NUMBER AND PHYSICAL CHARACTERISTICS OF GRAIN ELEVATORS

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Since no comprehensive list of the field of grain elevators has ever been made, number of specific types of grain storage facilities is undefined. Survey data from six grain belt States on storage capacity, receiving leg numbers and capacity, truck and rail loadout spouts, number and capacity of grain dryers, and throughput were analyzed. The data show great diversity in characteristics within and across storage types and States. Regression analysis showed no strong relationship existing between annual throughput and other physical characteristics of the surveyed elevators. Numbers of the elevators are estimated. Results of the study show that caution must be exercised in attempts to classify elevators or predict grain elevator industry response or potential when using physical characteristics of grain elevators as criteria.

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TABLES

SUMMARY

Publicly available data on grain elevators are inadequate for the Government decisionmaking process relating to the regulation of dust emissions. Such data consist basically of lists which give addresses, storage capacity, and receiving and shipping capacities. The data fail to indicate which facilities should be subject to regulations, since neither function of the structure nor average annual throughput, the volume of grain handled, is listed. Annual throughput data would best allow officials to determine the volume of grain with dust emission potential. As is often the case with data necessary for making compliance regulations, this information is private.

The study analyzes data furnished by an industry survey of six grain belt States. Regression analysis of the data revealed that no strong relationship exists between annual throughput and the various characteristics of elevators, including storage capacity, the most publicly documented characteristic of grain elevators.

Because of the differences among grain elevators, it is virtually impossible to use publicly available statistics to write blanket regulations having an equal impact on all such structures. Thus, a survey statistically designed to obtain the proper kind of data is needed to evaluate properly the potential impacts of proposed regulations affecting operational characteristics of grain elevators.

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by L. D. Schnake and
James L. Driscoll 1/

INTRODUCTION

Government officials considering programs and regulations affecting agribusiness industries need a thorough understanding of the industry with which they are dealing. In this report, various statistics and analyses useful to grain marketing researchers, industry, and those needing documentation on grain elevators are organized into four major parts: 1) Historical development of the grain marketing system, its organization, and practices; 2) estimates of the U.S. grain elevator universe; 3) physical aspects of grain elevators; and 4) regression analyses to predict grain throughput. Because of a lack of geographically diverse data, available data are more representative of the number of grain elevators than of regional differences among them. These data provide limited statistics for impact analyses, and point out the numerous variables which must be considered to properly conduct such analysis.

THE GRAIN MARKETING INDUSTRY

The grain marketing industry consists of an interrelated network of producers, physical facilities, merchants, and processors whereby seasonally produced commodities are transformed into consumer products or exported on a continuous basis. Between producers and consumers are various points of grain storage, including farm storage; country, subterminal, and terminal elevators; mills and other processors; and other elevators. Grain elevators are commonly classified as country, subterminal, and terminal, although there are no precise definitions for such classifications (4). 2/

1/ Agricultural Economist, Grains and Feeds Program Area, Commodity Economics Division, Economics, Statistics, and Cooperatives Service, stationed at the U.S. Grain Marketing Research Center, Manhattan, KS; and former Agricultural Economist, Commodity Economics Division, Economics, Statistics, and Cooperatives Service, stationed in Washington, D.C.

2/ Underscored numbers in parentheses refer to literature listed in the references section at the end of this report.

Development

In the development of the industry, the country elevator represented the point at which grain was sold by farmers. Country elevators developed as a series of way stations every few miles along rail lines. Concentration of production, quantity of sales from farms, and the distance grain could be hauled by horse and wagon were major factors influencing elevator size and the distance between elevators.

Terminal elevators were located in market centers where facilities existed for bringing buyers and sellers together to inspect grain, determine price, and transfer ownership. Country elevators consigned grain to a representative at these centers and were the owners until a bargain was struck. Much of the grain moving through the marketing system was shipped through these centers.

Development of better communications, standardized grain grading, commercial feeding, increased size of processors, growth of the export market, an evolving rail rate structure, improved highways and waterways, and other forces have caused significant changes. Recently, less grain moves exclusively in the country-terminal-user chain since there are more direct shipments from country points to final destination, especially in the case of exports.

Today, improved roads and transportation equipment make the distance from farm to elevator a much less important determinant of structure of the country elevator system. However, both production and sales from farms have increased substantially, providing a larger volume of business for country elevators. Thus, marketing patterns are influential in the location of storage, and these patterns vary geographically.

In some areas, farmers typically deliver a high percentage of their grain to elevators during harvest. In these areas, country elevators with large storage and handling capacities relative to annual throughput are needed. In other areas, farmers store much of their grain on the farm and deliver a smaller proportion of the crop during harvest, thus reducing the ratio of storage capacity to throughput, and permitting relatively smaller handling capacities. Some of the factors which influence these marketing patterns are ease of quality control in onfarm storage (related in part to climatic conditions), speed of harvest and use of custom services, potential for premiums (such as those based on the level of protein in wheat), tradition, and optimization of the farmers' seasonal workload.

In areas where much of the grain is delivered to country elevators at harvest, immediate shipment to other elevators in the marketing system is often needed to make room for additional farmer deliveries. This need led to the development of storage centers to serve as "surge tanks" in locations outside the traditional terminal markets. These elevators came to be called subterminal elevators. They provide functions such as blending to achieve greater uniformity of grain and facilitate marketing. Storage at an intermediate point in marketing channels also offers the ability to move grain quickly to the final position when needed. Thus, subterminal elevators have a year-round demand for their services.

As the grain marketing system becomes more complex, 3/ other factors besides farmer marketing patterns, such as changes in the freight rate structure, have become influential in the location of new storage facilities. For example, freight rates in some areas have encouraged construction of elevators with high speed loading capacities that require unit-train shipments for efficient facility utilization. There is, of course, a limit to the need for such facilities, since unit-train movements of grain are suitable for export shipments but impractical for most domestic situations.

3/ For more detailed information on the grain marketing system, see (3) and (4).

The Future

The grain marketing system will continue to evolve as economic forces cause changes in its structure. Because of the inherent nature of the task to be performed and the products handled, basic components of the system will probably remain the same. Farmers will continue to do the majority of their business with elevators located near production, and subterminals and terminals will continue to serve as "surge tanks" to even the flows from point of production to point of use, and to facilitate blending. The distinction between subterminal and terminal elevators will become increasingly blurred so that in time there may be no distinction. Many elevators will serve as specialized structures--to load multicar rail units, barges, and ships--while the more traditional elevators will continue to serve the needs of domestic processors and feeders.

The quantity of grain marketed is expected to increase to meet added demands generated by an increasing world population and improved economic well-being. This change, however, is largely independent of the structure of the grain assembly complex. The number of firms will likely continue to decrease while their average size increases, as in the past. However, increased business and specialization are stabilizing forces which will support the number of firms in the future. Increasing concentration of ownership and control may result in emergence of two simultaneous patterns of physical plant structure: 1) Existing storage facilities and equipment will remain in service, merely changing ownership; and 2) new, larger elevators will be built as the primary storage and handling facility, while older, generally smaller elevators are relegated to collection points, abandoned, torn down, or converted to handling other bulk materials. Two or more elevators under single ownership in the same vicinity may give some firms greater transportation versatility. Purchase of an elevator located on a different railroad, for example, might enable a firm to compete more effectively in certain markets.

USDA LISTS PERTAINING TO GRAIN STORAGE CAPACITY

Data concerning numbers and capacities of grain elevators are incomplete; thus it is difficult to establish the size of this universe or the number of a particular type of elevator, such as country, subterminal, terminal, or feed mill. Within USDA, the Agricultural Stabilization and Conservation Service (ASCS), and the Economics, Statistics, and Cooperatives Service (ESCS) 4/ maintain lists pertaining to grain storage facilities which are considered official. The lists are different, however, and are maintained to satisfy the needs of the respective agencies.

ESCS List of Grain Storage Structures

The Statistics Program of ESCS, formerly the Statistical Reporting Service (SRS), maintains a list of off-farm storage facilities for estimating off-farm grain stocks in its quarterly report of grain stored on- and off-farms in the United States.

The ESCS list includes structures used for the storage of grains, soybeans, and flaxseed, and excludes structures used to store only rice or peanuts, oilseed crushers processing only cottonseed or peanuts, tobacco and seed warehouses, and storage that handles only dry beans or peas. This list includes storage structures servicing commercial cattle feedlots, poultry production operations, feed mills, and similar business enterprises. In a few instances, this list includes only the headquarters for a

4/ On January 1, 1978, three USDA agencies--the Economic Research Service, the Statistical Reporting Service, and the Farmer Cooperative Service--merged into a new organization, the Economics, Statistics, and Cooperatives Service.

particular firm and not its several storage facilities. Thus, the list is not all-inclusive for structures capable of serving as grain storage and handling operations. In April 1977, SRS (now ESCS) listed 14,680 off-farm storage facilities (6).

In 1975, the Economic Research Service (now ESCS) used the SRS list for a probability survey of the industry (2). Respondents were asked to classify their firm in one of ten categories: country, subterminal, terminal, or export elevator; soybean processor; flour mill; feed mill; cattle feedlot; poultry producer; or other. Using addresses on the SRS list, ERS estimated that about 8,600 were country elevators and 450 were subterminal and terminal elevators. These estimates were derived by expansion to the universe represented by the ESCS list. This number declined slightly in the April 1977 estimates; thus, estimates of country and terminal elevators and the number of structures should still be valid.

ASCS List of Warehouses Approved Under the Uniform Grain Storage Agreement

ASCS manages inventories of grain acquired by the U.S. Government through price support programs of the Commodity Credit Corporation (CCC). That organization contracts with operators of commercial grain storage facilities for handling and storing these inventories. Since farmer-owned grain pledged under price support loans with the CCC and stored off-farm must be stored in an approved warehouse, there is a strong incentive for elevator owners in major producing areas to enter into a contractual arrangement known as a Uniform Grain Storage Agreement (UGSA) with CCC whenever inventories of grain under loan are desired or expected. Rice under loan is covered by the Uniform Rice Storage Agreement (URSA).

ASCS classifies grain warehouses under the UGSA as terminal or country elevators according to their ability to furnish official weights and grades on receipts and shipments (5). Official weights and grades normally are available only at elevators classified as subterminal and terminal; however, an elevator able to furnish official weights and grades can be classified in the other category. Thus, while it is acceptable to categorize these approved warehouses as terminal and country elevators, one must recognize that the distinction is not absolute.

ASCS also allows a warehouseman to include several distinct storage structures under the same contract if certain conditions are satisfied. For example, an elevator company with a main elevator at location X and satellites at nearby locations Y and Z may place all three storage structures under the same contract if rail transportation rates and tariff rates are identical. These data would be entered into the system under a single warehouse code number with approved storage capacity equal to the sum of the storage capacity at the three locations.

The number of contracts approved under the UGSA may fluctuate from time to time. If inventories of grain are desired or expected, the competitive position of an elevator may depend on gaining control of farm-originated grain; the lack of a contract under the UGSA restricts this competitive position under such conditions. Thus, one could expect a higher number of contracts under the UGSA during such periods, compared with periods of high throughput such as the record export years 1972-76. Elevator owners have less incentive to enter into the agreement when throughput is high, since greatest net revenue is likely related to throughput volume. Elevators not used for long-term storage because of the nature of the business, such as a feed mill, generally have the least incentive to enter into the CCC storage agreement.

Number of Warehouses Approved Under the UGSA

Average *capacity* of warehouses under storage contracts not providing official weights and grades varies significantly by region. The magnitude of difference in size of elevators may not be as great as indicated in table 1 if the average *number* of structures per contract also varies significantly by region. It is important to note that these data are not the *number and average size* of grain elevator structures, but the *number and average approved capacity* under UGSA. A complete count of the warehouse structures would involve perusal of all records associated with each storage contract.

Capacity of Warehouses Approved Under the UGSA

Average capacity under the CCC agreement not furnishing official weights and grades is 547,000 bushels nationally. 5/ Smallest average capacity is in the Northern Plains, where approved capacity runs about one-half the national average; largest average capacity is in the South and East. The sharp contrast may be attributed to differences in farmers' marketing practices: onfarm storage is used for a high proportion of the crops in the Northern Plains, as evidenced by the ratio of farm stocks relative to production (table 3). There is a lesser need to build large storage structures in this situation. But because of differences in farmers' marketing practices (table 3), a smaller elevator in the Northern Plains may handle as much or more grain during a season as a larger elevator in another region.

The size distribution of contracted capacity under the UGSA with the ability to furnish official weights and grades shows less variability among regions than those without. Only the West deviates sharply from the average.

Average contracted storage capacity under the URSA shows marked variation by State (table 2). Structures used for rice storage are similar to other grain warehouses and serve similar functions. ASCS makes no distinction on the basis of ability to furnish official weights and grades in the case of rice dryers (elevators) under the URSA. Normally, rice moves directly from dryer to mill and all shipments are graded prior to sale, differing from other grains in this respect.

Assuming that the incidence of multi-elevator agreements is more or less uniform among size categories, ASCS data may be expanded to the universe of elevators derived earlier (table 4). These data appear to be reasonable approximations of a universe for which reliable statistics are not available.

5/ The latest available ASCS data (March 31, 1978) indicate that average capacity approved under the UGSA for this category has increased to 570,835 bushels, consistent with current expectations of Government takeover of grain, a new UGSA schedule of rates, and statements made above about industry's expectations regarding grain inventories. Conclusions in this study would not be altered by using current UGSA data, and would cause comparisons with other data used in the study to cover different time periods.

INDUSTRY DATA ON GRAIN ELEVATORS

An Industry Survey

Following initial publication of the New Source Performance Standards (NSPS) (9) for particulate emissions by grain elevators, six State grain and feed associations surveyed their entire membership by mail questionnaire in May 1977. The purpose of the survey was to obtain information on location, storage capacity, throughput, number and capacity of receiving legs, total leg capacity, number of rail and truck loadout spouts, and number and rated capacity of grain dryers. This information was collected to assist in identifying facilities 6/ potentially subject to NSPS, and in evaluating the economic impact of NSPS. Since there was no followup of nonrespondents, these data are subject to the potential bias of any mail survey; that is, a greater than proportional response can be expected from those with the greatest direct interest in the subject. In addition, since not all elevator owners are members of the surveying organizations, part of the universe was not contacted; thus, generalizations of data analyses should be made with caution.

Coverage

Nearly 1,800 responses were received from the six States of Illinois, Iowa, Kansas, Minnesota, Nebraska, and Ohio (table 5). 7/ Depending upon the State, responses were received from 15 to nearly 40 percent of the number included in the SRS list of storage facilities. Response percentages would be higher based on grain elevators only. In general, response rate was good for a mail survey. It should be remembered, however, that this is a count of responses, and not a count of the number of elevators.

In some States, the percentage of storage capacity covered in the surveys was somewhat higher than the proportion of facilities included in the SRS list (table 6). However, Nebraska had the thinnest coverage in both cases, with about 15 percent of both numbers and capacity.

Location of Elevators

Over 70 percent of the respondents indicated that they were located in areas with a population of 1,500 or less; two-thirds of these were in rural areas (table 8). About 2 percent were located in an area inhabited by 25,500 or more people. In the low density population areas where a majority of the respondents are located, there are fewer sources of air pollution than is the case for many other industries.

There appears to be no correlation between population of the area where an elevator is located and its storage capacity (table 9). The smallest size class of elevators was reported in the largest population class, and the largest elevator class was reported in the rural areas.

6/ Facilities, as used here, refers to the definition in (9)--"Identifiable pieces of process equipment or individual components which when taken together would comprise a source" of emission.

7/ A few questionnaires were received after analyses were begun and are not included in these results.

Selected Physical Characteristics of Elevators

Storage Capacity

Average storage capacity of respondents to the industry survey generally corresponded to averages of UGSA contracts (table 7). In the largest storage capacity category, however, respondents' capacity was much less than the average UGSA contract. The overall average of the surveys was around 135,000 bushels smaller than the average of the UGSA contracts. Large elevators which already have extensive dust control systems may not have felt a need to respond, or in some cases may not have been members of the State organizations.

Approximately 40 percent of the respondents reported detached storage capacity, representing about 35 percent of total capacity (table 10). Almost 63 percent of respondents in Iowa had detached storage facilities, over twice the ratio in Illinois and Ohio. The percentage of detached storage capacity decreases as size increases. Overall average capacity of respondents with detached storage facilities was about 15 percent greater than for those with only primary storage (tables 11 and 12). Nebraska respondents had the greatest percentage of detached storage capacity--54 percent. Respondents in the smallest category averaged almost three times as much detached storage capacity as those in the 2.5 and 5.0 million bushel category.

Throughput Ratios

Throughput ratios 8/ were highest in all six States for the smallest storage capacity category (table 13); however, Kansas, the predominant wheat State, had the lowest turnover rate, and Illinois, a major corn State, had the highest. Throughput ratios for the next five categories generally decline. This trend reversed itself for elevators with over 5 million bushels capacity, rising, in Ohio for example, to a ratio greater than for the smallest category.

Receiving Legs

Overall, the modal number of receiving legs is two for respondents (table 14). The average is 2.53 (table 15), with substantial differences in average number of receiving legs. Extreme variations are most likely the result of averages computed from a small number of respondents.

Loadout Spouts

In storage capacity categories, over 89 percent of Kansas respondents reported rail loadout spouts for storage capacity of 100,000 bushels or less, compared with 21 percent for Ohio. About one-half the respondents in the other States reported rail loadout spouts for that capacity. At the other end of the capacity spectrum, all respondents with over 5 million bushels storage reported both rail and truck loadout spouts.

The average number of truck and rail loadout spouts is generally greater as storage capacity increases (tables 21 and 22). Illinois respondents had the greatest average number of both rail and truck spouts, while Ohio had the lowest average number of rail spouts, and Kansas the lowest number of truck spouts. The modal number of

8/ A throughput ratio is the ratio of annual volume to storage capacity.

rail loadout spouts for all respondents was one; however, two loadout spouts was the mode for respondents in the 1.0 to 2.5 million bushel storage capacity category (table 23). The modal number of truck spouts was two for Illinois, Iowa, and Kansas; and one for Minnesota, Ohio, and Nebraska (table 24).

Dryers

At 94 percent, Iowa and Ohio had the highest percentages of respondents with grain dryers by storage capacity, while in Kansas, the predominant wheat State, only 65 percent of the respondents had dryers (table 25). Generally, the greater the storage capacity, the more likely respondents were to have dryers; in Minnesota, however, the few respondents in the largest capacity categories did not have dryers (tables 26 and 27). The average number of dryers increased as respondents' storage capacity increased, with an average of two dryers for respondents with storage capacity greater than 500,000 bushels. As number of dryers tended to increase with storage capacity, so did dryer capacities (tables 26-28).

OPERATING CONSIDERATIONS

The preceding information, while useful, provides an incomplete picture of the complexity of elevator operations. Depending on the size of the elevator, legs and conveyor belts often serve a multiplicity of uses. A leg or belt can be used for receiving, loadout, and conditioning. In larger elevators, some specialization of equipment use is likely. However, in some cases, specification of regulatory mechanisms can have in impact upon the productivity of individual elevators and, in turn, the grain marketing-transportation complex. For example, the proposed NSPS required a completely enclosed shed for dumping railcars. Such a control might have reduced the productivity of the car dump by requiring uncoupling of each car. Further, if the leg servicing the car dump was also used for other purposes, such as loadout or turning inventory, productivity of equipment not directly related to the original control point might be reduced. Analysis of the economic impact of such a proposal must thus look at the regulatory impact upon the entire elevator rather than at individual parts.

REGRESSION ANALYSIS TO PREDICT THROUGHPUT

It was proposed that the New Source Performance Standards be applied to individual firms on the basis of receiving leg capacity. A cutoff point was established whereby elevators with greater leg capacity would be subject to the standards, but smaller elevators would not. Throughput, the annual volume of grain handled by an elevator, is a proper measure of grain business activities, and in the case of standards regulating dust emissions, directly correlates with the quantity of dust generated (allowing for differences in type of grain).

Regression analysis of industry survey data was used to determine the relationship between throughput and the number of legs, leg size, storage capacity, number of rail loadout spouts, and number of truck loadout spouts. The purpose of this analysis was to determine if the annual volume of business (bushels) was related to physical characteristics of the elevator. The results do not demonstrate a strong relationship between throughput and any of the physical characteristics of respondents' operations (table 29). Storage capacity was the most reliable indicator, yet it explained less than 40 percent of the variability in throughput. Total leg capacity and largest receiving leg capacity explains 22 and 23 percent of throughput variability, respectively. The number of rail or truck loadout spouts has no relationship to throughput.

These results are not surprising. Elevators are designed for the efficient handling and storage of bulk grain and are built to serve the objectives of the management and the needs of farmers in the local area. More important, management differs in its aggressiveness--two elevators, side by side and identical in all physical respects, will probably have differing annual volumes of business simply because of management.

Throughput differs by area of the country. Areas with a large proportion of on-farm storage need less storage and handling capacity than areas where farmers deliver a high proportion of the crop at harvest. Thus, for the same size elevator, an elevator in one area may have a lower annual throughput than one in another area. The data on throughput ratios (table 13) show that respondents in the various States did report differing average turnover ratios.

CONCLUSION

The universe of grain elevators must be defined in number and by type of operation to properly and accurately evaluate the impact of any situation having economic repercussions on grain elevators. Physical layout and business functions must likewise be defined before any regulations can be equitably applied.

Because of the physical differences among grain elevators, it is virtually impossible to use publicly available statistics to set blanket regulations having an equal impact on all such structures. Thus, a survey statistically designed to obtain the proper kind of data is needed.

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Table 1--Approved number and average capacity of warehouses under the Uniform Grain Storage Agreement, by region and ability to provide official weights and grades, 1977

Storage capacity (1,000 bu.)	Northern Plains		Mid-Plains		Southern Plains		West		Lake States		South and East		U.S. total	
	Ware-houses	Average capacity	Ware-houses	Average capacity	Ware-houses	Average capacity	Ware-houses	Average capacity	Ware-houses	Average capacity	Ware-houses	Average capacity	Ware-houses	Average capacity
	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.
						Do not furnish official weights and grades								
0-100	166	71	202	59	35	56	95	63	46	65	15	72	559	64
101-350	860	201	915	224	134	224	212	201	292	232	65	210	2,478	215
351-500	144	415	368	420	73	424	50	414	137	417	28	422	800	419
501-1,000	109	672	582	692	135	702	54	716	289	702	54	705	1,223	695
1,001-2,500	29	1,317	293	1,390	109	1,523	51	1,615	156	1,399	47	1,660	685	1,446
2,501-5,000	0	0	31	3,302	18	3,482	23	3,304	17	3,092	12	3,564	101	3,330
Over 5,000	0	0	2	5,584	8	6,659	1	9,481	4	5,751	5	6,424	20	6,452
Total-average	1,308	272	2,393	541	512	859	486	568	941	664	226	962	5,866	547
						Do furnish official weights and grades								
0-100	0	0	1	18	1	1	6	15	1	60	0	0	9	19
101-350	0	0	5	279	2	196	1	111	0	0	2	126	10	215
351-500	0	0	6	407	1	407	3	445	1	359	1	497	12	420
501-1,000	4	703	18	758	11	816	8	726	4	757	5	799	50	765
1,001-2,500	15	1,587	50	1,602	25	1,736	10	1,637	23	1,708	3	1,973	126	1,658
2,501-5,000	14	3,884	30	3,615	22	3,662	7	3,847	17	3,549	14	3,806	104	3,692
Over 5,000	8	11,210	30	11,259	20	10,861	6	6,198	18	10,103	16	7,573	98	10,050
Total-average	41	4,162	140	3,884	82	4,280	41	2,142	64	4,452	41	4,515	409	3,969

Source: (5).

Table 2--Approved number and average storage capacity of warehouses under the Uniform Rice Storage Agreement, 1977 1/

Storage capacity (1,000 cwt)	Arkansas		California		Louisiana		Mississippi	
	Warehouses	Average capacity	Warehouses	Average capacity	Warehouses	Average capacity	Warehouses	Average capacity
	No.	1,000 cwt	No.	1,000 cwt	No.	1,000 cwt	No.	1,000 cwt
0-100	4	65.25	0	0	8	81.62	1	31.00
101-350	21	266.05	10	241.90	31	231.23	6	174.50
351-500	7	402.14	8	406.12	9	419.44	2	383.50
501-1,000	12	706.33	13	779.85	9	678.67	1	641.00
1,001-2,500	12	1,563.25	9	1,509.11	1	1,582.00	0	0
2,501-5,000	5	3,168.60	2	2,887.00	1	3,253.00	0	0
Over 5,000	1	5,208.00	0	0	0	0	0	0
Total-average	62	918.53	42	837.19	59	382.02	10	248.40

Storage capacity (1,000 cwt)	Missouri		Texas		Total	
	Warehouses	Average capacity	Warehouses	Average capacity	Warehouses	Average capacity
	No.	1,000 cwt	No.	1,000 cwt	No.	1,000 cwt
0-100	1	56.00	9	74.22	23	72.57
101-350	3	293.67	38	218.13	109	232.94
351-500	0	0	16	411.19	42	409.12
501-1,000	0	0	22	686.55	57	709.95
1,001-2,500	0	0	7	1,852.14	29	1,616.83
2,501-5,000	0	0	3	3,027.33	11	3,086.55
Over 5,000	0	0	1	9,674.00	2	7,441.00
Total-average	4	234.25	96	649.59	273	660.92

1/ Only six States have warehouses with Uniform Rice Storage Agreements.

Source: (5).

Table 3--Percentage of stocks on farms relative to production for major production regions, selected major grains, and years

Region and State	Corn - January 1					Soybeans - January 1				
	1973	1974	1975	1976	1977	1973	1974	1975	1976	1977
	Percent									
Corn Belt:										
Illinois	54	55	51	51	51	34	39	44	42	44
Indiana	56	55	52	51	54	31	35	33	34	37
Iowa	77	66	61	65	64	39	51	63	53	55
Total	65	60	56	56	56	36	43	45	45	47
U.S. total	66	59	54	55	53	34	39	40	38	37
	Wheat - October 1					Barley - October 1				
	1972	1973	1974	1975	1976	1972	1973	1974	1975	1976
	Percent									
Northern Plains:										
Minnesota	90	63	59	59	54	130	88	85	84	80
Montana	91	69	73	75	85	78	77	86	81	73
North Dakota	126	88	79	75	83	112	105	85	80	81
Total	112	79	75	72	77	104	93	85	81	78
U.S. total	(see U.S. total below)					78	68	58	56	56
	Wheat - October 1					Sorghum - January 1				
	1972	1973	1974	1975	1976	1973	1974	1975	1976	1977
	Percent									
Southern Plains:										
Kansas	17	20	23	22	22	35	34	30	33	30
Oklahoma	13	14	17	17	15	28	20	45	18	15
Texas	4	4	7	9	7	8	8	5	9	8
Total	15	16	20	18	18	19	17	14	16	16
U.S. total	47	35	38	35	39	27	23	20	22	22

Source: (6), (7).

Table 4--Estimated number of elevators with and without official weights and grades, by size, 1977

Storage capacity (1,000 bu.)	Official weights and grades	
	Without 1/	With 2/
	Number	
0-100	800	25
101-350	3,650	25
351-500	1,150	25
501-1,000	1,800	50
1,001-2,500	1,000	150
2,501-5,000	150	125
Over 5,000	50	100

1/ Rounded to nearest multiple of 50.
2/ Rounded to nearest multiple of 25.

Table 5--Industry survey responses, approved warehouses under the Uniform Grain Storage Agreement, and firms in Statistical Reporting Service universe, 1977

State	Survey 1/	UGSA contracts 2/	SRS 3/
		Number	
Illinois	444	637	1,199
Iowa	398	760	1,184
Kansas	367	879	1,109
Minnesota	223	518	885
Nebraska	111	603	735
Ohio	220	147	693
Total	1,763	3,544	5,805

1/ Number of responses to Grain and Feed Association of Illinois survey, May 1977.
2/ Number of contracts under the Uniform Grain Storage Agreement.
3/ Number of firms included in the universe surveyed by the Statistical Reporting Service for the periodic stocks of grain report.

Source: Grain and Feed Assoc. of Illinois; Econ., Stat., and Coop. Serv., U.S. Dept. of Agr.; (5).

Table 6--Storage capacity from industry surveys, capacity licensed under the Uniform Grain Storage Agreement, and capacity estimated by Statistical Reporting Service, 1977

State	Surveys 1/	UGSA contracts	SRS
		Million bushels	
Illinois	304	569	726
Iowa	251	486	588
Kansas	265	705	780
Minnesota	107	315	355
Nebraska	72	429	470
Ohio	78	140	222
Total	1,078	2,644	3,141

1/ Surveys of six States coordinated by the Grain and Feed Association of Illinois, May 1977.

Source: Grain and Feed Association of Illinois; (5); Econ., Stat., and Coop. Serv., U.S. Dept. of Agr.

Table 7--Average storage capacity of warehouses approved under the Uniform Grain Storage Agreement, six States, 1977

Storage capacity (1,000 bu.)	Uniform Grain Storage Agreement			Surveys 1/
	Without official weights and grades	With official weights and grades	Average	
	1,000 bushels			
0-100	62	0	62	54
101-350	224	279	224	224
351-500	420	384	420	429
501-1,000	660	743	697	732
1,001-2,500	1,390	1,613	1,423	1,412
2,501-5,000	3,238	3,674	3,458	3,564
Over 5,000	5,695	11,410	10,724	7,492
Average	555	4,157	746	606

1/ Surveys of six States coordinated by the Grain and Feed Association of Illinois, May 1977.

Source: Grain and Feed Association of Illinois; (5).

Table 8--Number of firms by population of respondents' locations, 1977

Population	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Number			
Rural	209	173	91	85	207	55	820
0-1,500	124	114	64	50	64	25	441
1,501-5,500	78	70	42	41	64	19	314
5,501-25,500	24	32	17	34	24	11	142
25,501-100,500	6	6	2	5	5	1	25
Over 100,500	1	2	6	3	0	0	12
No report	2	1	1	2	3	0	9
Total	444	398	223	220	367	111	1,763

Source: Grain and Feed Association of Illinois.

Table 9--Cross classification of grain elevator storage capacity by population, six States, 1977

Population	Storage capacity (1,000 bushels)							
	0-100	101-350	351-500	501-1,000	1,001-2,500	2,501-5,000	Over 5,000	Total
				Number				
Rural	91	279	141	203	96	7	3	820
0-1,500	50	135	66	135	48	7	0	441
1,501-5,500	41	89	42	77	55	6	4	314
5,501-25,500	19	44	20	33	24	2	0	142
25,501-100,500	3	4	5	6	4	2	1	25
Over 100,500	1	2	2	0	4	2	1	12
No report	2	4	1	0	2	0	0	9
Total	207	557	277	454	233	26	9	1,763

Source: Grain and Feed Association of Illinois.

Table 10--Percentage of respondents with detached storage capacity and proportion which is detached, 1977

Storage capacity (1,000 bu.)	Illinois		Iowa		Minnesota		Ohio	
	Respondents	Storage capacity	Respondents	Storage capacity	Respondents	Storage capacity	Respondents	Storage capacity
	Percent							
0-100	10	23	42	49	21	40	21	52
101-350	19	51	56	48	29	47	22	30
351-500	37	39	61	44	27	38	40	31
501-1,000	31	28	67	42	58	31	40	28
1,001-2,500	36	32	85	33	15	51	10	27
2,501-5,000	29	12	80	11	0	0	1/	0
Over 5,000	0	0	50	19	0	0	0	0
Average	28	31	63	36	31	38	26	30

	Kansas		Nebraska		Total	
	Respondents	Storage capacity	Respondents	Storage capacity	Respondents	Storage capacity
	Percent					
0-100	22	41	14	44	22	45
101-350	35	34	32	65	32	45
351-500	50	40	56	54	46	42
501-1,000	48	26	68	56	50	35
1,001-2,500	44	23	57	50	48	31
2,501-5,000	50	21	0	0	42	15
Over 5,000	0	0	100	2/	12	19
Average	41	27	46	54	40	35

1/ No respondents for this capacity category in Ohio.
2/ Apparent error in data.

Source: Grain and Feed Association of Illinois.

Table 11--Average storage capacity for respondents with detached storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois			Iowa			Minnesota			Ohio		
	Warehouses	Attached	Detached	Warehouses	Attached	Detached	Warehouses	Attached	Detached	Warehouses	Attached	Detached
	No.	1,000 bu.		No.	1,000 bu.		No.	1,000 bu.		No.	1,000 bu.	
0-100	4	41	12	15	28	26	4	50	32	13	30	33
101-350	23	107	111	59	127	117	33	122	108	19	146	62
351-500	25	265	166	43	240	191	11	266	165	10	296	134
501-1,000	40	522	204	84	423	300	19	502	223	14	530	208
1,001-2,500	29	984	475	44	956	451	2	640	660	1	800	300
2,501-5,000	2	2,935	394	4	3,192	380	0	0	0	0	0	0
Over 5,000	0	0	0	1	4,911	1,129	0	0	0	0	0	0
Total-average	123	525	240	250	454	253	69	260	160	57	251	108

Storage capacity (1,000 bu.)	Kansas			Nebraska			Total		
	Warehouses	Attached	Detached	Warehouses	Attached	Detached	Warehouses	Attached	Detached
	No.	1,000 bu.		No.	1,000 bu.		No.	1,000 bu.	
0-100	9	31	21	2	45	36	46	33	28
101-350	34	160	84	11	88	164	179	129	105
351-500	27	259	175	10	198	232	126	252	179
501-1,000	49	521	185	19	320	405	225	466	255
1,001-2,500	28	1,083	329	8	635	625	112	965	442
2,501-5,000	5	2,567	694	0	0	0	11	2,861	525
Over 5,000	0	0	0	1	1/	1/	1	4,911	1,129
Total-average	151	539	195	51	278	331	700	437	223

1/ Apparent error in data.

Source: Grain and Feed Association of Illinois.

Table 12--Average storage capacity for respondents warehousing only at one elevator, 1977

Storage capacity (1,000 bu.)	Illinois		Iowa		Minnesota		Ohio	
	Warehouses	Average capacity	Warehouses	Average capacity	Warehouses	Average capacity	Warehouses	Average capacity
	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.
0-100	34	54	21	54	15	53	50	47
101-350	97	220	47	235	80	226	67	203
351-500	43	437	28	433	30	413	15	444
501-1,000	90	746	42	746	14	706	21	760
1,001-2,500	51	1,466	8	1,329	11	1,558	9	1,457
2,501-5,000	5	3,960	1	2,600	2	4,250	0	0
Over 5,000	1	6,000	1	5,909	2	5,450	1	6,000
Total-average	321	654	148	505	154	504	163	354

Storage capacity (1,000 bu.)	Kansas		Nebraska		Total	
	Warehouses	Average capacity	Warehouses	Average capacity	Warehouses	Average capacity
	No.	1,000 bu.	No.	1,000 bu.	No.	1,000 bu.
0-100	29	53	12	55	161	52
101-350	64	215	23	217	378	219
351-500	27	414	8	430	151	428
501-1,000	53	710	9	848	229	742
1,001-2,500	36	1,317	6	1,380	121	1,416
2,501-5,000	5	3,451	2	3,628	15	3,694
Over 5,000	2	12,930	1/	1/	7	7,810
Total-average	216	716	60	538	1,062	572

1/ Apparent error in data.

Source: Grain and Feed Association of Illinois.

Table 13--Annual throughput ratios by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
	Throughput ratio 1/						
0-100	13.0	9.8	7.4	5.3	4.5	10.2	7.9
101-350	5.0	3.1	3.5	3.0	3.6	4.2	3.7
351-500	3.9	2.5	3.0	2.2	1.5	2.9	2.7
501-1,000	2.3	1.8	2.5	2.2	1.6	1.9	2.0
1,001-2,500	2.2	1.5	2.9	2.0	1.4	1.5	1.8
2,501-5,000	2.1	1.4	2.9	2/	1.3	1.2	1.7
Over 5,000	2.6	1.1	5.8	6.7	1.3	3/	2.4
Average	2.7	1.9	3.3	2.8	1.6	4/ 2.2	2.3

1/ Throughput ratios were computed by dividing respondents' last fiscal year by volume by reported storage capacity.
2/ No respondents in this category.
3/ Data excluded because of error.
4/ Excludes data of the over 5,000 bushel storage capacity category.

Source: Grain and Feed Association of Illinois.

Table 14--Distribution of receiving legs by storage capacity. 1977

State and storage capacity (1,000 bu.)	Receiving legs					
	1	2	3	4	5	6+
	Number					
Illinois:						
0-100	20	15	1	1	0	0
101-350	28	59	21	9	2	1
351-500	12	26	19	6	4	1
501-1,000	6	41	40	22	11	10
1,001-2,500	3	23	13	14	15	11
2,501-5,000	1	0	1	2	1	2
Over 5,000	0	0	1	0	0	0
Total	70	164	96	54	33	25
Iowa:						
0-100	18	12	4	1	1	0
101-350	29	48	16	9	2	1
351-500	13	25	22	8	1	2
501-1,000	3	38	43	24	10	8
1,001-2,500	1	11	8	19	8	5
2,501-5,000	0	0	1	2	1	1
Over 5,000	0	0	1	2	1	1
Total	64	134	95	63	23	18
Minnesota:						
0-100	11	6	2	0	0	0
101-350	32	51	18	10	2	0
351-500	4	23	7	5	1	1
501-1,000	5	7	7	8	3	3
1,001-2,500	3	2	4	2	2	0
2,501-5,000	1	1	0	0	0	0
Over 5,000	0	1	1	0	0	0
Total	56	91	39	25	8	4
Ohio:						
0-100	29	24	8	1	1	0
101-350	15	29	19	14	2	7
351-500	3	7	10	4	0	1
501-1,000	0	17	10	7	0	1
1,001-2,500	0	2	2	3	1	2
2,501-5,000	0	0	0	0	0	0
Over 5,000	0	0	0	0	0	1
Total	47	79	49	29	4	12

Continued--

Table 14--Distribution of receiving legs by storage capacity, 1977--Continued

State and storage capacity (1,000 bu.)	Receiving legs					
	1	2	3	4	5	6+
	Number					
Kansas:						
0-100	27	9	0	1	0	0
101-350	33	49	13	3	0	0
351-500	14	32	2	6	0	0
501-1,000	17	55	22	6	1	1
1,001-2,500	6	22	19	14	1	2
2,501-5,000	0	2	3	3	1	1
Over 5,000	0	0	1	0	0	1
Total	97	169	60	33	3	5
Nebraska:						
0-100	10	4	0	0	0	0
101-350	13	14	3	3	0	1
351-500	5	7	5	1	0	0
501-1,000	4	14	8	1	0	1
1,001-2,500	0	3	3	5	2	1
2,501-5,000	0	1	0	1	0	0
Over 5,000	0	0	0	1	0	0
Total	32	43	19	12	2	3
Total:						
0-100	115	70	15	4	2	0
101-350	150	250	90	48	8	10
351-500	51	120	65	30	6	5
501-1,000	35	172	130	68	25	24
1,001-2,500	13	63	49	57	29	21
2,501-5,000	2	4	5	8	3	4
Over 5,000	0	1	4	1	0	3
Total	366	680	358	216	73	67

Source: Grain and Feed Association of Illinois.

Table 15--Average number of receiving legs by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Number			
0-100	1.50	1.75	1.53	1.75	1.32	1.29	1.57
101-350	2.17	2.12	2.11	2.79	1.86	2.00	2.18
351-500	2.51	2.52	2.51	2.80	2.00	2.11	2.42
501-1,000	3.18	3.23	3.24	2.80	2.24	2.43	2.91
1,001-2,500	3.67	3.73	2.85	4.10	2.83	3.64	3.42
2,501-5,000	4.29	4.40	1.50	1/	3.80	3.00	3.81
Over 5,000	3.00	5.00	2.50	8.00	5.50	4.00	4.56
Average	2.77	2.76	2.34	2.58	2.17	2.28	2.53

1/ None reported.

Source: Grain and Feed Association of Illinois

Table 16--Average capacity of receiving legs by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				100 bu./hr.			
0-100	26.09	30.27	28.69	18.69	27.20	19.67	24.44
101-350	33.16	35.95	32.07	24.42	33.68	25.79	31.40
351-500	36.27	39.09	41.39	29.66	37.94	27.82	36.91
501-1,000	41.14	44.32	44.04	35.20	39.99	46.41	41.99
1,001-2,500	55.18	54.14	73.24	42.85	54.67	40.98	54.11
2,501-5,000	74.14	79.09	93.33	1/	57.11	80.00	69.65
Over 5,000	130.00	115.50	180.00	28.75	124.55	66.25	105.12
Average	42.45	44.03	40.86	27.21	42.80	36.19	40.43

1/ None reported.

Source: Grain and Feed Association of Illinois.

Table 17--Combined average elevator receiving leg capacity, by storage capacity, 1977

State and storage capacity (1,000 bu.)	Elevators with less than 10,000 bu./hr. combined leg capacity			Elevators with 10,000 and over bu./hr. combined leg capacity		
	Elevators	Legs	Average leg capacity per elevator	Elevators	Legs	Average leg capacity per elevator
	---Number---		100 bu./hr.	---Number---		100 bu./hr.
Illinois:						
0-100	36	52	35	2	5	102
101-350	90	179	52	30	82	133
351-500	43	91	62	25	80	141
501-1,000	43	95	70	87	319	160
1,001-2,500	7	10	50	73	284	217
2,501-5,000	1	1	40	6	29	364
Over 5,000	0	0	0	1	3	390
Total-average	220	428	55	224	802	179
Iowa:						
0-100	32	50	2	4	13	140
101-350	79	143	54	27	82	140
351-500	38	77	60	33	102	142
501-1,000	27	65	75	99	342	161
1,001-2,500	4	9	68	48	185	213
2,501-5,000	0	0	0	5	22	348
Over 5,000	0	0	0	2	10	577
Total-average	180	344	57	218	756	175
Minnesota:						
0-100	15	21	28	4	8	101
101-350	91	175	50	22	63	139
351-500	25	51	61	16	52	169
501-1,000	9	15	65	24	92	171
1,001-2,500	0	0	0	13	37	208
2,501-5,000	1	1	80	1	2	200
Over 5,000	0	0	0	2	5	450
Total-average	141	263	51	82	259	172
Ohio:						
0-100	60	101	29	3	9	101
101-350	69	172	52	17	68	133
351-500	16	39	62	9	31	120
501-1,000	21	53	72	14	45	137
1,001-2,500	0	0	0	10	41	175
2,501-5,000	0	0	0	0	0	0
Over 5,000	0	0	0	1	8	230
Total-average	166	365	47	54	202	140

Continued--

Table 17--Combined average elevator receiving leg capacity, by storage capacity, 1977--Continued

State and storage capacity (1,000 bu.)	Elevators with less than 10,000 bu./hr. combined leg capacity			Elevators with 10,000 and over bu./hr. combined leg capacity		
	Elevators	Legs	Average leg capacity per elevator	Elevators	Legs	Average leg capacity per elevator
	---Number---		100 bu./hr.	---Number---		100 bu./hr.
Kansas:						
0-100	36	47	34	1	2	105
101-350	82	139	49	16	43	128
351-500	35	62	54	19	46	116
501-1,000	64	127	61	38	101	136
1,001-2,500	13	25	67	51	156	177
2,501-5,000	2	5	52	8	33	258
Over 5,000	0	0	0	2	11	685
Total-average	232	405	52	135	392	164
Nebraska:						
0-100	14	18	25	0	0	0
101-350	30	54	41	4	14	124
351-500	17	35	53	1	3	140
501-1,000	12	23	63	16	45	149
1,001-2,500	5	14	88	9	37	183
2,501-5,000	0	0	0	2	6	240
Over 5,000	0	0	0	1	4	265
Total-average	78	144	47	33	109	164
Total:						
0-100	193	289	33	14	37	112
101-350	441	862	51	116	352	135
351-500	174	355	59	103	314	139
501-1,000	176	378	68	278	944	156
1,001-2,500	29	58	67	204	740	202
2,501-5,000	4	7	56	22	92	303
Over 5,000	0	0	0	9	41	478
Total-average	1,017	1,949	52	746	2,520	171

Source: Grain and Feed Association of Illinois.

Table 18--Cross classification of combined receiving leg capacity and storage capacity, 1977

Combined receiving leg capacity (Bu./hr.)	Storage capacity		Total Elevators
	Less than 2.5 million bushels	2.5 million bushels and over	
	Number		
Illinois:			
Less than 10,000	219	1	220
10,000 and over	217	7	224
Total	436	8	444
Iowa:			
Less than 10,000	180	0	180
10,000 and over	211	7	218
Total	391	7	398
Minnesota:			
Less than 10,000	140	1	141
10,000 and over	79	3	82
Total	219	4	223
Ohio:			
Less than 10,000	166	0	166
10,000 and over	53	1	54
Total	219	1	220
Kansas:			
Less than 10,000	230	2	232
10,000 and over	125	10	135
Total	355	12	367
Nebraska:			
Less than 10,000	78	0	78
10,000 and over	30	3	33
Total	108	3	111
Total:			
Less than 10,000	1,013	4	1,017
10,000 and over	715	31	746
Total	1,728	35	1,763

Source: Grain and Feed Association of Illinois.

Table 19--Percentage of respondents with rail loadout spouts, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Percent			
0-100	47	44	53	21	89	50	47
101-350	49	58	83	43	96	82	67
351-500	57	65	83	72	98	83	74
501-1,000	62	83	85	74	98	86	80
1,001-2,500	78	94	92	90	98	100	90
2,501-5,000	71	100	100	1/	100	100	92
Over 5,000	100	100	100	100	100	100	100
Average	60	72	82	47	97	82	73

1/ No respondents.

Source: Grain and Feed Association of Illinois.

Table 20--Percentage of respondents with truck loadout spouts, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Percent			
0-100	92	100	84	98	65	93	90
101-350	93	99	98	100	82	97	95
351-500	100	100	98	100	83	83	95
501-1,000	96	98	100	97	86	100	95
1,001-2,500	99	96	69	90	95	100	95
2,501-5,000	86	100	100	1/	90	100	92
Over 5,000	100	100	100	100	100	100	100
Average	96	98	96	99	84	96	94

1/ No respondents.

Source: Grain and Feed Association of Illinois.

Table 21--Average number of rail loadout spouts, by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Number			
0-100	1.39	1.44	1.50	1.38	1.12	1.14	1.30
101-350	1.44	1.58	1.96	1.30	1.30	1.25	1.53
351-500	1.95	1.91	2.71	1.22	1.36	1.53	1.82
501-1,000	2.07	1.80	2.18	1.38	1.50	1.46	1.75
1,001-2,500	3.03	2.47	2.50	1.78	2.05	2.07	2.45
2,501-5,000	4.20	1.80	2.50	1/	2.60	2.00	2.71
Over 5,000	1.00	1.50	2.00	2.00	5.00	2.00	2.44
Average	2.13	1.86	2.15	1.37	1.54	1.49	1.80

1/ No respondents.

Source: Grain and Feed Association of Illinois.

Table 22--Average number of truck loadout spouts, by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Number			
0-100	2.77	2.53	1.38	2.55	1.88	1.62	2.33
101-350	3.96	3.28	3.59	3.79	1.88	2.85	3.33
351-500	4.28	4.28	4.50	5.96	2.91	3.33	4.19
501-1,000	5.94	6.24	5.18	8.26	2.42	4.32	5.33
1,001-2,500	7.03	7.10	3.89	11.67	3.08	6.79	6.00
2,501-5,000	11.50	6.60	1.50	1/	5.00	5.50	6.71
Over 5,000	1.00	3.50	1.00	2.00	5.00	3.00	2.78
Average	5.16	4.85	3.81	4.71	2.53	3.73	4.28

1/ No respondents.

Source: Grain and Feed Association of Illinois.

Table 23--Distribution of rail loadout spouts, by storage capacity, 1977

State and storage capacity (1,000 bu.)	Rail spouts					
	1	2	3	4	5	6+
	Number					
Illinois:						
0-100	11	7	0	0	0	0
101-350	38	18	1	2	0	0
351-500	22	10	3	1	1	2
501-1,000	33	27	14	0	3	3
1,001-2,500	15	23	12	2	1	9
2,501-5,000	2	0	0	1	0	2
Over 5,000	1	0	0	0	0	0
Total	122	85	30	6	5	16
Iowa:						
0-100	10	5	1	0	0	0
101-350	39	15	4	3	1	0
351-500	20	13	11	1	1	0
501-1,000	56	30	12	4	1	2
1,001-2,500	12	17	9	8	2	1
2,501-5,000	3	0	2	0	0	0
Over 5,000	1	1	0	0	0	0
Total	141	81	39	16	5	3
Minnesota:						
0-100	5	5	0	0	0	0
101-350	45	34	10	0	0	5
351-500	9	19	1	2	1	2
501-1,000	9	12	3	1	3	0
1,001-2,500	2	7	1	0	1	1
2,501-5,000	0	1	1	0	0	0
Over 5,000	1	0	1	0	0	0
Total	71	78	17	3	5	8
Ohio:						
0-100	9	3	1	0	0	0
101-350	31	3	1	2	0	0
351-500	14	4	0	0	0	0
501-1,000	19	5	1	1	0	0
1,001-2,500	3	5	1	0	0	0
2,501-5,000	0	0	0	0	0	0
Over 5,000	0	1	0	0	0	0
Total	76	21	4	3	0	0

Continued--

Table 23--Distribution of rail loadout spouts, by storage capacity, 1977--Continued

State and storage capacity (1,000 bu.)	Rail spouts					
	1	2	3	4	5	6+
	Number					
Kansas:						
0-100	29	4	0	0	0	0
101-350	69	22	3	0	0	0
351-500	39	11	1	2	0	0
501-1,000	60	30	10	0	0	0
1,001-2,500	31	19	6	4	1	2
2,501-5,000	3	2	2	2	1	0
Over 5,000	0	0	1	0	0	1
Total	231	88	23	8	2	3
Nebraska:						
0-100	6	1	0	0	0	0
101-350	21	7	0	0	0	0
351-500	7	8	0	0	0	0
501-1,000	14	9	1	0	0	0
1,001-2,500	3	7	4	0	0	0
2,501-5,000	0	2	0	0	0	0
Over 5,000	0	2	0	0	0	0
Total	51	35	5	0	0	0
Total:						
0-100	70	25	2	0	0	0
101-350	243	99	19	7	1	5
351-500	111	65	16	6	3	4
501-1,000	191	113	41	6	7	5
1,001-2,500	66	78	33	14	5	13
2,501-5,000	8	5	5	3	1	2
Over 5,000	3	3	2	0	0	1
Total	692	388	118	36	17	30

Source: Grain and Feed Association of Illinois

Table 24--Distribution of truck loadout spouts, by storage capacity, 1977

State and storage capacity (1,000 bu.)	Truck spouts					
	1	2	3	4	5	6+
	Number					
Illinois:						
0-100	9	11	7	3	0	5
101-350	19	26	20	17	7	23
351-500	8	14	14	9	5	18
501-1,000	6	20	18	13	13	55
1,001-2,500	8	5	10	10	7	39
2,501-5,000	1	0	0	1	1	3
Over 5,000	1	0	0	0	0	0
Total	52	76	69	53	33	143
Iowa:						
0-100	14	12	3	3	1	3
101-350	20	29	21	15	7	13
351-500	4	15	18	13	5	16
501-1,000	8	17	19	11	9	59
1,001-2,500	1	8	5	5	5	26
2,501-5,000	1	1	1	0	0	2
Over 5,000	0	1	0	0	1	0
Total	48	83	67	47	28	119
Minnesota:						
0-100	10	6	0	0	0	0
101-350	30	30	8	12	9	22
351-500	5	7	7	2	4	15
501-1,000	6	6	3	4	4	10
1,001-2,500	2	3	1	1	0	2
2,501-5,000	1	1	0	0	0	0
Over 5,000	2	0	0	0	0	0
Total	56	53	19	19	17	49
Ohio:						
0-100	21	19	9	9	2	2
101-350	22	16	15	10	4	19
351-500	3	5	2	1	1	15
501-1,000	0	1	1	4	2	26
1,001-2,500	1	0	0	0	2	6
2,501-5,000	0	0	0	0	0	0
Over 5,000	0	1	0	0	0	0
Total	47	42	27	24	11	66

Continued--

Table 24--Distribution of truck loadout spouts, by storage capacity, 1977--Continued

State and storage capacity (1,000 bu.)	Truck spouts					
	1	2	3	4	5	6+
	Number					
Kansas:						
0-100	14	6	2	0	1	1
101-350	32	38	5	2	1	2
351-500	8	24	3	4	0	6
501-1,000	23	46	8	4	1	6
1,001-2,500	9	32	8	5	0	7
2,501-5,000	2	2	1	2	0	2
Over 5,000	0	0	1	0	0	1
Total	88	148	28	17	3	25
Nebraska:						
0-100	9	1	2	1	0	0
101-350	13	6	5	4	0	5
351-500	3	6	1	1	1	3
501-1,000	5	8	4	2	0	9
1,001-2,500	2	2	1	3	0	6
2,501-5,000	0	0	0	0	1	1
Over 5,000	0	0	1	0	0	0
Total	32	23	14	11	2	24
Total:						
0-100	77	55	23	16	4	11
101-350	136	145	74	60	28	84
351-500	31	71	45	30	16	71
501-1,000	48	98	53	38	29	165
1,001-2,500	23	50	25	24	14	86
2,501-5,000	5	4	2	3	2	8
Over 5,000	3	2	2	0	1	1
Total	323	425	224	171	94	426

Source: Grain and Feed Association of Illinois.

Table 25--Percentage of respondents with grain dryers, by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Percent			
0-100	47	78	68	82	24	64	59
101-350	85	91	83	96	54	56	80
351-500	96	97	88	100	74	89	91
501-1,000	98	97	97	100	74	100	93
1,001-2,500	100	100	54	90	81	93	91
2,501-5,000	100	100	0	1/	80	100	85
Over 5,000	100	100	0	100	100	100	78
Average	90	94	78	94	65	74	84

1/ No respondents.

Source: Grain and Feed Association of Illinois.

Table 26--Average number of dryers per respondent so equipped, by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Total
				Number			
0-100	1.17	1.32	1.23	1.23	1.11	1.00	1.23
101-350	1.44	1.50	1.74	1.58	1.23	1.53	1.52
351-500	1.80	1.68	2.03	1.80	1.30	1.69	1.71
501-1,000	1.97	1.93	1.91	2.17	1.22	2.00	1.84
1,001-2,500	2.42	2.48	2.29	2.22	1.48	2.31	2.19
2,501-5,000	3.29	3.00	1/	2/	2.00	3.50	2.77
Over 5,000	2.00	3.50	1/	1.00	2.00	3.00	2.43
Average	1.85	2.01	1.81	1.65	1.31	1.89	1.74

1/ No respondents equipped with dryers.
2/ No respondents in this size category.

Source: Grain and Feed Association of Illinois.

Table 27--Distribution of dryers by storage capacity, 1977

State and storage capacity (1,000 bu.)	Dryers			
	1	2	3	4+
	Number			
Illinois:				
0-100	15	3	0	0
101-350	68	25	8	1
351-500	25	31	7	2
501-1,000	48	48	23	9
1,001-2,500	14	38	16	12
2,501-5,000	1	1	1	4
Over 5,000	0	1	0	0
Total	171	147	55	28
Iowa:				
0-100	20	7	1	0
101-350	50	44	2	0
351-500	33	27	7	2
501-1,000	47	48	18	9
1,001-2,500	9	20	14	9
2,501-5,000	1	1	1	2
Over 5,000	0	0	1	1
Total	160	147	44	23
Minnesota:				
0-100	10	3	0	0
101-350	45	36	9	4
351-500	10	18	5	3
501-1,000	11	14	6	1
1,001-2,500	1	4	1	1
2,501-5,000	0	0	0	0
Over 5,000	0	0	0	0
Total	77	75	21	9
Ohio:				
0-100	41	10	1	0
101-350	44	31	9	0
351-500	10	11	3	1
501-1,000	5	21	7	2
1,001-2,500	1	5	3	0
2,501-5,000	0	0	0	0
Over 5,000	1	0	0	0
Total	102	78	23	3

Continued--

Table 27--Distribution of dryers by storage capacity, 1977--Continued

State and storage capacity (1,000 bu.)	Dryers			
	1	2	3	4+
	Number			
Kansas:				
0-100	8	1	0	0
101-350	42	10	1	0
351-500	30	8	2	0
501-1,000	59	17	0	0
1,001-2,500	32	16	3	1
2,501-5,000	4	1	2	1
Over 5,000	1	0	1	0
Total	176	53	9	2
Nebraska:				
0-100	3	0	0	0
101-350	11	7	0	1
351-500	8	5	3	0
501-1,000	7	15	5	1
1,001-2,500	3	6	2	2
2,501-5,000	0	1	0	1
Over 5,000	0	0	1	0
Total	32	34	11	5
Total:				
0-100	97	24	2	0
101-350	260	153	29	6
351-500	116	100	27	8
501-1,000	177	163	59	22
1,001-2,500	60	89	39	25
2,501-5,000	6	4	4	8
Over 5,000	2	1	3	1
Total	718	534	163	70

Source: Grain and Feed Association of Illinois.

Table 28--Average capacity of grain dryers by storage capacity, 1977

Storage capacity (1,000 bu.)	Illinois	Iowa	Minnesota	Ohio	Kansas	Nebraska	Average
			100 bu./hr.				
0-100	6.00	10.14	4.69	4.64	5.30	4.00	6.21
101-350	7.98	6.79	5.99	7.02	5.57	6.28	6.79
351-500	9.97	10.50	8.10	10.53	7.23	5.63	9.25
501-1,000	11.57	11.87	12.08	14.05	7.54	9.70	11.20
1,001-2,500	16.27	14.47	13.94	15.45	8.56	9.83	13.81
2,501-5,000	26.35	26.64	1/	1/	10.19	22.14	21.26
Over 5,000	7.50	27.86	1/	20.00	7.00	11.67	19.00
Average	12.11	11.20	7.91	9.15	7.38	8.86	10.18

1/ No respondents equipped with dryers.

Source: Grain and Feed Association of Illinois.

Table 29--Coefficients of regression equations with annual throughput of an elevator as the dependent variable (standard errors in parentheses)

Equation	Constant	Independent Variables 1/									R^2
		ATFACIL	FRMFACIL	TOTSTOR	TOTLEG	LARLEG	CAPLEG	SQUARE	RAILSPT	TRKSPT	
1	216	0.234 (.007)	--	--	--	--	--	--	--	--	0.37
2	1,276	--	0.149 (.019)	--	--	--	--	--	--	--	.03
3	339	--	--	0.176 (.006)	--	--	--	--	--	--	.32
4	-124	--	--	--	15.056 (0.683)	--	--	--	--	--	.22
5	-628	--	--	--	--	40.691 (1.808)	--	--	--	--	.23
6	1,104	--	--	--	--	--	4.723 (0.846)	--	--	--	.02
7	1,377	--	--	--	--	--	--	0.004 (.001)	--	--	.01
8	1,001	--	--	--	--	--	6.702 (1.581)	-.003 (.002)	--	--	.02
9	982	--	--	--	--	--	--	--	262.772 (43.144)	18.937 (15.728)	.02
10	656	--	--	--	--	--	4.786 (.836)	--	264.037 (42.742)	20.405 (15.583)	.04

-- = not applicable.

1/ Definitions of the independent variables are:

ATFACIL = reported storage capacity in 100 bushels at site of respondent.
FRMFACIL = reported storage capacity in 100 bushels under control of respondent but located at a different site.
TOTSTOR = ATFACIL + FRMFACIL, the total storage capacity in 100 bushels.
TOTLEG = total reported receiving leg capacity in bushels per hour.
LARLEG = largest receiving leg reported by respondent in bushels per hour.
CAPLEG = TOTSTOR ÷ TOTLEG, ratio of total storage capacity to total leg capacity.
SQUARE = CAPLEG squared.
RAILSPT = number of rail loadout spouts reported by respondent.
TRKSPT = number of truck loadout spouts reported by respondent.

Source: Grains and Feeds Program Area, Econ., Stat., and Coop. Serv., U.S. Dept. of Agr.

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