

SUPPLY, DEMAND AND MARKETING OF FERTILIZER IN THE REPUBLIC OF KOREA*

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I. Introduction

The Korean fertilizer industry had made a rapid growth up to the mid 1970s by the ambitious government fertilizer development program and was expected to be one of major fertilizer exporting countries in Asia. However, the Korean fertilizer industry has lost her competitiveness in the world market since the second oil crisis in 1979. Because the Korean fertilizer industry uses naphta as raw material for urea production which generates much higher production cost than competing countries using natural gas. Furthermore, the domestic consumption of fertilizer has been stable and is not expected to increase in near future. Thus, one half of present production capacity may be redundant under current fertilizer price condition in the world market.

The Korean government has completely controlled production, consumption and marketing of fertilizer since 1960 in order to protect farmers and the same time to develop fertilizer industry by providing fertilizer subsidies. However, annual deficit in fertilizer account has incurred more than one hundred million dollars since 1980 and accumulated deficit in fertilizer account reached to approximately 800 million dollars in 1984. Thus fertilizer subsidy has been a serious financial burden to the government. Recently, the fertilizer demand and supply condition has changed substantially compared to the past such that;

- 1) Korean farmers are using sufficient amount of fertilizer with well-balanced ratio of each nutrient.
- 2) Over-production of fertilizer has created an inefficiency in both fertilizer industry and fertilizer marketing.
- 3) The government contract to the fertilizer industry requiring a certain amount of fertilizer regardless of demand condition will be terminated in 1987.

Thus, there is no logical ground for the goverment to continue an interven-

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tion in the fertilizer market even with providing more than one hundred million dollars of fertilizer subsidy each year.

The Korean government is planning to eliminate the fertilizer subsidy in near future and the same time to improve efficiency in fertilizer production and marketing. Eventually, the Korean government would reduce her intervention in the fertilizer market and promote free competition of the fertilizer industry. This paper attempts:(1) to make an over-all review on fertilizer supply and demand situation, (2) to evaluate current fertilizer marketing system and fertilizer subsidy policy, (3) to suggest future direction of fertilizer marketing and distribution system as well as fertilizer policy.

II. Fertilizer Supply

1. Trend in Fertilizer Production Capacity and Actual Production

Until the early 1960s, Korean fertilizer industry was in the beginning stage of its development. Most of fertilizers needed for domestic use were imported and a substantial amount of foreign exchanges were spent for the import. During the successive five-year economic development plan period(1962-71), Korean government gave a special priority for the expansion of fertilizer production capacity. Several large-scale fertilizer plants were constructed by government direct investment, foreign aid, and joint venture with foreign corporations.

As the results of the Korean government efforts, the fertilizer production capacity was drastically expanded since 1970 shown in Table 1. Specifically, the capacity was expanded six times from 191 thousands metric tons in 1965 to 1,354 thousands metric tons in 1970 and another two and a half times during 1970-82. However since 1982, the capacity was reduced because of reduced domestic demand and unfavorable price condition for exports.

The fertilizer plant operated at high capacity during 1965-75. But since 1975, the operation rate of the plants decreased to 90 percent due to the reduced demand. Table 2 presents a breakdown of fertilizer production in terms of plant nutrients. The production of P and K nutrients was remarkably increased compared to nitrogen. The P and K nutrients increased more than three times during 1970-83 while nitrogen increased only 50 percent. This is mainly due to the encouragement of balanced fertilizer use and hence an increase of compound fertilizer production.

Specifically, the production of the compound fertilizer increased almost four times from 488,000 metric tons in 1970 to 2,008,000 metric tons

TABLE 1 Fertilizer Production, Capacity and Operation Ratio, 1965-84

Year	Actual production	Capacity	Operation ratio
	...(thousands of metric tons)...		(%)
1965	164	191	85.9
1970	1,321	1,354	97.6
1975	2,075	1,780	116.6
1980	2,854	3,096	92.2
1981	2,595	3,096	83.8
1982	2,704	3,116	86.8
1983	2,632	2,905	90.6
1984	2,946	2,828	104.2

Source: Korea Fertilizer Industry Association(KFIA), *Fertilizer Yearbook*, 1984.

TABLE 2 Fertilizer Production by Plant Nutrient, 1965-84

Year	Net weight	Plant Nutrient			
		N	P ₂ O ₅	K ₂ O	Total
1965	164	75			75
1970	1,321	400	140	50	590
1975	2,075	583	195	100	878
1980	2,854	720	494	126	1,350
1981	2,595	666	324	178	1,168
1982	2,704	627	447	206	1,280
1983	2,632	595	458	174	1,227
1984	2,946	685	494	215	1,394

Source: KFIA, *Fertilizer Yearbook*, 1984.

in 1984. Reduced production of straight fertilizers such as urea, fused phosphate indicates that Korean farmers favor the type of compound fertilizer because of the convenience of fertilizer use (Table 3).

2. Import of Raw Materials

The imported fertilizer was main sources of fertilizer supply until mid-1960s. As the result of rapid expansion in the fertilizer production capacity, most fertilizer consumption was provided by domestic production. However, import of phosphate rock and potassium chloride, which are raw materials for the production of phosphate and potassium fertilizers has increased steadily. The import of these raw materials in the future are expected to sustain the present levels since there are no mines for these materials in Korea(Table 4).

3. Restructuring of Fertilizer Industry

The Korean fertilizer industry using naphta as raw material for urea lost her competitiveness in the world market since 1979 second oil crisis, com-

TABLE 3 **Fertilizer Production by Products, 1965-84**

	(thousand metric tons in weight)							
	1965	1970	1975	1980	1981	1982	1983	1984
Urea	163	684	917	958	851	546	500	651
Ammonium sulphate	-	-	135	186	189	192	190	198
Fused phosphate	-	149	280	206	114	86	64	33
Others	1	-	-	11	58	27	13	56
Compound fertilizer	-	488	743	1,493	1,383	1,853	1,865	2,008
Total	164	1,321	2,075	2,854	2,595	2,704	2,632	2,946

Source: KFIA, *Fertilizer Yearbook*, 1984.

TABLE 4 **Fertilizer Imports in Korea, 1975-84**

	(metric ton)					
	1975	1980	1981	1982	1983	1984
Phosphate rock	704,981	1,759,766	1,153,838	1,540,097	1,635,662	1,613,244
Potassium chloride	147,521	206,313	217,139	336,846	276,252	311,052

Source: KFIA, *Fertilizer Yearbook*, 1984.

pared to oil producing countries which are using natural gas. Along with her uncompetitiveness in the world market, domestic consumption has decreased since 1975. Furthermore, the Korean government is planning to terminate fertilizer subsidy within a few years since accumulated deficit in fertilizer account has reached 800 million dollars in 1984 (more than 100 million dollars of annual deficit in recent years) and created a serious burden in the government budget.

Since the 1980, the Korean government had made every effort to improve an efficiency of the fertilizer industry as well as a reduction in production capacity. In 1983, the government implemented the rationalization program of the fertilizer industry which reduce production capacity from 3,116,000 metric tons in 1982 to 2,905,000 metric tons in 1983 by closing Chungjoo Urea Plant(6th Plant) and allow only three producers would serve the needs of the government subsidized domestic fertilizer market; Namhae Chemical (7th Plant), Korean Fertilizer Co. (5th Plant), and the part of Yongnam Chemical (4th Plant). All other producers were left to export or sell domestic market with no subsidy. However, in fact the rationalization program did not help to reduce the deficit in the fertilizer account since the government had an unequal contract to her foreign partners, requiring to purchase a certain amount of fertilizer irrespective of market condition and guaranteeing 15-20 percent of annual profit for their investment.

In 1987 the contract between the government and the foreign partner will be terminated and thus the Korean government could choose alternative policy to restructure the fertilizer industry in order to implement

more effective rationalization program. In next rationalization program, the further reduction of the production capacity, the transformation of the government-owned-fertilizer manufacturing companies, to the private management, and free market system would be implemented.

III. Fertilizer Consumption

1. Trend in Fertilizer Consumption

Fertilizer consumption in Korea had increased rapidly until mid 1970s due to a continuous expansion of the fertilizer production capacity and strong government policy to encourage fertilizer application by providing fertilizer subsidies and various agricultural extension services. During the period of 1965–75, total fertilizer consumption increased more than twice, from 393,000 metric tons to 886,000 metric tons with the 7–8 percent of annual increasing rate. The composition ratio of N, P, K had changed from 55:32:13 in 1965 to 54:24:22 in 1980 to 51:24:25 in 1984, using more potassium. The composition ratio of each nutrient has been stable since 1980 and is much more balanced application of fertilizer compared to other developing countries (Table 5).

Table 6 presents consumption of fertilizers in terms of product during the period of 1970–84. The important change is that the consumption of the straight fertilizers such as urea, ammonium sulphate, fused phosphate and potassium chloride has decreased substantially while that compound fertilizer has increased more than twice. This is mainly due to farmer's favor to the compound fertilizers such as 21–17–17 and 17–21–17 which are blended in most fertilizer plants, and the government's encouragement to the balanced application of fertilizer.

TABLE 5 Fertilizer Consumption, 1965–84

Year	Net weight	N	P ₂ O ₅	K ₂ O	Total
		(%)	(%)	(%)	
1965	1,033	218(55)	123(32)	52(13)	393
1970	1,213	356(63)	124(22)	83(15)	563
1975	1,941	482(54)	237(27)	167(19)	886
1980	1,679	448(54)	196(24)	184(22)	828
1981	1,663	432(52)	199(24)	199(24)	830
1982	1,249	311(51)	149(24)	156(25)	616
1983	1,486	371(51)	172(24)	184(25)	727
1984	1,630	406(51)	186(24)	199(25)	791

Source: The Ministry of Agriculture and Fisheries, *Agricultural Policy Indicator*, 1985.

TABLE 6 **Consumption by Type of Product, 1970-84**

	(thousands of metric tons)						
	1970	1975	1980	1981	1982	1983	1984
Urea	587 (48.4)	767 (39.5)	568 (33.8)	511 (30.7)	350 (28.0)	423 (28.5)	456 (28.0)
Ammonium sulphate	22 (1.8)	74 (3.8)	20 (1.2)	15 (0.9)	11 (0.9)	21 (1.4)	27 (1.6)
Calcium cyanide	20 (1.6)	-	-	-	-	-	-
Triple superphosphate	32 (2.6)	193 (9.9)	-	-	-	-	-
Fused phosphate	77 (6.3)	168 (8.7)	75 (4.5)	72 (4.3)	64 (5.1)	60 (4.0)	40 (2.5)
Potassium chloride	56 (4.6)	152 (7.8)	46 (2.7)	46 (2.8)	40 (3.2)	44 (3.0)	44 (2.7)
Compound fertilizer	361 (29.8)	570 (29.4)	970 (57.8)	1,018 (61.2)	780 (62.4)	936 (63.0)	1,042 (63.9)
Others	58 (4.8)	17 (0.9)	-	1 (0.1)	4 (0.3)	2 (0.1)	21 (1.3)
Total	1,213	1,941	1,679	1,663	1,249	1,486	1,630

Note: () are percent.

Source: KFIA.

2. Fertilizer Consumption per Farm Household and per ha

Table 7 presents fertilizer consumption per farm household and per ha. Consumption of fertilizer per farm household had increased drastically during 1965-70 but has changed a little since 1980 except the sharp decrease in 1982. The decrease in 1982 is due to the increase of fertilizer price by 25 percent and the reduction of the planted area for high-yield rice varieties which require more fertilizer.

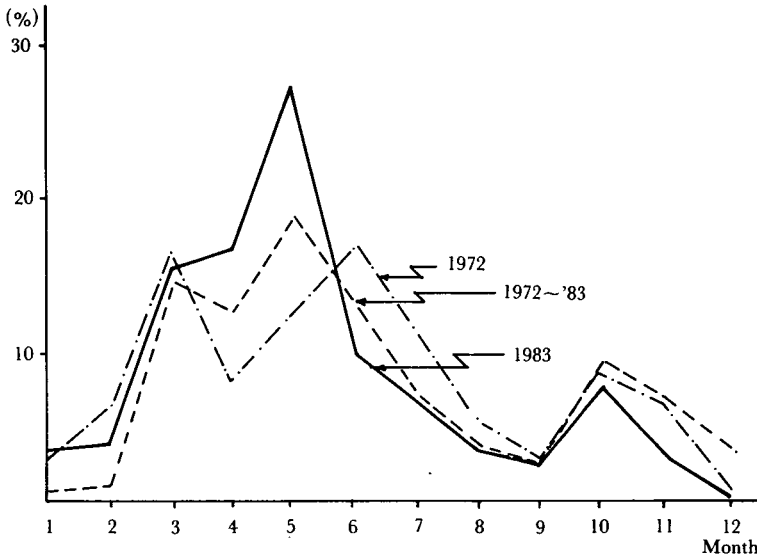
Fertilizer consumption per ha of agricultural land had also increased sharply during 1965-75, from 173kg in 1965 to 395kg in 1975. But since 1975 the fertilizer consumption per ha has decreased more or less. The main reason in the reduction of fertilizer consumption per ha is due to the decrease in cropping intensity in recent years. The rate of land utilization has decreased from 159 percent in 1965 to 124 percent in 1984. However, actual application of fertilizer to the cropped area has even increased in recent years.

3. Monthly Fertilizer Use

The monthly demand for fertilizer has changed during the 1972-1983. The peak demand for fertilizer in the early 1970 was June but the peak was moved to May in 1983 (See Figure 1). The movement of the peak demand for fertilizer is due to the expansion of the planted area for high-yield rice varieties which require earlier transplanting than the conventional rice variety. Meanwhile the second peak demand for fertilizer in the harvesting

season has remained the same during the same period. In 1984, approximately 72 percent of total fertilizer was sold on March through June and the rest on August through February (Table 8).

FIGURE 1 Monthly Fertilizer Use

TABLE 7 Fertilizer Consumption per Farm Household and per ha
(kilogram)

Year	Consumption per household				Consumption per ha			
	N	P ₂ O ₅	K ₂ O	Total	N	P ₂ O ₅	K ₂ O	Total
1965	87	49	21	157	96	54	23	173
1970	143	50	33	226	154	54	36	244
1975	202	100	70	372	215	106	74	395
1980	208	91	85	384	204	89	84	377
1981	212	68	68	409	197	91	91	379
1982	156	75	78	309	143	68	72	283
1983	186	86	92	363	171	79	85	335
1984	206	94	101	401	189	86	92	367

Source: The Ministry of Agriculture and Fisheries, Agricultural Policy Indicator, 1985.

TABLE 8 A Monthly Fertilizer Sale, 1984

Month	Ratio (%)	Month	Ratio (%)
January	0.8	July	5.5
February	7.2	August	3.2
March	15.9	September	2.8
April	20.1	October	5.9
May	26.6	November	2.1
June	9.0	December	0.9
Total		100.0	

Source: National Agricultural Cooperative Federation.

4. Export of Fertilizer

As shown in Table 9, the fertilizer export had expanded rapidly until 1980 in spite of an accelerated increase in domestic fertilizer consumption during the early 1970s. Over the period of 1976 to 1980, about 40 percent of fertilizer production was exported. However, since 1980, the export of fertilizer has decreased more or less since Korean fertilizer industry lost her competitiveness in the world fertilizer market. The substantial reduction of urea export since 1981 is due to the high production cost.

TABLE 9 **Export of Fertilizer in Korea, 1970-84**

	(thousands of metric tons)						
	1970	1976	1980	1981	1982	1983	1984
Urea	118	82	408	243	69	48	96
Ammonium sulphate	-	28	10	141	161	172	125
Fused phosphate	-	-	34	27	52	25	31
Compound fertilizer ¹⁾	-	8	717	375	711	909	1,015
Others	-	-	-	15	2	28	44
Total	118	118	1,309	801	995	1,182	1,311
Quantity							
Value in mill. dollars ²⁾	6	12	311	177	167	181	234

1) Compound Fertilizer include DAP.

2) Based on f.o.b. price.

Source: KFIA.

In spite of unfavorable competitiveness of the Korean fertilizer industry in the world fertilizer market, Korea has been able to continue fertilizer export because the government has protected the fertilizer industry by purchasing fertilizer for domestic consumption 50 percent higher than the world market price because if export price is greater than variable cost, it could give profits to fertilizer producers. However, the government considers to terminate the protection to the fertilizer industry in 1987 when the fertilizer purchasing contract between the government and the fertilizer manufacturing companies is over. Thus, in the long-run, it is evident that the export of fertilizer would decline.

5. Recommended Application Rates and Farmer's Actual Application Rates

The Office of Rural Development has made a continuous effort to establish optimum application rates of fertilizer for major crops. The recommended fertilizer doses for rice and barley are 350kg and 300kg per ha, respectively. However, the actual fertilizer application rates by farmers are far belower than the recommended doses. This is mainly due to that in the establish-

TABLE 10 Recommended Fertilizer Doses for Major Crops in 1983

Crop	(kg/ha)			
	N	P ₂ O ₅	K ₂ O	Total
Rice ¹⁾	150(140) ²⁾	90(60)	110(60)	350(260)
Barley	120(140)	110(50)	70(40)	300(230)
Corn	180	150	150	480
Soybean	40	70	70	160
Potato	100	100	120	320

1) High-yield variety

2) Numbers in parentheses are real fertilizer use while others are recommended fertilizer doses.

Source: Office of Rural Development.

ment of optimum fertilizer application rate, the Office of Rural Development was interested in the potential requirements for biologically maximum yield per land rather than economically optimum rate. As mentioned in Table 7, fertilizer consumption per ha decreased during 1975–82 and since 1982 the fertilizer consumption level has increased gradually but the consumption level is still lower than that of 1975.

The fertilizer consumption for rice and barley are not expected to increase in the foreseeable future, assuming the real price of those products will not increase. Based on the past trend of fertilizer consumption, it is strongly believed that the Korean farmers are already using sufficient amount of fertilizers for rice and barley.

Meanwhile actual application rates for other crops such as corn, soybean and potato are not known but are believed to be lower than optimum rates. In recent time, the government has encouraged to increase the production of these crops by price support and input subsidies and thus the fertilizer consumption level for these crops is expected to increase in the future.

6. Demand Projection Fertilizers 1985–2000

During 1970s, a number of demand projection of fertilizers for the period of 1985–2000 were made by many agronomists and agricultural economists. The results of the projections are turned out to be much higher than actual fertilizer consumption levels in the recent years. Especially, the results of demand projections conducted by agronomists were at least 50 percent higher than actual consumption level in the period of 1980–84 (See Bibliography Lee 1976; Oh 1982; Sim 1974; Sung 1974).

Over-estimation of the fertilizer demand for the period of 1980–2000 was due to the unrealistic assumptions used in the projection;

- 1) the favorable price conditions for agricultural products during 1970s would continue;
- 2) the cropping intensity in the early 1970s would remain;
- 3) the real prices of fertilizers would not increase;

- 4) the agricultural policy supporting to increase self-sufficiency in food grains would continue;
- 5) Korean farmer would increase the rate of fertilizer application close to the recommended rate in the future;

However, the above assumptions turned out to be unrealistic. Since the late 1970s, the Korean agriculture has confronted with many difficult problems such as the second oil crisis in 1979 and subsequent increase in fertilizer price, the abnormally low agricultural production due to the bad weather condition in 1980, minus economic growth rate in 1980, the continuous decrease in the land intensity due to the steady increase in feed grain imports since the early 1980s and freezing the real price of rice by the government in 1982, 1983 and 1984, and a substantial reduction in the acreage of high-yield rice varieties since 1980. Unfavorable economic situations surrounding agriculture since 1980 has resulted in reduction or stagnation of fertilizer consumption in the recent years.

Furthermore, the prospective of the Korean agriculture in coming years is not promising like the 1970s. Therefore, the demand projection of fertilizer for the future should be made based on changed economic conditions. Thus, the following assumptions are made for the demand projection of 1985-2000;

- 1) the grain imports for feed stock would increase and consequently the land intensity will decrease;
- 2) the real price of agricultural product would not increase;
- 3) the acreage of the high-yield rice variety would decrease because the quality of the high-yield rice variety is inferior to the conventional rice variety;
- 4) the real price of fertilizer would remain;

In order to project demand for fertilizers in the period of 1985-2000, two estimation methods were used;(1) the method using the current application rates of fertilizer for rice and barley and the recommended rates for other crops and the estimated acreage for major crops in the future;this method is more effective to estimate accurate fertilizer consumption because the Korean farmers are believed to be using already economically optimum rates of fertilizers for rice and barley;(2) the method based on time-series data of the real price of fertilizer, time trend and the cropped area during 1963-1983, using log function, can provide price elasticity of fertilizer consumption easily.

6-1 Demand Projection by Fertilizer Application Rates and Estimated Crop Acreage for Crops

Table 11 presents the results of demand projection of fertilizer for crops. The fertilizer demand for rice is expected to decrease continuously after 1986. Main reason to decrease in the fertilizer demand for rice is due to the

TABLE 11 Demand Projection for Fertilizer by Crops, 1985-2001

	(thousand nutrient ton)			
	1985	1986	1991	2001
Rice	301.3	300.8	256.4	186.6
Barley	68.1	67.8	32.1	25.7
Miscellaneous cereal	18.7	16.9	13.6	13.6
Pulse Crops	39.1	38.9	38.7	38.7
Potato & sweet potato	21.9	22.5	29.6	31.2
Vegetables	242.7	263.4	270.3	285.2
Fruits	62.2	64.4	75.3	75.9
Special crops	37.9	37.9	33.7	25.8
Tobacco	12.8	11.2	10.2	10.2
Grass-land	55.0	69.9	117.0	180.0
Total	860.2	893.7	876.9	872.9

Source: Kang, Jung-Il et al., *Demand Projection and Establishment of Optimum Storage for Fertilizer in Korea*, Korea Rural Economics Institute (KREI), 1984, pp. 38-41.

reduction in rice planted acreage because of changing food consumption pattern. Fertilizer demand for barley is also expected to decrease because the consumption of barley is expected to decline continuously in the future. Meanwhile, fertilizer demands for fruits and grass-land are expected to increase steadily because the demand for fruits and livestock would increase as national income increase. Fertilizer demands for other crops are expected not to change significantly from the current levels.

According to the estimation results, total fertilizer demand in 1985-2000 ranges from 860,000 to 894,000 metric tons which is about 170,000 metric tons higher than that of 1983(727,000 metric tons).

6-2 Demand Projection of Fertilizer based on Time-Series Analysis

In the estimation of demand function for fertilizer based on time-series data of 1963-83, the price of fertilizer, which is deflated by the price of rice and time trend, which reflects the effect of technology change, government policy and farmer's attitude on the fertilizer consumption were chosen as independent variables. However, fertilizer consumption per ha in stead of total fertilizer consumption was chosen as dependent variable because there was no significant relation between total fertilizer consumption and total cultivated acreage. This phenomenon could be explained by that an increase in fertilizer consumption during 1970s was generated through an increase in the fertilizer application rate per ha although actual planted area has decreased since 1970. Thus, the estimation of aggregate fertilizer demand was recalculated by the estimated fertilizer demand per hectare multiplied with the estimated total planted area.

The log function was used in the estimation of demand function and the function was estimated for each nutrient and also for aggregate fertilizer demand. The estimated demand function for each nutrient and the aggre-

gated fertilizer demand are as followings;

$$\log TCF = 6.0893 - 0.4293 \log IFP + 0.1230 \log T,$$

(23.9) (-2.4) (1.7)
R² = 0.72

$$\log CF = 4.9876 - 0.4450 \log TFP + 0.2583 \log T,$$

(24.0) (-3.0) (4.4)
R² = 0.90

$$\log CNF = 4.2964 - 0.3638 \log NFP + 0.2680 \log T,$$

(23.3) (-2.4) (5.1)
R² = 0.86

$$\log CPF = 4.1340 - 0.5569 \log PFP + 0.0827 \log T,$$

(11.9) (-2.2) (0.8)
R² = 0.63

$$\log CKF = 2.1073 - 0.1629 \log KFP + 0.7021 \log T,$$

(7.6) (-1.1) (8.7)
R² = 0.96

Where parentheses are T statistics;

TCF is total consumption of fertilizers in net weight per hectare of planted area:

CFF is total consumption of fertilizer in nutrient per hectare of planted area:

CNF, *CPF*, and *CKF* are fertilizer consumption of N, P, K, per hectare of planted area, respectively:

TFP is the price of fertilizer:

NFP, *PFP*, and *KFP* are the price of N, P, and K respectively.

The demand projections of fertilizer for 1985–2000 based on estimated fertilizer demand functions are presented in Table 12. In the projection of fertilizer demand, the real prices of fertilizers are assumed to be constant and thus the estimated coefficient of T which stands for the technology change, government policy and farmers' attitudes on fertilizer consumption and the estimated total planted are used.

TABLE 12 Demand Projection of Fertilizer, 1985-2001(based on time series analysis)

	1985	1986	1991	2001
Nutrient (1,000 tons)	800	825	802	798
Net Weight (1,000 tons)	1,582	1,625	1,531	1,447

Source: Kang, Jung-Il et al., Demand Projection and Establishment of Optimum Storage for Fertilizer in Korea, KREI, 1984. pp. 34-42.

According to the results of the demand projections based on time-series data, the fertilizer consumption levels for the period of 1985–2000 are expected to be very stable. The projected fertilizer consumption levels in 1985 through 2000 are approximately 70,000 metric tons higher than the actual fertilizer consumption in 1983. However, the demand projections estimated from time-series data are 60,000–70,000 metric tons lower than those estimated from the recommended fertilizer application rates for major crops. The difference in the results of demand projection between two methods could be explained by that Korean farmer may not use the recommended rates of fertilizer established by agronomists even in the future.

In general, the recommended rates of fertilizers established by agronomists tend to be higher than economically optimum rates of fertilizer or the actual rates of fertilizer applied by farmers because the agronomists are interested in the establishment of the application rates of fertilizer requiring for biologically maximum yield of crop per unit of land. In reality, yield of upland crops such as corn, soybeans, wheat, and potatoes are expected to increase by using more application of fertilizers as well as development of high-yield varieties. However, yield of rice would not increase significantly by more application of fertilizer because Korean farmers concern about quality of rice rather than the yield of rice.

From the results of the demand projection of fertilizer generated from two methods, we can conclude that fertilizer consumption in the future would be stable or increase slightly compared to the current consumption level of fertilizers. However, if economic conditions surrounding agriculture would change more favorably to agriculture in the future, the fertilizer consumption will increase in some extent.

7. Price Elasticities of Fertilizer Demand

The price elasticity of fertilizer demand has been estimated recently by a few economists. The results of estimated price elasticities of fertilizer demand are presented in Table 13, according to the results, the estimated values of price elasticities of fertilizer demand are different according to the period of data used in the estimation or the estimation method. The price elasticity of aggregate fertilizer demand ranges from -0.23 to -0.44 and those of each nutrient demand, N, P_2O_5 , and K_2O range from -0.50 to -0.17 , from -0.56 to -0.27 , and from -0.45 to -0.16 , respectively. There are substantial differences in elasticities among three approaches. Main reasons are due to the methods of estimating fertilizer demand functions. In Lee's estimation, prices of fertilizers were used as independent variable and estimated by log-function. In KREI I, prices of fertilizers, the previous year's fertilizer consumption level and T (stands for technology change and policy effect) were used as independent variables and were estimated by

TABLE 13 **Estimation of Price Elasticities of Fertilizer Demand**

	Lee ¹⁾	KREI	
		I ²⁾	II ³⁾
N	-0.50	-0.17	-0.36
P ₂ O ₅	-0.29	-0.27	-0.56
K ₂ O	-0.45	-0.32	-0.16
Aggregated fertilizer	-0.44	-0.23	-0.44

Source: 1) Lee, Sun, "Estimation of Social Cost of Agricultural Policy," *The Korea Development Review* 4(3), Korea Development Institute(KDI), 1982.

2) Kang, Jung-II et al., *Demand and Supply of Fertilizer in Korea*,

3) Kang, Jung-II et al., *Demand Projection and Establishment of Optimum Storage for Fertilizer in Korea*, KREI, 1984.

time-lag function. In KREI II, price of fertilizers and T were used as independent variables and fertilizer consumption per ha was used as dependent variable while aggregate fertilizer consumption was used as dependent variable in Lee and KREI I. Another reason is the different time period of data used in estimation of fertilizer demand functions.

In the 1960s and 1970s, it has been known that the price elasticity of fertilizer demand is inelastic. However, the results of the estimated price elasticities appear to be much higher than the previous study results or the other developing countries. The results may indicate that the Korean farmers are using sufficient amount of fertilizers and therefore, they are sensitive to the change in fertilizer price. This is probably true because the Korean farmers are using more than 360kg of fertilizer per hectare which is one of the highest fertilizer consumption level in the world.

IV. Fertilizer Price and Subsidy

1. Fertilizer Prices

The Korean government has practiced a strict control on the pricing of fertilizers at manufacturing, wholesale, and retail level because of the importance of fertilizer of agricultural production, farm income and their effects on the fertilizer industry. The purposes of government control on the fertilizer pricing are to set a stable price to farmers and to protect fertilizer manufacturing industry operating at much higher cost compared to competing countries due to the naphtha using production method of urea.

As consequence of the conflicting purpose of the fertilizer policy, price of fertilizer has not been determined by market conditions. Until the mid 1970s, Korean farmers purchased fertilizers at lower price than the world market price. However, since the late 1970s, Korean farmer has purchased fertilizer at 30 percent higher than the world market price due to

the drastic increase in oil price although price paid by farmer was still lower than the government purchased price. On the other hand, the fertilizer manufacturing company has sold fertilizer to the government at higher than the world market price. The differences between price paid by farmer and price received by the fertilizer manufacturing company have been subsidized by the government.

As shown in Table 14, fertilizers prices paid by farmers increased 2.5 times during 1976-84. The rate of increases in prices for all type of products maintained approximately the same during the period. It reflects the intension of the government to increase the fertilizer price at the same rate among differents products regardless of production costs.

TABLE 14 **Fertilizer Price Paid by Farmers, 1976-84**

	(Per Metric Ton by Type)									
	1976/79		1980		1981		1982/84			
	1000 Won	US\$	1000 Won	US\$	1000 Won	US\$	1000 Won	US\$	1000 Won	US\$
Urea	122	252	147	222	220	315	249	301	249	301
Compound fertilizer (17-21-17)	95	197	114	173	172	246	198	239	198	239
Fused phosphate	46	95	55	84	83	118	94	113	94	113
Potassium chloride	42	87	51	77	76	108	86	103	86	103

Source: KFIA(Korea Fertilizer Industry Association), Fertilizer Yearbook, 1984, pp. 362-363.

In recent years, Korean farmers have purchased urea at least, 50 percent higher than the world market price. For example, during 1982-4, Korean farmers paid 301 US dollars per one ton of urea which is the most expensive price among developing countries. However, the fertilizer manufacturing companies exportes urea at 160-200 US dollars in the world market. Consequently, Korean farmers seem to provide direct subsidies to the fertilizer industry. In fact, Korean farmers are using the most expensive fertilizers among developing countries.

2. Fertilizer Subsidy

As mentioned earlier fertilizers are sold to farmers at a below cost paid by the government. The differences is subsidized by the government. As shown in Table 15, total cost of urea delivered to farmers in 1983 was 312,935 won per metric ton:241,587 won for ex-factory and 71,338 won for various charges for delivering, including transportation, storage, and interest charges. The difference between total cost of fertilizer and retail price to farmers is 63,735 won which is subsidized by the government. The government subsidy in 1983 consisted 25.6 percent of the retail price.

TABLE 15 Unit Cost-Price and Sale Price of Urea, 1983-84

	1983	1984
	Won/MT	Won/MT
Ex-Factory price (A)	241,597	233,320
Marketing cost (B)	71,338(22.8) ¹⁾	66,695(22.2) ¹⁾
Total cost (C = A + B)	312,935	300,015
Retail price to farmers (D)	249,200	249,200
Subsidy (C - D)	63,735(25.6) ²⁾	50,815(20.4) ²⁾

1) Marketing cost as percentage of the total cost.

2) Subsidy as percentage of the retail price.

Source: NACF.

Ex-factory price of urea decreased from 241, 597 won/mt in 1983 to 233,320 won/mt in 1984 due to the decrease in naphta price. Along with the reduced ex-factory urea price, marketing cost also decreased from 71,338 won/mt in 1983 to 66,995 won/mt in 1984 since interest cost and NACF service charges are proportional to the ex-factory price. However, there was no change in retail price to farmers because the reduced portion in total cost of fertilizer was used to support the fertilizer account.

In subsidy to fertilizer, there is no specific rule to decide the rate of subsidy. In reality, the government has set fertilizer price considering rural economic condition, general price index, and agricultural price level. Thus, fertilizer subsidy is automatically determined by the gap between total cost of fertilizer distribution, including ex-factory cost and marketing cost, and retail price to farmers.

TABLE 16 Deficit in NACF Fertilizer Account, 1975-84

Year	(billion won)			
	Cost of fertilizer* (A)	Revenue from sale (B)	Deficit (A - B)	Accumulated deficit
1975	170	100	-70	-130
1976	125	127	-2	-101
1977	150	147	-2.6	-104
1978	195	175	-19.7	-123
1979	222	174	-48.3	-172
1980	326	200	-125.7	-297
1981	459	297	-162.3	-460
1982	365	248	-117	-577
1983	385	287	-97.7	-674
1984	408	372	-37.4	-711

* Included in distribution cost(1\$ is equal to 895 won in 1984)

Source: NACF, *Annual Statement in Fertilizer Accounting*, 1980-1984.

Recently, fertilizer subsidy policy in Korea has been critically reviewed by economist or even government officers. Principal purpose of

fertilizer subsidy is supposed to increase fertilizer consumption levels for increasing agricultural production and also to protect farm incomes. However, Korean farmers are already using a sufficient amount of fertilizer, more than 360kg per hectare and so there is no ground to increase fertilizer use in order to increase agricultural production. Furthermore, Korean farmers are paying much higher price for fertilizer compared to most developing countries. In fact, most of subsidy benefit belong to the inefficient fertilizer manufacturing company.

Conflicting purpose of the Korean fertilizer pricing policy, aiming to protect both consumer and producer of fertilizer at the same time, has inevitably incurred a serious financial burden to the Korean government. Annual deficit in fertilizer account has increased at accelerating rate since 1976 and accumulated deficit in fertilizer account in 1984 reached approximately 710 billion won which is equivalent in 793 million US dollars (Table 16). The deficit in fertilizer account has been one of major sources of the chronic deficit in the government budget.

Major sources of fund for the fertilizer account are loans from The Bank of Korea and NACF. As shown in Table 17, approximately 40-44 percent of total fund used in the fertilizer account has provided by The Bank of Korea, 22-29 percent by NACF and the remainder from other sources, respectively. The annual interest rate paid to The Bank of Korea and the NACF are 5 percent and 10 percent, respectively. The loan from The Bank of Korea has been criticized as one of major causes of inflation.

TABLE 17 **Source's and Uses of Funds in NACF's Fertilizer Account,(Balance Sheet Data, 1982-84)**

	(million won)		
	1982	1983	1984
<i>Use of Funds</i>			
Fertilizer purchasing expense	388,836	300,323	312,253
Payment of distribution cost	35,315	35,877	36,278
Repayment of loan interest	53,382	57,397	59,071
Repayment of NACF's loan	262,121	339,739	321,336
Repayment of BOK's loan	370,000	470,000	570,000
others	70,369	93,123	77,933
Total	1,180,023	1,296,458	1,376,961
<i>Source of Funds</i>			
Revenue from sale	281,672	327,199	345,614
Subsidy from gov't	-	-	60,000
Loans from BOK	470,000	570,000	570,000
Loans from NACF	339,738	321,336	311,736
Others	88,613	77,923	89,611
Total	1,180,023	1,296,458	1,376,961

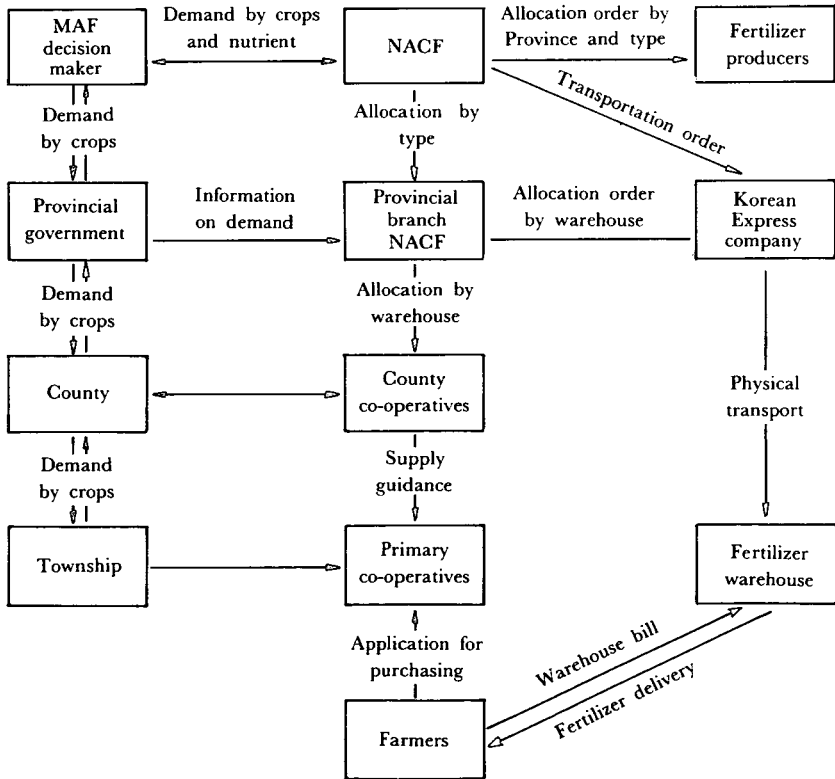
Source: NACF

V. Distribution and Marketing of Fertilizers

1. Fertilizer Distribution System

Fertilizer distribution in Korea has been entirely controlled by the government except the period of 1957–62 and early 1970s since the independence of the nation after the second World War. In fact, the National Agricultural Cooperative Federation (NACF) distributes fertilizers. The NACF, a close vertical integration of local cooperatives into a centralized headquarter, has been a main distribution system since 1961 and has provided financing, insurance and other services for fertilizer distribution. NACF distributes fertilizers through its chain of County and primary cooperatives (See Figure 2).

FIGURE 2 Fertilizer Allocation Process in the Republic of Korea



Source: NACF.

In the 1950s and early 1970s, some fertilizers such as urea and potassium sulphate were imported and distributed by private sector. However, the private dealers made a excessive profit by providing only the most profitable fertilizers such as nitrogeous fertilizers but they did not supply enough potash and potassium. Thus, the government prohibited the distribution of most fertilizers except a few fertilizers by the private sector. In present, more than 90 percent of chemical fertilizers are distributed by NACF while the private dealers distribute only a few type of fertilizers such as compound fertilizers 11-10-10, 10-16-11, and 16-11-12 for special crops and organic fertilizers.

The fertilizer destirbution operation of NACF are handled by the Division of Fertilizer, the Purchasing Department. Purchasing planning is made at the end of each year for the next fiscal year by the NACF with the cooperation of the Ministry of Agriculture and Fisheries(MAF). MAF draws up "annual fertilizer demand and supply scheme" and formulate "a guideline for fertilizer supply" in the cooperation with the Office of Rural Development and the Korean Fertilizer Industry Association. Based on this plan and guidelines, NACF purchases the required fertilizers from fertilizer companies and allocates fertilizer to each province. The provincial offices of NACF in turn reallocate fertilizer to each local cooperatives(primary cooperatives) and local cooperatives sell fertilizer to farmer. At the end of each month, fertilizer manufacturing company submits monthly production reports to MAF and NACF and NACF also submits monthly sale reports to MAF.

2. Marketing Cost and Margin

As mentioned in previous section, the fertilizer distribution is entirely controlled by the government and therefore, the marketing cost such as transportation and storage cost are also set by the government as well as fertilizer price. Since the government determines fertilizer price and marketing cost, there is little difference in marketing cost among various products of fertilizers in spite of substantial differences in fertilizer price among fertilizers. Thus, almost unified rate of marketing cost is applied to all type of fertilizers.

Marketing cost is composed of several components covering costs for transportation, storage, handling, physical losses during the distribution, interest charges, and marketing margin. Table 18 presents a breakdown of the marketing cost in 1984. The total marketing costs per metric ton was 66,965 won, which constitutes 22.2 percent of the price of one ton of urea(included government subsidies) and about 26.7 percent of the retail price of urea to farmers.

The highest single cost item was the interest charges which constitutes 60 percent of the total marketing cost and costs for transportation and

TABLE 18 **Breakdown of the Marketing Cost, 1984**

	Won/Metric ton	Percentage
Transportation cost	10,118	15.2
Storage cost	4,972	7.5
Bagging cost	107	0.1
Handling cost	2,384	3.6
Physical losses	57	-
Interest charges	40,120	60.2
Marketing margin	8,937	13.4
- Wholesale margin	1,545	(2.3)
- Retail margin	7,392	(11.1)
Total marketing cost	66,695	100.0

Source: NACF

storage constitutes 15.2 percent and 7.5 percent of the total marketing cost, respectively. The marketing margin in 1984 was 8,937 won per metric ton, which constitutes 11.1 percent of the total marketing cost and only 3.6 percent of the retail price of urea. The costs for bagging, handling and physical losses all together constitute only less than 4 percent of the total marketing costs.

As shown in the Table 18, the interest charges are abnormally high compared to other countries. This is mainly due to the interest charges generated from over inventories of fertilizers which are equivalent to 80.5 percent of fertilizer consumption in 1983, and 66.3 percent in 1984. If the inventory level was reduced to the optimal level (500,000 metric tons in net weight), the half of interest charges could be reduced and hence it is possible to cut down at least 30 percent of the total marketing cost.

TABLE 19 **Comparison of NACF Fertilizer Purchasing, Sales and Inventory, 1980-83**

	(thousands of metric tons)				
	1980	1981	1982	1983	1984
Gov't purchasing ¹⁾ (A)	1,429	1,629	1,578	1,362	1,398
Sales (B)	1,672	1,663	1,249	1,432	1,534
Inventory ^{b)} (C)	930	896	1,225	1,154	1,017
C/A × 100(%)	65.1	55.0	77.6	84.7	72.7
C/B × 100(%)	55.6	53.9	98.1	80.5	66.3

1) Excluded in carry over

2) Based on the end of the year

Source: NACF

3. Fertilizer Inventory

Over inventory in the management of the NACF fertilizer distribution has been a conflicting problem which is a main reason to increase fertilizer

distribution cost due to the storage and interest charges generated by over-inventory. As shown in the Table 19, the fertilizer inventory level at the end of each year during 1980-84 ranged 930,000-1,225,000 metric tons which constitutes 55-85 percent of the government purchase and 54-98 percent of the NACF's sale, respectively.

According to the estimation of optimum fertilizer inventory level conducted by the Korea Rural Economics Institute in 1984, the optimum inventory level ranges from 400,000 to 600,000 metric tons. Thus, at least, 500,000 metric tons of fertilizer could be reduced from the inventory level of 1984. A main reason to the over-inventory level is due to the decrease in fertilizer consumption in recent years and the government's contract to the fertilizer manufacturing company, requiring to purchase a certain amount of fertilizer regardless of domestic demand condition. All inventory is held in primary-cooperatives' ware-houses and the government pays storage costs to the primary-cooperatives.

4. Future Directions in Fertilizer Marketing in Korea

In order to promote fertilizer use during 1950-1970s, Korean government has taken various measures such as introduction of modern farm management techniques and high-yielding varieties, improvement of irrigation facilities, fertilizer subsidy, and strict government intervention in fertilizer marketing. Among these measures, the government intervention in fertilizer marketing and distribution has played a significant role in the increased application of chemical fertilizers during the period 1960 to 1970s in Korea whereby an average fertilizer consumption level had reached approximately 400 kg/ha of nutrients in the mid-1970s.

The National Agricultural Cooperative Federation(NACF), which was established in 1961 by merging the Agricultural Cooperative Federation and Agricultural Bank, has distributed more than 90% of chemical fertilizer during the last two decades. The government has strictly controlled fertilizer price, trade regulation, product allocation, subsidies, and marketing cost to ensure that fertilizers reach farmers at stable and reasonable price. As a result, fertilizers are sold at an uniform price throughout the country irrespective of the distance involved. In this sense, the fertilizer marketing system in Korea may be regarded as the mixed marketing system whereby cooperative and public system co-exist although more than 90 percent of fertilizers distribution have been handled by the NACF.

The government intervention in fertilizer marketing in the past was an avoidable measure due to the following reasons:(1) until the late 1960s Korean farmer used fertilizer much lower than a target level and farmer's purchasing power was very low;(2) and the same time, the government had to protect the fertilizer industry because the fertilizer industry was just beginning stage of its development;(3) the composition ratio of fertilizer

nutrient in 1960s was unbalanced such that the N:P:K ratio was 55:32:13 and thus the public extension program for the balanced fertilization was necessary. Although the government intervention in fertilizer marketing has made an important role in the increase of fertilizer consumption and the development of the fertilizer industry during 1960–70s, it created inefficiency in fertilizer management, especially chronic accumulation of fertilizer inventory and enormous deficit in fertilizer account in recent years and over-protection to the fertilizer industry which requires high production cost due to the naphtha using urea processing method.

In fact, the government intervention in fertilizer marketing after mid-1970s seems to protect fertilizer industry rather than Korean farmers because Korean farmers have been forced to purchase fertilizers at least 30% higher than the world market price and the Korean fertilizer manufacturers have exported at much lower price than their domestic prices. In recent years the government has made an effort to eliminate inefficiency in the fertilizer industry. However, it was not successful because the government has an unequal contract to the fertilizer manufacturing companies.

In recent years the government is planning to reduce its involvement in fertilizer marketing since fertilizer marketing conditions have been changed substantially compared to the past. The changed fertilizer marketing conditions are as followings; (1) the production capacity is much higher than domestic consumption level; (2) the Korean farmers are using sufficient amount of fertilizer with well-balanced ratio of nutrients; (3) the production cost of fertilizer could be reduced considering the recent world energy condition; (4) the unfavorable government contract to the fertilizer manufacturing companies will be terminated in 1987; (5) more than one hundred million dollars of annual deficit in the fertilizer account are scheduled to be eliminated within a few years according to the government plan.

Future development of fertilizer marketing in Korea should be to reduce government intervention and to promote more free market condition in order to improve marketing efficiency as well as increasing the competitiveness of the fertilizer industry. The private sector will be allowed to participate in fertilizer marketing. In this case, however, the role of the NACF will not change significantly since the NACF holds its well organized chain of primary co-operatives with about 5,700 of fertilizer warehouses throughout the country. Thus, the current market share of chemical fertilizers by the NACF is not expected to reduce in the near future since the private sector will not be able to compete the NACF due to the huge investment required to build fertilizer warehouses. But in the long-run, the market share of the private sector would increase like the pesticide market in Korea whereby more than 60% of the market share are handled by the private sector and the rest are handled by the NACF.

Under the future fertilizer market system which will be handled by

the NACF and the private sector, the government intervention in fertilizer marketing will be reduced substantially such that strict trade regulation, product allocation, subsidies, and control on marketing cost are removed. However, the government involvement in fertilizer price is expected even under the new market system because fertilizer are considered to be strategic agricultural inputs and most raw materials are imported. It is expected that future marketing system would be more or less like that of Japanese case where more than 85% of the fertilizer market share are handled by the Japanese Agricultural Cooperatives even though the private sectors are allowed to participate in the fertilizer market. In Japan, fertilizer prices are determined by a negotiation among the government, fertilizer manufacturers and agricultural cooperatives.

Specific policy directions in future fertilizer marketing are under study by the Korean government and the Korea Rural Economics Research Institute. Main issues in future fertilizer marketing and distribution are:(1) the degree of the government intervention in determination of fertilizer prices and marketing costs;(2) the time schedule of the rationalization of the inefficient fertilizer industry and the method of the transformation of the government owned-fertilizer manufacturing companies to the private management;(3) how to eliminate fertilizer subsidies without a substantial increase in fertilizer price to farmers;(4) amendments in fertilizer trade regulation;(5) the market share between the NACF and private sector.

According to the tentative government schedule, the policy framework of future fertilizer marketing and distribution will be prepared before the late 1987 when the government contract to the fertilizer companies is terminated. Thus, the new marketing system could start in 1988. However, many trial and errors are expected in the implementation of the new marketing system. Two or three years of transitional period would be necessary in order to reduce unexpected trial and errors and thus the implementation of free marketing system will be possible around 1990.

VI. Summary and Conclusions

1) During the successive five-year economic development plan periods(1962-1982), the fertilizer production capacity was drastically expanded from 191 thousands metric tons in 1961 to 1,354 thousands metric tons in 1975 and to 3,116 thousand metric tons in 1982 by the government direct investment, foreign aid, and joint venture with foreign corporations. Along with the rapid expansion of the production capacity, fertilizer production increased remarkably from 164 thousand metric tons in 1965 to 2,075 thousand metric tons in 1975 and 2,854 thousands metric tons in 1980. Thus, domestic needs of fertilizers was provided by domestic produc-

tion and furthermore more than one million metric tons of fertilizer has been exported annually since 1978. However, Korean fertilizer industry using naphtha as raw material for urea lost her competitiveness in the world market since the second oil crisis in 1979 and furthermore domestic fertilizer consumption has decreased or stagnated since 1975. Under current price condition in the world fertilizer market, the fertilizer industry can not operate its full capacity without government export compensation subsidy. Thus, in the near future the Korean fertilizer industry should reduce the current production capacity down to the domestic consumption level.

2) Fertilizer consumption had increased very fast until mid-1970s due to continuous increases in fertilizer production and strong government policy to increase fertilizer consumption by providing fertilizer subsidies and various agricultural extension program to encourage fertilizer use. Fertilizer consumption increased more than twice during the period of 1965–1975, from 393,000 metric tons (in nutrient terms) in 1965 to 886,000 metric tons in 1975 with 7-8 percent of annual increasing rate. The composition ratio of N, P, K had changed from 55:32:13 in 1965 to 54:24:22 in 1980 and 51:24:25 in 1984, using more potassium. The composition ratio of each nutrient consumption has been stable since 1980 and is well-balanced application of fertilizer compared to most developing countries in Asia.

3) Fertilizer consumption per ha of planted land had also increased sharply during 1965–1975, from 173 kg in 1965 to 395 kg in 1975. However, fertilizer consumption per ha of land and the same time, total fertilizer consumption has decreased more or less since 1975 due to the increase in relative price of fertilizer to agricultural products and decreased in cropping intensity in recent years. According to the fertilizer demand projections for the 1985-2000, total fertilizer demand in 1985-2000 ranges from 860,000 metric tons of nutrient to 894,000 metric tons which is about 170,000 metric tons higher than that of 1983 (727,000 metric tons). From the results of the demand projection of fertilizer, we can conclude that fertilizer consumption in future would be stable or increase slightly compared to the present consumption level of fertilizer. However, if agricultural policy would change more favorably to agricultural production in future, the fertilizer consumption would increase in some extent.

4) According to the recent study on the price elasticity of fertilizer demand, the elasticity of aggregate fertilizer demand is -0.44 and the elasticities of each nutrient, N, P, K are -0.36 , -0.56 , and -0.16 . These estimate on price elasticity of fertilizers are much higher than the previous study results and the most Asian countries. This may indicate that the Korean farmers are using sufficient amount of fertilizers and therefore, they are sensitive to the change in increase of fertilizer price.

5) Fertilizer distribution system in Korea is entirely controlled by the government. In fact, under the government control, the National Agricultural cooperative Federation(NACF) distributes more than 90 percent of fertilizer consumption through its chain of county and primary cooperative system. The government set fertilizer price and marketing cost. The government intervention in fertilizer marketing, which was an unavoidable measure to increase fertilizer application and to protect domestic fertilizer industry in the past. However, considering that the supply of fertilizer exceeds domestic consumption level and Korean farmers are using sufficient amount of fertilizers with well-balance of each nutrient, the government controlled distribution system may not be the best alternative. The development of free market system which is progressive and flexible in its management, willing to take a risk, and always cost conscious would be desirable for the improvement in marketing efficiency and better service to farmers.

6) Recently, the fertilizer policy in Korea has being reviewed critically by the government because annual deficit in fertilizer account has increased at accelerating rate and the accumulated deficit reached 793 million US dollars in 1984. In fact, the deficit in fertilizer account seems to be created to protect inefficient domestic fertilizer industry since Korean farmers have been forced to purchase fertilizer in much higher price than the world market. New policy directions are to reduce its involvement in fertilizer marketing in order to improve the competitiveness of the fertilizer industry and the marketing efficiency. Main issues in the renovation of fertilizer policy in Korea are:(1) the degree of the government intervention in determination of fertilizer prices and marketing costs:(2) the time schedule of the rationalization of the inefficient fertilizer industry and the method of the transformation of the government owned-fertilizer manufacturing companies to the private management:(3) how to eliminate fertilizer subsidies without a substantial increase in fertilizer price to farmers:(4)amendments in fertilizer trade regulation;and (5) to determine market share between the NACF and private sector.

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