

PHOSPHATES: THE NEXT CARTEL ?

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In the first six months of 1974 the world price of a scarce commodity rose 400 percent by the decree of the largest exporter, an Arab country. Other large exporters, located in the Middle East and in Northwest Africa, raised prices by the same multiple. Consumption declined, a rush began to develop alternate supplies, and a meeting of the major exporting countries raised concern in the market about more permanent cartel-like action by producers.

The commodity here is not oil: it is phosphate rock, a raw material needed for much of the world's fertilizer. The largest exporter is Morocco, which first announced the price rise; excluding United States exports to Canada and Soviet exports to Eastern Europe, Morocco's share of the international market is 40 percent, and with the other African and Middle Eastern producers, Morocco controls 55 percent of world trade in phosphates. The domination of those exporters is even greater in some regional markets; for example, they supply 76 percent of the requirements of Western Europe.¹

The purpose of this article is to examine the chances for the long-term success of cartel-like action in the world phosphate market by a group of less-developed country exporters. The term "cartel-like action" should be understood to imply a pattern of market control raising prices above costs (with consequent oligopoly rents) without, however, the formal market share agreements that are involved in legal definitions of cartels.²

There are three types of manufactured fertilizers: nitrogenous, phosphatic, and potassic. Nitrogenous fertilizers are manufactured from hydrocarbon feedstocks, while phosphatics and potassics are extracted

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1. Richard B. Reidinger, *World Fertilizer Review and Prospects to 1980/81*, United States Department of Agriculture, Economic Research Service (Washington, D.C.: 1974), p. 26.

2. Zuhayr Mikdashi, *The International Politics of Natural Resources* (Cornell University Press: 1976), p. 77. Mikdashi says: "An export cartel must not only include agreements on prices, but also related agreements on such key areas as production control and market sharing. The export cartel must be responsible for monitoring the activities of its constituent members with a view to policing violations and penalizing violators."

from the ground as rock and milled. All three types are essential for crop nutrition. Phosphates, used as supplements to almost all crops, are particularly important in tree crops, such as coffee and cocoa. In the 1974/75 fertilizer year, 48 percent of fertilizers applied were nitrogenous, 29 percent were phosphatic, and 23 percent were potassic.³

Demand for fertilizer grows almost continuously while production capacity grows incrementally. When a new plant comes on stream it increases production significantly. If several plants come on stream simultaneously, production may exceed demand for several years. Such excess supply existed from 1969 until 1972, and fertilizer prices slumped.⁴ In the 1972/73 fertilizer year demand began to catch up with production, because plans for new productive capacity had been cancelled or postponed during the period of excess supply and low prices. In that year the price of nitrogenous and phosphatic fertilizers increased 50 to 100 percent and plans were made to expand capacity.

In the 1973/74 fertilizer year demand continued to rise, while the Arab oil embargo left supply contracts for hydrocarbon feedstocks unfilled. Much nitrogenous intermediate fertilizer is mixed with phosphatic intermediates; this fact in conjunction with tight supply of phosphate rock and psychological market reaction put pressure on the prices of both fertilizers. For example, the price of bagged urea rose from about \$80/ton in early 1973 to about \$385/ton in mid-1974.⁵

In January, 1974, with these market conditions, Morocco trebled its export price of high grade rock to \$42/ton from the previous level of \$14. By July, 1974, the price had risen to \$68—a total increase of 400 percent in seven months. The other principal exporters, except the United States, announced corresponding increases. The U.S. phosphate rock export price remained below world levels but did reach \$58/ton for comparable grades.

Western Europe is the developed area most dependent upon imports of phosphate rock, particularly from Morocco, and, as prices rose, production costs for finished materials more than trebled. Diammonium phosphate, for example, which sold for \$100/ton in early 1973, increased to roughly \$380/ton in the summer of 1974. Consumption of phosphatic fertilizers fell 5 percent world-wide in 1974/75

3. Calculated from data in United Nation Food and Agriculture Organization, *Monthly Bulletin* (July/August, 1976), p. 17. A fertilizer year runs from 1 July to 30 June. It should also be noted that some phosphatic fertilizers are made from basic slag. Though that material has been less important to manufacturing in recent years, it is still used in about 10 percent of production in Western Europe. See United Nations Economic Commission for Asia and the Far East (1969) E/CN. 11/837, pp. 42-43.

4. Although the dollar price of phosphates increased because of the devaluation of the United States currency, prices in the currencies of the other exporters fell. See United Nations Food and Agriculture Organization, *Trade Yearbook* (1975).

5. See FAO *Monthly Bulletin*, op. cit., p. 20.

and 16 percent in the developed market economies.⁶

Most United States millers are also miners of phosphate rock and therefore have a cost advantage over European manufacturers who are dependent upon foreign supplies. As supply in the United States tightened under demand pressure from Western European markets, U.S. consumption decreased by about 12 percent in 1975. As Western European importers began to shift their demand away from Moroccan rock, it was reported that several North African producers began to offer discounts.

Hoping to secure an agreement prohibiting discounts, Morocco convened a meeting in 1965 of the World Institute of Phosphates which she had promoted to improve export conditions. (United States anti-trust laws prevent that country's producers from joining the Institute.) No agreement was reached, and after her exports fell 30 percent during 1975 Morocco was forced to announce a January, 1976, price reduction of one-third.⁷

In November, 1976, a meeting of developing country producers was held in Senegal and market information was exchanged. Members of the Afro-Arab Phosphate Commission (APC), an export group to which Morocco, Tunisia, Senegal, and Jordan belong, attended the meeting. The APC and non-member producers now seek only price stabilization and a guaranteed minimum price. There is, of course, the chance that the long-term plans of the APC will extend to the explicit allocation of market shares and to the establishment of output quotas and a discussion of that possibility constitutes the next section of this article.

Table 1 lists the major producers in 1974 of phosphate rock.⁸

TABLE 1: Producers of Phosphate Rock ['000 metric tons]

United States	40,458
Soviet Union	22,505
Morocco	19,750
Tunisia	3,826
China	3,000
Togo	2,553
Spanish Sahara	2,386
Senegal	1,974
Jordan	<u>1,675</u>
Total	98,127
Developed market countries	43,144
Developing market countries	39,623
Centrally planned countries	<u>27,105</u>
World Total	109,872

6. *Ibid.*, p. 24.

7. *The Economist*, 13 December 1975, p. 97.

8. All data in Tables 1-5 are calculated from FAO, *World Fertilizer Review* (1974).

If we assume that the cartel-like group would only include developing countries, these data show that developing countries control only 36 percent of current output, and that the United States alone produces more than twice as much as Morocco. The concentration of production of crude oil in developing countries, by contrast, is much higher, about 58 percent in 1973.⁹

Table 2 lists the major exporters of phosphate rock.

TABLE 2: Major Exporters of Phosphate Rock ['000 metric tons]

Morocco	18,700
United States	12,889
Soviet Union	5,945
Tunisia	2,651
Togo	2,558
Spanish Sahara	2,179
Senegal	1,898
Jordan	<u>1,469</u>
Total	48,289
Developed market countries	13,681
Developing market countries	35,036
Centrally planned countries	<u>6,845</u>
World Total	55,562

TABLE 3: Major Importers of Phosphate Rock ['000 metric tons]

France	5,861
Japan	3,845
Canada	3,323
Australia	3,094
West Germany	3,089
Poland	2,861
Spain	2,801
Belgium	2,407
Netherlands	2,358
United Kingdom	2,042
Italy	<u>2,016</u>
Total	33,697
Developed market countries	37,710
Developing market countries	6,808
Centrally planned countries	<u>10,221</u>
World Total	54,739

Although the concentration of exports from developing countries

9. Calculated from data in British Petroleum Statistical Review of the World Oil Industry (1975). All oil statistics in this paper are from this source.

implies some capacity among those producers to raise prices, the case is not analogous to that of oil exports. In 1973, developing countries exported more than 90 percent of the petroleum that entered world trade and developed market economies exported almost none. Table 3 and Table 4 show that the United States is the only developed market country self-sufficient in phosphate rock production.

Because most (roughly 80 percent) phosphate rock is used in the manufacture of phosphatic fertilizers, it is generally true that consumers of rock are producers of fertilizers. Table 4 shows the international distribution in 1974/75 of phosphatic fertilizer production.

TABLE 4: Producers of Phosphatic Fertilizers ['000 metric tons]

United States	6,049
Soviet Union	3,868
France	1,720
China	1,302
West Germany	900
Poland	823
Canada	734
Japan	729
Australia	<u>727</u>
Total	16,852
Developed market countries	15,504
Developing market countries	2,366
Centrally planned countries	<u>7,806</u>
World Total	25,676

Table 5 shows the primary consumers of phosphatic fertilizers.

TABLE 5: Major Consumers of Phosphatic Fertilizers ['000 tons]

United States	4,076
Soviet Union	3,226
France	1,688
China	1,318
Poland	888
West Germany	877
Brazil	<u>807</u>
Total	12,880
Developed market countries	11,846
Developing market countries	3,467
Centrally planned countries	<u>7,470</u>
World Total	22,783

As can be seen, developed market economies produced and consumed the largest fraction of the world's output of phosphatic fertilizers, and also exported about one-quarter of their output. Developing countries, on the other hand, import about one-third of their (much smaller) consumption, and the centrally planned economies are roughly self-sufficient, with a small surplus for export.

Although the average crustal abundance of phosphates is 0.12 percent, the lowest concentration recoverable at current technologies and prices is 8 percent. If the real price of phosphate rock rises, of course, less concentrated resources will be added to proved reserves. Table 6 lists world reserves of rock under varying assumptions about prices and technologies.

TABLE 6: World Reserves of Phosphate Rock [billion metric tons]

Region	Reserves	%Total	Other resources	Total	%Total
USA	2.3	14	4.1	6.4	8
USSR	0.7	4	2.9	3.6	5
Africa	11.6	72	49.0	60.6	80
Morocco	9.1	57	45.4	54.4	71
Sp. Sahara	1.5	9	1.8	3.4	4
Tunisia	0.5	3	1.4	1.8	2
Asia	0.3	2	1.8	2.1	3
Australia	0.9	6	1.8	2.7	4
Total	15.8		59.6	75.4	

The reserves category includes materials recoverable at the 1974 US export price, with (then) current American technology. The other resources category includes estimates made with different assumptions about prices and technology. Source: Reidinger, *op. cit.*, p. 28.

Morocco alone holds 57 percent of present reserves, and with those of the former Spanish Sahara, which Morocco recently divided with Mauritania, Morocco holds two-thirds of current reserves. Price increases and technological changes, according to the estimates shown here, can only increase that concentration of reserves under Moroccan control. Developing countries as a group control three-fourths of present reserves and more than 80 percent of all estimated resources, while developed market countries hold 3 percent of present reserves and 12 percent of estimated resources.

The implication of these figures is unclear unless the rate of depletion is known. In the United States, for example, production of phosphate

rock is now about 50 million metric tons/year and reserves are about 2.3 billion metric tons, implying a reserve life of less than 50 years.¹⁰ As United States production is able to meet less and less of world and domestic demand, the world and then the United States will become increasingly dependent upon imports from those countries which hold the largest share of current and estimated reserves. Seemingly, exporter control over international trade in phosphates will rise and, with it, the likelihood of successful cartel-like action.

In the event of a sudden price rise, it is important to know that there is, in the United States, a lag of three to five years from the initial decision to mine to the actual extraction of phosphate rock, although incremental additions to existing capacity can be made.¹¹ There is a less serious lag in the milling of phosphate rock, in part because substitution of different grades of rock is possible within a single plant. Therefore, in the event of the restriction of supplies from certain sources, shifts in supply can be accommodated. As United States reserves and other developed country reserves are depleted, however, such shifts can occur less often.

Substitution is another option to be considered in the case of large price increases. Although the composition of demand for phosphate rock is weighted heavily toward fertilizer manufacturing (about 80 percent), some processes (e.g. soap making, metal plating, steel alloying) can substitute other raw materials. The fertilizer industry has only limited recourse to substitutes (mainly the resources found in guano and in basic slag). Substitution for phosphate products in consumption is also limited. That is, the mix of nutrients in fertilizers may be changed, but substantial reduction in the amounts of phosphates used is unlikely.

Another option is the substitution of crops which demand less phosphate. While this might cushion individual farmers from the effects of a substantial rise in the price of phosphates, it could not result in a worldwide reduction in the demand for phosphates without a major shift in the pattern of food consumption. Organic fertilizers, such as animal dung or crop residues, can also supply small amounts of phosphorus, but concentrated chemical phosphates are essential to modern agriculture and their importance will grow with the growth of world food demand.

Stockpiles are a factor which, in the cases of certain commodities (e.g. tin), can restrict cartel-like action by exporters. United States' stocks of

10. Telephone interview with Mr. W.F. Stowasser, United States Department of the Interior, Bureau of Mines, Division of Non-Metallic Minerals, 23 November 1976.

11. United States Department of Agriculture, Economic Research Service, "1975 Fertilizer Situation," (Washington, D.C.: December, 1974), p. 6.

phosphate rock are now about 15 ½ million metric tons, or less than 4 months consumption.¹² It is unlikely that those stocks (which must surely be smaller in the other developed countries which import phosphates) would enable the developed market economies to resist for long an imposed price increase.

The price elasticity of demand for phosphate rock—the percentage change in quantity demanded as the result of a one percent change in price—is, of course, the factor which limits price changes; that elasticity has been estimated to be between -0.20 and -0.05.¹³ These elasticities obscure the differences in demand between developing and developed countries. Farmers in industrial nations, for example, may well be willing to pay higher prices for fertilizers because returns to their use are high; farmers in developing nations may be unwilling to continue application of more expensive fertilizers because returns to their use are low. Those returns may be augmented in those developing countries where governments subsidize fertilizer purchases by farmers, but programs of subsidy will become more expensive, and less common, if fertilizer prices rise dramatically.

Another price effect must be considered: the price of the final good, food. In the United States it has been estimated that fertilizers represented 24 percent of the costs of wheat production, and 4 percent of consumer costs for all food consumed in that country.¹⁴ Fertilizer costs, as a share of the delivered price of food, may be higher in developing countries, especially if we recall that most fertilizers are imported by developing countries, and have, therefore, important foreign exchange costs. Additionally, increases in the costs of production in the food-exporting nations, principally the United States, would result in higher food prices in the developing countries, especially as domestic food production declined there as the direct result of higher fertilizer prices.

If we assume that demand is sufficiently inelastic, and that substitution possibilities are sufficiently small, a short-run increase in the price of phosphate rock can occur. The long-run problem of the cartel members is then to hold market shares constant. The group must, in other words, guard against “cheating” by those members whose individual interest diverge from those of the group. It is believed by experts in the phosphate industry and in government that cheating

12. Telephone interview with Mr. W.F. Stowasser, 22 February 1977. It should be noted that these stocks are unusually large and that they have forced some United States producers to cutback current operations.

13. Further information is available upon request from the author.

14. Grace Digest, W.R. Grace Corporation (New York: 1976) and “Crop Production Costs,” W.R. Grace Corporation, Planning Department. The high fertilizer prices of 1975 overstate fertilizer's share in crop costs.

would be a serious problem for a cartel of developing country phosphate exporters. The primary reason is that those exporters do not have entirely friendly relations; the case cited is usually the animosity between Algeria and Morocco over the problem of the Spanish Sahara, where there are huge phosphate resources. Algeria has, in fact, withdrawn from the APC because of the dispute over the Spanish Sahara. A second condition for the successful operation of this would-be cartel is product homogeneity, or, without that, agreement on price differentials. Togo has withdrawn from the APC because she and Morocco cannot agree on the value of Togolese rock, which is of generally higher quality. This split appears more likely to be healed than that between Algeria and Morocco.

We have seen that Morocco and the other developing exporters were, in 1974 and 1975, unable to hold prices, primarily because of the unexpectedly high elasticity of demand and the large supply response from United States producers.¹⁵ A further aspect of that inability was the cartel's failure to control "cheaters." To be sure, they are only cheaters in a loose sense of the word because there is no formal exporting association. Without a formal structure and agreement about differential prices and market shares, the "members" were associated only in their temporary belief that their common and individual interests were the same. On balance, the problem of cheating is not very great now (because most members of the cartel have such small shares of the market) but it will grow as United States reserves dwindle and the market shares of the developing countries grow.

It appears, therefore, that successful cartel-like action by developing country phosphate exporters is unlikely in the short-run, say 25 years, but that success is likely beyond that period, principally because the United States will become a net importer of rock. The phosphate position of the United States is roughly analogous to its petroleum position at the end of World War II. At that time, before world demand for petroleum soared, the United States was a net exporter even though the bulk of world reserves was in developing countries. This situation existed because, by the nature of the terms "developed" and "underdeveloped," developed nations have the incentives and the means to discover and exploit their resources (and those of other countries) while underdeveloped countries do not.

The projected decline in the phosphate market share of the United States comes at a time when world demand is growing rapidly, in both

15. Telephone interview with Mr. W.F. Stowasser, 23 November 1976. Stowasser estimates that there are 10,000,000 tons of idle phosphate mining capacity in the United States.

developed and developing countries.¹⁶ It is those changing market factors that are necessary for the success of a phosphate rock export cartel composed of developing countries. In the meantime, the exporters who may in the future comprise such a cartel, will continue to conduct meetings and attempt to cooperate on small issues.¹⁷ Over time, as market conditions shift in their favor, they may become a cohesive group capable of exploiting their market power.

16. *Chimie Actuel*, 7 April 1976, p. 35, suggests that demand in the developing countries is growing twice as fast as that in the developed countries.

17. Another forum may be the United Nations Conference on Trade and Development producer-consumer meeting to be held at Geneva in December, 1977, where an attempt will be made to negotiate a commodity agreement for phosphate rock.