

## **Assessment of Food Supply in North Korea**

KWON TAE-JIN\*  
KIM WOON-KEUN\*\*

### **I. Introduction**

North Korea continues to suffer from a severely depressed economic sector. Its agricultural environment is worse than that of South Korea. Only 15 percent of its total land is arable and there is a relatively short growing season. Frost-free days range from 130 to 190. Therefore, cropping patterns must take into account the duration of frost-free time available. More than 1/3 of rice and maize are planted in poor land that practically have no irrigation facilities with unsatisfactory soil.

The economic situation has limited the ability to produce or import agricultural inputs such as fertilizer, pesticides, and machinery. Per-capita gross national product (GNP) reached the highest point of \$911 in 1989, declined thereafter, and marked \$573 in 1998. The reduced food production is further aggravated by recurring adverse natural disasters which has also limited the ability of the country to import food to close the resulting substantial food import gap.

Extensive floods in 1995 and 1996 coupled with the worst drought in decades in 1997 and local heavy rain in 1998 crippled North Korea's agriculture and its ability to feed its population. This series of natural disasters came on top of several

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\* Senior Fellow, Korea Rural Economic Institute, Seoul, Korea.

\*\* Research Director, Korea Rural Economic Institute, Seoul, Korea.

years of economic slowdown and stagnation, which had already led to falling productivity and production in agriculture and dramatically reduced food availability. Efforts to increase the area under cultivation resulted in the degradation of hillside slopes, further aggravated by reforestation by exporting timber to earn foreign exchange. The environmental degradation had led to an increase in the incidence and severity of floods. Consequently the country has had to rely heavily on international food assistance.

The purpose of this study is to examine the possibility of food self-sufficiency and to figure out affordable measures to ensure food security in North Korea. This study consists of three parts. First, it reviews the food situation in North Korea. Second, it analyzes the causes of food shortage in the country. Finally, it reviews long-term food security in North Korea, including short-term measures to mitigate current food problems.

## **II. Current Status of Food Supply and Demand in North Korea**

### **1. Food Supply**

North Korea has made a desperate effort to enlarge the arable land since the 1970s. For example, the "Initiative of the Five Nature Remodeling" initiated in 1976, and the "Project of the Four Nature Reconstruction" initiated in 1981 are representative. However, the goals of the projects were not successfully accomplished because of the lack of resources. Some people argue that the recent natural disasters are exacerbated by the excessive exploitation of steep land.

The economy of North Korea has declined since the late 1980s. Since the late 1980s, various indications showed the possibility of the country's food shortage. It was not until the mid-1990s that international society became aware of the North's food shortage. In the 1990s, Kim Il Sung reiterated the famous slogan, "rice with meat soup" in his New Year messages. This indicates that food situation of the country was getting worse.

TABLE 1 Grain Production in North Korea

Year	Acreage (1,000ha)						Yield (tons/ha)	Production (1,000tons)
	Rice	Maize	Pulses	Potatoes	Other <sup>1)</sup>	Total		
1991	583	618	200	100	92	1,593	2.78	4,427
1992	570	618	200	100	100	1,588	2.69	4,268
1993	568	618	200	100	100	1,586	2.45	3,884
1994	570	618	154	84	59	1,485	2.78	4,125
1995	576	641	125	66	77	1,486	2.32	3,451
1996	576	641	115	56	78	1,466	2.51	3,690
1997	576	641	114	56	112	1,499	2.32	3,489
1998	576	629	115	56	147	1,523	2.55	3,886

1) Other include barley, wheat, sorghum, oats, rye, buckwheat etc.

Source: Rural Development Administration (RDA), 1998.

The economy began to deteriorate rapidly after the break-up of the former Soviet Union and eastern European countries. At the same time, it had a serious problem with agricultural production. Grain production declined with reduced yield and stagnant acreage in the 1990s (Table 1).

Thanks to favorable weather conditions and acreage increases, grain production increased by about 11 percent to 3.89 million tons in 1998. Nevertheless, it is far below the potential production level.<sup>1</sup> The Rural Development Administration estimated grain production in 1998 at 3.89 million tons, comprising 1.46 million tons of rice, 1.95 million tons of maize, 0.11 million tons of pulses, 0.16 million tons of potatoes, and 0.21 million tons of barley and others. FAO/WFP estimated production at 3.78 million tons, comprising 3.40 million tons of grain and 0.38 million tons of potatoes. The estimation of FAO/WFP is equivalent to USDA for the grain production. North Korea informally revealed the grain production level for 1998 as 2.83 million tons (Table 2).

<sup>1</sup> The potential production level in North Korea is estimated at 5.21 million tons under the current system. But, it increases to 6.63 million tons when equivalent commodity yields in South Korea are applied (Park and Kim 1999).

TABLE 2 Grain Production Estimates, 1998/99

	Rice	Maize	Others	Total
RDA	1,461	1,947	211	3,619
FAO/WFP	1,341	1,765	677	3,783
USDA <sup>1)</sup>	1,400	1,900	100	3,400
North Korea <sup>1)</sup>	-	-	-	2,831

Unit: 1,000 tons

1) Potatoes are not included.

Source: Rural Development Administration (RDA), 1998.

FAO-GIEWS, "FAO/WFP Crop and Food Supply Assessment Mission to Democratic People's Republic of Korea," Special Report, June 29, 1999.

## 2. Food Consumption

According to a recent FAO/WFP Crop and Food Supply Assessment Mission, much of the population faces the grim prospect of a continuing decline in nutritional standards. In 1998, a nutrition survey carried out in North Korea by the United Nations Children's Fund (UNICEF), the World Food Programme (WFP), and European Union (EU) revealed that over 60 percent of the children surveyed suffered from severe stunting resulting from inadequate nutrition. Although the FAO/WFP Mission notes a slight overall improvement in the nutritional situation, many regions of the country remain extremely vulnerable to food shortages. It is the same appraisal as that made by Catherine Bertini, Executive Director of WFP, who visited North Korea in early August in 1999.

It is infeasible to estimate market food demand under the economy of socialism, because food market is not operating normally. In North Korea, trading is entirely under state control and prices of foods are fixed by the Price Fixation Committee. Prices do not reflect supply and demand conditions in market. The quantitative rationing system is the main tool which permits the government to adjust food supply and demand. In determining

national food demand, a distinction must be made between the farm and non-farm population as well as among social status. Norms have been defined for the basic consumption needs in grams per day, with cereals normally providing 75 percent of daily calorie intake. These norms have been established for various population groups, initially determined according to their work activity. The original ration system had nine levels, the highest providing 900 grams of cereals per day, for coal miners, workers in heavy industry etc. and the lowest level providing 100 grams, for children in kindergarten. However, for sometime the government has not been able to provide rations according to the system. Moreover, although the government's initial objective was to provide 70 percent of the requirement in rice and 30 percent in maize, it has now changed to lower proportion of rice.

Food production has continuously declined since 1989. Whereas in 1989, per caput availability of food grains from domestic production was 345 kg, it was 272 kg, and 222 kg in 1994. In 1995, the food situation deteriorated more seriously than had been anticipated because of massive flood damage. Up to today the situation is getting worse. The combination of natural disasters from 1995 to 1998, and deepening economic slowdown since the early 1990s have severely undermined food security in North Korea.

There are significant differences in food consumption in North Korea. Some population groups, such as families receiving international food assistance and agricultural support, are in a better position to cope with food shortages than people in mountainous areas and families of industrial workers, especially in non-agricultural areas. Such families have depended almost entirely on PDS rations. As food distributions ceased in April 1999, they had to rely on alternative foods which have limited nutritional value. Moreover, the capacity of these groups to procure food in farmers' markets is highly limited, either because they are in non-agricultural areas and have limited resources to procure sufficient quantities.

According to the Ministry of Procurement and Food

Administration in North Korea, the 6.33 million cooperative farmers received an average post-harvest ration of 146 kg per person in 1998. This amount can be translated to a daily ration of 400 grams or 1,400 kcal. Farmers' rations vary considerably, between farms and parts of the country, ranging from 115 to 195 kg. However, farm rations are substantially higher than those received through the Public Distribution System(PDS). In addition, although farm rations from last year's harvest were below a minimum bench mark of 458 grams per person/day to meet 75 percent of a diet of 2,130 kcal for adult, farmers received additional supplementary food from this year's double crops of cereals and potatoes. Farmers also have the opportunity to produce food on family plots, about 100 m<sup>2</sup>. In some places farmers have other means to gather wild foods.

The average food distribution through the PDS from November 1998 to April 1999 was 35.5 kg of cereals per person. It is less than 50 percent of the food distributed to the farmers for the same period. The PDS resumed food distribution in mid-July.

As a result, the food situation in the DPRK has eased in some areas as the PDS has been distributing partial rations of potatoes

TABLE 3 Grain Requirements in 1999<sup>1)</sup>

Unit: 1,000 tons

Consumption Requirement	Food	Feed <sup>2)</sup>	Process and Seeds <sup>5)</sup>	Total
Normal	5,241 <sup>2)</sup>	681	888	6,810
Minimum	3,925 <sup>3)</sup>	292	632	4,849

1) The mid-year population of 1999 is assumed at 23.5 million.

2) Based on 610 g/day/person or the minimum daily calorie requirement of 2,130 kcal/day/person.

3) Based on 458g /day/person or 1,600 kcal/day/person, which is 75 percent of the minimum daily calorie requirement of 2,130 kcal/day/person.

4) The minimum feed requirement is based on 3 kilograms of meat/year/person, and the normal requirement is based on 7 kilograms of meat/year/person, which is the level of South Korean per caput meat consumption in the 1960s.

5) Based on 15 percent of food and feed requirement.

and barley.

Grain requirement to meet the normal consumption was estimated at 6.81 million tons in 1999, which is the similar level of North Korea's mid-term production goal. Grain requirement to meet minimum nutrition intake is about 4.85 million tons (Table 3).

Based on the FAO/WFP Crop and Food Supply Assessment Mission, rice and maize production in 1998, and taking into account barley, wheat, and potato production from this year's double crop, 1998/99 cereal availability is estimated at 3.78 million tons. Against this, minimum needs, including food, feed, and other uses are assessed at 4.85 million tons, which leaves an import requirement of 1.07 million tons for 1999. Of this requirement, it is estimated that commercial imports over the marketing year will be 300,000 tons. Food aid imports, already delivered and in the pipeline, amount to a further 642,000 tons. This leaves an uncovered import requirement of approximately 128,000 tons. But the deficit can be covered by China if the appointment between China and North Korea is realized in this year. China has made an appointment with North Korea to support 150,000 tons of food in 1999 when Yong-Nam Kim, chairman of the North Korean Presidium of the Supreme People's Assembly(SPA), visited China in early June.

### **III. Factors Affecting Food Shortage**

#### **1. Inefficiency of Collective Farms**

Agricultural production in North Korea is largely attributed to 3,000 cooperative farms nationwide. Cooperative farms account for nearly 90 percent of agricultural production in North Korea. Cooperatives also have crucial social and welfare functions in rural areas. Cooperatives have contributed to social and economic equality in rural North Korea. Since a typical co-operative farm size is between 550 and 750 hectares, and the number of labors per farm is about 1000, it is not easy to effectively manage farm

production activities. For this reason, the co-operative farms established several work teams according to their special production tasks. The number of teams vary from cooperative to cooperative. However, the size of a team is comparatively uniform, averaging around 100 to 115 persons. A typical cooperatives have three work teams for grain production. Each work team was divided into sub-work team with 15 to 20 members, or about five to six sub-work teams to every work team until 1996. The sub-work team is the basic unit for organizing labor cooperatives.

Cooperative farmers have two basic sources of income, their share in the farm's collective net income and their earnings from sideline household activities. Basically, net farm income is distributed among members in proportion to their total annual "workpoint" earnings. Workpoints are used to guide the use of labor during plan implementation. They serve also as the principal monetary incentive of cooperative members. The workpoints are affected by the skill requirements and physical difficulties of different tasks. There are five grades. Ideally, under the workpoint system, most cooperative members earn approximately equal incomes with appropriate adjustments for physical hardship and skill factors. However, there would be little incentive for cooperation under this simplified version of the workpoint system because the incomes of cooperative members would depend entirely on their own efforts.

A new sub-work team system was introduced in 1996 to motivate cooperative members to meet or exceed their production targets. The number of sub-work team reduced from 15-25 to 7-8 members. In some cases, a sub-work team consists of relatives, or two or three neighbor families. And the plan target was adjusted to a lower level. A sub-work team is eligible for bonus payments when its production exceeds 90 percent of its targeted production. Under the terms of the scheme, the members of the sub-work team are entitled to dispose all production over the 90 percent threshold. The threshold is set at 90 percent rather than 100 percent because the plan target are set so high. Although the surplus of farm production is left to the discretion of the



members under the new system, their production effects are not so much increased because plan target is still high to reach under the circumstance of input shortage.

On the other hand, the Ju-che farming method was designed to raise yields given the limited farmland. It greatly contributed to increase production in the 1960-70s when agricultural production base was sound and inputs were sufficient. Basically, the Ju-che farming method is an intensive farming method. It was invented to overcome limited farmland. It aims to increase agricultural productivity with intensive use of agricultural inputs and energy. The limited potential for expanding domestic food production through area expansion, coupled with the drive for self sufficiency have meant that the government has laid heavy stress on four aspects in modernizing agriculture. These are irrigation, mechanization, intensive use of chemicals and electrification. In addition the system of crop husbandry aims to be extremely intensive and relies heavily on the philosophy of individual plant care from seed to harvest. These are all involved in the Ju-che farming method. Recent malfunction of agricultural base and inputs constraints are degenerating the effectiveness of the farming method. According to the Ju-che farming method, most of the arable land is predominantly planted with two main cereals, rice and maize. However, continuous cropping of rice and maize and the absence of rotation and fallow systems together with high fertilizer applications in the past have led to declining soil fertility, further constraining productivity.

## **2. The Economic Recession and the Shortage of Agricultural Inputs**

In the mid-1980s, the economy of North Korea went into a long-term stagnation. The economic problems involving low foreign exchange reserves, a large and persistent trade deficit and low credit worthiness have meant that the country has serious problems in maintaining agricultural production and food supply. These factors have contributed to failure to supply agriculture with required inputs to maintain intensive production and a

reduced ability to import larger quantities of food grain commercially to meet a growing food deficit.

Shortage of agricultural inputs is one of the major causes of food deficits. Due to the faltering economy, imports of petroleum dropped from 18.8 million barrels in 1985 to 8.06 million barrels in 1995 and raw materials drastically declined by which the provision of agricultural inputs has been troubled. Recently, the operation rate of agricultural input factories was lowered to about 20 percent, and imports of agricultural inputs are insignificant due to foreign exchange constraints.

Fertilizer supplies were limited to 0.12 million tons, 24.8 percent of the adequate requirement of 0.50 million tons, and pesticide supplies were retracted to 3,100 tons, which is 14.7 percent of adequate requirements (Table 4). As for seeds, seed renewal for maize is insufficient and virus-contaminated seed potatoes have been diffused to farms. Also, only 20,000 tractors out of 70,000 tractors are operational due to obsolescence, lack of spare parts, and fuel shortage.

**TABLE 4** Requirement and Supply of Fertilizers and Pesticides in 1998

Unit: 1,000 tons

Item	Requirement (A)	Supply			B/A (%)
		Domestic	Import	Total (B)	
Fertilizers <sup>1)</sup>	500	47.0	77.0	124.0	24.8
Pesticides <sup>2)</sup>	21	2.7	0.4	3.1	14.7

1) active ingredient weight.

2) formulation weight.

### 3. Forest Damages and Natural Disasters

Along with the internal expansion of farmland, the external expansion of farmland is needed to feed large population given the limited area. As an intensive farming method, the Ju-che method has led to the internal expansion of farmland. The external expansion of farmland is represented by land reclamation,

cultivating crops on hill slopes, and building terrace dry-fields. In particular, the terrace dry-fields and hill slope cultivation have gradually caused forest damages. The flood damages in 1995 and 1996 resulted from natural disasters but forest degradation further intensified the damages. Torrential rains facilitated soil erosion on the degraded slopes to the extent which farmland and agricultural base were dislocated, buried, and destroyed. Deteriorated irrigation systems triggered by floods over the period further added to the drought damages in 1997. Rehabilitation for the agricultural base that was destroyed over the 1995-96 period, including a crop area of 19,000 hectares, 50 reservoirs, 400 pumping stations, 1,974km of irrigation canals, and 5,244km of levees has been delayed. Under these circumstances, agricultural production in North Korea is vulnerably unstable depending on natural disaster.

## **IV. Prospect of Food Production and Consumption in North Korea**

### **1. Prospect of Food Production**

North Korea is fundamentally an industrial country. Agricultural sector uses less than 2 million hectares of land including permanent crop and pasture. It is unrealistic to increase horizontally its arable land in the near future. Reclamation of land from the sea as well as terracing on steep slopes are expensive methods to increase arable lands. The realistic way to compensate for the lack of land is to increase land utilization and to increase productivity in the available farmland by increasing yields.

Land utilization can be increased by multi-cropping. Under the sponsorship of UN agencies, in 1996 North Korea introduced and developed double cropping of barley in an attempt to augment domestic food production. The objective was to make optimal use of the period, March to June, before the planting of paddy and maize. In view of the hard winter conditions during

the winter period, the main cereals, rice and maize, occupy the land between May/June and October. The interval between November up to May/June is normally left fallow. The basic intention of the double crop programme is to take advantage of this fallow period. Results of the 1997 and 1998 programmes were generally positive as a result by which the area under double crops was expanded in 1999 to include crop diversification mainly through potatoes, and to a lesser extent pulses and vegetables. For the 1999 programme, total 23,300 hectares in 400 co-operative farms were used for spring barley production. Winter wheat was planted on 62,900 hectares. To meet food shortages, North Korea has strongly promoted the cultivation of potatoes in 1999. As a result, 170,000 hectares were planted, compared to an average of around 40,000 hectares in past years. The North Korean government is planning to expand double cropping programme to maximum 300,000 hectares in the future. However, it will be difficult to realize the plan in the near future.

Yield increase can be achieved with sufficient agricultural inputs and advanced technologies. North Korea desperately needs to rebuild its input industry to increase agricultural productivity. High quality seed is most important input required for productivity improvement. Quality seeds do not only guarantee a dependable crop but also imply an economy in crop husbandry. There are 240 seed farms throughout North Korea, which need imperative attention in order to guarantee a safe product. North Korea needs a systematic seed production and multiplication program.

North Korean farmers use natural fertilizers to overcome the shortage of chemical fertilizers. Although natural fertilizers are effective to recover soil fertility, it would be more effective if used with chemical fertilizers. A total of 500,000 tons of chemical fertilizers is required to meet grain production. The amount of distributed and pipeline fertilizers would provide in total 163,000 tons of fertilizer in 1999. It is anticipated that North Korea can supply a total of 229,000 tons of fertilizers including the amount supported by South Korea. Although this suggests a big improvement in availability compared to 1997 and 1998, it only represents

around a half of the annual requirement to produce grains. Production capacity of fertilizers is estimated at 3,680,000 tons (actual weight) or 750,000 tons (active ingredient) of NPK. North Korea can supply sufficient fertilizers if raw materials and energy are provided.

Until the 1980s, North Korea was capable of providing necessary agricultural inputs such as fertilizers, pesticides, farm machinery and seeds. Presently, North Korea is facing a situation of almost discontinued pesticides production due to shortages of raw materials and energy.

Recently North Korea is adjusting crop acreage. The acreage of maize is decreasing, while the acreage of potatoes is increasing. A new program of land/crop distribution has been elaborated taking into account the introduction of stronger environmental measures and better land use practices. This new land/crop distribution plan is reflected in the Agricultural Recovery and Environmental Protection(AREP) Programme for DPRK. The plan indicates a significant reduction in the acreage of maize by the year 2001. Basically it promotes the elimination of maize cultivation from the marginal lands. It is estimated that North Korea can produce 5.8 million tons of grain if sufficient agricultural inputs are provided under the current technology

TABLE 5 Projection of Grain Production in North Korea

Crop	Acreage (1,000ha)		Yield (ton/ha)			Production (1,000tons)		
	Current	2004/10	Current	2004	2010	Current	2004	2010
Rice <sup>1)</sup>	580	580	2.30	4.50	5.00	1,341	2,610	2,900
Maize	629	500	2.80	4.00	5.00	1,765	2,000	2,500
Soybean	100	100	1.00	1.20	1.50	100	120	150
Potato <sup>2)</sup>	170	200	10.00	15.00	20.00	340	600	800
Other Cereals <sup>3)</sup>	115	150	2.55	3.00	3.00	294	450	450
Total	1,594	1530	-	-	-	3,840	5,780	6,800

1) Yield and Production are based on milled rice.

2) Potato production is based on cereal equivalent, which is 20% of original weight.

3) Barley, wheat, sorghum, buck wheat etc.

(Table 5). It is almost the same level of production in mid-1980s. In the long-run, the potential of grain production is evaluated at 6.8 million tons with improved technology and sufficient input supply under the adjusted acreage reduction plan.

## **2. Prospect of Food Consumption**

North Korea anticipates that food grain consumption should be increased to about five to six million tons by the year 2001. This demand target reflects both expected population growth and the need to reestablish a minimal level of food stocks and reserves. Based on the 1993 census findings, the population of North Korea will continue to increase, albeit at a slower rate (1.3 percent a year) and reach 23.5 million by mid-2001. The pace of urbanization will also have continued to slow down. There will be some 14.3 million city-dwellers or 62 percent of the total population and about 9.3 million people (38 percent) will live in the countryside. Assuming further that annual per capita consumption remains at 139 kg and 204 kg for urban and rural dwellers respectively, human demand for food grains will amount to 3.9 million tons in 2001. Additional consumption requirements, primarily for animal feed, seed, and industrial use will bring total food grain demand to 5.4 million tons (Table 6).

The projected grain production under sufficient input supply seems to meet the required amount of food on the basis of calorie. However, people will call for more meat as their living standard improves. In the long-run, 1,000 million tons of grain including feed grain will be required to meet the same level of food consumption as current South Korea. At this point, North Korea's self-sufficiency rate of food production will be less than 70 percent in the long-run.

**TABLE 6** Demand of Cereals, 1999-2001

	1999	2000	2001
Human Demand (million tons)	3.78	3.83	3.87
Rural (million tons)	1.85	1.87	1.89
- population (million)	9.09	9.18	9.27
- consumption per head	204	204	204
• rice (kg/year)	137	137	137
• maize (kg/year)	67	67	67
Urban (million tons)	1.92	1.95	1.98
- population (million)	13.85	14.06	14.27
- consumption per head	139	139	139
• rice (kg/year)	72	72	72
• maize (kg/year)	67	67	67
Seeds and Animal Feed	0.70	1.00	1.10
Other	0.20	0.30	0.40
Total	4.68	5.13	5.37

Source: UNDP. Thematic Roundtable on Agricultural Recovery and Environmental Protection in DPR Korea, May 28-29, 1998.

### 3. Measures to Secure Food

North Korea has tried to rehabilitate the drastically faltering economy and to cope with food deficits in the 1990s. As ways to achieve economic rehabilitation in 1994, North Korea adopted three strategies, namely agriculture-first-strategy, light industries-first-strategy, and trade-first-strategy. Agriculture was accordingly endowed with priority in resource allocation to expand the production level.

In addition, agricultural management and distribution systems were changed to solve the food crisis. To encourage work efficiency, farm structure was scale-downed and discretionary privilege expanded through reorganizing the 'sub-work teams' introduced in 1966 into the 'new sub-work teams' in 1996. The way of operating state farms was changed, too. The current self-supporting accounting system was fortified and managerial independency was expanded to secure autonomy from the governmental management system. Such systematic shifts were to give incentives to farms or farmers

and then to boost agricultural production.

The anticipated effects have not been accomplished, though. In contrast, the food situation has been worsened. It becomes the reason for lessening economic controls over certain categories. For instance, about 300-350 of farmer's markets nationwide are de facto permitted. Farm products and livestock from family gardens and arable land adjacent to factories and firms can be traded in farmer's markets. To a certain extent, farmer's markets are capable of handling food distribution in place of the malfunctioned state system.

On the other hand, North Korea is promoting agricultural cooperation with international organizations and other countries. In order to obtain foreign aid in its agricultural development, the North needs to open the market at least minimally and introduce market-economic principles. It can be a risk as well as a self-help effort for the country which has maintained closed economic systems for a long time, to open the market and adopt market-economic principles.

Of the several policies, the rehabilitation and modernization of the product capacity is most urgent. This includes flood damage rehabilitation, the rehabilitation of irrigation infrastructure, provision of key inputs for agriculture, spare parts and raw materials for agricultural input industries, and modernization of the outmoded technologies. The government is conscious of the fact that the required inputs cannot be available on a sustainable basis without the development of a national capacity to import. Initial financial and technical assistance from outside, accomplished by the available substantial domestic resources would be able to jump-start industrial and agriculture revival over a period of a few years.

At this moment, the cropping intensity program such as the on-going double cropping is necessary to extend. However, gradual reorientation of land use towards a more diversified and sustainable agriculture is necessary in the long-run. This would include a shift away from maize monoculture towards more extensive cultivation of leguminous crops, root crops, greater use



of bio-fertilizers and bio-pesticides, energy and water saving irrigation techniques. In the field of livestock, the government should place emphasis from grain-consuming mono-gastic animals to grain-feeding ruminants such as goats.

International assistance to North Korea initiated by the deluge damages in 1995 amounted to 766 million dollars by 1998. Most aid is a humanitarian response and food is its major component.

TABLE 7 Strategies to Improve Food Situation

Category	Short Term	Medium and Long Term
Food	Aid of food deficit	Food-for-work assistance
Fertilizers	<ul style="list-style-type: none"> <li>• Min. requirements: 400,000 tons                             <ul style="list-style-type: none"> <li>- N 200,000 tons</li> <li>- P 100,000 tons</li> <li>- K 100,000 tons</li> </ul> </li> <li>• Increasing the production of organic fertilizers and microbial fertilizers</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation of production plants                             <ul style="list-style-type: none"> <li>- Operation of the Namheung and Heungnam fertilizer plants</li> <li>- Modernization of the outmoded technologies</li> </ul> </li> </ul>
Other Agricultural Materials	<ul style="list-style-type: none"> <li>• Provision of pesticides and sprayers</li> <li>• Use of bio-pesticides</li> <li>• Seeds: maize and potatoes</li> <li>• Machinery: diesel, spare parts, and small tractors</li> <li>• Plastic sheets for agricultural use</li> </ul>	<ul style="list-style-type: none"> <li>• Pesticides: production base of low poisonous pesticides</li> <li>• Seeds: improvement of seed selecting facilities, and technological assistance on virus-free potatoes production</li> <li>• Machinery: establishment of joint and combined corporations for Korean-type farm machinery production</li> </ul>
Others	<ul style="list-style-type: none"> <li>• Double cropping: seeds and agricultural materials</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation of the flood damaged areas and forest                             <ul style="list-style-type: none"> <li>- Recovering farmland</li> <li>- Rehabilitation of irrigation infrastructure</li> <li>- Afforestation and building fences to prevent soil erosion</li> </ul> </li> </ul>

The international community needs to shift its aid in a way that North Korea will be able to expand its agricultural production in the future. Although urgent provisions should be continued for a while, ensuring food security in itself requires agricultural inputs aid in the short term and agricultural development programmes in the medium and long terms. The short and long-term measures for North's agriculture are shown in Table 7.

## **V. Conclusions**

Since the mid-1980s, the economy of North Korea started to get stagnant. Along the economic stagnation, the agricultural production level has shrunk. The country has faced a food crisis since 1990, which was engendered by lowered food production and food import difficulties by foreign reserve constraints and natural disasters. In the midst of the crisis, North Korea has attempted to boost its agricultural production by reorganizing agricultural systems. Such an effort, however, has yielded no results and the current food crisis is likely to be continued. Due to the worsening economic difficulties and poor agricultural production base, it appears difficult for the North to recover from the food crisis by itself.

It is thus necessary to raise food production through all the possible means such as breeding new varieties, improving seeds expansion systems, developing agricultural base, fostering agricultural input industries, and research and guidance. The tasks call for international community aid and cooperation.

To solve the problem of food shortage by virtue of agricultural restructuring, the collective farming system should be redirected to give incentives to the individual farmers. If farmers are not allowed to pursue their own profits, a higher production level is hardly achievable.

Foreign aids and cooperations are of great importance in reforming the agricultural system since North Korea alone is not capable of proceeding it. The western countries as well as South

Korea are the most suitable partners with which North Korea can cooperate and develop the agricultural sector to a large extent.

In the short-term there is a continued need for food aid to vulnerable groups. In the last four years of natural calamities, declining food production and growing economic difficulties, North Korea has had to face a dramatic reduction in food rations and intake. These in turn have resulted in severe hardship and rapidly declining nutritional standards. Perhaps the most important reason that the incidence of chronic malnutrition has not become more widespread and entrenched in the population has been the unprecedented level of food assistance to the country, although no reliable estimates of the extent of the problem exist. International organizations such as FAO, WFP, UNDP, and IFAD continue to stress the importance of short and medium term international assistance to North Korea to help stabilize its food and agricultural situation. However, humanitarian food aid needs to be gradually shifted into the type of food-for-work assistance. Agricultural development aid must give priority to the imperative areas related to the expansion of food production. Cooperation among international organizations and other donors is highly effective in proceeding agricultural development aid and maximizing the results. In addition, North Korea must give all efforts to appeal for international aid. Assistance for agricultural rehabilitation and the provision of essential inputs such as seeds, fertilizers, and appropriate farm technology is a major necessity.

Notwithstanding the relevance and importance of short and medium term interventions, future food security in North Korea will depend heavily on solutions that address the major economic difficulties. In the absence of these, even without emergencies the food supply situation will remain highly precarious as productivity in agriculture falls, the ability of the country to finance food imports to cover shortfalls recedes further and exchangeable resources for barter become scarce. Unless the North reforms the economic system and opens the markets in the short run, there is likely no other ways but relying on the aids by the international community. The food aids to the North are the only short-term

alternative. If South Korea, for example, intends to help the country achieve a self-sufficiency level of food supply, new strategic methods are required. Given agricultural limitations, longer-term food security in North Korea will depend heavily on the general economic performance and effort to increase production substantially in agriculture. In the absence of economic reform, prospects for future food supply in North Korea remain extremely fragile.

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