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TRANSPORTATION COSTS OF FERTILIZER
USED IN MINNESOTA

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Introduction

Fertilizer is playing an increasingly important role in the agriculture of the Upper Midwest. Fertilizer consumption has grown over 400 percent in the four state region since 1955, compared to a 215 percent national growth. Total fertilizer consumption by state for selected years is shown in Table 1.

Adequate supplies of fertilizer are critical to farm productivity and agricultural prosperity. 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. With rising real estate prices in the Upper Midwest over the last few years, fertilizer has substituted for land as a way to increase output. Consequently fertilizer supplies are important for continued agricultural prosperity.

Transportation costs represent a significant component of the final delivered price a farmer pays for fertilizer. The four major modes of transporting fertilizer materials are barge, railroad, truck, and pipeline. Water transportation provides savings of up to $12.00 per ton over alternative modes to Minnesota locations near the waterway.

In 1975 St. Paul District ports received a total of 533,600 tons of fertilizer, most of which was destined for Minnesota and Wisconsin farms. This was equivalent to 33 percent of the total Minnesota use of all fertilizer other than potash. (The primary potash source is Saskatchewan, so potash movement on the Mississippi is primarily downstream.) In order to assess the relative importance of river transportation of fertilizer materials, each of the three major nutrient groupings (phosphorous, nitrogen, and potassium) will be discussed separately. A general discussion of comparative rates for the competitive modes for major movements will follow.

TABLE 1. Fertilizer consumption data for Minnesota, Wisconsin, North Dakota and South Dakota, 1955-1975

	All fertilizer materials			All materials exclusive of K_2O		
	1955	1965	1975	1955	1965	1975
	---------- 1,000 tons ----------					
Minnesota	373	799	1,927	329	693	1,598
Wisconsin	430	594	947	356	456	710
South Dakota	38	106	316	38	104	303
North Dakota	63	199	489	62	196	473
TOTAL	904	1,698	3,679	785	1,449	3,084

Sources: "1976 Fertilizer Summary Data," National Fertilizer Development Center, Tennessee Valley Authority, Muscle Shoals, Alabama.

Nitrogen

All four transportation modes are used in transporting nitrogen fertilizer to Minnesota and the Upper Midwest. Nitrogen is delivered to bulk points by barge, rail, and pipeline and then distributed to farms by truck. Anhydrous ammonia and urea are shipped from Medicine Hat, Alberta, Canada by rail, anhydrous ammonia is shipped by barge to Pine Bend, MN from Donaldson, LA and by pipeline to points in Iowa which serve southern Minnesota.

Pipelines have played an increasingly important role in nitrogen fertilizer marketing since their introduction in 1968. The percentage of shipments of anhydrous ammonia from manufacturing plants by pipeline increased from 24 percent in 1971 to 55 percent in 1975. Rail movements dropped from 15 percent to 2 percent during that time period while water shipments dropped from 53 to 34 percent. Pipelines link the Gulf Coast area (site of the greatest concentration of ammonia production) with heavy use areas, especially the Corn Belt. They are designed primarily to serve a market area located away from the navigable Mississippi River and other rivers. Pipelines compete effectively with systems of barges and river terminals in market areas located away from river systems.

For regions nearer the waterway, however, barges play a dominant role in anhydrous ammonia distribution. Because of the uncertainty regarding the future railroad structure in the Midwest and supplies of natural gas required to make anhydrous, barges will continue to be an important method for moving anhydrous ammonia and other nitrogen products from Gulf Coast production sites to distribution sites in the Corn Belt.

The barges used to carry anhydrous ammonia have independent cylindrical tanks mounted in a hopper-design vessel and are free to expand or contract independent of the hull structure. Ammonia is commonly transported in barges having total capacities of 1,000 to 3,000 tons. Storage may be under high pressure (250 psi) or under sufficient refrigeration to maintain ammonia in its liquid phase.

Corps of Engineers (COE) data on barge movements do not distinguish between types of nitrogen such as anhydrous ammonia or urea. However, in 1975 and 1976 nitrogen fertilizer accounted for 33,524 and 92,202 tons at Twin City ports above mile 830.0. This was 1.4 percent of all barge receipts at these ports in 1976. Receipts of nitrogen fertilizer increased at a compound annual rate of 13.6 percent at these ports between 1973 and 1976. Lower Pool 2 terminals[1/] below mile 830.0 had receipts of 86,235 tons in 1975 which was almost 2-1/2 times the quantity received at Twin Cities terminals in that year. Winona, MN also received 21,754 tons of nitrogenous fertilizer in 1975 [3].

The 145,242 tons of nitrogen fertilizer received by all St. Paul district ports in 1975 compares to a 600,000 ton total use of all types of direct application nitrogen fertilizers in Minnesota in 1975. All the nitrogen fertilizer received by barge is from points outside the COE St. Paul District, primarily from Donaldson, LA.

Transportation Costs for Nitrogen

Barge costs from Donaldson, LA to St. Paul or Pine Bend, MN will normally be from $16 to $22 per ton. Industry sources indicate that a three-barge (8,400 ton) unit tow is probably the cheapest way to move anhydrous on the Upper Mississippi. Transportation cost using a 3 barge unit tow from

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[1/] Lower Pool 2 consists of the Mississippi River between St. Paul and Lock and Dam 2 at Hastings, MN.

New Orleans to the Twin Cities is estimated at $17 to $18 per ton. Spot rates for a single barge movement might be as much as $25 per ton.

Current rail rates (ex parte 357) for anhydrous ammonia from Medicine Hat, Alberta to Minnesota locations in jumbo tankers (155,000 lbs.) are running $28 to $36 depending on location (Table 2).

The 90 ton rate (ex parte 357) for urea from Medicine Hat to Ada and Thief River Falls in the Red River Valley are $21.27 and $21.62 per ton.

Truck rates for intrastate shipments of anhydrous ammonia and fertilizer solutions are regulated by the Minnesota Public Service Commission. Rates are based on mileage and are the same for all carriers. Anhydrous rates are higher than chemical solutions rates. Rates extracted from the current tariff are included in Appendix Table 1.

Table 2 compares the transportation cost of anhydrous ammonia from Medicine Hat by rail with the transportation cost of anhydrous barged from Donaldson, LA to Pine Bend, MN and then trucked overland. This table points out the relative advantage of water movement near the river and the relative disadvantage inland. If the costs of the ammonia is equal at the production sites, then delivered cost savings of up to $9 per ton are possible near the Mississippi River while barge-truck costs are more than $25 per ton higher than rail in the northern Red River Valley.

Phosphate Chemical Fertilizers

For weight-losing processes--that is, those for which the output of a specified weight of product requires more than that weight of raw material(s)--it is usually more economical to locate the plant at the raw materials point than at the market. Doing so results in the overall

TABLE 2. Transportation costs of anhydrous ammonia to Minnesota locations in dollars per ton.

	Rail 1/ Medicine Hat Alberta, Canada	Barge 2/ Donaldson, LA to Pine Bend	Truck 3/ from Pine Bend	Barge-Truck TOTAL
Lakeville	33.69	18.00	6.80 (28 mi.)	24.80
Rochester	35.33	18.00	10.80 (64 mi.)	28.80
Clear Lake	32.21	18.00	11.90 (70 mi.)	29.90
Austin	35.33	18.00	13.80 (99 mi.)	31.80
Winnebago	34.82	18.00	17.00 (121 mi.)	35.00
Montevideo	31.64	18.00	19.90 (150 mi.)	37.90
Wadena	30.60	18.00	21.50 (170 mi.)	39.50
Canby	32.72	18.00	23.10 (172 mi.)	41.10
Moorhead	28.29	18.00	31.90 (250 mi.)	49.90
Thief River Falls	28.72	18.00	37.20 (307 mi.)	55.20

1/ Ex parte 357 - 155,000 lb. rate

2/ 8,400 ton unit tow

3/ Minnesota Intrastate rate effective 1/2/79

movement of less weight than if the plant is located at the market. These factors are significant for many of the phosphatic fertilizers, as the production of a ton of phosphoric acid, for example, requires over 3 tons of phosphate rock. Phosphoric acid plants, as a consequence, are usually located adjacent to, or very near, the sources of phosphate rock in central Florida.

The main watergoing vessel used for transporting these products is the covered barge. Usually constructed of welded steel, these vessels have covers of different designs to protect the product shipped from the elements. The most popular size barge carries about 1,500 tons.

Over 95,000 tons of phosphate chemical fertilizer were received at St. Paul District port by barge in 1975. Seventy-seven percent of this was received in Pool 2 below mile 830 with most of the rest going to the Minnesota River. Only 2,800 tons or two barges of rock phosphate were received in the St. Paul District in 1975. All receipts of phosphatic fertilizer originated out of the District.

For purposes of comparison, Minnesota's use of superphosphate (the most important of the phosphate fertilizers) was approximately 100,000 tons in 1975. This indicates that barge traffic plays a very important role in supplying the area's phosphate needs.

Transportation Costs of Phosphate Chemical Fertilizers

The phosphate fertilizers used in Minnesota are mined in Florida. Table 3 gives the single car rail rates from Bartow and nearby points in Florida to selected points in Minnesota. These are rates for super phosphate (0-46-0) type fertilizers and not rock phosphate.

Industry sources expect the market rate for barge transportation for bulk fertilizer movements from Louisiana to the St. Paul area to be $4.50 to $5.50 per ton during the 1979 shipping season. The market rate in January 1979 was $4.75 to $5.00 per ton. Movement up the Minnesota River would be an additional 25¢ per ton. Because the bulk fertilizer movement is generally a backhaul, rates tend to run from 50 to 70 percent of the downbound bulk rates.

Phosphate fertilizers are transported from Florida to the lower Mississippi by water. The cost from Tampa, Florida to New Orleans by 25,000 ton vessel including transfer to barge is $8 to $9 per ton.[1/] Total cost of water movement of bulk superphosphate from Florida to Minnesota in 1979 will run from $12.50 per ton to $17.50 per ton with most of the movement at the lower end of the range.

Interstate truck rates for bulk fertilizer in Minnesota are filed with the Minnesota Public Services Commission. Truck rates for bulk fertilizer are based on a mileage scale, but, unlike anhydrous and liquid fertilizers, rates differ between firms. Table 1 in Appendix A has rates from representative tariffs of bulk fertilizer haulers. The rate in colum 3 headed "dry fertilizer and urea" is that of a major trucking firm that has specialized fertilizer hauling equipment. This rate is for both intra and interstate movements. The rate in column 4 titled "bulk fertilizer" is from an intrastate tariff for fertilizer by a trucking firm that frequently hauls fertilizer as a backhaul.

[1/] The cost from Florida to New Orleans using a 1500 ton shallow draft barge would run from $10 to $12 per ton.

TABLE 3. Single car rail rates to selected Minnesota points for super phosphate type fertilizers in dollars per ton.

Minnesota Destination	Shipment Minimum Weight	Ex parte 357 Rate From Bartow, Florida
Lakeville	95 T	$ 27.17
Rochester	95 T	26.12
Clear Lake	95 T	27.82
Austin	95 T	25.72
Winnebago	95 T	26.45
Montevideo	95 T	27.82
Wadena	50 T	29.09
Canby	95 T	27.82
Moorhead	50 T	32.06
Thief River Falls	95 T	32.80

Table 4 gives single car rail rates for bulk fertilizer from the Twin Cities and Winona, Minnesota to selected Minnesota locations. These rates are the effective intrastate rates which have not had the last two nationwide rail rate increases applied, i.e., they are current rates but likely to be increased in the near future.

Table 5 gives existing truck rates for dry bulk fertilizers from the Twin Cities and Winona to the selected Minnesota locations. These are based on the mileage rates found in Appendix Table 1. Firm 1 rates are based on the third column and firm 2 rates are based on the fourth (last) column.

Table 6 compares the rate for single car shipments from Florida to Minnesota locations with the combination of 25,000 ton vessel to Louisiana, 1500 ton barge to the Twin Cities or Winona and truck to final destination and with the vessel, barge, and rail car to final destination.

Table 6 indicates that the combination of Gulf vessel, barge to Minnesota and rail in Minnesota costs up to $12 a ton less than single rail direct from Florida. Unlike anhydrous, however, substantial savings from water transportation appear possible through the state with the smallest water savings being $8.70 per ton at Winnebago.

Table 6 also indicates that the vessel/barge/truck rate is less than the direct rail rate to all of the selected Minnesota points, but is always more than the vessel/barge/rail rate. Unlike many commodities, Minnesota intrastate truck rates for fertilizer are higher than rail rates for short hauls. A review of the dry fertilizer mileage tariffs of 6 firms found the lowest rate to be $4.20 per ton up to 20 miles. Rail rates were less than this out to 100 miles or more.

TABLE 4. Single car intrastate rail rates for super phosphate type fertilizers to selected Minnesota locations in dollars per ton.

Minnesota Destination	Shipment Minimum Weight	Ex parte 343 Level Current Minnesota Intrastate Rate From Twin Cities or Roseport	Ex parte 343 Level Current Minnesota Intrastate Rate From Winona
Lakeville	95 T	$ 2.19	$ ---
Rochester	95 T	3.51	2.45
Clear Lake	95 T	3.07	5.99
Austin	95 T	4.06	3.51
Winnebago	95 T	4.75	5.70
Montevideo	95 T	4.54	---
Wadena	95 T	5.51	---
Canby	95 T	5.25	7.19
Moorhead	95 T	7.89	---
Thief River Falls	95 T	9.46	---

TABLE 5. Truck rates to selected Minnesota locations from the Twin Cities and Winona for dry bulk fertilizers in dollars per ton.

Minnesota Destination	Twin Cities		Winona	
	Firm 1	Firm 2	Firm 1	Firm 2
Lakeville	6.40 (28 mi)	7.00	12.80 (109 mi)	7.00
Rochester	9.00 (64 mi)	7.00	8.00 (46 mi)	7.00
Clear Lake	10.00 (70 mi)	7.00	18.00 (173 mi)	8.40
Austin	12.20 (99 mi)	7.00	10.60 (85 mi)	7.00
Winnebago	14.40 (121 mi)	7.40	15.80 (148 mi)	7.80
Montevideo	15.80 (150 mi)	7.80	23.60 (240 mi)	9.60
Wadena	17.40 (170 mi)	8.20	26.40 (269 mi)	10.20
Canby	18.00 (172 mi)	8.40	26.40 (262 mi)	10.20
Moorhead	24.40 (250 mi)	9.80	33.80 (349 mi)	11.80
Thief River Falls	30.00 (307 mi)	11.00	39.00 (410 mi)	13.00

TABLE 6. Transportation costs of super phosphate to selected Minnesota locations from Florida in dollars per ton.

Minnesota Destination	Single Car Rail Rate From Bartow, FL [1]	Truck Rate From Twin Cities	Vessel/Barge/ Truck Rate [3]	Vessel/Barge/ Rail Rate [3]
Lakeville	27.17	6.40	19.40	15.19
Rochester	26.12	7.00	20.00	15.45 [4]
Clear Lake	27.82	7.00	20.00	16.07
Austin	25.72	7.00	20.00	16.51 [4]
Winnebago	26.45	7.40	20.40	17.75
Montevideo	27.82	7.80	20.80	17.54
Wadena	29.09 [2]	8.20	21.20	18.51
Canby	27.82	8.40	21.40	18.25
Moorhead	32.06 [2]	9.80	22.80	20.89
Thief River Falls	32.80	11.00	24.00	22.46

[1] 95 ton ex parte 357 rate.

[2] 50 ton ex parte 357 rate.

[3] Vessel/barge cost to Twin Cities was estimated at $13.00 per ton.

[4] Transferred to rail at Winona, MN.

Other Fertilizers

The commodity category "Other Fertilizer" includes mixed fertilizers but not those classified as nitrogenous, phosphatic, or potassic fertilizers, nor does it include phosphate rock or limestone. Receipts of these commodities at the Twin Cities terminals above Mile 830.0 increased at an average annual rate of 12.9 percent from 1967 to 1976 with receipts of 95,114 and 136,600 tons in 1975 and 1976. Since the oil embargo the annual growth rate at terminals above Mile 830.0 has slowed to 2.2 percent. In 1975 more other fertilizer was received in Pool 2 below Mile 830.0 than at Twin Cities terminals (133,511 tons). This was up from 122,356 tons in 1972. The port of Winona received 65,513 tons of fertilizer in 1975, up from 33,151 tons in 1972. The origin of all "other fertilizer" barge receipts is below Baton Rouge on the lower Mississippi with significant amounts coming from Texas.

For the purpose of comparison, total 1975 receipts of "Other Fertilizer" in the district were 294,000 tons. Mixed fertilizer use in Minnesota for that same year was 757,000 tons.

Transportation Costs of Other Fertilizers

Rates for movement of other bulk fertilizers are commonly the same as for super phosphate type fertilizers by truck or barge. Rail rates are generally slightly higher.

Potassium Fertilizer

Barge shipments play a very minor role in satisfying the Upper Midwest demand for potassic fertilizers. This is because the major supplier for the region is Canada, and rail movements are virtually required as there are no

waterways between the regions. There are significant potash supplies in the southwestern United States, but these, too, are best served by rail.

In 1975 outbound shipments of potassic chemical fertilizers were 10,045 tons from the Twin Cities terminals above Mile 830.0. No other St. Paul District ports shipped potash in 1975. This fertilizer was all shipped to locations on the Tennessee River. During that same year the demand for direct application potassic fertilizers exceeded 250,000 tons of K_2O equivalent in Minnesota alone.

Transportation Costs of Potassium Fertilizers

Most Minnesota potash comes from Saskatchewan by the single car rates given in Table 7. Small quantities may come from the Carlsbad, N.M. area on occuasion. The single car rates to Minnesota are zone rate so large areas pay the same rate. There are no unit train shipments to Minnesota, although there are probably unit train type rates from Canada to blending locations or bulk plants in major fertilizer using states to the south.

The tariff from Canada allows for shipments loaded to the "full visible capacity of car" to go at the 95 T rate. Consequently, smaller capacity cars can go at this rate if fully loaded. It is possible to ship to locations on branch lines at the 95 ton rate if small cars are available.

TABLE 7. Rail potash rates to Minnesota locations

Minnesota Destination	Minimum Shipment Weight	Saskatchewan, Canada	Carlsbad, New Mexico
Thief River Falls	95 T	$ 28.17	$ 29.23
Canby	95 T	28.17	29.23
Albert Lea	95 T	28.17	29.46

SUMMARY

Water transportation is very important for the movement of nitrogen, phosphate, and mixed fertilizers to the Upper Midwest. Potassium fertilizer sources are in Canada and move into this area by rail.

In 1975, nearly 25 percent of the direct application nitrogen fertilizer used in Minnesota was shipped by barge to terminals in Winona, Pool 2, the Twin Cities and the Minnesota River. Total transportation costs of nitrogen fertilizer delivered to the farm by the barge-truck mode were up $9 a ton less near the river than shipments by rail.

The least cost mode for direct application nitrogen is quite sensitive to distance from the river as truck costs increase rapidly. Transportation costs of direct rail shipments are only one-half that of barge-truck in the Red River Valley.

In 1975, quantities of superphosphate type fertilizers equal to 95 percent of Minnesota use were received at Winona, Pool 2, the Twin Cities and the Minnesota River.

The least transportation cost method is barge-rail throughout the state with savings of $9 to $12 per ton over direct rail being normal. The barge-rail mode appears to be $2.50 to $4.00 a ton less than the barge-truck alternative. Unlike the rates for grain and many other commodities, rail rates for fertilizer in Minnesota are cheaper than truck at very short distances as well as at long distances.

The quantity of other mixed fertilizer received at Winona, Pool 2, Minnesota River, and Twin Cities terminals in 1975 was 294,000 tons. This was equal to 38.8 percent of the mixed fertilizer used in Minnesota in

that year. Rail rates for mixed fertilizer are generally slightly higher for superphosphate while barge and truck costs are generally the same. Consequently, water transportation is used from locations where available.

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3. Fruin, et.al. Waterborne Commodity Movements Through Upper Mississippi River Ports, Draft, December 1978.

4. Paul, et.al. The Changing U.S. Fertilizer Industry. ERS, USDA, Agricultural Economic Report No. 378.

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APPENDIX

TABLE 1. Representative Truck Rates for Fertilizer Movement in Minnesota in Dollars Per Ton

Miles	(1) Anhydrous Ammonia[1/]	(2) Fertilizer Solutions[1/]	(3) Dry Fertilizer and Urea[2/]	(4) Bulk Fertilizer[3/]
10	6.30	4.70	6.00	7.00
20	6.30	4.70	6.00	7.00
30	6.80	5.10	6.40	7.00
40	8.00	5.60	7.00	7.00
60	9.70	7.30	8.80	7.00
80	11.90	8.90	10.20	7.00
100	13.80	10.30	12.20	7.00
150	19.90	13.80	15.80	7.80
200	24.90	17.60	20.20	8.80
250	30.70	21.50	24.40	9.80
300	36.10	25.70	29.00	10.80
350	42.10	30.10	33.80	11.80
400	48.20	34.10	37.80	12.80

[1/] Mileage rate for all intrastate truck shipments of these commodities effective Jan. 2, 1979.

[2/] Source: Representative individual carrier commodity tariff from Minneapolis and St. Paul, MN commercial zone, Pine Bend, Port Cargill and Stillwater, MN on Minnesota intrastate movement and interstate movements to 11 states effective February 26, 1979. Other carriers may have different rates on file with the Minnesota P.S.C.

[3/] Source: Representative individual carrier commodity tariff for Minnesota intrastate movements effective March 1, 1978. Other carriers may have different rates on file with the Minnesota P.S.C.