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THE WORLD FERTILIZER SITUATION AND ITS IMPLICATIONS TO THE ANDEAN PACT COUNTRIES*

World plant nutrient consumption reached 72 million tons in 1972 (table 1). This 6.1% increase in use over 1971 is in line with TVA's estimate (1) of 5.9% annual growth rate between 1971 and 1975 and also with the projected growth rate of 5.0% per annum between 1971 and 1980. Nitrogen accounted for 33.7 million tons,** P_2O_5 20.9 million tons, and K_2O 17.5 million tons in 1972.

According to TVA's projected growth figures, fertilizer use should reach about 85.8 million metric tons of nutrients by 1975 and 105.6 million tons by 1980. By 1980, nitrogen is forecast to make up nearly half of total nutrient use, 51.5 million tons, with P_2O_5 forecast to exceed 29 million and K_2O to approach 25 million metric tons.

Percentagewise, the projected growth rate of the 1970's represents a slowing down over that realized in the period 1962-1970 (figure 1). The annual growth rate during this eight-year period exceeded 10% as world fertilizer consumption doubled, increasing from 30 million to about 60 million metric tons. Although a further increase of 30 million tons is expected during the eight-year period 1972-1980, the growth rate will be less, on a percentage basis, because of the larger base value. Table 2 shows statistics on individual nutrients N, P_2O_5 and K_2O.

This slowing of the rate of growth, expected to occur both in the developed and developing regions, is viewed as an indication of the maturing of the fertilizer market. Future increased productivity will

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*To be presented to Acuerdo de Cartagena Junta seminar June 22-27, 1973, Lima, Peru, by Dr. Donald L. McCune, Director, International Fertilizer Development Staff, Tennessee Valley Authority, Muscle Shoals, Alabama 35660.

**Metric tons unless stated otherwise.

Table 1. World Fertilizer Use (Million Metric Tons)

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
1971	31.5	19.8	16.8	68.1
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

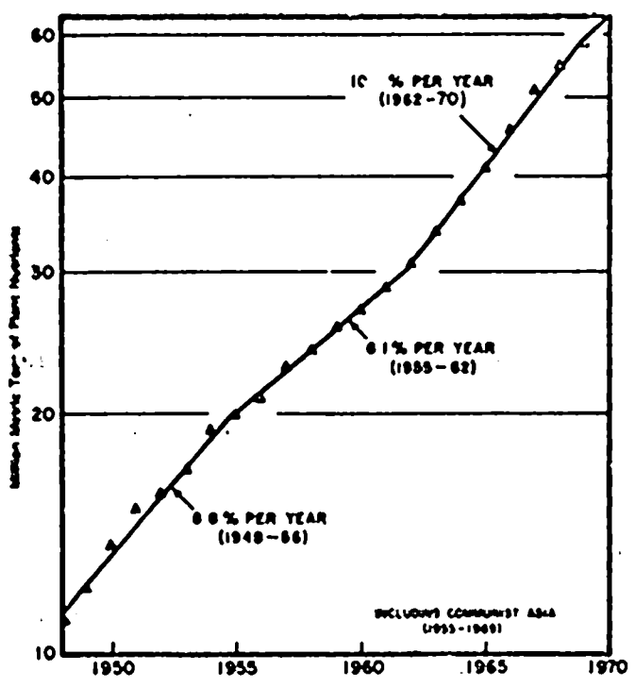

Figure 1. World Fertilizer Consumption

Table 2. CONSUMPTION OF PLANT NUTRIENTS (N, P_2O_5, K_2O)

Region	1971 Total Demand (mil tons)	1971 Annual Growth '65-'71	1975 Total Demand (mil tons)	1975 Annual Growth '71-'75	1980 Total Demand (mil tons)	1980 Annual Growth '71-'80
Developed Regions	54.8	7.5%	67.1	5.2%	81.8	4.5%
Developing Regions						
Asia	5.2	16.6	7.1	8.3	9.0	6.4
Africa	1.1	8.9	1.3	4.6	1.6	3.8
Latin America	3.1	13.8	4.6	10.7	5.8	7.4
Communist Asia	4.0	19.8	5.6	9.0	7.4	7.1
TOTAL	68.2	8.8	85.7	5.9	105.6	5.0
NITROGEN						
Developed Regions	23.0	10.1%	29.3	6.2%	36.7	5.3%
Developing Regions						
Asia	3.3	16.3	4.4	7.6	5.5	5.8
Africa	0.7	8.0	0.8	3.5	0.9	3.2
Latin America	1.4	12.6	2.0	9.7	2.6	7.1
Communist Asia	3.2	22.0	4.5	8.9	5.9	7.0
TOTAL	31.6	11.6	41.0	6.7	51.6	5.6
PHOSPHATE						
Developed Regions	16.6	5.2%	19.8	4.4%	23.5	3.8%
Developing Regions						
Asia	1.2	16.6	1.8	10.1	2.4	7.8
Africa	0.3	12.8	0.4	6.1	0.5	4.6
Latin America	0.9	13.0	1.4	9.9	1.8	7.0
Communist Asia	0.7	14.4	0.9	8.6	1.2	6.8
TOTAL	19.7	6.4	24.3	5.2	29.4	4.4
POTASH						
Developed Regions	15.2	6.6%	18.1	4.4%	21.7	4.0%
Developing Regions						
Asia	0.6	18.3	0.9	8.1	1.4	6.7
Africa	0.2	7.7	0.2	6.5	0.2	5.0
Latin America	0.7	17.4	1.2	13.7	1.5	8.3
Communist Asia	0.1	5.2	0.2	11.7	0.3	9.6
TOTAL	16.8	7.2	20.6	5.1	25.1	4.4

depend more heavily on optimum combination of farm inputs, fertilizer, water, pesticides, herbicides, varieties, etc., rather than just the result of increased use of only one input--fertilizer. Fertilizer has been the key to acceptance of new management techniques and its major impact in some areas has already been achieved. In our opinion, the rapid growth rates of the past few years will be more difficult to achieve in the future.

Increased use of fertilizer will continue in the developing regions at higher rates than in the developed regions (table 3). Latin America will probably lead all other regions in increased rate of fertilizer use. However, even with the faster growth rates in the developing regions, the developed regions will continue to use over three-fourths of the total fertilizers. Latin America, even with high growth rates, will only increase from 4.5% to 5.5% of total world fertilizer usage between 1971 and 1980.

Production statistics over the past year indicate gains almost equal to consumption increases. Closer examination, however, indicates that the major increases took place in the U.S.S.R. and China while production in most other areas either remained the same or declined. Thus, a tight supply situation developed as inventories were depleted. Importing countries not having long-term contracts came into the market only to find that the sellers had little to offer and that prices had recovered, and in some cases exceeded, previous all-time high achieved during the early 1960's.

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

Table 3. Percent of Total World Consumption

	1971	1975	1980
Developed Regions	80.4	78.2	77.4
Developing Regions	19.6	21.8	22.6
Latin America	(4.5)	(5.3)	(5.5)

large producers had found new markets for their export production--Latin America being one of them. As a result, the needs of countries not in the market every year were not anticipated and supplies were not available. 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.

World Fertilizer Supplies

In 1972 TVA 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 1972 (table 4). 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 5). 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 4) 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 anticipated that the improved price situation should stimulate investment and that needed additional capacity will be forthcoming. Additions now being planned, however, will not have a major impact on the market prior to 1975.

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*Experience has shown that a supply/demand ratio of at least 1.05 is necessary to assure adequate fertilizer.

Table 4. World Nitrogen Production Capacity

Year	Total Capacity	Potential Fertilizer Supply[a]
	(million metric tons)	
1965	27.8	18.0
1970	48.4	30.3
1971	53.0	33.2
1972	58.0	36.3
1973	62.1	39.3
1975	67.8	43.1

[a]Assuming an operating rate of 90% in developed regions and 80% in developing regions, less industrial use and losses.

Table 5. World Nitrogen Supply and Demand

Year	N Production	N Consumption	S/D Ratio
		(million metric tons)	
1965	17.3	16.3	1.06
1970	30.2	28.7	1.05
1971	32.7	31.5	1.04
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.

With the 1972 report (2), 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 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 6). 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 most phosphate materials may be over for the time-being. Some spot shortages may occur in the international marketplace.

While no shortage of potash should exist, 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

Table 6. 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.

restrictions will continue with adjustments made as demand levels increase. The result of these controls will mean a stable market with price changes reflecting changes in production and distribution costs.

Raw Materials 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 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 in 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 present tight situation in nitrogen fertilizers will probably continue for at least the next 20 to 24 months. With the increasing demand

for natural gas, it would appear that nitrogen fertilizer prices should remain high for the foreseeable future. Thus, it would appear that areas with surplus gas should now consider the building of plants not only to service their own needs but also to participate in anticipated favorable world markets. To compete on the world market, however, only large-scale, modern facilities should be considered. Andean Pact countries with excess gas should look for future nitrogen markets through Latin America, in North America and across the Pacific.

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 5.3 million tons of rock between 1968 and 1971 (table 7) (4). At an average of 33% P_2O_5 content, this represents less than 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 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.

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

Table 7. 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

possibly Peru and Angola--would bring the total capacity to over 155 million tons, well above the suggested demand. 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 2, supply is well above demand, but only if the proposed expansions are forthcoming.

The U.S. Market Situation

Since the United States plays such a large role in world and Latin American fertilizer markets, a review of the U.S. situation may be meaningful. Fertilizer use during 1972 and continuing into 1973 has been less than anticipated. This has been due to a large extent to unfavorable weather during the planting seasons. Grain supplies are at a low level in the United States due to poor harvests and to greatly increased exports. Low grain supply, large export demand and favorable prices have produced a situation where large domestic fertilizer consumption increases can be anticipated when weather returns to normal.

At the same time, demand for fertilizers on the world market are increasing. In 1972 the U.S. exports of urea and ammonium phosphates increased quite rapidly (table 8) Exports have become such a major segment of the U.S. fertilizer market that they now play a significant role in market strategy rather than just offering an outlet for excess production (table 9).

The question then becomes, can the U.S. fertilizer industry produce for both the increasing U.S. fertilizer market and the strong world market demand?

Looking ahead to the prospective supply situation in the United States between now and 1975, we find that nitrogen plant expansion is at a minimum while a large expansion in phosphoric acid production capability

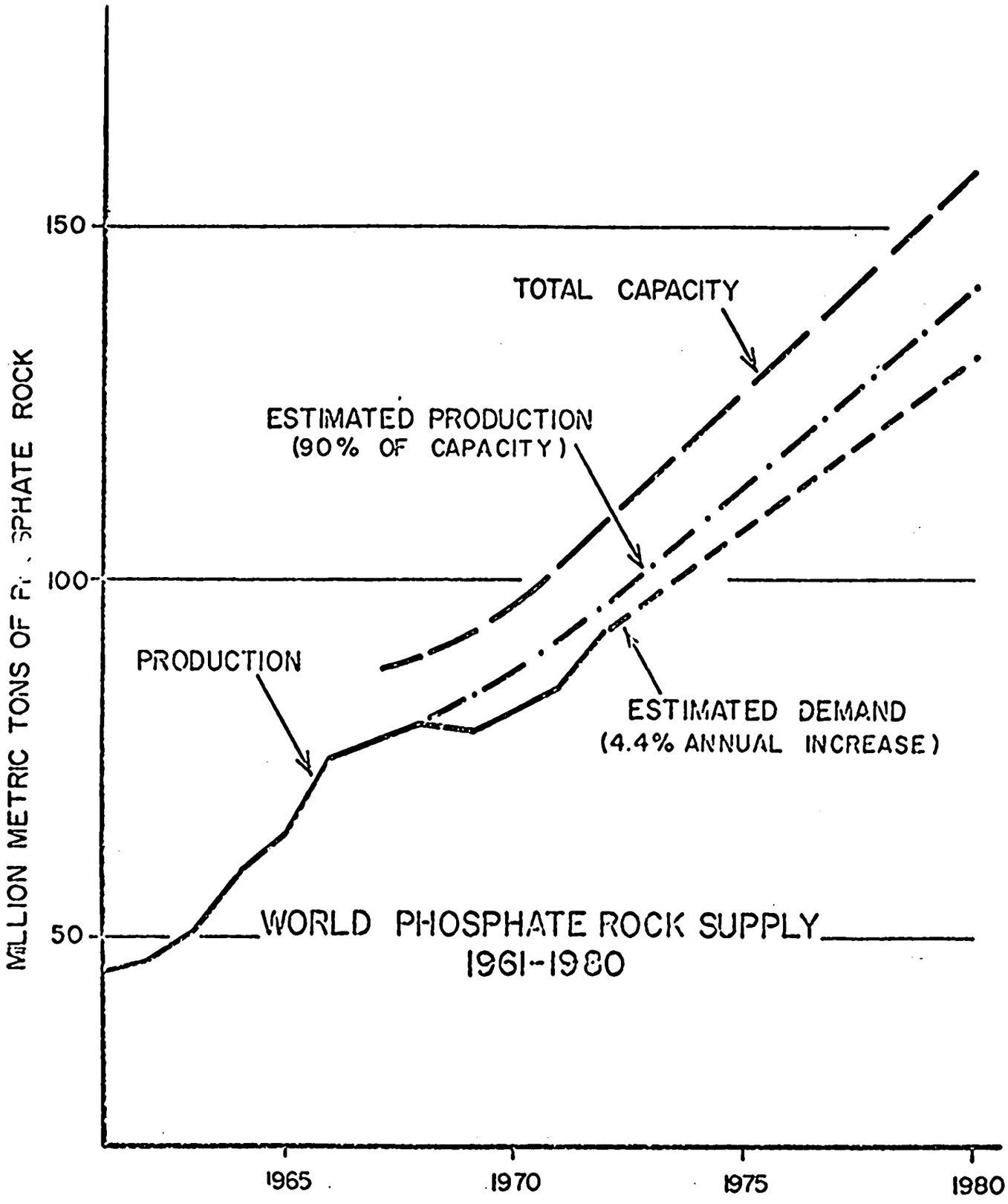
150
100
50
MILLION METRIC TONS OF PHOSPHATE ROCK
TOTAL CAPACITY
ESTIMATED PRODUCTION
(90% OF CAPACITY)
PRODUCTION
ESTIMATED DEMAND
(4.4% ANNUAL INCREASE)
WORLD PHOSPHATE ROCK SUPPLY
1961-1980
1965
1970
1975
1980

Figure 2.

Table 8. 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 9. 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. supe. hosphate	1661.4	326.2	19

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

is taking place. At the start of 1973, the United States had a total ammonia capacity of 17 million short tons of materials, while wet-process phosphoric acid stood at 6.1 million short tons of P_2O_5. Additional ammonia capacity currently scheduled for the next 2 years amounts to only 1 million short tons, which will not be enough to cover expected domestic demand increases. The small increase is believed to be the result of the feedstock supply situation plus a general uncertainty of world markets.

Phosphoric acid is another story, however. By 1975, if all announced expansions and new production units are brought in as currently scheduled, the United States 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.

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 3 indicates the increases that have occurred since 1965 in U.S. shipments of phosphate rock to Latin America and Brazil.

As stated earlier, 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.

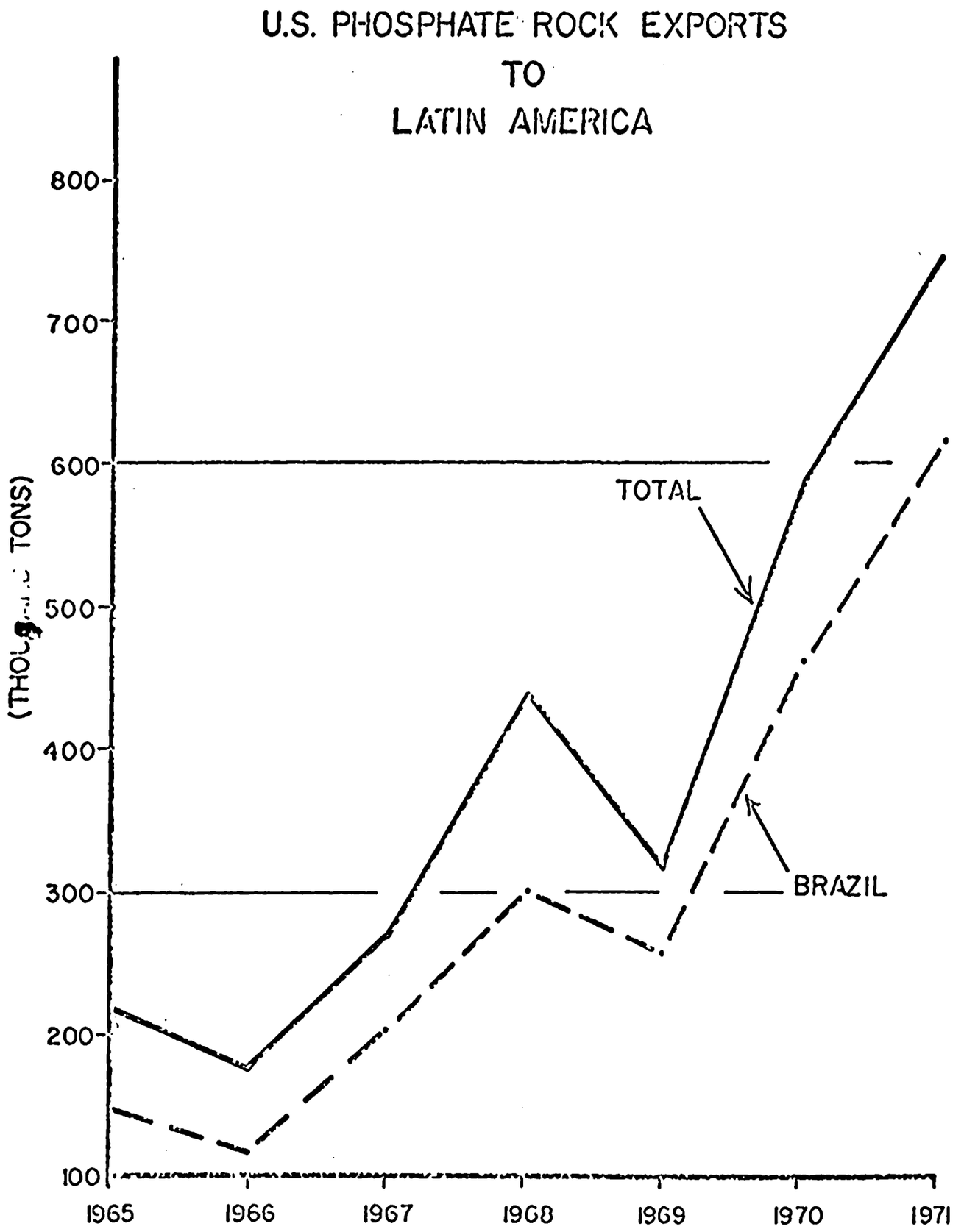
U.S. PHOSPHATE ROCK EXPORTS
TO
LATIN AMERICA
(THOUSAND TONS)
800
700
600
500
400
300
200
100
TOTAL
BRAZIL
1965
1966
1967
1968
1969
1970
1971

Figure 3

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. 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.

As indicated in table 10, Latin America plays a major role and depends heavily on imports from the United States. Latin America represents well over half of the total U.S. export shipment and Latin America depends heavily on the United States as its primary source for imports. Rapid change either in demand or supply in either region can lead to chaos in a very short period of time.

The Fertilizer Industry of Andean Pact Countries

According to FAO statistics (7), fertilizer use in the Andean Pact countries has been increasing over the past 5 years (table 11). The average increase has been about 10% per year--slightly above the world 1965-71 average of 8.8% but below the developing countries' average of 14.6% and below Latin America's average of 13.8%. (Brazil's phenomenal gain going from 600,000 tons of nutrients in 1968 to over 1.5 million tons in 1972 has been the overriding factor in Latin American fertilizer use.) There are also variations in rate of increase among the Pact countries (table 12).

Table 10. 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 phosphate	25.6	32.7
Conc. superphosphate	32.5	55.7
Potash	20.5	51.9

Table 11. Fertilizer Use in Andean Pact Countries, 1968-1972

	N	P_2O_5	K_2O	Total
		(metric tons of nutrients)		
1968	166,609	184,912	71,957	423,478
1969	201,512	187,749	77,548	466,809
1970	207,984	177,586	97,821	484,138
1971	218,744	210,809	107,693	537,246
1972	273,533	216,784	110,556	600,873

Table 12. Fertilizer Use by Individual Andean Pact Countries

	1968	1969	1970	1971	1972
		(thousand metric tons of nutrients)			
Bolivia	2.9	1.6	2.9	1.6	2.4
Chile	107.1	135.1	140.4	158.1	170.0
Colombia	142.0	147.5	170.8	177.0	206.8
Ecuador	34.7	61.3	41.4	34.1	49.9
Peru	78.3	67.7	81.6	84.3	99.9
Venezuela	43.2	53.4	47.0	82.2	87.0

According to TVA's estimated fertilizer use growth rate for Latin American countries over the next 5 years, the Pact countries may be using about 1 million metric tons of plant nutrients by 1977. Nearly half, 480,000 tons, would be nitrogen, 338,000 tons P_2O_5, and 195,000 tons K_2O (table 13).

Table 14 shows present installed capacity in the Pact countries. This does not include Chilean nitrate or guano capacity. It indicates that at present use there is adequate capacity within the region if no fertilizer is exported. It is known that Venezuela expects to export sizable quantities of nitrogen products outside of the region. Thus, probably some deficit already exists. If fertilizer use continues to grow, there soon will be a market for additional capacity within the region. There is also the possibility that it would be in the interest of the Pact countries to consider additional modern capacity that would replace present capacity that may be obsolete under present conditions.

Another consideration that should be considered is the external market. The Pact countries individually and as a whole are in a good position as far as basic raw materials are concerned. With the present situation in natural gas and rock phosphate, there is a good possibility that world markets would justify sizable expansions to utilize these resources to the advantage of the Pact countries. Possible markets would be other Latin American countries that are not as fortunate in having resources, Asian countries, and possibly the United States as far as nitrogen products are concerned. Thus as stated previously, it would appear that now is a good time for Pact countries to consider a move into world supply.

Table 13. Fertilizer Consumption 1972 Actual (FAO) 1977 Estimate (TVA)

	Actual 1972			Projected 1977		
	(thousand metric tons of nutrient)					
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Bolivia	1.3	1.0	0.1	7.0	5.0	2.0
Chile	49.7	103.6	16.7	85.0	150.0	30.0
Colombia	88.2	61.8	56.8	155.0	95.0	80.0
Ecuador	19.7	10.0	5.0	38.0	15.0	13.0
Peru	81.3	15.0	3.6	135.0	28.0	25.0
Venezuela	33.4	25.3	28.3	60.0	45.0	45.0
	273.6	216.7	110.5	480.0	338.0	195.0
	600.8			1,013.0		

Table 14. Estimated Installed Production Capacity for Solid Chemical Fertilizers, Thousand tons per year

	N	P_2O_5	K_2O
Bolivia	-	-	-
Chile	-	50	-
Colombia	104	66	50
Ecuador	8	10	4
Peru	37	6	6
Venezuela	191	139	36
Totals	340	271	96
		976	

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