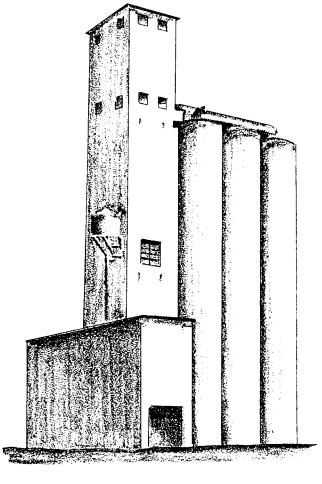
An Analysis of Wheat Receipts at Oklahoma Country Elevators 1949-1955



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An Analysis of

Wheat Receipts at Oklahoma Country Elevators 1949-55

By Kenneth B. Boggs, Virgil Lee McClain, Jr. and Nellis A. Briscoe
Department of Agricultural Economics

IN RECENT YEARS, technological advancements and governmental programs have brought about sweeping changes in wheat harvesting and marketing operations. These changes have created storage problems for commercial country elevators.

This bulletin reports results of a study to determine the most important characteristics of the farm-to-elevator wheat delivery pattern, as indicated by an analysis of daily wheat receipts at country elevators. Specifically, an attempt was made to determine: (1) The seasonal distribution and concentration of the wheat delivery pattern, and (2) the load-size characteristics of wheat deliveries to local country elevators.

The information developed by the study is expected to help country elevator managers evaluate seasonal and day-to-day wheat storage requirements during the harvest season.

Time Period and Area of Study

THE STUDY INCLUDES the crop years 1949 through 1955. These years were selected for several reasons. Both the smallest and largest Oklahoma wheat crops of recent years were harvested during this period. The 1955 crop was the smallest since 1916, while the 1952 crop was the largest on record. (The 1958 harvest came after the study was completed.) Secondly, during these years grain storage facilities in Oklahoma increased rapidly. Thirdly, country elevators frequently do not keep daily wheat receipts for long periods of time, and records prior to 1949 were not expected to be available for sampling purposes.

The area selected for study represents the major wheat producing region of Oklahoma. This wheat region was divided into five sub-areas for detailed analysis. The sub-areas (Figure 1) differ in one or more of the following categories: (a) production, climate, soil, topo-

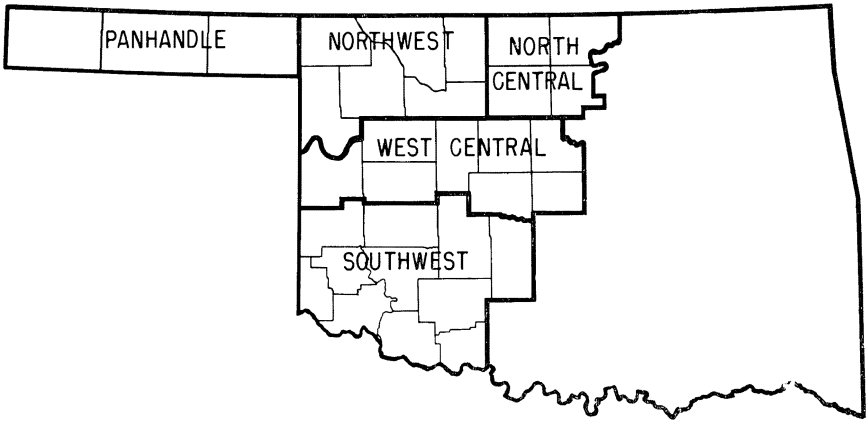

Figure 1. Sub-area divisions of the major wheat producing region of Oklahoma.

graphical and geographical characteristics; (b) transportation facilities, including differences in location involving the freight-rate structure; and (c) general wheat storage conditions such as temperature, moisture, and other factors affecting the costs of operating commercial wheat storage facilities.

Method of Procedure

TWO GOVERNMENTAL AGENCIES supplied lists of grain storage facilities in the state.[1] These two lists were combined and storage facilities were grouped according to size. While it was known that many of the storage facilities on the combined list might not be operating as wheat receiving points, they were included for sampling purposes because of insufficient information for specific identification. Only those firms at Enid and Oklahoma City reporting storage in excess of 250,000 bushels were excluded. These firms were believed to be more important as terminal market and milling facilities than as country receiving points.

For sampling purposes the remaining storage facilities were assumed to be operating as commercial country elevator wheat receiving points. A ten percent random sample was drawn from each of the various size groups within each sub-area. The size of sample included

[1] The Federal-State Crop Reporting Service, AMS, USDA, Oklahoma City, provided one list along with their most recent reported storage facilities (October 1, 1954); the Agricultural Stabilization and Conservation Service of the USDA provided the results of a survey by the State ASC offices dated January 1, 1955. (See Table I).

consideration of individual firm storage facilities that were not operating as commercial wheat receiving points. The size of the sample also allowed for lack of available records for any reason. No substitutions were permitted under the sampling procedure. While many elevator operations were relatively large and involved one or more "houses" at a specific location, such firms were considered as single units so long as they operated as a unit under single management and were not geographically separated.

Forty-eight elevators were included in the original sample. However, data from only 36 elevators were analyzed. Some of the 12 firms not included in the analysis reported records were not available; others were not operating as commercial wheat receiving points, etc.

The 36 elevators represent a 7.7 percent sample of the total original population (Table I). Only one area failed to be represented by an elevator in every size classification. This occurred in the west central area.

The actual percentage distributions of the sample by elevator size varied from 4.2 percent for the smallest size elevators to 12.8 percent for the 50,000 to 100,000 bushel size elevator class. The sample percentage by areas varied from 5.4 percent for the southwest to 10.3 percent for the panhandle area. A fairly even distribution of the sample in terms of actual numbers was obtained for both elevator size and subarea group classifications.

The Peak Wheat Delivery Season

DAILY WHEAT RECEIPTS from sampled elevators were accumulated by harvest year and area from May 23, the earliest date at which "new wheat" was received, through July 31 for the seven-year period 1949-1955. This period proved to be adequate for estimating the peak delivery season characteristics of each area and will be referred to in the remainder of this report as "the wheat receiving season."

An average of the receipts from sampled elevators for the seven-year period was computed for each area by days for the 70-day period, May 23-July 31. These averages are shown graphically in Figures 2 through 6. Wheat deliveries begin in the southwest area around May 25, followed by deliveries in both the west central and north central areas approximately six days later. These two areas precede the northwest area by 2 to 4 days and the panhandle area by 12 to 14 days.

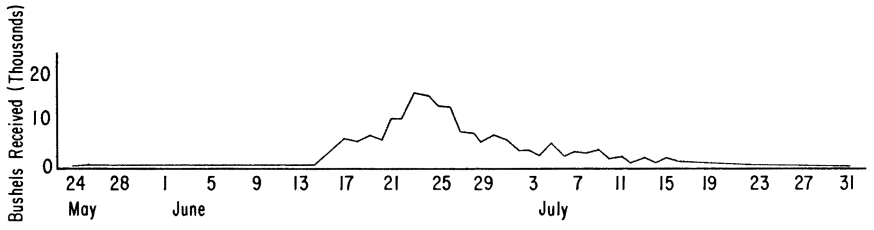

Figure 2. Daily averages of wheat receipts by sample elevators, Oklahoma Panhandle, wheat receiving seasons, 1949-1955.

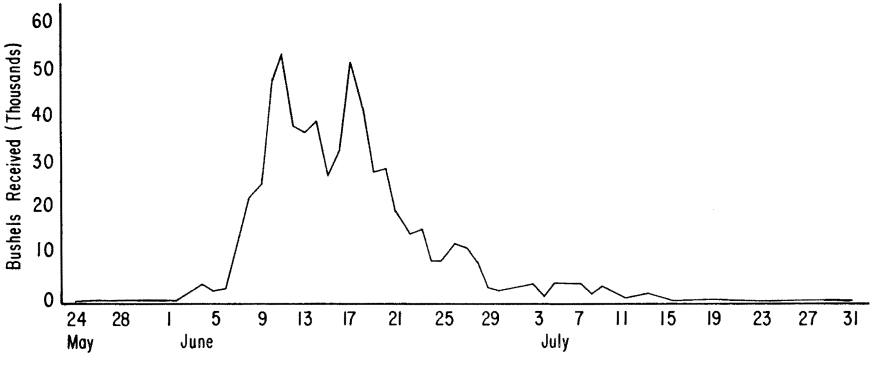

Figure 3. Daily averages of wheat receipts by sample elevators, Northwest Oklahoma, wheat receiving seasons, 1949-1955.

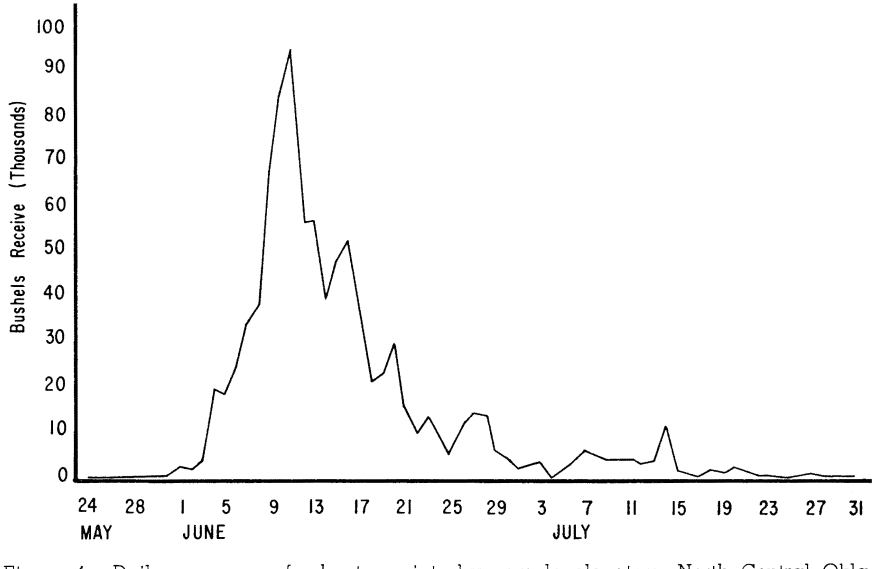

Figure 4. Daily averages of wheat receipts by sample elevators, North Central Oklahoma, wheat receiving seasons, 1949-1955.

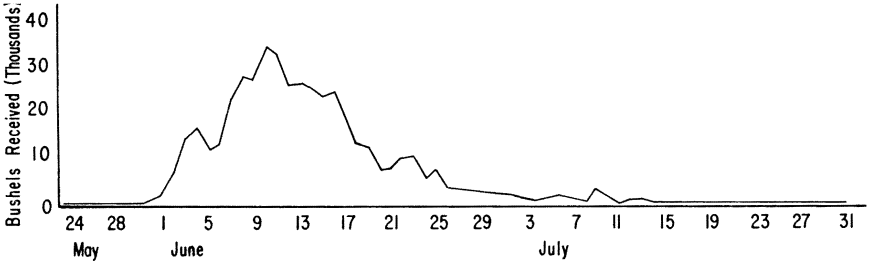

Figure 5. Daily averages of wheat receipts by sample elevators, West Central Oklahoma, wheat receiving seasons, 1949-1955.

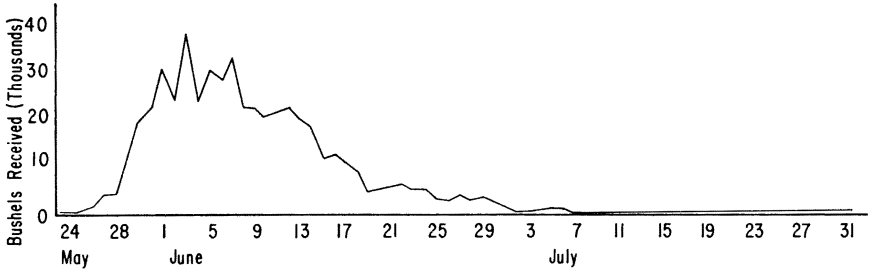

Figure 6. Daily averages of wheat receipts by sample elevators, Southwest Oklahoma, wheat receiving seasons, 1949-1955.

By using percentages of the total crop receipts by days to determine when the largest volume of wheat was received, the beginning and end of the peak delivery season was determined for each year and each area. The beginning and end of the peak season is shown for each area in Table II. In the remainder of this report this period shall be referred to as "the peak wheat delivery season."

For the average of all areas, the peak wheat delivery seasons of 1952, 1953, and 1954 were relatively short compared with other years. The 1952 delivery season was only seven days in length, the shortest season for any year. Significantly, this short season occurred the year in which the largest Oklahoma wheat crop on record was produced.

The average length of peak delivery season over the seven-year period was shortest in the northwest and north central areas (Table III). For this latter area, the yearly variation in the length of the peak delivery period was five days less than for any other area.

The panhandle area had a longer average peak delivery season than

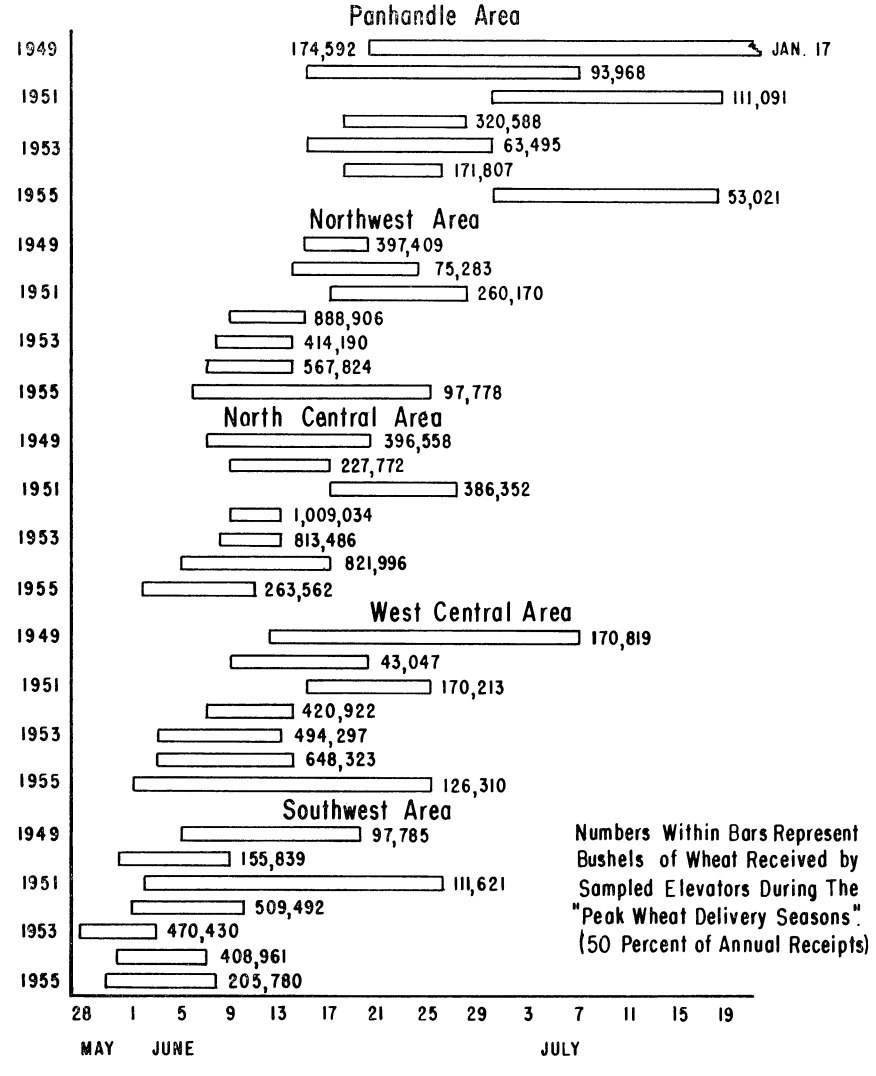

Figure 7. Distribution of the "Peak Wheat Delivery Seasons" by areas, Oklahoma, 1949-55.

any of the other areas. The greatest variation in length of peak delivery season between years, 203 days, was also in the panhandle area. This was due to an unusually long peak delivery season in 1949.

The distribution of the delivery periods for each area is shown by years in Figure 7. This figure indicates a trend toward earlier harvesting

in every area except the panhandle from 1949 through 1955. It also suggests that the peak delivery season is relatively short for large crop years and relatively long for small crop years. For example, 888,906 bushels of wheat were delivered in six days to sample elevators in the northwest area in 1952, a large crop year, while in the same area in 1955, a small crop year, nineteen days were required to deliver only 97,778 bushels of wheat.

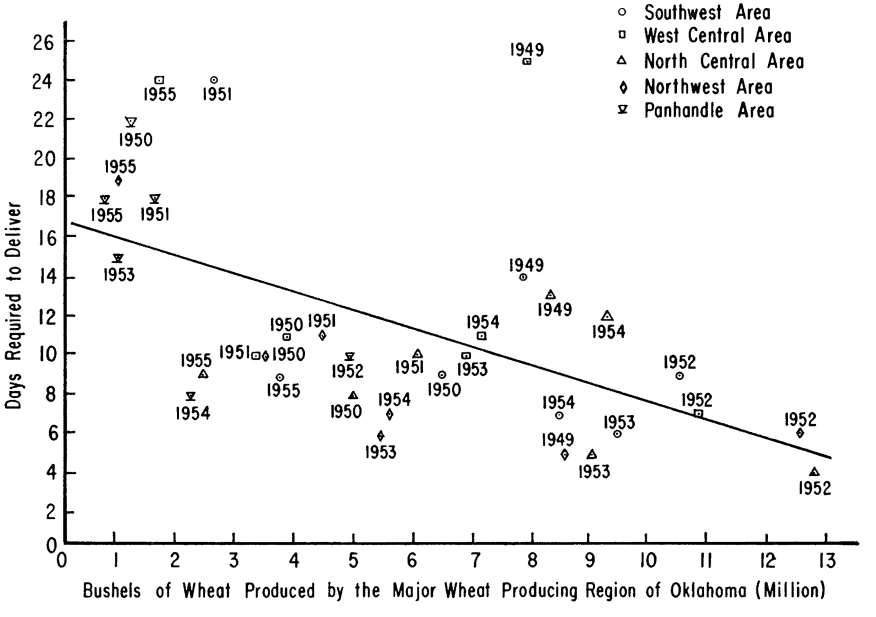

Figure 8. Regression of length of "Peak Wheat Delivery Season" on crop size. Regression analysis shows the length of the "Peak Wheat Delivery Season" decreases by 0.94 day ($S_{b} = 0.25$) for each one million bushels increase in size of the crop.

Regression analysis indicates that as the size of the crop increases by one million bushels, the length of the peak wheat delivery season decreases by 0.94 of one day. The result of the regression analysis is shown graphically in Figure 8.

The fact that large quantities of wheat have been delivered to local country elevators in a few days indicates that elevators have been able to receive and handle large quantities of wheat in a short period of time. However, this analysis does not show the number of bushels of wheat that elevators had to turn away during this period or the manner in which they had to handle the wheat they actually received. For example, in 1952 numerous elevator operators continued to receive

wheat long after their normal storage was filled to capacity. However, this was possible only by using improvised storage facilities which resulted in sizable losses of wheat.

The trend toward earlier and more concentrated delivery seasons indicates the demand for shipping facilities may continue to come earlier in the year, in all areas except the panhandle. The peak wheat delivery season in this latter area may be expected to have an unusual delivery pattern if past performance is sufficient for predicting the future.

Load Size Characteristics of Wheat Deliveries

THE INDIVIDUAL LOAD RECEIPTS were separated into five load-size categories. These categories were based on the number of bushels hauled per load as recorded on the receipt tickets. No information was available on actual truck sizes used for these deliveries, but it appeared that load size did provide a rough measure of truck size. The load-size categories used were: 0-50 bushel, 50.1-100 bushel, 100.1-150 bushel, 150.1-200 bushel, and 200.1 bushel and above. The number and percentage distribution of loads within each load-size group are shown in Table IV.

The largest percentage of loads was in the 50.1-100 bushel group. This group accounted for 36 percent of all loads, twice that of any other load-size classification. The smallest percentage of loads was in the 100.1-150 bushel group. Each of three load-size groups, 0-50 bushel, 150.1-200 bushel, and 200.1 bushel and above, accounted for approximately the same percentage of total loads.

The average size of load for each load-size group was estimated from receipts of selected elevators. These averages were used to estimate the distribution of bushels received among load-size groups. Both estimates are included in Table V.

The largest load-size classification, representing 16.8 percent of the total loads received, accounted for approximately one-third of all wheat received. The smallest load-size classification, representing approximately the same percentage of loads, accounted for only 5.2 percent of the bushels received.

Approximately 60 percent of the wheat was received in loads within the two largest load-size groups. However, these two groups accounted for only 34.5 percent of all loads. The two smallest load-size groups accounted for 28 percent of the total bushels received, but represented more than 50 percent of all loads.

Effect of Load-Size and Location on Load-Size Delivery Pattern

AN ANALYSIS WAS MADE to determine the effect of elevator size and geographical area upon the distribution of size of load received.

Percentage figures were used, rather than the actual number of loads, for two reasons. First, some of the sample elevators did not have complete records for all years. While the number of such cases was not large, the percentage figures represent a more accurate estimate of the distribution of loads for purposes of this analysis. Second, and perhaps more important, an unequal number of elevators were represented in each area and elevator-size classification.

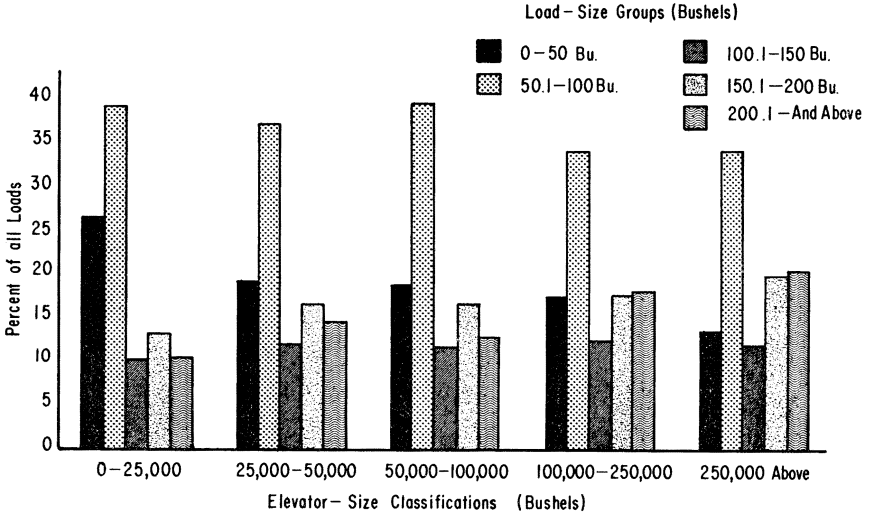

Figure 9. Percentage distribution of loads within load-size groups by elevator-size classifications.

A graphic representation of the percentage distribution of loads within load-size groups by elevator-size classifications is shown in Figure 9. The 50.1-100 bushel load-size represented the highest percentage of loads in each of the elevator-size classifications. The percentage of loads in the smallest load-size group decreased with an increase in elevator size, while the percentage of loads in the two largest load-size groups increased with an increase in elevator size. The percentage of loads in the median load-size group, 100.1-150 bushel, was relatively constant for all elevator-size classifications.

Table VI shows the percentage distribution of loads by load-size group for each area of the state. The north central area had the greatest percentage of all loads, 31.0 percent, while the panhandle area had the lowest percentage of all loads, 7.0 percent. The percentages of all loads received by the remaining three areas were: northwest, 26.2 percent; west central, 19.2 percent; and southwest, 15.7 percent.

A comparison, by areas, of the percentage distribution of loads received within specific load-size groups indicates that small loads, 0-50 and 50.1-100 bushels, tend to be concentrated in the west central and northwest areas while large loads, 150.1-200 and 200.1 bushel and above, tend to be concentrated in the southwest, panhandle, and north central areas.

Significantly, the north central area ranked lowest in the percentage of loads received in the smallest load-size group. This area ranked third for the 50.1-100 bushel group and ranked first, along with the panhandle area, in the percentage of loads received in the 100.1-150 bushel load-size group. For the two largest load-size groups, the north central area ranked second. The pattern of the percentage distribution of loads received indicated a tendency for loads to be in the three larger load-size groups.

The southwest area ranked considerably above all other areas in the percentage of loads in the largest load-size group. This area ranked unusually low in the percentage of loads in the 50.1-100 bushel load-size group.

The panhandle area was comparable with the north central area in many respects. This area ranked relatively low in the percentage of loads in the two smallest load-size groups but third in the percentage of loads in the three largest load-size groups. The percentage of loads in the 150.1-200 bushel load-size group was the highest of all areas.

The percentage distribution of loads in the northwest area indicates a tendency for loads to be concentrated in the smaller load-size groups. The 50.1-100 bushel load-size group ranked the highest and the 0-50 bushel load-size group was second only to the west central area in the percentage of loads received. Significantly, this area ranked lowest in percentage of loads received in both the 100.1-150 bushel and the 200.1 bushel and above groups and ranked relatively low for the 150.1-200 bushel load-size group.

The west central area apparently has many of the characteristics

of the northwest area. It ranked relatively high in the percentage of loads in the two smaller load-size groups. This area ranked highest in the percentage of loads in the smallest load-size group and was second only to the northwest area in the 50.1-100 bushel load-size group. Significantly, this area ranked lowest in the percentage of loads in the 150.1-200 bushel load-size group and second from the lowest in the 200.1 bushel and above load-size group.

Effect of Crop Size on Percentage Distribution of Size of Loads

AN ATTEMPT WAS MADE to determine the effect of crop size on size of load received at country elevators. Using annual estimates of production and the percentage of total receipts in each load-size group, statistical least-squares regressions were computed for each of the groups.

The results of the regression analyses suggest a tendency for crop size to have some effect on size of load received by country elevators. During years when total production is relatively small, elevators may expect a higher percentage of total loads received to be in the 0-50 bushel load-size group. During years of relatively large crops, the percentage of loads in the larger size groups may tend to increase.

Summary

SEASONAL WHEAT DELIVERIES in Oklahoma begin in the southwest area around May 25. Deliveries usually begin in the west central and north central areas about 6 days later, and in the northwest area approximately 8 to 10 days later. Deliveries in the panhandle area are usually 10 to 12 days later than deliveries in the northwest area. The heavy demand for handling and shipping facilities is likely to occur first in the southwest area then, with a few days lag, in each adjoining area.

A comparison was made of the average length of "peak wheat delivery seasons" for all areas by years. This comparison indicates that the average "peak wheat delivery seasons" of 1952, 1953 and 1954 were relatively short. The shortest average peak delivery season of seven days occurred in 1952, a year in which the largest Oklahoma wheat crop on record was produced. These averages also indicate some tendency toward a shorter average "peak wheat delivery season" in recent years. These data do not appear to be sufficient to indicate a definite trend; however, if this tendency toward shorter peak delivery seasons continues, the peak requirements for wheat transportation and storage facilities may occur over a shorter period of time.

A comparison of the average length of the peak delivery seasons for all years by areas indicates that the northwest and north central areas had the shortest average peak delivery season. The north central area not only had a relatively short average peak delivery season but the variation between years in the length of the delivery period was five days less than for any other area.

The panhandle area had the longest average peak delivery season, and appeared to have the most erratic wheat delivery seasonal pattern of any area. However, the seven-year average for this area was affected by the exceptionally long delivery season of 1949.

In every area except the panhandle, there appeared to be a trend toward earlier wheat receipts at country elevators. This suggests that peak wheat handling, storing, and shipping facility requirements may occur somewhat earlier in future years.

There was a negative relationship between the size of crop and the length of the delivery season. As the size of the crop increases by one million bushels, the length of the peak wheat delivery season decreases by 0.94 of one day.

The 50.1-100 bushel load-size group accounted for 36 percent of the loads received by sampled elevators, but the most bushels of wheat were delivered by the two largest load-size groups. The latter two groups delivered almost 60 percent of the total bushels while accounting for 34.5 percent of all loads received. In contrast, the two smallest load-size groups accounted for 28 percent of the total bushels and 53 percent of all loads.

Neither area nor elevator size had a statistically significant effect upon the size of load received by elevators in the sample. However, the size of sample was small. When the data were pooled for each elevator-size classification, regression analyses indicated a positive relationship between elevator-size and the percentage of loads in the two largest load-size groups. Moreover, there appeared to be a negative relationship between elevator-size and the percentage of loads in the two smallest load-size groups. Large-size loads tend to be received at large-size elevators and small-size loads tend to be received at small-size elevators.

The percentage distribution of specific size loads indicates that small loads tend to be concentrated in the west central and northwest areas. Large loads tend to be concentrated in the southwest, panhandle, and north central areas.

There was a negative relationship between the size of crop and the percentage of loads in the smallest load-size group, and a positive relationship between crop size and the percentage of loads in the 150.1-200 bushel group.

TABLE 1—Distribution of Wheat Storage Facilities and Size of Sample By Area and Elevator Size for the Major Wheat Producing Region of Oklahoma.

	Less than 25,000 bu.			25,000 to 50,000 bu.			50,000 to 100,000 bu.		
	Total No. of Elev.	No. in Sample	Percent of Total	Total No. of Elev.	No. in Sample	Percent of Total	Total No. of Elev.	No. in Sample	Percent of Total
nhandle	20	1	5.0	18	2	11.1	7	1	14.3
'hwest	23	1	4.3	9	1	11.1	6	1	16.7
th Central	44	1	2.3	11	1	9.1	6	1	16.7
st Central	41	3	7.3	11	0	0	16	2	12.5
thwest	61	2	3.3	19	1	5.3	12	1	8.3
al	189	8	4.2	68	5	7.4	47	6	12.8

	100,000 to 250,000 bu.			250,000 bu. & over			TOTALS		
	Total No. of Elev.	No. in Sample	Percent of Total	Total No. of Elev.	No. in Sample	Percent of Total	Total No. of Elev.	No. in Sample	Percent of Total
nhandle	6	1	16.7	7	1	14.3	58	6	10.3
thwest	18	2	11.1	16	2	12.5	72	7	9.7
th Central	20	2	10.0	26	3	11.5	107	8	7.5
st Central	11	1	9.1	23	2	8.7	102	8	7.8
thwest	22	2	9.1	16	1	6.3	130	7	5.4
l	77	8	10.4	88	9	10.2	469	36	7.7

TABLE II—Length of "Peak Wheat Delivery Season" in Days By Years and Areas, 36 Elevators, Oklahoma, 1949-1955.*

Years	Panhandle Area			Northwest Area			North Central Area		
	Peak Delivery Season		No. of	Peak Delivery Season		No. of	Peak Delivery Season		No. of
	Beginning	Ending	Days	Beginning	Ending	Days	Beginning	Ending	Days
1949	June 20	Jan. 17	211	June 15	June 20	5	June 7	June 20	13
1950	June 15	July 7	22	June 14	June 24	10	June 9	June 17	8
1951	June 30	July 18	18	June 17	June 28	11	June 17	June 27	10
1952	June 18	une 28	10	June 9	June 15	6	June 9	June 13	4
1953	June 15	June 30	15	June 8	June 14	6	June 8	June 13	5
1954	une 18	June 26	8	June 7	June 14	7	June 5	June 17	12
1955	June 30	July 18	18	June 6	June 25	19	June 2	June 11	9

Years	West Central Area			Southwest Area		
	Peak Delivery Season		No. of	Peak Delivery Season		No. of
	Beginning	Ending	Days	Beginning	Ending	Days
1949	June 12	July 7	25	June 5	June 19	14
1950	June 9	June 20	11	May 31	June 9	9
1951	June 15	June 25	10	June 2	June 26	24
1952	June 7	June 14	7	June 1	June 10	9
1953	June 3	June 13	10	May 28	June 3	6
1954	June 3	June 14	11	May 31	June 7	7
1955	June 1	June 25	24	May 30	June 8	9

* Calculations of total crop receipts by days indicated that the peak delivery season begins after 5 percent of the total crop has been received and continues until 55 percent has been received. Thus, the beginning period listed here was the day on which 5 percent of the crop had been received and the ending period is the day on which 55 percent of the total crop had been received.

TABLE III—The "Peak Wheat Delivery Season" Expressed in Average, Range and Variation of Days, Over a 7-Year Period, 1949-1955.

Areas	7-Year Average (Days)	Range (Days)	Variation (Days)
Panhandle	43	8-211	203
Northwest	9	5- 19	14
North Central	9	4- 13	9
West Central	14	7- 25	18
Southwest	11	6- 24	18

TABLE IV—Number and Percentage Distribution, By Load Size, of Loads Received By 36 Elevators, Oklahoma, 1949-1955.

Load-Size Groups (Bushels)	Number of Loads		Percentage of Total
0- 50	35	1,095,745	5.2
50.1-100	75	4,789,500	22.9
100.1-150		21,124	11.9
150.1-200		31,362	17.7
200.1-Above		29,881	16.8

TABLE V—Estimated Average Size of Load; Number and Percentage Distribution, By Load Size, of Bushels Received By 3 Elevators, Oklahoma, 1949-1955.

Load-Size Groups (Bushels)	Estimated Average Size Load Received (Bushels)	Estimated Number of Bushels Received	Percentage of Total
0-50	35	1,095,745	5.2
50.1-100	75	4,789,500	22.9
100.1-150	125	2,640,500	12.7
150.1-200	175	5,488,350	26.3
200.1-Above	230	6,872,630	32.9

TABLE VI—Percentage Distribution of Loads By Load-Size Group and Area of State, Oklahoma, 1949-1955.*

Load-Size Groups (Bushels)	Areas of Oklahoma					
	Panhandle	Northwest	North Central	West Central	Southwest	All Areas
			Percent			
0 - 50	15.5	20.2	13.3	21.2	18.8	17.6
50.1-100	33.8	42.4	35.4	39.4	23.1	36.0
100.1-150	13.6	10.6	13.6	11.0	11.0	11.9
150.1-200	21.5	15.0	20.6	14.8	18.0	17.7
200.1-Above	15.6	11.8	17.1	13.6	29.1	16.8
All Loads	7.0	26.2	31.9	19.2	15.7	100.0

* Data in this table represent wheat receipts from May 23 through July 31.