OUTLOOK FOR NITROGEN FERTILIZERS

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ABSTRACT

The nitrogen fertilizer outlook is clouded by rising feedstock costs, uncertainty of feedstock supplies, and the changing role of traditional world suppliers. Nitrogen plant construction continues, however, and potential supplies appear adequate. The United States' nitrogen market is experiencing high feedstock costs and oversupply, and increased imported nitrogen has brought about several plant closures. Strong demand for agricultural products is expected to increase nitrogen application. Logistics problems will exist in many areas. Urea continues to gain in importance as capacity additions far outstrip those of other nitrogen products. In the United States, however, nitrogen solutions are gaining in importance.

This paper describes today's market situation and the market trends that are expected in the next few years. More important, however, it discusses the market factors that should be watched and evaluated by foresters as they attempt to carry out an economically sound, long-term forest fertilization program.

FERTILIZER MARKETS

Fertilizer markets are characterized by steady, long-term growth in demand while supply levels show a classic commodity market cycle. The typical pattern is one of a short period of undersupply, followed by an abrupt shift to excess capacity and production, and finally a long, slow return toward equilibrium as demand moves upward to meet the potential supply availability. These periods of under- and oversupply are caused in part by both the weather-related cyclical agricultural market and the cyclical nature of the nation's chemical processing industry.

Compared with the use of fertilizer on the nation's major crops (corn, wheat, cotton, and soybeans) forest fertilization has little impact on the overall fertilizer supply-demand cycle. Yet forest fertilization programs are based on the same economic factors as those of the Iowa corn farmer or the Kansas wheat grower, and keeping abreast of market changes is just as important.

The fertilizer market in recent years has had some rapid shifts in supply-demand balances, with large increases and decreases in fertilizer prices from one month to another. New market factors have come into the picture in recent years that have been responsible in part, along weather-related problems in some areas of the world, for the accelerated changes that are now taking place. The outlook for fertilizers and the N market is expected to change rapidly in the coming years and is very difficult to assess.

THE AGRICULTURAL OUTLOOK

United States fertilizer markets are directly tied to the fortunes of the farmer both in the United States and throughout the world. The market has been through some hectic periods recently, related mostly to the rise and fall of crop prices that are received by the farmer. Farm commodity prices have been in a long decline from their peaks of 1973 when the United States sold off grain reserves to Russia and the specter of a world food shortage was seen as imminent. In 1974 crop acreage controls were abolished; and with the help of several years of excellent weather conditions for crop production, U.S. farmers were able to rebuild crop carryover stocks, forcing prices generally lower. Since October 1977, the new Farm Bill effectively placed a floor under U.S. grain prices, the market stabilized, and prices turned upward.

In the last few months, however, commodity prices have increased sharply as once again poor crops in Russia and several other parts of the world have brought about an increase in demand for U.S. commodities in world agricultural markets. Estimates of total agricultural exports for the year ending September 1979 approach $32 billion—a 17% increase in total value and a 5% increase in the total volume entering the world market. Preliminary estimates for 1980 are placed at $38 billion (USDA 1979), based primarily on continued increases in U.S. commodity prices. Any time the farmer expects higher prices for what he produces he uses every way possible to expand his production, such as planting more acres and increasing fertilizer application rates. With projected large-scale increases in farm income, the 1980 fertilizer market is now expected to exceed the record tonnage level of 51.6 million tons (46.8 million metric tons [t]) set in 1977.

There is a direct relation between fertilizer use by the farmer and ratio of crop prices to fertilizer prices. When crop prices are rising and fertilizer prices remain steady, such as in 1974,

fertilizer demand rises sharply. When fertilizer supply does not keep pace with the demand and prices increase, farmers do not increase fertilizer application rates and demand growth is flat. Or if, as in 1975, fertilizer prices should increase in the face of declining crop prices, the demand fails. Total fertilizer use in 1975 was off about 10% as crop-fertilizer price ratios were at their all-time low levels.

Thus, a word of caution should be injected into the outlook for 1980. Fertilizer prices have been on the increase during most of 1979, pushed higher by exogenous factors that in the past seemed to have no bearing on the supply situation in the United States. If fertilizer prices should go too high in relation to grain prices, then fertilizer demand in 1980 will not increase as expected.

WORLD NITROGEN OUTLOOK

One of the factors that has a profound effect on the U.S. N market is the outlook for world N supply. A year ago it appeared that world N prices would not increase because the world's N producers had scheduled more than ample potential production to meet expected demand increases for 1980 and beyond. This expansion of N capacity was brought about by the high price levels of 1975 and several years in which demand exceeded supply, drawing down world inventories to very low levels. With the proposed expansion begun in 1977 it looked as if supply would be more than enough to meet demand until at least 1985 (Harris and Harre 1979).

In the past an imbalance in the world market would have had little or no effect on the U.S. market situation, but the world market share for U.S. producers has declined to 20% of total world capacity and no longer are domestic prices being determined only by domestic market conditions. Today, and increasingly in the future, N markets and prices will be determined by events in Russia, the Middle East, China, Mexico, and other areas far removed from the Iowa corn belt or the forest lands of the Pacific Northwest.

FEEDSTOCKS FOR NITROGEN PRODUCTION

The reason for the change in the world N market can be summed up in one word—feedstocks. A shortage of hydrocarbons to supply H to world ammonia plants has completely altered the role of the United States in the world N industry. Natural gas is used to produce over 95% of the N fertilizers used in the United States. Its price has risen sharply as demand has been high and U.S. production has been on the decline. In 1978 almost 4.0 million tons (3.6 million t) of ammonia capacity stood idle because high feedstock costs did not allow these plants to remain competitive in U.S. markets. On the world scene, Japan was forced to close half its N and urea capacity because of high feedstock prices. Western Europe, another traditional world supplier, also faces the same problems as almost a third of its N production is based on imported, high-cost raw materials (Douglas and Harre 1979).

Higher feedstock costs and the question of availability of supply at any cost will be leading factors in shaping the world N market in the coming years. Currently the United States ranks a distant third behind Russia and Iran in total proven natural gas reserves. In the past 7 yr, our actual natural gas production has declined by 13%, but production has risen some 150% in Asia and almost 90% in the communist countries (Seaton 1979).

The availability of low-cost natural gas has attracted a large investment in new ammonia capacity to these two areas. Between 1980 and 1985 it is expected that total world N capacity will increase by 18.7 million tons (17.0 million t). Forty percent of this increase will be in Asia, 30% in Russia, but only 5% in the United States, Western Europe, and Japan—the traditional world suppliers (Table 1). As this new capacity comes into production it will create a dramatic shift in world N trade patterns in the years ahead.

Many countries that are rich in natural gas reserves have little or no domestic market for N and must either export their output or not produce at all. Also, over half of the world's N capacity will be controlled by government corporations. These public-sector agencies operate under a much different set of economics than U.S. producers, who function in a competitive market both for fertilizer and for alternative use of their feedstock supplies (Shields and Harre 1978).

THE U.S. NITROGEN OUTLOOK

As the 1980 fertilizer year begins, the United States has almost 4 million tons (3.6 million t) of ammonia capacity standing idle. Yet the outlook for N is one of inadequate supplies if demand growth in 1980 is as large as expected. Reasons for this current paradox can be found by examining events of the past several years.

Table 1. Regional ammonia capacity changes (in millions of tons of N and percentage of 5-yr growth; Shields and McIntyre 1979).

Region	1980	1985	%
North America	19.2	19.2	
Latin America	4.9	7.5	14
Western Europe	17.7	18.0	1
Eastern Europe	11.9	13.7	9
USSR	21.4	27.2	32
Africa	3.2	3.9	4
Asia	27.0	34.5	40
Oceania	0.4	0.4	
World	105.7	124.4	100

United States ammonia producers completed an expansion program in 1978 that raised the nation's capacity by 28% in a 5-yr period (Harre and Handley 1978). During this same time total U.S. N fertilizer demand increased only 9% (Hargett and Berry 1979). There was too much production for the market to absorb, inventory began to climb, prices fell, and plants were forced to close (Table 2). Several of the new plants, upon completion of construction, went through trial runs and were shut down for several months waiting for market conditions to improve.

At the same time N imports from other countries began to enter the United States, and in 4 of the past 6 yr a N trade deficit was recorded—the first since 1965 (Mahan and Stroike 1979). The cost of natural gas went up sharply in response to the escalation of petroleum and energy prices throughout the world. Older, inefficient ammonia plants could not remain competitive in the face of both higher production costs and relatively low-priced imported ammonia. Today the nation's ammonia capacity stands at 16.7 million tons (15.2 million t) of N with a strong possibility of further closures and no new projects anticipated.

At the beginning of the 1980 fertilizer year the N market began to change. Prices of N materials rose sharply as plants around the world began to close or curtail production because of high feedstock costs. United States producers were able to import large amounts of ammonia, convert it to N products such as urea and ammonium nitrate, and, along with diammonium phosphate, increase deliveries of these secondary products to the world market. Preliminary estimates indicate that a net trade surplus of 308,000 tons (279 400 t) N was achieved by the United States for fertilizer year 1979.

With higher prices received for these materials and the increased tonnage delivered, U.S. producers were able to keep an ample number of plants in operation to maintain their ability to provide the needed materials for the U.S. market despite the threat of low-priced imported materials and high-priced feedstocks.

In the next few years however, serious questions face U.S. N producers. If the currently idle capacity can be brought back into production, the national will have adequate capacity to meet expected demands; but this capacity will reopen only if ammonia prices are high enough to cover the cost of production from these plants. This also assumes that feedstock supplies will be available, which may or may not be the case.

Finally, looming overhead is the possible overcapacity for worldwide N production that has already been scheduled but is now delayed by current market conditions. If higher world prices serve to reactivate some of these projects, there will be no shortage of N by the mid-1980's. The medium-term N outlook is clouded by many variables and at this time no clear pattern has emerged.

OUTLOOK FOR NITROGEN MATERIALS

Urea is now the leading N fertilizer materials in the world market. High analysis saves transportation and handling costs and urea can be used on almost all crops. Production costs are generally lower because the large-scale, single-train ammonia-urea complexes take advantage of economies of scale. Disadvantages include a lack of compatibility with some phosphate materials and the need for skilled management to achieve maximum benefits.

A comparison of world urea and ammonia capacity indicates the rapid growth in market share that urea has achieved. In 1967 urea capacity accounted for 22% of total ammonia capacity, while in 1979 it had jumped to 38%. By 1985, based on current announcements, urea will be 41% of ammonia capacity. In Asia, urea represents almost two-thirds of all N capacity while in the developed regions it is a third of the total. (Records of Economics and Marketing Research Section, National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Ala., October 1979).

Urea does not command as high a share in the U.S. fertilizer

Table 2. U.S. nitrogen production demand, and prices (in millions of tons of N and dollars per ton N; USDC Bureau of Census 1974–1979a,b,c; USDA Crop Reporting Board 1974–1979, 1979).

Fiscal year	Capacity[a]	Production[b]	Inventory[c]	Export	Import	Fertilizer consumption	Retail price[d]
1974	14.12	12.84	0.69	1.13	1.04	9.16	223
1975	15.08	13.07	1.46	1.01	1.06	8.61	323
1976	15.61	13.26	1.55	1.15	1.16	10.41	233
1977	17.68	13.66	1.35	1.18	1.84	10.65	229
1978	18.06	14.34	2.18	1.72	1.87	9.97	216
1979	16.70	14.12	1.88	2.47	2.16	10.64	209

[a]Records of Economics and Marketing Research Section, National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Ala., October 1979. [b]Includes production for both fertilizer and nonfertilizer markets. [c]Ending inventory June 30. [d]Ammonia retail price per unit ton of N.

market because of the predominant use of fluid fertilizers. In 1978, however, urea surpassed ammonium nitrate as the leading solid N reported for direct application in the United States (Table 3). It is expected that urea will continue to gain in importance in the U.S. market. A review of recent capacity changes shows little addition to solid ammonium nitrate capacity while there has been a continued growth in the nation's capacity for solid urea—especially in granular form. Granular urea, which can be used in bulk-blended mixed fertilizers without segregation, will continue to gain in importance in the coming years.

The use of ammonium nitrate, while still an important segment of the N fertilizer market, has been in a steady decline since reaching its peak in 1973. Production of total ammonium nitrate has continued to increase but primarily for use in N solutions (Table 4). All indications are that the U.S. fertilizer market is moving toward the greater use of fluid fertilizers, for both direct application of N and as complete mixtures. The ease of handling and the greater flexibility in use for either preplant or sidedress applications are primary reasons for the shift from dry to liquid materials.

IMPLICATIONS FOR FOREST FERTILIZATION PROGRAMS

The N fertilizer market gives every indication of remaining cyclical in nature, with periods of short supplies and rising prices followed by overexpansion and excess supply levels. With close ties to energy supplies there will be continued upward pressure on N prices, but large-scale overexpansion of capacity, forcing sharply lower prices, may be a thing of the past. Yet by careful monitoring of the world and national agricultural situations and the world N fertilizer market, there will remain opportunities to develop a successful forest fertilization program.

Studies of retail fertilizer outlet have shown that procurement practices are the most important item in the success of the retailer (Foster et al. 1979). The same is true for the buyer of fertilizer for forest fertilization. Protection can be provided from wide market supply and price movements through larger storage capacities and lower inventory turnover. This allows increased flexibility and minimizes any disruption of supplies by poor weather conditions and the transportation problems that get worse every season, and will enable the buyer to take full advantage of any overreactions of suppliers or farmers to market conditions.

Decisions to apply fertilizer and at what level are the same for the forester as for the corn or wheat farmer. As long as the value of the increased yield covers the increased cost of materials, fertilizer demand will remain strong. A fertilizer procurement program must be designed to get the maximum value from each pound of fertilizer used at a minimum cost.

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Table 3. U.S. Consumption of nitrogen direct-application materials (in thousands of tons of N; USDA Crop Reporting Board 1979, Hargett and Berry 1979).

Year	Ammonia	Nitrogen solutions	Ammonium nitrate	Urea
1973–74	3427.7	1184.5	1061.7	467.9
1974–75	3294.8	1191.7	941.9	524.2
1975–76	4025.3	1620.3	985.6	729.3
1976–77	4040.3	1685.0	936.9	855.3
1977–78	3721.3	1591.9	820.4	880.8
1978–79	4003.8	1723.9	841.3	967.0

Table 4. U.S. production of nitrogen fertilizer materials (in thousands of tons of N; USDC Bureau of Census 1974–1979a, U.S. International Trade Commission 1974–1977).

Year	Ammonium nitrate		Urea		Nitrogen solutions
	solution	solid	solution	solid	
1974	836.8	1273.3	605.6	645.8	2101.8
1975	804.5	1095.8	649.6	673.9	2067.8
1976	776.5	1179.5	542.7	1094.9	2117.1
1977	830.6	1059.5	663.1	1207.8	2468.1
1978	892.7	994.3	1246.1	1038.8	2432.5

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