	2	27
Gypsophila:		
Total	186	168
Of which Japan	186	168
Other young plantmaterial:		
Total	753	1196
Of which The Netherlands	168	301

Statistical Yearbook of Foreign Trade

Worthwhile to mention is the increasing import of orchids, in 1990 1.2

million and in 1991 2 million US dollars. Main import are from Taiwan, Japan and Thailand.

Korean export of floriculture products increased also but could not keep pace with the increase in imports. The Korean export of floriculture produce has only doubled in 10 years. Only the export of young plants increased steadily from 336,000 to 1,665,000 US dollars in the period from 1986 to 1991. The export of cutflowers increased from 296,000 US dollars in 1986 to 565,000 US dollars in 1989 and then dropped to 373,000 US dollars in 1990 and to only 110,000 US dollars in 1991. According to Prof. Dr. Chong Hwan Chu of the Dongguk University in Seou the reason for this dramatic fall back is the bad quality of the flowers.

Japan is the main supplier of vegetable seed to Korea, followed by the USA and The Netherlands. Imports of vegetable seed increased sharply, from 4.4 millions in 1990 to 7.6 millions US dollars in 1991.

Specialists expect a steady growth of the import of seed. Korean seed companies are very strong in chinese cabbage and radish seed, they have however no competitive power as far as the quality of other seeds is concerned.

Table 6.8 Imports of vegetable seeds in 1990 (liter).

Liberalized seeds:		Not Liberalized seed:	
Chinese cabbage	2,954	Spinach	445,850
Lettuce	33,327	Radish	213
Leek	7,713	Pumpkin	19,350
		Onion	1,973
		Melon	285
		Quota	453,000
			400
			20,000
			2,500
			300

Source: Statistical Yearbook of Foreign Trade

The import of table potatoes is zero and only possible by recommendation of the NACF. Only Japan and some states of the USA are allowed to provide seed potatoes due to phytosanitary reasons. The import volume is small, 351 tons in 1991 and 5 tons in 1990. Import is only possible by the recommendation of the MAFF.

Import of onion (fresh and refrigerated) is only possible by recommendation (quota) of the MAFF. The MAFF will recommend to import onions in case of a local shortage. Taiwan was allowed to bring in onions for a value of 1.7 million US dollars in 1991, at an import tariff of 50 percent.

The import is liberalized for various fresh vegetables, however there is no import of most of these products. The imports of the other vegetables is small. Shallots are mainly imported from China. In 1991 669 tons were imported from this country. Some iceberg lettuce is imported from Japan and USA, 32 tons in 1991. 3 tons of witloof chicory was imported in 1991 of which 642 kgs from The Netherlands.

In Korea the demand for imported trees and tree stocks is limited and the quarantine procedures for imported trees are difficult. In 1989 for 13,365 US\$ of grapes vines, 38,822 US\$ of persimmon trees and 5,220 US\$ of walnut trees are imported together with some other items, in total for 119,571 US\$.

The Korean export of fruits increased from 17.3 million US dollar in 1980 to 64.7 million in 1989. Important items are fresh apples and pears, processed products and juices.

The imports of fruits increased very strong in 1987 and 1989. Imports of bananas was liberalized from January 1st 1991. The import of bananas

increased enormously in 1991. In the first four months of 1992 97,881 metric tons were imported. MAFF expects an import of bananas of about 300,000 metric tons by the end of the year, 1992. The total quantity of bananas imported in 1990 was just 21,834 metric tons. At that time the state owned AFMC could only import bananas from countries as Taiwan in exchange for apples. Korea now imports bananas from countries as Taiwan, Ecuador, Philippines, Malaysia, Vietnam and Columbia. About 30 Korean companies are involved in the import of bananas. 10 companies import kiwifruit from New Zealand, Japan and the USA.

As a negative result of the increasing imports of fruit about 615 hectares of local fruit were taken out of production, because of the competition of the imports.

Lists with names of importers of young plants (nurseries), seeds, flowerbulbs and cutflowers are given in a appendix.

6.5 Trade liberalization and rules for import

6.5.1 Liberalization

Korean people and especially the agricultural sector have a great interest in the recent trends in the General Agreement on Tariffs and Trade (GATT) and the Uruguay Round negotiations to open up the markets. For Korean farmers opening up the rice market will be a bitter pill to swallow. Rice is regarded as the life blood of rural Korea. More than 92 percent of the Korean farmers are involved in the production of rice and more than half of their income is derived from it. Not long ago, even as late as the 1970's eating rice three times a day was a luxury because of the shortage of rice. To encourage more production, the government bought rice from farmers at high prices. Pretty soon rice was seen as a gold mine by the farmers and production soared. By the early 1980's the goal of self-sufficiency was achieved and the rice surplus then began to mount. For the last 11 years Korean farmers have had bumper crops and they are expected to continue, but the domestic demand for rice has been declining. In 1980 the consumption was around 132 kgs per capita. Last year it had dropped to 119 kgs, a decrease of 9.8 percent in 10 years. Korean rice is also five to seven times more expensive than foreign rice ,153 US\$ against 27 US\$ for a bag of 80 kgs. Once the market is opened, up Korean rice will have no chance to compete. The only way for Korean farmers to survive is to switch from rice to other crops and to an other way of farming. It is a necessity to increase labour productivity and mechanization is a necessity. The small size of the farms is a limiting factor. Another possibility is to switch to horticultural crops with a high added value. Farmers are doing this, but the applied technology is still on a low level. The Korean government recently announced that it will invest 57 billion US\$ in the agricultural sector to strengthen the competitive power of this sector.

Korea's flower market has been opened up to foreign exporters since July 1981. The imports of cutflowers is still on a low level, as described in paragraph 6.4. Imported flowers are subject to inspection before custom clearance as stated in the Plant Protection Act before custom clearance and require a certificate of inspection which is issued by the government of the exporting country concerned.

From July 1, 1989, Korea has implemented post entry quarantine (PEQ) system of imported bulbs, seedlings and tubers, to prevent the incoming of any virus.

The Korea's phytosanitary regulations are strict like the phytosanitary regulations in Japan. In appendix 3 a list is given of horticultural produce

which cannot be imported due to phytosanitary regulations.

The liberalization of fruits has started later, (table 6.9). The whole domestic production of bananas in greenhouses collapsed after the free import. A positive result of the free import of fruits is the strong increase in the consumption of fruit per capita.

Table 6.9 Import liberalized fruits.

1989	Dates, Mangoes, Mangosteens, Guava, Strawberry, Sloes, Gooseberry, Papaya, Cranberry and Pistachio
1990	Pecan, Kiwifruit
1991	Pineapple, Banana, Melon, Walnuts and Hazelnuts

Several fruits are not liberalized e.g. citrus, apples, pears, grapes and peaches. From the beginning of 1991 the imports of radish, chinese cabbage, spinach and carrot are also liberalized and from the beginning of 1992 of red pepper, tomato, watermelon, pumpkin, cucumber, Welsh onion and onion.

Some of the not yet liberalized items will be liberalized in the coming years, for all kinds of horticulture produce. The number of liberalized products is already large however limited in turnover. In the case of fruits the quarantine regulations are also restricting the imports of many kinds.

6.5.2 Import regulations of vegetable seeds

Related regulations in the Unity Announcement in clause 2 of article 18 of the Foreign Trade Act:

- Only a licensed seed company (person) is allowed to import the following vegetable seed subject to the confirmation of the chairman of the Korean Seed Association in accordance with clause 1 of article 3 of the Seed Administration Act. However the organization (company, person) approved by the Government (MAFF or provincial governor) is also allowed to import vegetable seeds in accordance with the exceptional provision, clause 3 of article 3 in the Seed Administration Act:
the species of radish, chinese cabbage, red pepper, tomato, cucumber, melon, watermelon, pumpkin, spring leek, onion and spinach.
- Only a licensed seed company (person) is allowed to import the following vegetable seeds in accordance with clause 1 of article 3 of the Seed Administration Act (including the organization approved by the government):
the species of cabbage, lettuce and leek.

Quota system

The vegetable seeds, of which the import has not been liberalized, can be imported within the limit of the quota. The quota is set by the Vegetable Division of the Ministry of Agriculture and distributed among the seed companies by the Korean Seed Association.

Test Cultivation

In case a seed company tries to import a new variety of vegetable seed not registered in Korea the seed company shall carry out two years of test cultivation and submit the results of the tests to the Korean Seed Association. The Korean Seed Association is entitled to allow the import of

new varieties of vegetable seed not registered in Korea in accordance with the submitted results of test cultivation.

6.5.3 Regulations of bulbs

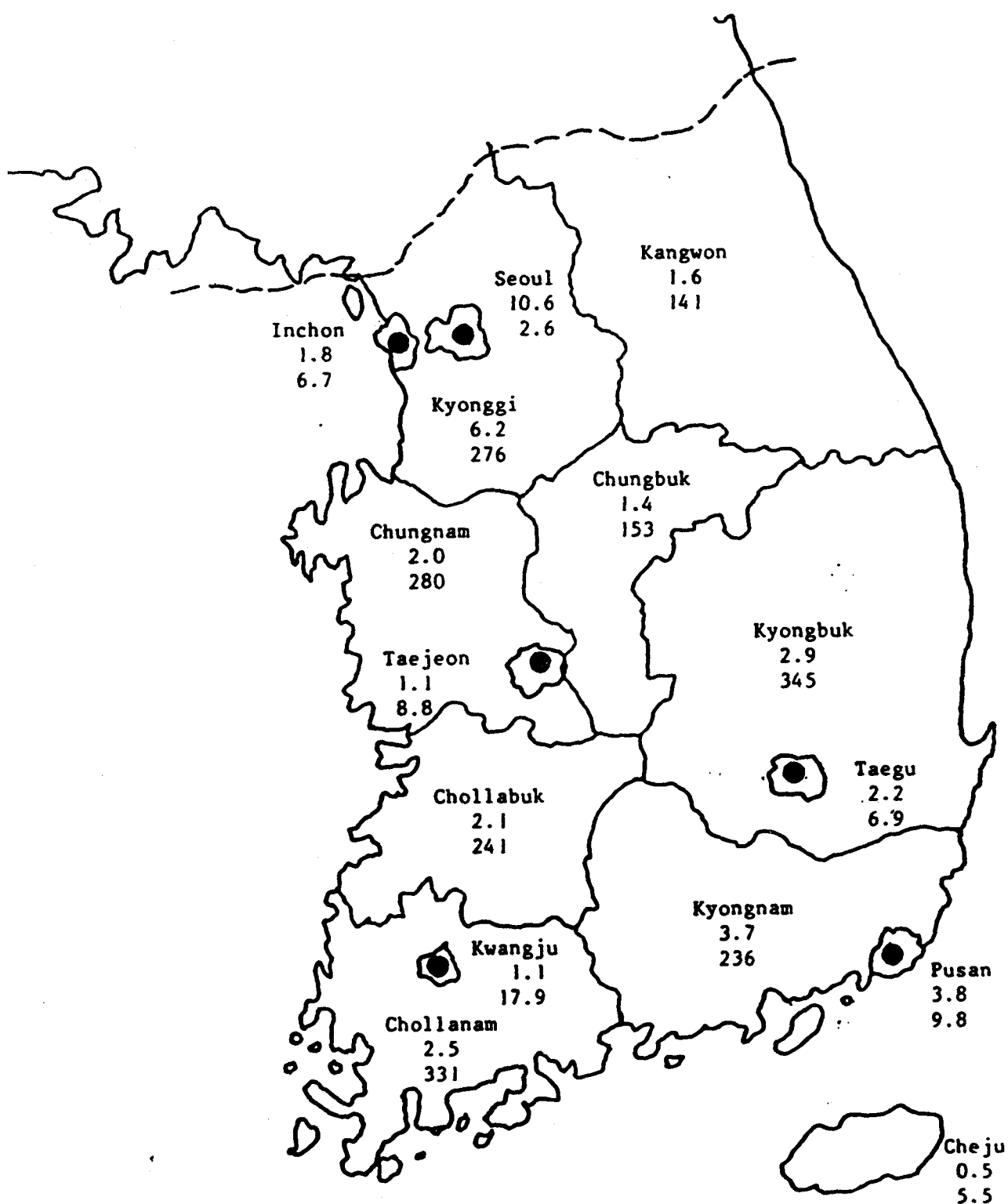
In Korea only commercial flower growers are allowed to cultivate imported flowerbulbs. Imports of bulbs for consumer sales (dry sale) is not allowed although there is a big potential.

The import of flowerbulbs into Korea is only possible under Plant Quarantine, a post entry quarantine system in Korea. Any commercial import of flowerbulbs cannot be exempted from this quarantine system.

Republic of Korea

Number of inhabitants x 1 million (1990)

Area of cultivated land x 1000 hectares



Source: MAFF

Woo Young Corp.
add. : 3rd Floor, Woo Young Bldg.,
254-6, Yangjae-Dong, Seocho-Ku, Seoul, Korea
tel. : (02) 577- 6326
fax. : (02) 577-1983
contact person : Mr. Young-Cheol, Park, Managing Director

Korea Flower Currency
add. : 328, Bonggang-Ri, Jiphyun-Myun, Chinyang-Kun,
Kyungnam, Korea
tel. : (0591) 41-5411
fax. : (0591) 746-6797
contact person : Mr. Jai-Hyun, Shim

Importers of vegetable seeds

Choong Ang Seed Co., Ltd.
Central Post Office Box 2689, Seoul, Korea
Tel : 82-2-567-5131/5
Fax : 82-2-554-4897
Contact person : Dr. Hong, Sung-Ho, Managing Director

Han Nong Seeds Co., Ltd.
Address : Yongdong Post Office Box 69, Seoul, Korea
Tel : 82-2-547-3541/8
Fax : 82-2-546-5539
Contact Person : Mr. Lee, Yeol-Hwa, manager

Seoul Seeds Co., Ltd.
Address : 182-14, Chongro-5-ka, Chongro-ku, Seoul, Korea
Tel : 82-2-569-7147
Fax : 82-2-552-9439
Contact person : Mr. Kim, Kuk-Kyun, senior manager

Hungnong Seed Co., Ltd.
Address : 1338-20, Sucho-dong, Sucho-ku, Seoul, Korea
Tel : 82-2-553-0971
Fax : 82-2-555-5602
Contact person : Mr. Lee, Joon-Byung, Director

Nong Woo Seed Co., Ltd.
Address : 86, Joong-dong, Jangan-ku, Suwon city,
Kyunggi-do, Seoul, Korea
Tel : 82-331-48-4891
Fax : 82-331-43-0350
Contact person : Mr. Kim, Sang-Ryul, Director

Importers of flower bulbs

Choong Ang Flower Co., Ltd.
Central Post Office Box 2689, Seoul, Korea
Tel : 82-2-579-1507/9
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Sin Nong Sa Co., Ltd.
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Hungnong Seed Co., Ltd.
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Contact person : Mr. Lee, Joon-Byung, Director

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Contact person : K.S. Ahn, President
(Note : This company is suffering financial difficulties
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Bug-Ku, Kwang Ju, Korea
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Korea Coop-Trading Co., Ltd.
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Tel : 82-2-712-8121
Fax : 82-2-719-2521
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Jeong Daun Trading
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Sungnam-Shi, Kyunggi-Do, Korea
tel. : (034:) 759-7679
fax. : (034:) 759-7679
item : lily
contact person : Mr. Jin-Man, Chung, President

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Fax : 82-331-43-0350
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fax. : (02)542-4026
contact person : Ms. Sang-Hee, Kim
item : carnation

Kyoung Young Ind. Co.
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300-7, Yangjae Dong, Seocho-Ku, Seoul, Korea
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item : dried cut flower

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Mr. Jae-Seo, Kim, Director

Jin Myung Corp.
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fax. :
item : orchid

Shinan Trading Co.
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fax. : (02) 295-1020
item : dried cut flower
contact person : Miss Kim

Seosan Corp.
add. : 1489-1, Seocho-3-Dong, Seocho-Ku, Seoul, Korea
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fax. : (02) 586-9268
item : orchid, gladiolus
contact person : Ms. Hae-Seung, Lee

Mee Hwa Trading Co., Ltd.
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tel. : (02) 712-0097
fax. : (02) 706-0169
item : orchid, cymbidium, carnation
contact person : Mr. Jong-Won, Lee, Director

Horticultural produce forbidden to import in Korea due to phytosanitary reasons

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 1. All fresh fruits including fruits from vegetables, except coconut palm, green banana and pineapple. | Mediterranean fruit fly
(<i>Ceratitis capitata</i>) |
| 2. Fresh fruits or kernels of Juglandaceae(walnut, wild walnut, etc.), Rosaceae(apple, apricot, cherry, peach, pear, plum, etc.). | Codling moth
(<i>Cydia pomonella</i>) |
| 3. Living vines, stems, leaves and tubers of Solanaceae (egg plant, potato, red pepper, tobacco, tomato, etc.). | Potato wart diseases
(<i>Synchytrium endobioticum</i>) |
| 4. Living vines, stems, leaves and fresh fruits of Solanaceae. | Tobacco blue mold
(<i>Peronospora tabacina</i>) |
| 5. Living vines, stems and leaves of cabbage, black pepper ;
<i>Cirsium</i> spp. (thistle, etc.)

and Solanaceae. | Colorado potato beetle
(<i>Leptinotarsa decemlineata</i>) |
| 6. Living tubers of <i>Chenopodium</i> spp.(goosefoot, etc.) and Solanaceae. | Potato cyst nematode
(<i>Heterodera rostochiensis</i>) |
| 7. Stalks and leaves of <i>Agropyron</i> spp.(wheatgrass, etc.),
<i>Hordeum</i> spp.(barley, etc.),
<i>Triticum</i> spp.(wheat, etc.). | Hessian fly
(<i>Mayetiola destructor</i>) |
| 8. Unhulled rice, chaffs and rice straws and their processed goods. | Nematodes and other plant pests or diseases that are not found in Korea. |

VISITED GREENHOUSE FARMS

Introduction

Two regions were visited to see farms specialized in greenhouses. These were Great Seoul and Great Pusan. Both cities have a large area of agriculture land around the built-up area. "Great" includes the province by which both cities are surrounded.

Great Seoul

Hyunin Nung Flower Complex

This concentration of 250 growers specialized in potted plants is situated about 10 kilometers south of the Yangje-Dong Seocho-Ku Flower Auction and left of the highway in the direction of Suwon. The area of land covered with greenhouses is 0,3 hectares on average per holding. The construction of the greenhouses consists of steel pipes or wood. The greenhouses are walk-in tunnels or of the type with a-symmetric roof of one to three spans. Each grower has several greenhouses each of an average small area. The greenhouses are covered with three layers. The middle layer is a synthetic cloth and the other two are of a thin plastic foil. The middle layer is used in the winter period as an energy screen and in the summer as a sun screen for shading. The construction of three layers is in the Seoul area the normal technique for greenhouses used for potted plants. The green houses are heated. In the winter period with heavy frost the growers use two energy sources, oil and coal. Before and after this period coal burning is stopped and only oil burning is used. The reason is to reduce the costs. Other climatic facilities are not available. All kinds of potted plants are to be found. A part of the growers is specialized in one or two crops others in more species.

At the entrance of the complex is a central selling point with about 30 individual booths. Growers who are situated near to this point usually also have an outlet in front of the farm.

Hyuseoung, Jeun holding

This holding is situated in the village Kodeungdong not far from Hyunin Nung Flower complex.

The grower is specialized in import material. He buys sticks (e.g. *Dracaena*) and unrooted young plants from intermediaries.

The plants are sold after some months to other growers after rooting and the appearance of a few leaves. Only twenty percent of the production is sold directly to the end consumer. The assortment consists of about ten different potted plants. The planting material is imported from Singapore and Taiwan.

The grower has 5 greenhouses of 600 m² each. Each house has seven spans and is covered with the wellknown three layers. Each house has two heaters, for which coal and oil are used. The heated air is lead through big plastic tubes with holes to get a better distribution of the heat in the greenhouses. The grower has sprinklers installed in the top of the roof and uses a railway for indoor transport.

Pankyo area

This area is situated in the direction of Suwon along the highway Seoul-Suwon. Farmers are specialized in vegetables as chinese cabbage, radish and spinach. For these crops simpler tunnels are used without heating. The tunnels are covered with one layer, of plastic foil. The tunnels are between 1.50 and 2.00 meter high and much longer than the higher tunnels used for potted plants. The foil is pulled up at one or two sides during the day and lowered in the afternoon to keep the sun heat in.

On the market one can find these crops in the winterperiod, in much smaller quantities however than in the spring and against much higher prices. These crops have to be heated during the growing period and are cultivated in the so-called flower greenhouse type, high tunnels, mostly multispans. There is no winter production in the Pankyo area.

Keshik, Lee Holding

The holding is situated near Ich'on, between Suwon and Wonju. The grower started 13 years ago and the total area with greenhouses is now 2 hectares. The main specialization is a year round production of the cutflower liliu, with a peak in the months of February, March and April, months with high market prices. Each year 300,000 bulbs are bought from The Netherlands. The bulbs are used two or three times for producing a new crop. After harvesting a special shade is installed outside the roof to reduce the soil temperature during sprouting. Beside liliu the grower cultivates some potted plants as the so-called 5-degrees tulips in a certain period of the year.

All greenhouse are from the two spans type. The houses in which the liliu is cultivated are heated only with oil heaters connected to plastic tubes. For the greenhouses with potted plants the farmer uses a special heating system to save energy. In principle the greenhouse construction consists of two tunnels above each other. Ground water with a temperature of 15 to 17 degrees Celsius is pumped between the two layers. To reach a temperature of 5 degrees Celsius in the greenhouse when the outside temperature is 20 degrees below zero only an additional heater of a very low capacity is used. With this system he can reach inside the greenhouse a maximum temperature of about ten degrees Celsius. On account of the low maximum temperature this system is not suitable for liliu.

Great Pusan

Soonglo, Yun farm

This farm is established in Kangsuh-Gu in Kimhae on about 1.5 kilometer distance from the Horticultural Experimental Station. Kimhae is very closely situated to the airport of Pusan. The farmer started with greenhouse cultivation 10 years ago and slowly built up the farm. The new complex was built some years ago. The multispans greenhouse spans an area of 3,000 pyung (one pyung is 3.3 m²). This beautiful greenhouse is 4.8 meter high from the ground to the top of the roof, from gutter to gutter 7.2 meter long and covered with vinyl with a thickness of 0.08 mm. The vinyl is fixed on the roof by an extra net. September is the storm season and it is very difficult to build high storm-proof greenhouses. In the greenhouse two automatically operating screens are working independently and both are installed not to save energy but to hold the temperature at the right level in case of frost. One screen is not enough to keep the temperature up in time of severe frost. The night temperature is kept at 18 °C and the day temperature at 23 °C in winter and at 25 °C in the summer. The ventilation system is designed by the farmer

himself and is manually operated from outside the greenhouse, each span separately. The farmer built the greenhouse by himself. Investments for construction and covering material were 50,000 Won per pyung and included internal systems at 70,000 Won. A greenhouse manufacturer would calculate 30 to 40 percent more. Automatic ventilation was too expensive at the time. The farmer puts up a permanent screen to protect the gerbera plants against direct sunshine from May till September. After the storms in September he replaces the vinyl covering. This can be done in one day with the help of 25 hired labourers. Five air heaters are used to heat the greenhouse. The fuel for the heating is light oil. Price per litre 153 Won tax free. Farmers pay no taxes. The energy costs are 20 million Won per year. The plant material is bought from a Korean firm, Nung Nong and multiplied by tissue culture. The plants are planted in long high trays, so working is easy. Watering is done by drip irrigation including the fertilizing. The labour used is the farmer himself, his wife and 6 regular labourers of which 4 are women and 2 are men. Labour costs for a 8-9 hour working day for a woman are 12,000 and for a man 25,000 won per day, including meals. The high use of labour is caused by the specific way of the preparation of gerbera before selling. In each flower a wire is inserted. When the farmer would build a new greenhouse he would build one of a smaller size on account of the shortage of labour.

The harvest amounted to 1.5 million gerbera flowers last year, this year the harvest will be bigger. The highest prices of 500 Won are received in February (graduation at the high schools) and in November (special ceremonies), the lowest prices 50 Won (1,000 Won is 2.4 Dutch guilder). The farmer was conscious of the great risk to his company. The covering material with vinyl is an extra great risk by damage. Most of the flowers are sold on the auction in Pusan and are transported to Seoul. A small percentage is exported to Japan.

The farmer has close contacts on basis of mutual interests with some other farmers also producing gerbera. There is also a good contact with the Experimental Station. This is easy to realize because the farmer is also working as a researcher on this station. The extension is still too much orientated on rice. The owner told that a great interest exists with farmers to make use of the subsidy the government is willing to give for modern greenhouses covered with glass.

Five years ago during the first visit to Korea people were saying that the greenhouse area of Kimhae was the most developed at that moment. Now other areas in the south are also mentioned. The area of Masan, roughly 25 kilometers west of Kimhae, mainly for flower growing, Chinju roughly 70 kilometer west of Kimhae for vegetable growing and Sunchon roughly 130 kilometers west of Kimhae, for flowers and vegetables. Greenhouse are only built in flat areas.

Mr. Park farm

Banana were cultivated in this greenhouse till some years ago. The size of the greenhouse is 1,500 pyung. After the import restrictions were cancelled by the government the whole domestic banana production collapsed. At that moment the farmer took over this farm. Before he started with this farm he produced carnations elsewhere. The soil is excellent to grow roses. Originally the farmer was a researcher at a Korean institute. The farmer now cultivates roses, 6 varieties. Only one variety is fit for export. Korean people prefer the other varieties. According to the farmer the Korean market is a low quality market. Quality is not paid at this moment on the Korean market. That was the reason why these varieties were chosen. Export was still beginning and not yet developed. The height of the greenhouse from the ground to the gutter is 4.50 meter and

from the ground to the top of the roof 6.50 meter. The plastic on the house was fixed with strings. The plastic on the roof is removed in hot weather. A special screen against the hot sun could be a better solution, the grower remarked. An electric operated ventilator was installed per span and two screens for saving energy, drip irrigation and pipe heating were used in the whole greenhouse. For heating the circulating water extra heavy oil was burned. The grower himself and 4 women are working on this farm.

Mr. Park, Kyu-Keun farm

This farm is established close to the farm reviewed above. This greenhouse was also used for growing bananas. The size is 900 pyung. The grower cultivates carnations in this banana house. The cuttings are directly imported from The Netherlands. Before he started with this farm 2 years ago he already had 30 years of experience in growing carnations. The farmer sells the flowers on the domestic market. He told us that for his carnations with a good quality he received a much better price. He should receive a good price if he could export the flowers. Only the farmer and his wife were running the farm. Only one energy screen had been installed on this farm and the temperature is increased by air heaters. At night the lowest acceptable temperature is 8 degrees, during the day he increases the temperature to 22 degrees Celsius. The yield was 600,000 flowers last year.

More farms were visited in this area, farms specialized in flowers or in vegetables. These farms have old banana greenhouses to produce flowers or simple tunnels of 1.70 meter height to produce vegetables. All types of houses can be found between these two. The unheated plastic tunnels are covered by hand with mats of rice straw to keep in the sun heat during the night and to protect the plants against cold and frost in the late afternoon. There is a strong development to increase the height of the houses and to build more multispans. Flowers are grown in better developed greenhouses than vegetables. Other cutflowers cultivated in this area are especially gypsophila and snapdragon. Many farmers had serious complaints about the planting material. Beside the excellent growers there are a great number of greenhouse farmers who are not technically educated.

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