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**Article**

# Agricultural Status and Soils in Korea

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**Korea's agriculture had many inherent problems. Korea is a mountainous country with only 22 percent farmland and less rainfall than most other neighboring rice-growing countries. A major land reform in the late 1940s and early 1950s spread ownership of land to the rural peasantry. Individual holdings, however, were too small or too spread out to provide families with much chance to produce a significant quantity of food. The enormous growth of urban areas led to a rapid decrease of available farmland, while at the same time population increases and bigger incomes meant that the demand for food greatly outstripped supply. The result of these developments was that by the late 1980s roughly half of Korea's needs, mainly wheat and animal feed corn, was imported. Korea's agriculture is facing a new round of difficulties from the inevitable process of market opening. Therefore, we have reviewed the agricultural status and soils in Korea how we can meet the coming issues with respect to production and prospect based on the government documents and articles published on the journals.**

**Key words:** Agricultural Conditions, Soils, Korea

## Introduction

Compared with the industrial and service sectors, agriculture remained the most sluggish sector of the economy. Most economists agreed that the country's rural areas had gained more than they had contributed in the course of industrialization. However, the gains were even more impressive because they added to a traditionally high level of productivity (Aiken, 1983; RDA. 1985).

In the recent years, as the scope and intensity of human activities altering the nature of soils have been ever increasing, anthropogenic factors have become a major concern. In Korea, while demands for land have increased from various sectors, the per capita land area is very small (Yoo, S.H. 1990; 1991; 1989). The alteration of the nature of soils is occurring due to both agriculture and non-agricultural land use practices. Within agriculture, the alteration of the quality of soils has occurred in two directions, both positively and negatively. The proper use of the adequate amount of fertilizers by a majority of farmers has resulted in an increase in soil fertility levels in open fields (RDA. 1985). On the other hand, the overuse of manure by protected farms in greenhouses has resulted in degradation of soil quality due to accumulation of undesirable components derived from organic manure. When this happens, as a means of remedy, some farmers add large quantities of fresh earth collected from the mountain side. Such earth is extremely infertile. This practice is unhealthy because it both destroys the hillside lands and requires farmers to use more manure to grow crops on the infertile earth (Park, 1991; Yun et al., 2009; Jo et al., 2009; http://soil.rda.go.kr/soil/soilact/agriCulture.jsp).

**Generals in soils** Detailed knowledge of soil characteristics is of great importance for both the use and conservation of soil resources, which are essential for human welfare and the sustainability of ecosystems (http://www.mongabay.com/history/south_korea/south_korea-agriculture.html). Soil genesis is influenced not only by parent rocks but also by climate, vegetation, and time. Korean soils, derived from an acidic granite are rather coarse and liable to erosion (http://soil.rda.

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go.kr/soil/soilact/agriCulture.jsp). Coarse soil distribution reaches 31.9% for paddy and 23.3% for arable upland. Surface soil erosion reaches 2-3 mm, i.e. 30 t $ha^{-1}$ in sloped upland soil, thus, soil becomes acidic with low fertility. On the other hand, the soils under concentrated management for cash crop growing or those in greenhouses contain high phosphates and potash (http://www.naas.go.kr). It is therefore urgent that RDA set up an integrated policy on soil improvement, conservation, and balanced application of fertilizer in harmony with the environment for sustainable agriculture (http://soil.rda.go.kr/soil/board/dataBoardDetail.jsp?bid=1029&aid=2447; Yun et al., 2009; Jo et al., 2009).

## Soil Forming Factors in Korea

**Climate** Korea is located in the humid temperate climatic zone affected by the influence of both continental and oceanic air masses. National average annual rainfall is about 1,300 ㎜. About 50-60 percent of annual rainfall occurs during the summer months; July to September, with occasional typhoons. During summer, although the ambient temperature is high (mean temperature; 20-25℃), and crop canopies are thick, the precipitation exceeds the potential evapotranspiration because of concentrated heavy rainfalls (http://www.naas.go.kr; RDA. 1989; Yun et al., 2009; Jo et al., 2009, http://www.mongabay.com/history/south_korea/south_korea-agriculture.html). As a result, the base saturation ratio is rather low in the majority of soils. With the exception of soils developed from alkaline rocks containing a large proportion of calcium and/or magnesium carbonates, it typically results in a low soil pH. Temperatures in spring and autumn are mild (mean temperatures of 10-15℃) and winter months are rather cold (monthly mean temperature of -5-2℃), particularly in the central and northern regions. During winter, spring and autumn, the rainfalls are much smaller than in summer. Despite these seasonal differences, the amount of precipitation and the potential evapotranspiration remain similar all throughout the year because of the lower ambient temperatures in the drier seasons (http://www.naas.go.kr; http://soil.rda.go.kr/soil/board/dataBoardDetail.jsp?bid=1029&aid=2447; http://www.mongabay.com/history/south_korea/south_korea-agriculture.html).

**Topography** Korea is a mountainous country. More than two-thirds of the country is occupied by mountains with steep slopes. Plains are subdivided into inland plains, coastal plains, and plains in the narrow valleys. The plains have been under intensive use for agricultural productions (http://www.mongabay.com/history/south_korea/south_korea-agriculture.html). The high relief of the land coupled with the heavy downfalls of rain in summer affects the characteristics of Korean soil profoundly (Yun et al., 2009; Jo et al., 2009). Erosion of soils has been intensive throughout the country for a long time, particularly where the population density is high. In olden days, people in the rural areas used to rely upon the mountains for their fuel and composts for farming. Exploitation of forest vegetations by the people increased soil erosion to such an extent that there are very few mature soils in the country. Continued erosion has not allowed soil development to occur (http://www.naas.go.kr; Yun et al., 2009; Jo et al., 2009).

**Parent materials** The parent materials of Korean soils are part of about ten recognized geologic systems from different geological time series. Dominant rock types include granitic gneiss (32.4%), granite (22.3%), schist (10.3%), and limestone of the Chosun Group (Cambrian-Ordovician: 10.1%). The former three lithologies are present in about 60% of the land area and are known as acidic rocks (Yun et al., 2009; Jo et al., 2009). The fact that the rainfall exceeds the potential evapotranspiration, coupled with the abundance of acidic rocks, results in the wide occurrence of acidic soils in the country (http://www.mongabay.com/history/south_korea/south_korea-agriculture.html). The limestones of the Chosun Group are alkaline, thus the soils derived from these rocks tend to be neutral or slightly alkaline. These soils are only found near Gangwon-do (Yun et al., 2009; Jo et al., 2009). Some areas contain sandstone bedrock which results in coarse-textured soils. However, even among soils derived from the same parent rock, textures can vary depending upon the location in the soil catena. Soils developed in higher places tend to be coarse due to loss of fine particles by erosion. Soils developed at the locations where soil erosion is not severe tend to be fine-textured (http://www.naas.go.kr).

**Vegetation** In Korea, vegetation was not a major factor influencing the soil characteristics even in the mountains. In the past, with the exception of remote areas, forests were heavily used resulting in extremely low soil fertility due to exploitation by humans. During the last three decades or so, mountains in the country have become green because the exploitation of forests has stopped as electricity and fossil fuels became widely available in rural areas (http://www.mongabay.com/history/south_korea/south_korea-agriculture.html). The wide use of chemical fertilizers also contributed for this change. With the convenient fertilizers in their hands, farmers did not need to go to mountains to collect the grasses to make compost (Yun et al., 2009; Jo et al., 2009). If these trends continue, vegetation in the forests may exert a noticeable influence on soil formation in the future. To this point in time, it appears that the influence of vegetation on the characteristics of Korean soils is generally not significant as compared to those of climate, topography and humans (http://www.naas.go.kr).

**Time** Undoubtedly time is a very important factor affecting the characteristics of soils. The older the soil, the more mature the soil. Distinct soil horizons reflect the history of the soil. As mentioned earlier, due to unique rainfall patterns and topographical conditions (e.g. mountains with steep slopes) soils in the highland are eroded severely, while soils lying in low land frequently receive new parent material (http://www.mongabay.com/history/south_korea/south_korea-agriculture.html). Either of these conditions does not result in long periods of stability necessary for soils to mature. It follows that, with the exception in some locations, time is a minor factor in the development of soils in Korea (http://www.naas.go.kr; http://soil.rda.go.kr/soil/board/dataBoardDetail.jsp?bid=1029&aid=2447).

**Soil distribution** When described using the Soil Taxonomy of the USDA, soils in Korea are classified into seven Soil Orders which are then further divided into 14 Sub-Orders (Fig. 1). Among those seven Soil Orders, the younger soils, Entisols and Inceptisols, are dominant (Yun et al., 2009). Entisols are the youngest soils, followed by Inceptisols. Alfisols and Ultisols are relatively older soils. The working unit of soil classification is the Soil Series. So far 390 Soil Series have been identified in Korea (Table 1). The occurrence of younger soils (Entisols and Inceptisols) is overwhelming because of the influences of both Korea's unique climate, with concentrated rainfalls in summer, and rugged topography as characterized by the wide occurrence of highly-sloped mountains. This strongly suggests that, if the soil resources are to be adequately conserved, serious attention must be paid to the development of measures to minimize soil erosion in hilly lands (http://www.naas.go.kr; http://soil.rda.go.kr/soil/board/dataBoardDetail.jsp?bid=1029&aid=2447).

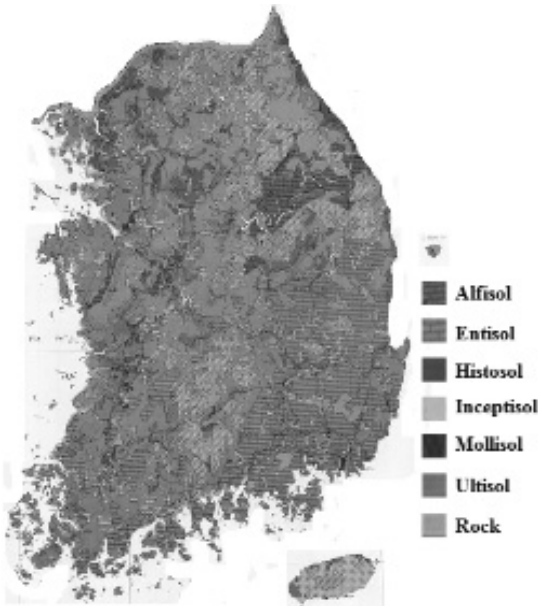


**Fig. 1. Map of soil order distribution in Korea.**

**Table 1. The areal extent of the different soil orders and the number of soil series in Korea.**

| Orders | Sub-Orders | No. of Series | Area (ha) |
|---|---|---|---|
| Inceptisols | Aquepts | 77 | 370,580 |
| | Udepts | 133 | 276,103 |
| Ectisols | Aquents | 14 | 657,124 |
| | Fluvents | 13 | 46,896 |
| | Orthents | 17 | 103,730 |
| | Psamments | 20 | 2,041,352 |
| Ultisols | Udults | 28 | 92,064 |
| Alfisols | Aqualfs | 7 | 786,848 |
| | Udalfs | 37 | 4,060,307 |
| Andisols | Udands | 39 | 871,222 |
| | Vitrands | 1 | 48 |
| Mollisols | Udolls | 2 | 337 |
| Histosols | Saprists | 1 | 309,677 |
| | Hemists | 1 | 5,866 |

**Erosion** Using the USLE to calculate soil loss per year, Jung (1976, 1985) estimated that potential soil loss from erosion from steep slope (22.5%) could be as high as 485 Mt $ha^{-1}$ per year, but suggested that this could be reduced to less than 13 Mt $ha^{-1}$ per year with proper soil conservation measures. Measured soil loss using different cropping systems from 1977 to 1982 ranged from 0.1 Mt $ha^{-1}$ per year in grass plot to 226 Mt $ha^{-1}$ per year from the clean tilled plot. A large amount of nutrients can also be lost from surface soil as the topsoil erodes. Measurements in a corn field found that 15.5 kg of nitrogen and 10 kg of phosphorus were washed away by runoff water with topsoil when 21.5 Mt of topsoil were eroded in a year.

**Soil fertility and soil management** Over the last five decades, Korea has experienced dramatic changes in farm practices as a result of government-supported programs for the development and dissemination of improved agricultural technology for achievement of self-sufficiency in staple foods and increase in farm incomes. Since the 1960s, agriculture in Korea has done a tremendous job of producing enough rice for self-sufficiency, and providing consumers with food of high quality at a reasonable price. As in other industrialized countries, the pattern of modern agriculture in Korea has aroused public concern over environmental problems such as contamination of water by agricultural chemicals, pesticide residues in food, growing resistance to pesticides among insects and pests, loss of genetic diversity, loss of natural soil productivity, and aggravated salinity (Lee and Kim. 2009).

The increased inputs of modern agriculture are largely of artificial origin, and may have a negative impact on the environment. Chemical fertilizer applied to soils can provide crops with specific ingredient elements, but not with all the essential elements they need. The other essential nutrients for plant growth must be supplied from other sources, that is, from the soil. Crops can not take up all the nutrients added as fertilizer (Lee and Kim. 2009). Thus, farming practices which use heavy applications of chemical fertilizer may cause some elements in the soil to be depleted and others to be deposited in excess, resulting in a worsening of the soil's nutrient balance and reduced soil productivity. Some of the surplus chemicals may degrade the soil ecosystem and act as pollutants (Yoo, 1990).

In Korea, sustainable agriculture received little attention, because farming had been focussed on maximizing yield. It was not until 1990 that the term "sustainable agriculture" was publicly discussed for the first time in Korea. In terms of agricultural technology, the major components of sustainable agriculture are cultural practices and plant breeding, soil and water management, pest and weed control, and integrated plant-animal production and nutrient cycling. Soil is the key natural resource in agricultural production. This paper discusses current problems of Korean soils associated with agricultural productivity, and a soil management strategy for sustainable agriculture.

**Changes in soil management in Korean agriculture** Until the 1920s, Korean farmers made little use of chemical fertilizer. The consumption of chemical fertilizer in 1925 was only 21,000 Mt, so farming had to depend mainly on natural soil fertility and organic manure. However at this time, rice yields from paddy fields were less than 1.5 mt $ha^{-1}$. By 1937, 570,000 Mt of chemical fertilizer were being applied, and average national rice yields had increased to 2 Mt $ha^{-1}$. The recommended application rates for chemical fertilizers at this time were 26 kg $ha^{-1}$ of nitrogen, 34 kg $ha^{-1}$ of phosphorus and 39 kg $ha^{-1}$ of potassium (Jo et al., 2009).

By the early 1960's, Korea still suffered from a food deficit, and the government began a program to boost agricultural production. Farmers began to make widespread use of agricultural chemicals, as fertilizers and for pest management and weed control. In the 1970s, high yielding rice varieties bred by crossing Japonica and Indica were disseminated throughout Korea, and as a result average rice yields soared to 4.5 Mt $ha^{-1}$. Small-scale farmers began to mechanize their farm operations, and heavy inputs of chemical fertilizers and pesticides became common. By the mid 1970s, self sufficiency in rice, the staple crop, was achieved, and Korea even recorded a surplus in rice production during the 1980s (http://www.index.go.kr/egams/index.jsp).

Agricultural practices have been changed and fewer nutrients are being recycled as the harvested plant parts are removed from the field. In Table 2 we can compare

**Table 2. The total amount of fertilizers recommended by the rural development administration in Korea.**

| | Year | N | $P_2O_5$ | $K_2O$ | Remarks |
|---|---|---|---|---|---|
| | | ---------- kg $10a^{-1}$ ---------- | | | |
| Before | 1930s | | | | Traditional organic farming |
| | 1930s | 26 | 34 | 39 | Chemical fertilizes introduced |
| | 1940s | 39 | 21 | 24 | |
| | 1950s | 36 | 39 | 34 | Varietal development begun |
| | 1960s | 54 | 55 | 41 | Agricultural development boosted |
| | 1970s | 105 | 56 | 66 | Tongil Indica variety bred |
| | 1980s* | 150 | 90 | 110 | Further high-yielding varieties |
| | | 110 | 70 | 80 | Japonica varieties become common |
| | | 110 | 120 | 130 | Cool regions of Korea |
| | | 120 | 100 | 110 | Nation-wide |
| | 2008 | 90 | 45 | 87 | Normal paddy field |

**Table 3. Soil management problems and their corrective measures needed.**

| Soil management problems | Corrective measures needed |
|---|---|
| **Soil fertility** | **Reevaluation of soil fertility** |
| · Low soil fertility (low pH, OM and nutrient elements) | · Monitor changes in soil status |
| · Accumulation of unused elements | · Develop new soil testing Methods |
| | · Study dynamics system |
| **Fertilizers** | **New fertilizers** |
| · Mainly chemical fertilizes of major elements of N, P, K and Ca | · Based on changed soil conditions |
| · Based on yield goals, Excessive use | · Timely release of nutrients |
| | · Improved phytoavailability |
| **Depletion of organic matter** | **Nutrient Movement** |
| **Soil erosion :** Loss of soil and nutrients | · Dynamics of constituent elements |
| **Conservation practices** | **Proper management of crop residues/manure** |
| · Proper soil management of land | · Crop residue management tech |
| **Livestock wastes** | **Recycling of organic resources** |
| · Loss of organic resources | · Efficient use of animal wastes |
| · Pollution problems | · Combined cropping/livestock farming |

the total amount of fertilizers recommended by the Rural Development Administration (RDA) with the actual fertilizer consumption by farmers. There is little difference in the amounts of phosphorus and potassium recommended and those purchased, but the amount of nitrogen fertilizer purchased by farmers exceeded the recommended amount by more than 90%. It is clear that too much nitrogen fertilizer is being applied.

There has been a steady decline in the organic matter and magnesium content since 1936, while the phosphorus content has been increased. The organic matter content was 3.3% between 1936 and 1946, at a time when soil fertility was still being maintained with organic manure (http://www.index.go.kr/egams/index.jsp). In the 1960's, the organic matter content of the soil fell to 2.6%, and simultaneously the average pH rose and the potassium and calcium content also increased. This marks the period at which chemical fertilizers came into widespread use as intensive farming began (Table 2).

**Soil management for sustainable agriculture** Soil properties have changed as a result of intensive cropping, monoculture, and the heavy use of agro-chemicals. The present recommended rates for fertilizers in Korea were set when soil fertility was rather low, so it is not appropriate to apply these to the soils of today or in the future. The accumulation of some nutrient elements in soil is already evident, and it is time to reevaluate soil fertility (Table 3).

## Agriculture in Korea

**Farmland area** The total land area of Korea is 9.965 million ha. Of this land area, approximately 17% or 1.7 million ha was arable land as of 2011. The areas of paddy and upland was about 0.96 million ha and 0.74 million ha (http://www.index.go.kr/egams/index.jsp). However, the area of farmland gradually decreased from 1.88 million ha in 2001 to 1.69 million ha in 2011, representing that the decrease in the farmland was approximately 10% between 2011 and 2011 (http://www.index.go.kr/egams/index.jsp). And the area of the paddy was also gradually decreased from about 1.15 million ha to 0.96 million ha in 2011 while the area of the upland was slightly increased from 0.73 million ha in 2001 to 0.74 million ha in 2011 (Table 4) . This indicated that a large portion of the farmland was diverted to other uses such as residence or industry. The decrease in the cultivated area of paddy rice was brought about by the change in field form and quality, and the construction of buildings as well as a drop in rice prices and rice purchase by the government.

The total cultivation area of farm products is continuously decreasing, and these decreases are occurring across all crop types (http://www.index.go.kr/egams/index.jsp). From the years 2000 to 2011, the cultivation areas of each type of farm product are in the order of grains (64.1%), vegetables (12.5%), fruit orchards (7.8%), and greenhouse crops (5.3%).

**Uses of chemical fertilizer and pesticides** Use of chemical fertilizer per ha increased by 183% from 162 kg in 1970 to 458 kg in 1990, but has been decreased by 21% to 350 kg in 2003 and 50% to 232 kg in 2010. Nevertheless, the use is still regarded as high and the government continues its hard effort to reduce the use of chemical fertilizer (http://www.fert-kfia.or.kr/neo). On the other hand, instead of reducing the use of chemical fertilizer, efforts are made to protect the soil by utilizing livestock and poultry waste as compost and by distributing soil conditioner (http://www.index.go.kr/egams/index.jsp).

**Production in agriculture** Comparing the production structure of Korean farm products and total agricultural production, the production proportion of sowing to livestock-breeding, which was about 90:10 in the early 1950s, changed to 70:30 in the early 2000s, illustrating an expansion in stock breeding and a contraction in sowing.

The cultivation trend by crop shows the continuous decrease in ratio of cereals, while high-profit products or products in growing demand have become more and more cultivated through greenhouse farming. The amount of production by crops has shown a decreasing trend in food crops, while vegetables, fruits, flowers, and livestock and poultry products have shown increasing trends.

The 15 major agricultural products in 2010 are rice (27.6%), pig (10.1%), Korean beef cattle (8.0%), milk, egg, chicken, red pepper, grape, water melon, straw-

**Table 4. Changes of farmland area in Korea since 2001.** **(Unit : ha)**

| Category | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2001 | 2003 | 2005 | 2007 | 2009 | 2010 | 2011 |
| Area | 1,876 | 1,846 | 1,824 | 1,782 | 1,737 | 1,715 | 1,698 |
| Paddy | 1,146 | 1,127 | 1,105 | 1,070 | 1,010 | 984 | 960 |
| Upland | 730 | 719 | 719 | 712 | 727 | 731 | 738 |

**Table 5. Consumption of pesticide and chemical fertilizer in Korea since 2001.**

| Category | | Year | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2001 | 2003 | 2005 | 2006 | 2007 | 2009 | 2010 |
| Pesticide | Total (ton) | 28.2 | 24.6 | 24.5 | 24 | 24.3 | 22.8 | 19.3 |
| | (kg $ha^{-1}$) | 13.5 | 12.7 | 12.8 | 12.9 | 13.1 | 12.2 | 10.6 |
| Chemical Fertilizer | Total (ton) | 717 | 678 | 722 | 477 | 631 | 500 | 423 |
| | (kg $ha^{-1}$) | 343 | 350 | 376 | 257 | 340 | 267 | 232 |

berry, garlic, straw, tomato, ginseng, and cabbage, which account for 72% of the total amount of agricultural production, valued at around KRW 40.5 trillion. Rice is the most important food to Koreans; its ratio to total agricultural production is 27.6%, 2.7 times that of the second largest product, pig with 10.1%. Compared with that of 1990, production of garlic, apple, sesame, tobacco, and orange tangerine is decreasing, while watermelon, grapes, and ginseng have made it to the list of 15 major agricultural products (http://www.index.go.kr/egams/index.jsp).

The proportion of rice to total agricultural production, however, is still relatively high. Hence, the production variations of rice influences the entire agricultural production totals. The production of grains other than rice expanded until the late 1960s, but declined noticeably after that. The production proportion of grains, which accounted for 11 percent in the 1960s, fell to 1 percent in the early 2000s (http://www.index.go.kr/egams/index.jsp). The production of beans decreased from the late 1970s, and the production of potatoes decreased from the early 1960s, but has recently begun to increase. In the meantime, vegetables and fruits experienced the opposite trend, with an annual production growth of 4.1 percent and 6.4 percent, respectively. In the early 2000s, the production proportions of fruits and vegetables rose to 13 percent and 26 percent, respectively, constituting about 37 percent of total production (http://www.index. go.kr/egams/index.jsp).

The production proportion of rice, the staple food for Koreans, occupies over 85 percent of total food grains. However, rice consumption has been continuously decreasing due to, a better understanding of health, and an increased consumption of substitute foods, such as fruits and vegetables (Table 6). The annual rice consumption per person in Korea has been on the decline, with per person consumption levels of 112.7 kg in 1960, 136.4 kg in 1970, 132.4 kg in 1980, 119.6 kg in 1990, 93.6 kg in 2000, and 72.8 kg in 2011. Consequently, the cultivation area for rice in the past 10 years has decreased continuously. The production output of rice rises and falls every year depending on the weather conditions, but the overall trend is a decrease. The production output of rice for each province (do) are not consistent in their rankings, but usually Jeollanam-do has the highest production, and Jeju Special Self -Governing Province has the lowest production (http://www.index.go.kr/egams/index.jsp).

The consumption of vegetables in Korea has grown considerably due to changes in eating habits, so the production proportion of vegetables has increased significantly. The utilization of farmland to total cultivated acreage, which was 3.9 percent in the 1960s increased to 12.5 percent in 2005. The cultivation acreage for vegetables reached 374,000 ha in 1995 and 282,000 ha in 2005, constituting about 18 percent of total cultivated acreage of food. The most highly produced vegetables in Korea are green vegetables, including Korean cabbage, spinach, and lettuce, root vegetables, including icicle radish and carrots, fruits and fruit vegetables, including Korean melon, watermelon, cucumber, tomato, and strawberries, and seasoning vegetables including hot pepper, garlic, green onions, onions, and ginger. In 2005, the production proportions of each vegetable type were: green vegetables (31.7 percent), fruit vegetables (27.3 percent), seasoning vegetables (25.7 percent), and root vegetables (15.3 percent). The rankings of cultivated acreage of vege-

**Table 6. Yield, self sufficiency, and consumption of crops and forage.**

| Category | | Year | | | | |
|---|---|---|---|---|---|---|
| | | 2002 | 2004 | 2006 | 2008 | 2010 |
| Yield (1000 Ton) | Rice | 5,515 | 4,451 | 4,768 | 4,408 | 4,916 |
| | Vegetable | 9,796 | 10,468 | 9,994 | 9,934 | 8,381 |
| | Fruit | 2,500 | 2,411 | 2,504 | 2,698 | 2,489 |
| | Meat | 147 | 145 | 158 | 174 | 186 |
| Consumption (kg per capita) | Rice | 87 | 82 | 78.8 | 75.8 | 72.8 |
| | Vegetable | 144.6 | 156.8 | 153.8 | 154.2 | - |
| | Fruit | 58.8 | 58.8 | 62.2 | 65.5 | 58.3 |
| | Meat | 33.5 | 31.3 | 33.6 | 35.6 | 38.8 |
| | Beef | 8.5 | 6.8 | 6.8 | 7.5 | 8.8 |

**Table 7. Self-sufficiency rates of food, vegetables, fruit, and livestock in Korea since 1985.**

| Year | Food | Vegetables | Fruits | Livestock |
|---|---|---|---|---|
| 1985 | 45.5 | 18.3 | 5.7 | 25.5 |
| 1990 | 44.0 | 18.8 | 7.4 | 22.2 |
| 1995 | 31.7 | 25.2 | 11.7 | 23.0 |
| 2000 | 37.6 | 21.1 | 8.1 | 25.4 |
| 2003 | 30.6 | 23.9 | 7.3 | 27.8 |
| 2008 | 27.8 | 22.4 | 6.9 | 28.2 |
| 2010 | 26.7 | 19.8 | 6.4 | 28.7 |

tables are, in order, Korean cabbage, garlic, icicle radish, watermelon, green onion, and onion (http://www.index.go.kr/egams/index.jsp).

The cultivated acreage of fruit trees in Korea, which was 20,000 ha in 1955, increased to 176,000 ha by the end of the 1990s. However, the acreage gradually decreased to 155,000 ha by 2005, yet this figure is still seven times larger than the acreage of orchards in the 1950s. Meanwhile, the production output for fruit increased to 2,593,000 tons in 2005 from 117,000 tons in 1955. The most significant fruit trees in Korea and their production rankings for 2005 were tangerines, Korean pears, grapes, apples, persimmons, and peaches. The acreage ranking in 2005 was apples, persimmons, grapes, Korean pears, tangerines, and peaches. Gyeongsangbuk-do cultivated the most fruit trees, constituting 31.4 percent of total national production and 32.7 percent of total cultivated area.

**Food security and food self-sufficiency** In view of the rapid changes in the agricultural structure of Korea, it has made persistent efforts to secure its total food security and food self-sufficiency. As of 2010, self-sufficiency rate of rice was over 100%; on the contrary, total self-sufficiency rate of major grain products is 26.7% including feed grains and 54.9% for food grains only. However the self-sufficiency rate of livestock was gradually increased to 28.7% in 2010 (http://www.index.go.kr/egams/index.jsp).

**Environmentally-friendly agriculture (EFA)** In Korea, EFA is one farming technique to pursue both environmental preservation and safety of agricultural products by establishing sustainable agricultural production with harmonization between agriculture and the environment (Ministry of Agriculture and Forestry). This articulation was established by the Korean government in 1997 as the EFA Promotion Act and 1998 was declared to be the starting year for EFA. In addition, a direct payment system for EFA was introduced in 1999. Subsequently, the EFA Promotion Act was revised and a five-year plan for EFA was implemented in January 2001. These policies greatly romoted EFA and as a result EFA, including organic agriculture, increased rapidly. Currently private certification institutions are increasing to privatize the certification of environment-friendly agricultural products. This participation from private certification institutions is expected by the local government and farmers to be an important key in revitalization of the local communities. This paper focuses on the current state and characteristics of these private certification institutions to promote environment-friendly agricultural products and contributes to the development of EFA and local communities.

Korea places great importance on self-sufficiency in food staples, and achieving income parity between rural and urban households. To attain these goals, considerable support has been provided to its agriculture sector. Korea's policy support to the agriculture sector ranks among the worlds' highest. Small holdings still persist, entry into the sector is difficult, and the farm population is aging rapidly. Demographics and resource scarcity are therefore likely to shape the sector's evolution in the coming decades.

## Prospects of Agriculture in Korea

Korea's agriculture is facing a new round of difficulties from the inevitable process of market opening. Markets for agricultural goods other than rice have gradually opened over the past 10 years; and even rice will be subject to full opening in 2014. Such opening is only likely to accelerate if Korea signs FTAs with the EU and China (http://english.mifaff.go.kr/eng/list.jsp?group_id=1002&menu_id=1027&link_menu_id=&division=H).

The most pressing issue for farm management now comes down to: (1) product differentiation through improvements in product and service quality, and (2) improvement of farmers'skill sets as entrepreneurs as well as cultivators. Thus far, farming strategies have stressed cost competitiveness through more efficient

production. As inexpensive imported produce intensifies pressure on local farmers, however, higher profit margins from differentiated products will be the only way for Korean farmers to survive. In addition, agriculture urgently requires farm entrepreneurs who can implement product differentiation in production, distribution, and marketing (http://english.mifaff.go.kr/eng/list.jsp?group_id=1002&menu_id=1027&link_menu_id=&division=H).

Korean farmers, as well as the handful of successful entrepreneurs mentioned above, the time is now past due for a shift in government policy that moves from simple subsidies to fundamental strengthening of market competitiveness. As market liberalization proceeds apace, the government cannot continue to protect agriculture in defiance of all international norms. Policies that are oriented only toward relief of short-term problems has tended only to increase the dependence of agriculture on the government and made it even less viable.

## Summary

It is our understanding that the concerns about country's rural areas are being increased with growing food security and safety of food. The situation of Korean agriculture is not much competitive with other advanced countries that have enough land resources with plenty agricultural materials such as fertilizer and pesticides. Also we are facing market opening of agricultural products including main foods as well as vegetables and fruits in 2014. However, the prospect of Korea's agriculture is not bright due to low self sufficiency rate of food crops and high-reliance of forage crops about poultry feeds which are relied import. And we have highly relied on chemical fertilizers and pesticides in crop production while people favors agricultural products produced by organic farming or EFA. With these problems we should prepare and develop our own agricultural practices to meet the people's needs and to compete with foreign agricultural products.

## References

Aiken, W. 1983. The Goal of Agriculture. In: Agriculture, Change, and Human Values, R. Haynes and R. Lamer (eds.). Vol. I.. Cransville University, USA, pp. 29-54.

http://english.mifaff.go.kr/eng/list.jsp?group_id=1002&menu_id=1027&link_menu_id=&division=H

http://soil.rda.go.kr/soil/soilact/agriCulture.jsp

http://www.mongabay.com/history/south_korea/south_korea-agriculture.html

http://www.fert-kfia.or.kr/neo

http://www.index.go.kr/egams/index.jsp

http://www.naas.go.kr

Jo, I.S., P.K. Jung, L.Y. Kim, S.K. Ha, D.Y. Chung. 2009. Soil Physical Properties and Soil Conservation. J. Korean. Soc. Soil Fert. 42:28-52.

Jung, P.K., M.H. Ko and K.T. Um. 1985. Discussion of cropping management factors for estimating soil loss. J. Kor. Soc. Soil Fert. 18:7-13.

Jung, Y.S., J.S. Shin and Y.H. Shin. 1976. Erodibility of soils of Korea. J. Korean. Soc. Soil Fert. 9:109-115.

Park, Y.D. 1991. The present situation of using nitrogen fertilizer and its effects on upland crops in Korea. Paper delivered at the International Seminar on Increasing Nitrogen Efficiency in Upland Crop Production, June 23-30, 1991. RDA, Suweon, Korea.

RDA. 1985. Soils of Korea and their improvement. ASI, RDA, Suwon, Korea, p. 71.

RDA. 1989. The Report on the 10-Year Soil Amendment Project in Korea, J.H. Han, (ed.). Rural Development Administration (RDA), Korea, p. 508.

Yoo, S.H. 1990. Present status and Prospect on Soil Pollution in Korea. The 21st Century Committee Report. Seoul National Univ. Korea, p. 41.

Yoo, S.H. 1991. Soil management for sustainable agriculture: In: Proceedings of a Symposium on Conservation of Agriculture, Korean Society Env. Agr., Korea, pp. 79-95.

Yoo, S.H., Y.S. Jung and Y.H. Shin. 1974. Deterioration of the physical and chemical properties of vinyl house soils by continuous vegetable cropping. J. Kor. Soc. Soil Fert. 7: 227-234.

Yun, E.S, Y.T. Jung, Y.K. Sonn, S.Y. Hong, B.K. Hyun, G.S. Hyun, C.H. Yoo, K.Y. Jung. 2009. Soil Survey, Classification and Interpretation of Korea. J. Korean. Soc. Soil Fert. 42:5-27.

Lee, K.S. and W.J. Kim. 2009. The development and use of fertilizer for 40 years in Korea. J. Kor. Soc. Soil Fert. 42L:195-212.