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THE WORLD FERTILIZER MARKET AND ITS IMPACT ON THE CENTO REGION

by

Victor L. Sheldon and John T. Shields*

Fertilizer is well recognized as a major factor in increasing food production. It has become and still is the "backbone" of agricultural development programs in many countries. Although the importance of fertilizer is well documented, probably at no time in history, including the prime years of the "Green Revolution," has the spotlight been more on fertilizer than it is today.

This seminar unfolds amidst universal concern and interest in global food scarcity and rising food prices. This is primarily the result of world grain reserves being drawn down to the danger point, possibly insufficient to sustain the world through a period of widespread drought or similar catastrophe. Such is the concern that developmental experts are now advocating the creation of an internationally managed world food bank as a means of maintaining some semblance of order and stability in the world food economy (1).

The concern over potential global food scarcity is compounded when one considers that the current world fertilizer supplies are insufficient to meet demand. The outlook for future supply adjustments are cloudy especially for nitrogen production. Numerous developmental organizations, such as the World Bank, FAO, TVA, and country governments, are addressing themselves to the problem of trying to understand and resolve the present dilemma.

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*Professor of Agriculture, College of Applied Sciences, Western Illinois University, Macomb, Illinois 61455, and Agricultural Economist, International Fertilizer Development Staff, Tennessee Valley Authority, Muscle Shoals, Alabama 35660.

It is against this background that we appraise the world fertilizer situation and its probable impact on the CENTO region.

Experience dictates that any discussion of the world fertilizer market "today" will probably have to be revised "tomorrow" in order to reflect the rapidity and magnitude of changes that continually affect the world fertilizer supply and demand. During the last decade, the pendulum has swung from a market of short supply and firm prices of the early 1960's to the chaotic market of overcapacity and falling prices of the late 1960's and now back to a market characterized by an upward movement of prices and a tight supply and demand situation with occasional spot shortages.

A brief review of past and recent world fertilizer developments may help to put the present market situation and its effect on the CENTO region in perspective. This paper draws heavily on data compiled and maintained at the National Fertilizer Development Center (NFDC), especially TVA's most recent biennial world survey (2) plus several recent papers (3, 4).

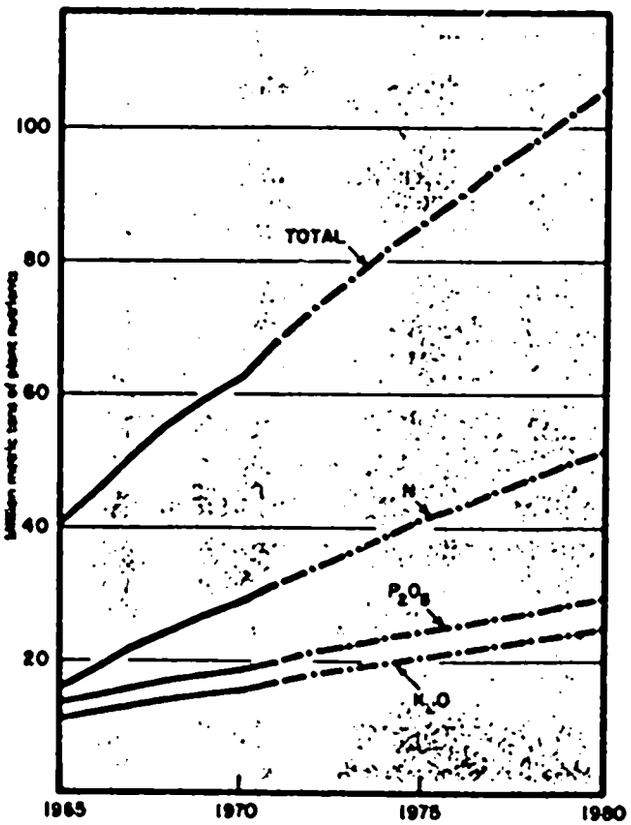


Figure 1. World plant nutrient consumption and forecast (2)

World Fertilizer Demand

As illustrated in figure 1, world fertilizer use in 1972 was estimated at over 72 million metric tons (mt) of nutrients--nitrogen 33.7 million

mt, P_2O_5 nearly 21 million mt, and K_2O at 17.5 million mt. TVA's projections for 1975 and 1980 are estimated to be in the range of 86 million mt and 106 million mt respectively. Thus, the expected annual increase between now and 1975 is about 6% and 5% between now and 1980. This estimate is now being reevaluated, especially in light of the increasing emphasis on replenishing and maintaining acceptable levels of world food grain reserves. It is conceivable that the 1974 TVA estimates for 1980 could approach 110 million mt of nutrient use if supporting institutional and market infrastructure is available.

During 1972 both nitrogen and phosphate products were in tight supply. Closer examination of the production data indicates that the major increases took place in the U.S.S.R. and China, while production in most free world countries either remained unchanged or declined. Thus, a tight supply situation developed as the large inventory buildup of the past few years was depleted and importing countries came back into the international market, only to find that the sellers had little to offer and that prices had recovered to the previous all-time highs achieved during the early 1960's.

The reasons for this sudden change are complex but explainable. First, little new investment was attracted to the industry because of the low rates of return experienced during the last few years; alternative uses of capital looked better in other segments of the economy than expansion in the fertilizer industry. Secondly, numerous construction delays moved startup dates back for many plants that were anticipated during the 1971-72 fertilizer year and operating difficulties kept plant utilization rates well below the anticipated minimum level. Thirdly, many large producers had found new markets for their export production.

Consequently, the needs of countries not in the market every year were not anticipated and supplies were not available. Manufacturers require advance time to adequately plan increases in production. Because of the magnitude of the world fertilizer industry, there is a fine line between a supply and demand balance and a surplus or deficit. The pendulum can swing quickly from one side to the other and go back just as fast, as has already been demonstrated.

World Fertilizer Supplies

In 1972 TVA projected that world nitrogen capacity and demand would follow parallel growth patterns through 1975. In 1971 total world N capacity was estimated at 53 million mt with a scheduled jump of 5 million mt for 1973. This increase was not forthcoming, either from construction delays or increased startup problems; as a result, total N fertilizer production reached just over 35 million mt rather than the predicted 36.3 million tons (table 1). The supply-demand ratio remained at 1.04--well within the limits indicating a balanced market--and spot shortages began to appear.

Table 1. World Nitrogen Production and Consumption for Selected Years

Year	N Production	N Consumption	S/D Ratio
1965	17.3	16.3	1.06
1970	30.2	28.7	1.05
1972 (prel.)	35.1	33.7	1.04
1975[a]	43.1	41.0	1.05

[a]Estimate assuming an operating rate of 90% in developed regions and 80% in developing regions.
S/D = Supply/Demand

The planned additional capacity has not been abandoned. Much of it will come on-stream between now and 1975. As a result, the world N capacity expected for 1975 of 67.8 million mt (table 2) remains as a guide to the medium term future market situation. The world nitrogen market should remain very close to a balance with firm prices but with supplies adequate to meet increased demand. There is now evidence that the improved price situation is stimulating new investment and that additional nitrogen capacity is being contemplated. However, these additions should not have a major impact on the world market before 1975.

Table 2. World Nitrogen Production Capacity

Year	Total Capacity	Potential Supply[a]
	(million metric tons)	
1965	27.8	18.0
1970	48.4	30.3
1972	58.0	36.3
1975	67.8	43.1

[a]Assuming an operating rate of 90% in developed regions and 80% in developing regions.

It is difficult to establish a true world P_2O_5 capacity figure. Supply estimates, based on a combination of production estimates and capacity data for phosphoric acid, indicated that the world P_2O_5 market would achieve a balance in 1972; without further plant expansion or a significant improvement in operating rates, shortages would occur (table 3). This situation was due to the lack of expansion in the industry to cover any more than the decline in production of low-analysis materials. With greater amounts of phosphoric acid per unit of P_2O_5 being consumed, demand soon caught up with available supplies. While this movement toward the greater use of acid was occurring, several

Table 3. World Phosphate Production and Consumption for Selected Years

Year	Production	Consumption	S/D Ratio
	(million metric tons)		
1965	14.7	13.7	1.07
1970	19.2	18.6	1.03
1972 (prel.)	21.7	20.9	1.03
1975[a]	22.0	24.3	.91

[a]Estimate assuming an operating rate of 80% in developed regions and 60% in developing regions.
S/D = Supply/Demand

phosphoric acid plants in the United States were closed. Other plants suffered operating difficulties and new plants had prolonged startup problems. These factors led to a shortage of phosphoric acid, even with plants reportedly operating at 95% of capacity; products derived from phosphoric acid--triple superphosphate and diammonium phosphate--disappeared from inventory and the marketplace. Prices of phosphate materials rose sharply, bringing about the reopening of some plants and a flurry of new plant construction plans. It now appears that the shortage of phosphate materials may be over for the time-being, but prices may continue firm well into 1974.

Raw Material Supplies

Certain factors on the horizon could restrict fertilizer industry growth. The first of these restrictive factors is natural gas. The world nitrogen industry is based primarily on natural gas as a feedstock and as an energy source. Natural gas has an almost unlimited demand. Although ammonia accounts for only a small percentage

of gas use, the projected limited supply levels indicate that producers will pay more for the gas they use in the future and that they will have to operate with interruptible supplies and curtailments. It is difficult to determine the exact position of gas supplies, but the following factors should be considered. First, since low price levels have limited exploration, it can be assumed that higher prices will revive new explorations and also increase activity in the area of transport facilities. Second, several areas of the world have large gas reserves and could supply deficit areas--with natural gas, ammonia, or nitrogen fertilizers. Third, there are major programs under way to develop alternative energy sources, such as synthetic gas or the use of the large reserves of low-sulfur coal. While these are long-term considerations, it should be remembered that short-supply situations are usually a short-lived phenomena unless artificial restrictions are imposed on the marketplace. Nitrogen fertilizers are vital to the world food situation; thus, while the gas situation may hurt in some places its overall effect will be minimized by the actions and reactions of a free marketplace.

The second possible restriction to increasing fertilizer supplies in the short run could be phosphate rock. While large expansions in phosphoric acid capacity have been announced, few additions to rock mining capacity have been indicated. There has been a steady increase in total P_2O_5 production throughout the world but rock production has not kept pace. In the United States, for example, production reached a peak of 37.4 million mt in 1968. Estimates for 1972 show production at 37.0 million mt (5). In 1971 only 9 of the world's 15 major producing countries showed increased production over the previous year and in some cases the changes were minor. World output gained only about 6 million mt of

rock between 1968 and 1971 (table 4) (6). Using an average of 33% P_2O_5 content, this represents about 2 million mt of P_2O_5 compared to a fertilizer production increase of almost 2.8 million mt of P_2O_5 (7). The large overproduction of phosphate rock in the late 1960's led to high inventory levels, very low prices, and a delay in new mine additions and expansions. Now demand is again approaching the available supply level and more rock mining capacity is needed. However, the additional cost of further exploiting existing mines will be considerably greater than in the past.

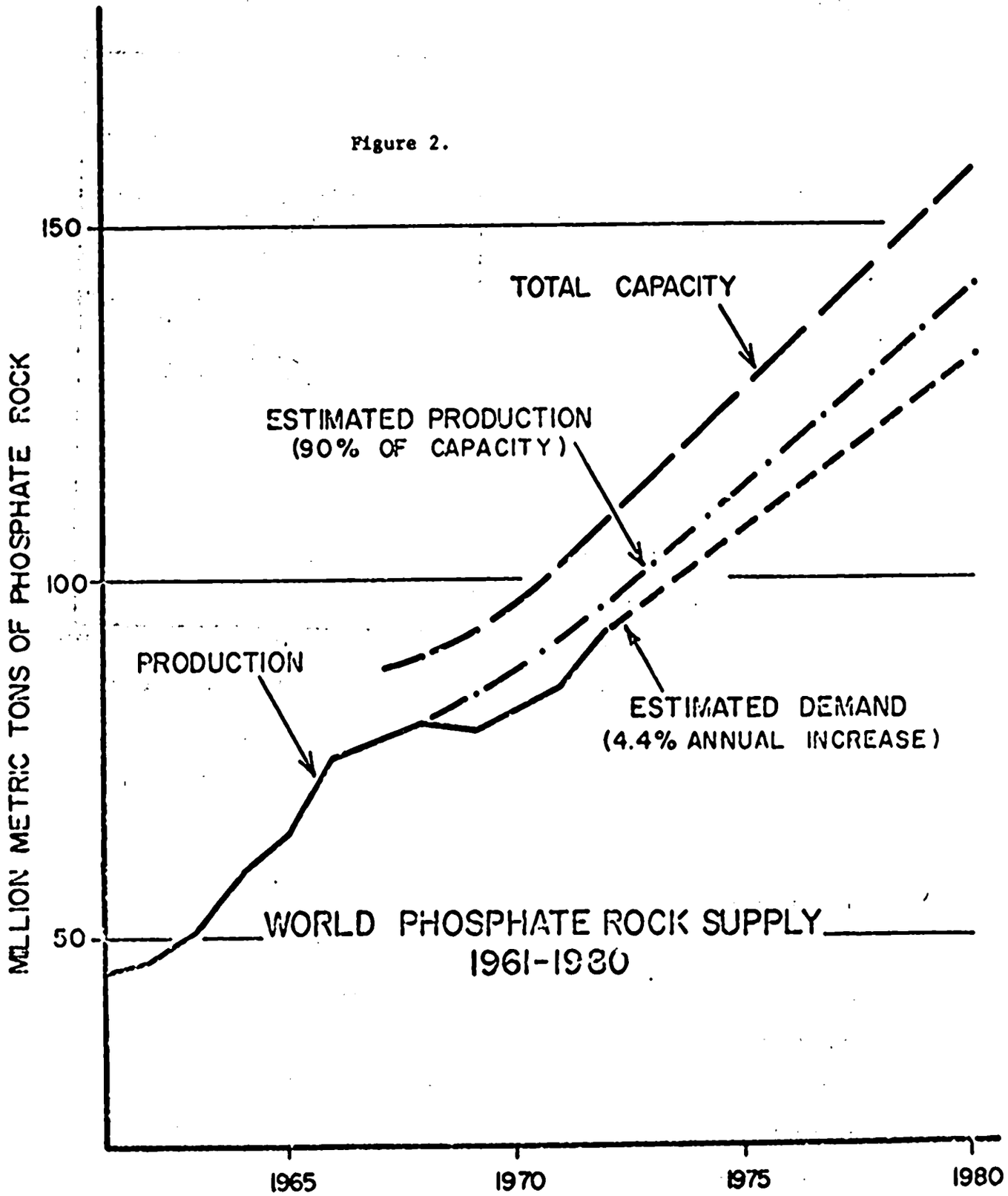
Table 4. World and Regional Phosphate Rock Production, 1968 and 1971

Region	1968	1971
	(million metric tons of material)	
North America	37.4	35.0
Africa	18.8	20.7
Asia	2.1	1.5
U.S.S.R.	14.8	20.1
World Total	79.6	84.9

Recent TVA projections of world P_2O_5 show consumption increasing at an average rate of 4.4% per year; thus, rock demand by 1980 should exceed 130 million mt. By 1980 planned additions to capacity (8) along with the assumed opening of several new mining areas--Australia, Spanish Sahara, Peru, and possibly Angola--would bring the total capacity to over 155 million mt, well above the suggested demand. Bearing in mind that these are total capacity data and need adjustment for saleable production, we have used an operating rate of 90% of capacity--the level attained

during 1967 and 1968—to indicate supply. As shown in figure 2, supply is well above demand, but only if the proposed expansions materialize.

Figure 2.



The future of the potash market will be one of restricted production levels for some time to come. Total K_2O consumption reached 17.5 million mt in 1972 as potash continued its steady growth rate (figure 3). But total world potash capacity remained at 26 million mt with only 19 million mt being produced. With most of this overcapacity centered in Canada, it is to be expected that production restrictions will continue with adjustments made as demand levels increase. While no shortage of material should exist, the result of these controls will mean a stable market with price changes reflecting changes in production and distribution costs.

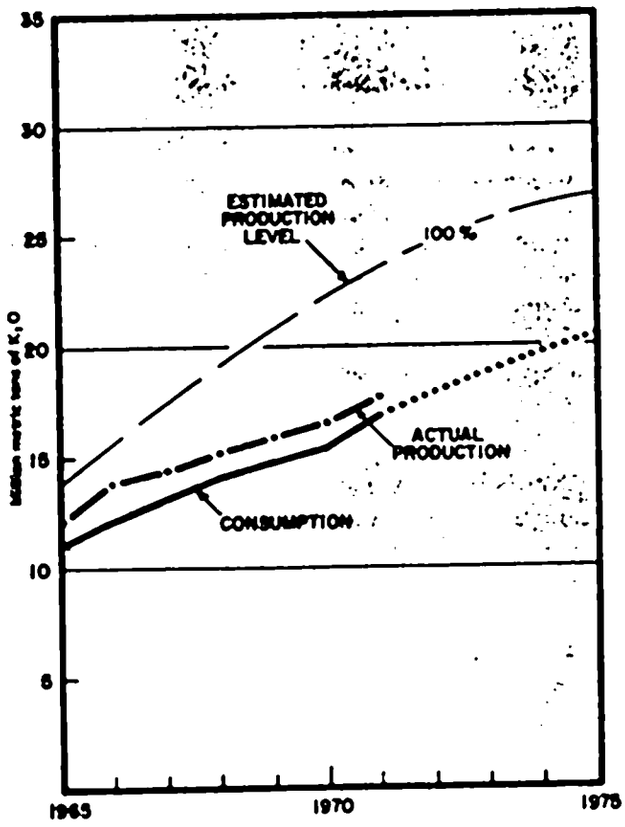


Figure 3. World potash market situation (2)

While potash reserves occur in all regions of the world, 94% of the production is in North America, Western and Eastern Europe.

Product Trends

The world and regional fertilizer production picture has undergone significant changes in the past 10 years and even more significant changes can be expected in the next decade. Low-analysis fertilizers are continuously being replaced by higher analysis materials. Ammonium sulfate and ammonium nitrate are losing ground to urea and in some areas to anhydrous ammonia and nitrogen solutions.

Single (normal) superphosphate is being replaced partly by concentrated superphosphate (CSP) and to a greater extent by high-analysis complex fertilizers of the nitrophosphate or ammonium phosphate types. Anhydrous ammonia has become the basic building block for nitrogen fertilizers while wet-process phosphoric acid is now the prime intermediate source of phosphate. Little change has taken place in potash production; muriate of potash (KCl) is the principal type of potash fertilizer.

Indicative of these changes in production and use are the patterns that are evolving in world and regional fertilizer trade. In 1971/72 nearly 30% of the world fertilizer consumption was exported. The rise of urea, a major nitrogen fertilizer, has had a significant impact in the world market. Urea now accounts for nearly 20% of world nitrogen production and over 33% of the world nitrogen exports. Even more significantly, by 1975 urea capacity will account for 50% of total world nitrogen product capacity (figure 4) with the major shift taking place in the developing regions. By 1975 it is expected that three-fourths of all nitrogen

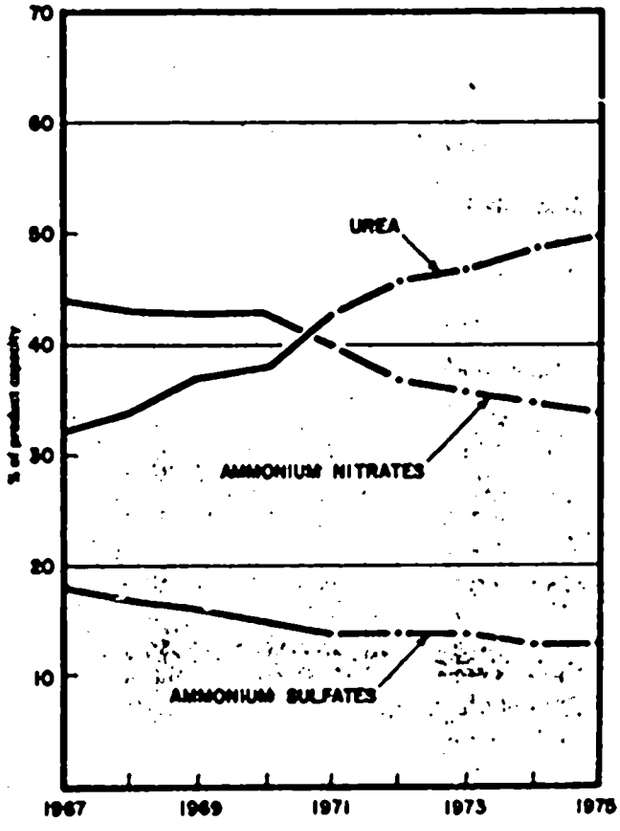


Figure 4. Relative importance of selected nitrogen materials (2)

product capacity will be in these regions if plants are brought to completion as scheduled. The Asian nations are leading this shift to urea by scheduling over 80% of their planned product nitrogen capacity by 1975 as urea.

In terms of phosphate fertilizers, the significant development has been the increased production and use of fertilizers including the ammoniated phosphates such as diammonium phosphate (18-46-0) (figure 5). Although over 80% of the total P_2O_5 capacity is in the developed regions of the world, the developing regions are gradually increasing their P_2O_5 capacity primarily in the form of complex fertilizers based on wet-process phosphoric acid. With the development of new technology in the ocean transport of phosphoric acid and since production economics favor large-scale plants near raw material sites, expanded trade in phosphoric acid is contemplated.

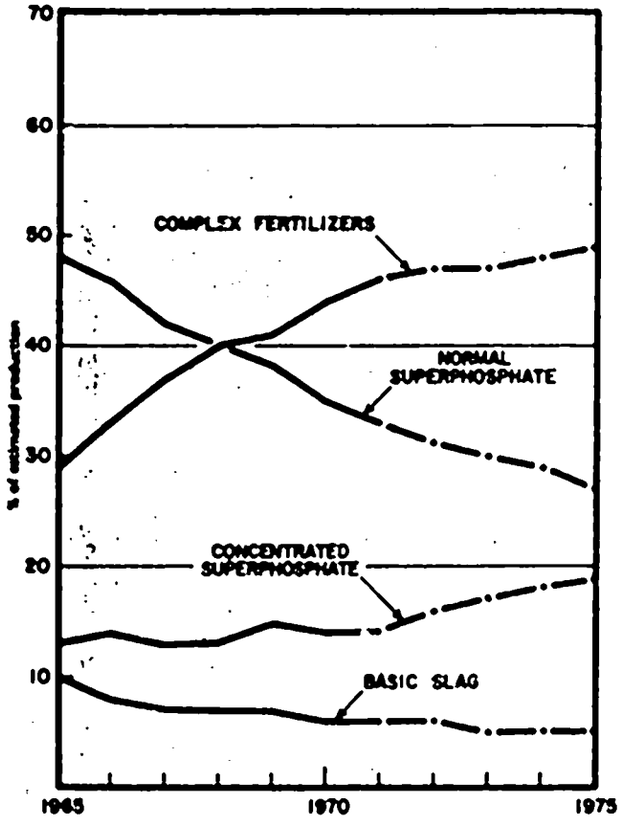


Figure 5. Relative importance of selected phosphate materials (2)

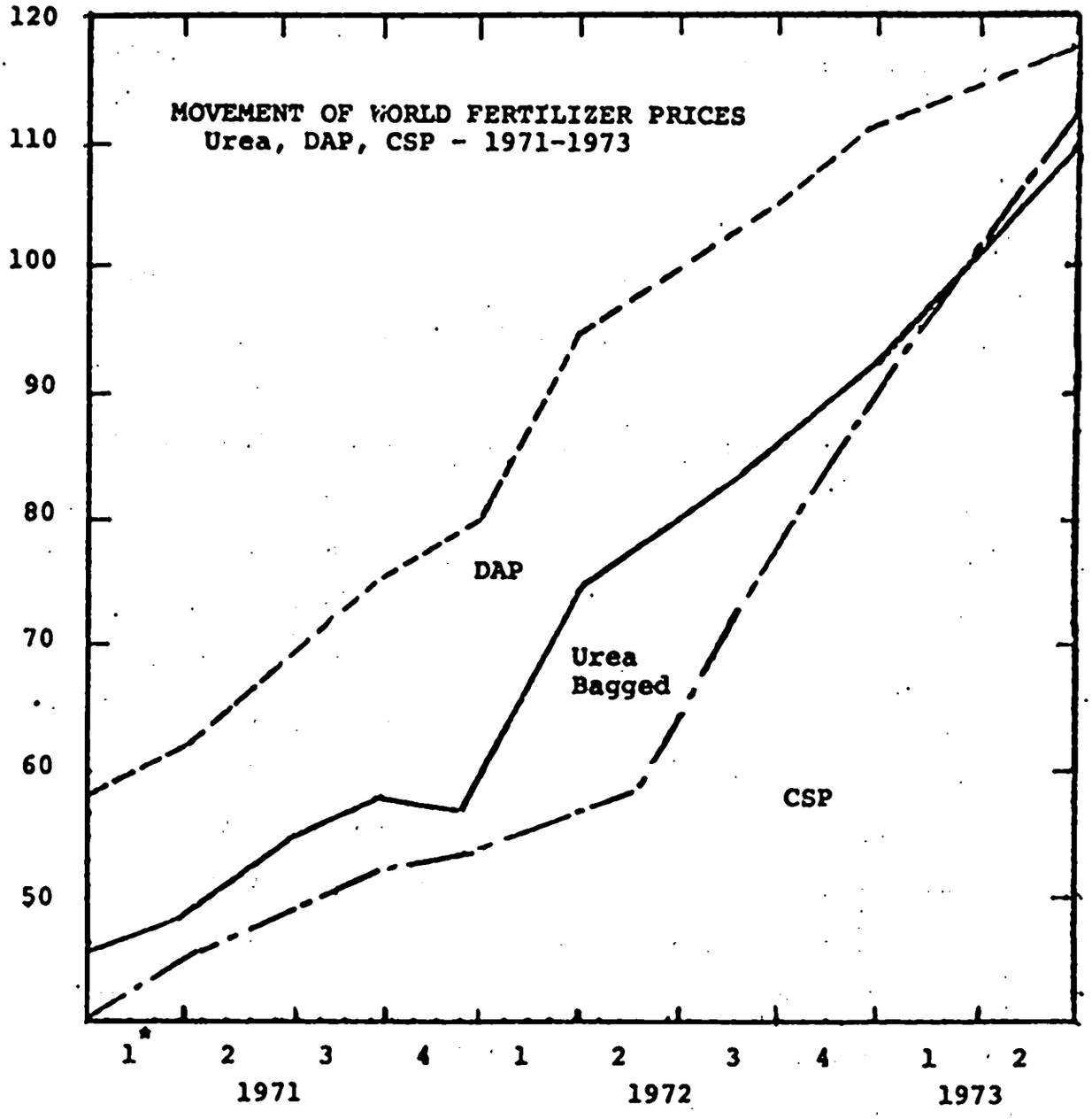
Price Developments

The changing world supply/demand situation along with shifts in marketed products has had its effect on international prices. Beginning with mid-1971 F.O.B. prices for the major traded fertilizer materials

began to move upward and by the end of the first quarter of 1972 prices of nitrogen products had risen 10% to 20% and by the end of the year further increases of 40% to 50% had been recorded. Since mid-1971 urea prices have risen from $55 F.O.B. to about $110 F.O.B. in mid-1973, while diammonium phosphate has risen from $70 F.O.B. to over $120 F.O.B. during the same period. Concentrated superphosphate prices have experienced the steepest rise, moving from about $47 in mid-1971 to over $110 through the second quarter of 1973 (figure 6). While these prices represent U.S. shipments, they also reflect price trends of Japan and Western Europe.

Prices of potash fertilizers have been rising since 1970, after having fallen to low levels following the opening of a number of new mines in Saskatchewan, Canada. European producers raised the price of potash salts by about 10% in 1972. This was the third increase in three years, and brought prices in line with those of the North American industry, which in January 1970 had imposed an increase of about $10 per mt. At the same time, the Saskatchewan Government had raised the price of potash from the extreme low of Can. $10 per short ton of K_2O ex-mine to a floor of Can. $33.75 by imposing a quota on production and prorating it among producers in the province. This floor price has since remained unchanged but, owing to increased rail freight and other charges, quotations for 1973 sales have been $35 to $36 per mt F.O.B. Vancouver (9).

While prices of finished product have been rising, raw material and intermediate prices have also increased. Ammonia prices have risen from under $40 F.O.B. in 1971 to approximately $65-$66 F.O.B. in mid-1973.



Source: Unpublished Fertilizer Statistics, TA/AGR/AID Washington, D.C.

*By quarters

Figure 6.

Phosphate rock and phosphoric acid prices have also moved upward during the past year.

In conjunction with the changing fertilizer supply and price situation have been adjustments in international currency values. For countries which traditionally quote export prices in dollars, the dollar devaluations of 1971 and 1973 could, in effect, reduce returns and may result in further compensatory price increases.

CENTO Region

Now, the paramount question, what is the impact of the current world fertilizer situation on the CENTO region? Obviously, the situation is complex and it is extremely difficult to draw definite conclusions. Add to this the fact that the agriculture and fertilizer conditions in the countries comprising the region are extremely heterogeneous and the task of evaluating the impact is done with considerable risk of being in error.

Situation--In 1971/72 over 9.2,000 mt of fertilizer nutrients were consumed in the region (figure 7). Turkey accounts for 52% of regional consumption, Pakistan 29% and Iran 19%. The total regional consumption represents about 1.3% of world consumption; however, the region imported nearly 5% of the total world nitrogen traded in 1972. More important is the fact that the countries imported nearly 50% of the total fertilizer consumed in the region. Turkey imports between 60% and 80% of its annual fertilizer requirements while Pakistan depends on imports for roughly one-third of its annual consumption. Over two-thirds of the fertilizer used in the region is in the form of nitrogen products.

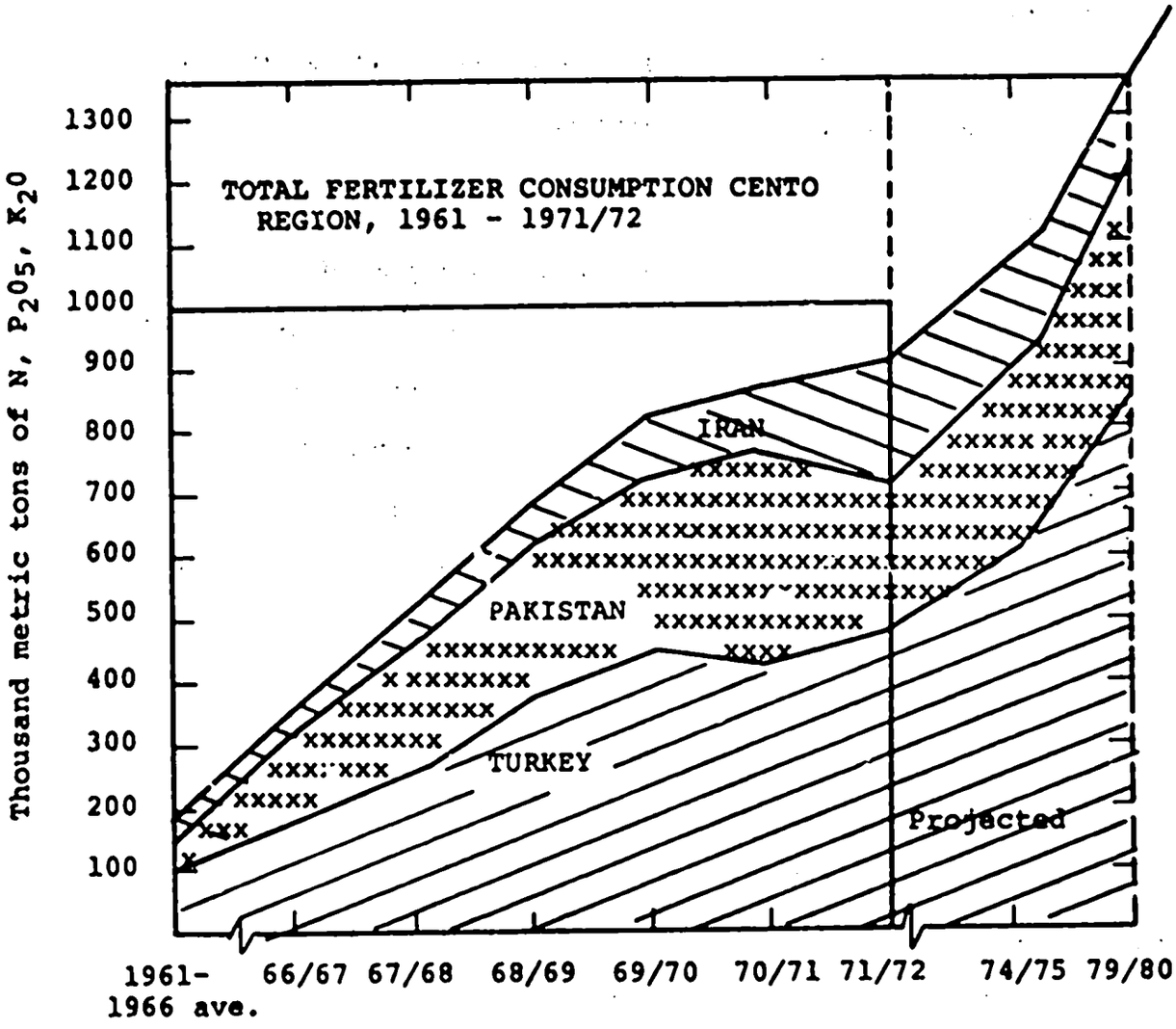

TOTAL FERTILIZER CONSUMPTION CENTO REGION, 1961 - 1971/72
Thousand metric tons of N, P_2O_5, K_2O
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
IRAN
PAKISTAN
TURKEY
Projected
1961-1966 ave.
66/67
67/68
68/69
69/70
70/71
71/72
74/75
79/80

Figure 7.

Future Growth Potential--The fertilizer market of any country or region grows and is sustained by two dimensions--hectarages fertilized and rates of application. Papers to be presented in later sessions of this seminar will deal specifically with these two dimensions; however, some general comments on land/fertilizer/crop yield relationships may serve to illustrate the relative importance of fertilizer use on crop yields in estimating effective demand.

Per hectare consumption estimates can be misleading statistics; however, they can also demonstrate the significance of higher levels of fertilizer use on food production. Reviewing data in figure 8 illustrates the effect of fertilizer use on rice yields. With 150 to 300 kg of N, P_2O_5, K_2O per hectare, Japan, Taiwan, and Korea are able to obtain 3.5 to nearly 6 mt of rough rice per hectare. In 1971/72 Pakistan, Turkey and Iran consumed approximately 15, 16, and 6 kg of nutrients per hectare respectively for all crops.

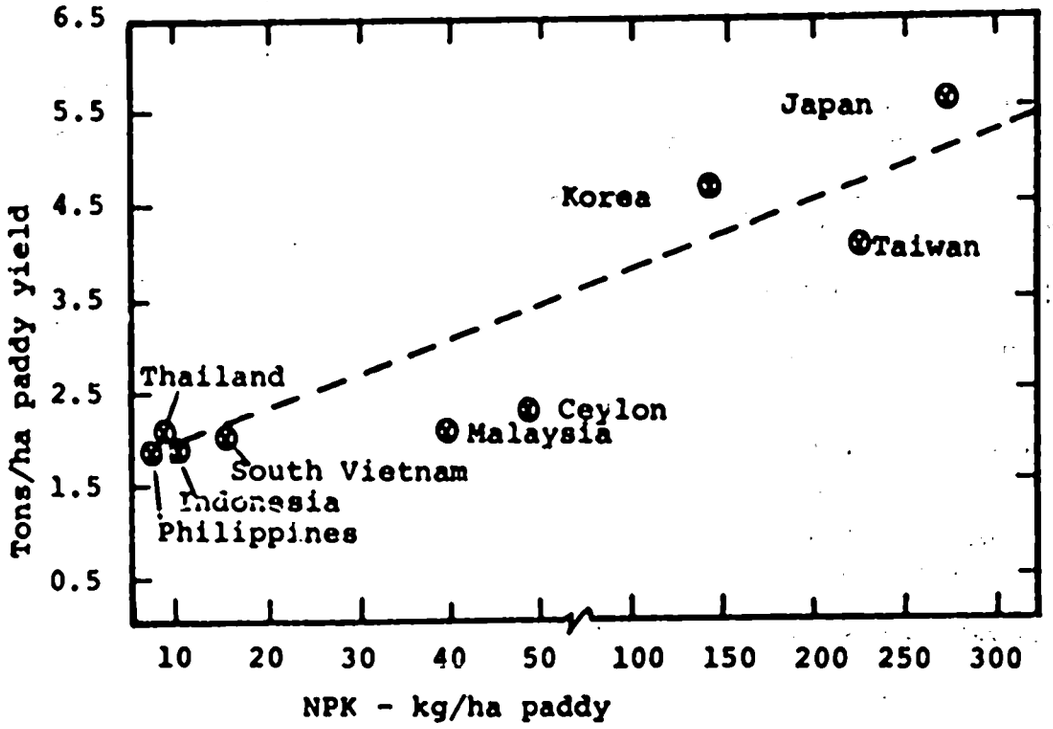


Figure 8. Fertilizer-paddy rice yield relationships in selected Asian countries, 1969/70

There can be no doubt that fertilizer consumption per planted hectare in the region must increase significantly if food production is to keep pace with population growth. Unfortunately, such objectives require large capital expenditures whether for domestically produced or imported fertilizers.

A reasonable 1980 "effective demand" estimate for the region appears to be in the area of 1.5 to 1.8 million mt of nutrients. This represents a 40% to 50% increase in consumption. Growth rates, no doubt, will vary within the region with Pakistan likely to achieve much higher growth rates than either Turkey or Iran.

What is the capability of each country to meet its future fertilizer requirements? First, let's look at nitrogen. Evaluation of existing and projected nitrogen fertilizer capacity in the three countries indicates that by 1975 the region will have approximately 1.0 million mt of nitrogen capacity and 1.5 million mt by 1980 (table 5). Translating this capacity

Table 5. Estimated Nitrogen Fertilizer Supply/Demand for the CENTO Region, 1975 and 1980

Year	Total nitrogen capacity[a]	Nitrogen supply[b]	Nitrogen demand	Surplus or deficit
1972	859,000	474,000	613,000	- 139,000
1975	1,062,000	590,000	807,000	- 217,000
1980	1,500,000	978,000	1,107,000	- 208,500

[a]Factor of 80% of capacity used.
[b]Considers loss factor of 10% and industrial use of 10%.

Source: Based on estimates calculated from TVA's worldwide capacity data bank, by Distribution Economics Section.

into supply estimates after allowing for losses and industrial use the region would have approximately 590,000 mt of nitrogen supply in 1975 and nearly 1.0 million mt by 1980. This means that the region would continue to be deficit in nitrogen through 1980, although Iran would be in a surplus situation and thus be a potential net exporter of nitrogen products.

By 1975 and 1980 nitrogen capacity in the region should be fairly well distributed among the countries with Iran having nearly 40% of the capacity (table 6) but Pakistan and Turkey will have over 80% of the regional nitrogen demand.

Table 6. Nitrogen Capacity in the CENTO Region, 1975 and 1980

	Iran	Pakistan	Turkey	Total
		- 000 mt -		
1975	303	346	403	1,062
(%)	(28)	(33)	(39)	
1980	574	522	413	1,500
(%)	(38)	(35)	(27)	

[a]Unadjusted capacity.

In terms of P_2O_5 capacity, the region was deficit by approximately 54,000 mt based on the assumption of an 80% production factor. However, we know that over 130,000 mt of P_2O_5 were imported in the region primarily because of low capacity utilization in Turkey. Looking ahead, the region could be surplus in 1975 and then deficit again in 1980 (table 7). If Turkey could achieve 80% capacity utilization during the latter 1970's, it would be surplus in P_2O_5 assuming the demand estimates are correct.

Table 7. Estimated P_2O_5 Supply/Demand for the CENTO Region 1975 and 1980

Year	Total phosphate capacity[a]	Phosphate supply[b]	Phosphate demand	Surplus or deficit
1972	409,000	233,000	287,000	-54,000
1975	667,000	529,000	402,000	127,000
1980	667,000	616,000	625,000	-9,000

[a]Expressed as phosphoric acid capacity.
[b]Assumes 80% production capacity and 6% loss factor.

Such conclusions relative to future regional nitrogen and phosphate supplies suggest possible intraregional fertilizer trade as a means of meeting individual country fertilizer requirements. This could result in critical foreign exchange savings especially for Pakistan and Iran. Turkey may be somewhat disadvantaged unless the Suez Canal is reopened.

Critical to fertilizer supply in the region in the latter 1970's will be the capability of the fertilizer industry to operate at or near capacity levels.

Failure to obtain adequate supplies of phosphate rock and ammonia will limit production capability as will power and gas interruptions.

Import requirements should be determined and solicited at least a year in advance of need and fertilizer-crop price relationships should continually be evaluated in view of higher import prices.

In a seller's market, we sometimes forget that the importance of marketing and distribution is not diminished but enhanced. In times of short supplies and higher prices, the responsibility of reducing cost and improving efficiency lies within the marketing channel.

Hopefully, during the course of this seminar we will gain insights into solving problems and exploiting opportunities for improving fertilizer marketing, distribution, and use in the CENTO region.

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