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**THE IOWA GRAIN FLOW SURVEY:
A COMPARISON OF IOWA CORN
AND SOYBEAN MOVEMENTS
IN 1977 AND 1985**

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**THE IOWA GRAIN FLOW SURVEY:
A COMPARISON OF IOWA CORN
AND SOYBEAN MOVEMENTS
IN 1977 AND 1985**

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INTRODUCTION

Approximately 45 percent of the corn and 55 percent of the soybeans produced worldwide are grown in the United States. As the world's largest producer of corn and soybeans, the United States is also the dominant exporter of these grains. During the mid-1980s, approximately 70 percent of the world corn exports and 55 percent of the world soybean exports originated in the United States.

Iowa is a major producer of corn and soybeans. In 1985, Iowa was the largest producer of corn—19.3 percent of total U.S. production—and the second leading producer of soybeans—14.8 percent of total U.S. production.

There is little information on the quantities of corn and soybeans shipped from individual states to various destinations or on the modes of transport used to ship them. To provide information on these flows, a group of land grant universities conducted surveys of 1977 and 1985 grain flows and the results were aggregated into national flows. The purpose of this publication is to provide a more detailed analysis of the Iowa survey of the 1977 and 1985 flows of corn and soybeans by type of receiving and shipping facility, market destination and mode of transport.

Methodology

Grain flow data were collected by questionnaire from country elevators, feed mills, barge terminals, corn processors and soybean processors. The 1977 survey data were collected by personal interviews of the sampled firms. Reduced funding dictated that the 1985 data be collected by mail questionnaire. Telephone follow-ups were used to correct apparent errors on respondents' questionnaires and to encourage participation from nonresponding firms.

A stratified sampling technique was used to draw samples of country elevator plants. The country elevator population, consisting of elevators, subterminals and terminals, was first stratified by storage capacity. The plant locations were arranged in descending order by storage capacity. Starting with the plant with the largest storage capacity, each plant was included in the sample until the accumulated total storage capacity was equal to 25 percent of the total elevator storage capacity in the state. This group consisted of 54 elevators in 1977 and 57 elevators in 1985. The remaining smaller plant locations were stratified into three areas of the state which were delineated by north-south boundaries of the crop reporting districts as shown in Figure 1. In the 1985 survey, random samples of country elevators were drawn from each of the three areas. In the 1977 survey, each of the three areas was further subdivided for sampling purposes by defining the

southern crop reporting districts as separate areas. Random samples of country elevator locations were drawn from each of six regions. These methods resulted in samples representing 17 percent of the populations of small country elevators in both years. The populations of country elevator locations were taken from the 1977 and 1985 directories of the Iowa Grain and Feed Association.

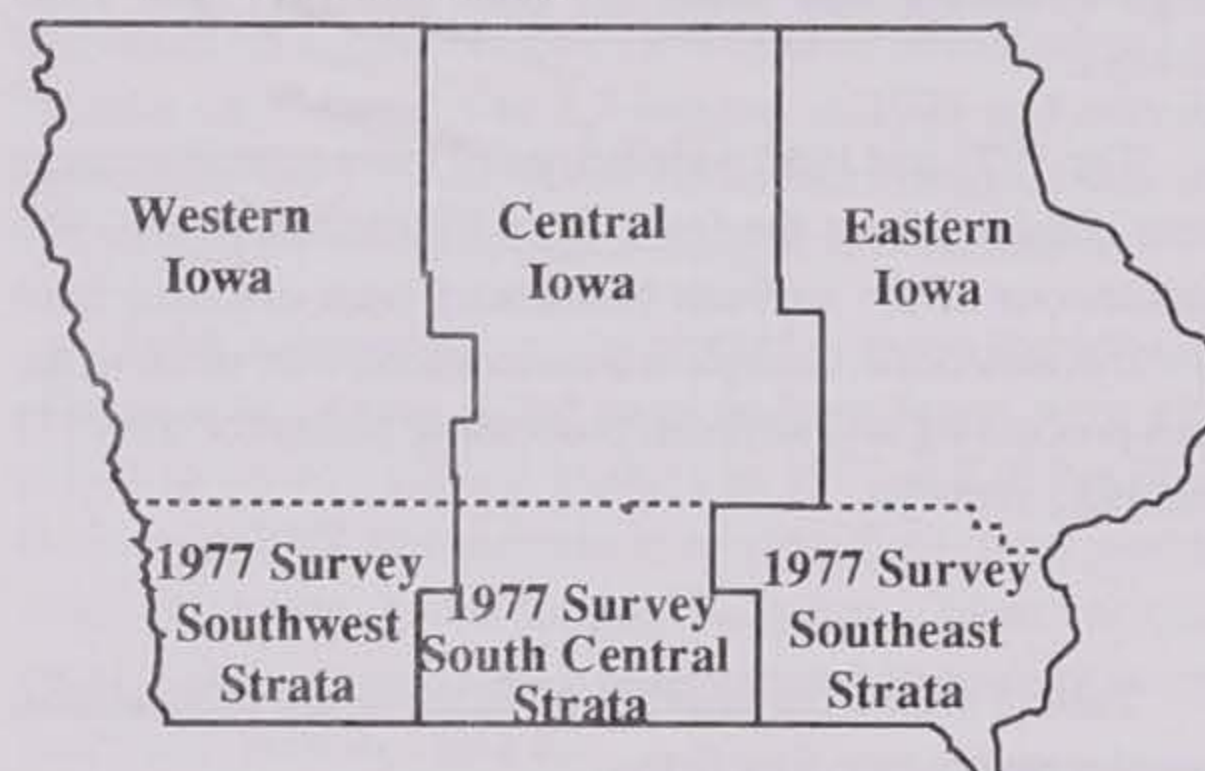


Figure 1. The sampling strata used in the 1977 and 1985 Iowa grain flow surveys.

Feed manufacturing plants were defined as those facilities which manufacture animal feeds including the production of complete feeds, feed ingredients and premixes, feed grinding and feed mixing. The 1977 population of feed manufacturers was obtained from the Iowa Department of Agriculture. In the 1977 survey, the sampling procedure for feed manufacturing firms consisted of a complete enumeration of 26 large feed firms, and a 14 percent random sample of the remaining firms stratified by the areas outlined in Figure 1. The large feed firms were identified by personnel from the Iowa Department of Agriculture. Care was taken to avoid including the same plant locations in the country elevator and feed manufacturers populations.

The completed 1977 feed manufacturing questionnaires indicated that numerous firms on the Iowa Department of Agriculture list of feed manufacturers neither received nor shipped whole grains. Since the purpose of the study was to identify whole grain corn and soybean receipts and shipments by origin, destination and grain flows, the 1985 population of feed manufacturers was taken from the 1985 directory of the Iowa Grain and Feed Association. This directory distinguishes between firms who receive and process whole grains and firms which mainly retail premixed feed products. Although this population source was valuable in identifying feed manufacturers, it lacked adequate information on each firm's storage capacity. For this reason, it was not possible to duplicate the sample design used in 1977. Therefore, a

complete enumeration was made of the 1985 feed firm population in order to increase the probability of the receipt of information from both large and small operators.

The 1977 population of barge terminals was obtained from the River Division of the Iowa Department of Transportation and the 1985 population was taken from the Iowa Barge Terminal Directory. A complete enumeration of the barge terminals was made for both the 1977 and 1985 surveys.

The 1977 and 1985 populations of Iowa corn processors were obtained from the Iowa Corn Promotion Board. The populations of the soybean processors were obtained from the *Soya Bluebook*. Complete enumerations were made of the corn processing and soybean processing plants for the 1977 and 1985 surveys.

Table 1 shows the number of firms in the populations, samples and responding firms.

Table 1. Populations, sample sizes and number of responding plants by type of firm, 1977 and 1985.

Type of firm	Year	Population	Sample size	Number responding	Percent responding
Country elevators	1977	932	214	154	72.0
	1985	1,040	237	178	75.1
Feed mills	1977	244	61	51	83.6
	1985	57	51	31	60.8
Barge terminals	1977	20	20	18	90.0
	1985	23	23	14	60.9
Corn processors	1977	7	7	3	42.9
	1985	7	7	4	57.1
Soybean processors	1977	14	14	12	85.7
	1985	18	18	8	44.4

The procedure used to estimate the quantity of corn and soybean receipts was to first calculate the average receipts of the responding plants for each type of grain, by location strata, mode of transport, and type of origin of the grain. Total

receipts of each grain were estimated by the following equation:

$$R = \sum_{ijk|m} W_{ijk|m} \bar{r}_{ijk|m}$$

where

R = the population estimate of total receipts

W = weight to convert sample means to population estimates.

i = origin strata of the grain

j = location strata of receiving plant

k = type of origin where 1 = nonfarm origin, 2 = farm origin

∫ = type of receiving plant

m = mode of transport

\bar{r} = average receipts of the responding plants

The weight to convert the sample means to population estimates was defined as:

$$W_{ijk|m} = \left[\frac{n_{ijk|m}}{N_{j^{\text{th}}}} \right] P_{j^{\text{th}}}$$

where

n = number of plants of type ∫ within the jth strata receiving grain from the ith location from the kth type of origin by the mth mode of transport.

N = number of sampled plants of type 1 with the jth location

P = population of plants of type 1 within the jth location.

The same procedures were used to estimate total shipments except that destination markets were substituted for origin location strata.

The estimated Iowa shipments and receipts were then adjusted to accommodate differences in estimated shipments to and from Iowa obtained from grain flow surveys conducted in other states. In addition, barge grain shipment data from the Corps of Engineers and from the carload railroad waybill sample collected by the Interstate Commerce Com-

mission were also considered in the adjustments to the data. When large differences existed in estimated receipts from an out-of-state origin or shipments to an out-of-state destination, Corps of Engineers barge shipment data and the carload railroad waybill data were used to determine if and how much the Iowa survey results were to be modified. Since some of the estimates presented in these results were modified through the above procedure, no estimates of the variances are presented.

Results

The data were analyzed by receipts and shipments of corn and soybeans. Estimates of country elevator and feed mill receipts and shipments were grouped together to reduce the number of tables. This is a logical grouping because, in many cases, these two groups of firms perform the same functions. The major difference between the two groups of firms is the relative emphasis on grain merchandising and feed manufacturing and merchandising. Thus, in the remainder of this report, the term country elevator should be interpreted as including both country elevators and feed mills.

Corn Receipts

Table 2 shows the estimated 1977 and 1985 receipts from farms by Iowa elevators, corn processors and barge terminals. The estimated receipts were adjusted to obtain an estimate of the net receipts from farms by deducting ship-

Table 2. Comparison of estimated corn shipments from farms and corn receipts, Iowa, in million bushels, 1977 and 1985.

	1977	1985
Estimated shipments from farms		
Beginning inventory	751.3	895.8
Production	1,092.0	1,707.0
Less on farm consumption	538.8	529.3
Less ending inventory	797.3	1,246.0
Net shipments from farms	507.2	827.5
Estimated receipts by		
Country elevators	726.6	893.2
Barge terminals	10.1	16.6
Corn processors	0.0	2.2
Less back to farm shipments	210.8	98.0
Net receipts	525.9	814.0
Difference	- 18.7	13.5
Percent difference	- 3.7	1.6

ments back to farms and the net receipts of Commodity Credit Corporation stocks. An estimate of the deliveries of corn from farms was obtained by adding the net change in on-farm inventories and deducting the estimated amount of grain fed to livestock (USDA). Comparison of the two estimates provides a check on the estimated receipts from farms by country elevators, barge terminals and corn processors. The estimates in Table 2 indicate that the percent difference between estimated net shipments from farms and estimated survey net receipts from farms was 3.7 percent in 1977 and only 1.6 percent in 1985. These small differences suggest that the estimated corn receipts in this analysis are reasonable.

Table 3 shows the corn receipts from farms by each type of receiving facility. Total receipts from farms were estimated to be 737 million bushels in 1977 and 912 million bushels in 1985. The increase in receipts from farms was the result of increased corn production in Iowa. However, total receipts were tempered by a large increase in on-farm inventories as shown in Table 2.

Table 3. Estimated receipts of corn from farms by type of receiving facility, in million bushels, Iowa, 1977 and 1985.

Receiving facility	Receipts	
	1977	1985
Country elevators	726.6	893.2
Barge terminals	10.1	16.6
Corn processors	0	2.2
Total	736.7	912.0

Table 4 shows the corn receipts from nonfarm sources by receiving facilities in Iowa. Nonfarm receipts are those that have previously been received from farms and then shipped from the original receiving facility to another buyer in Iowa. Total nonfarm receipts increased from 335 million bushels in 1977 to 482 million bushels in 1985.

Table 4. Estimated receipts of corn from non-farm sources by type of receiving facility, in million bushels, Iowa, 1977 and 1985.

Receiving facility	Receipts	
	1977	1985
Country elevators	65.1	67.9
Barge terminals	156.5	122.1
Corn processors	113.2	291.7
Total	334.8	481.7

There was little change in nonfarm receipts by country elevators from 1977 to 1985. Corn processors' share of nonfarm receipts increased from 33.8 percent in 1977 to 60.5 percent in 1985. The increased share in 1985 reflects the growth in corn processing capacity in Iowa between 1977 and 1985 and the rapid increase in the use of corn for food, alcohol and industrial uses during the 1980s. The barge terminal share of corn receipts from nonfarm sources declined from 46.7 nonfarm sources in 1977 to 25.3 percent in 1985.

Table 5 shows the corn receipts from farms at country elevators by areas in Iowa. Western Iowa country elevators received 44 and 39 percent of the total receipts from farms in 1977 and 1985. Central Iowa country elevators received 36 and 41 percent of the receipts from farms while Eastern Iowa country elevators received 20 percent of the total receipts from farms during both 1977 and 1985. The larger shares of farm receipts by Western and Central Iowa elevators probably reflect the continued shift to cash grain farming in these two areas. Moreover, Eastern Iowa increasingly tends to bypass country elevators and move directly to processors and barge terminals.

Table 5. Estimated receipts of corn by country elevators from farms by elevator location, in million bushels, Iowa, 1977 and 1985.

Elevator Location	Receipts	
	1977	1985
Western Iowa	317.7	345.7
Central Iowa	263.6	365.3
Eastern Iowa	145.3	182.2
Total	726.6	893.2

Table 6 shows the country elevator receipts of corn from nonfarm sources by areas of the state. Country elevator

Table 6. Estimated receipts of corn by country elevators from nonfarm sources by elevator location, in million bushels, Iowa, 1977 and 1985.

Elevator Location	Receipts	
	1977	1985
Western Iowa	50.7	41.1
Central Iowa	13.0	19.7
Eastern Iowa	1.4	7.1
Total	65.1	67.9

receipts of corn from nonfarm sources were the largest in

Western and Central Iowa. This is probably the result of the large number of unit train loading facilities and the large number of cooperative elevator mergers in these two areas. Both of these developments encourage intercountry elevator shipments of corn.

Table 7 shows the mode of transport of corn receipts by country elevators. Over 99 percent of all corn received by country elevators was delivered by truck and farm tractors and wagons. Less than one percent of all country elevator receipts of corn were by rail and most all of that was in Western Iowa.

Table 7. Estimated receipts of corn by country elevators from farm and nonfarm sources by elevator location and mode of transport, in million bushels, Iowa, 1977 and 1985.

Elevator location	Mode of transport	Receipts	
		1977	1985
Western Iowa	Truck	368.0	385.8
	Rail	0.4	1.0
Central Iowa	Truck	276.6	384.7
	Rail	0	0.3
Eastern Iowa	Truck	146.7	189.3
	Rail	0	0
Subtotal	Truck	791.3	959.8
	Rail	0.4	1.3
Total		791.7	961.1

Table 8 shows the corn receipts at barge terminals on the Missouri and Mississippi Rivers by origin of the receipts. Total corn receipts at all barge terminals decreased from 167 million bushels in 1977 to 139 million bushels in 1985.

Table 8. Estimated receipts of corn by Iowa barge terminals, by river and type of origin, in million bushels, 1977 and 1985.

River	Type of origin	Receipts	
		1977	1985
Missouri	Farm	0.8	6.8
	Nonfarm	11.7	6.2
Mississippi	Farm	9.3	9.8
	Nonfarm	144.8	115.9
Subtotal	Farm	10.1	16.6
	Nonfarm	156.5	122.1
Total		166.6	138.7

Corn receipts at Missouri River terminals remained

about constant between the 1977 and 1985 while receipts at Mississippi River terminals decreased 18 percent. The 1985 shares of total corn receipts at barge terminals were 91 percent for Mississippi River terminals and 9 percent for Missouri River terminals.

A shift occurred in the origin of the corn receipts at barge terminals. In 1977, only 6 percent of all corn receipts at barge terminals came directly from farms. In 1985, 12 percent of corn receipts at barge terminals came directly from farms.

Table 9 shows the origin and mode of transport of corn receipts at Missouri River barge terminals. In 1977, 11.8 million bushels or 94 percent of the corn receipts at Missouri River barge terminals came from Western Iowa. By 1985, only 47 percent of the Missouri River barge terminal receipts came from Western Iowa, 40 percent came from out-of-state and 13 percent came from Central Iowa. As shown in Table 8, 52 percent of the 1985 corn receipts at Missouri River barge terminals came directly from farms. In 1977, 2 percent of all corn receipts were transported to the terminals by rail; almost all of these rail receipts originated from Western Iowa. In 1985, no Missouri River barge terminal corn receipts were by rail. Thus, between 1977 and 1985, the Missouri River corn receipts shifted from truck and rail receipts from Western Iowa country elevators to all truck-delivered corn from Western Iowa and out-of-state origins with the majority originating directly from farms.

Table 9. Estimated receipts of corn by Missouri river barge terminals by origin and mode of transport, in million bushels, Iowa, 1977 and 1985.

Origin	Mode of transport	Receipts	
		1977	1985
Western Iowa	Truck	11.6	6.1
	Rail	0.2	0
Central Iowa	Truck	0.2	1.7
	Rail	0	0
Out of state	Truck	0.4	5.2
	Rail	0.1	0
Subtotal	Truck	12.2	13.0
	Rail	0.3	0
Total		12.5	13.0

Table 10 shows the origin and mode of transport of corn receipts at Mississippi River barge terminals. In 1977, 16 percent of the total corn receipts were delivered by rail; by 1985, rail receipts had increased to 47 percent of total

receipts. This sharp increase in the rail share of corn receipts at Mississippi River barge terminals was the result of reduced railroad rates in both published tariffs and railroad contracts. These lower rates made railroads competitive with truck shipments to Mississippi River barge terminals.

Table 10 also shows that the share of total receipts at Mississippi barge terminals originating in Eastern Iowa declined from 84 percent in 1977 to 29 percent in 1985. The increased shares from Western and Central Iowa origins were made possible by the increased rail shipments to barge terminals from those areas.

Table 10. Estimated receipts of corn by Mississippi river barge terminals by origin and mode of transport, in million bushels, Iowa, 1977 and 1985.

Origin	Mode of transport	Receipts	
		1977	1985
Western Iowa	Truck	0.6	3.5
	Rail	3.3	24.5
Central Iowa	Truck	5.6	21.2
	Rail	9.1	32.9
Eastern Iowa	Truck	118.1	36.7
	Rail	11.7	0
Out-of-state	Truck	5.6	5.2
	Rail	0.1	1.7
Subtotal	Truck	129.9	66.6
	Rail	24.2	59.1
Total		154.1	125.7

Table 11 shows the corn receipts by Iowa corn processors from farm and nonfarm sources. Total receipts by corn processors more than doubled from 113 million bushels in 1977 to 294 million bushels in 1985. Receipts from nonfarm sources (typically country elevators) dominated the sources of corn receipts by corn processors. However, receipts direct

Table 11. Estimated receipts of corn by corn processors by type of origin, in million bushels, Iowa, 1977 and 1985.

Type of origin	Receipts	
	1977	1985
Farm	0	2.2
Nonfarm	113.2	291.8
Total	113.2	294.0

from farms increased from zero bushels in 1977 to 2.2 million bushels in 1985.

Table 12 shows the corn processor receipts by origin and mode of transport. In 1977, Eastern and Central Iowa were the dominant suppliers of corn to corn processing plants. By 1985, Central and Western Iowa were the dominant sources of corn for Iowa corn processors; most of the increased receipts from these two areas were delivered by rail. The largest percentage increase in shipments to corn processors were from Western Iowa origins which increased from 3.3 million bushels in 1977 to 79.5 million bushels in 1985. This dramatic increase in rail shipments to corn processors was the result of reduced railroad rates, mainly contract rates.

Table 12. Estimated receipts of corn by Iowa corn processors from nonfarm sources by corn origin and mode of transport, in million bushels, 1977 and 1985.

Origin	Mode of transport	Receipts	
		1977	1985
Western Iowa	Truck	3.0	10.3
	Rail	0.3	69.2
Central Iowa	Truck	20.4	43.2
	Rail	10.5	84.9
Eastern Iowa	Truck	73.2	63.7
	Rail	0	0
Out-of-state	Truck	5.5	10.5
	Rail	<u>0.3</u>	<u>12.2</u>
Subtotal	Truck	102.1	127.7
	Rail	<u>11.1</u>	<u>166.3</u>
Total		113.2	294.0

Corn Shipments

Table 13 shows the quantities, destinations and modes of transport of corn shipments from Iowa country elevators. Back-to-farm shipments declined from 211 million bushels in 1977 to 98 million bushels in 1985. This reduction in back to farm shipments is partially the result of reduced cattle feeding between the two years. It could also be the result of increased on-farm storage and on-farm feed mixing and manufacturing activities. This reduction in back-to-farm shipments occurred in all three regions in Iowa but the largest decrease took place in Western Iowa.

Table 13. Estimated shipments of corn by country elevators by destination and mode of transport, in million bushels, Iowa, 1977 and 1985.

Destination	Mode of transport	Shipments	
		1977	1985
Back to farm	Truck	210.8	98.0
Within Iowa	Truck	259.0	218.2
	Rail	35.5	211.7
Out of Iowa	Truck	91.4	53.5
	Rail	<u>165.8</u>	<u>139.1</u>
Subtotal	Truck	561.2	369.7
	Rail	<u>201.3</u>	<u>350.8</u>
Total		762.5	720.5

Shipments to within Iowa destination increased sharply from 294.5 million bushels in 1977 to 429.9 million bushels in 1985. There was a shift in transport modes between the two years. In 1977, trucks transported 88 percent and railroads transported 12 percent of the within Iowa corn shipments. While the total shipments by both modes increased from 1977 to 1985, the truck share declined to 51 percent and the rail share increased to 49 percent of the total within Iowa shipments.

Railroads dominated the out-of-state shipments from country elevators in both years; moreover, the truck share decreased from 36 percent in 1977 to 28 percent in 1985.

Overall, railroad shipments of corn from Iowa country elevators increased from 201.3 million bushels in 1977 to 350.8 million bushels in 1985. Excluding back-to-farm shipments which are not possible by rail, the railroad share of total corn shipments was about 37 percent for 1977 and 56 percent for 1985. Between the two years, the number of miles of railroad track in Iowa declined 34 percent from 6,919 miles to 4,566 miles. While much of the increased railroad shipments is probably the result of increased pricing freedom granted to the railroad industry by the Staggers Rail Act of 1980, the increased shipments between 1977 and 1985 indicate that a reduction in the number of miles of track did not reduce the ability of the railroads to attract grain freight.

Tables 14 and 15 show the destinations of truck and rail shipments from Iowa country elevators to out-of-state destinations. Total out-of-state shipments by truck declined from 91.4 in 1977 to 53.5 million bushels in 1985, a decline of 41 percent. While truck shipments nearly doubled to Arkansas-Missouri and to Nebraska-South Dakota destinations, truck

shipments declined sharply to Illinois and to Minnesota-Wisconsin destinations.

Table 14. Estimated truck shipments of corn from Iowa country elevators to out-of-state destinations, in million bushels, 1977 and 1985.

Destination	Shipments		
	Annual average	1977	1985
Arkansas-Missouri	1.0	14.8	25.6
Illinois	10.5	28.4	8.2
Minnesota-Wisconsin	3.9	34.6	4.2
Nebraska-South Dakota	1.5	7.2	15.1
Other	0.3	6.4	0.4
Total	17.2	91.4	53.5

* Source: Thompson

As shown in Table 14, truck shipments of corn from Iowa increased sharply from the mid 1960s to 1977 and 1985. However the destinations remained essentially the same.

Table 15. Estimated rail shipments of corn from Iowa country elevators to out-of-state destinations by destination, in million bushels, 1977 and 1985.

Destination	Shipments		
	Annual average	1977	1985
Arkansas-Missouri	13.8	31.6	24.0
Illinois	22.7	24.3	40.4
Louisiana	2.2	36.3	7.3
Mexico	0	0	3.2
Texas	0.6	60.7	15.5
West Coast	10.5	1.6	15.4
Other	27.5	11.3	33.3
Total	77.3	165.8	139.1

*Source: Thompson

Rail shipments of corn to out-of-state destinations more than doubled from the mid 1960s to 1977 and were slightly less than double in 1985. The mid 1960s destinations were similar to those in 1985.

Total rail shipments from Iowa country elevators to out-of-state destinations declined 16 percent between 1977 and 1985. Declining shipments to export ports in Louisiana and

Texas accounted for most of this reduction. Rail shipments increased modestly to Illinois corn processors and barge terminals, to West Coast export ports and feed lots and to a number of other states.

Table 16 shows the shipments of corn from Mississippi River barge terminals. Total shipments decreased from 154 million bushels in 1977 to 125 million bushels in 1985. Shipments from these terminals were almost exclusively by barge to Louisiana export ports. Only a small amount was shipped by truck and rail in 1985. Barge shipments of corn increased more than six times from the mid 1960s to 1977 and almost five times in 1985. The major destination was Louisiana in each time period.

Table 16. Estimated shipments of corn from Mississippi River barge terminals by destination and mode of transport, in million bushels, Iowa, 1977 and 1985.

Mode of transport	Destination	Receipts		
		Annual average	1977	1985
Truck	Eastern Iowa	0	0	1.0
	Missouri	0	0	0.6
Rail	Illinois	0	0	2.2
Barge	Alabama	0.1	0.3	0
	Louisiana	25.4	153.7	121.5
	Other	2.4	0	0
Total		27.9	154.0	125.3

* Source: Thompson

Table 17 shows the shipments of corn from Missouri River barge terminals. In 1977, only 22 percent of the shipments were by barge and 74 percent were by rail, mostly to West Coast ports. In 1985, 100 percent of the shipments were by rail, mostly to West Coast ports. Thus, in 1985, Missouri River barge terminals functioned exclusively as railroad subterminals.

Table 17. Estimated shipments of corn from Missouri River barge terminals by mode of transport and destination, in million bushels, Iowa, 1977 and 1985.

Mode of transport	Destination	Receipts	
		1977	1985
Truck	Nebraska	0.5	0
Rail	Arkansas-Missouri	1.8	1.7
	Texas	3.0	0
	West Coast	4.4	11.3
Barge	Louisiana	<u>2.7</u>	<u>0</u>
Total		12.4	13.0

Soybean Receipts

Table 18 shows the estimated 1977 and 1985 receipts from Iowa farms by Iowa elevators, soybean processors and barge terminals. Also shown are the Iowa production, and beginning and ending soybean inventories for the two years (USDA). Comparison of the two sets of estimates provides a check on the compatibility of the two sets of estimates. There was only a difference of 2.5 percent between the two sets of 1977 estimates and 5.7 percent difference between the two sets of 1985 estimates. This suggests that the 1977 and 1985 survey estimates of soybean receipts are reasonable.

Table 18. Comparison of estimated soybean shipments from farms and soybean receipts, in million bushels, Iowa, 1977 and 1985.

	1977	1985
Estimated shipments from farms:		
Beginning inventory	130.7	132.3
Production	251.3	309.7
Less ending inventory	<u>134.8</u>	<u>164.1</u>
Net shipments from farms	247.2	277.9
Estimated receipts by:		
Country elevators	239.3	275.6
Barge terminals	1.6	14.7
Soybean processors	0	3.4
Net receipts	<u>240.9</u>	<u>293.7</u>
Difference	6.3	- 15.8
Percent difference	2.5	- 5.7

Table 19 shows the receipts of soybeans direct from farms by type of receiver. An estimated total of 241 and 294 million bushels were received from farms in 1977 and 1985,

respectively. The 21.9 percent increase in receipts from farms reflects a 58 million bushel increase in soybean pro-

Table 19. Estimated receipts of soybeans from farms by receiving facility, in million bushels, Iowa, 1977 and 1985.

Receiving facility	Receipts	
	1977	1985
Country elevators	239.3	275.6
Barge terminals	1.6	14.7
Soybean processors	<u>0</u>	<u>3.4</u>
Total	240.9	293.7

duction from 1977 to 1985. However, the increased production was partially offset by an increase in on-farm ending inventories in 1985.

Country elevators received the largest share of the receipts from farms. In 1977, country elevators received 99 percent of the soybeans delivered from farms. By 1985, the country elevator share of farm delivered soybeans fell to 94 percent. The loss in the share of country elevator receipts was the result of deliveries direct from farms to barge terminals and soybean processors. Barge terminals had the largest gain in soybean receipts direct from farms, increasing from zero bushels in 1977 to 3.4 million bushels in 1977.

Table 20 shows the soybean receipts from nonfarm sources. Soybean processors in Iowa received the largest share of the receipts from nonfarm sources. In 1977, soybean processors received 119.5 million bushels or 65.8 percent of the nonfarm soybean receipts. By 1985, soybean processors received 165.4 million bushels or 77.8 percent of all nonfarm soybean receipts in Iowa.

Table 20. Estimated receipts of soybeans from nonfarm sources by receiving facility, in millions of bushels, Iowa, 1977 and 1985.

Receiving facility	Receipts	
	1977	1985
Country elevators	13.0	4.5
Barge terminals	49.0	42.7
Soybean processors	<u>119.5</u>	<u>165.4</u>
Total	181.5	212.6

Table 21 shows the soybean receipts by soybean processors by location of the processing plants and mode of transport. In 1977, soybean processors received 93.5 percent of

their soybeans by truck and only 6.5 percent by rail. In 1985, the truck share fell to 85.3 percent while the rail share increased to 14.7 percent of the soybean processor receipts. While rail shipments to processors increased substantially, trucks continued to dominate the transport of soybeans to Iowa processor markets.

In 1977, soybean processors in Western and Central Iowa received 30 and 60 percent of the total Iowa processor receipts. By 1985, Central Iowa processors received 58 percent of the total receipts while Western Iowa processors' share rose to 36 percent of total receipts. Eastern Iowa soybean processor receipts fell both absolutely and relatively.

Table 21. Estimated receipts of soybeans by soybean processors by processor location and mode of transport, in million bushels, Iowa, 1977 and 1985.

Location of processor	Mode of transport	Receipts	
		1977	1985
Western Iowa	Truck	33.6	47.5
	Rail	2.1	13.1
Central Iowa	Truck	66.6	86.8
	Rail	5.7	11.7
Eastern Iowa	Truck	11.5	10.1
Subtotal	Truck	111.7	144.4
	Rail	7.8	24.8
Total		119.5	169.2

Table 22 shows the origins of the soybeans trucked to soybean processors. The majority of the trucked soybeans

Table 22. Estimated truck receipts by soybean processors from nonfarm sources by processor location and soybean origin, in million bushels, Iowa, 1977 and 1985.

Location of processor	Origin of soybeans	Receipts	
		1977	1985
Western Iowa	Western Iowa	22.9	40.8
	Central Iowa	0.4	0
	Out-of-state	10.3	6.5
Central Iowa	Central Iowa	48.9	71.4
	Western Iowa	14.9	12.0
	Eastern Iowa	2.2	2.6
	Out-of-state	0.6	0.4
Eastern Iowa	Eastern Iowa	11.5	3.1
	Central Iowa	0	4.2
Total		111.7	141.0

came from the local area. Thus, most of the soybeans delivered by trucks to soybean processors originate locally.

Table 23 shows the origin of the soybean receipts delivered by rail. In 1985, Western and Central Iowa processors received approximately the same number of bushels of soybeans by rail. Eastern Iowa processors received no soybeans by rail in 1977 or 1985.

Table 23. Estimated rail receipts of soybeans by soybean processors from nonfarm sources by processor location and soybean origin in million bushels, Iowa, 1977 and 1985.

Location of processor	Origin of soybeans	Receipts	
		1977	1985
Western Iowa	Western Iowa	0.5	13.1
	Central Iowa	0	0
	Out-of-state	1.6	0
Central Iowa	Central Iowa	2.9	5.6
	Western Iowa	1.9	5.0
	Eastern Iowa	0	0.1
	Out-of-state	0.9	1.0
Total		7.8	24.8

Table 24 shows the amount of soybeans received directly from farms by soybean processor locations. In 1977, Iowa soybean processors received no soybeans directly from farms. In 1985, 82 percent of the soybeans delivered directly from farms were received by Eastern Iowa processors.

Table 24. Estimated truck receipts of soybeans by soybean processors directly from farms by processor location, in million bushels, Iowa, 1977 and 1985.

Location of processor	Receipts	
	1977	1985
Western Iowa	0	0.2
Central Iowa	0	0.4
Eastern Iowa	0	2.8
Total	0	3.4

Table 25 shows the soybean receipts at Mississippi River barge terminals. Total receipts were approximately the same in 1977 and 1985. Less than 3 percent of the 1977 soybean receipts at Mississippi River barge terminals were delivered directly from farms. In 1985, nearly 22 percent of the soybeans came directly from farms. More than half of all the

Mississippi River barge terminal soybean receipts came from Eastern Iowa.

Table 25. Estimated receipts of soybeans by Mississippi River barge terminals by soybean origin, type of origin, in million bushels, Iowa, 1977 and 1985.

<u>Origin</u>	<u>Type of origin</u>	<u>Receipts</u>	
		<u>1977</u>	<u>1985</u>
Western Iowa	Nonfarm	2.3	11.5
Central Iowa	Nonfarm	10.0	4.8
Eastern Iowa	Farm	1.4	9.7
	Nonfarm	34.5	17.7
Out-of-state	Farm	0	1.0
	Nonfarm	<u>0.6</u>	<u>4.4</u>
Subtotal	Farm	1.4	10.7
	Nonfarm	<u>47.4</u>	<u>38.4</u>
Total		48.8	49.1

Table 26 shows the soybean receipts at Missouri River barge terminals. Total receipts were only 1.8 million bushels in 1977 and 8.3 million bushels in 1985. Half of the 1985 receipts were from out-of-state sources and almost half of the total receipts were directly from farms.

Table 26. Estimated receipts of soybeans by Missouri River barge terminals by soybean origin of and type of origin, in million bushels, Iowa, 1977 and 1985.

<u>Soybean origin</u>	<u>Type of origin</u>	<u>Receipts</u>	
		<u>1977</u>	<u>1985</u>
Western Iowa	Farm	0.2	2.6
	Nonfarm	1.3	1.6
Out-of-state	Farm	0	1.4
	Nonfarm	<u>0.3</u>	<u>2.7</u>
Subtotal	Farm	0.2	4.0
	Nonfarm	<u>1.6</u>	<u>4.3</u>
Total		1.8	8.3

Soybean Shipments

Table 27 shows the quantities, destinations and modes of transport of soybean shipments from Iowa country elevators.

Markets within Iowa were the dominant destinations for soybeans shipped from Iowa country elevators, representing 70 and 79 percent of the total 1977 and 1985 country elevator shipments, respectively. Trucks hauled 92.4 percent of the 1977 shipments within Iowa and 77.0 percent of the 1985 shipments within Iowa. The major reason for the truck dominance is that soybean processors purchase most of their supplies locally. In addition, elevators frequently haul soybean meal back to their elevators in trucks as a backhaul, thereby reducing total transport costs. The railroad share of within Iowa shipments increased from 7.6 percent in 1977 to 23 percent in 1985. The major reason for the increased railroad share was the lower railroad rates brought about by railroad contracts.

Table 27. Estimated shipments of soybeans by country elevators by destination and mode of transport, in million bushels, Iowa, 1977 and 1985.

<u>Destination</u>	<u>Mode of transport</u>	<u>Receipts</u>	
		<u>1977</u>	<u>1985</u>
Within Iowa	Truck	148.0	144.7
	Rail	12.2	43.2
Out-of-Iowa	Truck	28.2	16.4
	Rail	<u>39.5</u>	<u>33.9</u>
Subtotal	Truck	176.2	161.1
	Rail	<u>51.7</u>	<u>77.1</u>
Total		227.9	238.2

Railroads were the dominant carrier of out-of-state soybean shipments hauling 58 and 67 percent of the 1977 and 1985 out-of-state shipments. Overall, trucks hauled 77 and 68 percent of all the soybeans shipped by Iowa country elevators in 1977 and 1985.

Table 28 shows the out-of-state destinations of the truck shipments from Iowa country elevators. Out-of-state truck soybean shipments are generally to the states surrounding Iowa. Overall, truck shipments to out-of-state destinations declined 42 percent between 1977 and 1985. The largest decline was for truck shipments to Minnesota, Kansas and Nebraska. However, truck shipments to Illinois nearly doubled between the two years. Truck shipments of soybeans to out-of-state destinations increased almost six times between the mid-1960s and 1977. In all three time periods, truck shipments were to states surrounding Iowa.

Table 28. Estimated truck shipments of soybeans from Iowa country elevators to out-of-state destinations by destination, in million bushels, 1977 and 1985.

Destination	Shipments		
	Annual average	1977	1985
Illinois	3.5	5.5	9.0
Wisconsin	0	0.9	0.2
Minnesota	1.3	11.0	2.1
Missouri	0	2.0	3.6
Kansas and Nebraska	0.1	8.8	1.5
Total	4.9	28.2	16.4

* Source: Thompson

Table 29 shows the out-of-state destinations of rail shipments of soybeans from Iowa country elevators. Soybeans were shipped by rail to a large number of destinations. In 1977, Louisiana was the destination of the largest amount of rail shipments from Iowa. In 1985, however, Louisiana received only 1 million bushels of soybeans by rail from

Table 29. Estimated rail shipments of soybeans from Iowa country elevators to out-of-state destinations by destination, in million bushels, 1977 and 1985.

Destination	Shipments		
	Annual average	1977	1985
Illinois	5.3	5.6	9.1
Louisiana	0	18.9	1.0
Mexico	0	0	1.8
Mississippi	0	0	2.6
Missouri	1.1	1.6	13.7
Texas	0	6.0	1.2
Other	5.0	7.4	4.5
Total	11.4	39.5	33.9

* Source: Thompson

Iowa. The destination receiving the most rail soybeans in 1985 was Missouri. Overall, rail shipments of soybeans declined 14 percent between 1977 and 1985. Rail shipments of soybeans to out-of-state destinations increased almost four times between the mid-1960s and 1977.

Table 30 shows the shipments of soybeans from Mississippi and Missouri River barge terminals. In both 1977 and 1985, almost all of the Mississippi River barge terminal shipments were by barge to Louisiana. However, almost 62 percent of Missouri River barge terminal soybean shipments were by rail to Washington export ports. The remaining Missouri River terminal shipments were by truck to Western Iowa processors. Barge shipments of soybeans to out-of-state destinations increased more than four times between the mid 1960s and 1977 and nearly six times between the mid 1960s and 1985.

Table 30. Estimated shipments of soybeans from Iowa barge terminals by river and mode of transportation, in million bushels, 1977 and 1985.

River	Mode of transport	Shipments		
		Annual average	1977	1985
Missouri	Truck	0	0	2.4
	Rail	0	0	3.9
	Barge	0	0.8	0
Mississippi	Truck	0	0.6	0.5
	Rail	0	0.1	0
	Barge	7.1	29.5	34.5
Subtotal	Truck	0.0	0.6	2.9
	Rail	0.0	0.1	3.9
	Barge	7.1	30.3	34.5
Total		7.1	31.0	41.3

* Source: Thompson

SUMMARY AND CONCLUSIONS

Data were collected on 1977 and 1985 corn and soybean flows from Iowa country elevators, feed mills, barge terminals and corn and soybean processors. These data, along with similar data from other states as well as barge shipment data from the Corps of Engineers and railroad shipment data from the carload waybill sample, were used to estimate 1977 and 1985 Iowa corn and soybean flows by origin, destination and mode of transport. The major conclusions from these surveys are:

I. Corn Receipts

- A total of 737 million and 912 million bushels of corn were received from Iowa farms by country elevators, barge terminals and corn processors in 1977 and 1985. Most of the corn was received by country

elevators although corn receipts by barge terminals and corn processors from farms increased sharply between 1977 and 1985.

- Corn receipts by corn processors more than doubled from 1977 to 1985 reflecting the large increases in corn processing in Iowa.
- In 1977, corn processors received more than 90 percent of their corn by truck and less than 10 percent by rail. By 1985, the shares were reversed when corn processors received over 57 percent of their corn by railroads and 43 percent by truck.
- Corn receipts by barge terminals decreased from 167 million bushels in 1977 to 139 million bushels in 1985. Corn receipts declined 18 percent between the two years at Mississippi River barge terminals but increased 4 percent at Missouri River barge terminals. In 1985, Mississippi River barge terminals received 91 percent of the total corn receipts by Iowa barge terminals.
- In 1977, 84 percent of the corn received by Mississippi River barge terminals was delivered by truck. By 1985 the truck share had declined to 53 percent and the rail share increased to 47 percent.

II. Corn shipments

- Excluding back-to-farm shipments, corn shipments from country elevators to destinations within Iowa increased 46 percent while corn shipments to out-of-state destinations declined 28 percent between 1977 and 1985.
- Excluding back-to-farm shipments, the railroad share of country elevator shipments increased from 36 percent in 1977 to 56 percent in 1985. Between the same two years, the number of miles of railroad track declined 34 percent. Thus, the reduction in the number of miles of track did not affect the ability of railroads to increase the total quantity and share of corn shipments.
- Rail shipments to export ports in Louisiana and Texas declined from 1977 to 1985 but rail shipments to the West Coast, to Iowa and Illinois barge terminals and corn processors increased sharply.
- Almost all of the corn shipments from Mississippi River barge terminals were to Louisiana export ports by barge.
- In 1985, all corn shipments from Missouri River barge terminals were by railroads to West Coast markets. Thus, Missouri River barge terminals

functioned as grain subterminals rather than as barge terminals.

III. Soybean receipts

- A total of 241 and 294 million bushels of soybeans were received from Iowa farms by country elevators, barge terminals and soybean processors in 1977 and 1985. Almost all of the soybeans were received by county elevators although soybean receipts by barge terminals and soybean processors increased sharply between 1977 and 1985.
- Trucks dominated the shipment of soybeans to soybean processors. In 1977, more than 93 percent of the receipts by soybean processors were by truck and less than 7 percent were by rail. By 1985, the truck share declined to 85 percent and the rail share increased to 15 percent. The reason trucks dominate soybean shipments is that processors buy most of their soybeans from nearby country elevators and these elevators then haul soybean meal back to their elevators as a backhaul.
- Soybean receipts by barge terminals increased from 50.6 million bushels in 1977 to 57.4 million bushels in 1985. In 1985, Mississippi River barge terminals received 86 percent of the total soybean receipts by barge terminals.

IV. Soybean shipments

- Trucks dominate the shipments of soybeans within Iowa by country elevators. The truck share was 92.4 percent in 1977 and 77 percent in 1985.
- Railroads continue to dominate the out-of-state shipments of soybeans with 58 percent of the 1977 and 67 percent of the 1985 out-of-state shipments.
- The major destinations of truck soybean shipments within Iowa were the same areas in which the shipping country elevators were located.
- The major destinations of 1977 rail soybean shipments were export ports in Louisiana and Texas. The major destinations of 1985 rail soybean shipments were Missouri and Illinois.
- Almost all soybean shipments from Mississippi River barge terminals were by barge to Louisiana export ports.
- All 1985 soybean shipments from Missouri River barge terminals were by truck and railroad. Thus, in 1985, Missouri River barge terminals functioned as rail subterminals.

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