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THE WORLD FERTILIZER MARKET AND ITS IMPACT ON PERU*

In August 1972 TVA published the 4th edition of its biennial report on the world fertilizer industry. We warned that the chaotic buyer's market of the late 1960s was changing to a seller's market and that the downward trend in fertilizer prices would come to an end prior to 1975. Several significant events have taken place in the fertilizer industry recently. Thus, before looking to future developments a short review may be helpful. Since this paper is based primarily on the TVA report of August 1972 (1) dealing with the world fertilizer market situation, the conclusions presented in that report can serve as our starting point.

World Fertilizer Demand

First of all, the TVA long-range forecasts of demand were revised downward in that report to reflect changes in the market. Total demand for 1980 was projected to be in the range of 105 million metric tons of plant nutrients. As indicated in table 1, nitrogen use was forecast to exceed 51 million tons, P_2O_5 over 29 million and K_2O almost 25 million tons.

Preliminary estimates place world use during the 1972 fertilizer year at over 72 million metric tons of plant nutrients. Of this, nitrogen accounted for 33.7 million tons, P_2O_5 almost 21 million and K_2O at 17.5 million tons (2). The total represents a gain of 6.1% from the previous year--very close to the estimated 5.9% average annual growth projected

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Table 1. World Fertilizer Use

Year	N	P_2O_5	K_2O	Total
1965	16.3	13.7	11.0	41.0
1970	28.7	18.6	15.4	62.7
1972 (prel.)	33.7	20.9	17.5	72.1
1975	41.0	24.3	20.5	85.8
1980	51.5	29.3	24.8	105.6

between now and 1975. This indicates a maturation of the fertilizer market in many parts of the world. Future increases in agricultural productivity will depend more on an optimum combination of all farm inputs and not just fertilizer. Fertilizer has been used as a key to the introduction of new farm management practices and as a result its impact may be reaching a peak. In our opinion the rapid growth rates of a few years ago will be more difficult to achieve in the future.

Production gains over last year exceeded the rate of increase for demand. However, during the year supplies of 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 areas either remained the same or declined. Thus, a tight supply situation developed as the large inventory buildup of the last 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 1960s.

The reasons for this change are not hard to find. First of all, little new investment was forthcoming because of the low rates of return experienced during the last few years; alternative uses of capital looked better than expansion in the fertilizer industry. Secondly, construction delays of all sorts 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. As a result, the needs of countries not in the market every year were not anticipated and supplies were not available. Producers must have advance time to adequately

plan increases in production levels. 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.

World Fertilizer Supplies

The 1972 TVA report projected that world nitrogen capacity and demand would follow parallel growth patterns in the next 3 years. In 1971 total world N capacity was estimated at 53 million metric tons with a scheduled jump of 5 million tons 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 tons rather than the predicted 36.3 million tons (table 2). The supply-demand ratio remained at 1.04--well within the limits indicating a balanced market--and spot shortages began to appear.

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 tons (table 3) remains as a guide to the medium-term future market situation. We expect that the world nitrogen market will remain very close to a balance with firm prices but with supplies adequate to meet increased demand. It is possible that the improved price situation could stimulate investment and that additional capacity may be forthcoming. None of these additions will have a major impact on the market prior to 1975, however.

With the 1972 report, TVA revised its method of estimating P_2O_5 supplies because it was impossible to establish a true world P_2O_5 capacity number. Supply estimates, based on a combination of production estimates

Table 2. World Nitrogen Supply and Demand

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.

Table 3. 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.

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 rapid improvement in operating rates, shortages would occur (table 4). This situation had been brought about by the lack of expansion in the industry to cover any more than the decline in production of low-analysis materials. The product mix of the world phosphate market changed rapidly as complex fertilizers replaced the low-analysis goods. This required greater amounts of phosphoric acid per unit of P_2O_5 used and demand soon caught up with available supplies of phosphoric acid. While this movement toward the greater use of acid was occurring, several 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.

Raw Material Supplies

Factors on the horizon could restrict fertilizer industry growth, however. 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

Table 4. World P_2O_5 Supply and Demand

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.

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 increase this activity and also increase activity in the area of transport facilities. Second, many areas of the world have large gas reserves and could begin to 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, it is our opinion that 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 tons in 1968. Estimates for 1972 show production at 37.0 million metric tons (3). 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 tons of rock between 1968 and 1971 (table 5) (4). At an average of 33% P_2O_5 content, this represents about 2 million tons of P_2O_5 compared to a fertilizer production increase of almost 2.8 million tons of P_2O_5 (5). The large overproduction of phosphate rock in

Table 5. Phosphate Rock Production

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

the late 1960s 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.

The world phosphate rock market situation as projected for the next 7 years could have a beneficial effect on the economy of Peru. Phosphate rock reserves are located in the northern part of your country; and if properly developed and adequate resources committed to world marketing, especially in Southeast Asia, phosphate rock could earn some valuable foreign exchange for Peru.

Based on recent TVA projections of world P_2O_5 consumption increasing at an average rate of 4.4% per year, rock demand by 1980 should exceed 130 million metric tons. By 1980 planned additions to capacity (6) along with the assumed opening of several new mining areas--Australia, Spanish Sahara, and possibly Angola--would bring the total capacity to over 155 million tons, well above the suggested demand. Peru has been included in these projections at a capacity level of 1 million tons of rock per year. Bearing in mind that these are total capacity data and need adjustment for saleable product 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 1, supply is well above demand, but only if the proposed expansions are forthcoming.

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 metric tons in 1972 as potash continued its steady growth rate. But total world potash capacity remained at 26 million tons with only 19 million tons 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

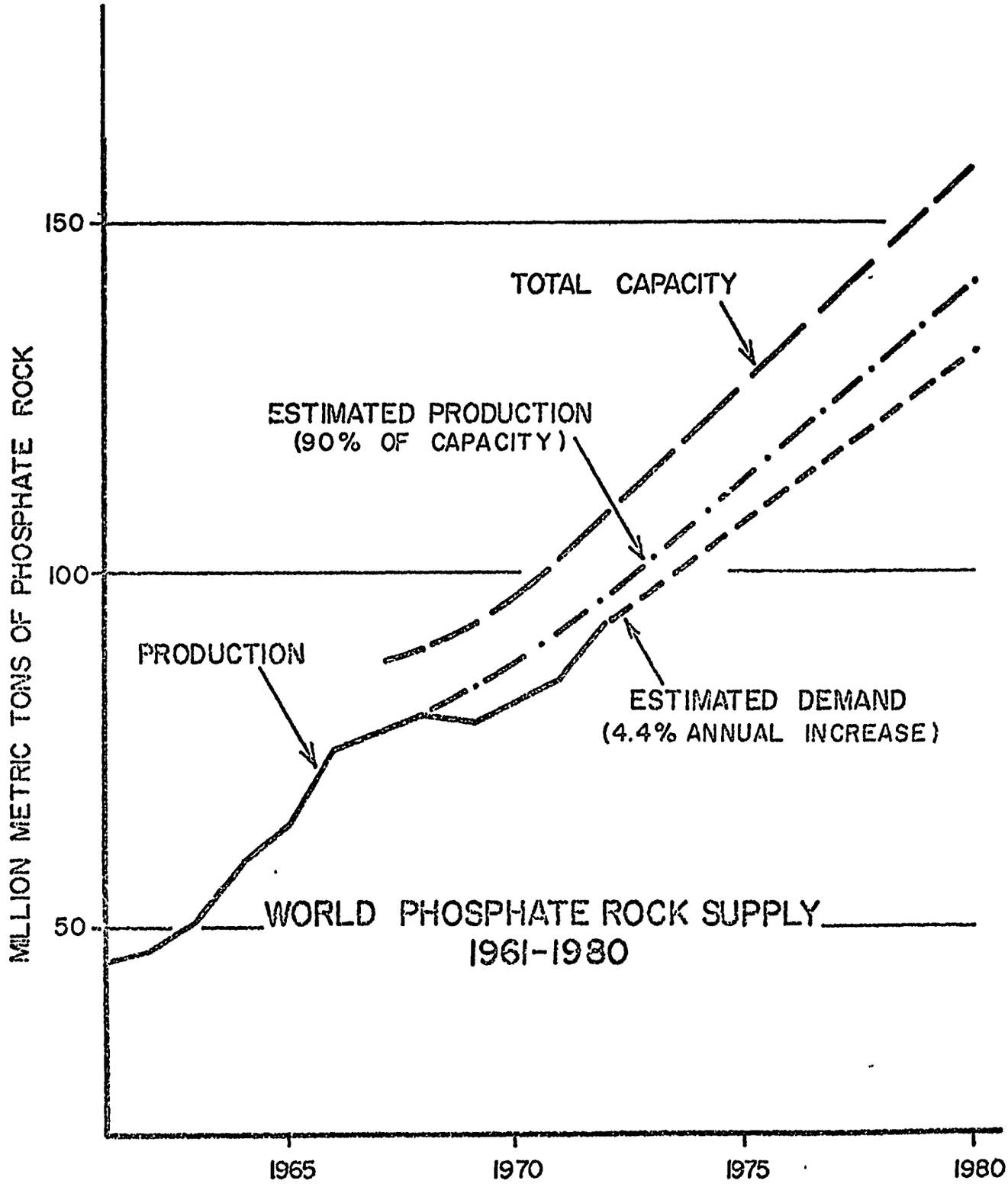

Figure 1.

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should exist, the result of these controls will mean a stable market with price changes reflecting changes in production and distribution costs. Under present market conditions, opportunities for Peru to sell potash on the world market do not appear favorable. Development of potash production along with the phosphate rock reserves should involve supply levels for home or regional sales only.

The U.S. Market Situation

Since the U.S. plays such a large role in world markets, the changes in the U.S. market situation will affect your supply situation here in Peru. In quick review, there was little change in the U.S. demand for plant nutrients in 1972, primarily because of poor weather conditions during critical planting periods. This weather pattern continued during the past harvest and a very poor autumn season resulted. On the other hand, production levels continued to increase, with the additional output being exported (table 6). World trade demand increased so rapidly that U.S. producers did not have adequate supplies of phosphoric acid to produce the quantities demanded. With the price freeze holding U.S. market price levels constant, U.S. export prices rose almost overnight. U.S. producers were, in fact, too successful in their attempts to find overseas outlets where prices were free to fluctuate. Exports became a major segment of the U.S. fertilizer market (table 7), reaching a level in which they now play a significant role in market strategy rather than just offering an outlet for excess production.

The present U.S. market situation shows indications of being the most exciting in a good many years. We expect a strong demand as farmers make up for last year and are further stimulated by high output price levels brought about by the large grain exports and a generally strong export market in most agricultural commodities. The large movement of export grain to

Table 6. Production and Export Changes in the United States - 1972

Product	Percent change from 1971	
	Production	Export
Ammonium sulfate	-0.6	-7.2
Urea	4.5	24.1
Ammonium phosphates	7.1	35.6
Conc. superphosphate	16.0	13.1

Table 7. Exports take a large share of U.S. Production - 1972

Product	Production	Export	Percent
	('000 short tons)		
Ammonium sulfate	2362.4	557.7	23
Urea	3270.9[a]	464.5	14
Ammonium phosphates	2438.6	677.3	27
Conc. superphosphate	1661.4	326.2	19

[a]Total primary solution including feed grade and industrial product production.

our port cities has reduced the transportation facilities available to move fertilizer from production points to the marketing area. Potash appears to be affected most because storage space available last fall was used for phosphate materials. All nitrogen products are ''sold out'' at the producer level, not because of the much publicized ''energy crisis'' but because of an exceptionally strong demand which started last summer.

However, poor weather has delayed the spring selling season in many parts of the United States. Heavy rains and flooding of large areas have kept farmers out of fields. As of May 1, dealers' inventories remained high in anticipation of the spring rush. Unless this material is sold and applied this month, the prospects for a good fertilizer year will be dimmed.

Phosphate rock supplies are also being pressured by the increased demand. U.S. producers have added little in the way of new capacity while both exports and increased production levels over the past 2 years have seen substantial increases. Figure 2 indicates the increases that have occurred since 1965 in U.S. shipments of phosphate rock to Latin America and Brazil.

Looking ahead to the prospective supply situation in the U.S. between now and 1975, we find that nitrogen plant expansion is at a minimum while a large expansion in phosphoric acid production capability is taking place. At the start of 1973, the United States had a total ammonia capacity of 17 million short tons of material, while wet-process phosphoric acid stood at 6.1 million short tons of P_2O_5. In the next 2 years, there is only 1 million short tons of additional ammonia capacity currently scheduled. The feedstock supply situation plus a general uncertainty of world markets probably has held expansion to a minimum as this increase will not be great enough to cover expected domestic demand increases.

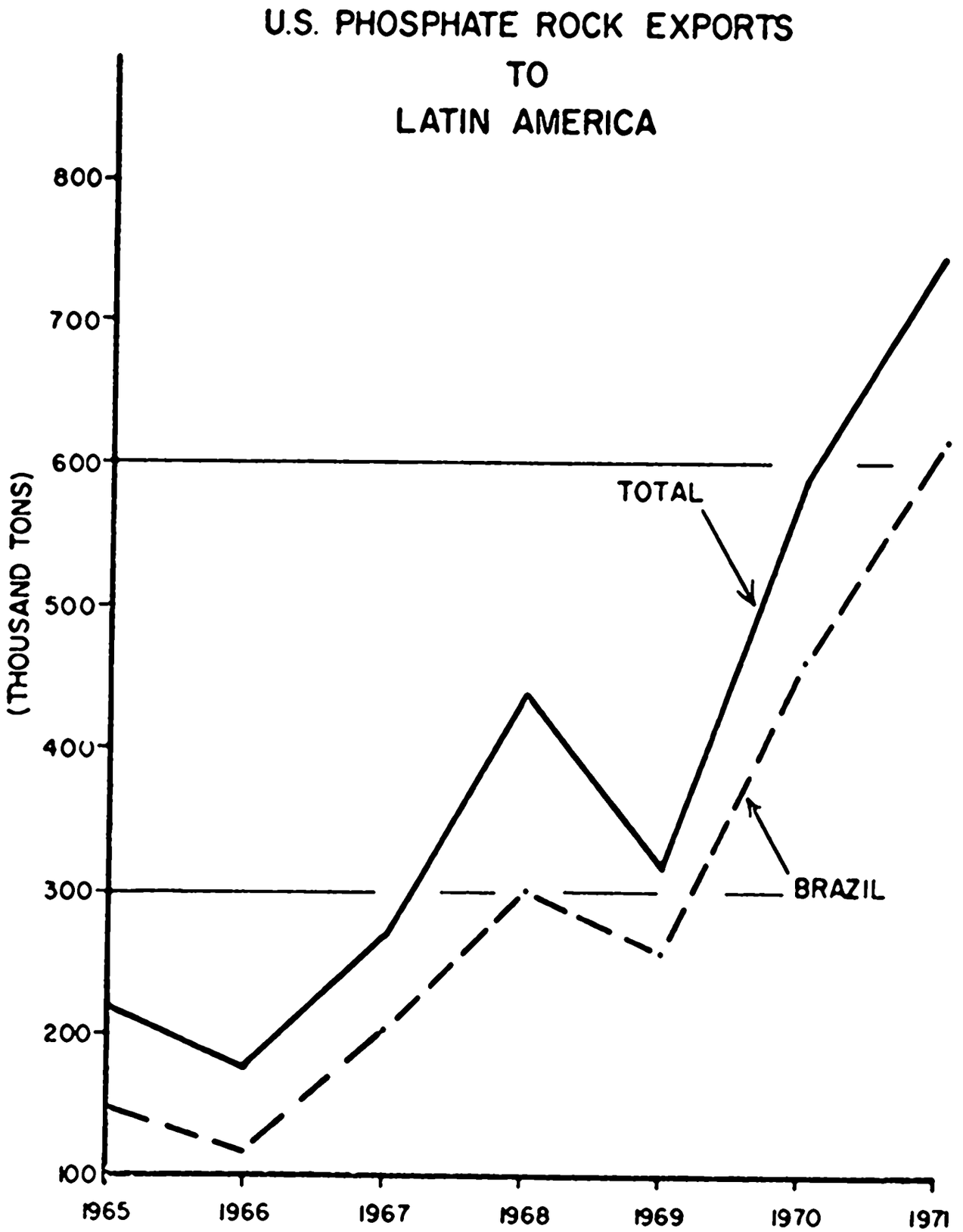

Figure 2.

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Phosphoric acid is another story, however. By 1975, if all announced expansions and new production units are brought in as currently scheduled the U.S. will have a P_2O_5 capacity of almost 7.9 million short tons--a 30% increase over the 1973 level. Although the change in product mix, shifting from low- to high-analysis materials based on phosphoric acid, will require slightly more acid to produce at the same total P_2O_5 level, the increase in capacity far exceeds these and normal domestic demand increases.

The recent world P_2O_5 shortage was brought on primarily by new phosphoric acid construction not meeting scheduled startup dates or experiencing poor operating rates. These plants will be coming on-stream along with the large expansion in the United States and could again bring about a surplus supply situation. At present, it appears that the only limitation on phosphate production over the next few years will be phosphate rock supplies.

In terms of individual product capacities that would affect the U.S. export situation, we expect little in the way of new ammonium sulfate capacity except that associated with caprolactum or smelter operations. The large amounts of ammonium sulfate potentially available from SO_2 removal is a long way from having any effect on the supply situation. Urea is shaping up to be the solid nitrogen product of the future. Capacity will increase by about 10% over the next 2 years. As it is accepted by dealers and farmers, demand could increase sharply, so that the typical U.S. blending plant will be using urea, ammonium phosphates and potash as the basic materials. Both ammonium nitrate and concentrated superphosphate will probably maintain their production levels of the past few years but will be consistently losing their share of the market.

Latin America and U.S. Fertilizer Exports

Latin America plays a large role in the plans of U.S. fertilizer producers who participate in the export market. As illustrated in table 8, three of the five major fertilizer export items had shipments in 1971 to Latin America representing well over half of the total U.S. export shipment. Almost 70% of the ammonium sulfate, over 50% of all potash and triple superphosphate and almost a third of all urea and ammonium phosphates shipped by the United States was used in Latin America. This region has emerged only in the last few years as a major fertilizer trade area for the United States; as in 1968, only one product accounted for up to a third of U.S. export shipments.

The fertilizer industries of Latin America and the United States must establish and maintain a vital interest in each other's market conditions. Just as you depend on the United States for your fertilizer supplies, the U.S. industry must maintain export shipments to Latin America if they are to operate in an orderly domestic market. Rapid change either in demand or supply in either region can lead to chaos in the marketplace in a very short period of time. No one benefits from these market swings and, in the long run, steady growth in the economics of both regions can be curtailed. From the standpoint of the market researcher and the marketing manager, communications must remain open and a free exchange of market data developed.

The Fertilizer Industry in Peru

For almost 10 years, the use of fertilizers in Peru has been at a standstill. Total consumption today is no different than it was in 1961 although there has been a slight change in the relative importance of nitrogen compared to phosphates and potash. As shown in table 9, Peru used 85 thousand tons of plant nutrients in 1970, over 80% of which was nitrogen; while 10 years

Table 8. Relative Importance of Latin America to U.S. Exports

Product	Percent of total U.S. Exports 1968	1971
Ammonium sulfate	16.4	69.3
Urea	12.5	30.4
Ammonium phospnate	25.6	32.7
Conc. superphosphate	32.5	55.7
Potash	20.5	51.9

Table 9. Plant Nutrient Consumption in Peru

Year	N	P_2O_5	K_2O	Total
		('000 tons)		
1961	54.3	30.3	6.8	91.4
1962	71.0	33.0	9.1	113.1
1963	70.0	20.0	8.0	98.0
1964	60.5	18.1	4.6	83.2
1965	64.2	14.1	6.2	84.5
1966	80.0	16.0	8.0	104.0
1967	68.0	10.0	7.0	85.0
1968	58.4	7.6	1.7	67.7
1969	65.1	10.5	5.0	80.6
1970	71.7	8.0	5.9	85.6

ago, nitrogen represented around 60% of total use. The consumption data has been plotted in figures 3, 4, and 5 and an average trend line determined in order to show the lack of progress that occurred from 1961 to 1970.

Forecasting under these circumstances is difficult because if these trends were to continue Peru would no longer use any phosphates after this year and by 1980 less than 1,000 tons of potash would be sold. Nitrogen growth would only be about 500 tons per year, bringing total projected use to only 75,000 tons, easily obtainable in any given year just from normal market variation.

What happens to the agriculture and the fertilizer industry in Peru will depend on the types of programs and the policy that is developed in the next few years. Peru has the resources to provide the levels of nutrients that Peru should be using. However, under present market conditions within the country, development cannot be economically justified.

Declining fertilizer demand means that the farmer has no economic incentive to use fertilizer to increase crop production. Either the prices he receives for his production are too low or the price of his inputs--fertilizer--are too high in relation to the risk that he must assume. While it is difficult to take the risk out of farming, Peru should be able to do something about the high cost to farmers of fertilizers. A systems approach in which a look is taken at raw material costs, production costs and their relation to import prices, transportation costs and marketing requirements is needed in order to find ways of providing low cost fertilizers to farmers in every agricultural area of the country.

But that is only part of it. Farmers need a realistic credit program for the purchase of all farm inputs and they need relatively stable prices for their output. If these programs can be implemented to provide the farmer with the capital he needs and ensure a favorable benefit-cost

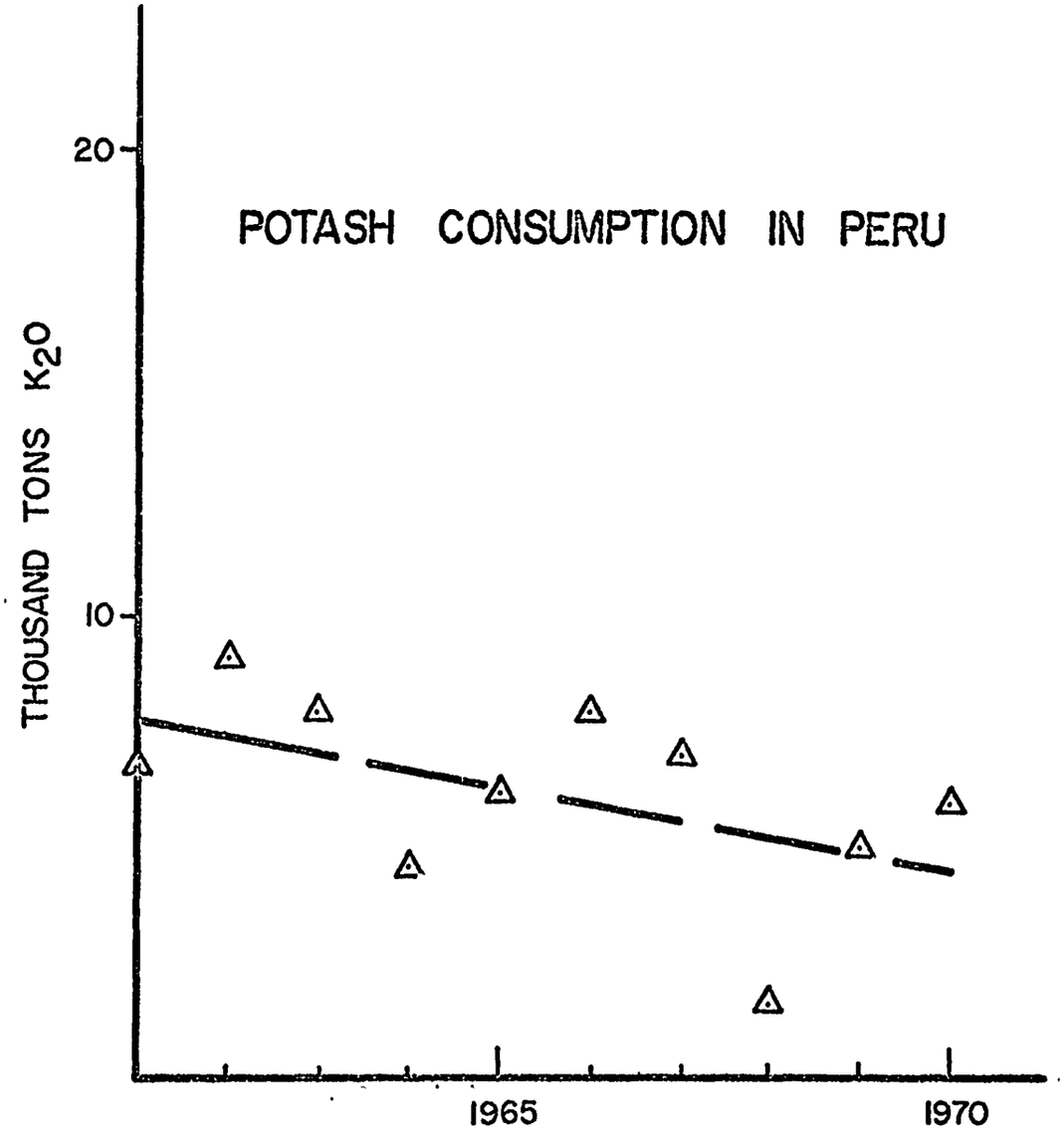

Figure 3.

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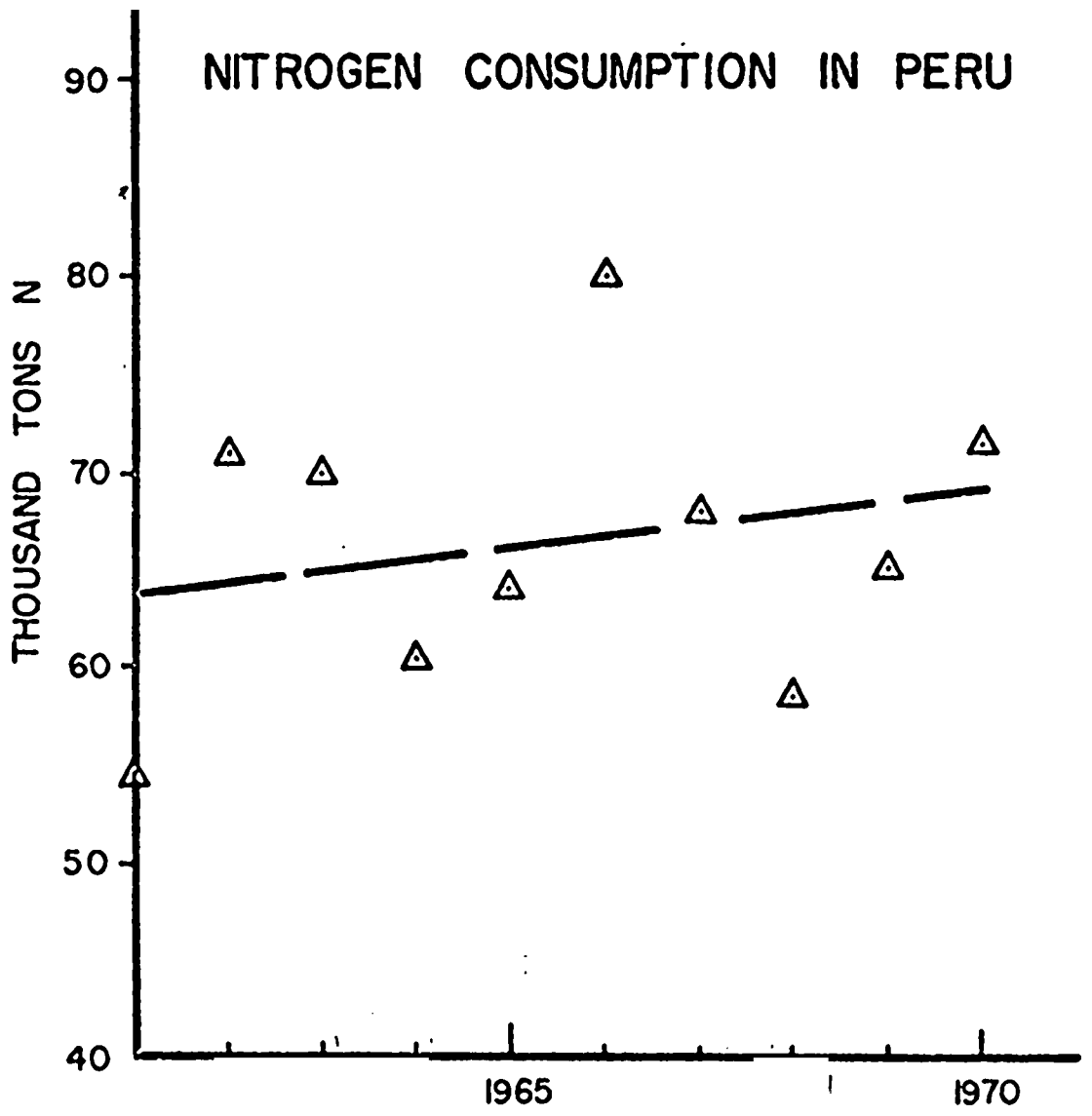

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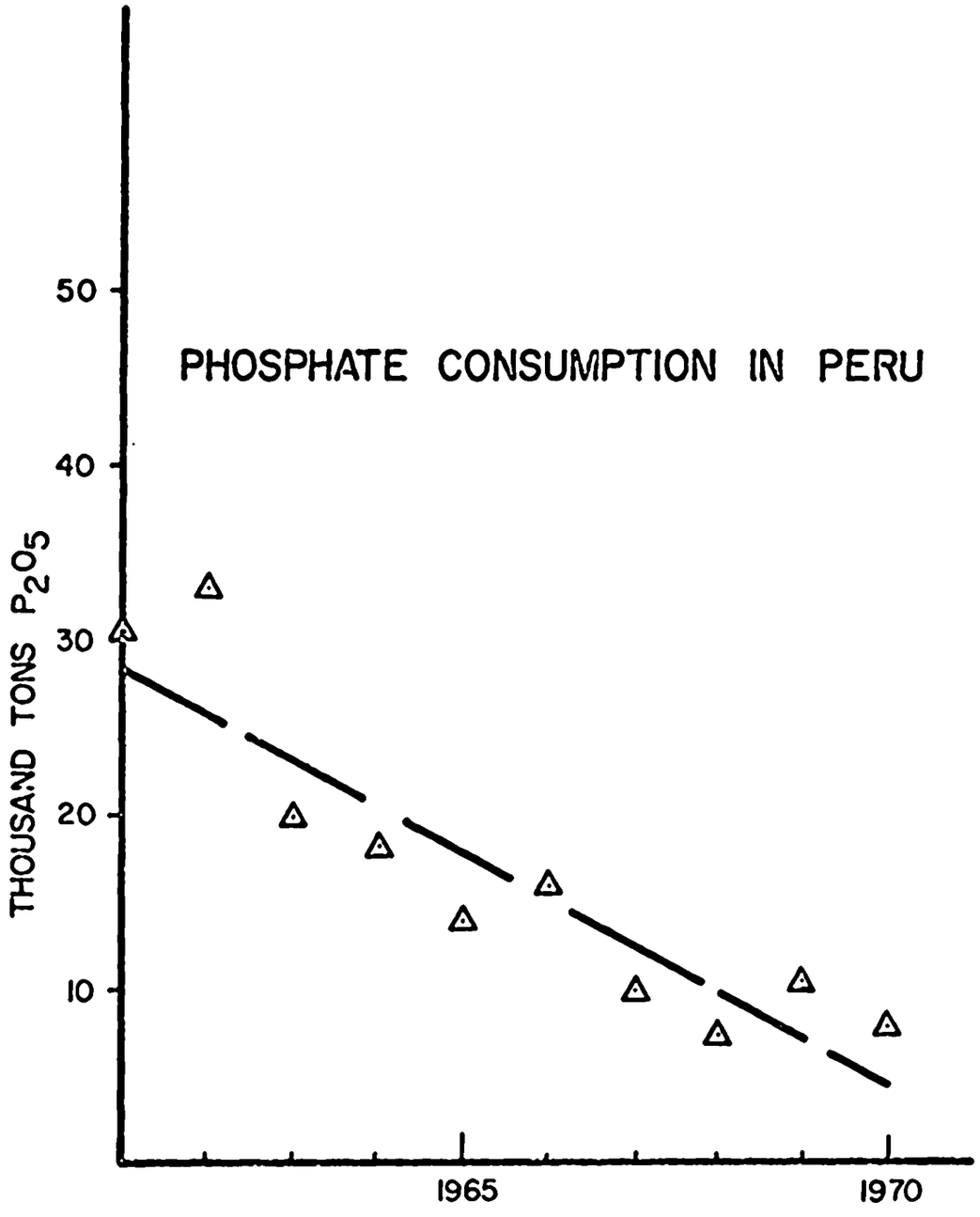

Figure 5.

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ratio for fertilizer and other farm inputs, Peru will be able to turn these demand curves upward. They will grow at remarkable rates until Peru approaches its potential optimum use, and agriculture will be able to provide a sound basis for increased growth in all sectors of the economy.

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