

The Problems of Fertilizer Use by Farmers in Korea

by

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I.

Although most of the agricultural commodities are consumed as food by the people, Korea's production has not been sufficiently great to provide enough food for its people. "During the 1960's the demand for food crops rose at an annual average of 5 percent, whereas the domestic supply rose at an annual average of 2.5 percent.....the supply shortage had to be met with imported food grains. Total import of food grains rose from the 500,000-600,000 ton level in the early 1960's to the two million ton level toward the end of the decade."⁽¹⁾ The demand for food is expected to rise continuously during the third plan period because of population growth and increased national income. To overcome a potentially serious problem of growing deficits in food grains, agricultural production should increase at a higher rate than ever before.

Up to the present, all farms are very small in size with large farm families and low yields. This results in a very low per capita farm income and in poverty conditions for the largest segment of the rural economy. It impedes the introduction of new technology into their farming. If farmers could increase output per Dan-bo (area), it would increase their farm income, resulting in a higher rate of

economic growth in the agricultural sector. More income for farmers also would increase the purchases of non-food items, a condition which would stimulate economic development of the nation as a whole.

To achieve this desired target of increased production, either more land must be used for cropping or more land substitutes must be employed. With the limitation of arable land, many new marginal lands are being brought into crop cultivation, but the soil is of poor quality. Previous experience has shown that this reclaimed land is not of great value for crop production. In view of this, the major goal of increased food production in the future must be largely achieved on the land area already under cultivation.

"Much of the new technology needed to raise productivity per hectare and per man is embodied in the form of chemical or biological inputs."⁽²⁾ Among these agricultural inputs, chemical fertilizer is by far the most important item to Korean agriculture.

II.

The utilization of chemical fertilizer in terms of the actual nutrient basis—nitrogen, phosphorus pentoxide, and potassium oxide—for the years 1952 to 1971 is shown in table 1. Aggregate trends of

(1) Government of the Republic of Korea. *Economic Development Plan*, the third five year (1972-76), 1971, p. 33.

(2) V.W. Ruttan, "Agricultural Product and Factor Markets in Southeast Asia," *Economic Development and Cultural Change*, Vol. 17, No. 4, pp. 503.

Table 1. Total consumption of chemical fertilizer by type of nutrients, Korea, 1952-1971

Year	Total consumption (metric tons)	Consumption index (1952=100)	Proportion		
			N	P	K
1952	133,444	100.0	94	1	5
1953	112,647	84.4	80	17	3
1954	167,826	125.8	69	30	1
1955	183,541	137.5	80	15	5
1956	220,596	165.3	72	24	4
1957	219,006	164.1	66	31	3
1958	243,462	182.4	71	27	2
1959	225,044	168.6	72	25	3
1960	279,424	209.4	78	20	2
1961	308,494	231.2	68	26	6
1962	59,855	44.9	33	67	—
1963	307,095	230.1	62	31	7
1964	364,145	272.9	48	42	10
1965	393,098	294.6	55	32	13
1966	423,271	317.2	57	29	14
1967	486,491	364.6	57	27	16
1968	478,460	358.5	60	26	14
1969	534,689	400.7	60	24	16
1970	557,677	417.9	59	25	16
1971	617,436	462.7	59	24	18

Sources: Year 1952-61 Fertilizer Year-Book, NACF, 1965.
 1962 One half year (August-December 1962).
 1962-69 MAF. Year-book of Agriculture and Forestry Statistics, 1970.
 1970 Monthly Review, NACF, August 1971.
 1971 MAF. Estimated figure.

Table 2. Average fertilizer use by farmers per Chung-bo of crops planted area, Korea, 1963-69

Year	N	P	K	Total
				(kilograms)
1963	65.7	32.4	7.2	105.3
1964	56.5	50.1	12.2	118.8
1965	67.1	38.0	15.9	121.0
1966	76.9	40.1	18.9	135.9
1967	88.5	42.3	24.3	155.1
1968	92.1	39.1	22.9	154.1
1969	104.5	42.7	27.3	174.5

Source: MAF Year Book, 1970.

utilization on the basis of nutrients has increased by a little more than four and a half times during the last 19 years. The use of fertilizer per Chung-bo of crop planted area was 175 kg in 1969 on the average (table 2). It indicates a relatively heavy use of fertilizer as compared to many other Asian countries, but it was still well below the level prevailing in Taiwan and only half that used per hectare in Japan (table 3).

During the last several years, many of the large size farms used more fertilizer per hectare than the small size farms and their actual rate of nitrogen fertilization for rice exceeded the rate of the gover-

Table 3. Area planted, average yield and fertilizer used in selected Asian countries for the production of rough rice, 1968-69

Country	Area planted (1,000 ha.)	Average yield of rice (tons/ha.)	Estimated fertilizer use-kq/ha				Plant nutrients used per metric ton of rice
			N	P	K	Total	
Taiwan	837	3,913	186	45	66	297	76
S. Korea	1,246	3,908	120	50	30	200	51
Ceylon	572	2,378	31	9	20	60	25
Philippines	3,199	2,100	30	15	5	50	24
India	36,700	1,547	8	2	1	11	7
S. Vietnam	2,300	1,956	16	9	6	31	16
Japan	3,280	5,713	160	120	120	400	70

Source: *South Vietnam's Fertilizer Situation and Alternatives for Production*, Harold G. Walkup, Donald Waggoer and Conrad Kresge, TVA, 1971, p.47.

Table 4. Average quantity of fertilizer recommended by the Korean government for all crops and major crops per Chung-bo

Year	Quantity for all crops (Kilograms)	Type of fertilizer			Main crops	
		N	P	K	Rice	Barley
1965	110.7	54.3	37.7	18.7	124.3	143.9
1966	119.7	59.4	39.2	21.1	130.1	152.6
1967	129.9	63.7	40.7	25.4	141.4	151.2
1968	141.2	75.7	39.1	26.4	155.6	136.6
1969	145.8	78.2	40.0	27.6	166.0	147.9
1970	141.9	77.3	36.5	28.1	191.5	131.4

Source: NACF. Report.

Table 5. Optimum rate of fertilizer use for major crops as reported by the experimental station per Chung-bo, Korea, 1965-69

Crops	Volume of fertilizer			Total	Yield (kg/ha)
	N	P	K		
Paddy rice	106.8	42.1	47.8	196.7	5,011
Barley	118.0	86.0	59.0	263.0	3,320
Wheat	111.0	91.0	62.0	264.0	3,580
Corn	131.0	105.0	123.0	259.0	5,540
Soybean	40.0	56.1	44.1	140.2	1,330

Source: The Office of Rural Development, Suwon, Korea.

nment recommendation. The government recommendation was aimed at dividing the available fertilizer among farms rather than identifying optimum use levels. Fertilization of barley, the second most im-

portant crop next to rice, was well below government recommended rates (table 4). In other words, farmers allocated more fertilizer for rice cultivation and a less amount for barley within their rationed quantity.

It may largely depend on the price of barley compared to the price of rice. If farmers are willing to follow the optimum level or a proper nutrient ratio of application of fertilizer for barley and other grains (table 5), a great potential exists for an increased usage. Of course this would depend largely on the price of barley and other grains relative to the price of rice.

III.

The payment for fertilizing each farm accounted for 22.5 percent of farm expenditures, on the average, second only to wages (27.5 percent) in importance during 1967-69. Nevertheless, "the crop yield levels of Korea are still low compared with those in Japan. The explanation for this is low soil fertility and pH levels."⁽³⁾ Also, preliminary evidence suggests that there are other limiting factors: prices of farm products, water facilities, plowing depth, disease and pest control, and varieties of available seeds.

In addition, most Korean farmers have not been able to purchase enough chemical fertilizer. Because of the limited supply, fertilizer has been rationed by the government. When fertilizer supply is limited, the amount of fertilizer used may be less than optimal or may be inefficiently used. If fertilizer was available to match farmers' needs, and if farmers could improve farming practices many students of Korean agriculture allege that more fertilizer would be used. Korean farmers may have the potential of increasing their use of fertilizer to the level of fertilization used in Japan. By using additional fertilizer, thus increasing production, the Korean farmers could possibly realize comparable prices of the various grains as is received in Japan. Japan is similar to Korea in regard to climate, crop, soil and farming practices. Other variables may play roles not now evident. The low consumption of P and K, has lagged behind that of N. If farmers follow a more balanced fertilizer program which encourages the use of phosphate and potassium along with nitrogen, P

and K usage may expand substantially.

Also, the government plans to introduce a new variety of rice (IR 667) which is more responsive to fertilizer—a new seed, as a part of the "Green Revolution" from the International Rice Research Institute of the Philippines (IRRI)—on 25 percent of the total paddy fields next year. As a result, the government estimates that demand for fertilizer in 1976 will increase 45.4 percent over 1970 levels.

In accord with the foregoing discussion, one dimension of an economic analysis of the fertilizer situation in Korea must concentrate on estimations of the demand for fertilizer in this country.

IV.

The input markets are not only new in contrast to the product markets, but the organization and structure of the Korean fertilizer market is much different from those existing in developed countries. Further, its organizational structure is just emerging. In the distribution of fertilizer private business interests are prohibited. The National Agricultural Cooperative of Korea purchases and distributes all chemical fertilizers including both domestic production and imports. Domestic manufacturers of fertilizers (most of which are private businesses) simply produce and store the fertilizer in their own warehouses. They do not participate in the distribution. The National Cooperative makes all arrangements for fertilizer shipments from the producing or importing points to the 139 county cooperatives it serves. For this, the National Cooperative contracts with shipping companies to move the fertilizer from the producing points which are located in the southeastern part of Korea to the major agricultural area in the southwestern region. The county cooperative in turn transport the fertilizer by truck to each Myun (subdivision of a county).

Finally, farmers who are members of village cooperatives carry their rationed fertilizer to their own farms from the nearest county cooperative or Myun

(3) TVA Fertilizer Consultant Team, "Projected Fertilizer Needs for Korea, 1967-71," June, 1965, p. 3.

branch either by rented truck as a group or on their own shoulders individually.

The tonnage shipped has increased greatly, but transportation facilities, particularly freight cars, have not been expanded in proportion to the amount needed to be moved. These are rationed to the shippers. All of the roads leading to rural villages are unpaved; for many villages even bad roads are nonexistent. Farmers in some areas have no mode of convenient transportation and truck rental is expensive. While there is a long sea coast and water transport is generally more economical than rail or highway shipment, no barges are available for shipping fertilizer by sea. Therefore, any kind of infrastructural improvement, such as the extension of rural roads and/or introduction of barge traffic, may make possible improved distribution channels.

It is alleged that the cooperatives do not have sufficient storage facilities and mechanization for materials handling. Furthermore, cooperatives do not give the farmers technical guidance or other valuable information as to the use and type of fertilizer best suited for their particular needs. In view of this, we may say that the present fertilizer distribution system is a product of expediency under the pressure of need to direct the expanded use of fertilizer in order to increase agricultural production. Fertilizer distribution may be too great a task for cooperatives created to handle farm products, their original function. Some alleged problems of the cooperative distribution system may have been caused from too heavy a load being placed on relatively weak institutions at the early stage in their evolution.

V.

The price of fertilizer delivered at the distribution points by a cooperative is kept uniform throughout the country. From time to time, fertilizer is allocated to each village, but these volumes are usually less than a carload. Thus each farmer receives a very small amount, the quantity being determined by the area of planted land. The unit cost of fertilizer at farm level must include the amount of the transportation cost from the Myun coopera-

tive plus the official rate. Recently the price of fertilizer has been decreasing relative to other manufactured goods. However, the actual price of fertilizer is relatively expensive in comparison to the price of grains and the prices paid by farmers in developed countries. In addition, lack of available credit at a low rate, or enough cash to buy fertilizer when it is rationed precludes the use of fertilizer at optimum production levels.

It is asserted that these logistical and facilitative problems could be solved if Korean farmers could obtain more of the proper types of fertilizer at the right time at lower costs. This would permit a more intensive cultivation of arable lands and the yield per hectare would increase greatly.

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