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Structural Changes in Minnesota Fertilizer Distribution . . .

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INTRODUCTION

Twenty-five years ago the traditional method of marketing fertilizer was to sell ungranulated and liquid materials to small mixing plants. These plants chemically combined the basic nitrogen, phosphate, and potash (N,P,K) into small quantities of dry bagged fertilizers. The mixers sold the fertilizer to many independent retail merchants who sold it to the farmer (figure 1A). During the intervening 25 years there have been dramatic changes in the marketing system.

Advancing technology in the fifties introduced granulated dry materials. The lower cost and greater availability of phosphoric acid increased the production of fluid fertilizer. These two factors began to change the system (figure 1B). Granulated materials allowed a new form of mixing: nonchemical combining or dry bulk blending by a small retailer with small capital investment. The granulated materials (produced either by the primary producers or by ammoniation granulators) could be shipped directly to the bulk blenders for blending according to a farmer's needs. This contrasts with the traditional system of mixing for the "common denominator," or the average fertilizer requirements.

Figure 1A. Pre-1955 fertilizer distribution system

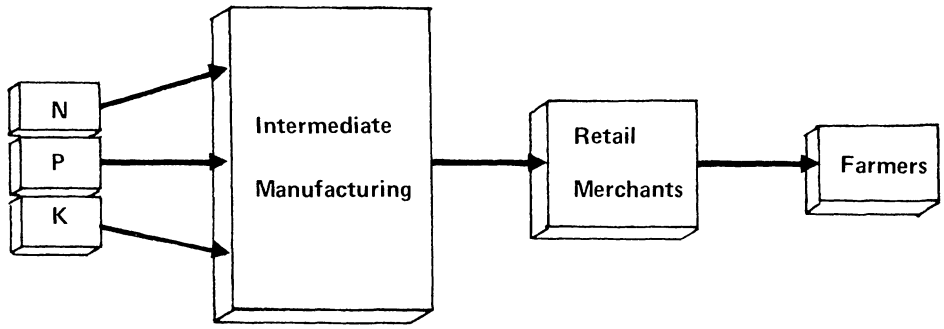
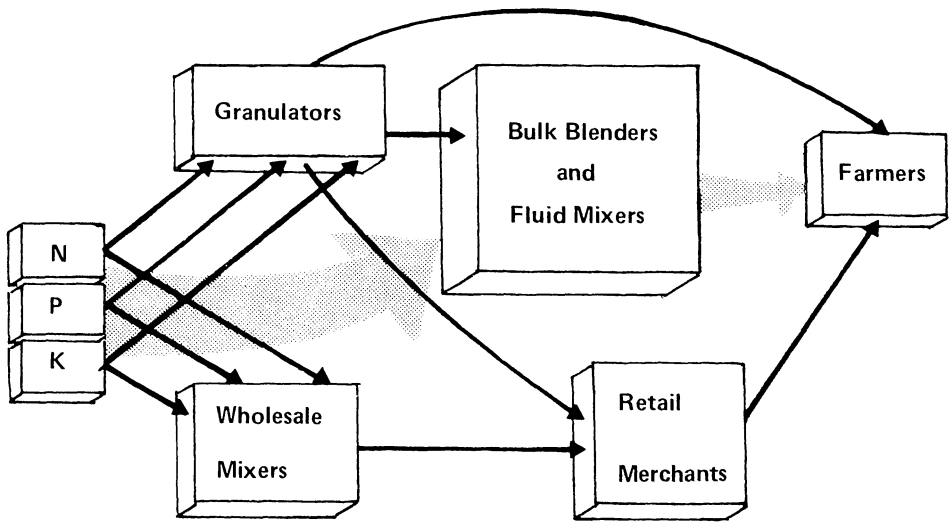


Figure 1B. Post-1955 fertilizer distribution system



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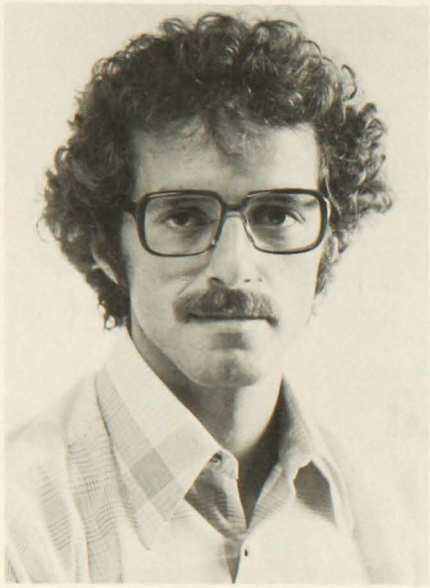

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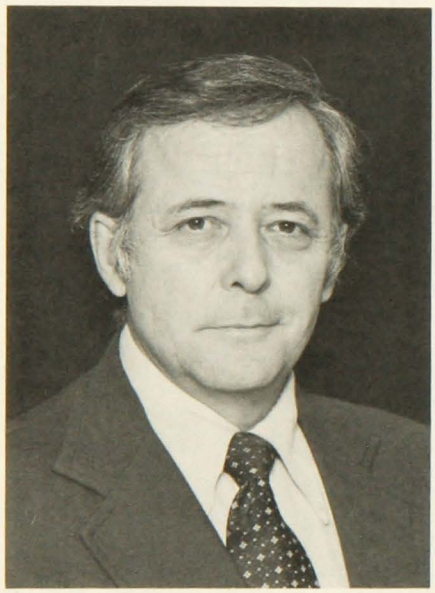

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A similar situation occurred in fluid mixing as lower cost phosphoric acid accorded fluids a cost competitive position with dry fertilizers.

Some of the bulk blenders were small manufacturers of mixed fertilizers, but most were retail fertilizer merchants or other local entrepreneurs.

Remnants of the pre-1955 system still exist. Nonblending retailers, on a smaller scale than before 1955, obtain chemically formulated fertilizer mixtures from wholesale mixers and granulators. However, the primary flow is through bulk blenders and fluid mixers. Close to 90 percent of U.S. fertilizer moves through bulk blenders, fluid mixers, and granulation plants.[1]

Table 1. Minnesota fertilizer consumption, selected years

Year	Total fertilizer materials, tons (000)	Year	Total fertilizer materials, tons (000)
1955	373	1974	1,800
1960	538	1975	1,927
1965	799	1976	2,186
1970	1,307	1977	2,058
1973	1,781		

Sources: "1976 Fertilizer Summary Data," National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama; and "Commercial Fertilizers—Consumption in the United States, Fiscal Year Ended June 30, 1977," USDA, SRS, Crop Reporting Board, Sp. Cr. 7 (11-77).

The new system, by eliminating one step in the manufacturing process, reduced farmer fertilizer costs. Wholesale markups, wholesale outfreight costs, mixing, bagging, sales, and storage costs were eliminated.[2]

There has been a very rapid growth nationwide in bulk blending, while fluid mixing has grown moderately.

Fertilizer distribution system changes have been well documented. It is important to note where the system stands and to consider its future. The Minnesota fertilizer industry is used here as a model.

The following discussion is, of necessity, less than comprehensive. Limitations were imposed by the data, part of which were obtained from the Tennessee Valley Authority. The selective focus here covers in the following order: fertilizer demand, firm numbers and location, firm production activities, types of fertilizers distributed, number of products carried, cooperative distribution, firm size, fertilizer storage, services, sales for nonfarm use, and resale activities.

DEMAND

Minnesota's fertilizer consumption (table 1) has grown 552 percent since 1955, compared to a 215 percent national growth.

Most of the increase in fertilizers used has been in direct application materials. These are primarily single nutrient materials applied in manufactured form without mixing or blending with other nutrients. Even though direct application materials require no blending or mixing, the materials still move from the manufacturers through the bulk blenders and fluid mixers. Of the 1977 use, 64 percent was in direct form and 36 percent in mixtures which could be fluid, mechanically bulk blended dry blends, or chemically formulated.[3] The primary direct application fertilizers were potassium chloride (dry), anhydrous ammonia (gaseous), nitrogen solutions (liquid), and urea (dry). These four materials accounted for 46 percent of all direct application fertilizers. Diammonium phosphate made up 50 percent of all mixtures. About 25 percent was liquid form; the rest was dry granulated (table 2).

Increasing fertilizer use is called a key factor in rising farm produc-

Table 2. Distribution of fertilizer materials by class in Minnesota, 1977

Class	Percentage of total fertilizer distributed
Bulk dry blends	44.1
Bagged dry blends	6.0
Bulk manufactured granulated grades[a]	3.2
Bagged manufactured granulated grades[a]	1.4
Dry direct application materials	19.6
Liquid mixtures	4.7
Liquid suspensions	2.6
Anhydrous ammonia	10.5
Nitrogen solutions	6.6
Liquid direct application materials	1.3
Total	100.0

[a]Refers to mixed fertilizers chemically formulated by the granulator or wholesale mixer.

Source: 1977 survey of licensed Minnesota fertilizer distributors.

[1]All footnotes listed as sources at end of article.

tivity. Fertilizer use has risen at a greater rate than the slow increase in harvested acres during the last 20 years. From 1965 to 1976 Minnesota farmers increased their per harvested acre application 137 percent, while for all U.S. farmers the increase was only 44 percent.[4] It has been estimated that increased fertilizer use has accounted for about 55 percent of the increase in U.S. farm productivity from 1958 to 1972.[5] With rising real estate prices in Minnesota over the last few years, fertilizer has substituted for land as a way to increase output. Between 1972 and 1976 the index of farm real estate values rose 131 percent in Minnesota, compared with 85 percent nationwide. The impetus in Minnesota to substitute fertilizer for expensive land is plain.

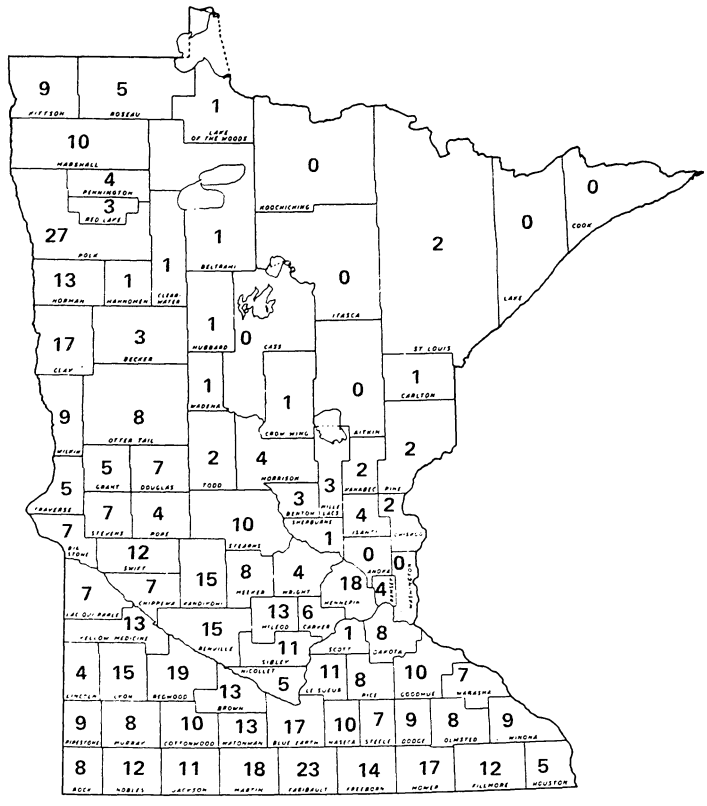
Previous fertilizer demand studies have shown fertilizer consumption to be tied to fertilizer price, fertilizer/crop price ratios, other farm input prices, land acreage, technological change, and farmer knowledge.[6]

Fertilizer prices fell and use grew throughout the sixties, largely due to technological advances that produced fertilizer at lower cost. In the seventies, fertilizer prices increased, but they lagged behind crop price increases. The resulting favorable fertilizer/crop price ratios allowed farmers to profitably increase their use of fertilizer. From the mid-sixties through 1977, excepting 1967 and 1975, the fertilizer/crop price ratio fell.

The prices of other farm inputs throughout the sixties and seventies have risen at a greater rate than fertilizer prices except in 1975 when fertilizer prices skyrocketed, due to the domestic shortage. In 1976 prices backed down. Thus, fertilizer consumption has increased not only in absolute terms but relative to other farm inputs.

Pre-1973, when land acreage was restricted by government programs, farmers often would retire marginal land. On the remaining acres fertilizer application was increased to maintain production. With the present acreage set-aside program this substitution of fertilizer for land will likely occur again.

Figure 2. Number of licensed fertilizer plants and manufacturers by county, 1977



Hybrid crop varieties, more efficient farm equipment and machinery, improved methods of fertilizer application, and improved fertilizer quality are a few of the technological factors that have greatly increased fertilizer use.

Increased farmer knowledge concerning the proper and advantageous use of fertilizer and better farm management have also promoted consumption. The U.S. Department of Agriculture, the Tennessee Valley Authority, the fertilizer industry, cooperative education, and university extension programs have led the way in spreading this information.

Presently, the average N,P,K nutrient content of all fertilizer used in Minnesota is 58 percent, the highest in the nation.[7] It is indicative of an active industry.

MINNESOTA FERTILIZER DISTRIBUTION

In 1977 there were 642 Minnesota licensed fertilizer plants. Most fertilizer plants were located in the state's high agricultural use areas, such as the Red River Valley in the northwest and the south central region (figure 2). A comparison was made with the 1973 population to determine short term net exit or entry. There were 552 firms licensed in 1973 resulting in a *net* entry of 90 firms by 1977. Between 1973 and 1975 the net change resulted in only six new firms entering. The much larger increase in 1973-77 relative to 1973-75 may have been due to the upsurge in fertilizer prices in 1975 and increased demand when prices backed down in 1976.

Production Activities

There were few relative changes in firm production characteristics between 1973 and 1977 (table 3). A pronounced change was the decrease of aqua ammonia producers due to the declining use of this fertilizer in Minnesota.

In 1977 about 75 percent of all firms were involved in bulk blending and 25 percent in liquid blending. This ratio follows closely the consumption ratio of dry versus liquid fertilizers.

The vast majority of firms were either involved exclusively in dry bulk or liquid blending operations. Fewer were specialty products dealers. About 20 percent of all firms dealt in more than one of the described activities, and 50 percent of this group dealt in both liquid and dry blending.

Product Diversification

Data on product diversification among fertilizer firms were obtained from a 1976 search through Minnesota telephone directories. Six hundred seventy-nine fertilizer firms were identified, with most either reporting selling only fertilizer *or* fertilizer and one other input (table 4). Very few firms diversified: those which were, carried an average of only 1.5 products in addition to fertilizer.

Cooperatives

The directory search uncovered a nearly 50-50 split of cooperatives and noncooperatives. The co-ops were more diversified: the majority in the fertilizer plus one and plus two categories yielding an average of 1.7 products carried in addition to fertilizer. The nonco-ops were more specialized in fertilizer only. The average additional products carried tallied 1.2.

Cooperatives play a very important role in Minnesota's agriculture. As of 1973-74, Minnesota had 626 farm supply co-ops or 11 percent of the nation's supply co-ops, the highest number in the nation.[8] A majority of the co-ops were involved in fertilizer distribution, more so than any other farm input category, and they accounted for about 43 percent of the expenditures for fertilizer in Minnesota in 1973-74.[9] Minnesota co-ops have garnered substantial market shares by conferring on members democratic, farmer-owner philosophies and more tangible benefits, such as growth in services, product diversification, and favorable prices.

Survey

To gain supplementary structure data, a survey of licensed distributors and manufacturers in the state was undertaken in fall 1977. To supplement comparative 1973 data, statewide results from a similar nationwide 1974 TVA survey were obtained. The 1977 responses accounted for 68 percent of the fertilizer distributed in the state, while no such data were available on the 1974 survey. The TVA data were complete in all respects except that confidential tonnage data were deleted.

Ninety-four percent of the 1974 firms and 92 percent of the 1977 firms reported involvements in fertilizer manufacturing or mixing. The remaining 6 and 8 percent were nonmixing or nonblending retailers, specialty products dealers, or wholesalers.

Subsidiaries numbered 13 percent in 1977 (not present on the 1974 survey) and were equally split among co-ops and nonco-ops. (Subsidiaries here refer to fertilizer firms controlled through ownership by the parent companies that supply their products.) In the mid-sixties, there was a rash of overbuilding of retail outlets, particularly in the Midwest, by basic producers.[10] The producers simply had exaggerated views on increased demand and deceived themselves as to their own growth capabilities. In the late sixties and early seventies, this integration trend began to contract. This coincided with the growth in cooperatives and a resurgence in independent outlets that had previously been selling out to the integrating manufacturers.

Table 3. Numbers and percentages of firms in Minnesota involved in various fertilizer activities, 1973 and 1977

Production activity	1973		1974	
All firms involved in bulk blending	422	(76%)	494	(77%)
Exclusive bulk blenders	341	(62%)	414	(64%)
Firms involved in both bulk blending and liquid blending	35	(6%)	52	(8%)
All firms involved in liquid blending	128	(23%)	149	(23%)
Exclusive liquid blenders	83	(15%)	79	(12%)
Manufacturers:[a]				
Ammoniation granulators	6	(1%)	5	(0.7%)
Aqua ammonia producers (using anhydrous ammonia)	40	(7%)	24	(4%)
Nitrogen solutions manufacturing (urea-ammonium nitrate solutions)	2	(0.4%)	1	(0.2%)
Low pressure nitrogen solutions manufacturing	19	(3%)	22	(3%)
Liquid hot-mix manufacturers (ammoniation of phosphoric acid)	4	(0.7%)	5	(0.7%)
Liquid cold-mix manufacturers (dissolving potash for mixed liquid grades)	19	(3%)	28	(4%)
Suspension manufacturing	19	(3%)	22	(3%)
All firms involved in specialty products	23	(4%)	32	(5%)
Exclusive specialty products	16	(3%)	28	(4%)
Total firms	552		642	

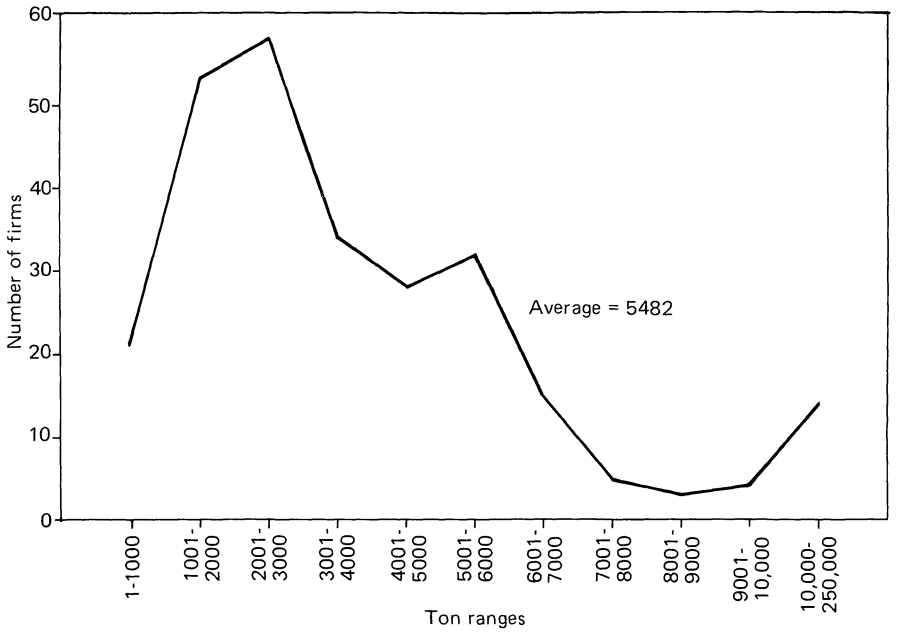
[a]Each category in the manufacturer's group accounts for all firms involved in the particular activity.

Table 4. All firms, co-ops and nonco-ops, carrying fertilizer and fertilizer plus other inputs (seed, feed, petroleum, farm chemicals, and farm hardware) 1976

Firm type	Fert. only	Fert. +1	Fert. +2	Fert. +3	Fert. +4	Fert. +5	Firm totals
All firms	170	203	164	106	33	3	679
	(25%)	(30%)	(24%)	(16%)	(5%)	(1%)	
Co-ops	62	93	95	64	23	2	339
	(18%)	(27%)	(28%)	(19%)	(7%)	(1%)	
Nonco-ops	108	110	69	42	10	1	340
	(32%)	(32%)	(20%)	(12%)	(3%)	(1%)	

Note: All percentages correspond to row totals and may not add to 100 percent due to rounding.

Figure 3. Frequency distribution of firm outputs



Fertilizer Products Diversification

Firms in 1977 were more diversified within fertilizer products. Table 5 shows that 1977 firms relied less on the distribution of one particular product, and instead spread distribution among the seven product categories. In 1974, however, firms averaged higher percentages in all seven categories. Table 6 lends additional support to the increased diversification by depicting the tendency for firms in 1977 to handle more fertilizer categories (2.6 products) compared with 1974 (2.4 products). These tables should not be construed as contradicting table 3, which stated the majority of firms were exclusive bulk blenders. Nothing prevents a dry blender with no liquid blending facilities from having ammonia or nitrogen solution storage tanks and offering these products for sale.

Table 5. Average firm's percentage distribution per product out of total firm distribution. Figures include all firms that reported at least one percent of total distribution in a particular product category.

Product distribution	1974	1977
	----percent----	
Dry blend	74	69
Fluids	23	22
Granulation manufactured grades	24	19
Anhydrous ammonia	23	21
Nitrogen solutions	19	14
Dry direct materials	20	19
Liquid direct materials	24	15

Table 6. Percentage of firms offering one or more product categories[a]

Product diversification	1974	1977
	----percent----	
Number of fertilizer product categories involved in		
one line	15.0	9.0
two lines	44.0	32.0
three lines	28.0	32.0
four lines	11.0	19.0
five lines	2.0	8.0
six lines	0.6	1.0
seven lines	0	0.4

[a]Totals do not add to 100 due to rounding.

Firm Size

Figure 3 shows the largest single grouping of firms occupying the output range of 2,001 to 3,000 tons per year. The average output was 5,482 tons in this nonnormal distribution of firm sizes.

Nonco-ops had higher annual fertilizer distributions than did co-ops. A possible explanation may be that since nonco-ops, on the average, carried fewer other farm supplies, they were forced to rely more on their fertilizer sales than co-ops and thus pursue fertilizer sales more intensively.

Fluid plants had larger distributions than dry plants. This is in stark contrast to national TVA figures which showed dry plants averaging 5,593 tons while fluid plants distributed 3,047 tons per year.[11] Table 7 breaks down output by fertilizer product class among different firm groups.

Table 7. Annual distribution for 1977 (no data available for 1974)

Firm sizes	Tons
Average firm distribution for all responding firms	5,482
co-ops	4,292
nonco-ops	5,983
exclusive bulk blenders	4,354
exclusive fluid mixers[a]	4,923

[a]Includes liquids and suspensions.

Storage

Average total storage capacities declined between 1974 and 1977 for the firms reporting at least one ton of storage (table 8). However, the percentage of firms reporting storage in 1977 was considerably greater than in 1974: 96 percent to 61 percent. So over all firms, average total storage increased in 1977. This was consistent with the growth in consumption since 1974. Firms need to maintain greater capacity and materials to meet unanticipated peak season demand as consumption increases. In view of the potential shortages of railroad cars used in transporting fertilizers, particularly during spring and fall, firms would be expected to have greater capacities to fill to allow for such a contingency.

Such a shortage did occur during the nationwide fertilizer shortage in 1975 and continues to be more than an occasional problem.

Table 8. Average firm storage capacities for responding firms and for all firms

Storage	Percent of firms	Tons for responding firms	Tons over all firms
		1974	
Total storage capacity	61	2,371	1,442
Bulk dry storage	55	1,807	990
Bagged dry storage	44	464	206
Fluid storage	28	465	130
Base solution storage	11	304	33
Anhydrous ammonia storage	39	214	83
Phosphoric acid storage	0.3	183	0.7
		1977	
Total storage capacity	96	2,162	2,074
Bulk dry storage	86	1,848	1,593
Bagged dry storage	55	296	162
Fluid storage	41	470	195
Base solution storage	NA[a]	NA	NA
Anhydrous ammonia storage	68	156	107
Phosphoric acid storage	1	297	4

[a]Not present on 1974 survey.

Bulk dry capacity, averaged over all firms, increased substantially due to the greater proportion of firms possessing bulk storage in 1977. Anhydrous ammonia capacity increased over all firms for the same reason. Phosphoric acid is shown to be an insignificant part of Minnesota's fertilizer consumption whether used as an irrigation fertilizer or more commonly in manufacturing fertilizer.

Bagged fertilizer consumption has been on the decline relative to bulk blends since the advent of bulk blending. Prescription bulk blending has increased in popularity. For example, in Minnesota in 1974 bagged fertilizers comprised 25 percent of all mixed fertilizer consumption. In 1977 the figure had dropped to 13 percent.[12] Even so, the proportion of firms with bagged storage was greater in 1977. However, over all firms the average tonnage figure fell.

Farmers primarily apply fertilizers in March, April, and May. In 1977, a sample of various states showed that nearly 50 percent of the total year's consumption was applied then.[13] Application continues throughout the remaining months. For the same sample states during the fall months of 1977, 13 percent of the year's total consumption was applied. Winter prevents Minnesota farmers from applying as much fertilizer as other farmers. Minnesota farmers apply as much as 50 percent of the year's total in fall.[14]

Since consumption is seasonal, storage facilities are not needed for year-round steady inventory levels as in many business enterprises. Particulary in Minnesota after the fall season and through the winter, fertilizer plants stockpile inventory. Basic nutrient producers and granulators encourage off-season retail purchases to augment their year-round demand. This helps offset peak season demand fluctuations. If the basic nutrient producers and granulators can produce at relatively steady rates year-round, they can avoid excess capacity which causes costs to increase. Primary producers even offer off-season discounts to distributors to encourage these purchases.[15]

Retailers who fill storage in the off-season can alleviate transportation bottlenecks and rail car shortages that occur in the spring and fall when shipping becomes frenetic.

December storage in 1977 was filled at nearly three quarters of capacity (table 9). This situation carries through until April-May when filled storage falls. In June, following peak demand, storage is filled below one-third capacity. Firms then build up inventory for fall.

Storage capacity as a percentage of distribution equalled 41 percent for all 1977 firms or roughly equal to 1977 TVA national data.

Table 9. Storage used, 1977 only (not present on 1974 survey)

As of December 31, 1976, average used total capacity	72%
As of June 30, 1976, average used total capacity	27%
December capacity filled	1,647 tons
June capacity filled	566 tons

Services

It is evident from table 10 that a tremendous jump in services has taken place since 1974. The smaller increase in bagging equipment was due to the declining importance of bagged fertilizers. Yet, this illustrates the importance firms place on services. Even for a declining product, more firms provided the service. Note the jump in adding micronutrients to fertilizers. As the trend toward high analysis fertilizer has occurred, so has the decrease in impurities present in fertilizers. These impurities often included the micronutrients, elements such as boron, zinc, and iron, that are required in very small quantities by growing plants. Therefore, the micronutrients must be specifically added.

Table 10. Percentage of plants offering services

Service	1974	1977
Bagging equipment	22	32
Adding pesticides to fertilizers	16	36
Adding micronutrients to fertilizers	29	66
Adding seed to fertilizers	11	23
Spreader rentals	49	81
Soil test	NA[a]	89
Custom application	48	79

[a]Not present on 1974 survey.

Soil testing is very important in prescription mixing and blending as farmers specific fertilizer needs may be analyzed and satisfied. Instead of relying on one of a few bagged grades mixed to accommodate average needs of a farming area as in the past, the farmer is encouraged to discover soil requirements.

Firms in 1977 were more diversified than in 1974 (table 11). Note the very high percentage of firms in 1974 offering none of the six services. This does not imply a total absence of customer services be-

cause it did not consider farm delivery, credit, and discounts. The average number of services carried was 1.7 compared to 4.1 in 1977. Granted, the absence of soil testing on the 1974 survey negates a parallel comparison. But even assuming that every firm in 1974 offered soil testing, the average would only increase to 2.7 still considerably lower than 4.1.

Table 11. Number of services offered by all firms

Services	1974	1977
No services	42%*	5%
One service	6%	4%
Two services	15%	6%
Three services	17%	18%
Four services	10%	22%
Five services	6%	26%
Six services	2%	15%
Seven services	NA	4%

*Totals may not add to 100 due to rounding.

Services assume great importance in fertilizer distribution. Fertilizers are largely homogeneous goods made up of chemical elements. The very nature of grading by nutrient analysis structures the standardization. Ammonia or a 5-10-10 grade, for example, will contain a fixed amount and ratio of nutrients (within state prescribed limits).

Services allow a retailer to offer a product-service package which is differentiable on the basis of the services offered. Services, unlike the technical characteristics of fertilizer products, are more easily recognizable and potential for differentiation is increased.

Resale Sales

Minnesota firms did not confine themselves totally to farmer sales. Table 12 refers to the firms selling fertilizer to other firms that eventually resell the product. This activity is becoming more pervasive, as noted by the nearly doubling of the proportion of firms involved from 1974 to 1977. Some of this is carried on by neighboring retailers who confront temporary shortages due to transportation delays and buy fertilizer from competitors. However, many of the firms were obviously carrying on wholesale-retail functions or perhaps exclusive wholesaling.

Table 12. Firms selling for resale

Sales for resale	1974	1977
Percentage of all firms selling for resale	18	35
Percentage (for firms selling for resale) of resale tonnage to total distribution	41	31
Percentage (for all firms) of resale tonnage for total distribution	7	11

Reselling makes up a substantial segment of the firm's distribution, 41 and 31 percent in 1974 and 1977, respectively. Proportionately more firms in 1977 (than in 1974) were selling for resale a smaller proportion of their output. Over all firms, the percentage of output sold increased in 1977. The 1977 firms were larger-than-average firms, reporting 4,922 tons or 31 percent of their distribution sold for resale. One reason for the growth in this segment of the industry may be that transport problems causing delivery delays from the primary producer have caused retailers to turn to local sources for more available supply.

Nonfarm Sales

Firms selling for nonfarm use have been increasing in number, proportionately more than doubling from 1974 to 1977 (table 13). The situation was very similar to selling for resale in that more firms were selling smaller amounts. Over all firms, the proportion of output sold for nonfarm use declined in 1977. The tonnages involved were small, averaging only 134 tons in 1977.

Table 13. Firms selling for nonfarm use

Nonfarm sales	1974	1977
Percentage of all responding firms selling for nonfarm use	16	37
Percentage (for firms selling for nonfarm use) of nonfarm tonnage to total distribution	10	2
Percentage (for all firms) of nonfarm tonnage to total distribution	2	0.7

FUTURE PROSPECTS

The future should bring an increase in importance of cooperative fertilizer distribution. The large regional and federated cooperatives are growing at fantastic rates. As advanced technology, greater fertilizer availability, and perhaps lower costs are passed back to the local dealers, this will further improve the competitive position of the local association.

The number of company-owned subsidiaries will not likely increase to the extent of the co-ops and independent stores.[16] The overcapacity problem of the late sixties and early seventies has "cured" the expansionist tendencies of the forward integrating manufacturers.

The import of services will continue to increase for a couple of reasons. First, as farms decrease in number, but increase in acreage, the larger farmers will assume an even greater proportion of a firm's sales. To assure continued patronage of these important large buyers, more firms will have to offer more services desired by the buyers. Secondly, as farmer expertise of fertilizers and proper fertilizer use grows, dealers will have less influence in encouraging overall or specific fertilizer use. Firms will be forced to rely more on customer service to increase business.

Firm numbers are very difficult to predict. As consumption increases, firm numbers will likely increase, but at what rate? TVA research has indicated that since 1970 the growth in the number of fluid mixers and bulk blenders has trailed off even though consumption continued to increase.[17] Perhaps market saturation is being approached: the point where market areas in the state can no longer accommodate new firms.

New plant construction costs may become significant. The somewhat traditional or conservative nature of farmer purchase patterns, manifested in an unwillingness to do business with newcomer firms, may prevent new firms from gaining a solid foothold in a market area. Also, as farm numbers continue to decrease, there will be fewer, but larger, buyers. This may imply instead of a large growth in firm numbers, a larger increase in existing firm output since the large buyer will most likely purchase from only one firm.

The wholesale function should continue to increase, particularly if rail transportation problems are not remedied. Local blenders may look to local suppliers rather than undependable shipments from the basic producers.

SUMMARY

The Minnesota fertilizer distribution system is progressive. It leads the nation in primary nutrient content, adapting to farmer needs for more nutrients per unit of fertilizer. It has greatly increased customer services by providing labor savings to farmers. Greater services to nonfarmers are provided in increasing numbers of firms devoting attention to nonfarmer sales. A strong cooperative industry segment has offered more farm supply products than the average noncooperative and provided other tangible benefits to farmers. An increasing number of firms have undertaken wholesaling activities which may alleviate supply problems in getting fertilizer from the basic producers to the local retail outlet.

Sources

[1]Norman L. Hargett and Louis G. Sills, "Fertilizer Distribution in Centers in the U.S." Paper presented to The Fertilizer Roundtable, Washington, D.C., October 1977, p. 1

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[3]*Commercial Fertilizers—Consumption in the United States, Fiscal Year Ended June 30, 1977.* U.S. Department of Agriculture, SRS, Crop Reporting Board, Sp Cr 7 (11-77).

[4]Norman L. Hargett, "1976 Fertilizer Summary Data." National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama.

[5]*Economic Impacts of Shortages on the Fertilizer Industry.* Report to Federal Energy Administration C-77382, Arthur D. Little, Inc., 1975, pp. III-4.

[6]Zvi Griliches, "The Demand for Fertilizer: An Economic Interpretation of Technological Change." *Journal of Farm Economics,* 41, May 1959; Earl O. Heady and Martin H. Yeh, "National Regional Demand Functions for Fertilizer." *Journal of Farm Economics,* 41, May 1959; J. R. Brake, "Fertilizer Demand in the South Atlantic and East North Central Region." *Journal of Farm Economics,* 44, August 1960, p. 676.

[7]*Commercial Fertilizers, op. cit.* The higher the nutrient analysis, the lower the amount of inert elements and other nutrient elements such as oxygen and hydrogen.

[8]"Statistics of Farmer Cooperatives." U.S. Department of Agriculture, Farmer Cooperative Service, FCS Research Report 39, pp. 23-25.

[9]Computed from "Statistics of Farmer Cooperatives" and "1974 Minnesota Census of Agriculture."

[10]George R. Allen, "The Marketing and Distribution of Fertilizer." Address to the International Superphosphate Manufacturer's Association, Amsterdam, May 1971, p. 6.

[11]Hargett and Sills, *op. cit.*

[12]*Commercial Fertilizers, op. cit.*

[13]*Commercial Fertilizers,* U.S. Department of Agriculture, Crop Reporting Board, Statistical Reporting Service, Sp Cr 7-1-1 (3-77) through (2-78).

[14]Hargett, Norman L., "1976 Fertilizer Summary Data." National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama, p. 62.

[15]Conversation with Don Phelps, manager, Cenex Co-op, Willmar, Minnesota, March 1978.

[16]D. C. Dahl, "Discussion: Changing Structure of the Farm Input Industry." *American Journal of Agricultural Economics,* December 1970, no. 52, p. 687.

[17]Hargett and Sills, *op. cit.*

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