CHAPTER

03

Agricultural Industry Trends by Item

1. Grains
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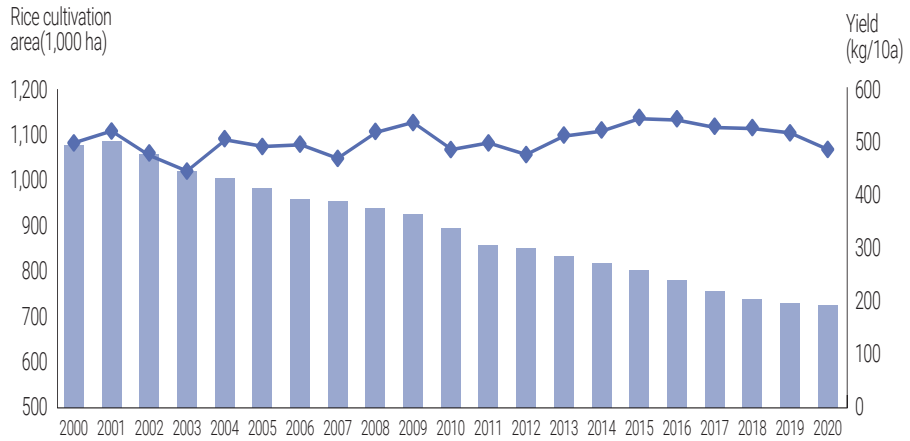
Agricultural Industry Trends by Item

1. Grains

With the end of the 20-year rice tariffication delay since the Uruguay Round (UR) negotiations on agriculture, anyone could import foreign rice at a 513% tariff rate from January 1, 2015. However, Korea still had to continue importing its mandatory quota, which reached 408,700 tons, at a 5 percent tariff rate.

When it comes to rice, consumption declines at a faster rate than production, causing oversupply. To solve this problem, Korea has encouraged farmers to cultivate crops other than rice. As part of such endeavors, the government introduced a direct payment program in 2005, which continued until 2019. Entering 2020, the government abolished the program applicable to rice, adopting a new public-purpose direct payment program applicable to all crops instead.

Figure 3-1 Trends in the rice cultivation area and rice yield



Source: Agricultural Outlook 2020, *Trends in Rice Supply and Demand and Prospects*.

Rice

Supply and Demand Trends

Due to technological advancements in cultivation, rice yields have increased. Nonetheless, the rice production area has continued to decrease because of aging, farmland conversion, etc., and rice production tends to decrease as a result. Over the last ten years, rice yields have risen by an average of 0.7% a year due to advances in cultivation technology and infrastructure maintenance. By contrast, the rice cultivation area has shrunk by an annual average of 2.2% over the last decade. Despite this trend, an oversupply of rice continued as rice consumption decreased faster than the rice supply. To deal with this structural oversupply of rice, the government has implemented a policy to reduce the rice cultivation area since 2016. The space for raising rice was 729,814 ha in 2019,

Table 3-1 Rice consumption per capita

Food grain year	Rice consumption per capita (kg)	Annual rate of change (%)
1990	119.6	-1.5
1995	106.5	-1.7
2000	93.6	-3.4
2005	80.7	-1.6
2010	72.8	-1.6
2015	62.9	-3.4
2016	61.9	-1.6
2017	61.8	-0.2
2018	61.0	-1.3
2019	59.2	-3.0

Source: Ministry of Agriculture, Food and Rural Affairs (MAFRA), Aug. 2019, *Rice Policy Data*.

accounting for 46.2% of the total agricultural land area (about 1.59 million ha) and 88% of the total paddy area (829,778 ha).

The number of farm households cultivating rice stood at 555,000 in 2019, taking up 54.4% of the total farm households. The ratio of rice farmers to the entire farmers amounted to 77.9% in 2000 but has steadily decreased. Though the rice cultivation area per farm household gradually expanded, it remained just at 1.33 ha in 2019, showing that small farms were still prevalent.

Rice consumption per person has steadily decreased due to rising consumption of rice substitutes, changing dietary patterns, etc. In the 1990s, rice consumption per person fell by an annual average of 2.3%. Entering the 2000s, it decreased further by an annual average of 2.6%. Per capita, yearly rice consumption reached 93.6kg in 2000 but significantly fell to 59.2kg in 2019. Due to the fall in rice consumption per person, rice consumption for table purposes continued decreasing from 4.42 million tons in 2000 to 3.16 million tons in 2018. And this decreasing trend would continue in the future.

The annual aggregate demand for rice, including rice for processing, alcohol,

Table 3-2 Stocks, demand for processing and alcohol, and aid to North Korea

(in 1,000 tons)

	Stock	Processing	Foreign Aid
2000	958	175	-
2001	1,335	183	-
2002	1,447	337	400
2003	924	313	400
2004	850	335	105
2005	832	324	309
2006	830	373	168
2007	695	424	173
2008	686	436	-
2009	993	366	-
2010	1,509	549	5
2011	1,051	644	-
2012	763	566	-
2013	801	526	-
2014	875	535	-
2015	1,354	575	-
2016	1,747	659	-
2017	1,888	708	1
2018	1,442	756	62

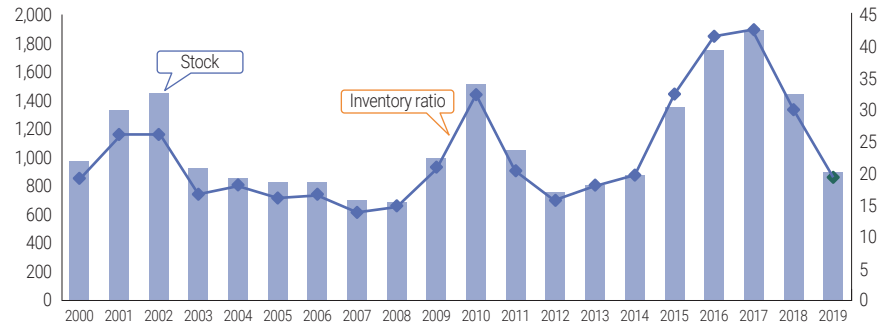
Note: "Foreign aid" means aid to North Korea until 2016, and Korea has broadened foreign aid to include other countries since 2017.
Source: MAFRA, Aug. 2019, *Rice Policy Data*.

and aid to North Korea, dropped to less than 5 million tons in 2004, and to 4.2 million tons in 2015. On the other hand, rice for animal feed and processing began to increase in 2016, reaching 4.81 million tons in 2018. This phenomenon happened because the government supplied some of the rice stock for processing and animal feed if the stock of rice surpassed a certain level. Therefore, the share of rice consumption for table use in the aggregate demand fell from about 85% in the early 2000s to 65-75% recently.

These days, the government has released rice for processing at low prices. The rice flour price is KRW 400 per kilogram and that for general processing, KRW 800 per kilogram. These prices are less than 20% or just over 40% of the market price.

The rice inventory has fluctuated, according to harvests or government

Figure 3-2 Rice stocks and inventory ratios



Source: MAFRA, Aug. 2019, *Rice Policy Data*.

policies. Recently, rice stock has plunged drastically decreased due to food aid or use as animal feed. From the early 2000s to the mid to late 2000s, rice stock remained stable at an average of 800,000 tons. However, at the end of the 2010 food grain year, the stock amounted to 1.5 million tons due to successive rich harvests in 2008 and 2009. In the early 2010s, subsequent poor harvests caused the rice inventory to decrease to the previous level (800,000 tons on average). After that, however, good harvests exceeding an average of 520 kg/10a have continued, leading to a gradual increase in the stock of rice. To reduce the surplus stock, the government made various endeavors, such as using rice as animal feed, providing food aid, increasing processing, and implementing public sale. As a result, the inventory fell to 1.44 million tons at the end of the 2018 food grain year. The inventory ratio also fluctuated depending on harvest conditions. The ratio stood at 19.1% in 2000 but was maintained at about 20% for some years. It then exceeded 40% in 2016, dropping again to about 30% in 2018.

Production Policy

Before the rice policy reform in 2004, the government operated a procurement program to achieve self-sufficiency by encouraging farmers to produce rice. Thus the government set the purchase price above the market price until the first half of the 1990s to increase farm income. The average purchase price between 1990 and 1994 was KRW 124,468/80kg, which was 80.2% higher than the production cost (KRW 69,068/80kg) and 19.2% higher than the market price at harvest time during the same period. Rice production went up due to the procurement program, but the consumption of rice as food turned downward after the mid-1980s. Therefore, the rice stock increased and the inventory ratio amounted to 39% at the end of the 1991 food grain year. Although the procurement program effectively secured markets for farm households and increased rice income, it caused the side effect of oversupply.

With the conclusion of the UR negotiations in 1993 and the launch of the World Trade Organization (WTO) in 1995, circumstances concerning rice policy changed. The UR negotiations decided to reduce domestic subsidies, or the aggregate measurement of support (AMS), from KRW 2.18 trillion in 1995 to KRW 1.49 trillion in 2004. However, 91% of the average AMS from 1989 to 1991, which was the base period for calculating the AMS, stemmed from the procurement program. Therefore, the rice purchase program was restricted.

In the DDA agricultural negotiations, the tariff cap and AMS reductions were discussed. Therefore, with the 2004 rice renegotiation, the government abolished the procurement program, introducing public stockholding for food security instead.

Since 2000, rice consumption has decreased faster than rice production, continuously causing an oversupply of some 300,000 tons per year. To improve this structural oversupply of rice, the government temporarily implemented a

production control policy three times in the 2000s.

Harvesting rice

Between 2003 and 2005, the government adopted a set-aside program. If farmers set aside land from production, The government granted a subsidy of KRW 3 million per ha. However, because non-cultivation could devastate rice paddies, the government allowed farmers to cultivate green manure crops and fodder crops for non-commercial purposes. This program was effective in considerably reducing the rice cultivation area. However, because most participating farmlands were unproductive, the actual output reduction was not significant compared with the reduced area. Of the total participating farmlands, only 22% were productive. Moreover, the output per unit area of the participating farmlands was 3.8% lower than that of non-participating farmlands.

As overproduction caused a drastic fall in rice prices, the government conducted an income source diversification in paddy field program from 2011 to 2013. If farmers cultivated crops other than rice, the government paid a fixed amount to them. Unlike the set-aside program, this program was designed to convert rice to other crops. While reducing rice production, the government also intended to raise the self-sufficiency rate by raising production of other crops. To this end, it provided a compensation payment of KRW 3 million per ha to paddies that were converted to farmlands for other crops. In 2011, the first year of the program, many farmers joined the endeavors, raising the rice price at harvest time by 20.3% year on year. However, the output per unit area fell by

9.5% from 532kg/10a in 2010 to 482kg/10a in 2011, raising concerns about rice shortages. In response, the government drastically reduced the target area to 10,000 ha, and the participating regions also decreased considerably.

In 2016, rice production increased, lowering the rice price by 13.9% year on year. As a result, variable direct payments the government provided when the rice price fell exceeded the payment limit (KRW 1.49 trillion). In response, the government adopted the program to convert rice to other crops from 2018 to 2019. Under the program, the government paid subsidies to farmers if they cultivated crops other than rice as the government did under the paddy field program's income source diversification. From 2019, it permitted set-aside as well.

Obviously, both the set-aside program and the income source diversification program effectively reduced the rice cultivation area, but such an effect did not last long. In particular, the latter caused inefficient use of resources because many farmers returned to rice cultivation after the program ended.

Income Policy

In 2004, fundamental changes occurred in rice policy. Rice negotiations were in progress in the year. Korea could open its rice market under tariffication from 2005, or it might extend the delay of tariffication further. In any case, a fall in the rice price seemed inevitable. Under these circumstances, farmers' anxiety increased. If the nation opened its rice market with tariffication, rice imports could soar due to international rice prices, tariffs, and exchange rate conditions, causing severe damage to farmers. Even if the country extended the tariffication delay, rice imports in the market would increase each year and the rice price would drop inevitably. Hence, it was urgent to develop a means of policy to stabilize farm household income.

To alleviate rice farmers' anxiety about income, the government introduced

the income compensation program for them in 2005. Under the program, the government set the target price and subsidized 85% of the difference between the target price and the market price. Even if the rice price fell, the price perceived by farmers, which included direct payments, did not change a lot from the target price. Therefore, the program contributed to farmers' income stability. The direct payment program was divided into fixed direct payments and variable direct payments. Fixed direct payments were classified as green box policy because a fixed amount was paid regardless of the market price. Variable direct payments were categorized as amber box policy because the payments were linked to the market price. The government set the target price of KRW 170,083/80kg by including the income effect of the procurement program in the market price. Farmlands, where rice was cultivated during the base period of 1998-2000, were eligible for fixed direct payments. Farmers had to maintain the shape of paddies to receive the payments even when they set aside the paddies from production or cultivated other crops. Farmlands eligible for variable direct payments were the same as those eligible for fixed direct payments. However, farmers must cultivate rice to receive such direct payments. Because variable direct payments were coupled with production, criticism has been steadily raised that this scheme of direct payments could bring about oversupply.

When the government first introduced the direct payment program for rice income compensation, it decided to adjust the target price every three years. However, when the target price applicable to rice, produced from 2008, declined, demand to freeze the target price increased. The government maintained the current target price of 170,083/80kg, and amended the relevant Enforcement Decree to alter the target price every five years. Five years later, a demand arose to include the production cost and the target year's inflation rate. In response, the government raised the target price for rice produced in 2013-

Table 3-3 Direct payments for rice provided

(in KRW/80kg, KRW 100 millions)

Production year	Price at harvest time (Oct.-Jan. of the following year)	Fixed direct payments (A)	Variable direct payments (B)	Direct payments provided (A+B)
2005	140,028	6,038	9,007	15,045
2006	147,715	7,168	4,371	11,539
2007	150,810	7,120	2,791	9,911
2008	162,307	7,118	-	7,118
2009	142,360	6,328	5,945	12,273
2010	138,231	6,223	7,501	13,724
2011	166,308	6,174	-	6,174
2012	173,779	6,101	-	6,101
2013	174,707	6,866	-	6,866
2014	166,198	7,560	1,941	9,501
2015	150,659	8,422	7,257	15,679
2016	129,711	8,383	14,894	23,283
2017	154,603	8,314	5,392	13,706
2018	193,448	8,169	1,114	9,283
2019	189,994	8,020	2,336	10,356

Source: MAFRA, Apr. 2019, *Rice Policy Data*, Press release, etc.

2017 to KRW 188,000/80kg. As for fixed direct payments, KRW 700,000 per ha was provided. However, the government raised the payments step by step from 2013, paying KRW 1 million from 2015. Also, it raised the target price for rice produced after 2018 to 214,000/80kg, considering the inflation rate, etc.

Regarding direct payments for rice income compensation, the price of rice produced in 2016 plunged, causing variable direct payments to amount to the payment limit. As a result, the aggregate of variable and fixed direct payments rose to about KRW 2.33 trillion, which was the highest ever. On the other hand, regarding rice produced in 2008 and in 2011-2013, the rice price at harvest time was higher than the base price for payments. Therefore, no variable direct payments were made to rice farmers. Only fixed direct payments were made to rice farmers.

Regarding the income compensation program for rice farmers, it was steadily pointed out that the program was causing an imbalance in rice supply and demand due to the variable direct payment scheme. That was because the scheme was a relatively solid management stability program nonexistent for crops other than rice. Moreover, the direct payments were provided in proportion to the cultivation area. For such reason, a big difference occurred in payments received by large farm owners and small farm owners, broadening the gap between the two. Meanwhile, in designing variable direct payments, the government considered environmental elements by making the payments only when farmers observed the standards for using pesticides and chemical fertilizers. In reality, however, no such environmental effects were obtained. Due to these issues, the government abolished the direct payment program for rice income compensation and instead adopted the public-purpose direct payment program in 2020. The new payment program secured equity by targeting all crops, making direct payments to small farm owners, and by adopting a regressive unit price system. In addition, the program was reorganized toward strengthening obligations regarding the ecosystem and environment to enhance the public benefits of agriculture.

Public Stockholding Program

Public stockholding means that the nation stockpiles a certain quantity of goods in preparation for disasters or emergencies. Rice is a staple grain and its price elasticity of demand is small. For such reason, a bad harvest could lead to a surge in the rice price and cause social disorder. Therefore, adequate stockholding is necessary to achieve food security.

In the past, the government used the procurement program to increase farmers' incomes through price support and accomplish food security. If the rice

Table 3-4 Quantity of rice for reserves

(in KRW/80kg, KRW 100 millions)

Production year	Quantity of reserves
2005-2007	864,000 tons
2008-2010	720,000 tons
2011-2013	720,000 tons
2014-2016	720,000 tons (additional 30,000 tons purchased for APTERR)
2017-2019	680,000 tons (additional 10,000 tons purchased annually for APTERR)

Source: MAFRA.

supply to the market decreased due to a bad harvest, the government released rice reserves to stabilize the market. However, the government had limitations in achieving food security through the procurement program because the total AMS was reduced according to the WTO agreement and additional AMS reductions were discussed in DDA negotiations.

Therefore, with the abolition of the procurement program in 2004, the government introduced the public stockholding program. For this program to be recognized as green box policy under the WTO agreement, the government must meet some requirements. Specifically, it must not give price support to producers, and the rice inventory for food security must be predetermined. In addition, the government must purchase rice at the market price and sell it at a price not lower than the market price.

When introducing the public stockholding program, the government decided to reset the quantity of rice reserves every three years based on changes in consumption. The government did so in the beginning but maintained a similar level of rice reserves from 2008, failing to reflect the decreasing trend in rice consumption. For example, from 2005, the government set the base quantity for rice reserves at the end of the 2005 food grain year at 864,000 tons, establishing the operating rule of purchasing and releasing 432,000 tons annually. In 2008,

considering a fall in consumption, the government set the quantity at 720,000 tons, which was about 17% of the average consumption in 2005-2007. Then it decided to purchase 360,000 tons annually. From that year to 2016, the government maintained the purchase quantity of 720,000 tons. Then in 2017, it altered the quantity of reserves to 680,000 tons, reflecting the declining rice consumption trend. Meanwhile, the country has additionally stockpiled rice for the ASEAN Plus Three Emergency Rice Reserves (APTERR) since 2014.

The government purchases rice for reserves at the market price during the harvest period (October to December). The price at harvest time is not yet determined while the government purchases rice for reserves. Therefore, the government preferentially paid a certain percentage of the average rice price in producing areas across the country in August (some 80-90% of the price, based on the first-grade rice) for rice produced until 2016, and then settled the payment after the price at harvest time was decided. Meanwhile, it was pointed out that the amount the government preferentially paid influenced the rice price in the harvest season in the relevant year. Therefore, the government altered the payment method, paying a fixed amount (KRW 30,000/40kg, based on the 1st-grade rice) starting from rice produced in 2017. As to the price of rice reserves released, it was determined based on the market price.

Import Management

With the launch of the WTO in 1995, Korea became its member. According to the results of UR negotiations, the country agreed on tariffication of all agricultural products, but it was permitted to delay tariffication twice (1995-2004 and 2005-2014) exceptionally for rice. In exchange for the tariffication delay, the mandatory minimum market access (MMA) quantity gradually increased. The MMA quantity was determined based on rice consumption (based on milled rice)

in the base period of 1988-1990. The MMA volume was gradually raised from 1% of the consumption (51,307 tons) in 1995 to 4% (205,229 tons) and 8% (408,700 tons) of the consumption in 2004 and 2014, respectively.

When the tariffication delay ended in 2014, the government decided to open its rice market through tariffication. It set a tariff rate at 513% based on the difference in rice prices at home and abroad in 1986-1988, notifying the WTO of the tariff rate on September 30, 2014. Five countries, namely the U.S., China, Australia, Thailand, and Vietnam, raised objections to the method of the tariff rate, the method of operating a tariff rate quota (TRQ), etc. After undergoing the verification by such countries, the tariff rate was finally set at 513% and the existing MMA quantity of 408,700 tons was maintained. In addition, the obligation to import table rice, which had been applied since 2005, was deleted. Meanwhile, the government applied quotas to the five countries that had objected to the MMA volume of 388,700 tons.

Yellow Soybeans

Supply and Demand Trend

Over the last decade (2009-2019 food grain years), the annual demand for beans was slightly less than 1.4 million tons. Of the quantity, animal feed accounted for about 1 million tons; processing, some 300,000 tons; and food, about 100,000 tons. Soybeans for animal feed and processing mostly rely on imports. Most soybeans produced in Korea are used for food, and a tiny quantity of the beans are used for processing. Recently, the output of Korean soybeans has been slightly rising due to consumer preference for domestic soybeans, and the government endeavors to raise the sufficiency rate of soybeans.

Table 3-5 Soybean supply and demand by year

(in 1,000 tons, kg/person)

Food grain year	1990	1995	2000	2005	2010	2015	2016	2017	2018(p)
Supply	1,450	1,820	1,781	1,493	1,448	1,603	1.574	1,457	1,493
Carryover from the preceding year	106	231	79	117	73	147	129	88	69
Production	252	154	116	139	139	139	104	75	86
Import	1,092	1,435	1,586	1,236	1,236	1,317	1,342	1,294	1,338
Demand	1,254	1,558	1,694	1,420	1,381	1,474	1,486	1,388	1,370
Table purpose	355	402	399	441	417	315	304	237	232
Animal feed	866	1,142	1,282	965	952	1,041	1,066	1,045	1,033
Seed and others	33	14	13	14	12	11	8	7	7
Inventory at year end	196	262	87	73	67	129	88	69	121
Annual consumption	-	9.0	8.5	9.3	8.3	8.2	8.0	6.5	6.4

Regarding the shares of soybeans by use (based on 2018), soybeans for cooking oil and tofu account for a large percentage at about 58% and 18%, respectively. Soybeans for non-food use also take up a high share of 16%. Almost 100% of the cooking oil and non-food soybeans are produced using imported soybeans, while some 20% of tofu is made using domestic soybeans.

Per capita annual consumption of soybeans has gradually decreased. About 10 years ago, soybean consumption was about 8kg per year, but it fell to about 6.5kg recently.

Production Support Policy

For soybeans, the government has implemented a procurement program since 1968 to prepare for unstable international grain supply and demand. The government intended to set the purchase price at a level higher than the market price to induce soybean production, thereby raising the soybean sufficiency rate. However, the market price of soybeans fluctuated depending on harvests. As a result, the market price became often higher than the purchase price. In this case, farmers who signed an agreement on government procurement often failed

Table 3-6 Soybean procurement status by year

Classification		2013	2014	2015	2016	2017	2018	2019
Planned procurement (tons)		15,000	10,000	20,000	25,000	30,000	55,000	60,000
Procurement price KRW/kg)		3,868	3,868	3,868	3,868	3,868	4,011	4,200
Procurement performance (tons)	Total	8,944	9,404	11,424	2,114	10,729	547	16,676
	(Procurement ratio, %)	59.6	94.0	57.1	8.5	35.6	1.0	27.8

Note: 1) The procurement ratio means the ratio of the planned procurement to procurement performance.
2) The procurement price is based on the price of the 1st class large-seed soybeans.
Source: Korea Agro-Fisheries and Food Trade Corporation.

to fulfill their obligations, causing poor public procurement results. In 2019, for instance, the purchase price was raised by 3.7% from the preceding year, but the procured quantity was only 547 tons, down about 5% from the year earlier.

When the rice price sharply fell due to overproduction, the government introduced a crop conversion program in the 2010s. Under the program, the government paid a fixed amount to farmers if they cultivated crops other than rice in their paddies. Through this program, the government intended to alleviate an oversupply of rice and enhance the self sufficiency rates of food crops like soybeans. From 2011 to 2013, it implemented the income source diversification in the paddy field program, paying KRW 3 million per ha if farmers cultivated soybeans in their paddies. Also, the government adopted a program to support other crops in rice paddies, annually adjusting the unit price of support according to budgetary conditions.

Meanwhile, to increase the consumption of Korean soybeans, the government implemented a different compensation program (for soybeans produced in 1989-1991). Through the program, the government made up the difference in prices of domestic and foreign soybeans for processing companies that consumed soybeans.

Import Management System

In UR negotiations, a tariff was set on soybeans based on the tariff equivalent (TE) that corresponded to the difference in domestic and foreign soybean prices. In response, Korea has imported the current market access (CMA) quantity since 1995. The CMA volume is 1.03 million tons, including 186,000 tons for table purpose and 846,000 tons for animal feed. The CMA volume has been determined based on the average quantity imported from 1988 to 1990. The government has arbitrarily increased the CMA quantity, considering domestic soybean supply and demand, etc. in the relevant year. This is a measure to minimize a rise in consumer prices because the unit price of soybeans affects the prices of processed goods like tofu, raising consumer prices. On the other hand, some criticize that the measure to arbitrarily increase CMA quantity weakens the price competitiveness of domestic soybeans and undermines the production base.

Barley

When Korea was not self-sufficient in rice, barley was important as a major staple food for Koreans. However, as the nation became self-sufficient in rice and wheat consumption surged, barley consumption and production gradually decreased, losing its position as a key food crop. The cultivation area of barley, including hulled barley, hulless barley, and two-rowed barley, has shrunk from about 68,000 ha in 2000 to 40,000 ha in 2020. The yield per unit area of barley has fluctuated dramatically depending on the weather conditions. From 2000 to recent years, the yield per ha was 1.4-3.0 tons. The output also significantly fell from some 270,000 tons to less than 100,000 tons during the same period. On the other hand, the aggregate demand for barley decreased only slightly

from 343,000 tons in 2000 to 328,000 tons in 2018. That was because domestic production declined during the period but imports went up. The share of barley for table purpose in the aggregate demand is about 20%. Except for about 5% used for animal feed, some 70% of the total demand is used for alcohol. Entering the 1990s, per capita annual consumption of barley decreased to 2kg or less and remained at about 1.5-1.7kg until the early 2000s. However, it has reduced to just above 1kg since 2003.

While barley consumption for table purpose declined, barley for processing, which accounted for most consumption, was supplied through imports. As a result, the stock of domestic barley rose, amounting to 319,000 tons, a quantity equivalent to annual consumption, in 2005. However, with domestic production gradually decreasing, the inventory of barley plunged to about 50,000 tons recently.

When the nation lacked rice, the government introduced a procurement program to encourage farmers to produce barley. However, when barley consumption fell each year, it abolished the procurement program in 2012. In UR negotiations, the market for general barley was opened through tariffication. Because there were no imports between 1986 and 1988, MMA opportunities were guaranteed. The MMA volume rose from 14,150 tons in 1995 to 23,582 tons in 2004. The MMA quantity for 2004 was equivalent to 5% of the consumption in the base period. A tariff of 20% was set on the MMA volume in 2004, and 324% was imposed on barley, except for the MMA volume. The CMA has been applied to two-rowed barley. A tariff of 30% applies to the CMA volume, while a 513% tariff is imposed on the quantity other than the CMA volume. The imports of barleycorn have risen from 146,000 tons in 2000 to 239,000 tons in 2018 due to the volume used for alcohol.

Corn

Corn produced in Korea is mostly green corn. A shortfall in corn demand for processing is met by imports. Based on the self-sufficiency rate of grain, including corn for animal feed, the nation's self-sufficiency rate of corn has remained at about 1% since 2000. The domestic output of corn is insignificant.

Corn production slightly decreased from 79,000 tons in 2000 to 73,000 tons in 2018. Demand tended to rise from 8.61 million tons to 9.89 million tons during the same period. Of the demand in 2018, corn for table purposes was just 95,000 tons (1.0%), and corn for animal feed was 7.67 million tons, taking up 77.5%. Recently, the output of domestic corn has remained at a level satisfying the demand for table purposes.

Corn imports rose from 8.89 million tons in 2000 to 9.99 million tons in 2018. That was because the price of imported corn was lower than domestic corn and thus, demand for processing and animal feed increased fast.

Corn was subject to government procurement. Therefore, the government endeavored to reduce price volatility by purchasing a certain quantity and then releasing it to the market when necessary. However, it abolished the procurement program in 2011.

Through UR negotiations, the government has imported the CMA volume of 6.1 million tons at a tariff of 3%. For the other volume, it lowered the tariff rate from 365% in 1995 to 328% in 2004. However, considering the impact of imports on corn prices, the government has imported corn by imposing a low tariff on a certain quantity of corn other than the CMA volume.

Wheat

The share of wheat produced in Korea is insignificant, and the nation is heavily dependent on imports for wheat consumption. Since 2000, its self-sufficiency rate of wheat has remained at less than 1%. Wheat was the first grain to be influenced by market opening, and the abolition of the wheat procurement program in 1984 caused a drastic fall in domestic production. In 1980 when the procurement program was in effect, the nation produced 92,000 tons of wheat, but its wheat production dropped to less than 10,000 tons since 1990. In the late 2000s, due to rising demand for domestic wheat, wheat production recovered to about 30,000 tons. In 2019, the government resumed the wheat procurement program, which was suspended in 1984, purchasing some 10,000 tons of wheat.

Wheat imports were less than 3 million tons in the 1990s but increased to over 3 million tons in 2000. In 2012, the country imported 3 million tons only for animal feed, making the total wheat imports surpass 5 million tons. In 2018, it imported about 3.7 million tons of wheat. Major wheat exporters included the United States, Australia, and Canada. Among them, the U.S. and Australia have exported a large portion of wheat for milling.

Demand for wheat rose from about 3.28 million tons in 2000 to about 3.70 million tons in 2018. In 2018, wheat consumption for food was 1.09 million tons, and domestic production of wheat took up only 1.2% of the wheat demand for food. Wheat demand for animal feed was met entirely by imports. Of the aggregate demand for wheat in 2018, the share of wheat for processing and animal feed accounted for 27.7% and 41.3%, respectively.

Prospects and Tasks

Through rice negotiations in 2004, the government abolished the rice purchasing program, which was price support policy, and instead promoted a balance in rice supply and demand through market functions. It also introduced the public stockholding program to ensure food security, as well as the income compensation program for rice farmers to stabilize their incomes. However, the income compensation scheme biased toward rice caused a continued oversupply of rice and the excess of the total AMS. Therefore, it became inevitable to reorganize the direct payment program for rice. Moreover, because direct payments for rice were provided in proportion to the cultivation area, income inequality worsened between small and large farm owners. In addition, while public interest in and expectations for public functions of agriculture and rural areas were growing, the existing direct payment program had limitations in satisfying such public needs. Hence, the government has reorganized the income compensation scheme biased toward rice into the public-purpose direct payment program. Through this reorganization, the government should endeavor to alleviate an imbalance in supply and demand for rice, while helping the new program contribute to increasing farm household income. Farmers should faithfully fulfill their obligations, making utmost efforts to enhance the public benefits of agriculture and rural areas. Only when they do so, the direct payment program can be justified by the general public.

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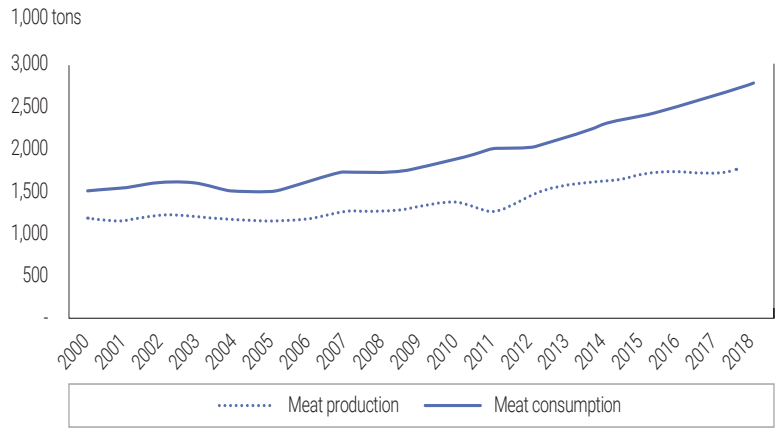
2. Livestock

Outline

Despite many challenges concerning the domestic livestock industry, demand for livestock products has risen with national income and the population increasing. As a result, livestock production has grown and the share of the livestock industry in agriculture has gone up. Meat consumption rose from about 1.51 million tons in 2000 to about 1.82 million tons in 2018, growing by an annual average of 3.4%. Meat production increased 2.3% from some 1.19 million tons to some 1.78 million tons. During the same period, the growth rate of meat consumption exceeded that of meat demand. Consequently, meat imports went up and the self-sufficiency rate of meat went down from 78.8% to 63.0%.

The output of meat temporarily decreased in 2011 due to the burial of

Figure 3-3 Trends in meat consumption and production



Source: National Agricultural Cooperative Federation (NACF), *Data on Prices of, and Supply and Demand for, Livestock Products*.

cattle and pigs after foot-and-mouth disease (FMD) broke out at the end of 2010. Nonetheless, meat production has been steadily growing due to rising consumption.

Beef

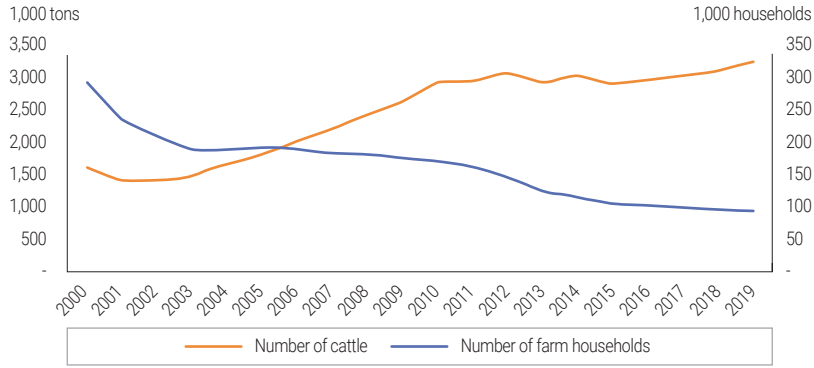
Korean cattle (Hanwoo)

Due to the financial crisis in 1998 and tariffication of beef imports in 2001, the number of Korean cattle has decreased to about 1.4 million in 2001. However, due to rising demand for Korean beef and an increase in Korean beef prices, the number surpassed 3 million in 2012. The number of Korean cattle was slightly adjusted after 2013, but it began to increase again in 2017, reaching approximately 3.24 million in 2019.

The number of farm households raising Korean cattle fell from 290,000 in 2000 to 94,000 in 2019. Due to the financial crisis and import liberalization, the number of farms with less than ten heads drastically decreased. This trend has accelerated recently due to subsidization for FTA-related business closure. While the number of cattle increased, the number of farms raising cattle decreased. Therefore, the number of cattle per farm household rose from 5.5 in 2000 to 34.4 in 2019.

With an increase in national income, annual beef consumption per capita rose

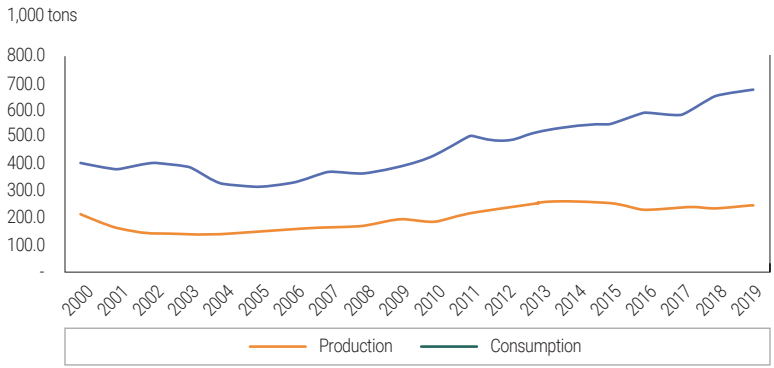
Figure 3-4 Number of farms raising Korean cattle and cattle raised



Source: Statistics Korea, *Livestock Statistics*.

from 8.6kg in 2000 to 13kg in 2019. However, due to the outbreak of mad cow disease in the United States, it decreased to 6.6kg in 2005 and then recovered to 8.1kg in 2009. The self-sufficiency rate of beef exceeded 50% before 2000,

Figure 3-5 Beef production and consumption



Source: NACF, *Data on Prices of, and Supply and Demand for, Livestock Products*.

Table 3-7 Beef import volume by country (based on inspection)

(in tons)

Year	The U.S.	Australia	Canada	New Zealand	Mexico	Others	Total
2005	0	101,363	0	39,001	0	2,227	142,593
2010	90,567	121,791	0	30,948	1,780	0	245,146
2011	107,202	145,241	0	33,121	3,892	0	289,444
2012	100,359	124,210	2,059	25,590	1,282	0	253,522
2013	89,238	142,799	1,491	22,299	108	682	257,107
2014	104,953	150,863	2,739	20,961	295	661	280,472
2015	112,512	164,109	800	18,169	395	1,407	297,394
2016	153,179	177,531	5,556	20,295	1,355	3,616	361,532
2017	168,471	149,877	4,512	17,670	1,396	2,257	344,184
2018	219,772	167,452	3,818	18,276	4,301	2,077	415,696
2019	237,639	163,160	5,771	12,760	6,192	1,121	426,643

Source: Ministry of Food and Drug Safety.

but it fell to 42.3% in 2001 when tariffication of beef imports was implemented. In 2003, it decreased further to 36.3%. Since 2004, beef imports have dropped significantly due to a quarantine issue over U.S. beef, while domestic beef production has risen, causing the beef self-sufficiency rate to recover to 50.0% in 2009. However, because a rise in Korean beef prices led to an increase in imports, the rate fell to 36.5% in 2019.

Due to a growth in the number of cattle raised, domestic beef production has steadily increased since it reached the lowest level in 2003. Though domestic production temporarily slowed due to the outbreak of FMD in 2010, beef consumption has continued to rise with the expansion of the market to beef imports.

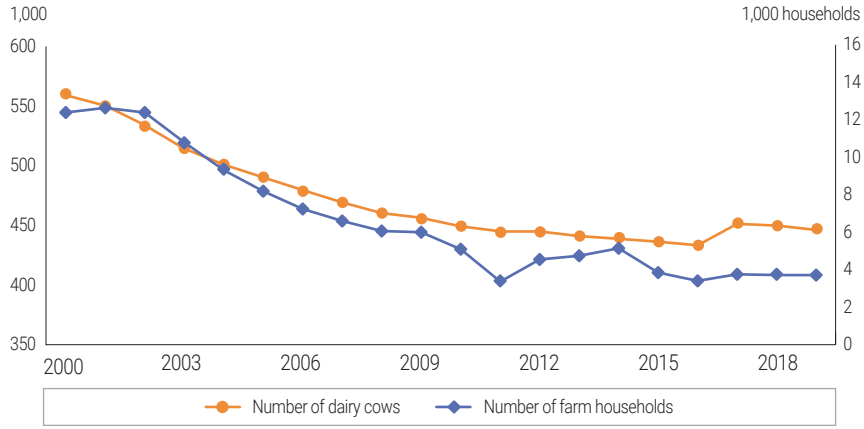
According to the UR negotiations concluded in December 1993, beef imports were completely liberalized. The tariff imposed on beef imports was 41.6%. The tariff was reduced equally every year and 40% applied to beef imports from 2004. However, since the Korea-U.S. FTA came into effect in 2012 and

the Korea-Australia FTA, in 2014, tariff rates of major beef exporting countries have gradually declined. Import tariffs of U.S. and Australian beef are equally lowered over 15 years after the FTAs enter into effect. In 2019, the beef import volume was 426,600 tons. Of the volume, U.S., Australian, and New Zealand beef accounted for 55.7%, 38.2%, and 3.0%, respectively.

Milk

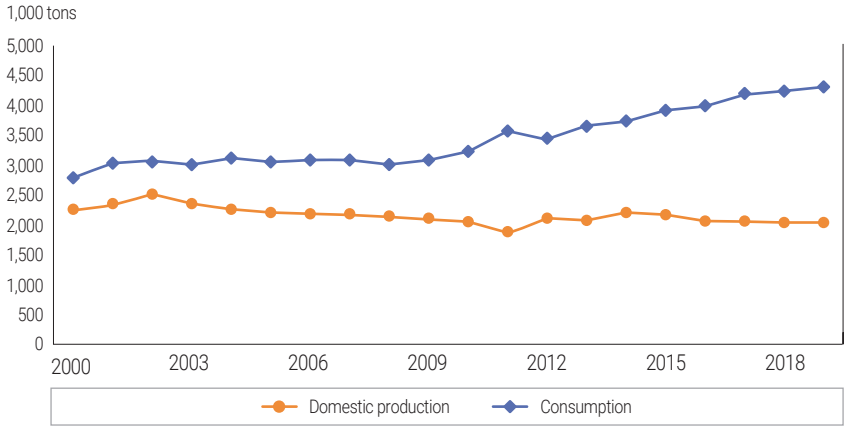
The number of dairy cows dropped from 543,708 in 2000 to 408,135 in 2019. Also, the number of dairy farm households decreased from 13,348 in 2000 to 6,168 in 2019. The number of farms decreased more rapidly than the number of dairy cows. Therefore, the number of dairy cows per farm rose from 40.7 in 2000 to 66.2 in 2014. Due to an increase in business closure of small farms, the number of farms raising dairy cows is declining steadily. The number of dairy cows per

Figure 3-6 Trends in the number of farms raising dairy cows and dairy cows raised



Source: Statistics Korea, *Livestock Statistics*.

Figure 3-7 Milk consumption and domestic production



Source: MAFRA, Statistics Korea.

farm household is rising accordingly.

Despite a fall in the number of dairy cows, the quantity of milk per head increased, causing raw milk production to rise from about 2.25 million tons in 2000 to about 2.53 million tons in 2002. In contrast, milk consumption remained stagnant and thus, the issue over an overstock of powdered milk arose. In response, the government implemented a differentiated pricing system for surplus milk to reduce the production of raw milk. Due to this policy, raw milk production fell to about 2.05 million tons in 2019.

Per capita annual consumption of dairy products rose from 59.8kg in 2000 to 83.9kg in 2019. Of the dairy product consumption, market milk consumption increased from about 1.67 million tons in 2000 to about 1.70 million tons in 2008, but it reduced to some 1.69 million tons in 2018. In contrast, the consumption of cheese (natural and processed cheese) soared from 44,189 tons in 2000 to 154,680 tons in 2018.

Table 3-8 Value of dairy imports by year

(in USD thousands)

	Total value of imports	Milk powder				Butter	Whey	Cheese
		Fortified (19 types)	Mixed	Skim	Whole			
2000	193,176	6,022	42,381	4939	1,307	1,999	12,748	70,640
2005	370,204	23,026	72,657	14,634	4,342	12,806	14,746	143,572
2010	682,649	36,829	90,696	24,502	4,410	24,401	40,662	258,750
2015	1,054,691	64,499	92,165	55,754	6,392	26,912	46,445	501,736
2016	998,654	72,696	89,048	43,203	10,303	39,281	38,201	429,009
2017	1,223,539	75,081	117,731	53,438	15,818	51,219	42,767	535,770
2018	1,293,932	83,482	123,652	49,552	20,193	71,491	40,843	533,869
2019	1,369,889	88,327	133,424	6,077	19,508	86,113	46,155	555,074

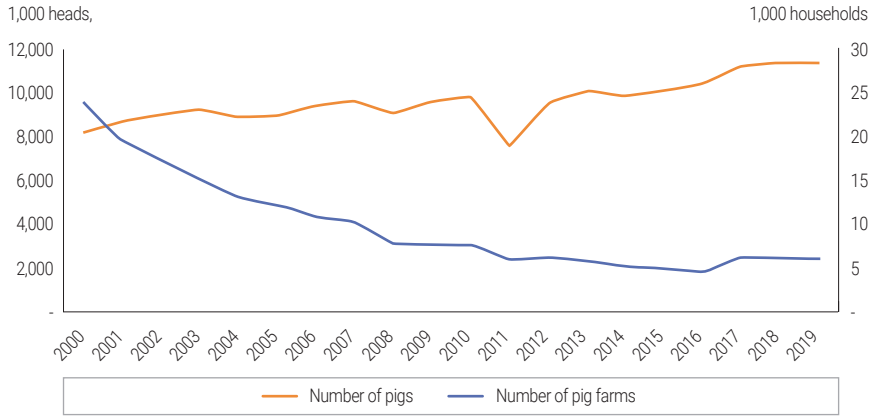
Source: Korea Dairy Committee.

In 2019, the amount of dairy imports reached about USD 1.40 billion, which was significantly higher than USD 193.2 million in 2000. Of the dairy products imported in 2019, cheese accounted for the highest share at 40.5%. Because skim milk powder and whole milk powder are imported at high tariffs for quantities exceeding TRQs, they take up a small share in imported dairy products. The tariff rate of mixed milk power is low, so it accounts for the second-highest share of 9.7% in the total amount of dairy imports, following cheese.

Pork

The number of pigs raised at farms went up from 8.21 million in 2000 to 11.38 million in 2019. Though the number of pigs amounted to 9.82 million in 2010, it fell to 7.58 million in 2011 due to FMD that broke out at the end of 2010. Due to a decline in the number of pigs released in 2011, the wholesale price of pigs increased. Thus, the number of sows rose, exceeding 10 million for the first time

Figure 3-8 Trends in the number of pig farms and pigs raised



Source: Statistics Korea, *Livestock Statistics*.

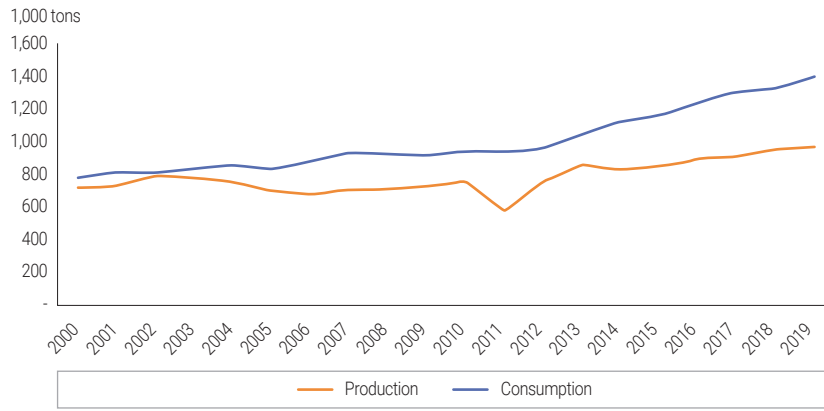
in 2013.

The number of pigs underwent temporary adjustments as the wholesale price dropped in 2014. However, it increased again due to a continued rise in demand and reasonable prices. On the other hand, the number of farms raising pigs decreased from 23,841 in 2000 to 6,152 in 2019, making the farming scale per farm household sharply increase during the same period.

With national income growing, per capita annual consumption of pork rose from 16.5kg in 2000 to 28kg in 2019. Pork production also increased from 714,445 tons to 968,895 tons during the same period. As pork consumption grew faster than pork production, imports went up as well, lowering the pork self-sufficiency rate from 91.6% in 2000 to 69.7% in 2019.

According to the outcomes of UR negotiations, the import tariff for pork was equally reduced each year from 33.4% in 1997 to 25% in 2004. The Korea-Chile FTA that took effect on April 1, 2004 decided to lower tariffs on Chilean

Figure 3-9 Trends in pork production and consumption



Source: NACF, *Data on Prices of, and Supply and Demand for, Livestock Products.*

pork imports, completely eliminating them within 10 years. The Korea-U.S. FTA, which entered into force in 2012, decided to eliminate tariffs on U.S. pork imports starting from 2016. In addition, according to the Korea-E.U. FTA that came into force in 2011, tariffs on E.U. pork imports would be fully removed from 2020.

Pork imports grew from 95,892 tons in 2000 to 421,124 tons in 2019. However, due to the impact of FMD that broke out from November 2010 to April 2011, 3.3 million domestic pigs were killed. As the pork production fell, pork imports in 2011 surged to 370,248 tons. Afterwards, the volume of pork imports decreased to 180,000 tons in 2013 due to a rise in domestic production. Nonetheless, domestic consumption has increased more rapidly than production, leading to a continued rise in imports. Pork has been mostly imported from Europe and the United States. Of the pork imports in 2019, U.S. pork accounted for 41.3%.

Table 3-9 Volume of pork imports by country

(in tons)

Year	Denmark	Belgium	Hungary	Canada	The U.S.	The Netherlands	Chile	France	Austria	Poland	Others	Total
2005	8,597	16,889	6,866	20,182	43,155	9,483	25,334	0	0	0	43,050	173,556
2006	10,033	18,497	9,636	26,060	60,849	10,746	22,346	0	0	0	52,388	210,555
2007	11,102	16,809	10,005	29,358	70,169	13,453	31,808	21,431	13,984	11,584	17,700	247,403
2008	6,504	14,191	8,966	28,406	72,365	11,390	19,447	17,274	16,387	6,695	12,664	214,289
2009	1,813	10,578	4,738	26,244	74,826	11,295	36,303	14,207	12,839	2,496	14,502	209,841
2010	1,005	13,277	3,506	17,740	50,969	13,154	29,862	13,852	13,332	2,130	20,664	179,491
2011	16,330	13,831	7,523	47,544	142,954	18,893	24,969	16,465	17,934	9,241	54,564	370,248
2012	3,581	9,672	4,054	22,944	111,106	13,967	27,506	11,335	12,012	10,231	49,747	276,155
2013	1,826	6,958	1,907	10,430	75,720	8,627	19,470	6,403	8,424	6,661	38,535	184,961
2014	5,838	9,915	4,593	11,422	93,911	9,608	18,132	10,982	14,782	3,553	91,151	273,887
2015	11,100	11,471	4,218	16,695	129,363	15,267	26,562	8,723	15,492	0	119,905	358,796
2016	7,559	10,723	4,472	13,093	106,089	14,409	22,179	7,122	13,365	0	119,485	318,496
2017	8,857	9,230	3,540	14,706	135,085	22,650	21,779	7,441	13,895	0	132,077	369,260
2018	11,040	0	3,056	22,480	184,639	24,699	25,965	7,940	14,002	0	169,682	463,503
2019	7,994	0	0	25,305	173,753	19,877	24,882	5,314	10,682	0	153,317	421,124

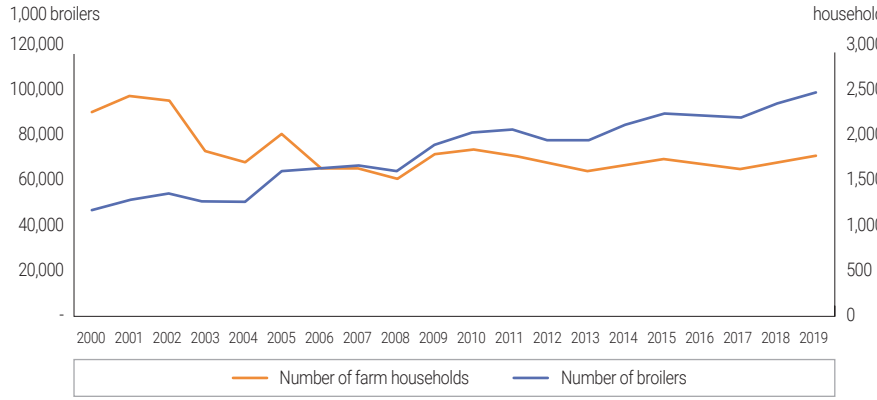
Source: Ministry of Food and Drug Safety.

Chicken Meat

The number of broilers raised grew from 46.89 million in December 2000 to 98.14 million in December 2019. Due to the outbreak of avian influenza (five times in 2003, 2006, 2008, 2010, and 2014), the number temporarily decreased, but it has continued rising. The number of farm households raising broilers fell from 2,259 in 2000 to 1,765 in 2019. While the number of broilers grew, the number of broiler farms dropped, thereby increasing the number of broilers per farm from 20,763 to 55,602.

With the number of broilers rising, the number of slaughtered chickens also increased from 394.91 million in 2000 to 1.06 billion in 2019. The weight of broilers released hardly changed. Due to the rise in broilers, production of

Figure 3-10 Trends in the number of broiler farms and broilers raised

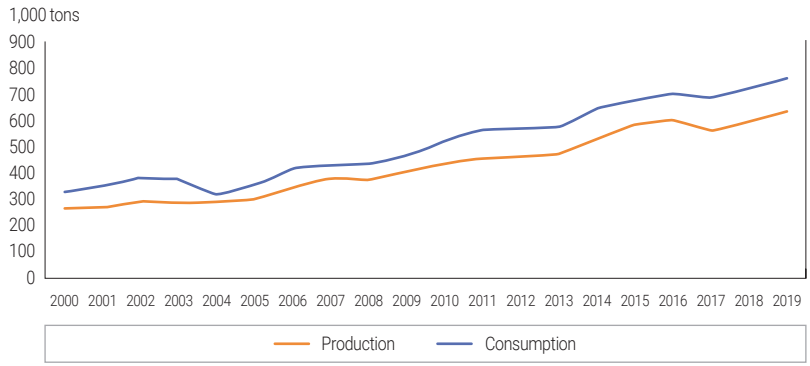


Source: Statistics Korea, *Livestock Statistics*.

chicken meat jumped from 261,500 tons in 2000 to 636,004 tons in 2019.

In livestock, integration has been actively promoted for the broiler industry. As a result, integrated chicken meat production currently accounts for over 90%

Figure 3-11 Trends in chicken meat production and consumption



Source: NACF, *Data on Prices of, and Supply and Demand for, Livestock Products*.

Table 3-10 Volume of chicken meat imports by country

(in tons (%))

	The U.S.	Denmark	Brazil	China	Others	Total
2005	20,651	20,346	1,140	7,165	9,201	58,503
2006	40,482	4,088	15,847	11,484	3,674	75,575
2007	19,921	1,637	22,583	11,889	4,000	60,030
2008	34,123	2,592	21,030	6,576	5,794	70,115
2009	29,423	2,065	30,161	3,516	5,460	70,625
2010	54,744	3,339	34,025	4,246	9,447	105,802
2011	86,620	3,874	24,904	3,255	12,297	130,949
2012	54,479	3,411	56,919	2,379	13,201	130,389
2013	45,308	5,422	59,411	2,468	14,083	126,693
2014	64,937	6,483	52,377	2,384	15,220	141,400
2015	10,752	7,208	80,114	3,089	17,437	118,600
2016	7,110	6,357	93,553	3,468	17,849	128,336
2017	12,368	5,349	86,289	4,261	23,606	131,873
2018	10,041	5,465	108,485	6,174	32,622	162,787
2019	3,007	7,654	116,996	6,768	43,373	177,797

Source: Korea Agricultural Trade Information (KATI).

in the total chicken meet production. Per capita annual consumption of chicken meat considerably rose from 7.0kg in 2000 to 14.8kg in 2019. The self-sufficiency rate of chicken meat climbed from 79.9% in 2000 to 83.2% in 2019.

As the Korea-E.U. FTA and the Korea-U.S. FTA took effect in 2011 and 2012, respectively, tariffs for imported frozen chicken meat dropped. The government has steadily lowered tariff rates for chicken meat imported from the E.U. and the U.S. It would completely eliminate the tariff rates in 2020 and 2021, respectively. In 2010, the volume of chicken meat imports surpassed 100,000 tons as the market for chicken meat imports expanded due to a boom in Korean chicken food called dak gangjeong (sweet and sour chicken). In 2015, avian influenza broke out in the United States, causing restrictions on chicken meat imports from the country. In contrast, Brazilian chicken meat imports surged

due to a rise in demand for boneless chicken thighs. As of 2019, the volume of chicken meat imports reached 177,797 tons, out of which Brazilian chicken meat accounted for 65.8%.

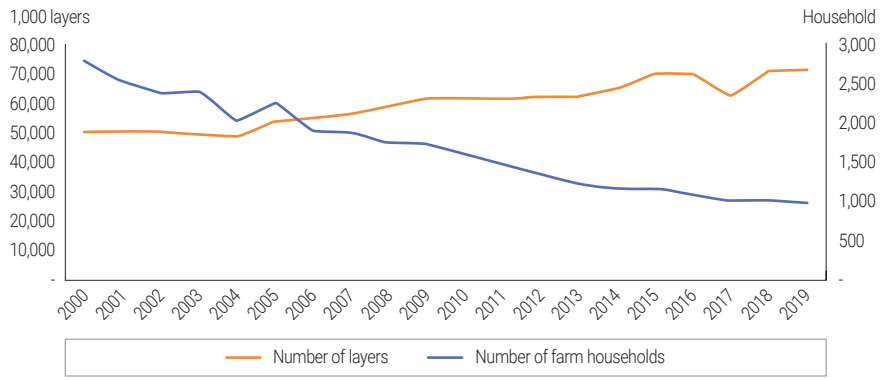
Chicken meat exports grew from 1,710 tons in 2000 to 49,542 tons in 2019. The government promoted chicken meat exports in earnest from 2002. However, it faced difficulties in 2002, 2004, 2011, 2014, and 2017 when avian influenza broke out. The volume of exports sharply increased to 26,117 tons in 2013, but it plunged from the year earlier as avian influenza broke out again in 2014 and 2017. Of the volume of chicken meat exports in 2019, whole chickens (frozen) made up 59.3% and chicken thighs (frozen), 17.8%. These chickens were mostly exported to Vietnam. In addition, exports of sealed chicken soup with ginseng accounted for 4.8% and these products were exported to the U.S., Japan, Taiwan, and Hong Kong.

Eggs

Laying hem

The number of layers raised rose from 50.64 million in December 2000 to 71.11 million in December 2019. Due to the outbreak of avian influenza in 2003, 2006, 2008, 2010, 2014, and 2017, the number of layers temporarily decreased, but it continued to rise nonetheless. The number of farms raising layers decreased drastically from 2,722 in 2000 to 965 in 2019. While the number of layers rose, the number of farms raising them

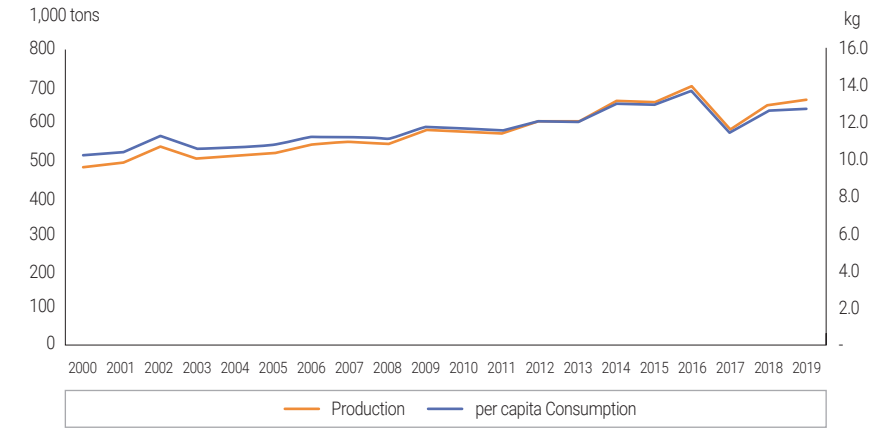
Figure 3-12 Trends in the number of layer farms and layers raised



Source: Statistics Korea, *Livestock Statistics*.

fell. Consequently, the number of layers per farm grew from 18,231 to 73,690 during the period.

Figure 3-13 Trends in egg consumption and production



Source: NACF, *Data on Prices of, and Supply and Demand for, Livestock Products*.

A rise in layers led to a sharp growth in egg production. Egg production soared from 478,800 tons in 2000 to 700,716 tons in 2016, reaching a record high. However, as pesticide-contaminated eggs were found in many farms, egg production plunged to 577,100 tons in 2017. Nevertheless, the production quickly recovered, rising again to 658,910 tons in 2019. Per capita annual consumption of eggs increased from 10.2kg in 2000 to 12.8kg in 2019. No change occurred in the self-sufficiency rate of eggs as it stood at 99.6% and 99.5% in 2000 and 2019, respectively.

Prospects and Tasks

Despite the livestock market's opening, the nation's livestock industry has grown through quality improvement, productivity improvement, and cost reduction. In the process, livestock farm income has steadily increased as well. In addition, the livestock industry has supplied high quality protein to the people and led the growth of related industries, considerably contributing to creating jobs.

In the development of the industry, however, environmental pollution caused by livestock manure and civil complaints about livestock odors have triggered conflicts in local communities. Without solving these environmental problems, the livestock industry is unlikely to grow continuously. In order for the nation's livestock industry to develop into a sustainable industry, it should endeavor to create a livestock environment harmonized with the surroundings, in addition to enhancing its competitiveness through productivity improvement.

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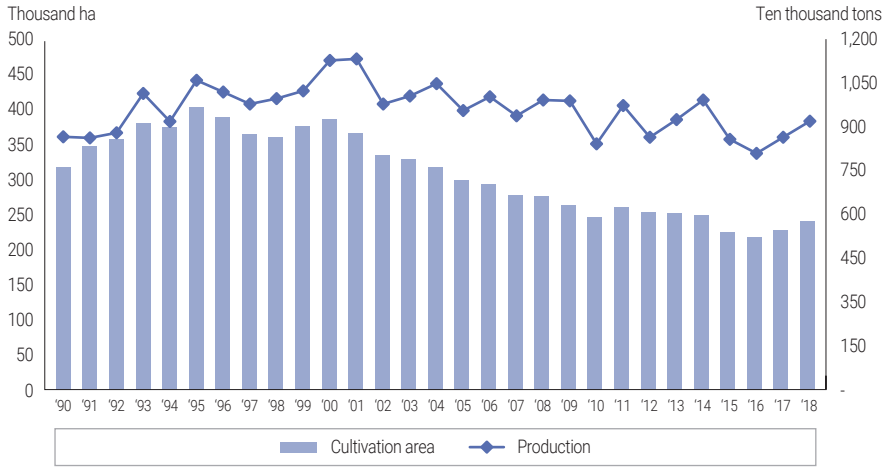
3. Horticulture and Specialty Crops

Vegetables

Production Trends

The cultivation area of vegetable expanded from 320,000 ha in 1990 to 400,000 ha in 1995. Then the area turned to decrease, reaching 370,000 ha in 2000, 260,000 ha in 2010, and 240,00 ha in 2018. This phenomenon happened because farmers grew old and the nation's agricultural market was further opened with the conclusion of the FTAs. The vegetable cultivation area declined by an annual average of 1%. In contrast, vegetable production increased by an average of 0.2% a year to 9.19 million tons in 2018 due to facility modernization and technological advancement. In particular, the share of facilities for vegetables steadily rose from 12.6% in 1990 to 23.1% in 2018 due to active

Figure 3-14 Trends in the vegetable cultivation area and production



Source: MAFRA, each year, *Greenhouse Status of Protected Vegetables and Production Performance of Vegetables*.

Table 3-11 Trends in the cultivation area by vegetable type

(in thousands ha (%))

Category	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
Condiment vegetables	136.4 (43.1)	172.7 (42.8)	162.7 (42.1)	132.4 (44.4)	107.5 (43.8)	111.3 (42.7)	111.2 (44.1)	112.9 (44.9)	103.6 (42.0)	90.8 (40.4)	92.1 (42.3)	93.4 (41.2)	104.5 (43.6)
Root vegetables	41.8 (13.2)	42.4 (10.5)	45.3 (11.7)	31.3 (10.5)	25.5 (10.4)	26.6 (10.2)	24.9 (9.9)	25.2 (10.0)	24.4 (9.9)	24.3 (10.8)	22.6 (10.3)	26.0 (11.4)	26.6 (11.1)
Leafy vegetables	63.3 (20.0)	72.2 (17.9)	74.3 (19.2)	59.5 (20.0)	47.3 (19.3)	59.5 (22.9)	52.4 (20.8)	52.2 (20.7)	53.1 (21.5)	46.5 (20.7)	43.6 (20.0)	50.4 (22.2)	51.1 (21.3)
Fruiting vegetables	57.7 (18.2)	90.4 (22.4)	75.7 (19.6)	67.0 (22.5)	56.5 (23.0)	54.0 (20.7)	56.0 (22.2)	54.0 (21.5)	57.5 (23.3)	56.7 (25.2)	52.1 (23.9)	49.3 (21.7)	49.7 (20.7)
Western vegetables	0.4 (0.1)	0.5 (0.1)	1.7 (0.4)	2.3 (0.8)	3.7 (1.5)	3.6 (1.4)	3.4 (1.3)	3.5 (1.4)	3.7 (1.5)	3.6 (1.6)	3.6 (1.6)	4.0 (1.7)	3.8 (1.6)

Note: Each figure in round brackets shows the ratio of the cultivation area of the relevant vegetable to the total vegetable cultivation area.

Source: MAFRA, each year, *Greenhouse Status of Protected Vegetables and Production Performance of Vegetables*.

government support for facility modernization.

Vegetables are classified into condiment vegetables, root vegetables, leafy vegetables, fruiting vegetables, western vegetables, etc. The area for growing condiment vegetables has taken up the largest share in the vegetable cultivation area (43.6% in 2018). The area for condiment vegetables slightly declined from 136,000 ha in 1990 to 104,000 ha in 2018, shrinking by an average of 0.9% a year. The area for root vegetables also decreased from 42,000 ha in 1990 to 27,000 ha in 2018, shrinking by an average of 1.6% a year. The cultivation area of leafy vegetables declined from 63,000 ha in 1990 to 51,000 ha in 2018, showing an annual average decrease of 0.8%. Fruiting vegetables generated a high income per unit area, so the cultivation area expanded to 90,000 ha in 1995. Afterward, however, it considerably declined to 50,000 ha in 2018. Though western

vegetables made up a small share of the total vegetables, the cultivation area of such vegetables increased from 400 ha in 1990 to 4,000 ha in 2018, growing by an average of 8.1% per year.

Chinese cabbage

The area for cultivating chilis and garlic, which rep resent condiment vegetables, has continuously decreased due to aging farmers, lack of labor, and rising imports from China. The area for chilis was maintained at 60,000 ha until 2005, but afterward, it decreased a lot to some 30,000 ha recently. The garlic cultivation area stood at 40,000 ha in 2000, but it declined to about 20,000 ha in 2010. Recently, it climbed to just below 30,000 ha recently. The area for growing onions rose by an average of 4.6% per year due to the relatively stable price and their image as healthy food. The production of onions amounted to 1.52 million tons in 2018. As a result, the share of onions in the cultivation area of condiment vegetables sharply increased from 5.6% in 1990. In contrast, the area for growing chilis fell from 46.0% to 27.6% and that for garlic, from 32.0% to 27.1% during the same period.

The cultivation area of radishes and carrots, among root vegetables, has been declining by an annual average of 1.6% and 2.4%, respectively, because of reducing consumption and rising imports. The area for cultivating Chinese cabbage, a representative item of leafy vegetables, tends to decrease by an average of 1.5% per year due to a fall in kimchi consumption, while the area for cabbages grows by an average of 2.5% a year due to an increase in eating out.

Table 3-12 Cultivation area and production by major item of vegetables

(in thousands ha, thousands tons)

Category		1990		2000		2005		2010		2015		2018	
		Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
Condiment vegetables	Chili	62.8	132.7	74.5	193.8	61.3	161.4	44.6	95.4	36.1	97.7	28.8	71.5
	Garlic	43.6	416.8	44.9	474.4	31.8	375.0	22.4	271.6	20.6	266.3	28.4	331.7
	Onion	7.6	407.4	16.8	877.5	16.7	1,023.3	22.1	1,411.6	18.0	1,093.9	26.4	1,521.0
Root vegetables	Radish	37.1	1,760.6	40.2	1,759.4	27.1	1,277.5	21.9	1,039.3	20.1	1,249.3	23.4	1,234.6
	Carrot	4.3	87.0	4.5	157.8	3.2	121.4	2.7	102.1	3.1	118.6	2.2	73.1
Leafy vegetables	Chinese cabbage	47.5	3,373.4	51.8	3,149.3	37.2	2,325.3	28.3	1,783.0	26.2	2,059.8	31.1	2,391.9
	Cabbage	4.0	146.9	6.1	274.1	5.2	289.9	4.5	252.7	6.4	318.2	7.9	371.7
Fruiting vegetables	Cucumber	7.0	216.1	7.3	453.5	5.9	403.3	4.4	306.0	4.1	271.0	5.3	391.2
	Pumpkin	4.1	82.3	8.4	240.5	9.3	339.1	9.0	302.9	10.6	364.4	9.2	310.2
	Tomato	2.5	77.7	4.9	276.7	6.7	439.0	5.3	324.8	7.0	457.0	6.1	388.7
	Strawberry	6.9	108.6	7.1	180.5	7.0	202.0	7.0	231.8	6.4	194.5	6.1	183.6
	Watermelon	25.7	593.2	30.5	922.7	23.2	904.9	16.4	678.8	15.2	634.4	11.8	476.6

Source: MAFRA, each year, *Greenhouse Status of Protected Vegetables and Production Performance of Vegetables*.

Among fruiting vegetables, watermelons have the largest cultivation area, which is declining by an average of 2.7% per year due to the aging of farm households and a rise in imported fruits. Consequently, the cultivation area of watermelons took up 44.6% of that for fruiting vegetables in 1990, but it significantly shrank to 23.8% in 2018. The cucumber cultivation area has decreased every year due to the lack of labor and the burden of fuel costs, declining by an average of 0.9% a year. The cultivation area of strawberries once expanded to about 8,000 ha. However, because aging farmers, etc., the area has declined to less than 6,000 ha and recently, it is maintained at about 6,000 ha. On the other hand, the area for cultivating pumpkins and tomatoes has been increasing due to health-conscious consumers and the well-being boom. In particular, the tomato cultivation area declined after the mid-1990s but in

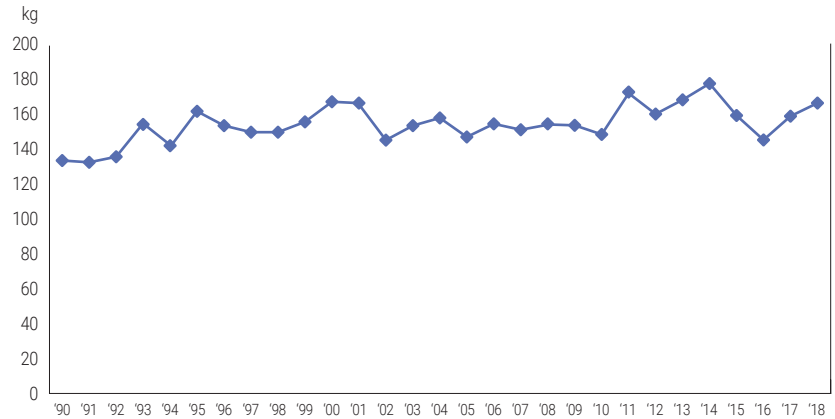
2007, it increased by 49.6% compared with 2000 as consumption rose due to the continued advertisement that tomatoes were good for health. Since then, however, a surge in production led to a fall in tomato prices, and the cultivation area has fluctuated afterward.

Consumption Trends

Per capita annual consumption of vegetables went up from 132.6kg in 1990 to 165.9kg in 2000 but afterward, it went down to about 140-150kg. However, due to a growth in dining-out, changing consumption patterns, etc., vegetable consumption per person rose again, reaching 176.2kg in 2014. It declined to some 160kg recently, standing at 165.3kg in 2018.

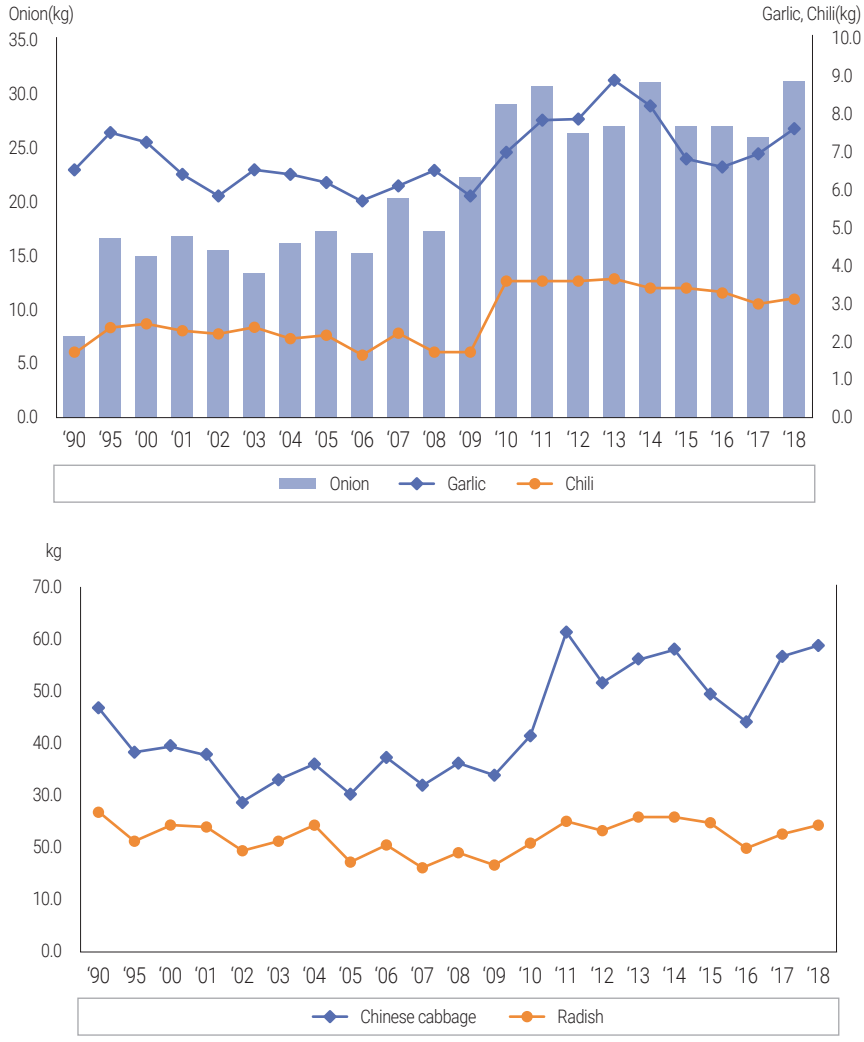
By item, the consumption of chilis and garlic was 3.1kg and 7.6kg, respectively, in 2018, but it has declined due to a fall in kimchi consumption. The consumption of onions remained at 7.4kg in 1990, but it has since increased

Figure 3-15 Trends in per capita annual consumption of vegetables



Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food*.

Figure 3-16 Trends in per capita annual consumption by major item of vegetables



Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food*.

4.2 times to 30.8kg in 2018. As for Chinese cabbages, annual consumption per person dropped from 46.9kg in 1990 to 33.8kg in 2009 as kimchi consumption decreased. However, it rose to about 50kg recently, reaching 58.7kg in 2018. Per capita annual consumption of radishes tended to decline as a whole due to decreasing kimchi consumption, but it was maintained at some 20kg recently.

Export and Import Trends

Vegetable exports soared 3.9 times from USD 110 million in 1995 to USD 430 million in 2019. Among others, exports of kimchi, tomatoes, strawberries, and paprikas, which were fruiting vegetables, were remarkable. In export statistics, kimchi has been classified as vegetables. Of the total volume of vegetable exports, kimchi accounted for the highest share of 24.5% in 2018, and kimchi exports exceeded USD 100 million in the year.

Paprika is the most exported item among fresh vegetables, and its exports surged from USD 24 million in 2003 to USD 92 million in 2018. Tomato exports amounted to USD 23 million in 2000 but sharply decreased since then. The exports went up again in 2010, recording USD 17 million in 2018. As for strawberries, exports to Hong Kong and Singapore rose due to the breeding of excellent domestic varieties. Strawberry exports steadily increased, amounting to USD 54 million in 2018.

Due to the expanded opening of the market for agricultural products, vegetable imports increased 7.1 times from USD 130 million in 1995 to USD 920 million in 2018. Consequently, the nation's trade deficit soared from USD 20 million in 1995 to USD 520 million in 2018. Among representative items of vegetable imports were, chilis, garlic, onions, and carrots. Imports of these vegetables have sharply increased since the 2000s. They are mostly imported from China. Due to a surge in Chinese kimchi, domestic vegetables, such as

Table 3-13 Trends in exports and imports of vegetables

(in thousands tons, USD hundred-thousands)

Category	1995		2000		2005		2010		2015		2019	
	Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount
Vegetable exports (A)	55.6	1,104.3	64.2	1,859.2	88.9	2,314.3	96.4	2,767.5	109.6	3,098.3	199.0	4,291.9
Tomato	2.1	35.2	12.7	229.5	4.3	88.3	2.3	66.4	5.7	125.9	7.5	174.9
Strawberry	2.4	48.6	3.5	95.3	1.0	44.1	3.3	261.2	3.7	330.3	5.7	544.5
Cucumber	2.6	55.3	5.8	98.9	1.0	15.5	0.1	1.6	0.2	7.5	0.2	8.8
Kimchi	12.5	509.1	23.4	788.5	32.3	929.6	29.7	983.6	23.1	735.4	29.6	1,049.9
Paprika	-	-	-	-	17.8	531.4	16.2	583.0	29.4	852.1	35.3	915.2
Vegetable imports (B)	93.2	1,322.4	220.1	1,872.6	587.6	3,812.4	853.9	7,194.9	1,104.4	9,215.8	1,236.1	9,448.4
Chili	4.8	128.5	6.3	108.2	83.1	516.0	156.1	1,137.4	199.2	1,230.3	244.3	1,477.6
Garlic	11.3	105.7	10.5	91.2	42.2	212.4	64.0	1,013.3	62.2	700.6	42.7	370.7
Onion	8.0	59.8	6.1	23.0	41.2	85.4	21.3	111.8	154.4	633.4	35.1	151.5
Carrot	1.1	15.8	11.4	50.6	73.2	292.4	86.4	405.1	97.4	490.4	112.6	464.6
Kimchi	-	-	0.5	2.0	111.5	513.4	192.9	1,020.2	224.1	1,132.4	306.0	1,309.1
Trade balance (A-B)	-	-218.1	-	-13.4	-	-1,498.1	-	-4,427.4	-	-6,117.5	-	-5,156.5

Note: 1) The data on tomatoes include data on (fresh and refrigerated) tomatoes, tomato juice, tomato paste, etc.
2) The data on strawberries include data on (fresh) strawberries, (frozen) strawberries, and (temporarily stored) strawberries.
3) The data on cucumbers include data on (fresh and refrigerated) cucumbers, (temporarily stored) cucumbers, and cucumbers (processed with vinegar or acetic acid).
4) Kimchi is categorized as a vegetable in the export and import statistics.
5) The data on chilis and onions include dried and temporarily stored ones; data on garlic includes frozen garlic; and data on carrots include dried carrots, etc. The yields of the vegetables are not reflected.
6) The data on carrots include data on (fresh and refrigerated) carrots, (frozen) carrots, and (dried) carrots.

Source: Korea Agro-Fisheries and Food Trade Corporation, *Agricultural & Fishery Trading Information* (http://www.kati.net).

Chinese cabbage, chilis, and garlic, are replaced by Chinese vegetables. As a consequence, the production conditions for domestic vegetables are worsening.

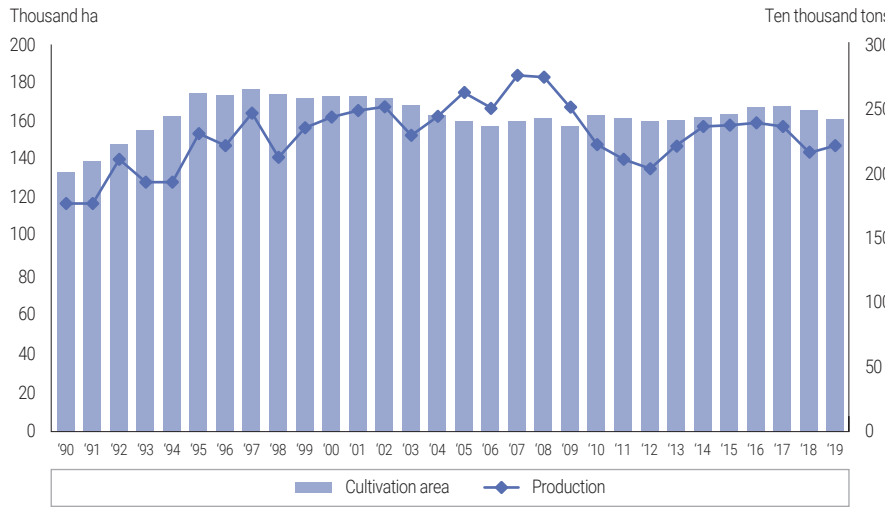
Fruits

Production Trends

The cultivation area of fruits increased from 130,000 ha in 1990 to 170,000 ha in 1998. However, with the agricultural product market opened in earnest, the area since decreased to 157,000 ha and recently, it remained at about 160,000 ha. The fruit cultivation area has shrunk since the late 1990s, whereas fruit production went up from 1.77 million tons in 1990 to some 2.20 million tons in 2019. The production grew by an average of 0.8% per year, which stemmed from rising yields caused by technological advancement.

The cultivation area of apples peaked at 53,000 ha in 1992 before declining to 26,000 ha in the early 2000s. Then the area began to rise again from 2003. This increasing trend happened because the apple price was reasonable compared

Figure 3-17 Trends in the fruit cultivation area and production



Source: Korean Statistical Information Service of Statistics Korea (http://kosis.kr).

Table 3-14 Cultivation area and production by item of fruit

(in ha, thousands tons)

Category		1990	1995	2000	2005	2010	2015	2019
Apple	Cultivation area	48,833	50,103	29,063	26,907	30,992	31,620	32,954
	Area for mature trees	26,002	32,222	21,259	16,379	20,582	21,965	23,911
	Production	628,947	715,982	488,960	367,517	460,285	582,846	535,324
Pear	Cultivation area	9,058	15,752	26,206	21,735	16,239	12,664	9,615
	Area for mature trees	7,137	7,602	13,290	17,059	14,772	11,782	9,074
	Production	159,335	178,321	324,166	443,265	307,820	260,975	200,732
Grape	Cultivation area	14,962	26,030	29,200	22,057	17,572	15,397	12,676
	Area for mature trees	12,845	13,955	22,245	16,481	13,060	11,007	8,902
	Production	131,324	316,443	475,594	381,436	257,128	223,695	166,159
Peach	Cultivation area	12,333	10,241	13,876	15,014	13,908	16,704	20,636
	Area for mature trees	10,466	7,473	7,688	9,830	9,923	10,811	15,385
	Production	114,578	129,640	170,044	223,701	134,665	153,882	210,345
Tangerine	Cultivation area	19,287	24,348	26,821	21,504	21,143	21,265	21,180
	Area for mature trees	17,089	19,460	23,705	18,642	17,573	16,112	15,386
	Production	492,676	614,801	563,470	637,961	614,871	639,892	629,745
Sweet persimmon	Cultivation area	9,869	20,158	23,816	17,199	15,244	11,849	8,639
	Area for mature trees	5,000	8,387	16,463	14,747	13,474	10,672	7,869
	Production	65,682	154,737	227,394	235,854	154,165	157,990	96,271

Note: The data on the area for mature trees are based on open fields.

Source: Korean Statistical Information Service (http://kosis.kr).

with the prices of other fruits. The area for mature trees reached 32,000 ha in 1995. After that, it steadily decreased to 16,000 ha and then turned upward after 2006.

The pear cultivation area expanded until 2000 due to a rise in national income and consumption. However, pear prices fell afterward, causing farmers to close farms and avoid planting additional trees. As a result, the cultivation

area began to decline from 2001, shrinking to less than 10,000 ha in 2018. Therefore, the area for cultivating adult trees had continued to decrease since 2003 when it reached its peak.

Apple

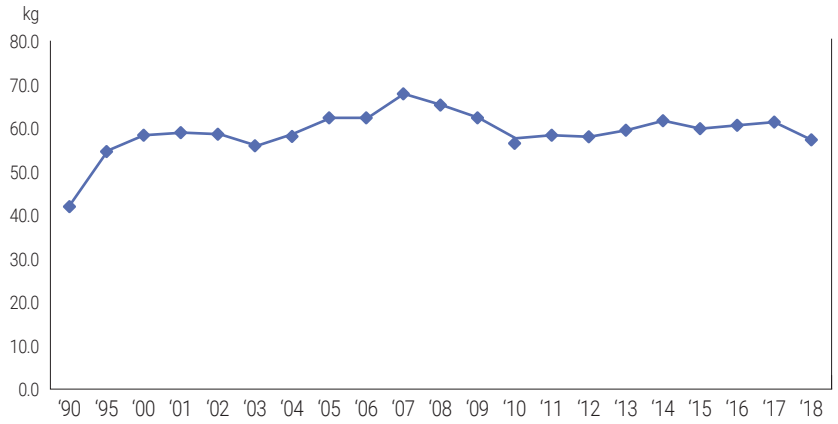
The area for cultivating grapes rose by an annual average of 7.4% until 1999. Since the 2000s, however, it has steadily declined due to aging farmers, the closure of unproductive orchards, government support for the closure of orchards. In response, the area for mature trees also shrank in the 2000s, drastically decreasing to 8,900 ha in 2019. Grape production amounted to 476,000 tons in 2000. Due to a decrease in the cultivation area, however, it turned downward, dropping to about 166,000 tons in 2000.

The peach cultivation area declined until the late 1990s, but it increased to 16,000 ha in 2003 because the prices were relatively stable. However, the area began to decrease again in 2004 because of subsidization for the closure of peach orchards. Recently, due to rising consumption, the cultivation area expanded, reaching over 20,000 ha in 2018.

Despite a rise in orange imports, the cultivation area of tangerines and mature trees increased by an annual average of 3% until 2000. However, due to government support for business closure in 2003-2004, the area declined, and recently, it fluctuated at around 21,000 ha.

The cultivation area of both persimmons and adult trees steadily rose until the late 1990s. However, due to aging farmers and conversion to other crops,

Figure 3-18 Trends in per capita annual fruit consumption



Note: Per capita consumption= (production + import volume −export volume)/ population
Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food.*

etc., the area has declined by an average of 5.2% a year since 2000.

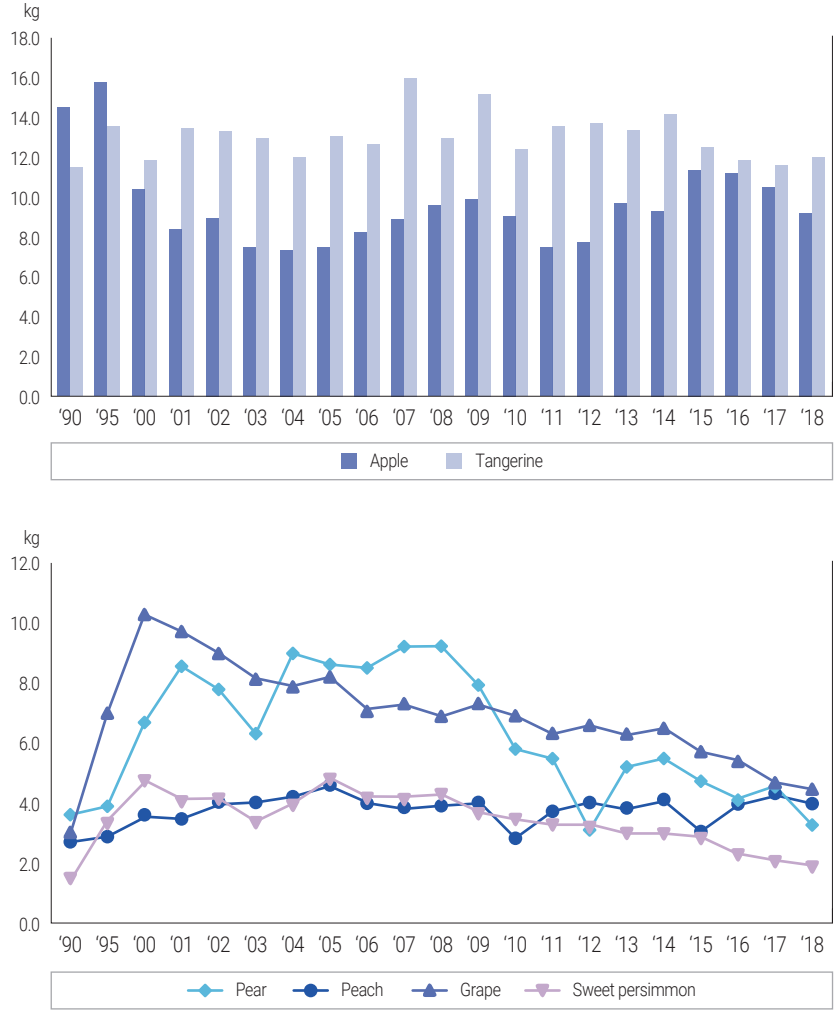
Consumption Trends

Because of a rise in national income and imported fruits, per capita annual consumption of fruits increased from 41.8kg in 1990 to 57.5kg in 2018, recording an annual average growth of 1.1%.

By item, annual apple consumption per person grew from 14.5kg in 1990 to 15.8kg in 1995, but it declined to around 7kg later because of a decrease in the cultivation area and an increase in consumption of alternative fruits. However, it went up again to about 9-11kg recently, except for years when production plunged due to typhoons, bad weather conditions, etc.

Per capita annual consumption of pears reached about 9kg once, but it plunged to some 4-5kg recently due to an increase in imported fruits, etc. As for

Figure 3-19 Trends in per capita annual consumption by major item of fruit



Note: Per capita consumption= (production + import volume −export volume)/ population

Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food*.

peaches, annual consumption per person rose from 2.7% in 1990 to about 4kg recently due to a rise in income and production.

Per capita annual consumption of sweet persimmons was maintained at around 4kg in the 2000s. However, it later went down to some 3kg, remaining at about 2kg recently. As to grapes, its annual consumption per person reached 10.3kg in 2000. However, despite a rise in imported grapes, domestic consumption declined to 4.5kg in 2018 due to closure of orchards. Per capita annual consumption of tangerines went down because consumer preferences for fruits diversified and orange imports increased. It remained at around 12.0kg in 2018.

Export and Import Trends

The export value of fruits increased 5.9 times from USD 60 million in 1995 to about USD 350 million in 2019. By item, apple exports amounted to USD 18 million in 2010, but then steadily decreased to USD 7 million in 2019. Tangerine exports reached up to USD 66 million in 1999 but decreased to USD 3 million in 2019. Pear exports stood at USD 7 million in 1995 and steadily increased to USD 83 million in 2019, recording the highest export value among fresh fruits. As for citrons, the country did not export them in the past. However, due to a rise in exports to China and Japan, it exported around USD 40 million of citrons. The value of grape exports remained at about USD 2 million until 2014 but it reached USD 24 million in 2019 thanks to a recent increase in exports of shine muscat grapes.

Due to the impact of the opening of the agricultural product market, the import value of fruit surged from USD 320 million in 1995 to USD 19.9 billion in 2018. By item, imports of bananas sharply increased from USD 50 million in 1995 to USD 300 million in 2019, followed by USD 250 million of oranges and

Table 3-15 Trends in exports and imports of fruit

(in USD hundred-thousands)

Category		1995	2000	2005	2010	2015	2019
Fruit exports (A)		599.8	451.4	1,208.8	1,954.2	2,501.7	3,514.5
	Apple	135.9	23.4	78.0	179.4	86.8	70.3
	Pear	70.9	171.0	560.9	541.2	578.4	832.7
	Sweet persimmon	0.9	39.2	55.9	83.5	111.9	83.3
	Tangerine	12.8	44.9	34.0	16.0	32.9	29.3
	Citron	-	-	-	326.1	410.0	385.0
	Grape	11.7	1.1	9.2	21.1	35.2	235.2
Fruit imports (B)		3,154.2	3,493.9	6,155.6	9,451.3	17,361.3	19,876.9
	Grape	206.0	311.0	529.8	1,231.1	2,423.6	2,392.7
	Orange	1,014.4	1,160.1	1,624.3	1,740.9	2,088.8	2,462.9
	Banana	495.1	752.5	1,148.4	2,103.5	3,171.2	3,015.5
	Pineapple	225.3	184.6	489.9	582.7	785.1	619.6
	Kiwi	96.5	86.5	533.1	565.1	569.1	950.3
	Mango	0.2	13.1	22.1	61.0	532.1	684.6
	Cherry	31.5	50.6	131.4	369.1	1,298.5	1,402.1
Trade balance (A-B)		△2,554	△3,042	△4,947	△7,497	△14,860	△16,362

Note: 1) The data on apples include data on (fresh and dried) apples, apple juice, etc.
2) The data on pears include data on (fresh) pears and pears (prepared by other methods).
3) The data on persimmons mean data on (fresh) persimmons, etc.
4) The data on tangerines mean data on (fresh and dried) tangerines.
5) The data on citrons mean data on citrons (prepared by other methods).
6) The data on grapes include data on (fresh and dried) grapes, fresh juice (others), grapes (prepared by other methods), etc.
7) The data on oranges included data on (fresh and dried) oranges, orange juice (others/frozen), etc.
8) The data on bananas include data on (fresh and dried) bananas, banana (plantains), and bananas (others).
9) The data on pineapples include data on (fresh and dried) pineapples, pineapples (prepared by other methods), pineapple juice (others), etc.
10) The data on kiwis mean data on (fresh) kiwis; and the data on mangoes mean data on (fresh and dried) mangoes.
11) The data on cherries include data on (fresh) cherries and cherries (prepared by other methods), etc.

Source: Korea Agro-Fisheries and Food Trade Corporation, *Agricultural & Fishery Trading Information* (http://www.kati.net).

USD 240 million of grapes in 2019. The rise in orange exports was caused by the conclusion of the Korea-U.S FTA and the increase in grape exports, the Korea-Chile FTA. Due to changing consumer consumption patterns, imports of kiwis and cherries increased each year. Recently, tropical fruit imports tended to rise,

making mango imports increase to USD 70 million in 2019. As the import value of fruit significantly surpassed the export value, the trade deficit has grown each year.

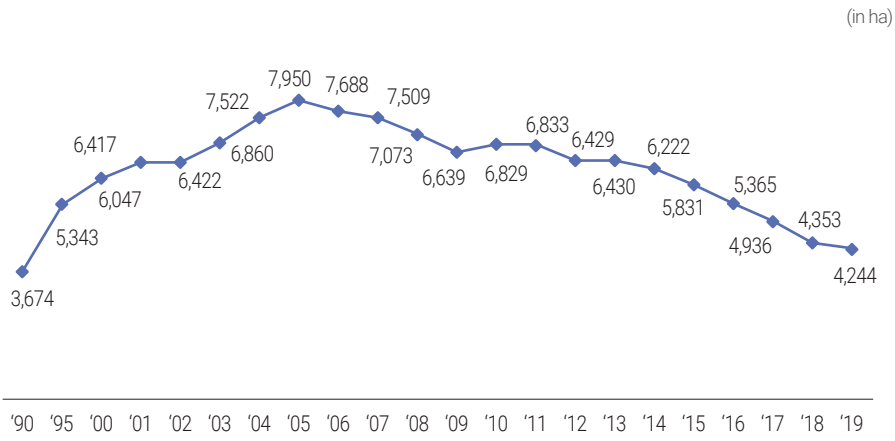
Flowers

Production Trends

The cultivation area of flowers, which stood at 3,674 ha in 1990, enormously increased, reaching a peak of 7,950 ha in 2005. However, the area decreased by an average of 4.5% per year between 2006 and 2019, remaining at 6,829 ha in 2010, 5,831 ha in 2015, and 4,244 ha in 2019. Recently, the cultivation area shrank to the level of the early to mid-1990s.

By type of flowers, the share of cut flowers in the total increased from 27.4% in 1990 to 32.7% in 2005. Due to a decline in the cultivation area, however, it fell

Figure 3-20 Trends in the flower cultivation area



Source: MAFRA, each year, *Cultivation Status of Flowers*.

Table 3-16 Cultivation area by type of flowers

(in ha, %)

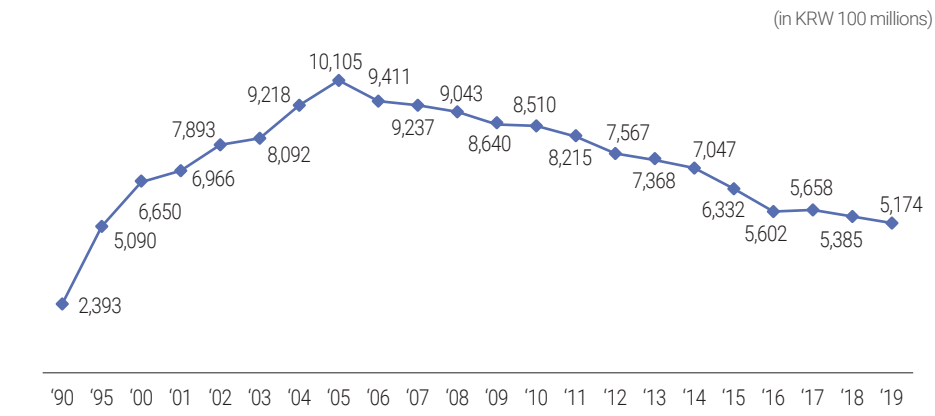
Category	1990	2000	2005	2010	2015	2016	2017	2018	2019
Total flowers	3,674 (100.0)	6,047 (100.0)	7,950 (100.0)	6,829 (100.0)	5,831 (100.0)	5,365 (100.0)	4,936 (100.0)	4,353 (100.0)	4,244 (100.0)
Cut flowers	1,006 (27.4)	2,625 (43.4)	2,597 (32.7)	1,975 (28.9)	1,459 (25.0)	1,364 (25.4)	1,314 (26.6)	1,215 (27.9)	1,183 (27.9)
Potted plants	840 (22.9)	965 (16.0)	1,288 (16.2)	1,249 (18.3)	905 (15.5)	830 (15.5)	788 (16.0)	746 (17.1)	732 (17.2)
Flowering plants	118 (3.2)	71 (1.2)	501 (6.3)	314 (4.6)	349 (6.0)	214 (4.0)	210 (4.3)	175 (4.0)	202 (4.8)
Ornamental plants	1,230 (33.5)	1,628 (26.9)	2,209 (27.8)	2,134 (31.2)	1,995 (34.2)	1,903 (35.5)	1,648 (33.4)	1,382 (31.7)	1,306 (30.8)
Flowering shrubs	377 (10.3)	685 (11.3)	1,274 (16.0)	1,087 (15.9)	1,068 (18.3)	996 (18.6)	921 (18.7)	788 (18.1)	775 (18.3)
Seeds and seedlings	18 (0.5)	5 (0.1)	64 (0.8)	25 (0.4)	27 (0.5)	30 (0.6)	28 (0.6)	21 (0.5)	24 (0.6)
Bulbs	85 (2.3)	68 (1.1)	18 (0.2)	45 (0.7)	29 (0.5)	27 (0.5)	27 (0.5)	27 (0.6)	22 (0.5)

Note: Each figure in round brackets shows the ratio of the cultivation area of the relevant flower to the total flower cultivation area.

again to 27.9% in 2019. The share of potted plants dropped from 22.9% in 1990 to 16.2% in 2005, remaining at 16-17% presently. As for flowering plants, their share rose from 3.2% in 1990 to 6.3% in 2005 but declined to about 4% later on. A representative type of flowers in the early 1990s, ornamental plants accounted for 33.5% of the total at that time, but it fell to 27.8% in 2005 due to a rise in the cultivation area of cut flowers. In 2019, ornamental plants took up 30.8%, which was the highest among types of flowers. The share of flowering shrubs increased from 10.3% in 1990 to 16.0% in 2005, standing at some 18% recently. Seeds and seedlings made up around 0.5-0.6% recently. Bulbs accounted for 2.3% in 1990, but its share decreased to about 0.5-0.6% recently.

Flower sales stood at KRW 239.3 billion in 1990 but soared to KRW 1.10 trillion in 2005. After reaching a peak in 2005, however, flower sales turned downward due to consumption slowdown triggered by economic slump, consumption

Figure 3-21 Trends in flower sales



Source: MAFRA, each year, *Cultivation Status of Flowers*.

control policy, and broader market opening. The sales continued to decline from KRW 851.0 billion in 2010 to KRW 517.4 billion in 2019, showing a 4.5% average annual decline between 2006 and 2019.

The sales of cut flowers remained at KRW 59.2 billion in 1990 but grew as many as 7.6 times to KRW 451.7 billion in 2005, reaching a record high. Afterward, however, the sales fell to KRW 297.6 billion in 2010 and to KRW 170-180 billion in 2016-2019, returning to the levels of sales before 1994. For example, roses as representative cut flowers once led the growth of the flower sales as the sales accounted for the half of the sales of cut flowers. However, after peaking at KRW 182.3 billion in 2005, the rose sales plunged to KRW 49.9 billion in 2019, down 72.6% from 2005.

The sales of potted plants increased over three times from KRW 115 billion in 1990 to KRW 349 billion in 2005 but afterward, remained stagnant at about KRW 320-330 billion until 2009. From 2010, the sales turned downward, falling to KRW 201.4 billion in 2019. The sales of orchids, which were representative

Table 3-17 Sales by major item of flowers

(in KRW 100 millions, %)

Category	1990	2000	2005	2010	2015	2016	2017	2018	2019
Total sales of cut flowers	592 (100.0)	3,012 (100.0)	4,517 (100.0)	2,976 (100.0)	2,174 (100.0)	1,774 (100.0)	1,833 (100.0)	1,786 (100.0)	1,781 (100.0)
Rose	102 (17.2)	1,271 (42.2)	1,823 (40.4)	996 (33.5)	677 (31.1)	528 (29.8)	502 (27.4)	525 (29.4)	499 (28.0)
Chrysanthemum	125 (21.1)	562 (18.7)	1,030 (22.8)	774 (26.0)	517 (23.8)	438 (24.7)	492 (26.8)	455 (25.5)	468 (26.3)
Lily	78 (13.1)	281 (9.3)	346 (7.7)	293 (9.9)	172 (7.9)	156 (8.8)	147 (8.0)	120 (6.7)	115 (6.5)
Carnation	78 (13.2)	162 (5.4)	327 (7.2)	197 (6.6)	132 (6.0)	100 (5.7)	89 (4.8)	88 (4.9)	83 (4.6)
Gypsophila elegans	81 (13.7)	197 (6.5)	271 (6.0)	60 (2.0)	45 (2.1)	50 (2.8)	59 (3.2)	59 (3.3)	67 (3.8)
Total sales of potted plants	1,150 (100.0)	2,617 (100.0)	3,490 (100.0)	2,942 (100.0)	2,215 (100.0)	1,947 (100.0)	1,928 (100.0)	1,969 (100.0)	2,014 (100.0)
Cactus	31 (2.7)	87 (3.3)	148 (4.3)	148 (5.0)	112 (5.1)	109 (5.6)	87 (4.5)	95 (4.8)	93 (4.6)
Orchid	154 (13.4)	1,071 (40.9)	1,214 (34.8)	852 (28.9)	584 (26.4)	518 (26.6)	339 (17.6)	464 (23.6)	448 (22.2)

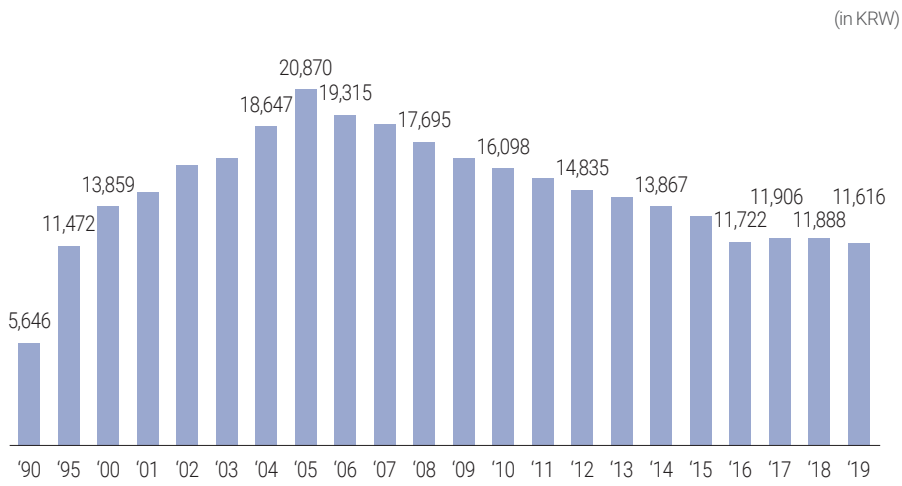
Source: MAFRA, each year, *Cultivation Status of Flowers*.

potted plants, surged 7.9 times from KRW 15.4 billion in 1990 to KRW 121.4 billion in 2005, growing enormously during the period. The orchid sales were maintained at around KRW 100 billion until 2009. However, the sales drastically declined afterward to KRW 44.8 billion in 2019, down 63.1% from 2005.

Consumption Trends

Since consumers mostly perceived flowers as a luxury item rather than a daily necessity, per capita annual consumption of flowers did not exceed KRW 10,000 until the early 1990s. However, due to rising national income caused by economic growth, annual flower consumption was on the increase. In other words, per capita flower consumption remained at KRW 5,646 in 1990, but it

Figure 3-22 Trends in per capita flower consumption



Source: MAFRA, each year, *Cultivation Status of Flowers*.

sharply increased to KRW 20,870 in 2005. However, per capita consumption then steadily declined by an average of 4.6% a year between 2006 and 2017, standing at KRW 11,906 in 2017, which was the level of consumption in the late 1990s. In 2019, flower consumption per person stood at KRW 11,616, down 2.3% year on year.

Export and Import Trends

As for flowers, imports exceeded exports until the mid-1990s. After the financial crisis, however, the consumption of relatively expensive and luxury orchids drastically declined and imports of bulbs fell due to a rise in the exchange rate. As a result, flower imports plunged from USD 26.74 million in 1995 to USD 10.34 million in 1998. On the other hand, a decrease in domestic flower consumption and flower prices caused farmers to increase exports.

Table 3-18 Trends in exports and imports of flowers

(in USD thousands)

Category	1995	1998	2000	2005	2010	2015	2018	2019
Flower exports (A)	6,363	11,484	28,888	52,142	103,067	28,460	18,685	17,159
Rose	47	3,419	10,324	10,597	34,235	3,264	1,591	1,709
Chrysanthemum	152	272	4,682	8,577	13,802	2,370	1,441	1,000
Lily	2,318	3,388	4,395	10,484	27,845	9,328	6,922	6,110
Cactus	3,312	2,266	2,736	1,881	2,756	3,786	3,931	4,063
Orchid	216	660	3,250	16,668	19,279	6,648	1,989	1,442
Flower imports (B)	26,739	10,336	19,472	28,845	44,744	60,769	80,799	86,515
Orchid	13,354	6,603	10,826	14,546	24,023	22,209	16,015	15,656
Chrysanthemum	-	3	88	134	728	9,572	10,394	10,407
Carnation	1,149	131	698	1,120	1,377	2,282	4,978	6,987
Trade baland (A-B)	△20,376	1,148	9,416	23,297	58,323	△32,309	△62,114	△69,356

Source: Korea Agro-Fisheries and Food Trade Corporation, *Agricultural & Fishery Trading Information* (http://www.kati.net).

Consequently, flower exports grew from USD 6.36 million to USD 11.48 million during the same period.

Flower exports steadily increased afterward, amounting to USD 100 million in 2010. In particular, cut flowers were leading flower exports. Among major cut flowers exported were roses, chrysanthemums, and lilies, which were called the Big 3 cut flowers. Though they accounted for over 60% of the flower exports, exports of these flowers were insignificant until the early 1990s. That was because domestic prices of such flowers were high at that time and a strict screening process was required to export flowers. Moreover, farmers were reluctant to export flowers due to a rise in logistics costs, including airfare, and concerns about importing countries' claims.

Almost all the cut flower exports were sent to Japan. However, because of continued yen weakness and fierce competition with new exporting countries

like Kenya and Columbia, Korea had difficulties exporting flowers. Consequently, the country's flower exports plunged to USD 17.16 million in 2019. On the other hand, flower imports steadily rose, surpassing USD 80 million in 2018. Particularly imports of chrysanthemums and carnations remarkably increased. As a result, flowers, which had previously recorded a trade surplus, ran a trade deficit of USD 69 million in 2019.

Specialty Crops

Production Trends

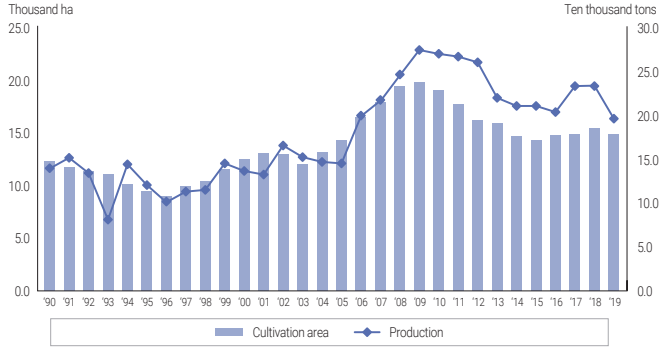
The cultivation area of ginseng decreased by an average of 4.3% a year from 12,184 ha in 1990 to 8,940 ha in 1996. However, with the market for agricultural products opened in earnest and ginseng recognized as a high-income crop, its cultivation area expanded by an average of 6.1% per year, reaching 19,702 ha in 2009. The area then decreased to 14,770 ha in 2019. Ginseng production increased to about 27,460 tons in 2009, but it fell to 19,582 tons in 2019 due to a decline in the cultivation area.

Ginseng fruit

Ginseng

Ginseng cultivation is categorized as reported cultivation (contract cultivation) and designated cultivation (non-contract cultivation). In 1990, the former accounted for 73.5% and the latter,

Figure 3-23 Trends in the ginseng cultivation area and production



Source: MAFRA, each year, *Statistics of Ginseng*.

26.5%, showing that reported cultivation took up a large share in the total cultivation area. The share of reported cultivation decreased afterward, falling to 40.8%. In contrast, designated cultivation rose to 59.2%, raising its share in the total cultivation. Then, the share of reported cultivation turned upward again, making reported cultivation and designated cultivation account for 70.1% and 29.9%, respectively, which were the levels of 1990.

Table 3-19 Trends in the cultivation area by classification of ginseng

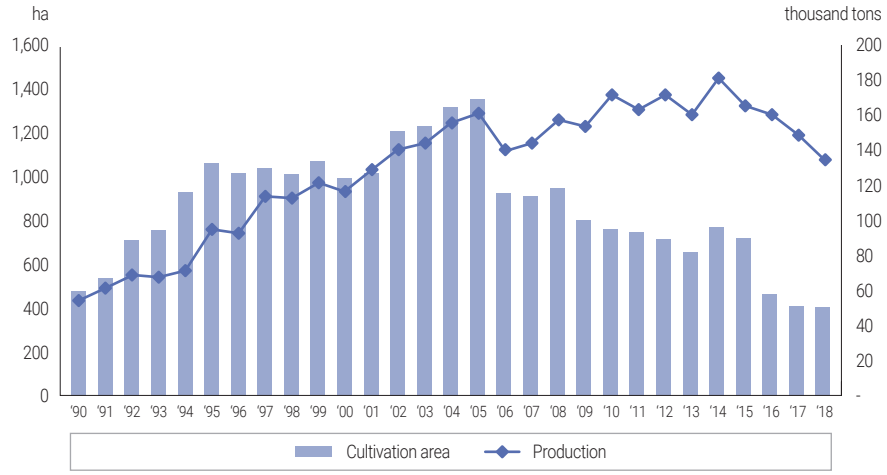
(in ha, %)

Category	1990	1995	2000	2005	2010	2015	2019
Cultivation area	12,184 (100.0)	9,375 (100.0)	12,445 (100.0)	14,153 (100.0)	19,010 (100.0)	14,213 (100.0)	14,770 (100.0)
Non-contract cultivation (reported cultivation)	8,955 (73.5)	5,642 (60.2)	9,811 (78.8)	8,856 (62.6)	9,742 (51.2)	6,364 (44.8)	10,439 (70.1)
Contract cultivation (designated cultivation)	3,229 (26.5)	3,733 (39.8)	2,634 (21.2)	5,297 (37.4)	9,268 (48.8)	7,849 (55.2)	4,421 (29.9)

Source: MAFRA, each year, *Statistics of Ginseng*.

Mushrooms are classified as agricultural mushrooms cultivated using agricultural by-product substrates; and forest mushrooms collected from forests or cultivated using solid wood as a substrate. The cultivation area of agricultural mushrooms increased from 483 ha in 1990 to 1,361 ha in 2005, growing by an average of 6.7% a year. However, due to changing consumption patterns and rising mushroom imports, the cultivation area turned downward, shrinking to 411 ha in 2018. As for mushroom production, it grew each year until 2005 due to increased cultivation area and yields. However, it decreased recently as the cultivation area declined further. In 2018, mushroom production stood at 135,598 tons.

Figure 3-24 Trends in the mushroom cultivation area and production



Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food*.

Regarding the production of each agricultural mushroom item, the cultivation area of oyster mushrooms was on the decrease after the mid-2000s, while

Table 3-20 Cultivation area and production by mushroom item

(in ha, tons)

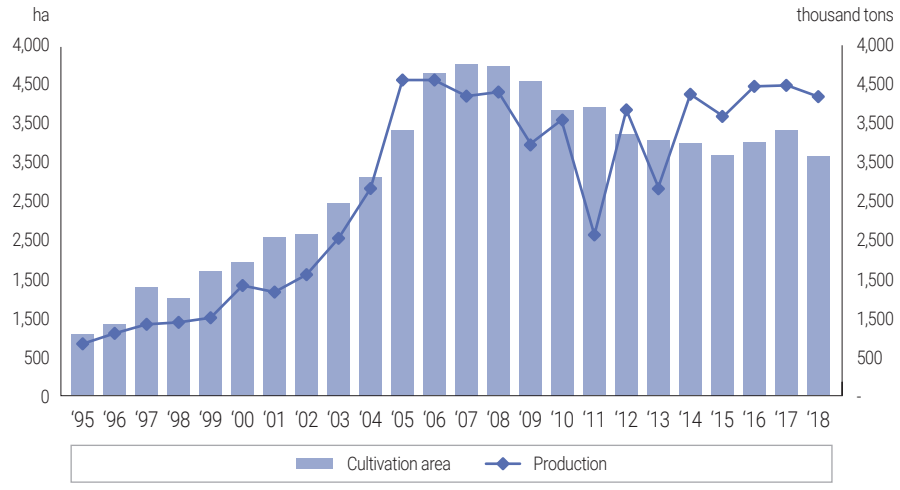
Category	1990		1995		2000		2005		2010		2015		2018	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
Button	54	10,281	121	15,723	148	21,813	174	18,985	125	22,635	92	9,732	102	11,348
Oyster	335	43,732	542	72,801	670	70,759	556	56,866	215	45,191	168	62,467	121	39.497
Reishi	94	810	393	3,346	100	653	91	448	26	650	18	140	11	79
Enoki	0.2	404	10	3,867	61	23,837	84	40,161	45	53,187	18	37,554	35	28,532

Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food; Production Performance of Specialty Crops.*

yields of the mushrooms sharply increased as the bag and bottle cultivation methods were introduced through technological advancement. Cultivated mainly on a substrate, button mushrooms required a lot of labor and thus, the cultivation area of the mushrooms has shrunk recently. In contrast, enoki mushrooms required less work and management costs than other mushrooms, thereby increasing farm household income. With farm income and consumption rising, production of enoki mushrooms grew but turned downward recently.

The cultivation area of tea leaves remained at 715 ha in 1995. However, as consumers recognized tea as healthy food, the consumption of tea leaves increased. As a result, the tea leaf cultivation area soared to 3,800 ha in 2007, growing by an average of 12.3% annually. However, due to the rising consumption of coffee and other substitutes, the cultivation area of tea leaves began to decline. In 2018, the cultivation area shrank to 2,744 ha, down 27.8% from 2007. Tea leaf production previously rose each year but it turned down due to a reduction in the cultivation area. Recently, it was maintained at about 4,000 tons due to a rise in yields.

Figure 3-25 Trends in the cultivation area and production of tea leaves

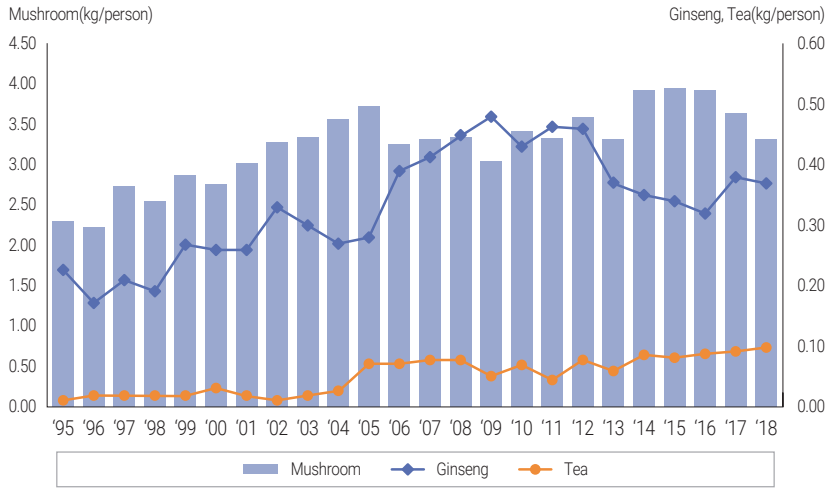


Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food*.

Consumption Trends

Ginseng was previously consumed as a gift, but due to an increase in national income, its consumption for family use grew. Therefore, per capita annual consumption of ginseng went up from 0.23kg in 1995 to 0.37kg in 2018. Mushroom consumption per person increased from 2.29kg in 1995 to 3.95kg in 2015. From 2016, however, the consumption remarkably decreased, standing at 3.31kg in 2018. Tea consumption remained at 0.01kg in 1995, but it rose to 0.08kg in 2008 as consumer interest in tea increased, raising its consumption. However, tea consumption has since remained at 0.08-0.10kg as tea was replaced by coffee and other substitutes.

Figure 3-26 Per capita annual consumption of specialty crops



Note: The data on consumption of mushrooms and tea are estimates calculated based on (production + imports − exports)/ population.

Source: MAFRA, each year, *Statistics of Ginseng; Major Statistics of Agriculture, Forestry, Livestock, and Food.*

Export and Import Trends

Ginseng is a representative export item. Each year, the country exported about 2,000 tons of ginseng, which was approximately 10% of the domestic production. Recently, the export volume increased to over 10,000 tons. Meanwhile, due to a surge in low-priced imports of Chinese ginseng, ginseng imports in 2006 soared ten times from 1995. However, due to safety problems, etc., ginseng imports have plunged recently, remaining at about 58 tons in 2019.

Mushroom exports soared from 97 tons in 1996 to 21,178 tons in 2010 owing to rising exports of enoki mushrooms produced with advanced technology. However, exports turned downward as mushroom production increased in China, a major importing country. Recently, mushroom exports grew again, reaching around 22,000 tons in 2019, which was similar to the export volume

Table 3-21 Trends in exports and imports of specialty crops

(in tons, USD 100 thousands)

Category		1995		2000		2005		2010		2015		2019	
		Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount	Volume	Amount
Exports	Ginseng	2,527	1,400	2,078	790	2,098	825	3,298	1,242	5,925	1,551	10,575	2,103
	Mushroom	97	12	187	56	504	28	21,178	389	15,079	366	22,010	544
	Tea	366	13	371	10	1,481	48	708	44	287	44	363	47
Imports	Ginseng	37	8	107	32	297	61	160	40	96	41	58	36
	Mushroom	7,600	104	11,801	91	17,411	154	16,185	138	48,976	336	56,391	402
	Tea	117	7	410	17	850	40	585	42	807	98	1,510	200

Source: MAFRA, each year, *Major Statistics of Agriculture, Forestry, Livestock, and Food; Production Performance of Specialty Crops*.

in 2010. Since 2010, mushroom imports have surged. Over 56,000 tons of mushrooms were imported in 2019.

Tea exports grew over four times from 366 tons in 1995 to 1,481 tons in 2005. However, due to a decline in the cultivation area, tea exports decreased to 363 tons in 2019. In contrast, due to an increase in black tea imports, tea imports tended to rise as a whole, amounting to 1,510 tons in 2019.

Prospects and Tasks

Because of aging farmers, market opening for agricultural products, a reduction in consumption, etc., the cultivation area for vegetables, fruit trees, and flowers has been decreasing. Moreover, broader FTA negotiations are likely to expand the market opening for agricultural goods. The cultivation area for vegetables will shrink further because imports of low-priced Chinese vegetables, such as chilis, garlic, onions, and carrots, will rise and consumption of kimchi

will decline due to changes in consumption patterns. Regarding fruit, imports of tropical fruits like mangoes as well as bananas, oranges, kiwis, and grapes have grown. Consequently, the consumption of these imported fruits will replace that of domestic fruits, causing the cultivation area to steadily decline. In addition, flower production is likely to reduce further due to sluggish consumption, weak exports, etc. The area for cultivating specialty crops, such as ginseng, mushrooms, and tea leaves, has decreased recently because of rising imports, aging, declining consumption, etc. This trend is predicted to continue in the future.

For the horticulture and specialty crop industry to overcome current difficulties and develop into a more competitive industry, the industry needs to concentrate on producing high-quality crops by introducing cutting-edge technologies and establishing the technology system. Second, by developing a low-temperature distribution system and promoting advanced packaging and standardization, the industry should enhance distribution efficiency so that fresh crops can be traded promptly. Third, it is required to establish measures to meet the needs of consumers, considering the recent well-being boom and changing consumption patterns. By doing so, the industry should encourage consumers to spend more on horticultural and specialty crops. Finally, as countermeasures against imported agricultural goods, such as low-priced Chinese imports, the industry needs to develop high-quality horticultural and specialty products into exports. To do this, the government should actively provide support to the industry.

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4. Forestry

Forest Resources and Forestry Households

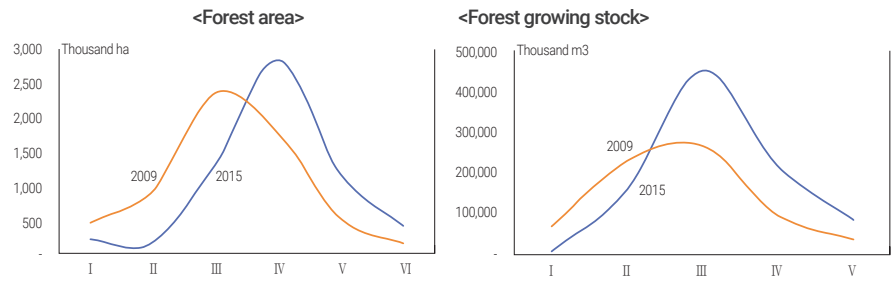
Forest Resources

Cypress plantation

As of 2019, Korea's land area was 10.040 million ha, and the forest area was 6.229 million ha, accounting for approximately 62.7% of the land area (Korea Forest Service (KFS), 2020c). Over the last decade, the forest area has decreased by an average of about 7,000 ha per year due to the forest conversion caused by population growth, urbanization, etc. The forest land is classified as conservation forests (4.789 million ha) and semi-conservation forests (1.545 million ha) according to their use. The conservation forests are subclassified for forestry (3.221 million ha) and public purposes (1.568 million ha). The former is required to develop forest resources and enhance forestry production. In addition to increasing forestry production, the latter is necessary to provide forests' function of enhancing public benefits, such as protecting water sources, conserving natural ecology, preserving the natural landscape, and improving public health and recreation. Specifically, forests for public purposes include green belts, forest protection areas, natural recreation forests, etc.

The total growing stock of forests stood at 1,016 million cubic meters in 2019. The forest growing stock increased from 63.46 cubic meters per ha in 2000 to

Figure 3-27 Forest area and forest growing stock by age class



Note: Age classes are classified every 10 years.

Source: KFS, 2020, *Statistical Yearbook of Forestry*.

161.4 cubic meters per ha in 2019. The area of the V age-class (40-50 years) or higher reached to 25.4% of the total forest area (KFS, 2020c). Over the last five years, the annual increment of the growing stock was 3.7-4.5 cubic meters per ha. According to predictions of the KFS (2018), the average growing stock would reach 180 cubic meters per ha, and the area of the V age-class or higher would amount to 79% in 2037.

Regarding the area of each forest type, the area of coniferous trees takes up 36.9% (2.339 million ha); non-coniferous trees 32.0% (2.029 million ha); mixed forests 26.9% (1.706 million ha); bamboo forests 0.3%; and unstocked forest land 3.8% (KFS, 2020c). By tree species, pines account for the highest share, followed by oak trees and other non-coniferous trees. Major species for plantation include pines, Korean pines, larches, cypress, etc.

The forest land terrain is rather steep and rugged. According to the distribution of sample points based on slopes specified in the National Forest Inventory, extremely rugged terrain (over 30 degrees) accounted for 48.9%; rugged terrain (25-30 degrees) 18.3%; and steep terrain (20-25 degrees) 15.6% (National Institute of Forest Science 2011: 28-29). About 80% of the forest falls under the terrain with

a slope of over 30 degrees, which is significantly unfavorable to forestry.

The forest road developed each year was 1,888 kilometers long in 1995, but it decreased to 695 kilometers in 2019 (KFS, 2020c). The cost of forest road installation is KRW 207 million per kilometer. The density of forest roads rose from 1.1 meters per ha in 1995 to 3.5 meters per ha in 2019. However, this density is considerably lower than that of other developed countries in terms of forestry. Forest roads are used not only for forest management but also for other purposes, such as forest recreation and forest disaster prevention.

Ownership Structure

Of the total forests, national forests made up 25.5%; public forests 7.4%; and private forests 67.1% (KFS, 2020c). The forest growing stock of private forests stands at 138.3 cubic meters per ha on average. This is less than 163.3 cubic meters per ha of national forests and 155.9 cubic meters per ha of public forests.

The number of private forest owners increased from 1.76 million in 1971 to 2.17 million in 2019. The average forest area owned declined from 2.7 ha in 1971 to 1.92 ha in 2019. By forest area owned, owners of a forest less than 1 ha take up 67.3%, while owners of a forest of over 100 ha account for 0.1%. Recently, an increasing number of urban residents have purchased forests, thereby raising the number of absentee forest owners. The share of absentee forest owners stood at 15.6% in 1971, 44.9% in 1993, and 48.7% in 2019. The forest area of absentee forest owners accounted for up to 54.7% of the total forest area (KFS, 2020c).

Gallup Korea (2011) surveyed 1,200 forest owners. According to survey results, they came to own a forest through inheritance (51.5%), purchase (37.9%), or a gift (10.3%). Also, the reason they purchased a forest was to invest in real estate (25.7%), followed by funeral and burial (20.1%), migration to rural areas (18.5%), and production of short-term forest products (15.1%).

Table 3-22 Management types of forestry households

(in thousands households, %)

	Total forestry households	Engaging in non-cultivation only				Engaging in cultivation and non-cultivation				Engaging in cultivation only
		Subtotal	Silviculture	Logging/ nursery	Gathering	Subtotal	Silviculture	Logging/ nursery	Gathering	
2010	96.1	10.2	2.3	1.0	6.9	4.7	1.1	0.3	3.3	81.2
	(100.0)	(10.6)	(2.4)	(1.0)	(7.2)	(4.9)	(1.1)	(0.3)	(3.5)	(84.4)
2019	80.0	3.7	1.6	0.3	1.8	5.1	1.8	0.7	2.6	71.2
	(100.0)	(4.6)	(2.0)	(0.3)	(2.2)	(6.4)	(2.3)	(0.9)	(3.2)	(89.0)
Growth	-16.1	-6.5	-0.7	-0.7	-5.1	0.4	0.7	0.4	-0.7	-10.0
Growth rate	(-16.8)	(-63.7)	(-30.4)	(-70.0)	(-73.9)	(8.5)	(63.6)	(133.3)	(-21.2)	(-12.3)

Source: Statistics Korea, 2020, Results of the Census of Agriculture, Forestry, and Fisheries.

Forestry Households

According to the 2019 census of agriculture, forestry, and fisheries conducted by the Statistics Korea, the total number of forestry households stood at 80,046, which was 16.8% down from 2010. The population of the households fell by 29.6% from 253,656 persons in 2010 to 178,479 persons in 2019. Only 9.4% of the families were full-time forestry households (engaging in work other than forestry for fewer than 30 days) and 90.6% of them had a side job. Among the households, up to 83.6% did not own any forest, and only 1.4% owned a forest of over 10 ha. That is because many forestry households produced short-term forest products on farmlands.

Table 3-22 shows types of forestry management by forestry household. Cultivation forestry households mean households growing short-term forest products in forest land or field. Non-cultivation forestry households mean those engaged in silviculture, logging, tree nursery, and gathering forest products (Statistics Korea 2020). The number of forestry households engaged only in cultivation stood at 71,000 (89.0%); those engaged only in non-cultivation at

Table 3-23 Analysis of forestry household income

(in KRW thousands, %)

Classification	2015	2016	2017	2018	2019
Forestry household income	32,223	33,585	34,590	36,476	37,499
Total income from forestry	20,530	21,214	21,542	22,882	23,748
- Income from timber (%)	3.6	5.0	4.3	4.5	4.0
- Short-term income forest products (%)	91.6	88.9	91.1	89.9	91.3
- Gathered forest products (%)	4.5	5.9	4.4	3.8	2.8
- Miscellaneous income from forestry (%)	0.2	0.3	0.2	1.8	1.8
Forestry operating expenses	9,944	9,900	10,006	10,471	10,577
Income from forestry (total income - operating expenses)	10,586	11,314	11,536	12,411	13,172
Income from work other than forestry	13,098	13,318	13,821	14,449	13,946
Transfer income	6,401	6,918	7,301	7,282	7,525
Non-current income	2,138	2,034	1,982	2,334	2,857
Forestry dependence (%)	32.9	33.7	33.4	34.0	35.1
Forestry household/farm household income (%)	86.5	90.3	90.5	86.7	91.1
Forestry household/fishing household income (%)	73.4	71.3	70.6	70.4	77.5

Source: KFS, 2020a, *Forestry Household Economy Statistics*.

4,000 (4.6%): those engaged in both types of business at 5,000 (6.4%). The number of forestry households engaging in silviculture, logging, and tree nursery was very small. Most households cultivated short-term forest products. By product, many forestry households growing short-term forest products cultivated astringent persimmons (31.1%), followed by wild vegetables (29.1%), and medicinal herbs (17.6%). Other major short-term forest products included landscape trees, chestnuts, shiitake mushrooms, matsutake mushrooms, etc.

According to the KFS (2020a), forestry household income in 2019 was KRW 37.50 million, of which income from forestry accounted for 35.1%. Forestry households earned a lot of income from work other than forestry. The total forestry income per household was KRW 23.75 million in 2019. Of this, income from timber made up only 4.0%; income from short-term forest products 91.3%;

income from gathered forest products 2.8%; and other income 1.8%. Only a small number of forestry households earn income from timber production. They earn a much lower income than farming or fishing households.

Production & Trade of Forest Products

Production of Forest Products

The production of forest products reached KRW 6.57 trillion in 2019. This figure included soil and stones and the value of the net gross growing stock of forest. If these two were excluded, then the production remained at KRW 3.34 trillion. The production of timber stood only at KRW 442 billion, accounting for a small share in the production of forest products. Because the profitability of timber production was low, forest owners mostly focused on growing short-term forest products, and the production of short-term forest products was

Table 3-24 Trends in forestry production

(in KRW billions)

	2014	2015	2016	2017	2018	2019
Net gross growing stock	2,511.8	2,140.5	2,170.0	1,950.3	2,046.5	1,568.6
soil and stones	1,921.4	2,737.0	3,661.9	3,460.1	1,776.4	1,654.9
timber	484.2	467.6	490.6	511.1	460.6	442.4
Reforestation/ tree seedlings	118.5	122.5	114.2	130.1	151.7	1,730
Short-term forest products	2,780.0	2,870.4	2,766.4	2,913.6	2,944.8	2,727.8
(Landscape materials)	637.9	736.0	653.7	671.4	677.4	413.8
(Nuts and fruits)	859.9	724.6	707.7	685.4	612.1	621.1
(Forest mushrooms)	204.2	244.1	237.9	248.1	240.5	230.5
(Wild vegetables)	369.7	383.2	406.0	411.9	473.2	474.1
(Medicinal herbs)	510.4	562.2	538.8	590.0	614.8	786.0
(Others)	199.1	220.3	222.4	307.0	326.9	202.2
Total	7,815.9	8,337.8	9,203.2	8,965.2	7,380.0	6,566.7

Source: KFS, 2020c, *Statistical Yearbook of Forestry*.

about KRW 2.73 trillion. The production of timber and short-term forest products remained stable without undergoing any significant fluctuations. Short-term forest products consisted of landscape materials, nuts and fruits, forest mushrooms, wild vegetables, medicinal herbs, etc. Korea's forestry has been characterized by low production of timbers and high production of short-term forest products.

Wood Supply and Demand

The wood industry manufactures various products by processing wood, and it is a forward industry leading the growth of forestry. Table 3-25 shows the status of the wood industry specified in Statistics Korea's Mining and Manufacturing Survey. Though various wooden goods are produced in many types of business, the value of shipments is highest in paper and paperboard sector.

The production status of major wood products is specified in Table 3-26.

Table 3-25 Shipments of the wood industry

(in KRW millions)

	2014	2016	2017	2018
Manufacture of wood and of products of wood and cork: except furniture	5,237,461	5,973,063	6,200,530	6,020,109
Sawmilling and planing of wood	1,429,261	1,578,268	1,580,864	1,391,805
Manufacture of wood products	3,802,758	4,388,695	4,613,775	4,622,226
Manufacture of articles of cork, straw and plaiting materials	5,442	6,100	5,891	6,078
Manufacture of pulp, paper and paper products	21,550,720	22,747,447	22,888,969	23,860,978
Manufacture of pulp, paper and paperboard	9,915,773	9,629,722	9,895,198	10,589,257
Manufacture of corrugated paper, paperboxes and paper containers	6,954,521	7,228,919	7,418,905	8,054,523
Manufacture of other paper and paperboard products	4,680,426	5,888,806	5,574,866	5,217,198

Note: This survey was conducted on businesses hiring at least 10 employees.

Source: Statistics Korea, *Mining and Manufacturing Survey* (kosis.kr, Aug. 15, 2020).

Table 3-26 Production in major wood products

(in 1,000 m^3, 1,000 tons)

Classification	2012	2013	2014	2015	2016	2017	2018
Lumber	2,082	2,343	2,406	2,418	2,293	2,188	2,052
Plywood	435	482	474	478	474	444	286
Fiberboard	1,712	1,678	2,011	1,901	1,859	1,840	1,740
Particle board	801	802	830	820	816	855	843
Wood pellets	51	66	90	82	53	67	188
Pulp	562	541	602	500	520	505	575

Source: Korea Forest Service. 2019b, Fact-finding Survey on Timber Use; Korea Wood Panel Association.

The production of plywood has gradually declined, while that of other wood products has remained stable. With the demand for renewable energy rising, the production of wood pellets has surged.

Wood consumption stood at 27.67 million cubic meters in 2019, of which the consumption of imported wood products accounted for 73.9% at 20.45 million cubic meters. Due to afforestation policy focusing on greening, the nation was poor in domestic forest resources. Therefore, the country was heavily dependent on overseas wood and the wood processing industry grew centering on the processing of imported timber. Of the wood consumption, log consumption took up 27.1% at 7.22 million cubic meters. Regarding log consumption, the supply of domestic logs was about 4.60 million cubic meters and that of imported logs was about 2.62 million cubic meters. The consumption of domestic logs made up 16.6% of the total wood consumption. The self-sufficiency rate of logs reached 63.8%. Nonetheless, imports of wood products increased and those of logs decreased. That was because with the revitalization of a forest tending project, domestic log production rose though the wood self-sufficiency rate had remained at about 4% before 1998. Since Korea has managed forests mainly through forest tending and species conversion, the

Table 3-27 Wood supply and demand

(in thousands cubic meters)

Classification	2010			2015			2019		
	Domestic log	Imported log	Product imports	Domestic log	Imported log	Product imports	Domestic log	Imported log	Product imports
For lumber	429	3,788	1,209	1,013	3,218	2,156	600	2,399	2,310
For plywood	-	393	2,560	5	427	2,822	-	194	1,671
For pulp	892	-	11,574	973	-	9,663	935	-	8,986
For panels	1,611	46	1,653	1,849	132	2,127	1,436	23	1,523
For biomass	29	-	-	373	-	2,791	406	-	4,286
Others	754	-	2,674	701	-	2,348	1,228	-	1,669
Total	3,715	4,227	19,670	4,914	3,777	21,907	4,605	2,616	20,445

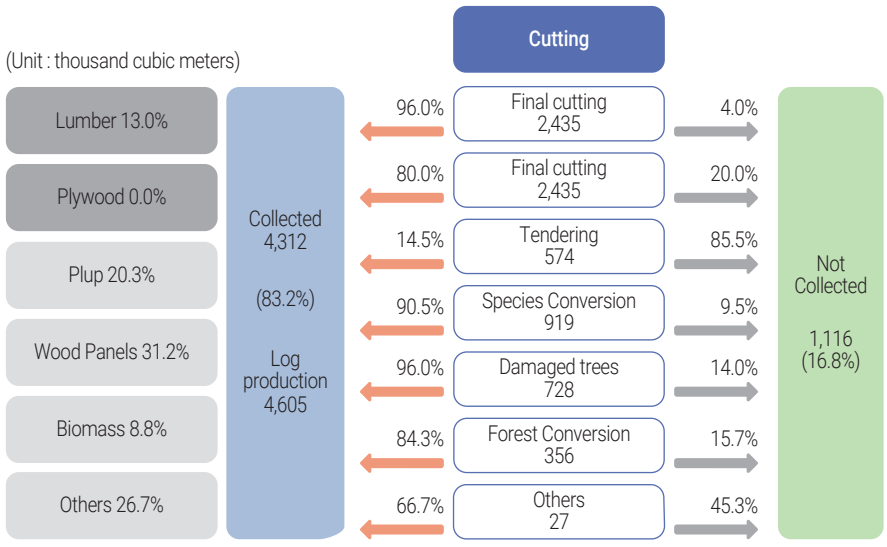
Source: KFS, 2020, *Statistical Yearbook of Forestry*.

nation produced small-diameter logs as a whole. Therefore, it depended mostly on imports for the consumption of large-diameter logs. Large-diameter logs were imported primarily from New Zealand. The imports of New Zealand log reached some 1.93 million cubic meters in 2019, accounting for 73.9% of the total log imports. Imported logs were mostly coniferous trees (94.4%), with radiata pine taking up 72.9% of the volume of log imports.

Regarding wood supply and demand, log consumption decreased, while imports of wood products increased. The largest portion of timber was consumed in the pulp industry (35.9%), followed by the sawmilling industry (19.2%). Due to declining demand for domestic timber, difficulty in obtaining large-diameter logs, and rising imports of wood products, the domestic wood industry tended to shrink. However, the use of biomass energy increased considerably.

The status of domestic log production and use is shown in Figure 3-28. The cutting amount yield of logs stood at 5.18 million m^3 in 2019. Of the yield, some 4.31 million m^3 (83.2%) of logs were released for use. The quantity of logs left in forests without being used reached about 0.87 million m^3 (16.8%). Domestic logs

Figure 3-28 Status of domestic log production and use (as of 2019)



Source: KFS, 2020, *Statistical Yearbook of Forestry*.

were used largely for wood panels (31.2%), pulp (20.3%), and lumber (13.0%). Also, final yields were mostly used to produce pulp and wood panels. Other use included use for hanok (traditional Korean houses), wooden houses, shiitake mushroom cultivation, and for sawdust.

Trade of Forest Products

Korea is heavily dependent on imports for domestic consumption of forest products. Its wood product imports reached USD 4.79 billion in 2019, while wood products exports remained at USD 169 million. Major imported wood products include plywood, pulp, etc., and they are imported mainly from Vietnam, Indonesia, and China. Since Korea opened its log market in 1978, its wood industry has grown by processing imported logs for exports. However,

Table 3-28 Imports and exports of forest product

(in USD thousands)

		2015	2016	2017	2018	2019
Export	Wood products	89,964	185,828	209,627	245,561	169,152
	Soil and stone	34,758	88,890	117,855	158,209	131,502
	Short-term forest products	147,230	144,882	106,424	117,146	106,451
Import	Wood products	3,111,956	4,640,485	5,165,348	5,873,108	4,793,059
	Soil and stone	703,574	998,945	1,086,262	1,116,539	935,148
	Short-term forest products	804,196	764,352	758,283	832,222	783,371

Source: KFS, 2020b, *Statistics on Forest Product Imports and Exports*.

since Southeast Asian countries banned log exports and instead nurtured their domestic wood processing industry, Korea's wood industry has gradually declined. Even today, there are many wood processing businesses in port cities, such as Incheon and Gunsan.

Imports of short-term forest products stood at USD 783 million and exports of the products at USD 106 million in 2019. Imports of key short-term products included nuts, shiitake mushrooms, balloon flower roots, chestnuts, etc. They were mostly imported from the U.S. and China.

Forest Recreation

People are increasingly using forests as recreation and healing sites. Thus the number of visitors to recreation forest sites amounted to approximately 16 million in 2019. In response, recreation forest sites have been developed, and they are operated by the KFS, counties, and private site owners. Because the public sector mostly provides forest recreation services, the private sector has some difficulty in developing relevant business.

With demand for forest welfare rising, experts in relevant fields are nurtured. They include forest healing instructors, forest interpreters, and forest trekking

Table 3-29 Visitors and revenue of forest recreation sites

		2015	2016	2017	2018	2019
KFS	Number of the sites	41	41	42	43	43
	Number of visitors	3,840,783	7,000,990	4,353,040	4,571,582	4,657,108
	Revenue (KRW millions.)	15,327	17,022	18,803	19,316	19,205
Counties	Number of the sites	101	101	101	104	109
	Number of visitors	10,776,919	6,885,172	10,307,850	9,674,823	10,285,639
	Revenue (KRW millions.)	29,907	34,312	34,747	35,498	38,046
Private owners	Number of the sites	23	23	23	23	23
	Number of visitors	1,011,335	1,352,555	2,052,302	1,085,113	1,046,033
	Revenue (KRW millions.)	4,651	4,533	5,709	5,533	8,951

Source: KFS, 2020, *Statistical Yearbook of Forestry*.

guides, etc. Until 2019, 1,282 forest healing instructors and 18,826 forest interpreters, etc. were trained as specialists.

Non-market Values of Forest Services

Forests provide various services to enhance public interests. Because such services are not traded in the market, it is hard to assess their value. The National Institute of Forest Science regularly evaluates and announces such non-market services as monetary values. The assessed value amounts to KRW 221 trillion (2018). If the value is calculated per person, it is KRW 4.28 million. Currently, discussions are underway on a direct payment program for forestry. This scheme is based on the idea that forests' appropriate non-market services should be evaluated to provide compensations to forest management entities. However, the program has not yet been legislated.

Table 3-30 Assessment of non-market services of forests

(in KRW billions)

	Assessed value			Assessment method
	As of 2014	As of 2018	Change in amount	
Storage and conservation of water sources	16,621	18,345	1,724	Replacement cost approach
Water purification	9,899	13,564	3,665	Replacement cost approach
Prevention of soil erosion	18,095	23,535	5,440	Replacement cost approach
Landslide prevention	7,922	8,111	189	Replacement cost approach
Greenhouse gas absorption	4,934	75,641	70,707	Replacement cost approach
Oxygen production	13,562	13,087	-475	Replacement cost approach
Air quality improvement	6,077	5,871	-206	Replacement cost approach
Heat island mitigation	1,096	810	-286	Replacement cost approach
Supply of forest landscape	16,318	28,359	12,041	Hedonic pricing method
Forest recreation	17,743	18,431	688	Travel cost method
Forest healing	2,433	5,151	2,718	Avoidance cost method
Biodiversity maintenance	11,086	10,247	-839	Use value method, benefit transfer method, and contingent valuation method
Total assessed value	125,787	221,151	85,365	

Source: National Institute of Forest Science (2020: 12-17).

Evolution of Forest Policy and Future Directions

Forest Land Restoration Period (-1972)

In the 1950s, forests in Korea were seriously devastated because of traditional *ondol* (an underfloor heating system using firewood), exploitation of wood during the Japanese colonial period, and forest destruction by war. Moreover, demand for wood rose due to post-war reconstruction, and slash-and-burn farming and illegal logging were prevalent due to lack of national forest management. In the early 1950s, unstocked forest land occupied half of the forest areas (Bae et al., 2010: 41). In 1953, GNI per capita was USD 67, and the forest growing stock was 6 cubic meters per ha. When it rained, the soil flowed down to make the riverbed

higher than rice paddies. Thus, dams collapsed, and farmlands were buried frequently. In the dry season, rivers dried up and damage from drought was so severe that no improvement was achieved in agricultural production. In the early 1960s, the political situation stabilized, making it possible to promote forest policy. In this period, the government established the institutional foundation for promoting forest policy. It enacted a series of statutes to protect forests, such as the Act on Crack Down on Forest Products Use (1961), the Forest Act (1961), the Erosion Control Work Act (1962), the Temporary Act on Facilitation of Greening of Land (1963), and the Readjustment of Slash-and-Burn Fields Act (1966). In 1967, the Korea Forest Service was launched. The Forest Act also included matters on forestry associations (sanrim-gye). Under the statute, the government organized forestry associations in villages across the nation, making it mandatory for them to participate in forest projects (Lee, 2013: 325-328).

While developing fuel production forests, the government implemented a slash-and-burn field readjustment project to prevent wildfire damage from slash-and-burn farming as well as reckless deforestation. The government also imported foreign timber to meet the demand for wood while restricting the annual cutting to 15% of the annual growth of standing forest. In 1969, it designated 14 afforestation complexes, promoting the growth of forest resources. It also supported the tree nursery business. As for the vicarious execution of afforestation, the government concluded a contract for profit allocation to guarantee forest owners' income. Also, it supported the production of forest products to ensure that forest owners can earn short-term income. If residents joined a forestry association or participated in erosion control or afforestation activities, the government provided food grain to motivate them to participate in forest projects.

Table 3-31 Success factors of forest rehabilitation

Economic	- economic growth, agricultural productivity growth - energy substitution - saving wood-using by developing heavy chemical industry - low interest loan for plantation
Social	- human resource, matured civil awareness - Saemaul Movement - residents participatory silviculture and protection system - plantation of fast growing fruit trees such as chestnuts - establishment of forest ownership - prevention of illegal logging and slash and burn
Ecological	- decrease of human intervention by population decrease in rural areas - steep terrain, abundant biodiversity, temperate climate

Source: http://theme.archives.go.kr, Bae et al. (2010: 79-132)

Period of Erosion Control and Greening (1973-1987)

During this period, the government set the fast greening of the land as its goal. To accomplish the goal, it transferred the Korea Forest Service to the Ministry of the Interior, implementing forest greening with strong administrative power. The government formulated the 1st and 2nd 10-year Plans for Erosion Control and Greening, setting fast afforestation, national afforestation, and economic afforestation as basic directions. According to policy for afforestation through public participation, the government set the national planting period (March 12-April 20) and encouraged organizations and villages to plant trees on Arbor Day. Because the greening of bare mountains was an urgent task, the government mobilized all the people to plant trees. It also designated economic forest complexes for planting fast-growing long rotation trees on a large scale. In this period, it implemented an aggressive government-led regulatory policy to produce results in a short period. The nation accomplished the goal of the first 10-year plan four years earlier than planned, completing the greening of 1 million ha of areas. In addition, the government ended the project to readjust slash-and-burn fields, securing sources of firewood.

Table 3-32 Evolution of forest mater plans

Classification	Period	Goal	Major policy
Large-scale forest land development plan	1970-2004 (suspended)	Sustained yield	- Establishing a comprehensive forestry development plan for 14 large-scale complexes
1st 10-year plan for erosion control and greening	1973-1982	Fast greening of national land	- Afforestation through public participation - Developing fuel production forests, restricted access to mountains - Completing a slash-and-burn field readjustment project
2nd 10-year plan for erosion control and greening	1979-1988	Converting forest land into resources	- Developing large-scale economic forest complexes - Removing unstocked forests and devastated land - Establishing a forest land use system
Plan for forest land resources (3rd forest master plan)	1988-1997	Maximizing efficiency of forest land (development of income from forest land + public interests)	- Designating forestry promotion areas - Developing recreation forests - Stressing public benefits of forests
4th forest master plan	1998-2007	Establishing the foundation for sustainable forest management	- Establishing a forest land management system - Facilitating management-centered forestry policy and nurturing persons engaging in forestry - Facilitating development of economic forests - Enhancing competitiveness of the forest industry - Strengthening preservation and management of forest bioresources - Preventing forest disasters and increasing urban forests - Promoting forest recreation culture and comprehensive development of mountain villages
4th forest master plan (revised)	2003-2007	Realizing a prosperous green country where people live in harmony with forests	- Establishing a system for sustainable forest management - Strengthening economic, ecological, and social functions of forests
5th forest master plan	2008-2017	Realizing a sustainable green welfare country	- Developing multifunctional forest resources and integrated management - Developing a resources circulation forest industry - Preserving and managing forests - Expanding green spaces and services
5th forest master plan (revised)	2013-2017	A green welfare country where all people enjoy happiness in forests	- Building a system for sustainable forest management by function - Establishing a forest carbon management system in response to climate change - Building a base for facilitating market functions - Establishing a system for integrated preservation and use of the forest ecosystem - Managing disasters in forest land and forests - Establishing a system to expand forest welfare services

Classification	Period	Goal	Major policy
6th forest master plan	2017-2037	Economic forest land, welfare forest land, ecological forest land	- Upgrading the management system for forest resources and forest land - Developing the forest industry and creating jobs - Stabilizing income of those engaged in forestry and revitalizing mountain villages - Establishing a forest welfare system in daily lives - Maintaining and enhancing health of the forest ecosystem - Ensuring the safety of people by preventing and responding to forest disasters - Leading international forest cooperation and completing forest greening on the Korean Peninsula

Sourcer: KFS, each year, *Forest Master Plan.*

The 2nd 10-year Plan for Erosion Control and Greening began in 1979. Under the plan, the government shifted to policy for using forest land as economic resources, establishing 80 large-scale economic forest complexes to promote intensive afforestation. However, with industrialization in progress and the population in rural areas decreasing, the government had difficulty in promoting forest projects. Moreover, it failed to support the development of economic forest complexes, public participation, and substantial forest management. The government, therefore, implemented the 2nd plan, focusing on afforestation again. Nonetheless, it completed the greening of the land in the 1980s, and success factors could be analyzed from economic, social, and ecological perspectives. Regarding Korea's success in forest rehabilitation, the FAO (1982) said that Korea was the only developing country to have succeeded in reforestation after World War II. Also, Lester R. Brown (1988) evaluated the nation's forest rehabilitation as a world-class success.

Period for Forest Land Resources (1988-1997)

Upon accomplishing the goal of afforestation through the success of the

Plans for Erosion Control and Greening, the government established the 3rd Forest Master Plan, intending to lay the foundation for forest resource uses. In other words, it intended to maximize the efficiency of forest land by developing income sources in forest land and enhancing public services of forests. To this end, the government set directions, focusing on the reasonable use of forest land, developing quality timber resources, and on expanding the foundation for forest management. It also concentrated its efforts on improving the distribution system for forest products and creating a pleasant living environment. This plan aimed to develop 320,000 ha of economic forests and promote silviculture for 3.03 million ha of land. While concentrating its efforts on silviculture, the government stressed the development of economic forests as a partial goal.

During this period, the government enacted the Forestry and Mountain Villages Development Promotion Act (1997). Under the Act, it formulated such policies as restructuring the forestry, developing forest resources, and supporting the distribution and processing business of forest products. It also invested in establishing conditions for activating forest management. As for forest policy, the government shifted from government-led projects and regulation to autonomy and encouragement. However, performance in planned silviculture, such as thinning and natural forest tendering, was insufficient. Moreover, it failed to facilitate private forest owner's business because forestry households were not adequately fostered and cooperative management entities were not well organized. There were also such problems as a lack of measures to secure forestry workforce due to a decline in the rural population, a decrease in the wood self-sufficiency rate, and increases in natural disasters.

Period for Laying the Foundation for Forest Management (1998-2007)

The 4th Forest Master Plan was aimed at establishing the foundation for sustainable forest management. To achieve such goal, the government set specific targets: I) developing more valuable forest resources, II) nurturing a competitive forest industry, and III) creating a healthy and pleasant forest environment. To this end, the government expanded a forest tending project and prepare for a future using domestic wood. In the second half of this period, it focused on improving the structure and conditions of forestry. As part of such endeavors, the government promoted as its key project the development of economic forest complexes, and improved the institutional base for developing the complexes by remedying the management system for seeds and seedlings. To facilitate private forest management, it established institutions for nurturing cooperative management and designated management, conducting forest projects to support such management. This was designed to realize economies of scale by grouping small-scale businesses, but this effort did not produce good results. During this period, the government enacted the Baekdu-Daegan Protection Act (2003) and the Forestry Culture and Recreation Act (2005).

Period of Sustainable Forest Management (2008-2017)

Under the 5th Forest Master Plan (2008-2017), the government set realizing sustainable forest management and a welfare state as the vision and goal of its forest policy. Specific implementation tasks included I) cultivating multifunc tional forest resources and promoting integrated management, II) nurturing

Medicinal herb in forest

circulative forestry and enhancing its competitiveness, III) preserving and managing forests as national environmental resources, IV) increasing green spaces and services to improve the quality of life, and V) expanding international cooperation to secure resources and preserve global forests. The government thus emphasized the provision of various forest welfare services, such as forest healing and forest education, increasing budgets for them. In this period, it enacted the Forest Protection Act (2009), the Forest Education Promotion Act (2011), the Act on the Management and Improvement of Carbon Sink (2012), and the Act on the Sustainable Use of Woods (2012).

While partially revising the Forest Master Plan in the second half of this period, the government set as its vision of realizing a green welfare country where all people could enjoy happiness in forests. The government then presented a goal of accomplishing a virtuous circle of forests in economic, environmental, and social terms so that citizens, forest owners, and those engaged in forestry could use a forest as a workplace, shelter, and place of living. Specific implementation tasks encompassed I) establishing a sustainable forest management system by its functions; II) building a forest carbon management system to tackle climate change; III) laying the foundation for facilitating the forestry market system; IV) establishing a system for integrated conservation and use of the forest ecosystem and forest bioresources; V) managing forest land and forest disasters to enhance the safety; VI) constructing a system for expanding and reproducing forest welfare services; and VII) taking the lead in global greening and preserving the global environment. In this period, the government enacted the Forest Welfare Promotion Act (2015). Focusing on welfare using forests, the Act included all matters concerning promotion of forest welfare, such as forest welfare services, experts, facilities, and business specializing in forest welfare.

Period of Forest Welfare Mnagement (2018~)

The 6th Forest Master Plan (2018-2037) set such visions as economic forests creating jobs, welfare forests everybody enjoyed, and ecological forests for humans and nature. Also, the government established, as its goals, the wood self-sufficiency rate of 30.0%, 70,000 jobs in forestry, and 100% of the population enjoying forest welfare benefits. Specific implementation tasks included I) upgrading the management system for forest resources and forest land; II) developing the forest industry and creating jobs; III) stabilizing incomes of those engaging in forestry and revitalizing mountain villages; IV) establishing a forest welfare system in daily lives; V) maintaining and promoting a healthy forest ecosystem; VI) ensuring the safety of the people by preventing and responding to forest disasters; and VII) leading international forest cooperation and completing forest greening on the Korean Peninsula.

Future Tasks for Forest Management

To make devastated forests green, Korea implemented various government-led projects, such as a tree-planting campaign, energy conversion in rural areas, and a slash-and-burn field readjustment project. Though the country succeeded in forest greening quickly due to a strict government-led forest protection policy, it did not achieve remarkable progress in converting forests into economic resources. Tasks facing the country are as follows:

First, the nation should realize forestry through resource circulation and increase the economical use of forests. Its forest resources have gradually matured, reaching harvest time. Therefore, it is necessary to harvest an appropriate amount of timber and renew forests, thereby keeping them healthy. To this end, the government should link forestry with the wood industry. Because the industry, particularly lumber, has grown by processing imported logs, its linkage with

domestic forestry is weak. Thus, the government should establish a structure that makes the wood industry process domestic logs and nurture forestry.

Second, realizing sustainable forestry is necessary. Since current forestry methods are economically infeasible, the industry is maintained with subsidies. Moreover, the methods are inappropriate for keeping the forest ecosystem healthy. Therefore, the government should seek a method suited to the nation's reality, which is low-cost forestry.

Third, the government should deregulate the forestry sector. Because the nation has accomplished forest greening through the aggressive forest protection policy, this policy remains. Such a policy violates the property rights of private forest owners and restricts proper forest management. Therefore, the government should improve relevant policies toward facilitating the use of forests. The first step to nurture forestry as a growth industry is to ease regulations on forest use.

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