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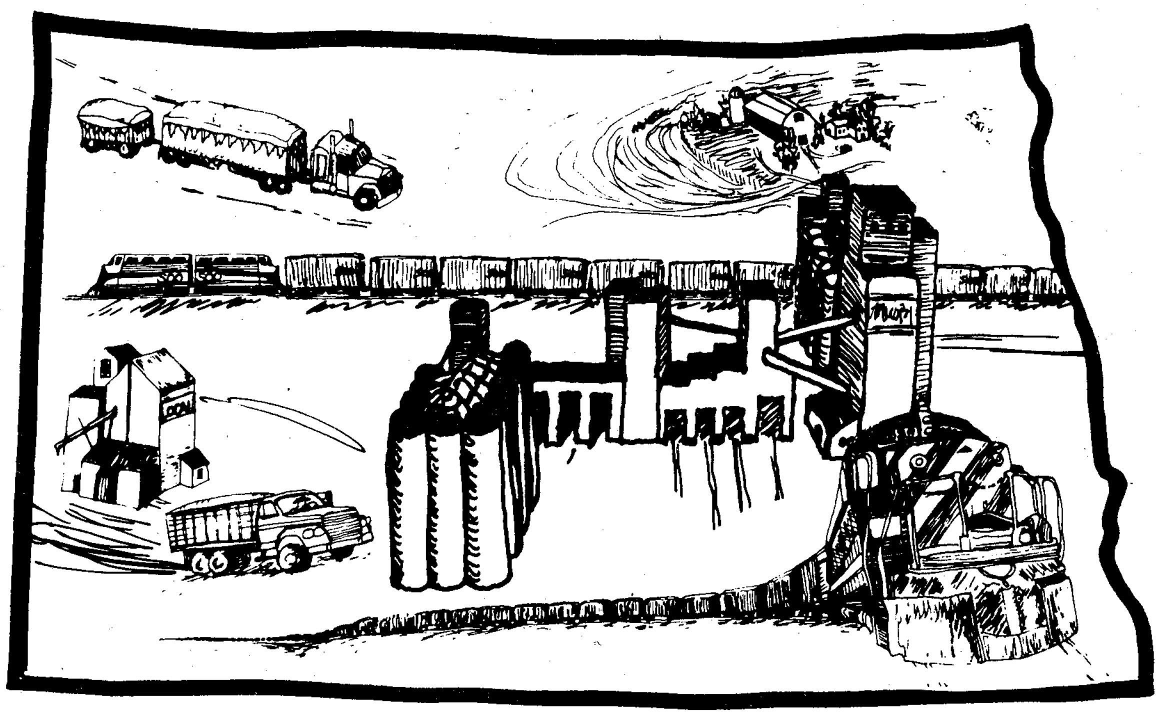
Characteristics and Costs of Operation of North Dakota's Farm Trucks



by

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Highlights

The farm truck is a vital link in the transportation/marketing process. The farm to country market movement of grain and oilseed is the initial step in a complex operation which results in supplying domestic and export demand. The farm truck provides the producer the ability to market his grain but not without a cost that becomes one important component of the marketing and production costs incurred by producers.

A mail survey that yielded 958 respondents indicated that almost all grain was marketed by the individual farmer using his own truck; few farmers employed custom haulers and only 3 percent leased trucks. Seventy-four percent of the farms were within 10 miles of an elevator and 64 percent of the farmers hauled to their closest elevator. Thirty-three percent of North Dakota farmers had one truck and 44 percent had two trucks. Eighty percent of the trucks were single-axle and 16 percent were tandem-axle. The average annual mileage and payload for single-axle trucks were 4,270 miles and 280 bushels compared to 11,979 and 540 bushels for tandem-axle trucks, respectively.

There were more trucks per farm, larger sized trucks, and less distance to elevators in eastern North Dakota than other areas of the state. Farm size was directly related to the number of trucks per farm, average annual mileage per truck, and truck size. Larger farms also had newer trucks.

Cost per mile and cost per bushel per mile were estimated at $1.01 and $.36 for single-axle trucks and $1.27 and $.23 for tandem-axle trucks, respectively. The variable costs for the typical truck fleet of a farm estimated at $.44/mile, could be considered the relevant cost for the decision whether to move grain additional miles for a higher market price. The relevant cost would decrease to $.30/mile if farmer labor was used, and the farmer considered his labor fixed.

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AN OVERVIEW

North Dakota Grain Handling, Transportation, and Merchandising Study

North Dakota's rail branch line system was developed in the late 1800s and early 1900s primarily for the purpose of moving farm commodities to markets outside the state and to bring freight such as farm inputs and other needed goods to the state's communities. The only other form of surface transportation available for moving bulk freight when the rail network was being developed (excluding some minor river transportation) was the horse-drawn freight wagon. The limited distance that a team of horses and wagon could travel influenced the design of the early branch line railroad network. This development pattern resulted in branch lines that were no farther apart than 10 to 20 miles, and even the most remote producing areas were accessible to rail transportation.

Development of the country's grain merchandising system also was influenced by the limited distance a team of horses and wagon could travel, the relative density of the branch line network, and available technology at that time. This resulted in a large number of country elevators spaced only a few miles apart on grain gathering rail lines. Although much of what existed in the past still exists today in the form of the branch line network, economic and technological forces that influenced its development have changed since the turn of the century. Other factors are currently at work that may influence rationalization of the railroad network and the country grain merchandising system.

Factors which will influence the future grain handling transportation and merchandising system include branch line abandonment, implementation of multiple car and unit train grain rates, and capital replacement decisions. Other factors include differing rates of cost increases in the two modes, causing shifts in their competitive relationship. Competition among producing regions also will influence the future system. Efficiencies gained as a result of changes in the marketing systems of competing producing regions will possibly influence a move to obtain those same efficiencies by other producing regions. The changing technology of farm trucks and the improved quality of the highway system makes it possible for producers to move grain much farther today than previously. These forces may very well influence changes in the state's traditional grain merchandising system. Government policies such as railroad deregulation also may have some impact on the system.

As a result of these impending changes that could alter a rather traditional grain handling, transportation, and merchandising system, many private and public decisions will have to be made. These include decisions regarding location, economic viability, size of plant, investment in grain facilities, investment in transportation equipment and infrastructure, efficiencies of merchandising, purchases of farm production equipment, and storage capacity. If such decisions are to be made on an informed basis, it is important that basic information about the industry be developed and published. It was for this reason that the Upper Great Plains Transportation Institute and the Department of Agricultural Economics of North Dakota State University have undertaken a study entitled "North Dakota Grain Handling, Transportation, and Merchandising Study." Cooperators in the study include Burlington Northern Railroad, Farm Bureau, Farmers Union, Grain Terminal Association, North Dakota Agricultural Experiment Station, North Dakota Department of Agriculture, North Dakota Grain Dealers Association, North Dakota Highway Department, North Dakota Public Service Commission, St. Paul Bank for Cooperatives, and the Soo Line Railroad Company. The purpose of this study is to provide relevant information to decision makers in meeting the challenge of a changing business environment in handling, transportation, and merchandising grain in North Dakota.

The study is composed of a number of research projects that will result in 13 separate publications of which this is one. The publications planned for release at varied time intervals are:

- Description of the Existing Country Elevator System
- Cost Analysis of Existing Country and Farm Storage System
- Cost Analysis of Subterminal Elevators
- Existing and Past Patterns of North Dakota Grain Movements
- Description of Rail Rate Structure, Multiple Car Movements, and Rates and Analysis of Shipper Owned Equipment
- Description and Analysis of Exempt Carrier Industry
- Economics of Branch Line Operation
- Farm Truck Costs
- Seasonal Behavior of Marketing Patterns for Grain from North Dakota
- Grain Merchandising
- Marketing Using Delayed Pricing Controls
- Analytical Model for Analyzing Economic Efficiencies of Subterminals
- North Dakota Grain Handling, Transportation, and Merchandising Study: Summary, Conclusions, and Policy Implications

These reports, as they are completed, will be available upon request from the Department of Agricultural Economics or the Upper Great Plains Transportation Institute, North Dakota State University.

CHARACTERISTICS AND COSTS OF OPERATION OF NORTH DAKOTA'S FARM TRUCKS

by

Gene Griffin, Wesley Wilson, and Ken Casavant*

Introduction

> . . . you will undoubtedly discover that a history of North Dakota transportation is really a history of the state itself. Whereas states along the eastern seaboard had been settled for 200 years before the whistle of a steamboat or a locomotive was heard, rail stretched across Dakota territory before there were any towns to serve. The development of agriculture was an immediate necessity if railroads were to survive . . . .
>
> "West of the Red"
> Richard Schneider

The interrelationship between transportation, agriculture, and North Dakota's economy has become even more identifiable as the state has developed over the past 100 years. The high productivity of the state's agriculture necessitates an efficient and progressive transportation system to have access to distant and international markets. Any improvements in this transportation system that decrease the cost of marketing can increase North Dakota's comparative advantage and/or increase the net price received by North Dakota producers.

The full effects on agriculture from numerous changes in the transportation system serving the state have yet to be ascertained. Deregulation of railroads, the advent of multiple and unit trains, railline abandonment, and new grain merchandising alternatives have put pressure on local elevators and their farm customers. This pressure has taken the form

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of decisions faced by the agricultural producers: How far can I afford to haul my grain and where should I go? Should I lease or buy a new truck or should I have my grain custom hauled? What type of truck best fits my farm operation? What demand will be put on my truck in the future?

These decisions reflect structural changes occurring in North Dakota agriculture. The size of farms in North Dakota has increased over the past 20 years from about 850 acres in the middle sixties to slightly over 1,000 acres in 1981. Larger farms, a higher proportion of harvested cropland per farm, and increased production per acre has significantly increased the volume of grain handled by each individual farmer. Acreage shifts to sunflower, a bulky commodity, has added to the grain volume problem during the past five years.

Changes in the marketing system, and increased commodity production per farm, are also affecting the demands placed on farm trucks. The average age of elevator facilities in North Dakota is 25 years; over 30 percent of the facilities are over 50 years old. Thus, many elevators in North Dakota are being replaced or consolidated. Also, railline abandonment has forced producers to seek alternative shipping points if the abandoned elevators do not survive. In almost every case these new shipping points are farther from the farm.

Farm truck transportation has received little attention in comparison to other modes of transporting North Dakota's agricultural products. However, research on farm truck costs and characteristics can offer significant benefits. Producers need information on costs of truck operation to evaluate the potential for custom hauling and truck investment alternatives. Elevator management needs knowledge of available trucking capacity and how producer decisions will affect their operation.

Owner-operator trucking companies can, with proper information, evaluate farm trucks as competitors or complements to their operation. Thus, the results of a farm truck study can be used by government policymakers, private industry, and farmers for making appropriate decisions on relevant transportation activities.

Objectives

The general purpose of this study was to evaluate the performance and use of farm trucks in the North Dakota grain industry. Specific objectives were to:

1) identify the characteristics of farm trucks moving North Dakota grain,

2) identify the costs of operation of farm trucks on different-sized farms and of different-sized vehicles,

3) evaluate potential changes in the future in operating costs and usage characteristics of farm trucks, and

4) evaluate impacts on costs of alternative managerial options regarding farm truck use on a typical farm.

Data Source

The primary source of data for this study was a mail survey of farmers in North Dakota. Questionnaires were sent to 5,000 farmers, 12.5 percent of the estimated population of 40,000 farmers in the state. The population was stratified into three groups size: 1-349 acres, 350-749 acres, and 750 or more acres. The sample was dispersed geographically throughout the state by use of Crop Reporting Districts (CRDs). The list and addresses of farms, by size and location in each sampling cell, was obtained from the Statistical Reporting Service (SRS) in Fargo.

Two mailings resulted in 988 useable questionnaires, a response rate of nearly 20 percent (see Appendix for a copy of the questionnaire). The first mailing produced 954 questionnaires or 96 percent of the responses.

Paired t-tests on the two mailings were used to evaluate differences between respondents and nonrespondents to the first mailing. An evaluation of main characteristics (farm size, location, number of farm trucks, truck type, and distances to the elevator) indicated no statistical differences between the two mailings and therefore allowed the two mailings to be pooled and inferences to be drawn from the sample to the population.

A survey of truck dealers, insurance agencies, and regulatory agencies was also conducted. These interviews provided the cost components necessary to develop an economic-engineering synthesis of costs of operation for a typical farm truck. This allowed comparison of the synthesized cost components to the statistically estimated cost functions from the survey data.

Industry Characteristics

The characteristics discussed in this section are based on responses from 988 farmers using farm trucks in 1980. The number of observations describing each characteristic varies from table to table because item response was incomplete on some questionnaires. However, as indicated earlier, statistical testing of the mailings did suggest that sample responses could be considered as reflective of all grain producers in North Dakota.

The farm truck analysis was based on the following primary characteristics: location, farm size, number of farm trucks, truck type, and distance to nearest elevator. These variables were then correlated to other general characteristics, such as annual mileage, truck payload, and attitudes towards truck leasing and custom hauling.

The distribution of responses is indicated in Figure 1. The eastern part of North Dakota (CRDs 3, 6, and 9) provided 383 or 39 percent of the

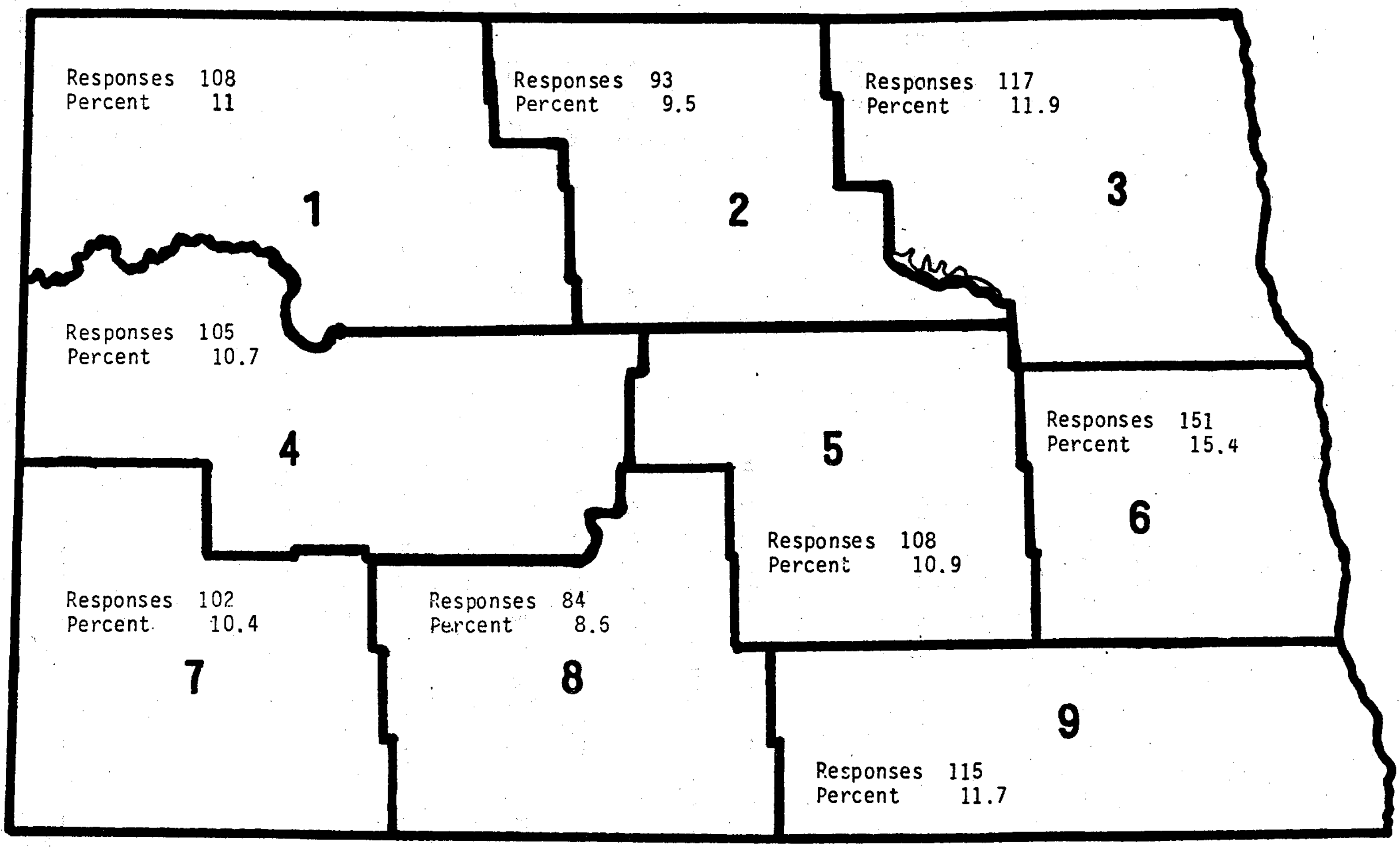

Figure 1. Location of Responses to 1980 North Dakota Farm Truck Survey, by Crop Reporting District

responses, compared to 29 percent for central North Dakota (CRDs 2, 5, and 8) and about 22 percent for western North Dakota (CRDs 1, 4, and 7).

Farm Truck Distribution

There were significant differences in the number of trucks per farm in the different sections of the state (Table 1). Almost 35 percent of the farms in the Red River Valley (CRDs 3, 6, and 9) had more than two trucks per farm, compared to 14 percent in the west and 18 percent in the central portion of North Dakota. Crop Reporting District 6, in the middle of the Red River Valley, had the highest incidence of trucks per farm with 39 percent of the farms reporting more than two trucks. Statewide, 33 percent of the farms had only one truck, with most of these farms in central North Dakota. Forty-four percent of all farms had two trucks, 17 percent had three trucks, and 5 percent of the farms utilized four or more trucks.

The type of truck used by North Dakota farmers also varies by location in the state (Table 2). Eighty percent of the trucks reported in the survey were single-axle trucks while 16 percent were tandem-axle vehicles. Totals of 11 semi-trucks, 16 pup trailers, and 10 other type of farm vehicles were reported on the 988 surveyed farms. In the Red River Valley (CRDs 3, 6, and 9), over 22 percent of the vehicles were tandem-axle compared to 12 percent in the west and 10 percent in central North Dakota. The location of semi-trucks was spread evenly throughout the state, but 50 percent of the pup trailers were in the north central Red River Valley, Crop Reporting District 6.

Smaller farms had significantly fewer farm trucks than larger operations in 1980 (Table 3). Sixty-eight percent of the farms less than 250 acres in size had only one truck compared to 42 percent for the medium-sized farms and 20 percent for the larger farms. Thirty-five

TABLE 1. NUMBER OF TRUCKS PER FARM, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

Trucks Per Farm	Crop Reporting District 1 No.	%	2 No.	%	3 No.	%	4 No.	%	5 No.	%	6 No.	%	7 No.	%	8 No.	%	9 No.	%	Total Responses[a] No.	%
1	33	(31)	24	(34)	16	(18)	40	(38)	39	(41)	28	(20)	48	(48)	42	(50)	29	(26)	299	(33)
2	55	(51)	29	(41)	42	(48)	49	(47)	39	(41)	58	(41)	43	(43)	33	(39)	51	(46)	399	(44)
3	17	(16)	16	(23)	19	(22)	15	(14)	12	(13)	36	(25)	10	(10)	7	(8)	23	(21)	155	(17)
4	2	(2)	1	(1)	5	(6)	0		2	(2)	12	(8)	0		0	(1)	4	(4)	27	(3)
5	0		0		1	(1)	1	(1)	1	(1)	4	(3)	0		0		2	(2)	9	(1)
6	0		0		3	(3)	0		2	(2)	0		0		0		1	(1)	6	(.6)
7	0		0		1	(1)	0		0		2	(2)	0		0		0		3	(.3)
8	1	(.1)	0		0		0		0		1	(1)	0		0		0		2	(.2)
14	0		0		0		0		0		1	(1)	0		0		0		1	(.1)
Total Responses	108		70		87		105		95		143		101		84		110		903	99.2

[a]Total percentage may not equal 100 because of rounding.

TABLE 2. FARM TRUCK TYPES, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

Truck Type	Crop Reporting District																		Total Responses	
	1		2		3		4		5		6		7		8		9			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Single-Axle	90	(83)	80	(86)	90	(77)	92	(88)	87	(81)	100	(66)	86	(84)	76	(90)	88	(76)	789	(80)
Tandem-Axle	15	(14)	8	(9)	21	(18)	11	(10)	19	(18)	38	(25)	14	(4)	5	(6)	26	(23)	157	(16)
Semi	1	(1)	3	(3)	1	(1)	0		1	(1)	3	(2)	1	(1)	0		1	(1)	11	(11)
Pup	0		1	(1)	3	(3)	1	(1)	1	(1)	8	(5)	1	(1)	1	(1)	0		16	(2)
Other	2	(2)	1	(1)	2	(2)	1	(1)	0		2	(1)	0		2	(2)	0		10	(1)

TABLE 3. TRUCKS PER FARM IN NORTH DAKOTA, BY FARM SIZE, 1980

Trucks Per Farm	Farm Size: 0-250 Acres No.	%	251-749 Acres No.	%	Over 749 Acres No.	%	Total Responses No.	%
1	60	(68)	127	(42)	99	(20)	286	(32)
2	25	(28)	139	(46)	229	(47)	393	(45)
3	1	(2)	31	(10)	120	(24)	152	(17)
4	0		3	(1)	24	(5)	27	(3)
5	0		1	(1)	9	(2)	10	(1)
6	0		0		6	(1)	6	(1)
7	0		0		3	(1)	3	(1)
8	0		0		2	(1)	2	(1)
14	0		0		1	(1)	1	(1)
Total Responses	88		301		493		882	

percent of the larger farms had three or more trucks compared to only 2 and 12 percent, respectively, for the small- and medium-sized farms.

Table 4 indicates that small farms relied most heavily on the single-axle truck to move their grain to market. The tandem-axle truck was found significantly more often (24 percent) on the larger farms than on either the small- or medium-sized farms. Obviously, some of the farms had both single- and tandem-axle vehicles.

TABLE 4. USE OF DIFFERENT TRUCK TYPES IN NORTH DAKOTA, BY FARM SIZE, 1980

Truck Type	Farm Size: 0-250 Acres No.	%	251-749 Acres No.	%	Over 749 Acres No.	%	Total No.	%
Single-Axle	89	(96)	322	(94)	514	(74)	925	
Tandem-Axle	4	(4)	18	(5)	150	(24)	172	
Pup	0		2	(1)	14	(2)	16	
Semi	0		0		11	(1)	11	

Further information on the frequency of truck types on each farm is given in Table 5. Farms having the single-axle truck type had more than one of them 59 percent of the time. In contrast, farms having the tandem-axle vehicle or pup trailer had only one of that truck type 71 and 94 percent of the time, respectively.

TABLE 5. FREQUENCY OF TRUCK TYPES ON NORTH DAKOTA FARMS, 1980

Number of Truck Type on Farm	Truck Types: Single-Axle No.	%	Tandem-Axle No.	%	Pup No.	%	Semi No.	%
1	385	(41)	126	(71)	16	(94)	9	(75)
2	410	(43)	32	(18)	0		3	(25)
3	134	(14)	8	(5)	0		0	
4	13	(2)	7	(5)	0		0	
5	5	(1)	1	(1)	0		0	
6	3	(1)	3	(1)	1	(6)	0	
Total Responses	950		177		17		12	

Farm Truck Usage

The North Dakota farmer has traditionally carried his grain to market in his own vehicle, originally a horse-drawn wagon and now a motor-driven vehicle. In recent years, spurred by high capital costs for new trucks and increased production volumes, producers have expressed more interest in leasing equipment or utilizing their equipment to perform custom hauling for their neighbors. Custom grain hauling for other farmers or elevators provides farmers an opportunity to spread the fixed costs of farm trucks over more acres.

Farmers were asked what percentage of their total annual truck mileage was used for carrying grain for personal use, for custom grain hauling service or other activities. Most mileage was used for hauling grain for personal use. Other activities (livestock, feed, seed, etc.)

accounted for very little mileage. Overall, 56 percent of the farm trucks were used in some activity other than hauling grain for personal use (Table 6).

Statewide, the percentage of farmers that did custom grain hauling for other producers varied from three in CRD 8 to nine for CRD 6 in the Red River Valley (Table 7).

The incidence of custom hauling for other farmers varied by type of truck utilized. Producers operating single-axle trucks custom hauled only 3 percent of the time compared to a state average of 6 percent (Table 8). Tandem trucks were used in custom hauling by 16 percent of the producers while owners of pup trailers and semi-trucks participated in custom hauling 19 and 50 percent of the time, respectively.

An increase in the number of trucks per farm did not necessarily mean more custom hauling would occur. Evidently farmers were adding to their truck fleet as the demand for personal grain movement increased, because the percentage of mileage for personal use for different numbers of trucks per farm is fairly stable (Table 6).

Examining custom work mileage by farm size reveals a slight increase in custom work mileage as the size of farm decreases (Table 9). Fifty-six percent of the farmers with less than 250 acres used their vehicles for personal grain hauling over 80 percent of mileage, compared to 66 and 75 percent of the medium- and larger-sized farms, respectively. This could reflect the low volume of grain produced on the smaller farms, a higher level of off-farm activity by operators of small acreage farms, or both.

Hired Custom Hauling

Few surveyed farmers employed custom haulers to move their grain. Farmers indicated that, irrespective of the commodity, almost all grain was marketed by the individual producer using his own truck (Table 10).

TABLE 6. PERCENT OF ANNUAL TRUCK MILEAGE USED BY NORTH DAKOTA FARMERS IN CARRYING GRAIN FOR PERSONAL USE, BY NUMBER OF TRUCKS PER FARM, 1980

Percent of Truck Mileage for Personal Use	Number of Trucks Per Farm																			
	1		2		3		4		5		6		7		8		14		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0- 25	15	(6)	13	(3)	6	(4)	4	(15)	1	(10)	1	(17)	1	(33)	0		0		41	(5)
26- 50	35	(14)	31	(8)	10	(6)	0		1	(10)	1	(17)	0		0		1	(100)	79	(9)
51- 70	13	(5)	23	(6)	6	(4)	2	(8)	1	(10)	0		0		0		0		45	(5)
71- 80	38	(15)	48	(12)	11	(7)	4	(15)	2	(20)	0		0		1	(50)	0		104	(12)
81- 90	9	(4)	70	(18	33	(21)	6	(23)	3	(30)	2	(33)	0		1	(50)	0		124	(15)
91- 95	23	(9)	40	(1)	22	(14)	2	(8)	1	(10)	1	(17)	0		0		0		89	(10)
96-100	126	(49	168	(43)	68	(44)	8	(31)	1	(10)	1	(17)	2	(67)	0		0		374	(44)
Total Responses	259		393		156		26		10		6		3		2		1		856	

TABLE 7. INCIDENCE OF FARMERS PROVIDING CUSTOM GRAIN HAULING SERVICE, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

	Crop Reporting District																			
	1		2		3		4		5		6		7		8		9		Total	
Custom Haul	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	4	(4)	7	(8)	5	(4)	5	(5)	4	(4)	13	(9)	6	(6)	2	(3)	5	(5)	51	(5)
No	100	(96)	84	(92)	108	(96)	98	(95)	102	(96)	134	(19)	94	(94)	77	(97)	105	(95)	902	(95)
Total Responses	104		91		113		103		106		147		100		79		110		953	

TABLE 8. INCIDENCE OF NORTH DAKOTA FARMERS PROVIDING CUSTOM GRAIN HAULING SERVICE, BY TRUCK TYPE, 1980

Custom Haul	Single-Axle		Tandem-Axle		Pup		Semi		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	20	(3)	24	(16)	3	(19)	6	(50)	53	(6)
No	746	(97)	130	(84)	13	(81)	6	(50)	905	(94)
Total Responses	766		154		16		12		958	

TABLE 9. PERCENT OF ANNUAL NORTH DAKOTA FARM TRUCK MILEAGE USED IN CARRYING GRAIN FOR PERSONAL USE, BY FARM SIZE, 1980

Percent of Mileage for Personal Use	Farm Size							
	0-250 Acres		251-749 Acres		Over 749 Acres		Total	
	No.	%	No.	%	No.	%	No.	%
0- 25	8	(9)	12	(4)	19	(4)	39	(4)
26- 50	15	(17)	31	(10)	36	(7)	82	(9)
51- 70	7	(8)	22	(7)	19	(6)	48	(5)
71- 80	6	(7)	45	(14)	61	(11)	112	(12)
81- 90	8	(9)	54	(17)	106	(20)	168	(18)
91- 95	2	(2)	24	(7)	63	(12)	89	(9)
96-100	40	(47)	135	(42)	233	(43)	408	(43)
Total Responses	86		323		537		946	

TABLE 10. PERCENT OF NORTH DAKOTA GRAIN HAULED TO MARKET IN PRODUCER'S TRUCK, BY COMMODITY, 1980

Percent Hauled by Producer's Own Equipment	Commodity											
	Wheat		Durum		Oats		Rye		Flax		Sunflower	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0- 25	8	(1)	7	(2)	1		4	(11)	3	(2)	10	(3)
26- 50	16	(2)	8	(2)	5	(1)	0		2	(1)	15	(4)
51- 75	12	(2)	4	(1)	0		0		1		3	(1)
76- 99	21	(3)	17	(4)	3	(1)	1	(3)	1		8	(2)
100	729	(93)	397	(92)	348	(98)	30	(86)	137	(96)	310	(90)
Total Responses	787		431		357		35		144		346	

One possible reason that producers rely heavily on their own equipment to move grain to market is a perception that custom hauling services are not available during harvest or in the off-season. Producers indicated concern when asked if they felt there was adequate custom hauling for either harvest or nonpeak movement times (Table 11). Only 39 percent felt strongly that custom services were adequate during peak demand times. The remaining farmers felt that custom service was inadequate (33 percent) or did not know (28 percent). More confidence was evident for off-season movement because

TABLE 11. FARMER PERCEPTION ON THE ADEQUACY OF CUSTOM GRAIN HAULING SERVICES, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

Crop Reporting District	Peak Demand				Off-Season			
	Yes	No	Don't Know	Total	Yes	No	Don't Know	Total
1	37 (36%)	42 (40%)	25 (24%)	104	64 (70%)	9 (10%)	18 (20%)	91
2	28 (32%)	32 (35%)	31 (32%)	91	60 (71%)	7 (8%)	17 (21%)	84
3	44 (40%)	40 (35%)	29 (25%)	113	74 (71%)	9 (9%)	21 (20)%	104
4	40 (41%)	30 (31%)	28 (28%)	98	61 (69%)	10 (11%)	17 (19%)	88
5	38 (37%)	36 (35%)	30 (29%)	104	70 (75%)	6 (7%)	17 (18%)	93
6	61 (43%)	39 (28%)	42 (30%)	142	92 (70%)	13 (10%)	26 (20%)	131
7	45 (46%)	28 (29%)	24 (25%)	97	57 (70%)	5 (6%)	19 (24%)	81
8	31 (39%)	20 (25%)	29 (36%)	80	40 (61%)	9 (14%)	17 (25%)	66
9	37 (36%)	40 (39%)	26 (25%)	103	66 (71%)	9 (10%)	18 (19%)	93
Total Responses	361 (39%)	307 (33%)	264 (28%)	932	584 (70%)	77 (9%)	170 (21%)	831

70 percent felt service was adequate and only 9 percent were positive that off-season custom service was inadequate. Perceptions of adequacy of service were similar by geographical regions of the state for either peak demand or off-season periods.

Leasing

Leasing trucks to move his grain provides a farmer an alternative to hiring custom haulers or purchasing truck equipment. This option was seldom used by North Dakota producers in 1980, and little difference was seen among Crop Reporting Districts (Table 12). Only 3 percent of the producers leased trucks.

Recent Changes in Farm Truck Fleet

The environment surrounding the agricultural producer in North Dakota has, as indicated earlier, undergone substantial changes, both off-farm and on-farm. Producers have been reacting to these changes in various ways with similar circumstances sometimes producing different actions.

It appears that location in the state has not been a major factor in the trucking equipment decisions of farmers (Table 13). About 11 percent of all farmers had made recent changes; only those in CRD 6 (central Red River Valley) had a significantly greater positive response (19 percent) to this question. A similar response is seen when examining recent equipment changes by size of farm (Table 14). The larger farms had a slightly higher incidence of changes. The incidence of recent changes in farm trucking equipment is, however, positively related to the number of trucks on the farm (Table 15). Recent changes for farms having more than two trucks were greater than the average.

TABLE 12. FARM TRUCK LEASING, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

Lease Trucks	Crop Reporting District																		Total Responses	
	1		2		3		4		5		6		7		8		9			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	2	(2)	3	(3)	3	(3)	5	(5)	2	(2)	4	(3)	4	(4)	2	(3)	5	(5)	30	(3)
No	103	(98)	88	(97)	111	(97)	97	(95)	104	(98)	143	(97)	96	(96)	79	(97)	104		925	(97)
Total Responses	105		91		114		102		106		147		100		81		109		955	

TABLE 13. INCIDENCE OF RECENT CHANGES IN GRAIN TRANSPORTATION EQUIPMENT OF FARMERS, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

Recent Equipment Changes	Crop Reporting District																		Total Responses	
	1		2		3		4		5		6		7		8		9			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	12	(11)	12	(13)	10	(9)	9	(9)	12	(11)	28	(19)	11	(11)	5	(6)	13	(11)	112	(11)
No	93	(89)	81	(87)	107	(91)	94	(91)	95	(89)	121	(81)	91	(89)	78	(94)	101	(89)	861	(89)

TABLE 14. INCIDENCE OF RECENT CHANGES IN GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY FARM SIZE, 1980

Recent Equipment Changes	Farm Size: 0-250 Acres No.	%	251-749 Acres No.	%	Over 749 Acres No.	%	Total Responses No.	%
Yes	8	(9)	23	(7)	80	(15)	111	(12)
No	84	(91)	303	(93)	455	(85)	842	(88)

A review of equipment changes by type of truck vehicle shows a definite movement toward tandem-axle trucks (Table 16). Eight percent of the owners of single-axle trucks had made recent changes, compared to 20 percent of those who had tandem-axles. The change is even more startling when noting that 63 percent of the farmers owning pup trailers and 58 percent of those owning semi-trucks had made recent changes.

It was expected that the weight and volume characteristics of sunflower may have generated farm trucking problems for producers in North Dakota. Thirty-five percent of the respondents indicated that sunflower had affected their truck needs (Table 17). Respondents to this item indicated that size of farm was an important variable because only 18 percent of the farms less than 250 acres had trucking needs affected by sunflower, compared to 26 and 41 percent, respectively, of the medium and larger farms.

Future Changes in Farm Truck Fleet

Farmers were also asked if they were planning to expand or update their present transportation equipment and were further asked what type of vehicle and size they would purchase if they were planning a purchase. In contrast to the past when only 11 percent of the farmers had undertaken equipment changes, 17 percent had decided to expand their equipment, and another 17 percent were considering expansion (Table 18). The incidence of planned expansion seemed

TABLE 15. INCIDENCE OF RECENT CHANGES IN GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY TRUCKS PER FARM, 1980

Recent Equipment Changes	Trucks Per Farm																		Total Responses	
	1		2		3		4		5		6		7		8		14			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	21	(7)	35	(9)	27	(18)	6	(23)	4	(40)	2	(29)	2	(67)	1	(50)	1	(100)	99	(11)
No	278	(93)	360	(91)	126	(81)	20	(77)	6	(60)	5	(71)	1	(33)	1	(50)	0		797	(89)

TABLE 16. INCIDENCE OF RECENT CHANGES IN GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY TRUCK TYPE, 1980

Recent Equipment Changes	Single-Axle		Tandem-Axle		Pups		Semi		Total Responses	
	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	65	(8)	31	(20)	10	(63)	7	(58)	113	(12)
No	720	(92)	126	(80)	6	(37)	5	(42)	865	(88)

TABLE 17. IMPACT OF SUNFLOWER ON THE TRUCKING NEEDS OF NORTH DAKOTA FARMERS, BY FARM SIZE, 1980

Sunflower Affected Your Truck Needs	Farm Size						Total	
	0-250 Acres		251-749 Acres		Over 749 Acres			
	No.	%	No.	%	No.	%	No.	%
Yes	8	(18)	48	(26)	145	(41)	201	(35)
No	31	(69)	116	(64)	197	(56)	344	(59)
Undecided	6	(13)	18	(10)	11	(3)	35	(6)
Total Responses	45	(100)	182	(100)	353	(100)	580	(100)

TABLE 18. INCIDENCE OF PLANNED CHANGES IN GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY FARM SIZE, 1980

Planning Equipment Changes	Farm Size						Total Responses	
	0-250 Acres		251-749 Acres		Over 749 Acres			
	No.	%	No.	%	No.	%	No.	%
Yes	12	(13)	38	(12)	113	(21)	163	(17)
No	71	(78)	237	(72)	321	(60)	629	(66)
Undecided	8	(9)	52	(16)	104	(19)	164	(17)

to vary throughout the state without an identifiable pattern (Table 19). The potential for changes in farm truck equipment does seem to increase as farm size increases (Table 18). Twenty-one and 19 percent, respectively, of the farms greater than 750 acres were definitely planning on changes or were considering changes. Of the medium-sized farms, 12 and 16 percent were planning on changes or considering them, compared to 13 and 9 percent, respectively, for the smaller farms.

Most (72 percent) of the farm operators who indicated a planned or potential expansion intended to purchase larger-sized vehicles, with 47 percent of these showing preference for tandem-axles and 27 percent favoring the purchase of single-axle trucks (Table 20). Twenty-three semi-trucks of larger size were going to be purchased. Little difference in purchasing intentions is evident by location, although the eastern sector of the state does seem to favor larger vehicles of either tandem-axle or semi-truck type.

TABLE 20. PLANNED EXPANSION OR UPDATE OF GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY CROP REPORTING DISTRICT AND VEHICLE TYPE AND SIZE, 1980

Expansion Type	Crop Reporting District									Total
	1	2	3	4	5	6	7	8	9	
	- - - - - - - - - - - - responses - - - - - - - - - -									
Same Size										
Single-Axle	7	7	5	1	7	7	9	5	5	53
Tandem-Axle	1	1	1	0	0	2	1	0	3	9
Semi	0	0	1	1	0	1	0	0	0	3
Other	0	0	0	0	0	0	0	0	0	0
Subtotal	8	8	7	2	7	10	10	5	8	65
Larger Size										
Single-Axle	3	7	7	2	5	6	5	7	3	45
Tandem-Axle	7	5	9	5	12	15	6	5	15	79
Semi	3	1	2	3	2	5	2	4	1	23
Other	1	2	2	2	3	5	2	2	2	21
Subtotal	14	15	20	12	22	31	15	18	21	168
Total	22	33	27	14	29	41	25	23	29	233

TABLE 19. INCIDENCE OF PLANNED CHANGES IN GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY CROP REPORTING DISTRICT, 1980

Planning Equipment Change	Trucks Per Farm																		Total Responses	
	1		2		3		4		5		6		7		8		9			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	16	(15)	16	(17)	19	(16)	9	(9)	24	(22)	30	(20)	21	(21)	11	(13)	22	(19)	168	(17)
No	67	(63)	57	(61)	79	(68)	82	(79)	62	(57)	100	(67)	72	(71)	51	(62)	74	(64)	644	(66)

Large- and medium-size farms are more likely to purchase larger vehicles when making truck changes (Table 21). Fifty-three percent of the smaller farms were planning to purchase vehicles of the same size, but only 26 and 29 percent, respectively, of the medium and larger farms planned to purchase the same sized vehicle when updating their equipment. Smaller farms planned to rely heavily on single-axle trucks while the larger farms were moving steadily to tandem-axle trucks and/or semi-trucks of a larger size.

TABLE 21. PLANNED EXPANSION OR UPDATE OF GRAIN TRANSPORTATION EQUIPMENT ON NORTH DAKOTA FARMS, BY FARM SIZE AND VEHICLE TYPE AND SIZE, 1980

Truck Type	Farm Size			Total
	0-250 Acres	251-750 Acres	Over 749 Acres	
	- - - - - - - - - - - -	responses	- - - - - - - - - - - -	
Same Size				
Single-Axle	7	12	31	50
Tandem-Axle	0	0	9	9
Semi	0	1	2	3
Other	1	2	4	7
Subtotal	8 (53%)	15 (26%)	46 (29%)	69 (30%)
Larger Size				
Single-Axle	4	16	24	44
Tandem-Axle	2	17	58	77
Semi	0	4	18	22
Other	1	6	14	21
Subtotal	7 ((47%)	43 (74%)	114 (71%)	164 (70%)
Total	15 (100%)	58 (100%)	160 (100%)	233 (100%)

Farmers were also questioned about trucking adjustments if faced with declining availability of elevator service nearby (Table 22). Almost 45 percent of the farmers who have recently upgraded equipment said they would rely on existing equipment while 34 percent indicated they would use custom hauling services. The least popular alternative, accepted by 22 percent of the farmers who had made recent equipment changes, was changing existing farm

TABLE 22. PLANNED USE OF GRAIN TRANSPORTATION ALTERNATIVES BY NORTH DAKOTA FARMERS IF DESIRED ELEVATOR SERVICE IS NO LONGER AVAILABLE, 1980

Recently Changed Equipment	Haul With Existing Equipment	Hire Custom Hauling	Change Equipment	Total
	- - - - - - - - - - - - -	percent	- - - - - - - - - - - - -	
Yes	45	34	21	100
No	17	33	40	100

farm truck equipment to handle the new stress of farmers' marketing their own grain. Of those who had not recently changed equipment, 40 percent said they would change equipment.

Grain Delivery

The distance that a farmer hauls his grain to the elevator affects his equipment utilization, costs of operation, labor, and harvest operation. As the marketing system changes, these interactions become even more important.

Distance to Elevator

Producers in North Dakota have different mileages to travel, depending on location, when moving grain to the closest elevator (Table 23). Twelve percent of the farms were within one or two miles of the elevator, 39 percent were within five miles, 35 percent were within 6 to 10 miles, while 16 percent of all farmers were within 11 to 15 miles of their elevator. Nine percent of the farmers were faced with distances between 16 and 25 miles; the longest distance faced by any of the farmers was 54 miles.

The distance to the nearest elevator increases as the density of grain production decreases throughout the state. Over 90 percent of the farmers in the Red River Valley were within 10 miles of the closest elevator. Only 70 and 50 percent of the producers from central and western North Dakota, respectively, were within 10 miles of an elevator.

TABLE 23. DISTANCE FROM FARM TO CLOSEST ELEVATOR, ONE-WAY, BY NORTH DAKOTA CROP REPORTING DISTRICT, 1980

Miles to Nearest Elevator	Crop Reporting District 1		2		3		4		5		6		7		8		9		Total Responses	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1- 2	8	(8)	12	(13)	11	(10)	5	(5)	17	(16)	32	(22)	6	(6)	7	(8)	17	(15)	115	(12)
3- 5	29	(27)	27	(29)	40	(35)	13	(12)	28	(26)	64	(43)	15	(15)	13	(16)	33	(29)	262	(27)
6-10	43	(40)	35	(38)	50	(43)	24	(23)	46	(43)	46	(31)	27	(27)	26	(31)	44	(38)	341	(35)
11-15	25	(23)	13	(14)	13	(11)	26	(25)	16	(15)	7	(5)	19	(19)	17	(21)	18	(16)	154	(16)
16-25	2	(2)	4	(4)	2	(2)	33	(31)	1	(1)	0		30	(29)	18	(22)	2	(2)	92	(9)
Over 25	0		2	(2)	0		4	(4)	0		0		5	(5)	2	(2)	1	(1)	14	(1)
Total Responses	107		93		116		105		108		149		102		83		115		978	(100)

Farmers do not necessarily haul grain to the closest elevator. The first and second most frequent trip distance to the preferred elevator was 6 to 10 miles and 3 to 5 miles, respectively (Table 24). Sixty-two percent of the farms were within 10 miles of their most common elevator destination, and only 19 percent were over 15 miles away.

TABLE 24. DISTANCE NORTH DAKOTA FARMERS TRAVEL TO PREFERRED AND SECOND CHOICE ELEVATORS, 1980

	Preferred Choice			Second-Choice		
Miles to Elevator	No.	%	Cumulative %	No.	%	Cumulative %
1- 2	89	(9)	9	20	(2)	2
3- 5	203	(21)	30	65	(8)	10
6-10	310	(32)	62	232	(28)	38
11-15	186	(19)	81	207	(25)	63
16-25	121	(13)	94	212	(26)	89
26-35	44	(5)	99	62	(7)	96
Over 35	14	(1)	100	35	(4)	100
Total Responses	967			833		

The impact on a farm operation of hauling to a second-choice elevator is quite evident. Only 38 percent of the producers were within 10 miles of an elevator of their second choice, compared to 62 percent for their most preferred location. Further, 37 percent of the farmers were over 15 miles away from their second-choice elevator location.

Elevator Preference

Farmers in North Dakota are quite loyal and patronize their closest elevator 67 percent of the time (Table 25). Producers were asked to identify reasons for not bringing their grain to the nearest elevator. "Low price," "poor elevator service," and "poor railroad service," were cited by 74, 27, and 24 percent of the respondents, respectively. Clearly, "low price" is the main reason producers bypass their local elevator.

TABLE 25. NORTH DAKOTA FARM DELIVERY OF GRAIN TO NEAREST ELEVATOR AND REASONS FOR NOT DOING SO, 1980

Item	Response Number	Response Percent
Deliver to Nearest Elevator		
Yes	648	67
No	332	33
Reasons for not Delivering to Nearest Elevator[1]		
Low Price	250	74
Poor Roads	42	12
Poor Railroad Service	81	24
Poor Elevator Service	92	27
Other	68	20

[1]Total percent is greater than 100 because producers could cite multiple reasons for not sending grain to nearest elevator.

Labor Requirements

Time spent in delivering grain can be divided into loading, unloading, driving, and waiting (Table 26). Loading was the most time-consuming activity; 34 percent of the farmers spent 20 to 30 minutes in this activity. Driving required the second most time; 22 percent of the farmers spent 20 to 30 minutes in this activity and 64 percent spent 11 to 30 minutes. Unloading was quite fast compared to other activities; 69 percent spent 10 minutes or less. Waiting was also a smaller time consumer because 66 percent waited 15 minutes or less. In sum, the four activities in a typical grain haul took about 60 minutes or less for 50 percent of the farmers. Conversely 10 percent of the farmers were faced with a combined time of 120 minutes.

Annual Truck Mileage

An examination of different truck types was conducted by grouping farms having solely single-axle trucks, solely tandem-axle, and those having

TABLE 26. TIME SPENT BY NORTH DAKOTA FARMERS IN DELIVERY OF GRAIN, PER LOAD, 1980

	Activity											
	Loading			Unloading			Driving			Waiting		
Minutes	No.	%	Cumulative %	No.	%	Cumulative %	No.	%	Cumulative %	No.	%	Cumulative %
1- 5	0	0	0	268	30	30	47	5	5	126	19	19
6-10	41	5	5	355	39	69	151	17	22	201	30	49
11-15	143	16	21	159	17	86	195	21	43	114	17	66
16-20	250	27	48	59	7	93	195	21	64	71	11	77
20-30	308	34	82	53	6	99	198	22	86	83	12	89
31-45	77	8	90	3	(1)	99	83	9	95	15	2	91
46-60	86	9	99	8	1	100	34	4	99	38	6	97
Over 60	14	1	100	2	0	100	15	1	100	21	3	100
Total Responses	919			907			918			669		

both types (mixed operations). The industry average for annual miles traveled was 5,162; tandem-axle operations had a significantly higher average of almost 12,000 miles (Table 27). Average length of haul varies little, but tandem-axle operators had the shortest haul.

TABLE 27. AVERAGE ANNUAL MILEAGE AND LENGTH OF HAUL FOR NORTH DAKOTA FARM TRUCKS, BY TRUCK TYPE, 1980

Vehicle Group	Annual Miles	Average Length of Haul
Single-Axle	4,270	11
Tandem-Axle	11,979	10
Mixed Operations[1]	8,170	13
Industry	5,162	12

[1]Farms having both single- and tandem-axle trucks.

Analysis of farm size showed significant differences in truck usage. Farm size was directly related to miles traveled annually per truck (Table 28). Miles traveled by the average truck increased steadily, from 3,005 annual miles for smaller farms to almost 9,200 miles for the farms over 1,000 acres in size. Conversely, the average length of haul decreased as the size of farm increased, from 13 to 11 miles.

TABLE 28. AVERAGE ANNUAL MILEAGE AND LENGTH OF HAUL FOR NORTH DAKOTA FARM TRUCKS, BY FARM SIZE, 1980

Farm Size in Acres	Annual Miles	Average Length of Haul
0- 250	3,005	13
251- 500	3,599	12
501- 750	4,800	12
751-1,000	5,392	11
Over 1,000	9,193	11

Truck Payload

The average payload of 540 bushels for tandem-axle operators was substantially larger than the 280-bushel average payload for single-axle truck operators (Table 29). Also, the average payload of trucks increased from 240 bushels on the smaller farms to 400 bushels on the larger farms (Table 30). The direct relationship between farm size and average truck payload corresponds to the earlier finding that larger farms had more tandem and semi-trucks than smaller farms had.

TABLE 29. AVERAGE PAYLOAD AND AGE OF NORTH DAKOTA FARM TRUCKS, BY TRUCK TYPE, 1980

Vehicle Type	Average Payload (Bushels)	Average Year of Trucks
Single-Axle	280	1960
Tandem-Axle	540	1971
Mixed Operations[1]	430	1968
Industry	310	1962

[1]Farms having both single- and tandem-axle trucks.

TABLE 30. AVERAGE PAYLOAD AND AGE OF NORTH DAKOTA FARM TRUCKS, BY FARM SIZE, 1980

Farm Size in Acres	Average Payload (Bushels)	Average Year of Trucks
0- 250	240	1955
251- 500	270	1960
501- 750	320	1961
751-1,000	340	1962
Over 1,000	400	1968

Truck Age

Over the entire range of farm size categories, truck age decreased as farm size increased (Table 30). The comparison of truck types from grouping farms having only single-axle trucks, tandem-axle trucks, and those having both types (mixed operations) indicated that tandem-axle trucks were significantly newer than either single-axle or mixed operations. The industry average was 18 years old, yet, the average tandem-axle truck was nine years old, suggesting that many producers in North Dakota are going to be faced with capital investment decisions in the near future (Table 29).

Cost Analysis

Specific attention is paid in this section to the costs of operating farm trucks in North Dakota. Costs of operation are developed using statistical estimation techniques. These cost estimates are then compared and evaluated with costs developed using an economic-engineering method of determining cost relationships.

Econometric Analysis

Various per unit cost relationships were analyzed using multiple regression. Multiple regression is a statistical process which allows the relationship between independent variables and the dependent variable to be mathematically determined. The relationships between the independent variables and the dependent variable must be known to use multiple regression.

In this study it was assumed that the chosen output measure, per-mile costs, bears a certain relationship to the alternative variables discussed below. Several measures of output (ton-miles, bushel-miles, and total miles traveled) could have been used for determination of average total costs in the statistical model. Total miles was used because it is more representative of the usefulness of a truck on a farm, as opposed to the utility derived from just moving grain.

The variables incorporated in the analysis of average total costs per mile were total annual miles, one-way distance to the elevator, average payload, number of trucks used in the farm operation, and age of equipment. All of these variables were significant except for one-way distance to the elevator. The relationships between these variables and per-mile costs are summarized in Table 31.

TABLE 31. EXPECTED AND OBSERVED RELATIONSHIPS OF OPERATING CHARACTERISTICS AND AVERAGE TOTAL COSTS PER MILE FOR FARM TRUCKS IN NORTH DAKOTA, 1980

Variable	Expected	Observed
Total Annual Miles	-	-
Distance to Elevator	-	-
Average Payload	+	+
Number of Trucks	+	+
Age of Equipment (60, 61, . . .)	+	+

The expected relationship between costs per mile and total annual miles was negative. The increased mileage allows fixed costs per year to be spread over more units of output and thus to decrease average total costs per mile. A longer distance from the farm to the elevator was expected to increase the total mileage for the farm truck and again decrease costs per mile. Labor costs associated with waiting, loading, and unloading time at the elevator are spread over more miles per trip, thereby lowering costs per mile.

It was expected that costs per mile would bear a positive relationship to average payload. The labor costs for loading and unloading the truck would increase as size of load increased, thus increasing per-mile costs.

The relationship between the number of trucks used on a farm and the per-mile costs could be either negative or positive. If all trucks were used to their individual maximum capacity, the overhead and maintenance of the farm might be spread over more units (similar to economies of scale or plant size). However, since North Dakota farms often have excess capacity in their use of trucks, the relationship was expected to be positive in this study. It appears that farmers accept slightly higher per-mile trucking costs to gain the increased harvest service and marketing flexibility associated with the larger truck fleet.

The age of the truck (1970, 1971, etc.) as a variable also could have varying effects on per-mile costs. The age of a truck is negatively related to per-mile maintenance and repair expenses. However, because of the high interest and depreciation costs associated with the large capital investment required for new vehicles, a newer truck (1970 vs. 1980) is expected to have a positive impact on costs.

The estimated cost equation was of the following general form:

$$\begin{aligned} LOG(ATC) = {} & b_0 + b_1\ LOG(MILES) + b_2\ LOG(ALH) + b_3\ LOG(AL) \\ & + b_4\ LOG(NOTRUK) + b_5\ LOG(AGE) + b_6\ BTMILES + b_7\ BTAL \\ & + b_8\ BMIXEDMI + b_9\ BMIXEDAL \end{aligned}$$

ATC = cost per mile

MILES = miles traveled in a year

ALH = average length of haul

AL = average load

NOTRUK = number of trucks in the farm operation

AGE = age of truck (70, 71, 72, . . .)

BTMILES = interaction term between solely tandem farm truck operation and miles traveled

BTAL = interaction term between solely tandem farm operation and average load

BMIXEDMI = interaction term between mixed farm truck operations (both single and tandem trucks) and miles traveled

BMIXEDAL = interaction term between mixed farm truck operations and average load

The interaction terms are used to differentiate between shape of the cost curves for those farms having solely single-axle, solely tandem-axle, or both types of farm trucks. These terms allowed both miles per year and average payload to be examined for different farm truck operations.

Estimating Equation

The regression analysis yielded the following estimating equation:

$$\begin{aligned} LOG(ATC) = {} & 5.027151^{a} - .610089^{a}\,[LOG(MILES)] - .025737\,[LOG(ALH)] \\ & + .680505^{a}\,[LOG(AL)] + .498671^{a}\,[LOG(NOTRUK)] \\ & + .152565^{a}\,[LOG(AGE)] + .176786^{a}\,[BTMILES] - .212268^{b}\,[BTAL] \\ & + .099725^{a}\,[BMIXEDMI] - .130193^{b}\,[BMIXEDAL] \end{aligned}$$

[a]Indicates significance at the 5 percent level.
[b]Indicates significance at the 10 percent level.

This estimated equation may be transformed into separate equations for each type of operation as shown in Table 32. All variables were significant at the 10 percent level except for average length of haul.

TABLE 32. ESTIMATING EQUATIONS FOR COST PER MILE OF SINGLE-AXLE, TANDEM-AXLE, AND MIXED FARM TRUCK OPERATIONS ON NORTH DAKOTA FARMS, 1980

Type of Operation	Dependent Variable (Cost/Mi.)	Coefficients (Independent Variables)					
		b_0	b_1 (Annual Miles)	b_2 (Haul Distance)	b_3 (Pay-load)	b_4 (Trucks/ Farm)	b_5 (Truck Age)
Single-Axle	LOG(ATC)	5.027151	-.610089	-.025737	.680505	.498671	.152565
Tandem-Axle	LOG(ATC)	5.027151	-.433303	-.025737	.468237	.498671	.152565
Mixed[1]	LOG(ATC)	5.027151	-.510364	-.025737	.550312	.498671	.152565

[1]Farms having both single-axle and tandem-axle trucks.

The coefficient on annual miles (b_1) indicates that tandem-axle trucks do not decrease costs per mile, as total miles increase, to the same degree as single-axle trucks. Further, the average load coefficient (b_3) indicates that an increase in the average load results in more expensive per-mile costs for single-axle trucks compared to either the tandem-axle or mixed operations.

Per-Mile Costs

The estimating equation was used to calculate per-mile costs using average data for the industry for single-axle, tandem-axle, and mixed operations for five different farm sizes. The data used in the analysis are presented in Tables 27 to 30 in this report and the per-mile costs are presented in Table 33.

TABLE 33. ESTIMATED PER-MILE COSTS FOR NORTH DAKOTA FARM TRUCKS, BY TRUCK TYPE AND FARM SIZE, 1980

Criteria	Estimated Cost
	(Cents/Mile)
Industry	103.80
Single-Axle	101.33
Tandem-Axle	126.62
Mixed Operations[1]	121.54
Farm Size of 0-250 Acres	99.21
Farm Size of 251-500 Acres	108.75
Farm Size of 501-750 Acres	109.94
Farm Size of 751-1,000 Acres	110.38
Farm Size Over 1,000 Acres	104.09

[1]Farms having both single-axle and tandem-axle trucks.

Industry average cost is about $1.04 per mile, but there are noticeable differences by type of truck operation and by farm size. The single-axle has $1.01 per-mile costs compared to $1.27 and $1.22 for tandem-axle and mixed operations. Although tandem-axles travel over twice as far a year, which has a decreasing effect on average costs, the significantly greater payloads and much newer equipment make average costs greater than the other two types of truck operation (Tables 27 to 30).

Farm size has a greater effect than truck type on per-mile truck costs. There is only an 11¢ range from $0.99 to $1.10 per mile. The estimated costs increase with farm size except for the largest size category. Each of the independent variables increases in magnitude as farm size increases with the exception of length of average haul, which fluctuates among farm sizes (Tables 27 to 30).

Examination of the per-mile costs might suggest that single-axle trucks are the lowest-cost truck type to move grain. However, the payload is significantly different among truck types. Table 34 indicates that the cost per bushel per mile is significantly different. The tandem-axle vehicle is the least expensive and costs 2.6¢ less per bushel for a 20-mile movement than using a single-axle vehicle.

TABLE 34. ESTIMATED PER-MILE AND PER-BUSHEL TRUCK COSTS FOR NORTH DAKOTA FARMS, 1980

Vehicle Type	Costs Per Mile	Payload	Cents Per Bushel Mile	Cents Per Bushel on a 20-Mile Trip
		(Bu.)		
Industry	103.8	312	.333	6.7
Single-Axle	101.3	278	.364	7.3
Tandem-Axle	126.6	543	.233	4.7
Mixed Operations[1]	121.5	434	.280	5.7

[1]Farms with both single-axle and tandem-axle trucks.

Economic-Engineering Analysis

This approach to cost estimation consists of constructing or synthesizing a "typical truck fleet" for a North Dakota farm. Estimates of the various cost components were developed by surveying equipment dealers, tire dealers, and regulatory agencies, and reviewing other economic-engineering studies of farm truck usage.

The costs are developed for the two different truck operations found most commonly in the survey of farms summarized earlier in this report. One farm model has two gas single-axle trucks, and the other farm model has one diesel single-axle truck and one diesel tandem-axle truck. The latter model corresponds to the mixed operation trucking type reviewed earlier. The cost methodology is presented here in a general fashion.

Fixed Costs

Fixed costs are those expenditures that do not vary with the level of production output which, in the case of this study, is annual miles. Economic-engineering studies provided the framework for these fixed cost estimates which were developed for late 1980. The fixed costs include depreciation on capital investment, interest costs or return on investment, license fees and taxes, insurance, and housing costs.

Depreciation. The trucks in both models were depreciated over a 10-year period using a straight-line depreciation schedule. Depreciation was calculated by dividing purchase price minus salvage value by the years of useful life. Salvage value was estimated by equipment dealers to be 25 percent of the original purchase price, reflecting a strong market for used or rebuilt equipment.

The cost of a new single-axle truck with box and hoist was $25,000 or $50,000 for the two vehicles. The tandem truck was estimated to cost $38,000, so the equipment cost for the mixed operation was $63,000. These costs resulted in annual depreciation expenses of $3,750 and $4,725 per year, respectively, for the single-axle and mixed operation truck models.

Return on Investment. These costs can arise from interest paid on debt capital or a return on equity investment. When a long-term asset such as a truck or storage building is purchased by a loan, the interest charges on the debt instrument represent a cash outlay or out-of-pocket cost to the farmer. Equity return, on the other hand, represents an opportunity cost of ownership or the return that could have been made on that capital if invested in its best alternatives.

The return on investment was calculated using 15 percent. Results from a survey of local banks and Production Credit Associations indicate that this was the approximate rate of interest charged in 1980 for these types of loans. It also served as an opportunity cost of equity capital since money markets were in this range during that period. The fixed costs were determined by dividing the purchase price minus salvage value in half to get the average investment over the lifetime period. This value was then added to the salvage value and multiplied by 15 percent to identify return on investment, resulting in annual costs for the single-axle and mixed operation models of $4,690 and $7,410, respectively.

License Fees and Taxes. License fees in 1980 were approximately $80 per vehicle when all permits were included. This did not vary significantly among models so license costs of $160 per model were used.

Insurance. Insurance agents indicated that farmers do not usually insure all vehicles for the entire year but rather for six months. In most cases a farmer carries both comprehensive and liability insurance on his main truck for the year. It was assumed that only one truck would be insured all year and in the mixed operation model this was assumed to be the tandem-axle truck. This resulted in insurance costs of $600 and $720 for the single-axle and mixed operation models, respectively.

Housing Costs. Housing farm trucks is usually done in multipurpose buildings. Only the amount of housing dedicated to truck storage was allocated to the truck. Most buildings utilized for machinery were pole buildings or quonset structures. The value of the building depreciation and associated costs for housing trucks was estimated to be $350 for each farm model.

Total Fixed Costs. The estimated fixed costs, each year, for both models are summarized below.

	Single-Axle Model	Mixed Operation Model
Depreciation	$3,750	$ 4,725
Interest on Investment	4,690	7,410
License Fees	160	160
Insurance	600	720
Housing	350	350
TOTAL FIXED COSTS	$9,550	$13,365

Variable Costs

Variable costs are defined as costs that vary with different amounts of production. Variable costs for trucks include tires, fuel, maintenance and repairs, and driver's labor.

Tire Cost. A survey of truck dealers and the survey of farmers indicated that a per-mile of tires for single-axle trucks is about $.03 per mile. The tandem-axle vehicle was estimated to have tire costs of $.05 per mile so the mixed operation model had an average tire cost of $.04 per mile. Farm tires are not driven at speeds as high as 18-wheel owner-operator trucks, but much of the farm truck mileage is on poorly maintained roads or in fields. Therefore, lower tire wear from reduced speeds is offset by rough travel surfaces.

Fuel Cost. Fuel consumption is different for gasoline- and diesel-powered trucks. Estimates of the efficiency were six miles per gallon for newer gasoline trucks and eight miles per gallon for diesel trucks. Fuel costs per gallon in 1980 were $1.25 for gasoline and $1.10 for diesel. The per-mile fuel costs for the single-axle and mixed operation models were $.22 and $.18, respectively.

Maintenance and Repair. Reliable maintenance and repair estimates were difficult to develop since many of these expenses arise sporadically and are not easily determined on a per-mile basis. Such costs include lubrication, tune-ups, engine overhauls, and general repair. Prior studies and personal interviews with local farmers were used to derive an estimate of $.08 per mile for each single- and tandem-axle truck.

Driver's Labor. Drivers must be paid whether they are driving or waiting. Individual hypothetical trips to elevators were synthesized that combined driving, waiting, and unloading time. An average wage rate of $5.00 per hour was used. This resulted in a wage per mile of 14¢ for both models.

Total Variable Cost Per Mile. The estimates of per-mile variable costs for the two models are shown below.

	Single-Axle Model	Mixed Operation Model
Tires	.03	.04
Fuel	.22	.18
Maintenance	.08	.08
Labor	.14	.14
TOTAL VARIABLE COSTS	.47	.44

Total Costs Per Mile

The fixed and variable costs developed above are combined to specify the average total costs of operation of the two farm truck models. Costs for varying levels of annual mileage are indicated in Table 35. Average

TABLE 35. ESTIMATED PER-MILE TRUCK COSTS FOR DIFFERENT USE LEVELS, FOR TYPICAL TRUCK COMPLEMENTS ON NORTH DAKOTA FARMS

Number of Miles: Farm	Number of Miles: Vehicle	Farm Model[1]	Total Cost Per Mile
6,000	3,000	Single-Axle	$\frac{6,000(\$.47) + \$\ 9,550}{6,000} = \$2.06$
		Mixed Operation	$\frac{6,000(\$.44) + \$13,365}{6,000} = \$2.67$
10,000	5,000	Single-Axle	$\frac{10,000(\$.47) + \$\ 9,550}{10,000} = \$1.43$
		Mixed Operation	$\frac{10,000(\$.44) + \$13,365}{10,000} = \$1.78$
15,000	7,500	Single-Axle	$\frac{15,000(\$.47) + \$\ 9,550}{15,000} = \$1.11$
		Mixed Operation	$\frac{15,000(\$.44) + \$13,365}{15,000} = \$1.33$
20,000	10,000	Single-Axle	$\frac{20,000(\$.47) + \$\ 9,550}{20,000} = \$\ .95$
		Mixed Operation	$\frac{20,000(\$.44) + \$13,365}{20,000} = \$1.11$

[1]Single-axle model indicates farm with two single-axle gas trucks and mixed operation model indicates farm with one single-axle diesel truck and one tandem-axle diesel truck.

per-mile costs are estimated at $2.06 and $2.67 for the single-axle and tandem-axle models, respectively, when the farmer only travels 6,000 miles (3,000 per vehicle) per year. If mileage per farm were to increase to 20,000 (10,000 per vehicle) per year, the per-mile costs drop to $.09 and $1.11, respectively, for the single-axle and mixed-operation trucking models.

The economic-engineering derived costs for the single-axle model are significantly higher than the econometric estimates but quite close for the mixed operation. The economic-engineering method estimates the cost of the single-axle model at $1.59 compared to $1.01 for the econometric estimate, when industry average mileages are used. The engineering model estimate for the mixed operation is $1.26 compared to $1.22 for the econometric estimate. The difference probably results because most single-axle vehicles are significantly older than the tandem vehicles, so the "new truck" models overstate the capital costs actually experienced for single-axle vehicles on North Dakota farms.

Management Options

The costs of operating a farm truck estimated in this report include all costs necessary to keep that factor of production in its existing use. These costs can be modified to aid the farmer in defining appropriate costs to consider when making farm truck investment. Examples of possible decisions for the mixed operation at average mileage and their impact on costs are summarized in Table 36.

If a farmer is considering movement of grain to different elevators because of better prices, the relevant cost of trucking might be only the variable or out-of-pocket costs associated with that movement. Thus, the relevant trucking cost per mile would be $.44, not $1.26. The relevant costs would decrease to $.30 per mile if the farmer were hauling the grain

TABLE 36. RELEVANT PER-MILE COSTS, USING AVERAGE MILEAGE, FOR MANAGEMENT DECISIONS ON A TYPICAL MIXED FARM TRUCK COMPLEMENT[1]

Decision	Per-Mile Fixed Costs	Per-Mile Variable Cost	Per-Mile Total Cost
Total Cost	$.82	$.44	$1.26
Fixed Costs Not Considered	.00	.44	.44
Fixed Costs and Drivers Labor Not Considered	.00	.30	.30
Backhaul at 25 Percent	.66	.35	1.01
Purchase of Used Equipment	.43	.54	.97

[1]Farm truck complement is one single-axle diesel truck and one tandem-axle diesel truck.

himself and considered his labor fixed. Thus, if a farmer had to travel 30 extra round trip miles to reach the higher-paying elevator, and his average load was 300 bushels, the out-of-pocket transportation cost would be 3¢ per bushel rather than the 12.6¢ needed to recover all costs. At any price increase greater than 3¢, the farmer is more than covering transportation costs. A 4.4¢ price increase is enough to recover all variable costs, including a return to labor for the farmer. Finally, at any price increase over 4.4¢ some contribution is made to pay the fixed costs of the farm truck.

Because an increasing amount of grain is being dried at commercial elevators, a farmer may have full loads going both ways. If backhauls were loaded even 25 percent of the time with dried grain, fertilizer, etc., the per-mile total cost could be dropped to $1.01 per mile on a round trip (Table 36).

A popular alternative to new farm trucks is the purchase of used or rebuilt trucks because of their lower capital costs and the need for a secondary vehicle during peak use time. The lower depreciation and interest charges for trucks purchased used is indicated in Table 36. However, some of these economies may be offset by an increase in fuel and maintenance costs. Therefore, the desirability of purchasing used trucks is sensitive to interest rates and operating efficiencies.

Summary and Conclusions

Increases in farm size, yields per acre, and production of bulky commodities such as sunflower, plus longer distances to elevators, have increased the volume and distance grain is carried in farmer-owned trucks. These changes necessitate decisions by individual farmers regarding their use of farm trucks.

The general purpose of this study was to identify costs and operating characteristics of farm truck usage in North Dakota agriculture. Questionnaires were mailed to 5,000 North Dakota farmers, a 12.5 percent sample of the state's estimated farm population. The sampling was stratified by size and geographical location. Questionnaire response was about 20 percent. An additional survey of truck dealers, insurance agencies, and regulatory agencies gathered cost components necessary to develop economic-engineering cost estimates.

There were significant differences in number of trucks per farm reported from different sections of the state. The percent of farms in the Red River Valley, central, and western portions of North Dakota having more than two trucks was 35, 18, and 14, respectively. Thirty-three percent of North Dakota farms had one truck and 44 percent had two trucks. Eighty percent of the trucks were single-axle while 16 percent were tandem-axles. Over 22 percent of the farm trucks in the Red River Valley were tandem-axle compared to 12 percent in the west and 10 percent in central North Dakota.

Twelve percent of the farmers were within two miles of their closest elevator, 39 percent were within five miles, 35 percent were within 6 to 10 miles, and 75 percent were within 10 miles of the elevator. Ninety percent of the farmers in the Red River Valley delivered grain to elevators located within 10 miles of their farm. In western North Dakota less than 50 percent of the farmers were within 10 miles of their delivery points, compared to 70 percent in the central areas.

Smaller farms had significantly fewer farm trucks than larger operations. Small farms relied most heavily on single-axle truck types while the tandem-axle truck was found more often on larger farms. Farmers that had tandem-axle trucks often did not employ other truck types.

Fifty-six percent of the farmers did not use their truck solely for hauling their grain. Custom hauling did not increase as the number of trucks increased. However, as farm size decreased the farmer did more custom hauling, possibly because of low grain volume or a higher level of off-farm activity by the small farm operator.

Nineteen percent of the Red River Valley farmers made recent changes in their truck equipment compared to 11 percent for farmers from other areas of North Dakota. Larger farmers have made more changes than the other farmers. Most changes have been towards tandem-axle and semi-trailers. Seven percent of the farmers indicated they planned change. Most farmers planned to purchase larger-sized tandem vehicles when they expanded their truck fleet. Smaller farms were often planning to purchase the same size equipment.

Farmers in North Dakota patronized their closest elevator 67 percent of the time. "Low price" was the reason cited most often by farmers as the reason for delivering at a different elevator. "Poor elevator service" and "poor railroad service" were distant second and third most common reasons farmers bypassed their closest elevator.

Grain delivery took 60 minutes or less for 50 percent of the farmers. Conversely, 10 percent of the farmers were faced with over 120 minutes for a load. Only 3 percent of the farms were leasing trucks, and only 39 percent of the producers felt custom hauling services were adequate during peak demand time. Thirty-five percent of the respondents indicated that sunflower had affected their truck needs. Distance traveled by trucks and the average payload of trucks increased from 3,000 to over 9,000 miles, and 240 to 400 bushels, respectively, as farm size increased. Large farms also have newer vehicles. Larger truck types like tandem-axle vehicles had higher annual mileage, higher average payload, and were newer.

Econometric estimation indicated that per-mile costs of trucks were affected by the following variables: total annual miles, average payload, number of trucks on the farm, and age of equipment. The industry average total cost was $1.04 per mile, but a noticeable difference by truck type and farm size was found. Total cost per mile was $1.01, $1.27, and $1.22 for single-axle, tandem-axle, and mixed truck size operations, respectively. The tandem-axle truck was least expensive on a cost per bushel per mile basis because it had a larger payload than the single-axle truck.

The economic-engineering cost method found costs per mile to be $1.59 for a farm having two single-axle trucks and $1.26 per mile for a mixed operation of one single-axle and one tandem-axle truck. Variable costs were about 30 percent of total costs due to the high capital and interest costs. Actual expenses by farmers would probably have a higher variable cost component because of older equipment, but less fixed capital costs.

In conclusion, trucks have become larger, more tandem-axles are being purchased, and there are more trucks on each farm. Costs of operating farm trucks vary significantly. The larger truck, if operated at a substantial level of miles each year, appears to offer cost savings.

APPENDIX A

Cost and Methods of Moving Grain by Farm Trucks in North Dakota (Survey)

C O N F I D E N T I A L

COST AND METHODS OF MOVING GRAIN BY FARM TRUCKS
IN NORTH DAKOTA

Please Estimate Your Answers as Accurately as Possible.

1. WHAT COUNTY DO YOU LIVE IN?______________________________

2. HOW MANY FARM TRUCKS (excluding pickups) DO YOU HAVE?

own______________ lease______________

A. How many of them are:

single axle	_______		
tandem	_______	pup	_______
semi/trailer	_______		
other, please specify	_______		

B. What percent of your total annual truck mileage is used in:

carrying grain for personal use	_______%
custom grain hauling service for others	_______%
other: (livestock/feed/seed)	_______%
TOTAL	100 %

C. It is important that we analyze specific operating costs in our study. The following question pertain to your farm truck's average annual operating costs.

I. Truck Information

	Truck #1	Truck #2	Truck #3
Size (1 ton, 2 ton, etc.)	__________	__________	__________
Make	__________	__________	__________
Year manufactured	__________	__________	__________
Year purchased	__________	__________	__________
Price paid	__________	__________	__________
Average annual mileage	_______mi.	_______mi.	_______mi.
Average miles per gallon	_______mpg	_______mpg	_______mpg
Average load (wheat bushels)	_______bu.	_______bu.	_______bu.

II. Average Annual Truck Expenses

	Truck #1	Truck #2	Truck #3
Operating Expenses (i.e.; tires, batteries, grease, oil, filters, antifreeze, tune-ups, and other repairs)	$______	$______	$______
Average price of gas per gallon	$______	$______	$______
Your annual hours in maintenance	______	______	______

III. Truck Housing (all trucks)

Present value of building(s) $________

Percent of building(s) used for trucks ________%

Average annual repairs to building(s) $________

Estimated life of building(s) ________years

IV. Other Truck Costs

	Truck #1	Truck #2	Other
Annual license fees	$______	$______	$______
Annual insurance	$______	$______	$______
Other costs, specify	$______	$______	$______

3. INFORMATION ON RECENT CHANGES AND/OR IMMEDIATE FUTURE PLANS CONCERNING FARM TRUCKS IS VALUABLE.

A. Have you made changes in your farm truck equipment recently?

Yes______ no______

Why, please comment____

____

B. Are you currently planning to expand or update your present transportation equipment?

Yes______ No______ Undecided______

If yes, what changes do you plan to make? (Check one or more.)

Purchase:	Larger Equipment	Present Size Equipment
single axle	______	______
tandem	______	______
semi-truck	______	______
other, specify	______	______

C. If you did purchase larger trucks how would they work on your farm operation? (Check one or more.)

no problem	________
cost restrictive	________
create difficult access to farm grain storage facilities	________
create difficult access into fields	________
lack of housing room for trucks	________
others, specify	________

4. YOUR ASSISTANCE IN HELPING US UNDERSTAND THE CURRENT PRACTICES OF DELIVERING GRAIN IS VALUABLE.

A. How far is it to the nearest elevator from your farm?

________miles (one-way)

I. What is the distance to your most common elevator destination?

	1st Choice (most common)	2nd Choice
Total one-way distance	________	________

II. Do you normally deliver grain to your nearest elevator?

Yes________ No________

If you don't, why?

1. Price is usually lower ________
2. Poor roads ________
3. Poor railroad service ________
4. Poor elevator service ________
5. Other, please specify ________________________

III. Percent of grain marketing trips to:

First choice delivery point ______%
Second choice delivery point ______%

IV. Average time required per load to move grain from farm storage facility to delivery points.

	1st Choice	2nd Choice	
1. Loading	________	________	minutes
2. Unloading	________	________	minutes
3. Driving time (one-way)	________	________	minutes
4. Waiting time	________	________	minutes
5. Traveling speed	________	________	m.p.h.

V. If service was not available at your 1st and 2nd choice delivery points, what changes would you make?

1. Haul my own using present equipment _______
2. Hire custom hauling service _______
3. Change my transportation equipment _______

If you continue to use your own equipment, how many more miles could you drive past your 1st and 2nd choice.

Distance	Harvest Time	Off Season
None	________	________
5-10 miles	________	________
10-15 miles	________	________
15-20 miles	________	________
20-25 miles	________	________
More miles	________	________

5. TRUCK EQUIPMENT NEEDS VARY WITH THE SIZE OF FARM UNITS AND TYPE OF PRODUCTION.

A. What is the total crop land of your farm, both owned and rented acres? (Check one blank.)

1-249 acres_______ 350-749 acres_______ 750-larger_______

B. Individual crop acres in production and the method of delivering your crop to market for an average production year is useful information.

Acres in Production		Method of Delivering Grain to Market		
Crop	Total Acres	Percent Hauled by Your Truck	Percent Hauled by Custom Truck Percent	Cents/Bu.
Wheat		%	%	/bu.
Durum		%	%	/bu.
Barley		%	%	/bu.
Oats		%	%	/bu.
Rye		%	%	/bu.
Flax		%	%	/bu.
Sunflowers		%	%	/bu.
Other		%	%	/bu.

6. CUSTOM HAULING IS AN ALTERNATIVE METHOD OF DELIVERING GRAIN TO COUNTRY ELEVATORS.

   A. Do you believe there is an adequate amount of custom hauling services available to you currently?

      peak demand yes_______ no_______ don't know_______

      off season yes_______ no_______ don't know_______

   B. Do you usually lease trucking equipment? yes_______ no_______

      If so, explain the arrangement.

      (i.e.; $.20/mile - $10/day)_______________________________

   C. Do you provide a custom hauling service to local farmers?

      yes_______ no_______

      I. If so, how many of your trucks are used in custom hauling? _______trucks(s).

      II. How many custom trips do you make per year?_____________trip(s).

      III. What percent of your total gross farm income relates to custom hauling services? _________percent.

7. IF YOU RAISE SUNFLOWERS, HAS IT AFFECTED YOUR NEED FOR TRUCKING EQUIPMENT?

   yes_______ no_______ don't know_______

   If yes, please comment:_______________________________

   ____

8. DO YOU HAVE FURTHER COMMENTS ON GRAIN TRANSPORTATION AND HANDLING?_________

   ____

   ____

THANK YOU