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U.S. GENERAL ACCOUNTING OFFICE
STAFF PAPER



THE FERTILIZER SITUATION--
PAST, PRESENT, AND FUTURE

Department of Agriculture

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ABBREVIATIONS

AID	Agency for International Development
TVA	Tennessee Valley Authority



CHAPTER 1THE PASTTHE SITUATION

During the past 25 years, the fertilizer industry has gone through several cycles of bust and boom. In 1974 fertilizer supplies were again in short supply and the United States did not have enough nitrogen and phosphate fertilizer to meet domestic demand. Although the absolute level of the shortages was not known, industry and Government officials considered the situation serious. Also the shortage occurred at a time when the United States no longer had a large surplus of grain.

As shown below, in November 1974 industry and Government estimates of the shortage differed, partly because of the difficulty of accurately quantifying unfilled demand.

Estimated Fertilizer Shortage or Surplus (-)
Fiscal Year 1974

	<u>Government</u>		<u>Industry</u>		<u>Difference</u>	
	<u>Tons</u>	<u>Percent of demand</u>	<u>Tons</u>	<u>Percent of demand</u>	<u>Tons</u>	<u>Percent of demand</u>
Nitrogen	424,000	4.2	900,000	9.5	476,000	5.3
Phosphate	649,000	10.9	800,000	13.1	151,000	2.2
Potash	-380,000	- 7.3	(a)	(a)	(a)	(a)

a

Supply considered tight but adequate to at least 1980.

FACTORS CONTRIBUTING TO THE SHORTAGE

1. Increased domestic demand.

--Agriculture experts estimate that 30 percent of U.S. crop production results from use of fertilizer.

--To increase crop production, the application of nitrogen in 1974 increased by 3.5 pounds an acre to an average of 55.3 pounds an acre planted.

--In 1973 and 1974, 62 million acres of additional cropland were released from Federal set-aside programs to increase U.S. grain supplies. (This was in addition to the 290 million acres harvested in 1972.)

2. Increased exports.

--Wage-price controls imposed beginning in 1971 froze domestic fertilizer prices.

--World fertilizer prices moved above domestic levels. Late in 1973 world prices were more than double domestic prices and provided a strong incentive to increase exports.

--Dollar devaluation created additional foreign demand for fertilizer because it, in effect, discounted fertilizer prices quoted in dollars.

--Over the past several years, net exports of nitrogen and phosphate generally increased. Potash imports far exceeded exports. Agency for International Development (AID) exports averaged about 11 percent of total fertilizer exports.

3. Logistic problems.

--Traditionally, transporting fertilizer from inventories to retail distributors has been a problem, particularly during February and March when large tonnages must be moved and enough railcars may not be available to move them.

--Because of large sales and movements of grain in the international and domestic markets, weekly railcar shortages on class I railroads increased over 700 percent from August 1972 (4,800 cars short) to September 1973 (34,500 cars short).

--In 1973 shipments of mined phosphate rock (raw material) to production plants as well as shipments of the finished product from plant to market were curtailed because of limited railcar facilities. Phosphate rock producers estimated that shipments were cut by almost 600,000 tons.

--During the 1974 crop year, the shortage of railcars to move fertilizer continued. The reported weekly shortage late in February 1974 was about 2,000 cars.

4. Plant expansion problems.

- There was a backlog of orders for new plants and equipment.
- A plant which produces ammonia used in producing nitrogen fertilizer takes 3 to 4 years to construct. Such plants are very complex.
- The worldwide demand for American-built plants delayed domestic deliveries. Canceling foreign orders would have caused losses in international trade and goodwill.

5. Curtailments of natural gas.

- Natural gas is the raw material used in producing ammonia and ultimately in producing nitrogen fertilizer.
- On the basis of industry estimates and applicable conversion factors (see p. 12), natural gas curtailments resulted in the following minimum reductions of ammonia production from desired production levels.

<u>Year</u>	<u>Ammonia for fertilizer</u>	<u>Nitrogen</u>
	(tons)	
1970	87,800	72,000
1971	123,000	100,900
1972	141,000	115,600
1973 (note a, b)	236,300	193,700
1974 (note b)	173,300	142,100 (note c)

a

Estimated by the Department of Commerce.

b

Fiscal year.

c

Represents 34 and 16 percent, respectively, of the fiscal year 1974 nitrogen shortage estimated by Government and industry. (See p. 1.)

ALTERNATIVES

1. Drawbacks to widespread, general use of animal wastes (manure).

--weight and relatively low nutrient value of manure make transporting it more than 25 miles not economically feasible (generally).

--Animal wastes are slow acting.

--Pollution problems result.

--Cattle feedlots were operating at reduced capacity, limiting available manure.

--It is difficult to determine the amount of nitrogen actually being applied to the land and the rate at which the nitrogen will become available for plant uptake.

2. Restricting fertilizer use for nonagricultural purposes.

--Nonfarm fertilizers are special mixes and are not economically efficient grain producers.

--Enforcement and control of restriction would be difficult.

--Nonfarm fertilizer use is probably 5 to 10 percent of total fertilizer use.

EFFORTS TO ALLEVIATE THE SHORTAGE

1. Establishment of Government interagency panel on the fertilizer situation.

--The panel worked with the Interstate Commerce Commission to make 1,000 additional railcars available weekly for fertilizer shipments.

--The panel encouraged the Federal Power Commission to grant priority relief to fertilizer producers whose natural gas supplies were being curtailed.

2. Reduction of fertilizer exports.

--In October 1973 the Cost of Living Council exempted fertilizer and nutrient materials used in fertilizer production from price controls in exchange for the industry's promise to redirect 1.5 million tons of fertilizer from foreign to domestic markets.

- AID-assisted countries were notified that AID-financed fertilizer was to be limited to the particular country's needs for the next planting season and was not to be stockpiled.
- AID-financed fertilizer purchases were curtailed from February through May 1974 when most of the fertilizer used by U.S. farmers was being distributed.
- From fiscal year 1973 to fiscal year 1974, AID awards of fertilizer to assisted countries from U.S. sources decreased by 109,000 metric tons.

3. Production capacity increased.

- Industry reopened six ammonia plants and deferred closing two others (combined total of 764,500 tons annual capacity).
- Old and obsolete ammonia plants were cannibalized for parts usable in plants being reassembled at locations where natural gas supplies were available.

CHAPTER 2

THE PRESENT
(FISCAL YEAR 1975)

THE SITUATION

The Department of Agriculture believed the fertilizer situation in fiscal year 1975 would not be as critical as they had estimated late in 1974. Two of the Department's assessments for fiscal year 1975 are compared below.

Estimated Tons of Fertilizer Surplus or Shortage (-)
Fiscal Year 1975

	<u>Estimated supply</u>	<u>Estimated range</u>		<u>Surplus or shortage (-)</u>	<u>Percent of demand</u>
		<u>Demand</u>			
(000 omitted)					
September 1974 estimate:					
Nitrogen	10,347	10,100 to	11,150	247 to -803	2.4 to -7.2
Phosphate	6,002	5,373 to	6,225	629 to -223	11.7 to -3.6
Potash	5,958	5,008 to	5,617	950 to 341	19.0 to 6.1
May 1975 estimate:					
Nitrogen	10,750	9,959 to	10,965	791 to -215	7.9 to -2.0
Phosphate	6,053	5,833 to	6,593	220 to -540	3.8 to -8.2
Potash	6,441	5,555 to	5,973	886 to 468	15.9 to 7.8

Note: The higher estimated demand figures assume good weather and favorable crop prices.

According to Agriculture officials, less favorable crop to fertilizer price relationships and bad weather which prevented application of fertilizer to farm acreage slowed fertilizer purchases this season (1975 crop year). As shown below, crop prices in 1975 sagged below their 1974 levels whereas fertilizer prices generally increased.

Price Indexes (1967 = 100)

	<u>April</u>		<u>Percent of change</u>
	<u>1974</u>	<u>1975</u>	
Crop prices	205	188	-8
Fertilizer prices	178	237	33
Price ratio--crop- to-fertilizer	1.15	.79	-31

This schedule shows that this April's crop-to-fertilizer price ratio was about one-third below last April's price ratio. This changed price situation caused farmers to reevaluate their fertilizer needs and, according to Agriculture officials, has been a major reason for reduced fertilizer consumption.

CONSUMPTION

The Department of Agriculture assembled reports from 16 States, for which comparable data was available, showing that the total consumption of fertilizer materials and mixtures for the 9 months ended March 1975 was 16 percent less than for the same period a year earlier. The drop was from 12.47 to 10.45 million tons. The 16 States are:

Alabama	Kentucky	Missouri	South Carolina
Arkansas	Louisiana	North Carolina	Tennessee
Florida	Maryland	Ohio	Texas
Georgia	Mississippi	Oklahoma	Virginia

PRODUCER INVENTORIES

As shown in the following table, producers' inventories of nitrogenous and phosphatic fertilizer--the two nutrients that were in short supply in 1974--have increased.

TABLE

Producers' Fertilizer Inventories

Commodity	January		Percent of increase or decrease (-)	February		Percent of increase or decrease (-)	March		Percent of increase or decrease (-)
	1974	1975		1974	1975		1974	1975	
	(thousand tons)			(thousand tons)			(thousand tons)		
Nitrogenous:									
Anhydrous ammonia	879.1	1,327.3	51.0	1,116.8	1,555.3	39.3	1,047.5	1,573.1	50.2
Ammonium nitrate	498.0	272.2	-45.3	427.7	214.1	-49.9	345.2	201.2	-41.7
Ammonium sulfate	124.0	163.6	-11.1	226.8	211.5	-6.7	116.3	191.6	64.7
Total	1,561.1	1,763.1	12.9	1,771.3	1,980.9	11.8	1,509.0	1,965.9	30.3
Phosphatic:									
Phosphoric acid	86.2	176.9	105.2	126.1	168.9	33.9	109.1	182.1	66.9
Concentrated superphosphate	112.8	163.7	45.1	111.3	171.2	53.8	92.8	180.1	94.1
Ammonium phosphate	110.0	131.3	19.4	106.2	137.3	29.3	126.6	152.2	20.2
Total	309.0	471.9	52.7	343.6	477.4	38.9	328.5	514.4	56.6

PRODUCER PRICES

Department of Commerce information shows that fertilizer prices have increased but that, for most fertilizer compounds, prices in fiscal year 1975 seem to be leveling off or increasing at a slower pace.

Producer Prices of Fertilizer

Commodity	October 1973	October 1974	April 1975	Percent of increase	
				October 1973 to October 1974	October 1974 to April 1975
<u>(per ton)</u>					
Nitrogenous:					
Anhydrous ammonia	\$65	\$160	\$210	146	31
Urea	72	175	175	143	0
Ammonium nitrate	62	115	115	85	0
Phosphatic:					
Phosphoric acid	78	157	173	101	10
Concentrated superphosphate	55	140	140	155	0
Ammonium phosphate	75	165	165	120	0

NATURAL GAS CURTAILMENTS

Natural gas supplies for ammonia producers continued to be curtailed during fiscal year 1975. On the basis of industry estimates, such curtailments resulted in nitrogen production being at least 218,900 tons below desired production levels. Although this reduction represents only a small part (about 2 percent) of the total fiscal year 1975 demand for nitrogen fertilizer estimated by the Department of Agriculture in May 1975, it could represent more than the maximum possible nitrogen fertilizer shortage estimated by the Department at that time. (See p. 8.)

FERTILIZER TASK FORCE

In September 1974 an Interagency Fertilizer Task Force, made up of representatives of the President's Council of Economic Advisors, the Domestic Council, and six Federal agencies ^{1/}, met for the first time. The objectives of this group were to (1) monitor the fertilizer supply-demand situation, (2) take immediate action on short-term supply bottlenecks, and (3) promote action to increase production capacity over the long run. Among other things, the Task Force has been working with the Census Bureau to improve accuracy and to shorten timelags in collecting and reporting fertilizer production statistics. This includes coordination to insure that data on output from new plants is collected and reported.

In March 1975 the President's Economic Policy Board Executive Committee recommended that the Task Force

- continue to monitor the fertilizer export situation;
- update and closely monitor plant capacity construction;
- identify ways to improve the data information system for fertilizer, in particular statistics on retail prices, inventories, and production; and
- coordinate U.S. Government international activities relating to fertilizer.

1

Departments of Agriculture, Commerce, and the Treasury; Federal Power Commission; Federal Energy Administration; and Office of Management and Budget.

The Task Force has addressed each of the recommended areas. A Task Force member said that the group should continue to function as long as interest continues in the fertilizer situation.

The continued operation of the Task Force should enable the Government to detect and take steps promptly to help alleviate serious fertilizer supply problems in the United States. The Task Force also can serve as a focal point for producers, consumers, and others to register their views, suggestions, and complaints.

CHAPTER 3

THE FUTURE

Although the fertilizer supply situation seems to have eased, some shortages could continue to develop, depending on such things as availability of raw materials, production, weather, and the relative prices of crops and fertilizer.

NITROGEN

Estimated Annual Demand for Nitrogen by 1980

	<u>Tons</u> (millions)
Industry	13.5
Department of Agriculture	12.3
Tennessee Valley Authority (TVA)	12.5

The industry figure is based on an estimated 7-percent increase in demand in 1975 and a 5-percent increase in demand each year thereafter; the TVA figure projects a 6-percent increase in demand each year through 1980; and the Agriculture figure is based on the estimated number of acres required to produce the food and fiber needed to satisfy domestic and export needs by 1980 and estimated fertilizer application rates. On the basis of currently announced and planned plant expansions, the United States should be able to approach the highest of these projected demand levels sometime between 1978 and 1980.

Planned increases in ammonia capacity

Construction is underway and additional orders have been placed to increase U.S. ammonia capacity and nitrogen production. A July 1975 TVA report showed that the industry planned to increase its annual ammonia production capacity from 17.6 million tons in 1974 to 25.6 million tons in 1978--an 8 million ton increase. This expansion includes the construction of 18 new ammonia plants. As shown in the following calculations, the planned expansion represents a potential increase of 3.97 million tons a year in agriculture nitrogen supplies by 1978.

Net increase in annual ammonia production capacity (note a)	7.18 million tons
Average percent-of-capacity operating rate of ammonia plants	<u>x90</u> percent
Ammonia produced	6.46 million tons
Percent of ammonia used to produce nitrogen fertilizer	<u>x75</u> percent
Ammonia used in nitrogen fertilizer production	4.84 million tons
Rate of conversion to nitrogen fertilizer	<u>x82</u> percent
Nitrogen fertilizer produced	<u>3.97</u> million tons

a
This excludes 850,000 tons of possible additional production capacity--510,000 tons for one planned plant for which natural gas supplies have not been committed and 340,000 tons for a planned plant that would use coal as a raw material.

If nitrogen fertilizer import and export levels remain at 1974 levels, net annual domestic nitrogen supplies in 1978 could total about 13.9 million tons. Nitrogen supplies of this magnitude would exceed Government and industry estimates for annual domestic nitrogen demand by 1980.

Planned Expansion of Ammonia Plant Capacity

<u>Calendar year</u>	<u>Increased capacity</u>	
	<u>Ammonia</u>	<u>Nitrogen</u>
	(tons)	
1975	1,217,000	674,000
1976	325,000	180,000
1977	2,695,000	1,492,000
1978	<u>2,940,000</u>	<u>1,627,000</u>
Total	<u>7,177,000</u>	<u>3,973,000</u>

In addition to the above, two large plants are under construction in Canada and three more are planned for construction. These plants are scheduled to start production by 1978 and would add a total of 2.1 million tons to Canada's annual production capacity. Some of this additional Canadian production may find its way to the U.S. market.

Limited natural gas supply for ammonia production

Limited natural gas supplies will continue to be a problem for several years and could reduce potential nitrogen fertilizer production. Limited gas supplies have also made plant expansion difficult. According to industry officials, there should be at least a 15-year guaranteed supply of natural gas before construction is approved for new ammonia production facilities. Producers have had some trouble obtaining guaranteed natural gas supplies. Currently, a commitment of gas supplies has not been obtained for one planned plant which will have a 510,000 ton annual capacity.

Industry officials maintain that, because of Federal regulation, natural gas supplies are limited and additional transportation problems will occur, because plants are being built where unregulated (intrastate) gas is available--far from end-use areas.

PHOSPHATE

Government and industry estimate that increased production capability should allow the United States to reach a supply-demand balance in phosphate fertilizer (P_2O_5) in 1975. Industry has estimated net annual demand at 6.7 million tons by fiscal year 1976. The Government has estimated 1980 requirements at 5 to 6 million tons. In May 1975 the Department of Agriculture estimated the U.S. phosphate supply for fiscal year 1975 at 6.05 million tons.

TVA has estimated that expansion and new construction increased domestic phosphate production capacity by 2 million tons during 1974 and should increase it by an additional 1.2 million tons between 1975 and 1978, bringing the U.S. capacity to a total of 9.95 million tons annually--well above the estimated demand.

The level of phosphate fertilizer exports will have a major effect on the adequacy of domestic supplies to meet future farmer demands. How much is exported will depend on

existing industry contracts with foreign buyers and foreign and domestic price levels. Phosphate fertilizer net exports during the past several years are shown below.

<u>Fiscal year</u>	<u>Tons</u>		<u>Net exports</u>
	<u>Imports</u>	<u>Exports</u>	
	(000 omitted)		
1971	283	898	615
1972	326	1,102	776
1973	312	1,422	1,110
1974	315	1,546	1,231
1975	275	1,751	1,476

Possible problem in obtaining adequate quantities of phosphate rock--a raw material for phosphate fertilizer

Additional phosphate rock supplies will be needed not only to satisfy current and planned production but also to increase or maintain inventories. The bulk of the phosphate rock used in U.S. fertilizer production is domestically mined. Although domestic mining of phosphate rock increased during the past 5 years from 38.7 to 45.7 million tons annually, the increase in consumption has been higher and phosphate rock inventories have been decreasing. Between 1971 and 1974, U.S. phosphate rock inventories decreased from 13.7 to 7.5 million tons. Efforts will be needed to further increase production and/or to cut back on exports. As shown below net exports of phosphate rock represent a large part of the domestically mined tonnage.

<u>Fiscal year</u>	<u>Tons</u>		<u>Net exports</u>
	<u>Imports</u>	<u>Exports</u>	
	(000 omitted)		
1971	84	12,587	12,503
1972	55	14,275	14,220
1973	65	13,875	13,810
1974	182	13,897	13,715

Equipment shortages and increased environmental control considerations have increased the length of time required to obtain and put into operation the dragline equipment

needed to strip mine phosphate rock. Currently, it takes 4 to 5 years to obtain and use such equipment--an increase of about 2 years since 1971. However, this problem seems to be short term. Thirteen draglines are due for delivery before 1977.

POTASH

A TVA official has estimated that potash supplies should be adequate for the next 3 to 4 years, provided that there are free trade conditions between Canada and the United States. The United States receives over 50 percent of its potash supplies from Canada. The fertilizer industry estimates that potash supplies will be tight but adequate, at least to 1980. However, continued adequate potash supplies will depend upon increased Canadian production and continuing free trade conditions between Canada and the United States.

SUMMARY OF OBSERVATIONS ON THE FUTURE

Until industry has time to expand its capacity and replenish depleted inventories, future fertilizer shortages will depend to a large extent on the weather and relative crop and fertilizer prices. However, it looks as though anticipated capacity should be adequate to supply the highest estimated demand for phosphate and nitrogen fertilizers in 1975 and 1978, respectively. Potash supplies are considered tight but adequate to at least 1980.

Limited supplies of natural gas will continue to be a problem for nitrogen producers.

The Interagency Fertilizer Task Force seems to be a good mechanism for monitoring the fertilizer situation and taking steps to help alleviate problems that arise.

Although the Task Force is working on ways to improve data collection of retail price statistics, it does not plan to interfere with the free market pricing system. It recognizes that higher fertilizer prices have adversely affected the farmer but believes that higher prices also have provided the investment incentive necessary for industry to expand production capacity.

SELECTED PUBLICATIONS RELATING TOTHE FERTILIZER SITUATION

Harre, Livingston, and Shields, World Fertilizer Market Review and Outlook, Tennessee Valley Authority, 1974.

Mahan and Stoike, The Fertilizer Supply 1974-75, Agricultural Stabilization and Conservation Service, U.S. Department of Agriculture, April 1975.

North American Production Capacity Data, National Fertilizer Development Center, Tennessee Valley Authority, periodic.

United States and World Fertilizer Outlook 1974 and 1980, Economic Research Service, U.S. Department of Agriculture, May 1974.

Fertilizer Progress, The Fertilizer Institute, periodic.

1975 Fertilizer Situation, Economic Research Service, U.S. Department of Agriculture, December 1974.

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Additional information on the fertilizer situation is available in the various factsheets and statistical publications prepared by the U.S. Departments of Agriculture, Commerce, and the Interior and the Tennessee Valley Authority.

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