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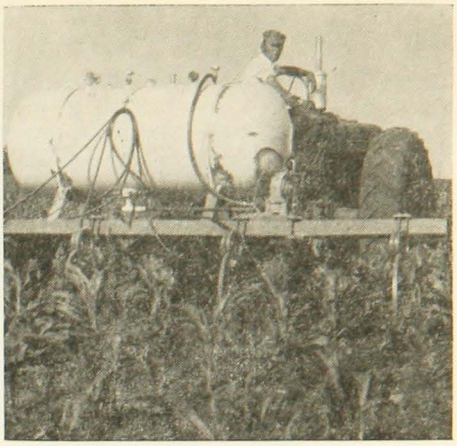

The position of smaller fertilizer retailers will probably continue to deteriorate as operating costs rise and farmers look to their farm supply dealers for associated services.

The Costs of Retailing Fertilizer in Minnesota

Robert A. Rathjen, Assistant Professor, Department of Agricultural Economics Oklahoma State University

Dale C. Dahl, Professor, Department of Agricultural and Applied Economics University of Minnesota

The Minnesota fertilizer industry has changed rapidly over the past decade. Consumption of fertilizer materials for agricultural use increased from 538,000 tons in 1960 to over 1.5 million tons in the state in 1969.[1]

In 1959, there were 29 licensed fertilizer plants registered to operate in Minnesota. By 1966 the number of licensed plants had increased to 204, and by January 1970 there were 511.[2] Besides the licensed outlets, there were an estimated 839 nonlicensed retailers handling fertilizer for agricultural use. This means that approximately 1,350 retail commercial fertilizer firms were operating in Minnesota in 1970.

The rapid increase in the number of licensed fertilizer outlets was accompanied by a change in the ownership structure of these firms. Prior to 1964, almost all licensed fertilizer retail outlets were owned and operated by farmer cooperatives and independent businesses. By 1970, an estimated 150 integrated (manufacturer-owned) outlets were operating in Minnesota, along with 200 farmer cooperatives and 161 independent dealers.

Excess manufacturing capacity at the national level, technological changes, and the increase in retailing capacity in Minnesota have created severe competitive pressures for the fertilizer industry in the state. Small volume outlets and specialized fertilizer outlets are finding it increasingly difficult to compete with large volume, multi-product competitors.

This article reports some analyses and findings of a study of the Minnesota fertilizer industry conducted in 1970.[3] Specifically, it presents findings concerning the size distribution of anhydrous ammonia outlets and dry bulk blending outlets, and it presents estimates of the cost of retailing these two types of fertilizer materials.

THE STUDY

This study examined, among other things, the retailing costs by size of the outlet for anhydrous ammonia and dry bulk blends. It also examined the relationship between costs and the internal structure of the firm with respect to the number of commodities handled. Costs were estimated for specialized anhydrous ammonia and dry bulk blending outlets and for these same two products associated with firms handling other commodities such as feed or petroleum, or an ele-

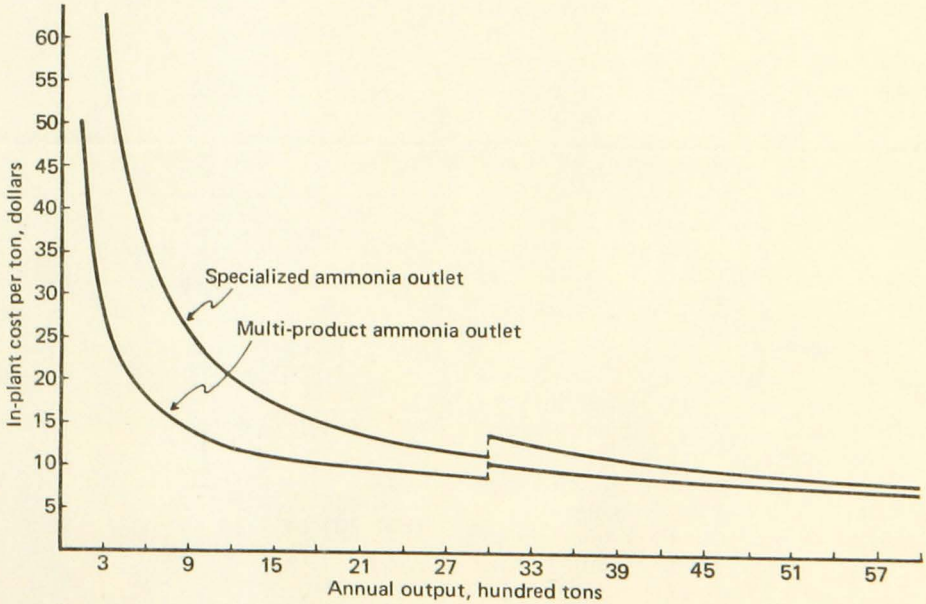

Figure 1. In-plant average total cost curves for specialized and multi-product ammonia outlets.

[1] *Consumption of Commercial Fertilizers in the United States*, Statistical Reporting Service, U.S. Department of Agriculture, Washington, D.C.

[2] Minnesota Department of Agriculture license applications. These represent plants located in the state that manufacture and/or mix fertilizer materials. Most are retail outlets. Besides in-state plants, there are large numbers of out-of-state manufacturers who are licensed to ship fertilizer materials into Minnesota for distribution.

[3] Rathjen, Robert A., *An Economic Analysis of Fertilizer Retailing in Minnesota*, Unpublished Ph.D. Thesis, University of Minnesota, December 1970. A publication reporting this study in more detail will appear later in 1971

[4] *Ibid.*, p. 67.

vator operation. The basic difference in the cost estimates between the specialized and multi-product outlets was the utilization of fertilizer department management and labor during the off-season. Fertilizer personnel could be effectively utilized in other areas of the business when not working directly on fertilizer operations and sales promotion.

In order to estimate comparable costs, hypothetical plants were constructed using current costs for buildings, equipment, labor, power, and supplies. It was assumed that an anhydrous ammonia outlet would have a 300 hour operating season and a dry bulk blending plant a 350 hour operating season, including spring and fall sales periods.

The reader should be cautioned about attempting to compare directly the costs presented in this article with a particular operational plant, even if the size and volume are similar to those used in the study. Initial investment, taxes, labor rates, etc. will vary depending on the specific location, age of the plant, and internal firm organization. The comparisons made in this article do give a general indication of the problems facing the fertilizer industry in Minnesota, particularly the small outlets.

ANHYDROUS AMMONIA OUTLETS

There were an estimated 375 fertilizer dealers handling anhydrous ammonia in Minnesota in 1970. Of this total, approximately 225 were licensed outlets. Table 1 shows the number and size distribution of ammonia plants associated with licensed fertilizer outlets. The 188 plants shown in table 1 are less than the estimated 225 because some firms reported a total for all plants rather than by individual plants. Thus, the data for the firms reporting in an aggregate manner could not be included in the table.

Approximately two-thirds of the ammonia outlets had volumes of less than 400 tons in 1969. Another 26.6 percent of the firms handled between 400 and 800 tons.

Cost Estimates

A majority of the ammonia outlets handle relatively small volumes. But little can be said about economic efficiency of the industry without cost data.

Estimated costs of retailing anhydrous ammonia are presented in figure 1. The upper curve represents the estimated cost for a specialized ammonia outlet. The lower curve represents the estimated cost of distributing ammonia through a multi-product outlet.

Industry-Cost Comparison

Using the information in table 1 and figure 1, it is possible to make some estimates of the general magnitude of costs facing outlets in the various size categories. This comparison is shown in table 2. Two facts stand out clearly in the table: (1) The multi-product outlets have a substantial cost advantage over specialized outlets. (2) Volume is critical in reducing costs for either type of plant.

Assuming a $20 retail margin, the break-even volume for a multi-product outlet is 550-600 tons. For a specialized outlet the break-even volume is 1,200-1,500 tons.

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Address comments or suggestions to Professor Arley D. Waldo, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, Minnesota 55101.

Table 1. Number and output of anhydrous ammonia retail outlets by size group, Minnesota, 1969

Ammonia output groups, tons per year	Number of outlets reporting*			
	Cooperatives	Integrated	Independent	Total
1- 399	65	20	32	117
400- 799	33	9	8	50
800-1,199	5	6	5	16
1,200-1,599	0	0	0	0
1,600-1,999	0	1	1	2
2,000-2,399	1	0	1	2
2,400 and over	1	0	0	1
Total	105	36	47	183
	Output of plants reporting, tons			
1- 399	33.7	24.6	36.1	32.5
400- 799	18,168	4,421	4,119	26,708
800-1,199	4,557	5,043	4,513	14,113
1,200-1,599	0	0	0	0
1,600-1,999	0	1,778	1,824	3,602
2,000-2,399	2,099	0	2,350	4,449
2,400 and over	2,432	0	0	2,432
Total	41,131	14,908	20,017	76,056
	Percentage of reported output			
1- 399	33.7	24.6	36.1	32.5
400- 799	44.2	29.6	20.6	35.2
800-1,199	11.1	33.9	22.5	18.6
1,200-1,599	0	0	0	0
1,600-1,999	0	11.9	9.1	4.7
2,000-2,399	5.0	0	11.7	5.8
2,400 and over	6.0	0	0	3.2
Total	100.0	100.0	100.0	100.0

Source: Minnesota Department of Agriculture.
* All licensed firms reported as required by law. However, many reported only total tonnage rather than by individual outlet, particularly in the case of integrated companies. Many nonlicensed dealers handle anhydrous ammonia and are not required to report the tonnage. The total number of anhydrous ammonia dealers in the state is estimated at 370-75.

Table 2. Comparison of ammonia cost analysis with size distribution of ammonia outlets in Minnesota, 1969

Ammonia output groups, tons per year	Number of firms in group	Percentage of all firms	Average volume, tons	Estimated cost per ton, dollars	
				Specialized firm	Multi-product firm
1- 399	117	62.2	211	87.38	38.69
400- 799	50	26.6	534	37.32	18.52
800-1,199	16	8.5	882	24.60	13.54
1,200-1,599	0	0	0	....	....
1,600-1,999	2	1.1	1,800	16.00	10.50
2,000-2,399	2	1.1	2,224	14.42	10.09
2,400 and over	1	.5	2,432	12.85	9.68

DRY BULK BLENDING OUTLETS

There were an estimated 365 dry bulk blending plants in Minnesota in 1970. Data for only 305 of these were available, however, because some firms reported a total tonnage rather than by individual outlet. Table 3 shows the size distribution of the 305 plants based on 1969 tonnage reports.

Sixty-nine percent of the plants had volumes of less than 2,000 tons. Thirty-three percent of these had volumes of less than 1,000 tons. Only 7 percent had volumes in excess of 4,000 tons.

The average volume for plants in the 1-999 ton range was 605 tons, while the average for the plants in the 8,000 and over group was 10,199 tons. Most bulk blending plants with annual volumes in excess of 6,000 tons have bagging facilities that are operated in the off-season. Plants without bagging operations probably can not exceed 7,000 tons annually because of the seasonality of fertilizer sales.

Cost Estimates

Dry bulk blending costs were estimated for plants with storage capacity ranging from 330 tons to 5,940 tons. It was believed that the plants could achieve an annual turnover rate of four and that the hourly capacity was 20 tons per hour.

Given these conditions, figure 2 shows graphically the estimated in-plant costs of selling dry bulk blended fertilizers. The upper curves represent the estimated cost for a specialized bulk blending plant, and the lower curves represent the cost for a plant associated with a multi-product firm.

The solid curves in the graph represent the per ton cost for plant sizes ranging from 330 to 5,940 tons of storage and a turnover rate of four. However, due to the seasonality of fertilizer sales, 7,000 tons would be an upper limit on the volume that could be sold in bulk form. Thus, the broken lines represent the cost to plants with more than 1,750 tons storage with no off-season bagging operations.

Two conclusions stand out in figure 2: (1) Economies of size are substantial up to about 4,000 tons. Beyond this point the curves are almost flat. (2) The differences between specialized and multi-product outlets are large for smaller plants but converge at higher levels.

Table 3. Number and output of bulk blending retail outlets by size group, Minnesota, 1969

Bulk blending output groups, tons per year	Number of outlets reporting*			
	Cooperatives	Integrated	Independent	Total
1- 999	55	11	36	102
1,000-1,999	68	17	26	111
2,000-2,999	34	8	11	53
3,000-3,999	11	0	6	17
4,000-4,999	6	1	1	8
5,000-5,999	1	2	5	8
6,000-6,999	2	0	2	4
7,000-6,999	0	0	0	0
8,000 and over	1	0	1	2
Total	178	39	88	305
	Output of plants reporting			
1- 999	35,489	6,238	19,944	61,671
1,000-1,999	97,245	24,685	37,228	159,158
2,000-2,999	76,729	19,770	24,866	121,365
3,000-3,999	36,912	0	20,547	57,459
4,000-4,999	26,942	4,060	4,503	35,505
5,000-5,999	5,654	11,086	27,253	43,993
6,000-6,999	13,101	0	12,683	25,784
7,000-7,999	0	0	0	0
8,000 and over	9,370	0	11,028	20,398
Total	301,442	65,839	158,052	525,333
	Percentage of reported output			
1- 999	11.8	9.5	12.6	11.7
1,000-1,999	32.2	27.5	23.5	30.3
2,000-2,999	25.4	30.0	15.7	23.1
3,000-3,999	12.2	0	13.0	10.9
4,000-4,999	8.9	6.2	2.8	6.7
5,000-5,999	1.9	16.8	17.3	8.5
6,000-6,999	4.4	0	8.1	4.9
7,000-7,999	0	0	0	0
8,000 and over	3.2	0	7.0	3.9
Total	100.0	100.0	100.0	100.0

Source: Minnesota Department of Agriculture.
* Not all firms reported for individual outlets. Of the 511 licensed plants in Minnesota, 360-65 are estimated to handle dry blends.

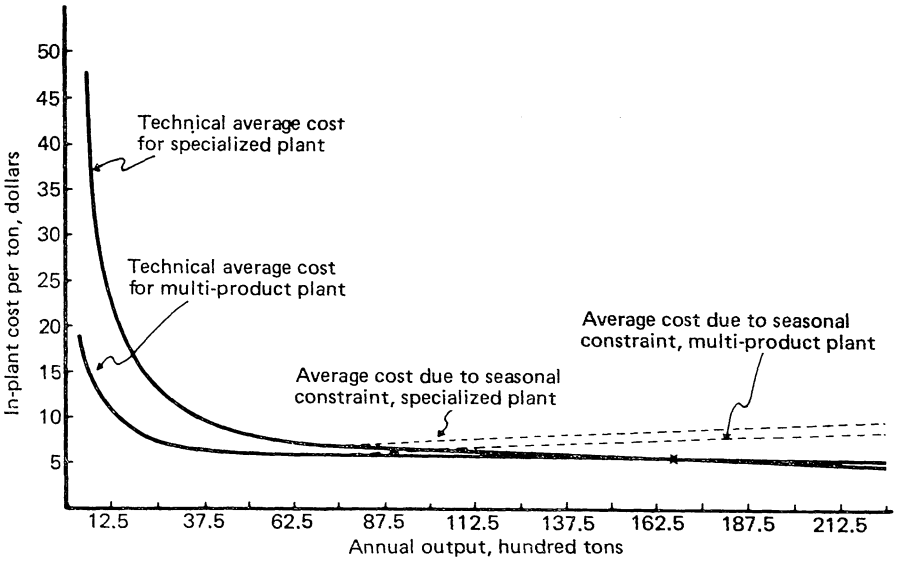

Figure 2. In-plant average total cost curves for alternative volumes for specialized and multi-product bulk blend outlets.

Costs of Retailing Fertilizers

Table 4. Comparison of bulk blending cost analysis with size distribution of bulk blending outlets, Minnesota, 1969

Bulk blending output groups, tons per year	Number of firms in group	Percentage of all firms	Average volume, tons	Estimated cost per ton, dollars*	
				Specialized firm	Multi-product firm
1- 999	102	33.4	605	40.50	16.04
1,000-1,999	111	36.4	1,434	19.46	9.66
2,000-2,999	53	17.4	2,290	13.17	7.92
3,000-3,999	17	5.7	3,380	10.60	6.98
4,000-4,999	8	2.6	4,438	9.05	6.51
5,000-5,999	8	2.6	5,499	8.09	6.22
6,000-6,999	4	1.3	6,446	7.50	6.05
7,000-7,999	0	0.0	0	...	...
8,000 and over	2	0.6	10,199	6.24*	5.66*

* These costs represent the average longrun cost permitted by economies of size. If plant storage of 1,750 tons and maximum bulk blend sales of 7,000 tons are assumed, the cost would be $7.23 per ton for the specialized plant and $5.96 per ton for the plant associated with a multi-product firm.

Industry-Cost Comparison

A comparison of the estimated cost figures with the size distribution of dry bulk blending plants in Minnesota is presented in table 4. Plants with volumes less than 1,000 tons appear to have substantially higher costs than firms with volumes over 1,000 tons.

Assuming a $12 retail margin on the cost of fertilizer materials used in the mixtures, the break-even volume for multi-product outlet is about 1,500-1,550 tons. For a specialized outlet, it is about 3,000-3,025 tons.

CONCLUSIONS

Although commercial fertilizer consumption has increased rapidly over the past decade, the increase in the number and capacity of retail outlets has occurred even more rapidly. The result has been the creation of conditions that require firms to struggle to meet the costs of selling fertilizer and make a return on investment. The fact that there were several large relatively new bulk blending facilities idle in 1970 testifies to the problem confronting the industry and individual firms.

What are the prospects for the seventies? The answer depends, in large part, on two considerations: (1) the increase in fertilizer consumption that is likely to occur, and (2) the increase in retail capacity.

Several estimates of fertilizer consumption in Minnesota for the year 1980 have been made.[4] The estimates that appear most likely to occur range from 1.9 to 2.2 million tons. This represents an average annual increase of about 3.8-4.5 percent over the 1969 consumption level.

Assuming that anhydrous ammonia consumption is around 294,000 tons in 1980 and that there is no increase in the number of ammonia outlets, the average volume would be about 780 tons. Assuming that dry bulk blend consumption in 1980 is 880,000 tons and that there is no increase in the number of plants, the average volume would be about 2,400 tons.

Although these estimates represent an improvement over 1970 average volume, they are not sufficient to make the industry economically viable in terms of return on investment. The position of smaller dealers will continue to deteriorate as operating costs continue to rise and as farmers increasingly look to their farm supply dealers for associated services. Apparently, the decade of the seventies will be a period of consolidation in contrast to the expansionist period of the sixties.

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Agricultural Extension Service
Institute of Agriculture
University of Minnesota
St. Paul, Minnesota 55101

Roland H. Abraham, Director

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