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FOOD SITUATION AND AGRICULTURAL REFORM IN NORTH KOREA

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I. Introduction

The recent food shortage in North Korea has resulted not only from inefficiency of collective farming system with little incentives to individual farmers, but also economic stagnation which started from the early 1990s. As the economic difficulty resulted in shortage of energy and raw materials such as fertilizer and agricultural chemicals, operational ratio of industries fell down below twenty percent. Agricultural productivity has sharply decreased as input supplies have become insufficient. It has been further worsened by cold weather, floods, and droughts which frequently occurred since 1993. Thus, North Korea is now in critical food crisis. Given these circumstances, they may not find feasible ways to overcome the agricultural situation.

Although international communities support foods to the North, they are not effectively distributed to the residents who are in need. Instead, the prestigious groups enjoy a higher priority in the distribution. Also, a poor transportation system hinders an even distribution of the food. Lack of energy and available vehicles prevent the people living in the rural areas from getting the aids.

North Korea has recently made more than a little reform to deal with the food problems. They include improving the brigade system of the Collective Farmland Management System, accelerating small agricultural product markets, adopting an incentive system for unit

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work teams, and expanding scientific farming. Despite all the efforts, the problem still prevails. And it casts a dark shadow that the country can not escape from the trouble by itself.

The purposes of this study are to identify the current food situation and problems and to prospect the effects of agricultural reform already launched in North Korea. The following section outlines North Korea's agriculture. The next section explains grain production and utilization. We examine the effects of the North Korean agricultural reform under the proceeding in the following section. The final section provides a summary and implications.

II. Background on North Korea's Agriculture

The population of North Korea is about 23 million which is half of that of South Korea. But arable land, about 1.85 million hectares, is almost the same as the South, making land per capita in the North twice as large.

Of the farmland, crop production accounts for 1.55 million hectares and tree crops such as fruit and mulberry occupy the rest. About 170,000 hectares covered by mulberry, fruit, and partly corn are marginal land on hilly sides with more than 16 degree slope. The climatic conditions such as temperature and rainfalls are inferior to the South. Of the total land, 52 percent is in high elevation above 400 meters with mountainous landscapes.

In the 1950s, the North changed the corn cropping system from a rotational cropping system to a single cropping system to maximize grain production. This shift, subsequently, threatened small grain production such as millet, sorghum, red bean, green bean, and Italian millet which had relatively low yield.

Farm labor accounts for about 40 percent of the total labor forces in the North which is higher than 11 percent in the South. A lower labor productivity in the North lies on the fact that the country uses many outside labors such as students and soldiers in farming seasons. As for corn, technologies in breeding and seed propagation are relatively high. Some improved varieties of rice are also available.

Climatic condition may not be a critical factor that limits agricultural production. It is viewed that recent abnormal weather

conditions including heavy rains, droughts, and extremely low temperature have simply occurred by chance. However, the frequent occurrences of flood are attributed to the poor afforestation in the mountains. In fact, a large part of forest has been fell down for wood to be used as fuel because of the lack of oils and coals.

Farmland arrangement programs were well implemented by the 1980s. The irrigation system extended even to the mountain areas. Reports showed that almost 100 percent of irrigation was achieved in paddy field and 60 percent in upland. Substantial investment has been made into reservoirs, canals, and pumping systems. It is reported that all but 300,000 hectares of irrigation areas need pumping from rivers with considerable lifts. But it is dubious since water supply was no longer continued in the mountain areas and some irrigation facilities were damaged by floods.

Farm mechanization has been in much progress since 1970s. But the replacement of farm machinery is very limited because of economic recession and the disintegration of former Soviet Union.

Until the 1980s, supply of nitrogen and potash fertilizers were not in short. However, entire amounts of potash fertilizers and most of agricultural chemicals have been imported since the 1990s. A shortage of oil and other raw materials resulted in a situation where the supply of fertilizers and chemicals is extremely limited.

The North has undertaken many development programs to boost food production. They include land reclamation of 300,000 hectares, opening terrace field on the hilly areas, and establishing farmland of 200,000 hectares. At the same time, irrigation projects in the western coast areas were set out to provide water supply in rice field. The projects established a 100km-long waterway consisting of 40km-long tunnels and 60km-long ditches. But, a recent failure in flood control indicates that they might be dysfunctional.

Some (Kim, 1998) point out that agricultural stagnation in North Korea attributes to recent natural disasters, the collective farm system, and the so-called 'Juche farming method,' which is a mainstream of agricultural technologies commanded by Kim Il Sung. Policy aspect of institutional change that allows farmland ownership can help get rid of the stagnation by motivating farmers to increase the production level on their partially owned parcel of land. But, this type of policy change can be hardly expected at present, given the

current political system in the North.

It is said that an over-exploitation of upland by bench-terracing on hilly areas is one of the main reasons that worsened the natural disasters. Such an expansion has stemmed from the ideology, the so-called 'Juche farming method'. The terrace fields plunge the areas into inundation and set off a situation in which farmers compete to obtain the secretly owned parcel of land on the hill side. There are two reasons for farmers to fire mountains. One is to get fire woods and the other is to secure a parcel of land from which they attain supplemental food for family.

However, the causes of the agricultural stagnation can be summarized as follows. First, the weakened foreign markets, especially in the allied socialism countries under the Soviet Union, deteriorated the supply of agricultural inputs. Second, a limited supply of energy, raw materials, and other component parts restricted industrial activities. A reduction in carrying capacity for the industry consequently led to a lower capacity for production of agricultural materials. Third, the decrease in agricultural production is in part due to the continued climatical hazards. Fourth, the trade ban against North Korea set by the western countries deterred them from importing resources and technologies. Fifth, heavy overheads for military maintenance and policy failures rooted in the social system depressed the agricultural sector.

There are other factors. The single cropping system for paddy rice and upland corn is widely adopted in the country. Continuing corn cultivation, however, tends to exhaust the soil fertility and increases risk in production because corn is a soil depleting crop. A shift to the rotation cropping system might deteriorate food situation. Unless enough chemical fertilizers are secured, corn production will be greatly decreased because corn is a heavy fertilizer consuming crop. At present, supply of alternative nutrient sources such as manures is also very limited since source materials for manures are utilized for other purposes such as livestock feeding and fuel materials.

III. Grain Production and Utilization in North Korea

North Korea officially announced that grain production was 1.9

million tons in 1946 and 10 million tons in 1984. The production level jumped more than 5 times in 38 years. In the same period, grain production in South Korea increased 2.5 times. The North set a grain production goal of 7 million tons in the first 7-year Economic Plan(1961~70), but the result was unveiled. In the 6-year Economic Plan that ended in 1976, the goal was set at 8 million tons. Then the second 7-year Economic Plan accomplished its goal of 10 million tons in 1984.

However, it was unknown whether the goal of 15 million tons (7 million tons of rice and 8 million tons of other grains) during the third 7-year Economic Plan (1987~93) was fulfilled. Instead, there was an announcement that output was 5.3 times larger than in 1946. It is equivalent to 10 million tons. For the first time since the 1960s, the North authorities announced that 3.76 million tons of grains were produced in 1995. This announcement indicates that either the previous statistics or current announcement is false. Even with the 10 million tons of grains produced in 1984, the North suffered from food shortage. As of January 1996, it was estimated that 45.83 million people in the South consume about 20 million tons of grains including feed grains. If the North produced 10 million tons at that time, the 23 million people should not have starved.

Since 1958, the North has boasted plenty of bumper crops. But a food shortage has been in fact worsening. In a speech delivered to the meeting of the Agricultural Workers' Union in Haeju on February 1, 1962, Kim Il Sung said "rice is socialism," and called upon the participants to put their efforts to "let all the people eat rice with meat soup."¹ In the 1980s, Kim Il Sung repeated it by saying that "rice is communism." He emphasized that communist construction could come true only when people are given enough food.²

On August 7, 1992, the Minju Choson, a government-supported newspaper, revealed the government announcement that the Central People's Committee (a top administrative body that controls the cabinet) would devote to settle all problems regarding food, clothing and quarters, and that policies by the Workers' Party would be focused on improving the standards of living and to let the people "eat

¹ Collection of Kim Il Sung's Work, Vol. Ⅲ, p. 258.

² Kim Il Sung's speech, April 14, 1992.

TABLE 1 Estimates of Grain Requirement and Production in North Korea (1997/98)

Unit : 1,000 tons

	North Korea ^a	FAO/WFP ^b	Ministry of Unification ^c		UNDP ^d	KREI ^e
			Normal	20% Reduction		
Total Requirement	6,270	4,614	6,386	5,413	4,200	6,188
- Food use	3,856	3,874	5,178	4,205	3,360	4,825
- Seed use	-	300	306	306	400	751
- Other uses	-	440	902	902	440	612
Production(1997)	2,148	2,663	3,480	3,480	2,240	2,559
Shortage(1997/98)	4,122	1,951	2,906	1,933	1,960	3,629

Note : ^a Released by the North Korean Government on March 2, 1998.

^b "FAO/WFP Crop and Food Supply Assessment Mission to Democratic People's Republic of Korea," Special Report, Nov. 25, 1997, Food and Agricultural Organization of the United Nations.

^c 1997 Estimation of North Korean Grain, Production, December 29, 1997.

^d The amount of 2.24 million tons includes 1.17 million tons of rice, 1.01 million tons of corn and 50,000 tons of other grains.

^e Korea Rural Economic Institute.

rice with meat soup and live in tile-roofed houses" in a few years. The newspaper also said that the government would plan to solve the problems by putting its priority on agricultural policies and bringing up moderate industrial revolution.

In the 1990s, Kim Il Sung reiterated the famous slogan, "rice with meat soup" several times in his New Year messages. This only indicated that food situation in the country was getting worse.

Cereal production was estimated to be 2.56 million in 1997, 60 percent less than normal production (Table 1). If favorable weather and input conditions were granted, it could have amounted to 6.8 million tons. The poor productivity is caused by natural disasters, lack of essential inputs, outdated technologies, and inefficient farming system.

For the second time since 1963, the North Korean government announced a statistic regarding grain requirement in 1998. According to it, the total requirement for grain was 6.27 million tons, consisting of

TABLE 2 Agricultural Production in North Korea, 1997

Items	Acreage	Normal		1997	
		Yield	Production	Yield	Production
Unit	1,000ha	ton/ha	1,000 ton	ton/ha	1,000 ton
Rice ^a	600	4.94	2,963	2.08	1,247
Corn	650	5.03	3,282	1.64	1,065
Soybean	100	1.43	143	0.72	72
Barley ^b	50	2.10	105	0.76	38
Potatoes ^c	40	5.44	218	2.35	94
Others ^d	50	2.00	100	0.86	43
Total	1,490	-	6,811	-	2,559

Note : ^a Milled rice.

^b Includes wheat, rye, and oats.

^c Include sweet potatoes.

^d Include sorghum, millet, and buckwheat.

Source : KREI, unpublished report, 1998.

3.86 million tons for food and the rest for other uses. Given 2.15 million tons of grain production in 1997, the shortage will be 4.12 million tons (Table 1). This measure is relatively reliable in a sense that the figures were disclosed when a U.N. survey team visited the country.

(Table 1) shows large differences in the estimates of food deficit in 1997/98 among the assessment bodies. FAO/WFP and the UNDP estimate the total requirement for grains at 4.2~4.6 million tons. Food grains are estimated at 3.4~3.9 million tons based upon the UN minimum nutrition supply standard of 458 grams per capita per day. Korea Rural Economic Institute (KREI) estimates food grain deficit at 2.2 million tons while FAO/WFP estimates it at 1.2 million tons.

The Ministry of Unification in South Korea estimates the total grain requirement in 1998 at 6.38 million tons and production to have been 3.48 million tons in 1997. KREI estimated the total food production to be 2.56 million tons including 1.25 million tons of rice, 1.07 million tons of corn, 72,000 tons of soybean, 38,000 tons of barley, 94,000 tons of potatoes, and 43,000 tons of other grains in 1997 (Table 2). The total food requirement is estimated at 6.19 million tons. With the population size of 23 million, the food shortage is estimated to be 3.6 million tons (Table 3).

Because of the frequent occurrences of natural disasters in the 1990s, the annual shortage of total grains amounts to more than 3 million tons (Table 4). Thus, the North had to import grains to meet the deficit.

TABLE 3 Production and Requirement by Crops in 1997/98

Unit : 1,000 tons

	Total	Rice	Corn	Soybean	Barley	Potatoes	Other Grains
Acreage(1,000ha)	1,490	600	650	100	50	40	50
Requirement(A)	6,188	3,100	1,876	220	462	436	94
Production(B)	2,559	1,247	1,065	72	38	94	43
Shortage(A-B)	3,629	1,853	811	148	424	342	51

TABLE 4 North Korea's Grain Production and Requirement

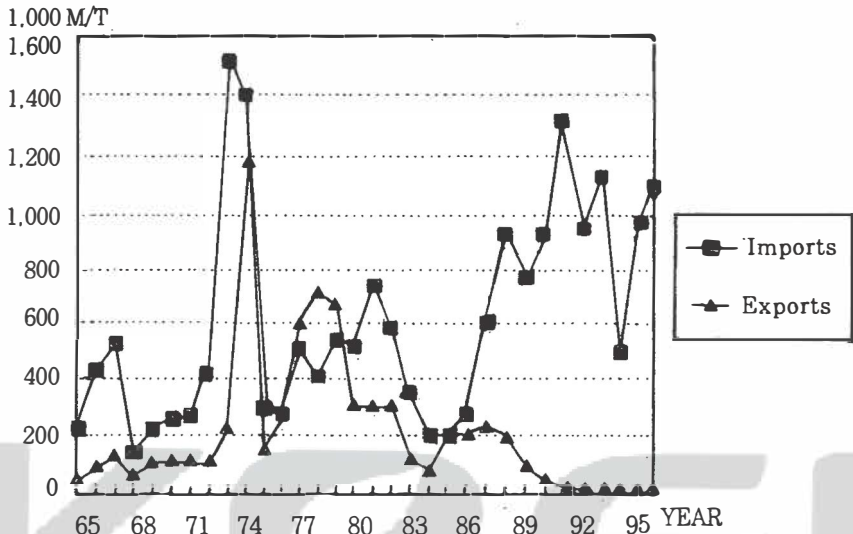
Unit : 1,000 tons

Year	Requirement (A)	Production(B)				Shortage (A-B)	Self- Sufficiency (%)
		Rice	Corn	Other	Total		
1984	5,303	2,214	2,450	936	5,600	△297	105.6
1985	5,402	2,010	2,530	490	5,030	372	93.1
1986	5,431	2,009	2,371	445	4,825	606	8.8
1987	5,515	2,034	2,409	509	4,952	563	89.8
1988	5,629	2,099	2,503	608	5,210	419	92.6
1989	5,762	2,159	2,681	642	5,482	280	95.1
1990	5,757	1,932	2,380	500	4,182	945	83.6
1991	5,762	1,641	2,210	666	4,427	1,335	76.8
1992	5,894	1,043	2,256	599	3,898	1,996	66.1
1993	6,065	904	1,690	529	2,923	3,142	47.2
1994	6,156	913	2,256	599	3,768	2,388	61.2
1995	6,224	761	1,370	475	2,006	3,618	41.9
1996	6,061	1,068	1,046	333	2,447	3,614	40.4
1997	6,188	1,247	1,065	247	2,559	3,629	41.3

Note: A declined requirement in 1996 was due to an estimate of a lower population.

Source: KREI, unpublished report, 1998.

FIGURE 1 North Korea's Grain Trade



(Figure 1) shows that the country exported rice and corn in exchange mainly for wheat or wheat flour which is cheaper by one-third to fill up the shortage. In the 1980s, however, the country stopped corn exports and began to import inexpensive corn from world markets.

Grain exports in 1979 decreased to a half of the level in 1974. Similarly, rice exports were limited to 0.2~0.3 million tons by 1988. Statistical figures show that the country's food condition began to worsen in the mid-1980s. In the 1970s, the North could supply the minimum food grains to the people by exporting rice in exchange for wheat flour or by importing grains from the socialist allies at generous prices that were lower than international prices.

Grain imports were greater than exports by 3 times in 1987, 4.5 times in 1988, 8.7 times in 1989, 21 times in 1990, and 116 times in 1991. Imports of grain were 0.83 million tons in 1992, 1.09 million tons in 1993, 0.49 million tons in 1994, 0.96 million tons in 1995, 1.05 million tons in 1996, and 1.1 million tons in 1997 with little export. The international community plans to provide them 420,327 tons in 1998.

TABLE 5 Anticipated Food Situation by Alternative Consumption Levels for 1997/98(Nov/Oct)^a

	Subsistence level ^b (minimum nutrition) 458 grams	1965 S. Korea level (pre-self sufficiency) 518 grams	1975 S. Korea level (self-sufficiency) 568 grams
Calorie requirement (kcal per day)	1,603	2,189	2,390
Total food requirement ^c per year(1,000 tons)	3,825	4,326	4,744
one month requirement	319	361	395
Consumption period	7.3 months	6.5 months	5.9 months

Note : ^a Based on total available domestic production, 2,335 million tons which excludes pre-consumed 500,000 tons of fresh corn last year, and includes 175,000 tons of double cropping grains produced in this year.

^b Around 75% level of recommended calorie, 2,130 kcal/day.

^c Based on a mid-year population of 23.2 million in the 1997/98 marketing year.

This, then, leads to the question of how long it will last if North Korea distributes all the grains produced during 1997/98 marketing year to the residents under the assumption of zero initial stock. The 2.56 million tons of grain produced last year are equivalent to the amount of 5~6 months' food requirement. When we subtract 0.5 million tons of fresh corn which were already consumed before 1997/98 marketing year, actual domestic grain supply will be 2.16 million tons. Fortunately, 175,000 tons of grains produced by double cropping program is additionally available at present. As shown in (Table 5), a simple calculation based upon the daily minimum consumption level of 458 grams per capita indicates that food stocks could run out within 7 months if foreign aids and commercial imports are not realized. If the daily ration had increased to 568 grams which is the same level of grain consumption in South Korea in 1975, food would be exhausted in 6 months.

The UN World Food Programme (WFP) appealed to the international communities for \$382.7 million to provide the

emergency feeding operation to North Korea. The WFP plans to provide 0.65 million tons of food to assist 7.47 million North Koreans, almost a third of the population, for the 12 months ending April 1999. The countries which have pledged to support the WFP are the United States (0.2 million tons), South Korea (50,000 tons), and Canada (20,000 tons). A record of 794,000 tons of international food aid were delivered for a year until April 1998. During the period November 1997 through March 1998, some 245,000 tons of food aid, including bilateral shipment, were delivered to the North. Of this amount, 140,000 tons or 57 percent were shipped under the WFP emergency operation. China supported 1 million tons of grains including trades last year. However, China's support will likely be reduced this year due to a declined corn production in the three north eastern provinces. Commercial imports including provincial barter trade should be realized over 0.7 million tons of grain to meet the minimum food requirement in 1997/98 marketing year. In the short term, food situation in North Korea is quite uncertain and largely dependent on additional international aids and commercial imports.

IV. Appraisal on Agricultural Reform In North Korea

Recent changes occurred in the agricultural sector of North Korea include; 1) distributing a new farming practice over the country, 2) promoting farmers to increase productivity by an innovative sub-work team system, 3) shifting from the 'Juche farming method', originated by the 'Juche identity ideology', to a system that accepts foreign partnerships, 4) permission to sell excess products to the farmers' markets, and 5) providing incentives to the individual farms.

Such innovative transformations are getting considerable attentions from outside from the view that top political leaders in the country including Kim, Chung Il is strongly supporting them. In particular, new administrative staffs of agriculture assumed their positions between 1995 and 1997. Top officers well recognized the importance of changes as food crisis has become serious. The government started to introduce a new sub-work team system to

motivate farmers to increase production in 1996. The old sub-work team consists of 10 to 25 farmers and each member receives an allocation of products according to his or her work days measured by the amount of production. From the very beginning in the early 1970s, however, this system has been challenged by many side effects such as overrating work performance to receive large allocation and assigning production goals for members improperly. Inefficiency embedded in this system is, therefore, blamed to worsen the agricultural condition.

A few changes have been made to give incentives to the members in a sub-work team. Key changes include 1) decreasing the number of members to 7 to 8, 2) adjusting goal settings so that a team is able to produce more than the assigned amount more easily, and 3) allowing the members to share the products in excess of the assigned production.

With fewer members, a sub-work team unit is able to comprise only family members or close relatives. This new structure can give opportunity to unify labor forces when natural disasters occur. A new quota system has been introduced to give incentives to farmers in which the work-teams on cooperative farms are allowed to manage excess products beyond the production quota for private purposes. A key problem underlying the system is how to accomplish the production goal under the economic difficulties.

It is generally recognized that the adjustment of the sub-work team system will give positive effect on farmers' income. Until 1997, there was a little doubt regarding the effects of the change. But, the structural change is now regarded as a viable tool to advance to an increased level of production by means of competition among teams and expanding incentives.

One of the prominent technological innovation is the so called 'the large seedling planting method' by which 45-day old rice seedlings are transplanted in the fields. This cultivation method aims 1) to increase rice production with less inputs, 2) to establish double cropping of barley with rice by shortening the growing period in the main field, and 3) to minimize the impact of floods.

A joint program by UN agencies and the North Korean government was introduced to develop double cropping system since 1996. The proposed double cropping system consists of barley and

corn, winter wheat and vegetables, or spring barley and rice. It is expected that the spread of the double cropping system could mitigate food shortage in spring seasons. About 38,000 hectares of spring barley were planted as a second crop to rice in 1997. In 1998, the acreage of spring barley substantially increased since last year with an estimated 70,000 hectares. The acreage of barley is planned to be increased up to 200,000 hectares in 2000 by the double cropping program. However, the technical validity of the plan does not appear to have been established fully. Problems of additional fertilizer requirement, rapid harvest of barley and planting of rice without mechanization, and pest carryover have not been overcome. Delays in these operations can have a serious impact on rice production.

To deal with the problem of food shortage through agricultural restructuring, they can not help but reform the collective farming system and introduce incentive programs for farmers. As long as the government controls all the economic activities from production to consumption, and does not allow the farmers to pursue their profits, an increase in agricultural production can never come true.

According to the forecast based on recent statistics, corn yield can be increased at least twice if sufficient fertilizers are supplied. In the past three years, corn yield was 1.3 tons per hectare mainly due to severe drought and flood in addition to the poor quality of seed, low level of technology, and inefficient economic system. Privatizing the collective farms can make the level of agricultural production twice. China, for example, doubled the agricultural output by reforming agricultural policies in the 1970s. Economic reform and liberalization also made Vietnam to substantially increase its agricultural productivity and thus change into a net exporting country that ships about 2 million tons of rice to world markets every year. The food situation will be further aggravated if the North insists on the 'Juche farming method' and the collective farming system.

As long as the severe food shortage prevails, farmers will distrust the collective farming system. Substantial amounts of agricultural inputs such as fertilizers and pesticides provided to collective farms are leaking to the private plots. Unless social and economic systems are fully reformed, the chronic food problem will not disappear, because current agricultural troubles are closely linked to the overall economic inefficiencies in the country.

In reforming the agricultural system in North Korea, foreign aids and cooperations, especially from South Korea and the western countries, can be valuable resources upon which it establishes a concrete basis for development. At an initial stage, the North and the South or the North and the western countries can set out cooperative farms or agricultural production based upon contracts. The cooperation between the two Koreas, in particular will ameliorate the food condition in the North by restoring confidence and by raising agricultural productivity. The NGOs of the western countries including Japan and the United States are also developing aid programs for North Korea. Ties with foreign countries can play a vital role to help the country escape from the predicament.

The aids to the North should be provided mainly with the assistance of fertilizers, pesticides, and other agricultural inputs from short-run direct food aids. Through the support of agricultural inputs, the North will be able to utilize their agricultural resources more effectively. They will be able to produce more food in the long-run with input aids rather than with direct food aids. And the input aids will be more easily accepted by the South rather than direct food aids.

V. Conclusions

The chronic food shortage in North Korea should be attributed to the structural problem in the farming system, based upon the Juche farming method and collective farms. Without proper remedies, it is hardly possible to improve the situation.

A collapse of the socialist camps brought about significant effects on North Korea which had heavily depended on the former Soviet Union, China, and the East European countries for economic and technological cooperation. Since then, the North could no longer engage in the socialist-style barter trades with the allies. Lack of foreign exchanges led the country to curtail the imports of grains and various other raw materials. Also, an insufficient level of fuel supply happened to shrink operation hours for factories. As a result, especially since 1993, the industry has failed to supply enough fertilizers and chemicals as well as farm machinery.

Another innovative policy in agriculture is the so-called 'the

large seedling planting method'. This method is directly linked to increasing productivity in the ways that it 1) increases rice production with less inputs, 2) achieves double cropping in paddy land by shortening the growing period, and 3) minimizes the effect of floods. It is, however, too early to give a full evaluation of the system since collectivist principles are still binding. Lack of farm machines and fertilizers is also a limiting factor. Along with the spread of 'the large seedling planting method', expansion of double cropping is being applied to handle the food shortage especially in spring seasons.

To solve the problem of food shortage by virtue of agricultural restructuring, the collective farming system should be redirected to give individual farmers high incentives in production. 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.

Unless the North reforms the economic system and opens the markets in the short run, there is most likely no other ways for improvement but to rely on the aids by the international community. The food aids to the North are only a 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 the agricultural limitations, a more long-term food security in North Korea will depend heavily on the general economic performance and effort to substantially increase production in agriculture. With an absence of economic reform, prospects for future food supply in North Korea remain extremely fragile.

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