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**KANSAS COUNTRY ELEVATOR  
WHEAT STORAGE PRACTICES, 1991**

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## KANSAS COUNTRY ELEVATOR WHEAT STORAGE PRACTICES, 1991

by F. Worman, C. Reed, B. Schurle, S. Duncan, and J. Pedersen

### INTRODUCTION

The quality of U.S. grain exported to other countries has been of concern to buyers for several years. The U.S. government and the grain industry have followed several avenues in attempting to improve the quality of exported grain. Two approaches to improving grain quality have been to research ways to improve the handling of grain, and to implement tighter grain inspection standards.

In 1986, as part of an on-going study of stored grain insect management practices, the managers of 85 randomly chosen, country elevators in western and central Kansas were surveyed to determine their pest control practices and buying policies for wheat (Reed et al., 1988). This survey found that many of the storage, marketing and pest control practices varied by geographic location, with the gradations of differences tending to run between northwest and southcentral districts. Managers tended to store wheat delivered at harvest time, whereas they quickly shipped wheat which had been stored on-farm. Managers generally sampled wheat from on-farm storage and determined test weight, moisture content, and less frequently, dockage and foreign material. More than half of the managers monitored insects only in farm-stored wheat. The type of ownership and size of facility affected the type of pest control practices used. About 15 percent of managers refused to accept severely insect infested wheat, whereas only 3.5 percent refused to accept wheat with any insect infestation. Approximately 90 percent of the managers who would accept insect infested wheat discounted the price.

The U.S. Grain Grade Standards directly or indirectly influence most managers' decisions on discounting for insects and insect-damage kernels in wheat. These standards were changed in May 1988, reducing the number of live insects from a maximum of 5 per 1000 gram sample to a maximum of 1 per sample before the lot was designated "infested". In addition, insect damaged kernels (IDK) were recognized as a separate quality factor, with  $\geq 32$  IDK per 100 grams reducing the lot to sample grade. How these changes have affected managers' policies on handling insect-infested grain, and whether this has caused a change in storage practices at elevators, as well as how farmers' have responded to these changes, have kindled much interest.

Flemming et al. (1990) studied the incidence of discounts for six north central Kansas elevators over a five year period. The results indicated that country elevator discounts to farmers for insect problems increased after the 1988 changes, while terminal elevator discounts to the country elevators decreased. In addition, wheat from on-farm storage was three times more likely to be discounted at the elevator after the changes.

The present study was undertaken to identify changes made at country elevators in the sampling, handling and storage, and discounting of wheat which may be attributed to the May 1988 modification in U.S. wheat standards.

## SURVEY METHODS

### Sample Selection

The sample used for this survey was the same sample used by Reed et al. (1988) in 1986. The original sample was drawn at random from 28 counties which were, in turn, drawn at random from all Kansas counties with wheat production at least 50 percent greater than the statewide county mean. Originally, an average of three elevators was drawn per county, based on a selection system weighted by the total number of country elevators in the county. While the sample was originally drawn to exclude terminal elevators and mills, one of each was encountered during the current survey.

Seventy-two elevator managers were surveyed in 1991 compared to 85 in 1986, a 15 percent decrease (Table 1). Elevators that had gone out of business (3), or no longer handling farm-stored wheat (2), accounted for almost half of this decline. Also, in 1991 at elevators managed by the same person only one interview, with the general manager, was recorded (4 cases). In 1991 there were fewer interviews at small elevators and more at large elevators, probably indicating that elevators have added storage capacity over the past five years.

### Interviews

Between January and March 1991 elevator managers were interviewed, when possible at their place of business, by one of two KSU researchers. Interviews were conducted by the researchers using both open and close-ended questions designed to elicit information on sampling practices, handling of infested wheat, storage, and discounts and discounting policy. Responses to questions, along with descriptive information on the elevator, were recorded on the survey form by the researcher.

### Data Analysis

Questionnaires for 72 elevator managers were used in this analysis. Elevators were classified by ownership (either cooperative or independent), by their organizational level (either headquarters or branch) and by the amount of registered storage capacity (size) as reported in the Kansas Grain & Feed Association, Kansas Official Directory for 1990. Small elevators were those with a capacity of less than 500,000 bushels, medium-sized elevators had a capacity of 500,000 to 1,000,000 bushels, and large facilities had a capacity of more than 1,000,000 bushels. Geographic location was defined by the Kansas Crop Reporting Service Districts (Figure 1). The 27 counties in which interviews were conducted fell within six Crop Reporting Service districts. These were aggregated into three regions (north, central and south) and two zones (west and central), as indicated in Figure 1. With the exception of one county, eastern Kansas was excluded from the study by the selection bias. Responses for the one eastern county where elevators were surveyed were included with those of the southcentral district.



later discussion. For example, there were significant differences among both regions and sizes in how elevators treated wheat which became insect infested in storage. Is the observed difference among elevators due to geographic location or the size of the elevator, or both?

Size and district are significantly ( $P < 0.01$ ) related with elevators' distribution as shown in Figure 2a. Size and region are significantly ( $P < 0.05$ ) related as shown in Figure 2b, while size and zone are significantly ( $P < 0.01$ ) related as shown in Figure 2c.

## RESULTS AND DISCUSSION

### General Description of Surveyed Elevators, and Locations

#### Classification Factors

Twenty-eight percent of the 257 elevators in the counties where surveys were conducted were sampled (Table 1). There was a significant difference between the percentage of elevators sampled by ownership types, i.e., a greater percentage of cooperatives (37% of 136 cooperatives) than independents (18% of 121 independents) were sampled. This difference, which also occurred in the 1986 data, was exacerbated by a larger reduction in the number of independents surveyed.

There was a significant difference among the number of interviews based on size of facility, with the small elevators having a disproportionately low number of interviews (18% of 114 small elevators, compared to 34% of 68 medium and 38% of 76 large elevators). The classification factors related to geographic location, i.e. region, zone and district, were all generally representative of the region as a whole.

#### Changes in Ownership and/or Management, 1986-1991

Of the 72 elevators, 12 percent changed ownership during the five years (Table 2). Cooperatives and branches were most likely to change ownership, while the west district had no changes in ownership. During the same period, 37 percent of the elevators changed managers. Of the 9 elevators which changed ownership, 4 did not change managers. Independents were more likely to change managers than were cooperatives. Significantly more elevators changed branch managers than headquarters managers during the five years. There was no recorded change in either ownership or management in the west district, whereas the northwest district had a 50 percent change in managers. Small elevators (<500,00 bu) also had a 50 percent change in managers and a 20 percent change in ownership. During the five years, an annual average of 7.4 percent of the elevators changed management. This may indicate that there is a need for in-service training, or other types of training, to maintain continuity and efficiency.

Figure 2. Geographic Distribution of Elevators by Size

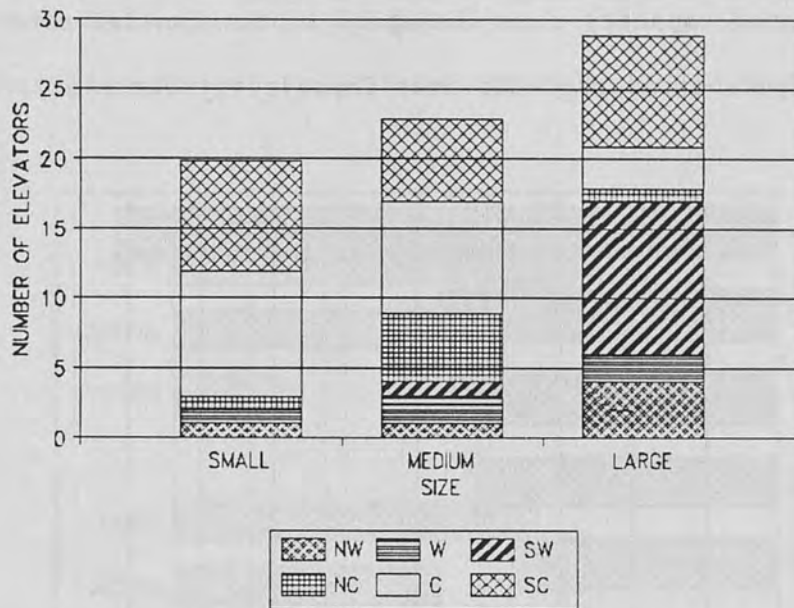


Figure 2a. Size by District

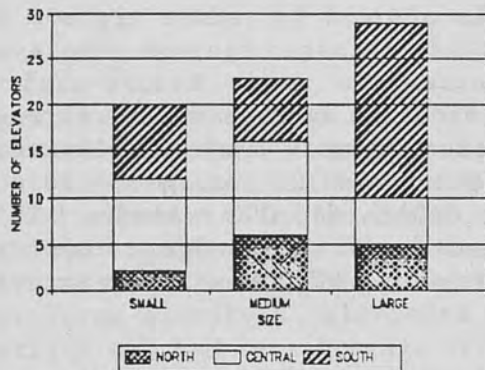


Figure 2b. Size by Region

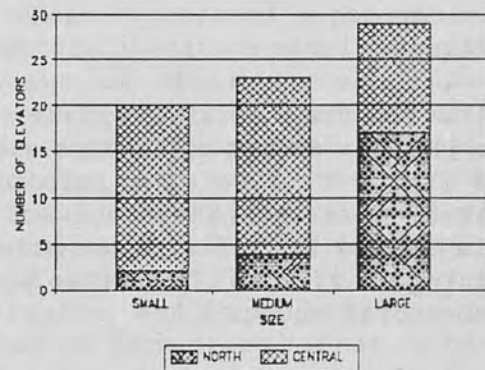


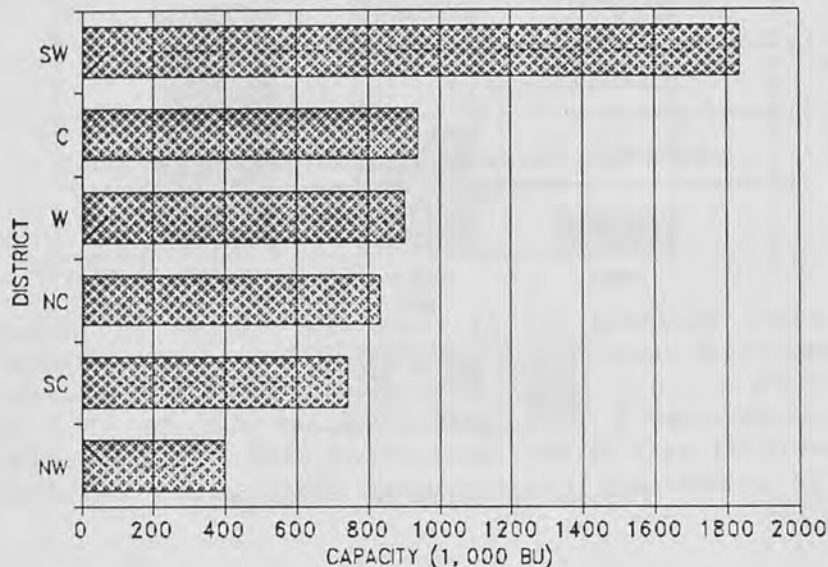
Figure 2c. Size by Zone

### Storage Capacity

The average storage capacity for selected elevators was 1,014,000 bushels, with a range from 50,000 to 5,178,000 bushels (Table 3). Small elevators, i.e. those under 500,000 bushels, averaged 290,000 bushels, while medium elevators (500,000 to 1,000,000) averaged 723,000 bushels, and large elevators (over 1,000,000)

averaged 1,743,000 bushels. The selected elevators from the southwestern district contained twice as much storage capacity, on the average, as elevators in other parts of the state (Figure 3), and those in the western zone had significantly greater capacity than elevators in the central zone.

Figure 3. Average Elevator Capacity by District



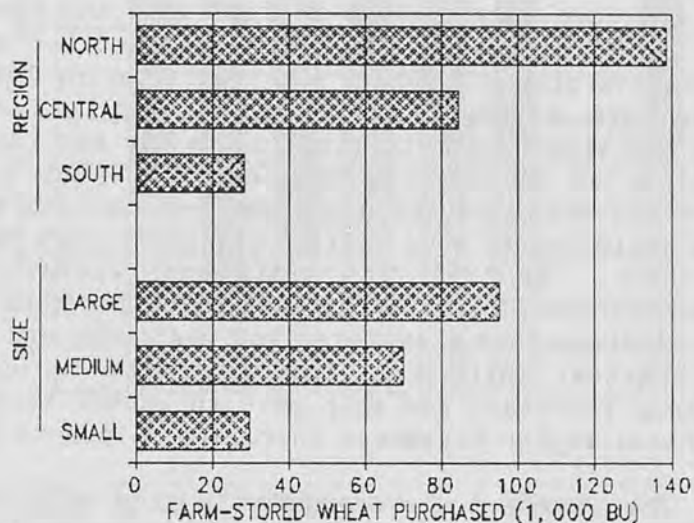
### Procurement

Managers reported receiving farm-stored wheat from an average of 24 farmers (Table 4). The number of farmers selling farm-stored wheat to surveyed elevators ranged from 2 to 300. The selected elevators purchased an average of 68,444 bushels of farm-stored wheat, with a range of 1,000 to 660,000 bushels. This data is skewed by a few observations, as 75 percent of the managers reported purchasing wheat from 17 or fewer farmers, and purchasing 65,000 or fewer bushels of farm-stored wheat.

Selected elevators which were headquarters operations purchased significantly more farm-stored wheat from a significantly higher number of farmers than did elevators which were branch operations. Elevators in the northwest, west and northcentral districts purchased more wheat from farm storage than those in the southwest and southcentral. This pattern is also reflected in the regional data with elevators in the south purchasing significantly less farm-stored wheat than elevators in the north and central regions (Figure 4). One reason for this may be that a larger proportion of the farm-stored wheat was going directly to feed lots in the southwestern district because of the relative prices of wheat and corn. An additional factor in the southcentral district may be the proximity to terminal elevators. Farmers can more easily go directly to the terminal elevator

and bypass the country elevator with their farm-stored wheat. As might be expected the amount of farm-stored wheat purchased increased as the size of the elevator increased, with large elevators buying significantly more wheat from farm storage than small elevators (Figure 4).

Figure 4. Average Amount of Farm-Stored Wheat Purchased by Region and Size



The average number of bushels of farm-stored wheat represents 9 percent of the elevators' storage capacity (Table 4). Headquarters elevators received an amount of farm-stored wheat equivalent to 13 percent of their storage capacity, significantly more than branch elevators, which received only 6 percent of their capacity from farm storage. Elevators in the north and central regions also received more than twice as much from farm storage, compared to their capacity, as did elevators in the south region. In the southwest district, elevators received significantly less farm-stored wheat, compared to storage capacity, than elevators in the northwest, west and central districts. The 1986 survey found that large elevators, elevators in the south region, and those in the southwest district all had less storage capacity dedicated to farm-stored wheat, a pattern similar to the findings in the 1991 survey.

### Disposition

Surveyed managers indicated that, on average during the preceding year, they shipped 49 percent of their wheat to other (terminal) elevators, 39 percent to flour mills, and 12 percent to feedlots or feed mills (Table 5). Of the potential destinations for wheat, we would expect the flour mills to be the most exacting customers. Wheat shipments to other elevators were significantly lower in the west and southwest districts than in most other districts (Figure 5). In these two districts a much higher percentage of wheat was destined for animal

feed. This was particularly true for the southwest district, whereas in the west district most wheat was shipped to flour mills. Comparing the west and central zones shows the west zone elevators shipping wheat for animal consumption and the central zone elevators shipping to other elevators. A significantly higher percentage of wheat was shipped to other elevators from small elevators, then from large elevators.

A comparison of the 1986 and 1991 survey results indicates that elevators reduced the amount of wheat shipped to other elevators from 76 percent in 1986 to 49 percent in 1991. They likewise increased wheat shipped to flour mills from 17 percent to 39 percent and doubled shipments to feed lots and feed mills from 6 percent to 12 percent. The increase in shipments destined for animal feed may be explained by the relative prices of wheat and corn. During 1991 the price of wheat fell below that of corn, making it more economical to feed wheat than corn. The increase in percent of wheat going to flour mills may not represent a major increase in actual volume of wheat going to flour mills but is a percentage increase because less wheat was being shipped from elevators for export markets. In 1986 elevators were beginning to ship part of the grain they had been storing under long term contracts. By 1991 this grain was generally depleted and elevators had only grain purchased during the year for sale, thus less grain was available for export. Medium sized elevators, and west zone and central region elevators showed the greatest shift away from shipments to other elevators. Medium size and west zone elevators now ship more to animal feeding operations than in 1986, while central region elevators increased shipments to flour mills.

Fifty-four percent of the surveyed elevators had a feed mill associated with their operation (Table 5). Cooperatives were nearly twice as likely to have a feed mill as independent elevators. This is probably due in part to the role of many of the independents, which are owned by major grain companies, and collect grain for shipment to the owner's terminal or export facilities. Also headquarters operations were more than twice as likely as branch operations to have an associated feed mill.

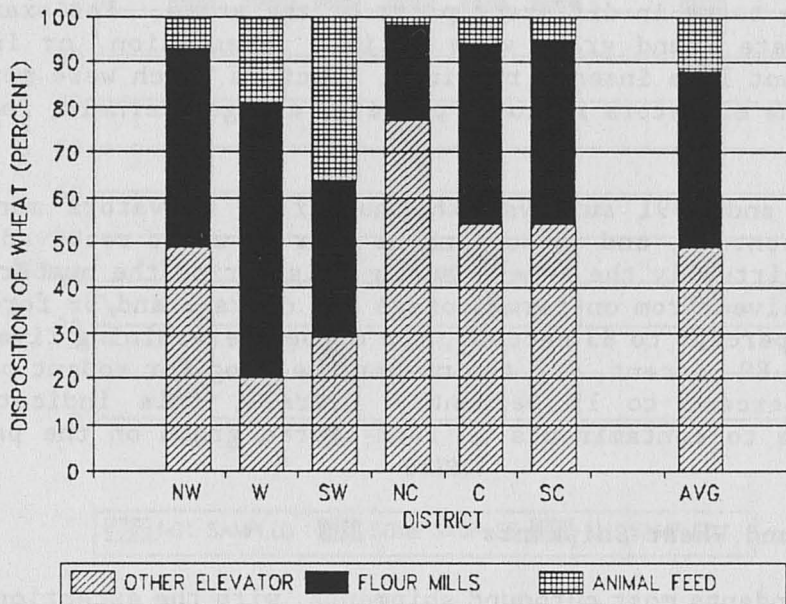
## Sampling Practices

### Sampling Practices at Harvest Time

Wheat arriving at an elevator was usually sampled to determine its quality. Generally, during the busy harvest season fewer loads coming from a particular source were sampled. Managers of the surveyed elevators were asked what quality factors they consider when sampling wheat received at harvest time. For this particular item the interviewer recorded only the answers volunteered regarding specific quality factors considered and did not prompt the respondent. All respondents indicated that they checked test weight and 97 percent determined moisture content (Table 6). A third factor determined by three-quarters of the elevators was dockage. Dockage was slightly more likely to be tested at independent operations, at branches and at small elevators. Dockage was determined at all surveyed elevators in the west district. Also, cooperatives in the central region and central zone generally tested for this factor. At some elevators dockage testing equipment has been installed in all of the branches.

Managers at these sites are now testing, and discounting, all loads based on the level of dockage.

Figure 5. Elevator Disposition of Wheat by District



No respondent reported checking for rodent pellets in wheat received at harvest time. Ten percent, or less, checked for foreign material, shrunken and broken kernels, damaged kernels, IDK, and odor. Eighteen percent monitored for live insects, with significantly more coop managers monitoring this factor than independents. Other factors, such as weeds, seeds, rye, pink wheat or soft wheat, were estimated at 14 percent of the elevators.

In 1986, dockage and/or foreign material was determined on wheat received at harvest time by 52 percent of elevators. In 1991, 79 percent of elevators were determining these factors. There was also an increase, from 2 to 18 percent, in the number of elevators sampling for live insects in wheat received at harvest.

#### Sampling Practices When Receiving Farm-stored Wheat

Because farm-stored wheat has a greater chance of developing quality problems, and because it is usually delivered to elevators at non-peak work periods; virtually all loads of farm-stored wheat were sampled when they were received at an elevator. The same three major factors considered by managers in sampling at harvest time, i.e. test weight, moisture, and dockage, were considered when sampling wheat arriving from on-farm storage (Table 7). In addition, 89 percent checked for live insects and 61 percent reported that they determined IDK. In checking for live insects there was a significant difference among the districts, with all elevators in the west and southwest districts examining this factor,

while only half of the elevators examined it in the northwest district. Elevator operators in the north region looked for live insects significantly less often than did operators in the central and south regions, whereas these same northern managers screened for IDK significantly more often than did managers in the other two regions. We found no apparent reason for this difference in addressing the question of live insects and IDK. One possibility is that there are colloquial definitions of quality terms which prevail in an area, and which are not as precise as the official inspection terms, giving rise to somewhat different definitions of the terms in different parts of the state. For example, "buggy" wheat could indicate sound grain with a light infestation, or insect-damaged grain whether or not live insects remained. Factors which were monitored at 10 to 25 percent of the elevators include: protein, damaged kernels, rodent pellets, and odor.

Between the 1986 and 1991 surveys, the number of elevators monitoring test weight, moisture content, and objectionable odor in wheat received from on-farm storage remained virtually the same. During this period the number of elevators testing wheat received from on-farm storage for dockage and/or foreign material increased from 58 percent to 83 percent, the number determining live insects rose from 68 percent to 89 percent, and the number checking for rodent pellets almost doubled from 7 percent to 13 percent. Overall, this indicates increased vigilance relative to contaminants in farm-stored grain on the part of Kansas grain dealers.

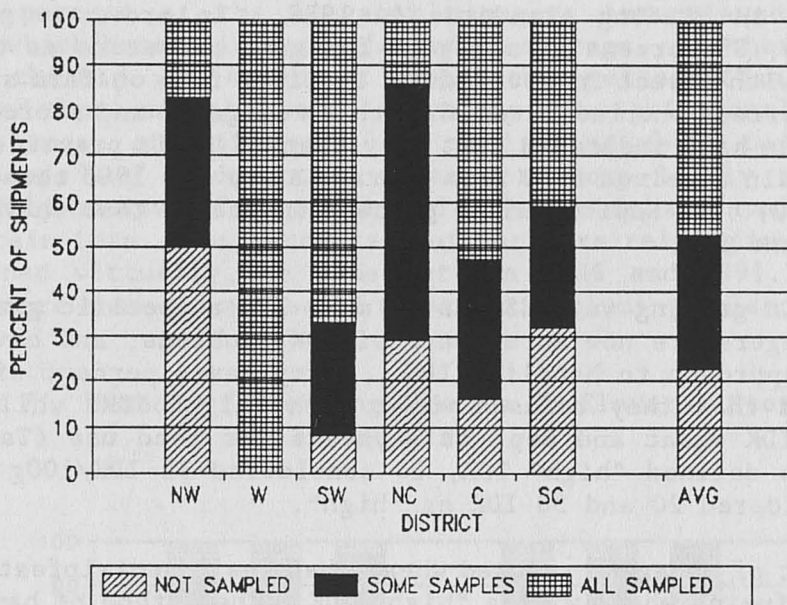
#### Sampling of Outbound Wheat Shipments

According to respondents most outbound shipments, with the exception of shipments moving between units of the same organization, were officially sampled at either the point of origin, e.g. the country elevator, or at the destination. Most respondents said they had official samples taken on rail shipments at the point of origin, while truck shipments were sampled for an in-house analysis at the point of origin and official sampling was done at the destination. This difference in where official samples were taken is probably due in part to custom but it may also be due to the smaller amount of grain in a truck shipment, which represents less risk for the elevator if quality becomes an issue. Ninety-one percent of the 64 elevator managers who indicated they shipped wheat by rail sampled all shipments, with only 3 percent not sampling rail shipments at all (Table 8). This was in contrast to truck shipments. Twenty-three percent of the 70 interviewed managers who shipped by truck indicated that they did not sample outbound trucks, while 47 percent sampled all truck shipments. There was considerable variability in sampling patterns by geographic location for truck shipments (Figure 6), but much less for rail shipments.

Of the managers surveyed, eleven percent submitted samples from truck shipments for official grade, while 64 percent conducted some type of in-house analysis (Table 9). Ninety-six percent of the managers conducting an in-house analysis of truck shipments checked test weight and 80 percent determined moisture. Slightly more than half said they inspected for live insects while one-third measured dockage. IDK and odor were checked by 24 percent of the managers and 13 percent checked for damaged kernels. Operators of large elevators inspected for damaged kernels at a significantly higher rate than did managers of small and medium elevators. This difference may reflect a difference in the level of

training, experience or sophistication among different sized elevators' employees.

Figure 6. Sampling of Truck Shipments by District



Eight of the surveyed elevators did not have rail facilities. Of those that did have rail available, 89 percent submitted samples from rail shipments for official grade (Table 10). Cooperatives submitted samples at a significantly higher rate than did independent operators. Small elevator managers submitted somewhat fewer samples than did medium-sized and large elevator operators. At only four elevators did the manager report conducting an in-house analysis of wheat being shipped by rail.

At 88 percent of the surveyed elevators, managers submitted samples for official grade (Table 11). Of this group, managers of small elevators submitted significantly less samples than did managers of the medium-sized and large elevators. Samples were submitted for official grade on all rail shipments by 79 percent of elevators submitting samples. In addition, 6 percent of the respondents said they submitted samples for official grade for all rail and truck shipments, and 14 percent submitted samples on some shipments.

In 1986, 54 percent of the elevator operators interviewed reported submitting samples for official grade. By 1991 this number had risen to 88 percent. The increase was particularly striking in the south region where managers obtaining official reports of grades increased from 29 to 82 percent.

## Practices in Handling and Storing Insect Infested Wheat

### Insect Infested Wheat from On-farm Storage

Slightly more of the respondents indicated that they were likely to refuse completely wheat with insects, or a small amount of IDK, now when compared to before the change in grading standards in 1988. In order to protect wheat already in storage, 89 percent of managers fumigate and store as their primary method of dealing with insect infested wheat received from on-farm storage. This was down from 93 percent who indicated that they fumigated and stored grain prior to 1988. More than half indicated that they changed their practices concerning the handling of grain received from farm storage after the 1988 change in grading standards (Table 12). An additional 15 percent indicated that they are now more aware of insects and IDK.

The major change in grading in 1988 was to make IDK a specific grading factor. Consequently, managers are now more aware of IDK problems, and have made major changes in their approach to handling IDK. Forty-seven percent of interviewed managers indicated that they refused wheat with "high" IDK, while 10 percent fumigated "high" IDK wheat and kept it separate for feed use (Table 12). Of those managers who defined "high" IDK, 14 considered 32 IDK/100g<sup>2</sup> as "high", while 1 each considered 20 and 30 IDK as "high".

In 1986, 15 percent of managers refused wheat that was insect-infested. By 1991, 47 percent were refusing wheat with a "high" IDK. The method of handling insect infested wheat that was accepted into the elevator did not change over the period, although the number of elevators receiving infested wheat for feed rose slightly by 1991.

### Long Term Storage

Since several questionnaire items used the phrase "long term storage", elevator managers were asked to define "long term". The average number of months that the 48 managers who answered the question considered to be "long term" was 9.33, with a standard deviation of 6.24 months. The minimum number of months storage to be considered "long term" was 2, and the maximum was 36. Twenty managers indicated that they considered 12 months to be "long term", while 50 percent considered 9 months or less to be "long term". There appears to be little consensus, or perhaps use of the concept of "long term storage" among Kansas grain handlers.

### Use of Protectants

Thirty-one percent of the elevator managers surveyed said they applied a chemical protectant (Reldan or malathion) to the wheat they stored. Almost half of the headquarters level elevators applied a protectant, significantly more than the 14 percent of branches (Table 13). Of the 22 elevator managers who applied a protectant, 23 percent applied it to all stored wheat, and another 23 percent applied the protectant only to "long term" storage. An additional 18 percent

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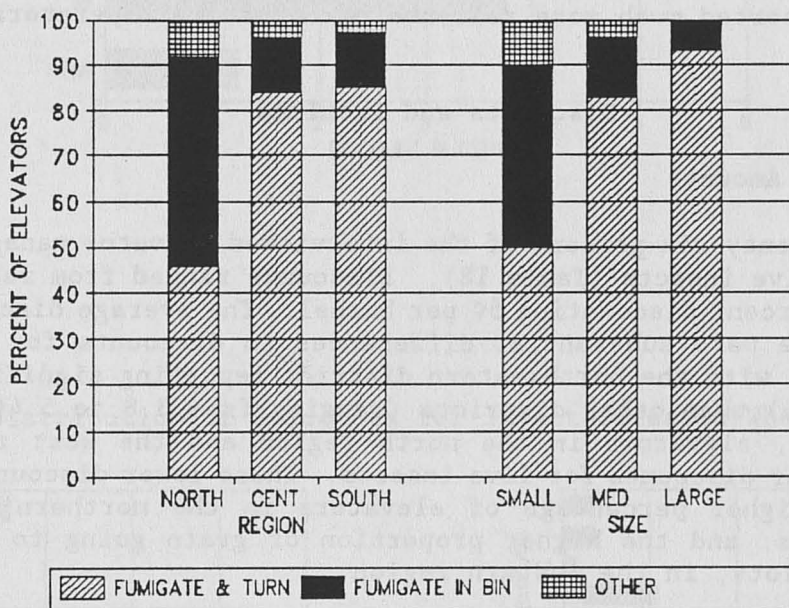
<sup>2</sup>An IDK content of 32 per 100g sample causes the sample to be considered "sample grade".

applied the protectant to flat storage. By 1991, the percentage of managers applying a chemical protectant had risen slightly from 1986 (25% compared to 31%).

### Treating Wheat Infested in Storage

Seventy-eight percent of the elevator managers interviewed fumigated while turning wheat which became insect infested in storage. Another 18 percent chose fumigation in the bin, and 4 percent chose other methods (Table 14). Managers in the north and those managing small elevators did significantly more fumigating in bins, and hence, significantly less fumigating while turning (Figure 7). Managers of coops and headquarters units were more likely to fumigate while turning, possibly because of ease or speed of handling, and availability of space to turn the grain into. The percentage of managers relying on fumigation while turning remained virtually the same between 1986 and 1991. Eight elevator managers used more than one method of treatment including: blending and aerating.

Figure 7. Method of Treating Insects in Elevator Stored Grain by Region and Size



### Fumigation Practices

Managers who fumigated wheat were asked if the fumigation was done on a pre-determined schedule or only if an infestation were detected. Sixty-eight percent indicated that they fumigated only when an infestation was found and 50 percent indicated that fumigation was done on a pre-determined schedule (Tables 15 & 16).

Some elevators practice both types of fumigation, depending on how the grain was stored, i.e., if it was stored in upright storage or as flat storage.

Eighty percent of the 39 managers who reported fumigation when insect infestations were found, indicated that they fumigated all wheat, while eight percent treated short term wheat, and six percent treated upright storage (Table 16). In contrast, 47 percent of the 36 managers fumigating on a predetermined basis treated all wheat this way, while 33 percent treated "long term" storage, and 14 percent treated flat storage (Table 15). There was a significant difference in the pattern of fumigation on a predetermined basis among the three regions. More than half of the elevators in the central region fumigated all wheat on a predetermined schedule while more than half in the southern region fumigated only "long term" storage on such a schedule. Forty percent of elevators in the northern region fumigated flat storage on a predetermined schedule.

Eighteen percent of the elevators used commercial pest control operators, and 14 percent used elevator personnel for upright storage and commercial pest control operators for flat storage. Fumigation was carried out by elevator personnel only for 61 percent of the surveyed elevators (Table 17). The use of commercial pest control operators by small elevators to do part or all of their fumigating was virtually unchange between 1986 and 1991. However, cooperatives and medium size elevators reported much more reliance on commercial operators in 1991.

## Discounts and Premiums

### Discount Type and Amounts

Live Insects - Seventy-six percent of the interviewed elevator managers reported discounting for live insects (Table 18). Discounts ranged from zero to 10¢ per bushel, with 46 percent discounting 5¢ per bushel. The average discount was 4.4¢ per bushel. There were substantial differences in discounts for live insects based on location, with the northwestern district reporting significantly lower discounts (1.2¢/bu) than other districts (ranging from 3.8 to 5.4¢/bu) (Figure 8). Consequently, elevators in the north region and the west zone reported significantly lower discounts for live insects. These lower discounts may be due in part to the higher percentage of elevators in the northern region which operate feed mills, and the higher proportion of grain going to animal feed, particularly feedlots, in the western region.

The value of the price discount that respondents reported for insect infestation was significantly ( $P < 0.01$ ) lower in 1991 (4.4¢/bu) than in 1986 (5.3¢/bu). The pattern across geographical areas was generally the same in 1986 and 1991. In 1991, 76 percent said they discounted for insect infested wheat compared to 62 percent in 1986. This finding appears to contradict other findings which indicated that discounting for live insects had increases. For example, in 1991, 76 percent said they discounted for insect infested wheat compared to 62 percent in 1986. This apparent discrepancy can be better understood by examining Figure 9. Although there was a drop in average discount from 1986 to 1991, there was an increase from 4¢ to 5¢ in the most commonly used discount. This indicates a

policy change of an increased discount rate. The figure also shows that a higher percentage of discounts were in the higher discount ranges, indicating perhaps that managers were discounting for lives insects and IDK in the 1986 discounts, and were separating them in the 1991 discounts.

Figure 8. Average Discounts for Live Insects by District

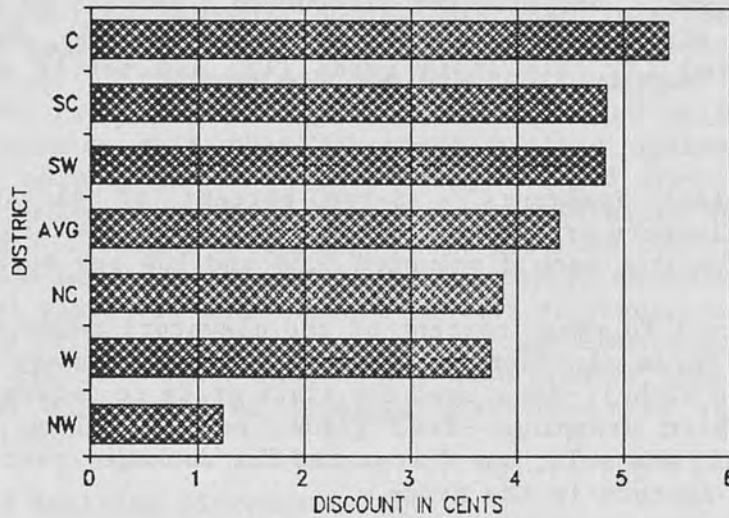
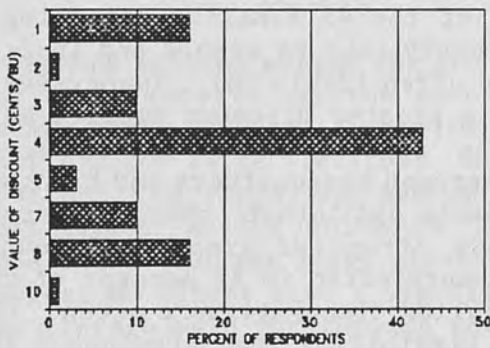
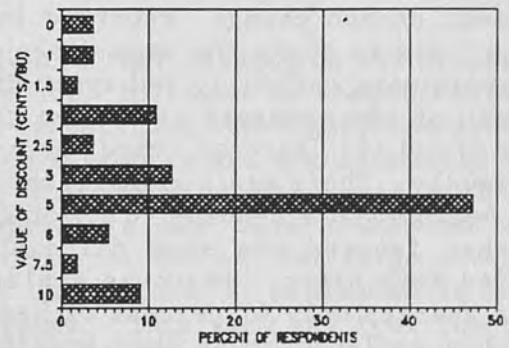


Figure 9. Distribution of Discounts for Insect-Infested Wheat, 1986 & 1991



1986 Discounts



1991 Discounts

**Insect Damaged Kernels** - Sixty-four percent of elevators reported discounting for IDK. Five elevators had fixed discounts of 5, 10 or 15¢ per bushel, and another fifteen elevators used a discount schedule from 3¢ to \$1.50 per bushel, depending on the amount of IDK. Ten elevators used a weight discount ranging from 1 percent to 10 percent, with five of those reducing weight 1 percent for each IDK. Ten elevators determined discount based on state grade, one based the discount on the terminal discount, and five purchased grain with over 32 IDK only as feed.

**COFO (Commercially Objectionable Foreign Odor)** - Forty-nine percent of the elevators reported discounting for odor (COFO). Twenty-three elevators discounted an average of 7.6¢ per bushel, with 11 discounting 10¢, and 9 discounting 5¢ per bushel. One elevator discounted 2 percent by weight. Other methods for handling grain with odor were: do not handle (4), discount varies (2), purchase for feed (2), use state grade (1), and settle after terminal discount (1).

**Dead Insects or Insect Fragments** - Seven percent of elevators reported discounting for dead insects or insect fragments. Three elevators discounted 5¢ per bushel and one elevator each discounted 0.5¢ and 10¢ per bushel.

**Other Discount Factors** - Fourteen percent of the elevators reported discounting for other factors. Three elevators discounted for heat damage (1 discounted 2¢/bu and 2 discounted 5¢/bu); three used the state grade to determine discounts; one discounted for bird droppings--feed grade; one passed on any discounts received when the grain was sold; one discounted for dockage--percent by weight; and one included all factors in the price.

#### Changes in Country Elevator Discount Policies

Sixty-four percent of the managers reported that the elevator's discount policy for insects in farm-stored wheat had changed during the 1988-90 period. Of the 45 managers reporting policy changes, 44 indicated that policies are stricter now. Seventy-five percent indicated that the policy change had occurred in 1988, after the change in grain grading standards, 18 percent indicated the change occurred in 1989, and 7 percent in 1990 (Table 19).

The most common change, reported by 39 percent of the 45 managers reporting a change, was to apply the same discounts as previously, but to sample and inspect the grain more carefully and apply discounts more often (Table 20). Twenty-seven percent of the managers indicated they now used a greater discount applied more often, and 14 percent used greater discounts applied about as often as previously. There was a significant difference between headquarters and branches with headquarters tending to favor greater discounts and "other" changes whereas branches favored the same discount applied more often and greater discounts applied more often. Branches applied discounts more often in 87 percent of the cases whereas only 47 percent of headquarters applied discounts more often. One possible explanation is that branches had less flexibility than previously and were coming more into compliance with discounting policies of the headquarters units.

Elevator managers perceived a number of different reactions from farmers to the changes in discount policy for insects. Forty percent indicated that farmers are now more careful with farm-stored wheat, while 29 percent indicated that farmers store less on-farm (Table 21). Although thirteen percent of the managers said that farmers have accepted the more stringent standards, 11 percent reported that farmers complain a lot about the situation, and have changed little. Almost half of the managers who reported a change in policy during the last three years, indicated that the change had caused the elevator to lose customers and/or sales. The loss of customers was most often a problem for coops, medium sized elevators, and in the northwest and west districts.

The fear expressed by managers during the 1986 interviews that a stricter discount policy would cause them to lose customers appears to have been realized in that 49 percent of the managers who made their discount standards stricter during 1988-1990 reported a loss of customers. Also in the 1986 survey, the majority of managers felt that discounts applied against them by terminal elevators were more severe than those they charged their clients. In 1991, several of the managers reported that terminal elevators would take wheat from farmers without a discount while they would discount country elevators for the same wheat. Some managers thought that this double discounting standard on the part of terminal elevators undercut the efforts of country elevators to increase grain quality by raising quality standards through discounts. It is worth noting that a 1986-87 discount study indicated a much greater likelihood that infested grain would get discounted at terminal elevators than at country elevators. (Reed, et al. 1989)

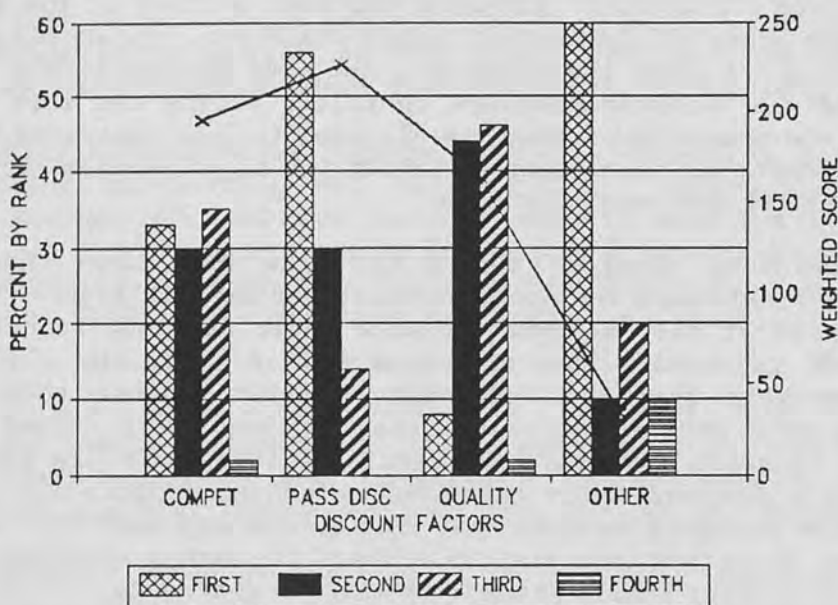
#### Determining and Applying Discount Policy

Managers were asked to rank several factors which they might consider in determining discounting policy. They were asked to rank:

1. Competition: match or beat the competition in their trade area.
2. Discounts received: pass along the discounts received by the elevator (from elevators and mills) to the producer.
3. Average wheat quality: the average wheat quality of farm-stored wheat in the area (station average).
4. Other factors

A weighted scoring system for the factors indicated that passing on the discounts they would receive was the most important factor, followed by competition and average wheat quality (Figure 10, Table 22). Competition was significantly more important for large elevators, while passing on discounts was significantly more important for coops and medium elevators. This finding is opposite to the conventional wisdom which is that small operators are more concerned with competition than the large elevators. One explanation may be that large elevator managers no longer have a significant part of their capacity dedicated to long-term storage paid for through government programs. Thus they may feel the need to compete aggressively with other elevators in order to fill their facilities. Small and medium elevator managers, on the other hand, may be able to fill a significant portion of their facilities with local wheat, and so are most concerned with passing on any discounts they may receive in order to protect their profit margin.

Figure 10. Ranking of Factors Considered in Determining Discount Policy



Sixty-six percent of the managers indicated that their discount policy for stored grain insects was applied equally for all customers, while 34 percent indicated that they adjusted the discount policy to meet the circumstance (Table 23). The number of managers indicating that they apply their discount policy in a standard manner, i.e., the same for everyone, decreased from 84.5 percent in 1986 to 66 percent in 1991. It may be that managers who are stricter in looking for insect problems, who are now considering IDK, and/or who are increasing discounts, feel that they have to be more flexible with certain customers and so are more likely to adjust their discount policies. Another explanation might be that they had not paid much attention to the issue prior to 1988, and could respond more accurately to the 1991 interview.

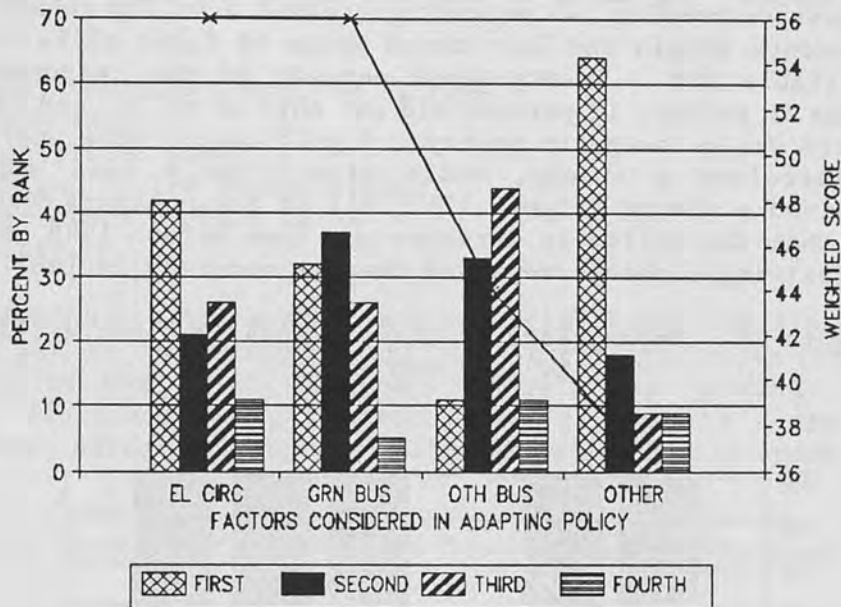
Those managers who adjusted policy were asked to rank several factors which they might consider in adjusting the discount policy. These factors were:

1. Elevator circumstances at the time (i.e., is there space, can the grain be blended off, etc.).
2. The amount of grain business the customer brings to the elevator.
3. The amount of other business the customer brings to the elevator (i.e., purchase of feed, fertilizer or other services offered by the elevator).
4. Other factors.

Based on a weighted scoring system, elevator circumstances and the amount of grain business provided by the customer were of equal importance, followed by the amount of other business the customer brings to the elevator, and finally other factors (Figure 11, Table 24). The amount of grain business done with the farmer

was significantly more important for cooperatives, while the amount of non-grain business from the customer was significantly more important to independents.

Figure 11. Ranking of Factors Considered in Adapting Discount Policy



### Premiums

Thirty-two (44%) of the managers indicated that their elevators provided premiums for wheat under some circumstances. Significantly more large elevators provided premiums than did small elevators (Table 25). Seven elevators paid premiums for more than one factor. Of the managers who did pay premiums, 69 percent paid a premium for high protein, 34 percent for high test weight, and 9 percent for low dockage.

### Perceived Changes in Terminal Elevator Discount Policy

Fifty (74%) of the elevator managers perceived a change in the last three years in the discount policies of terminal elevators to which they shipped wheat (Table 26). All of the managers thought the discount policies were stricter now. Eighty percent reported the change to have occurred in 1988, with the other 20 percent reporting the change in 1989.

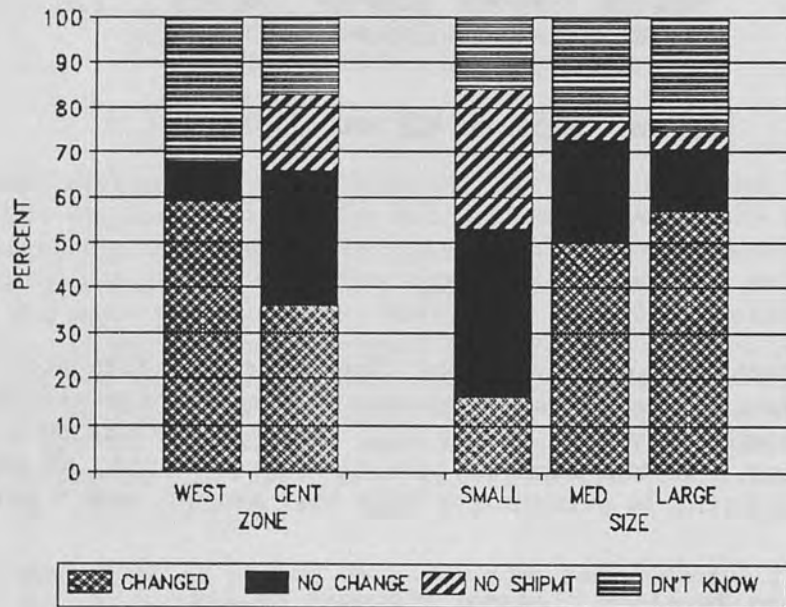
Managers were asked if buyers specified insect-free wheat in sales contracts. Forty-six percent indicated that they shipped to such buyers, while 34 percent did not ship to buyers specifying insect-free wheat (Table 27). Twenty percent of elevator managers (primarily branch managers) did not know the content of sales contracts because they did not merchandize. There was a significant difference between headquarters and branches, with headquarters reporting

significantly more sales requiring insect-free wheat. The percentage of managers who indicated that buyers required insect free wheat increased from 20 percent in 1986 to 46 percent in 1991.

### Perceived Changes in Flour Mill Discount Policy

Of the 69 managers responding, 43 percent perceived a policy change relating to stored grain insects within the last three years at flour mills to which they shipped wheat (Table 28). Twenty-three percent of the respondents did not perceive a change in policy, 12 percent did not ship to mills, and 22 percent did not know if there was a change in policy. Significantly more operators in the western zone perceived a change, while significantly less small elevator operators perceived a change (Figure 12). All of the managers who perceived a change thought that the policy is stricter now than before 1988, and 26 of the 30 managers perceiving a change reported that it occurred in 1988.

Figure 12. Perceptions of Changes Made by Flour Mills by Zone and Size



## Business Factors

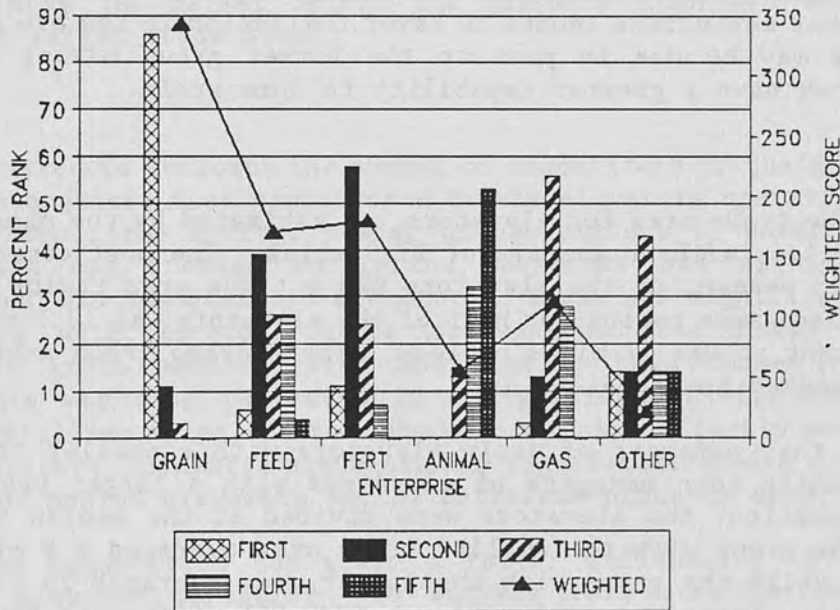
### Contribution of Enterprises to Elevator Profitability

Managers were asked to rank several enterprises by amount of contribution of dollar sales that each made to the elevator's operation. Factors to be ranked were:

1. Grain merchandizing and storage
2. Feed sales
3. Fertilizer sales
4. Animal health product sales
5. Petroleum product sales
6. Other

Based on a weighted scoring system, grain merchandizing and storage was almost twice as important as the second enterprise -- fertilizer sales (Figure 13, Table 29). Feed sales was third, followed by petroleum products. There were significant differences among districts and regions in terms of order of importance. Feed sales were significantly more important to independently owned businesses.

Figure 13. Ranking of Enterprises Contribution to Elevator Business



One question which may be of interest is whether elevator managers who depend on grain storage and merchandizing face different operating situations or have different policies from managers of elevators where other activities are more

important than grain storage and merchandizing. To examine this question the sample was divided into the group for which grain storage and merchandizing were the most important (61 elevators, 85%) and the group which had another activity as its most important activity (11 elevators, 15%). There was a significant ( $P<0.01$ ) difference among the districts based on these groupings. Elevators where grain was most important were distributed over all districts while 64 percent of the group that did not have grain storage and merchandizing as their primary activity were located in the southcentral district. The west, southwest and northcentral districts had no elevators in this latter group.

There were a few significant differences in how these groups handled their operations. The grain storage and merchandizing group diverted a significantly ( $P<0.01$ ) higher percentage of their grain to animal feeds (14% compared to 3%). One reason for this difference could be that firms which are primarily dependent on their grain business will have to take wheat of a low quality, in order to get good quality wheat from the same source, and will then divert this lower quality grain to feed lots or to feed mills. On the other hand, organizations to whom grain is of secondary interest may be in a position to refuse lower quality wheat.

The group which was most dependent on grain storage and merchandizing also averaged significantly ( $P<0.05$ ) more competitors in their petroleum operations (5.5 compared to 2.8). This group relied to a significantly ( $P<0.05$ ) greater extent on fumigation while turning (82% compared to 55%) to control insect infestations which develop in stored wheat, while the group which is more dependent on other activities tended to favor fumigation in the bin (36% compared to 15%). This may be due in part to the former group having more storage capacity, so they have a greater capability to turn grain.

#### Trade Area

The radius of the trade area for elevators, as estimated by the managers, ranged from 5 to 120 miles, with an average of 17.3 miles. The most common radius was 10 miles, and 25 percent of the elevators had a trade area radius of less than 9 miles. The trade area radius for half of the elevators was 12.5 miles or less, and for 75 percent it was 17 miles or less. The average trade area radiuses by factor are presented in Table 30.

It is possible that managers of grain elevators with a smaller trade area may respond differently than managers of elevators with a larger trade area. To examine this question, the elevators were divided at the median trade area of 12.5 miles. The group with the smaller trade area averaged 8.8 miles (range 5 to 12.5 miles) while the group with the larger area averaged 25.9 miles (range 14 to 120 miles). There was a significant ( $P<0.05$ ) difference among districts based on these trade area averages, with the central (38%) and the southcentral (35%) districts dominating the group with trade areas of 12.5 miles or less. The group of elevators with the larger trade area was relatively well distributed among the districts. This distribution in the districts is reflected in the zone aggregations where there is a significant ( $P<0.01$ ) difference between zones. Eighty-four percent of the elevators in the group with the smaller trade area were in the central zone while the distribution between zones for the group with

the larger trade area was almost equal.

As would be expected, within these trade areas the elevators with the smaller trade area faced significantly ( $P < 0.01$ ) fewer grain merchandising and storage competitors (3.4 compared to 5.6); and significantly ( $P < 0.05$ ) fewer fertilizer sales competitors (3.6 compared to 5.2) and petroleum competitors (3.8 compared to 6.5). This finding was not surprising, nor was the finding that the elevators with the larger trade areas had significantly ( $P < 0.01$ ) more large sized elevators while the elevators with the smaller trade area were predominantly small and medium sized elevators.

When managers of the elevators in the two groups were asked to rank factors they considered in determining discounting policy, they were almost identical in their ranking on competition. However, the group with the smaller trade areas ranked passing on discounts as first priority at a significantly ( $P < 0.05$ ) higher level than did the group with the larger trade areas (67% compared to 45%). Because the managers with the smaller trade areas faced fewer competitors, they may not have been so worried about competition and could be more concerned about maintaining the profit margins on the grain they did handle, by making sure that they could pass on any discounts they received. On the other hand, the managers working with smaller trade areas appeared to be more concerned about maintaining good relations with their customers as twice as many were willing to adjust discounts depending on the circumstances (not significant). This was also reflected in the finding that the managers with smaller trade areas placed significantly ( $P < 0.01$ ) more importance on adjusting discount policy to the amount of other business the farmer brings the elevator than did the managers of elevators with larger trade areas.

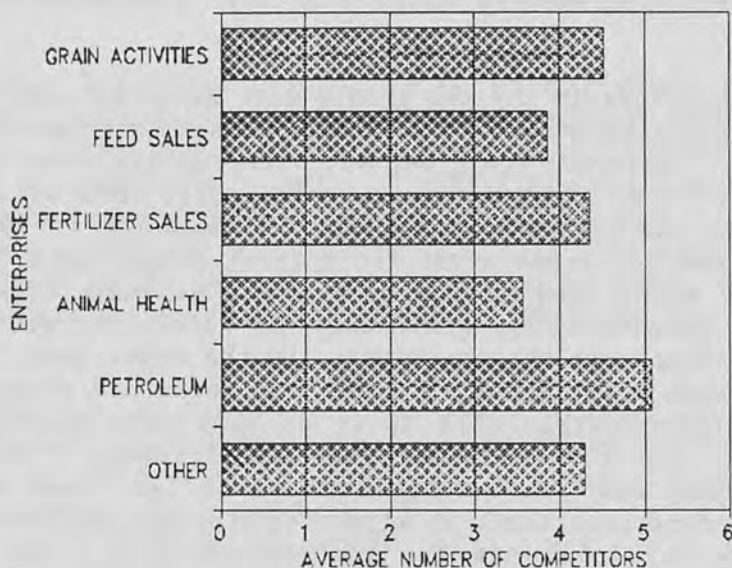
### Competition

Managers were asked to indicate the number of competitors in their trade area for each of the enterprises that contributed to the elevators operation. Figure 14 and Table 31 report the average number of competitors by enterprise. In the grain marketing and storage enterprise, branches had significantly fewer competitors than did headquarters elevators. There was significant variability among districts, with elevators in the northwest and west districts having more competition in grain merchandising and storage than those in the central district. This was also reflected in a significant difference by zone and region. In fertilizer sales, large elevators had significantly more competition than small elevators, and large elevators had significantly more competition than either small or medium elevators in the petroleum products enterprise.

Is the greater competition for grain a factor influencing the policies and practices of elevator managers? To address this question we divided the elevators by the median number of competitors for grain storage and merchandizing. The median was 3 and produced two groups, one with 31 elevators whose managers faced an average of 2.2 competitors (range 0 to 3) and a second group of 39 elevators whose managers faced an average of 6.4 competitors (range 4 to 15). Central zone elevators dominate the group with the smaller number of competitors (85%). This was significantly different ( $P < 0.01$ ) from the group with more competitors which was equally divided between west and central zones. As might be expected, the group with more competitors in the grain business also

had significantly ( $P < 0.01$ ) more competitors in the fertilizer sales business (5.5 compared to 2.7), in the animal feed business (4.9 compared to 2.5), and in the animal health business (4.5 compared to 2.4).

Figure 14. Average Number of Competitors by Enterprise



The managers from the group with fewer competitors shipped a significantly ( $P < 0.01$ ) greater proportion of their wheat to other elevators (64% compared to 38%), while the managers from the group with more competitors shipped a significantly ( $P < 0.05$ ) greater percentage of their wheat to flour mills (48% compared to 29%). This may well be related to the finding that there were significantly ( $P < 0.05$ ) more branches among the elevators with a smaller number of competitors (67%) while the elevators with more competitors were predominantly headquarters (62%). Thus, one reason for elevators with a smaller number of competitors shipping primarily to other elevators may be that they were shipping to their headquarters elevators, which then marketed the grain, including shipping to flour mills.

There was also a significantly ( $P < 0.05$ ) greater percentage of elevators in the group of elevators facing less competition (21% compared with 5%) which changed ownership between 1986 and 1991. Part of the reason for this may be that several of the larger cooperatives acquired branches, many of which probably were in the low competition category, during this period.

A few policy differences appear to be related to the number of competitors an elevator manager faced. While no managers of elevators with the smaller number of competitors examined grain for IDK at harvest time, 18 percent (significant,

P<0.01) of the managers with elevators facing more competitors did check for IDK at harvest time. Because this analysis was based only on volunteered information, it may be that the managers of elevators facing more competition did specifically examine grain for IDK, while managers of the elevators with smaller competition (which tended to be independent and/or branches) did this unconsciously and so did not mention checking for IDK as a specific separate activity. Another area of significant (P<0.05) difference between the two groups of elevators was in the percentage of elevator managers who submitted samples for official grade. Seventy-nine percent of the elevator managers in the group facing less competition submitted samples for official grade, while 95 percent of the other group obtained official grade. Again, this may be related in part to the number of branch operations in the first group which shipped wheat only to their headquarters unit.

## Summary and Conclusions

### General Description of Surveyed Elevators, and Locations

Slightly over one-quarter of the elevator managers, in over one-quarter of the counties (chosen from the group of high wheat producing counties), were interviewed in this survey. Among this group, managers of cooperative elevators were over represented, while those from small elevators were under-represented. For elevators where interviews were conducted, storage capacities ranged from 50,000 to over 5 million bushels. In 1991, managers purchased farm-stored wheat from a relatively small number of farmers -- three-quarters of the elevators purchased wheat from 17 or fewer farmers, and they purchased a relatively small amount of farm-stored wheat, with three-quarters purchasing less than 65,000 bushels. On average, the farm-stored wheat purchased filled less than 10 percent of the available elevator storage space. When moving from northcentral Kansas towards the southwest, there was an increase in storage capacity coupled with a decrease in the amount of wheat purchased from farm-storage, and therefore a decrease in the percent of capacity occupied by wheat coming from on-farm storage.

The destination of wheat shipped by surveyed elevators changed between 1986 and 1991, with shipments to other elevators decreasing by more than 25 percent, and shipments destined for animal feed doubling. There was an increased emphasis on providing insect free wheat to buyers, with almost half of the sales contracts requiring insect free wheat (more than doubling since 1986). The increase in wheat destined for animal feed, both from on-farm storage and from country elevators, was probably a result of stricter policies concerning live insects and IDK and, in 1991, the relative prices of corn and wheat. More than half of the elevators operated a feed mill in conjunction with the elevator, and were able to move insect damaged wheat through these facilities.

### Sampling Practices

Virtually all wheat received at harvest time continued to be checked for test weight and moisture. Over the last five years there has been a 25 percent increase in testing for dockage/foreign material, with over three-quarters of the

elevators now testing (and many discounting) for this factor. In addition to these three quality factors, grain received from on-farm storage was also scrutinized for live insects by 89 percent of the elevators, up 25 percent over 5 years, and for IDK by more than 60 percent of the elevators. Elevators in the northern part of the survey area tended to look for evidence of insects through inspection for IDK, while those further south tended to emphasize an examination for live insects. Almost all elevators loading-out wheat obtained official samples on out-bound rail shipments, while more than 60 percent took samples from out-bound trucks for in-house analysis, leaving the official sampling for the destination. The use of official samples has increased almost 35 percent in the last five years, with official sampling increasing 75 percent in the south region. Samples taken for in-house use were checked for test weight and moisture, and in more than half of the cases for live insects, while one-third were checked for dockage.

### Handling and Storing Insect Infested Wheat

Elevator managers have generally become more aware of insect problems, particularly IDK, since the 1988 change in grading standards. This was reflected by a decreased willingness to take infested wheat, or wheat with a "high" IDK. Generally, wheat coming from on-farm storage that had insect problems was fumigated and stored, and usually segregated for animal feed if there were major problems. Almost one-third of the managers used a chemical protectant on stored wheat, up slightly from 1986. More than three-quarters of the elevator managers fumigated wheat while turning it. Managers in more than two-thirds of the elevators fumigated when an insect infestation was found, whereas half fumigated on a pre-determined schedule. Almost half of the managers who fumigated on a pre-determined schedule treated all wheat, while a third treated only long term (9.3 month average) storage. One-in-five of the elevator managers relied on commercial pest control operators for fumigation services for all fumigation, while another 15 percent used commercial pest control operators for part of their fumigation, particularly for flat storage.

### Discounts and Premiums

Three-quarters of the interviewed elevator managers indicated that they have a discount policy for live insects. The average discount reported was 4.4¢ per bushel, and ranges from 0 to 10¢ per bushel. Although the average discount for live insects decreased a significant 0.9¢ per bushel between 1986 and 1991, the most commonly used discount increased from 4¢ to 5¢ during this period. Almost two-thirds of the elevators discounted for IDK, while half discounted for odor (COFO). A small percentage of elevators discounted for other factors.

Roughly two-thirds of the managers indicated that their discount policies had become stricter since 1988, with three-quarters instituting stricter policies after the 1988 change in grain standards. The most common change was to apply the same discount more carefully, i.e., more often. More than a quarter of the managers who changed their discount policy, increased the discount for insects, in addition to discounting more frequently. The most common farmer reaction to this increased strictness was to improve on-farm storage (2 in 5) or to discontinue on farm storage (1 in 3). Almost half of the managers reported that their stricter discounts had cost the elevator customers.

Three-quarters of country elevator managers thought that terminal elevator discount policies had become stricter since 1988, while less than half thought that flour mills had adopted stricter insect discount policies after the change in grading standards.

Elevator managers reported that passing on discounts, matching or beating the competition, and the average wheat quality (in that order) were the primary determinants they considered when setting their discount policy for insect problems. Even with a set discount, one manager in three would adjust the discount depending on the circumstances. This was double the number that would adjust discounts in 1986. The two most important considerations in adjusting discount policy were the elevator circumstances at the time, and the amount of grain business the customer brought the elevator.

Less than half of the elevator managers provided premiums for specific wheat quality factors. Of those managers who did pay premiums, two-thirds paid them for high protein and one third for high test weight. One elevator in ten provided a premium for low dockage.

### **Business Factors**

Based on managers' rankings, grain merchandizing and storage was the most important contributor to elevator income. In second place, with half as much impact, was fertilizer sales, followed by feed sales, and petroleum operations. Comparing a group of elevators with grain merchandizing and storage as their most important enterprise with a group that had another activities as their most important enterprise, indicated that the grain merchandizing group diverted over four times as much wheat to animal feed. They also used fumigation while turning to control insects to a much greater extent.

The average trade area for elevators interviewed had a radius of 17.3 miles, with a range of 5 to 120 miles. When the sample was divided into smaller and larger trade areas by using the median trade area radius of 12.5 miles, it was found that the central and southcentral districts dominated the smaller trade area group. Managers from elevators with a smaller trade area were most interested in passing on discounts when they formulated discounting policy. This group of managers was also the most willing to adjust discounts depending on the circumstances, particularly the amount of non-grain business the farmer conducted with the elevator.

Within their trade areas elevators faced an average of 4.5 other operations doing grain merchandizing and storage. While there were an average of 4.4 other fertilizer sales operations and 3.9 feed sales operations, the greatest number of competitors (5.1) was in the petroleum business. Almost two-thirds of elevators with fewer competitors in grain merchandizing and storage shipped their wheat to other elevators, while elevators with more competition shipped almost half of their wheat to flour mills.

## General Conclusions

Although there was considerable variability based on geographic location and elevator characteristics, during the last three years Kansas country elevator managers in the central and western part of the state have taken several steps that can increase the quality of grain in the market system. Discount policies for insect problems, both for live insects and IDK, have become stricter. Thus they provide more consistent indicators of potential loss and incentives to reduce the potential loss. Other factors such as dockage, foreign material, and odor have also become more important. Elevator operators have increased their use of the official sampling and reporting system in order to better control grain quality. Due in part to stricter policies for stored grain insects, and the reduction in the amount of government subsidized grain storage, there has been a decrease in on-farm wheat storage.

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Table 1. Size, Location, and Ownership of Country Elevators Surveyed, 1986 & 1991

| Factor       | 1991<br>Number of<br>Sites | 1986<br>Number of<br>Sites | Percentage<br>Decrease<br>1986 to 1991 | Percent of Country<br>Elevators Surveyed<br>1991 |
|--------------|----------------------------|----------------------------|--|--|
| Overall:     | 72                         | 85                         | 15                                     | 28   |
| Ownership:   |                            |                            |  |  |
| Cooperative  | 49                         | 54                         | 9                                      | 37 ***   |
| Independent  | 23                         | 31                         | 35                                     | 18   |
| Level:       |                            |                            |  |  |
| Headquarters | 35                         | a                          |  | a  |
| Branch       | 37                         | a                          |  | a  |
| District:    |                            |                            |  |  |
| Northwest    | 6                          | 8                          | 25                                     | 25   |
| West         | 5                          | 8                          | 38                                     | 25   |
| Southwest    | 12                         | 13                         | 8                                      | 34   |
| Northcentral | 7                          | 10                         | 30                                     | 23   |
| Central      | 20                         | 24                         | 17                                     | 27   |
| Southcentral | 22                         | 22                         | 0                                      | 30   |
| Region:      |                            |                            |  |  |
| North        | 13                         | 18                         | 28                                     | 24   |
| Central      | 25                         | 32                         | 22                                     | 27   |
| South        | 34                         | 35                         | 3                                      | 31   |
| Zone:        |                            |                            |  |  |
| West         | 23                         | 29                         | 21                                     | 29   |
| Central      | 49                         | 56                         | 12                                     | 28   |
| Size:        |                            |                            |  |  |
| Small        | 20                         | 40                         | 50                                     | 18 ***   |
| Medium       | 23                         | 24                         | 4                                      | 34   |
| Large        | 29                         | 21                         | +38 <sup>b</sup>                       | 38   |

a. Not recorded.

b. Increase.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 2. Changes in Ownership and Management between 1986 and 1991

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12% (9) elevators changed ownership

- Ownership: 16% Coops and 5% Independents
- Level: 9% Headquarters and 16% Branches
- Districts: NW and SW = 17%, W = 0%, NC and SC = 14%, and C = 10%
- Region: 15% North, 8% Central, and 15% South
- Zone: 13% West and 12% Central
- Size: 20% Small, 9% Medium and 10% Large

37% (27) elevators changed management

- Ownership: 35% Coops and 43% Independents
- \*\* - Level: 26% Headquarters and 49% Branches
- Districts: NW = 50%, W = 0%, SW = 33%, NC = 43%, C = 45%, and SC = 36
- Region: 46% North, 36% Central, and 35% South
- Zone: 30% West and 41% Central
- Size: 50% Small, 35% Medium and 31% Large

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\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 3. Mean Grain Storage Capacity of Sampled Elevators

| Factor       | Mean         | Standard Deviation |
|--------------|--------------|--------------------|
| Overall:     | 1,014,000    | 909,000            |
| Ownership:   |              |                    |
| Coops        | 983,000      | 131,000            |
| Independents | 1,079,000    | 191,000            |
| Level:       |              |                    |
| Headquarters | 1,117,000    | 154,000            |
| Branches     | 917,000      | 150,000            |
| Districts:   |              |                    |
| NW           | 899,000 x    | 350,000            |
| W            | 903,000 x    | 383,000            |
| SW           | 1,839,000 ya | 247,000            |
| NC           | 834,000 x    | 324,000            |
| C            | 941,000 b    | 192,000            |
| SC           | 744,000 b    | 183,000            |
| Region:      |              |                    |
| North        | 864,000      | 254,000            |
| Central      | 934,000      | 183,000            |
| South        | 1,130,000    | 157,000            |
| Zone:        |              |                    |
| West         | 1,391,000 x  | 183,000            |
| Central      | 837,000 y    | 125,000            |
| Size:        |              |                    |
| Small        | 290,000 ax   | 150,000            |
| Medium       | 723,000 ay   | 139,000            |
| Large        | 1,743,000 b  | 300,000            |

a. Factors with different letters (a,b) have significantly different means,  $P < 0.01$ , t-Test. Factors with different letters (x,y) have significantly different means,  $P < 0.05$ , t-Test.

Table 4. Number of Farmers Selling Farm-Stored Wheat and Amount Purchased

| Factor       | Mean No. Farmers | Mean No. Bushels | % of Capacity |
|--------------|------------------|------------------|---------------|
| Overall:     | 23.9             | 68,444           | 9.4           |
| Ownership:   |                  |                  |               |
| Coops        | 30.6             | 84,429           | 10.5          |
| Independents | 8.5              | 32,841           | 7.0           |
| Level:       |                  |                  |               |
| Headquarters | 38.4 a           | 104,171 a        | 12.9 x        |
| Branches     | 9.8 b            | 33,708 b         | 6.0 y         |
| Districts:   |                  |                  |               |
| NW           | 30.8             | 157,500 x        | 17.5 x        |
| W            | 26.2             | 154,000 x        | 18.4 x        |
| SW           | 8.4              | 19,182 y         | 1.6 y         |
| NC           | 45.6             | 122,857 x        | 11.1          |
| C            | 30.9             | 67,125           | 11.3 x        |
| SC           | 14.9             | 33,227 y         | 6.8           |
| Region:      |                  |                  |               |
| North        | 38.8             | 138,846 a        | 14.0 x        |
| Central      | 29.9             | 84,500 x         | 12.7 x        |
| South        | 12.8             | 28,545 by        | 5.1 y         |
| Zone:        |                  |                  |               |
| West         | 19.0             | 87,545           | 9.8           |
| Central      | 26.0             | 59,867           | 9.3           |
| Size:        |                  |                  |               |
| Small        | 9.5              | 29,750 x         | 11.1          |
| Medium       | 31.0             | 69,891           | 10.4          |
| Large        | 28.0             | 94,893 y         | 7.4           |

a. Factors with different letters (a,b) have significantly different means,  $P < 0.01$ , t-Test. Factors with different letters (x,y) have significantly different means,  $P < 0.05$ , t-Test.

Table 5. Disposition of Wheat

| Factor                  | Destination of Wheat Shipped |                          |                        | Operate                             |
|-------------------------|------------------------------|--------------------------|------------------------|-------------------------------------|
|                         | Other Elevator<br>(Percent)  | Flour Mills<br>(Percent) | Feed Lots<br>(Percent) | Feed Mill <sup>a</sup><br>(Percent) |
| Overall (N=67):         | 49                           | 39                       | 12                     | 54                                  |
| Ownership:              |                              |                          |                        |                                     |
| Coops                   | 48                           | 42                       | 10                     | 63 **                               |
| Independents            | 53                           | 33                       | 16                     | 36                                  |
| Level:                  |                              |                          |                        |                                     |
| Headquarters            | 44                           | 46                       | 10                     | 74 ***                              |
| Branches                | 54                           | 34                       | 14                     | 36                                  |
| Districts: <sup>b</sup> |                              |                          |                        |                                     |
| NW                      | 50                           | 44                       | 8 q                    | 67                                  |
| W                       | 20 aq                        | 61                       | 19                     | 40                                  |
| SW                      | 30 cs                        | 35                       | 36 ra                  | 33                                  |
| NC                      | 77 b d                       | 21                       | 2 b                    | 86                                  |
| C                       | 56 r t                       | 41                       | 7 b                    | 53                                  |
| SC                      | 54 r                         | 41                       | 5 b                    | 57                                  |
| Region:                 |                              |                          |                        |                                     |
| North                   | 65                           | 31                       | 4                      | 77                                  |
| Central                 | 48                           | 45                       | 9                      | 50                                  |
| South                   | 45                           | 39                       | 17                     | 48                                  |
| Zone:                   |                              |                          |                        |                                     |
| West                    | 32 a                         | 43                       | 26 a                   | 43                                  |
| Central                 | 58 b                         | 38                       | 5 b                    | 60                                  |
| Size:                   |                              |                          |                        |                                     |
| Small                   | 68 a                         | 28                       | 10                     | 55                                  |
| Medium                  | 46                           | 41                       | 31                     | 45                                  |
| Large                   | 39 b                         | 46                       | 30                     | 61                                  |

a. A feed mill is operated as part of the elevator business.

b. Factors with different letters (a,b) have significantly different means,  $P < 0.01$ , t-Test. Factors with different letters (x,y) have significantly different means,  $P < 0.05$ , t-Test.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 6. Factors Considered When Sampling Wheat Received at Harvest Time <sup>a</sup>

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|              |                |  |
|--------------|----------------|--|
| 100%         | (72 elevators) | check test weight  |
| 8%           | (6 elevators)  | check protein  |
| 3%           | (2 elevators)  | check wheat variety  |
| 97%          | (70 elevators) | check moisture   |
|              |                |  |
| 76%          | (55 elevators) | check dockage  |
| -            | Ownership:     | 73% Coops and 83% independent  |
| -            | Level:         | 71% Headquarters and 81% Branches  |
| -            | Districts:     | NW = 50%, W = 100%, SW = 58%, NC = 86%, C = 85% and SC = 77%   |
| -            | Region:        | 69% North, 88% Central and 71% South   |
| -            | Zone:          | 65% West and 82% Central   |
| -            | Size:          | 90% Small, 74% Medium, and 69% Large   |
|              |                |  |
| 3%           | (2 elevators)  | check foreign material   |
| 3%           | (2 elevators)  | check shrunken & broken kernels  |
| 7%           | (5 elevators)  | check damaged kernels  |
|              |                |  |
| 18%          | (13 elevators) | check for live insects   |
| **           | - Ownership:   | 24% Coops and 4% Independents  |
| -            | Level:         | 17% Headquarters and 19% Branches  |
| -            | Districts:     | NW = 17%, W = 0%, SW = 33%, NC = 14%, C = 15% and SC = 18%   |
| -            | Region:        | 15% North, 12% Central and 24% South   |
| -            | Zone:          | 22% West and 16% Central   |
| -            | Size:          | 15% Small, 17% Medium and 21% Large  |
|              |                |  |
| 10%          | (7 elevators)  | check insect damaged kernels   |
| -            | Ownership:     | 10% Coops and 9% Independents  |
| -            | Level:         | 9% Headquarters and 11% Branches   |
| -            | Districts:     | NW = 17%, W = 0%, SW = 17%, NC = 14%, C = 5% and SC = 9%   |
| -            | Region:        | 15% North, 4% Central and 12% South  |
| -            | Zone:          | 13% West and 8% Central  |
| -            | Size:          | 5% Small, 13% Medium and 10% Large   |
|              |                |  |
| No elevators |                | checked for rodent pellets   |
| 3%           | (2 elevators)  | checked for odor   |
|              |                |  |
| 14%          | (10 elevators) | checked other factors including weeds (6 elevators); seeds, rye, pink wheat or soft wheat (6 elevators). |
| -            | Ownership:     | 12% Coops and 17% Independent  |
| -            | Level:         | 9% Headquarters and 19% Branches   |
| -            | Districts:     | NW, W and NC = 0%, SW = 17%, C = 15% and SC = 23%  |
| -            | Region:        | 0% North, 12% Central, and 21% South   |
| -            | Zone:          | 9% West and 16% Central  |
| -            | Size:          | 20% Small, 9% Medium and 14% Large   |

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a. No breakdown on factors over 90% or under 10%.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 7. Factors Considered When Sampling Wheat Received from Farm Storage \*

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|     |                  |  |
|-----|------------------|--|
| 97% | (70 elevators)   | check test weight  |
| 14% | (10 elevators)   | check protein,   |
|     | - Ownership:     | 12% Coops and 17% Independents                               |
|     | - Level:         | 17% Headquarters and 11% Branches                            |
|     | - Districts:     | NW and SW = 0%, W = 20%, NC = 29%, C = 25% and SC = 9%       |
|     | - Region:        | 15% North, 24% Central, and 6% South                         |
|     | - Zone:          | 5 % West and 18% Central                                     |
|     | - Size:          | 10% Small, 17% Medium and 14% Large                          |
| 7%  | (5 elevators)    | check wheat variety  |
| 87% | (62 elevators)   | check moisture   |
|     | - Ownership:     | 92% Coops and 78% Independents                               |
|     | - Level:         | 91% Headquarters and 83% Branches                            |
|     | - Districts:     | NW = 83%, W, SW and NC = 100%, C = 75% and SC = 86%          |
|     | - Region:        | 92% North, 80% Central and 91% South                         |
|     | - Zone:          | 95% West and 84% Central                                     |
|     | - Size:          | 75% Small, 87% Medium and 96% Large                          |
| 75% | (53 elevators)   | check dockage  |
|     | - Ownership:     | 71% Coops and 83% Independent                                |
|     | - Level:         | 74% Headquarters and 75% Branches                            |
|     | - Districts:     | NW = 50%, W = 100%, SW = 55%, NC = 86%, C = 80% and SC = 77% |
|     | - Region:        | 69% North, 84% Central and 71% South                         |
|     | - Zone:          | 64% West and 80% Central                                     |
|     | - Size:          | 85% Small, 74% Medium, and 68% Large                         |
| 8%  | (6 elevators)    | check foreign material                                       |
| 7%  | (5 elevators)    | check shrunken & broken kernels                              |
|     | *** - Ownership: | 0% Coops and 22% Independents                                |
| 15% | (11 elevators)   | check damaged kernels  |
|     | - Ownership:     | 15% Coops and 17% Independents                               |
|     | - Level:         | 11% Headquarters and 19% Branches                            |
|     | - Districts:     | NW = 17%, W and NC = 0%, SW = 27%, C = 25% and SC = 9%       |
|     | - Region:        | 8% North, 20% Central and 15% South                          |
|     | - Zone:          | 18% West and 14% Central                                     |
|     | - Size:          | 10% Small, 13% Medium and 21% Large                          |
| 89% | (63 elevators)   | check for live insects                                       |
|     | - Ownership:     | 88% Coops and 91% Independents                               |
|     | - Level:         | 89% Headquarters and 89% Branches                            |
|     | ** - Districts:  | NW = 50%, W and SW = 100%, NC = 86%, C = 90% and SC = 91%    |
|     | ** - Region:     | 69% North, 92% Central and 94% South                         |
|     | - Zone:          | 86% West and 90% Central                                     |
|     | - Size:          | 90% Small, 87% Medium and 89% Large                          |

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Table 7. Factors Considered When Sampling Wheat Received from Farm Storage <sup>a</sup>  
(Continued)

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|     |                |   |
|-----|----------------|---|
| 61% | (43 elevators) | check insect damaged kernels  |
|     | - Ownership:   | 58% Coops and 65% Independents  |
|     | - Level:       | 66% Headquarters and 56% Branches   |
|     | - Districts:   | NW = 83%; W = 40%; SW, C, and SC = 55%; and NC = 100%   |
| **  | - Region:      | 92% North, 52% Central and 55% South  |
|     | - Zone:        | 59% West and 61% Central  |
|     | - Size:        | 55% Small, 61% Medium and 64% Large   |
|     |                |   |
| 13% | (9 elevators)  | checked for rodent pellets  |
|     | - Ownership:   | 12% Coops and 13% Independents  |
|     | - Level:       | 14% Headquarters and 11% Branches   |
|     | - Districts:   | NW, W, and NC = 0%; SW and SC = 18%; and C = 15%  |
|     | - Region:      | 0% North, 12% Central and 18% South   |
|     | - Zone:        | 9% West and 14% Central   |
|     | - Size:        | 10% Small, 17% Medium and 11% Large   |
|     |                |   |
| 25% | (18 elevators) | checked for odor  |
|     | - Ownership:   | 23% Coops and 30% Independents  |
|     | - Level:       | 26% Headquarters and 25% Branches   |
|     | - Districts:   | NW = 17%; W = 60%; SW = 28%; NC = 0%; C = 35% and SC = 18%  |
|     | - Region:      | 8% North, 40% Central and 21% South   |
|     | - Zone:        | 32% West and 22% Central  |
|     | - Size:        | 25% Small, 26% Medium and 25% Large   |
|     |                |   |
| 14% | (10 elevators) | checked other factors including weeds or birds (2 elevators each); rye, smut, heat damage or soft wheat (1 elevator each) |
|     | - Ownership:   | 19% Coops and 4% independent  |
|     | - Level:       | 9% Headquarters and 19% Branches  |
|     | - Districts:   | NW and NC = 0%; W = 40%; SW = 9%; C = 20%; and SC = 14%   |
|     | - Region:      | 0% North, 24% Central, and 12% South  |
|     | - Zone:        | 14% West and Central  |
|     | - Size:        | 20% Small, 22% Medium and 4% Large  |

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a. No breakdown on factors over 90% or under 10%.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 8. Sampling Procedures when Shipping Wheat by Truck and Rail

|                   | Truck Shipments (n=70)        |                             |                            | Rail Shipments (n=64)         |                             |                            |
|-------------------|-------------------------------|-----------------------------|----------------------------|-------------------------------|-----------------------------|----------------------------|
|                   | Do Not<br>Sample<br>(Percent) | Sample<br>Some<br>(Percent) | Sample<br>All<br>(Percent) | Do Not<br>Sample<br>(Percent) | Sample<br>Some<br>(Percent) | Sample<br>All<br>(Percent) |
| <b>Overall:</b>   |                               |                             |                            |                               |                             |                            |
| Percent           | 23                            | 30                          | 47                         | 3                             | 6                           | 91                         |
| Number            | 16                            | 21                          | 33                         | 2                             | 4                           | 58                         |
| <b>Ownership:</b> |                               |                             |                            |                               |                             |                            |
| Coop              | 26                            | 32                          | 43                         | 2                             | 7                           | 91                         |
| Independent       | 17                            | 26                          | 57                         | 5                             | 5                           | 89                         |
| <b>Level:</b>     |                               |                             |                            |                               |                             |                            |
| Headquarters      | 32                            | 29                          | 38                         | 3                             | 9                           | 89                         |
| Branch            | 14                            | 31                          | 56                         | 3                             | 3                           | 93                         |
| <b>District:</b>  |                               |                             |                            |                               |                             |                            |
| Northwest         | 50                            | 33                          | 17                         | 0                             | 17                          | 83                         |
| West              | 0                             | 0                           | 100                        | 0                             | 0                           | 100                        |
| Southwest         | 8                             | 25                          | 67                         | 0                             | 8                           | 92                         |
| Northcentral      | 29                            | 57                          | 14                         | 0                             | 0                           | 100                        |
| Central           | 16                            | 32                          | 53                         | 0                             | 12                          | 88                         |
| Southcentral      | 32                            | 27                          | 41                         | 11                            | 0                           | 89                         |
| <b>Region:</b>    |                               |                             |                            |                               |                             |                            |
| North             | 38                            | 46                          | 15                         | 0                             | 8                           | 92                         |
| Central           | 13                            | 26                          | 61                         | 0                             | 10                          | 90                         |
| South             | 24                            | 26                          | 50                         | 7                             | 3                           | 90                         |
| <b>Zone:</b>      |                               |                             |                            |                               |                             |                            |
| West              | 18                            | 23                          | 59                         | 0                             | 9                           | 91                         |
| Central           | 25                            | 33                          | 42                         | 5                             | 5                           | 90                         |
| <b>Size:</b>      |                               |                             |                            |                               |                             |                            |
| Small             | 20                            | 40                          | 40                         | 8                             | 8                           | 84                         |
| Medium            | 27                            | 32                          | 41                         | 0                             | 9                           | 91                         |
| Large             | 21                            | 21                          | 57                         | 3                             | 3                           | 93                         |

Table 9. Factors Considered When Sampling Wheat to be Shipped by Truck \*

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|     |                 |  |
|-----|-----------------|--|
| 11% | (8 elevators)   | submit samples for official grade  |
| -   | Ownership:      | 8% Coops and 17% Independents  |
| -   | Level:          | 11% Headquarters and 11% Branches  |
| -   | Districts:      | NW and SW = 17%, W = 0%, NC = 14%, C = 15% and SC = 5%   |
| -   | Region:         | 15% North, 12% Central and 9% South  |
| -   | Zone:           | 14% West and 10% Central   |
| -   | Size:           | 10% Small, 9% Medium and 14% Large   |
| 46  | elevators (64%) | conduct some type of in-house analysis of wheat being shipped, the following factors are considered by the 46 elevators. |
| 96% | (44 elevators)  | check test weight  |
| 7%  | (3 elevators)   | check protein  |
| 80% | (37 elevators)  | check moisture   |
| -   | Ownership:      | 77% Coops and 87% Independents   |
| -   | Level:          | 79% Headquarters and 81% Branches  |
| -   | Districts:      | NW and W = 100%, SW = 89%, NC = 50%, C = 77% and SC = 79%  |
| -   | Region:         | 67% North, 82% Central and 83% South   |
| -   | Zone:           | 93% West and 74% Central   |
| -   | Size:           | 71% Small, 79% Medium and 89% Large  |
| 33% | (15 elevators)  | check dockage  |
| -   | Ownership:      | 35% Coops and 27% independent  |
| -   | Level:          | 37% Headquarters and 30% Branches  |
| -   | Districts:      | NW and W = 0%, SW = 33%, NC = 75%, C = 38% and SC = 29%  |
| -   | Region:         | 50% North, 29% Central and 30% South   |
| -   | Zone:           | 20% West and 39% Central   |
| -   | Size:           | 43% Small, 29% Medium, and 28% Large   |
| 4%  | (2 elevators)   | check foreign material   |
| 13% | (6 elevators)   | check damaged kernels  |
| -   | Ownership:      | 13% Coops and 13% Independents   |
| -   | Level:          | 11% Headquarters and 15% Branches  |
| -   | Districts:      | NW, and W = 0%, SW = 33%, NC = 25%, C = 8% and SC = 7%   |
| -   | Region:         | 17% North, 6% Central and 17% South  |
| -   | Zone:           | 20% West and 10% Central   |
| **  | -               | Size: 7% Small, 0% Medium and 28% Large  |
| 54% | (25 elevators)  | check for live insects   |
| -   | Ownership:      | 61% Coops and 40% Independents   |
| -   | Level:          | 42% Headquarters and 63% Branches  |
| -   | Districts:      | NW = 50%, W = 75%, SW = 67%, NC = 25%, C = 62% and SC = 43%  |
| -   | Region:         | 33% North, 65% Central and 52% South   |
| -   | Zone:           | 67% West and 48% Central   |
| -   | Size:           | 43% Small, 79% Medium and 44% Large  |

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Table 9. Factors Considered When Sampling Wheat to be Shipped by Truck <sup>a</sup>  
(Continued)

- 
- 24% (11 elevators) check insect damaged kernels
    - Ownership: 23% Coops and 27% Independents
    - Level: 26% Headquarters and 22% Branches
    - Districts: NW = 100%; W = 25%; SW = 33%, NC = 0%, C = 23% and SC = 14%
    - Region: 33% North, 24% Central and 22% South
    - Zone: 40% West and 16% Central
    - Size: 14% Small, 14% Medium and 39% Large
  
  - 24% (11 elevators) checked for odor
    - Ownership: 23% Coops and 32% Independents
    - Level: 21% Headquarters and 26% Branches
    - Districts: NW and W = 50%; SW = 33%; NC = 0%; C = 31% and SC = 7%
    - Region: 17% North, 35% Central and 17% South
    - Zone: 40% West and 16% Central
    - Size: 14% Small, 36% Medium and 22% Large
  
  - 11% (5 elevators) checked other factors including in-house grade (2 elevators);  
rodent pellets, full grade and quality of blending job (1 elevator each)
- 

a. No breakdown on factors over 90% or under 10%.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 10. Factors Considered When Sampling Wheat to be Shipped by Rail \*

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89% (58 elevators) submit samples for official grade (8 elevators did not have rail facilities or did not answer the question)

- \*\*\* - Ownership: 96% Coops and 75% Independents
- Level: 94% Headquarters and 83% Branches
- Districts: NW and NC = 100%, W = 80%, SW = 92%, C = 88% and SC = 83%
- Region: 100% North, 86% Central and 87% South
- Zone: 91% West and 88% Central
- Size: 79% Small, 95% Medium and 90% Large

4 elevators (6%) conduct some type of in-house analysis of wheat being shipped, the following factors are considered by the 4 elevators.

100% (4 elevators) check test weight

75% (3 elevators) check moisture

50% (2 elevators) check dockage, live insects,

25% (1 elevator) check IDK, odor

0% (0 elevators) check foreign material, damaged kernels, protein, other

---

a. No breakdown on factors over 90% or under 10%.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 12. Change in Handling of Insect Infested Wheat Received from Farm Storage, Pre-1988 and Present

|                               | Pre-1988 |    | Present |    |
|-------------------------------|----------|----|---------|----|
|                               | No.      | %  | No.     | %  |
| Refuse completely             | 1        | 1  | 2       | 3  |
| Refuse until farmer fumigates | 0        | 0  | 2       | 3  |
| Fumigate & store              | 67       | 93 | 64      | 89 |
| Store as is & segregated      | 0        | 0  | 1       | 1  |
| Store as is & blend           | 1        | 1  | 0       | 0  |
| Other *                       | 3        | 4  | 3       | 4  |

| Factor          | Changed<br>(Percent) | Same<br>(Percent) | More Aware <sup>b</sup><br>(Percent) |
|-----------------|----------------------|-------------------|--------------------------------------|
| Overall (N=72): | 57                   | 28                | 15                                   |
| Ownership:      |                      |                   |                                      |
| Coops           | 55                   | 29                | 16                                   |
| Independents    | 61                   | 26                | 13                                   |
| Level:          |                      |                   |                                      |
| Headquarters    | 49                   | 37                | 14                                   |
| Branches        | 65                   | 19                | 16                                   |
| Districts:      |                      |                   |                                      |
| NW              | 67                   | 33                | 0                                    |
| W               | 80                   | 20                | 0                                    |
| SW              | 58                   | 17                | 25                                   |
| NC              | 86                   | 0                 | 14                                   |
| C               | 50                   | 40                | 10                                   |
| SC              | 45                   | 32                | 23                                   |
| Region:         |                      |                   |                                      |
| North           | 77                   | 15                | 8                                    |
| Central         | 56                   | 36                | 8                                    |
| South           | 50                   | 26                | 24                                   |
| Zone:           |                      |                   |                                      |
| West            | 65                   | 22                | 13                                   |
| Central         | 53                   | 31                | 16                                   |
| Size:           |                      |                   |                                      |
| Small           | 50                   | 30                | 20                                   |
| Medium          | 61                   | 26                | 13                                   |
| Large           | 59                   | 28                | 14                                   |

Table 11. Elevators Which Submit Samples for Official Grading

- 88% (63 elevators) submit samples for official grade
- Ownership: 92% Coops and 78% Independents
  - Level: 94% Headquarters and 81% Branches
  - Districts: NW, W and NC = 100%, SW = 92%, C = 85% and SC = 77%
  - Region: 100% North, 88% Central, and 82% South
  - Zone: 96% West and 84% Central
  - \*\*\* - Size: 70% Small, 96% Medium and 93% Large

Of 63 elevators submitting samples for official grade:

| Factor          | All Rail<br>(Percent) | All Rail<br>& Truck<br>(Percent) | Some Samples<br>(Percent) |
|-----------------|-----------------------|----------------------------------|---------------------------|
| Overall (N=63): | 79                    | 6                                | 14                        |
| Ownership:      |                       |                                  |                           |
| Coops           | 84                    | 7                                | 9                         |
| Independents    | 68                    | 5                                | 26                        |
| Level:          |                       |                                  |                           |
| Headquarters    | 91                    | 3                                | 6                         |
| Branches        | 68                    | 10                               | 22                        |
| Districts:      |                       |                                  |                           |
| NW              | 67                    | 0                                | 33                        |
| W               | 80                    | 0                                | 20                        |
| SW              | 82                    | 9                                | 9                         |
| NC              | 86                    | 14                               | 0                         |
| C               | 72                    | 6                                | 22                        |
| SC              | 88                    | 6                                | 6                         |
| Region:         |                       |                                  |                           |
| North           | 77                    | 8                                | 15                        |
| Central         | 74                    | 4                                | 22                        |
| South           | 85                    | 7                                | 7                         |
| Zone:           |                       |                                  |                           |
| West            | 77                    | 5                                | 18                        |
| Central         | 80                    | 7                                | 13                        |
| Size:           |                       |                                  |                           |
| Small           | 60                    | 7                                | 33                        |
| Medium          | 80                    | 10                               | 10                        |
| Large           | 89                    | 4                                | 7                         |

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 12. Change in Handling of Insect Infested Wheat Received from Farm Storage, Pre-1988 and Present (Continued)

When high IDK was present elevators took the following actions:

|                              | Percent | No. |
|------------------------------|---------|-----|
| Refuse completely            | 47      | 34  |
| Fumigate & separate for feed | 10      | 7   |
| Separate & keep for feed     | 1       | 1   |
| Other °                      | 2       | 3   |
| No response                  | 28      | 39  |

- a. Then: unknown (2), malathion & store (1), Now: malathion & store (1), use in feed mill (1), treat on truck (1).
- b. Elevators are more aware of insect damaged kernels and insect infestations.
- c. Take back to farm and fumigate (1) and clean (1).

Table 13. Use of Protectants in Elevator Storage

- 
- 31% (22 elevators) applied a protectant
- Ownership: 35% Coops and 22% Independents
  - \*\* - Level: 49% Headquarters and 14% Branches
  - Districts: NW = 16%, W = 40%, SW = 25%, NC = 29%, C = 35% and SC = 32%
  - Region: 23% North, 36% Central, and 29% South
  - Zone: 26% West and 32% Central
  - Size: 30% Small, 26% Medium and 34% Large

- Of the 22 elevators applying a protectant -
- 23% applied a protectant to all stored wheat
  - 23% applied a protectant to long term storage only
  - 0% applied a protectant to short term storage only
  - 18% applied a protectant to flat storage
  - 5% applied a protectant to upright storage
  - 32% applied a protectant in another manner \*

- In addition two elevators combined a second treatment with the above:
- 1 elevator treated long term-flat storage
  - 1 elevator treated flat storage & stave silos

- 
- a. Other treatments included: top dressing, Large bins to reduce need to turn (2), seed wheat, top and bottom 15 feet at harvest, and steel bins.
- \*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 14. Methods of Treating Wheat Which Becomes Insect Infested in Storage

| Factor          | Fumigate<br>and Turn<br>(Percent) | Fumigate<br>in Bin<br>(Percent) | Other <sup>a</sup><br>(Percent) |
|-----------------|-----------------------------------|---------------------------------|---------------------------------|
| Overall (N=72): | 78                                | 18                              | 4                               |
| Ownership:      |                                   |                                 |                                 |
| Coops           | 84                                | 14                              | 2                               |
| Independents    | 65                                | 26                              | 9                               |
| Level:          |                                   |                                 |                                 |
| Headquarters    | 83                                | 14                              | 3                               |
| Branches        | 73                                | 22                              | 5                               |
| Districts:      |                                   |                                 |                                 |
| NW              | 33                                | 67                              | 0                               |
| W               | 100                               | 0                               | 0                               |
| SW              | 100                               | 0                               | 0                               |
| NC              | 57                                | 29                              | 14                              |
| C               | 80                                | 15                              | 5                               |
| SC              | 77                                | 18                              | 5                               |
| Region:         |                                   |                                 |                                 |
| North           | 46                                | 46                              | 8 **                            |
| Central         | 84                                | 12                              | 4                               |
| South           | 85                                | 12                              | 3                               |
| Zone:           |                                   |                                 |                                 |
| West            | 83                                | 17                              | 0                               |
| Central         | 76                                | 18                              | 6                               |
| Size:           |                                   |                                 |                                 |
| Small           | 50                                | 40                              | 10 ***                          |
| Medium          | 83                                | 13                              | 4                               |
| Large           | 93                                | 7                               | 0                               |

a. Two elevators aerate and one uses infested wheat as feed.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 15. Fumigation of Wheat Done on Pre-Determined Schedule

| Factor          | All Wheat<br>(Percent) | Long Term<br>(Percent) | Flat Storage<br>(Percent) | Other <sup>a</sup><br>(Percent) |
|-----------------|------------------------|------------------------|---------------------------|---------------------------------|
| Overall (N=36): | 47                     | 33                     | 14                        | 6                               |
| Ownership:      |                        |                        |                           |                                 |
| Coops           | 46                     | 35                     | 15                        | 4                               |
| Independents    | 50                     | 30                     | 10                        | 10                              |
| Level:          |                        |                        |                           |                                 |
| Headquarters    | 50                     | 31                     | 13                        | 6                               |
| Branches        | 45                     | 35                     | 15                        | 5                               |
| Districts:      |                        |                        |                           |                                 |
| NW              | 0                      | 0                      | 67                        | 33                              |
| W               | 67                     | 33                     | 0                         | 0                               |
| SW              | 40                     | 60                     | 0                         | 0                               |
| NC              | 100                    | 0                      | 0                         | 0                               |
| C               | 55                     | 18                     | 27                        | 0                               |
| SC              | 42                     | 50                     | 0                         | 8                               |
| Region:         |                        |                        |                           |                                 |
| North           | 40                     | 0                      | 40                        | 20 **                           |
| Central         | 57                     | 21                     | 21                        | 0                               |
| South           | 41                     | 53                     | 0                         | 6                               |
| Zone:           |                        |                        |                           |                                 |
| West            | 36                     | 36                     | 18                        | 9                               |
| Central         | 52                     | 32                     | 12                        | 4                               |
| Size:           |                        |                        |                           |                                 |
| Small           | 55                     | 27                     | 9                         | 9                               |
| Medium          | 54                     | 23                     | 23                        | 0                               |
| Large           | 33                     | 50                     | 8                         | 8                               |

a. One elevator fumigates short term-upright storage and one fumigates large bins only on a pre-determined schedule.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 16. Fumigation of Wheat Done Only When Infestation is Found

| Factor          | All Wheat<br>(Percent) | Short Term<br>(Percent) | Upright Storage<br>(Percent) | Other <sup>a</sup><br>(Percent) |
|-----------------|------------------------|-------------------------|------------------------------|---------------------------------|
| Overall (N=39): | 80                     | 8                       | 6                            | 6                               |
| Ownership:      |                        |                         |                              |                                 |
| Coops           | 76                     | 9                       | 9                            | 6                               |
| Independents    | 86                     | 7                       | 0                            | 7                               |
| Level:          |                        |                         |                              |                                 |
| Headquarters    | 80                     | 8                       | 0                            | 12                              |
| Branches        | 79                     | 8                       | 12                           | 0                               |
| Districts:      |                        |                         |                              |                                 |
| NW              | 50                     | 17                      | 17                           | 17                              |
| W               | 67                     | 33                      | 0                            | 0                               |
| SW              | 90                     | 10                      | 0                            | 0                               |
| NC              | 100                    | 0                       | 0                            | 0                               |
| C               | 85                     | 0                       | 15                           | 0                               |
| SC              | 75                     | 8                       | 0                            | 17                              |
| Region:         |                        |                         |                              |                                 |
| North           | 73                     | 9                       | 9                            | 9                               |
| Central         | 81                     | 6                       | 12                           | 0                               |
| South           | 82                     | 9                       | 0                            | 9                               |
| Zone:           |                        |                         |                              |                                 |
| West            | 74                     | 16                      | 5                            | 5                               |
| Central         | 83                     | 3                       | 7                            | 7                               |
| Size:           |                        |                         |                              |                                 |
| Small           | 70                     | 10                      | 10                           | 10                              |
| Medium          | 86                     | 0                       | 14                           | 0                               |
| Large           | 80                     | 12                      | 0                            | 8                               |

a. Two elevators fumigated long term storage and one fumigated small bins only when an infestation is found.

Table 17. Use of Employees or Commercial Pest Control Company to Fumigate

| Factor          | Elevator Staff<br>(Percent) | Commercial Control<br>(Percent) | Both<br>(Percent) | Other <sup>a</sup><br>(Percent) |
|-----------------|-----------------------------|---------------------------------|-------------------|---------------------------------|
| Overall (N=72): | 61                          | 18                              | 14                | 7                               |
| Ownership:      |                             |                                 |                   |                                 |
| Coops           | 65                          | 14                              | 16                | 4                               |
| Independents    | 52                          | 26                              | 9                 | 13                              |
| Level:          |                             |                                 |                   |                                 |
| Headquarters    | 57                          | 14                              | 17                | 11                              |
| Branches        | 65                          | 22                              | 11                | 3                               |
| Districts:      |                             |                                 |                   |                                 |
| NW              | 33                          | 33                              | 17                | 17                              |
| W               | 100                         | 0                               | 0                 | 0                               |
| SW              | 75                          | 8                               | 17                | 0                               |
| NC              | 43                          | 43                              | 14                | 0                               |
| C               | 55                          | 10                              | 20                | 15                              |
| SC              | 64                          | 23                              | 9                 | 5                               |
| Region:         |                             |                                 |                   |                                 |
| North           | 39                          | 39                              | 15                | 8                               |
| Central         | 64                          | 8                               | 16                | 12                              |
| South           | 68                          | 18                              | 12                | 3                               |
| Zone:           |                             |                                 |                   |                                 |
| West            | 70                          | 13                              | 13                | 4                               |
| Central         | 57                          | 20                              | 14                | 8                               |
| Size:           |                             |                                 |                   |                                 |
| Small           | 40                          | 35                              | 15                | 10                              |
| Medium          | 61                          | 22                              | 9                 | 9                               |
| Large           | 76                          | 3                               | 17                | 3                               |

- a. Three elevators used pest control operators when they had Large amounts to fumigate, one used pest control operators for steel bins, and one depended on the situation at the time.

Table 18. Discounts Reported by Elevators for Live Insects

| Factor          | Mean <sup>a</sup> | Standard Deviation |
|-----------------|-------------------|--------------------|
| Overall (N=55): | 4.39              | 2.41               |
| Ownership:      |                   |                    |
| Coops           | 4.67              | 0.35               |
| Independents    | 3.33              | 0.68               |
| Level:          |                   |                    |
| Headquarters    | 4.61              | 0.46               |
| Branches        | 4.17              | 0.45               |
| Districts:      |                   |                    |
| NW              | 1.25 ax           | 0.90               |
| W               | 3.75              | 1.10               |
| SW              | 4.83 b            | 0.73               |
| NC              | 3.86 y            | 0.83               |
| C               | 5.42 b            | 0.63               |
| SC              | 4.84 b            | 0.50               |
| Region:         |                   |                    |
| North           | 2.65 a            | 0.63               |
| Central         | 5.00 b            | 0.56               |
| South           | 4.84 b            | 0.43               |
| Zone:           |                   |                    |
| West            | 3.47 x            | 0.54               |
| Central         | 4.84 y            | 0.38               |
| Size:           |                   |                    |
| Small           | 4.53              | 0.63               |
| Medium          | 4.37              | 0.56               |
| Large           | 4.30              | 0.51               |

a. Factors with different letters (a,b) have significantly different means,  $P < 0.01$ , t-Test. Factors with different letters (x,y) have significantly different means,  $P < 0.05$ , t-Test.

Table 19. Changes in Elevator Discount Policy for Stored Grain Insects for Farm-Stored Wheat Made During Last Three Years

- 64% (45) of the elevator managers thought that policy had changed
- Ownership: 65% Coops and 62% Independents
  - Level: 67% Headquarters and 62% Branches
  - Districts: NW and W = 60%, SW and SC = 67%, NC = 57%, and C = 57%
  - Region: 58% North, 64% Central, and 67% South
  - Zone: 64% West and 65% Central
  - Size: 74% Small, 48% Medium and 71% Large

| Factor          | Year of Change    |                   |                   |
|-----------------|-------------------|-------------------|-------------------|
|                 | 1988<br>(Percent) | 1989<br>(Percent) | 1990<br>(Percent) |
| Overall (N=45): | 75                | 18                | 7                 |
| Ownership:      |                   |                   |                   |
| Coops           | 68                | 23                | 10                |
| Independents    | 92                | 8                 | 0                 |
| Level:          |                   |                   |                   |
| Headquarters    | 76                | 14                | 10                |
| Branches        | 74                | 22                | 4                 |
| Districts:      |                   |                   |                   |
| NW              | 67                | 33                | 0                 |
| W               | 100               | 0                 | 0                 |
| SW              | 88                | 0                 | 12                |
| NC              | 75                | 25                | 0                 |
| C               | 62                | 31                | 8                 |
| SC              | 77                | 15                | 8                 |
| Region:         |                   |                   |                   |
| North           | 71                | 29                | 0                 |
| Central         | 69                | 25                | 6                 |
| South           | 80                | 10                | 10                |
| Zone:           |                   |                   |                   |
| West            | 86                | 7                 | 7                 |
| Central         | 70                | 23                | 7                 |
| Size:           |                   |                   |                   |
| Small           | 64                | 29                | 7                 |
| Medium          | 73                | 18                | 9                 |
| Large           | 84                | 11                | 5                 |

Table 20. Types of Changes in Discount Policy for Insects for Farm-Stored Wheat Made during Last Three Years

| Factor          | Greater Disc.<br>(Percent) | Same Disc.<br>More Often<br>(Percent) | Greater<br>More Often<br>(Percent) | Other <sup>a</sup><br>(Percent) |
|-----------------|----------------------------|---------------------------------------|------------------------------------|---------------------------------|
| Overall (n=45): | 14                         | 39                                    | 27                                 | 20                              |
| Ownership:      |                            |                                       |                                    |                                 |
| Coops           | 19                         | 41                                    | 22                                 | 19                              |
| Independents    | 0                          | 33                                    | 42                                 | 25                              |
| Level:          |                            |                                       |                                    |                                 |
| Headquarters    | 23                         | 23                                    | 23                                 | 31 **                           |
| Branches        | 5                          | 55                                    | 32                                 | 9                               |
| Districts:      |                            |                                       |                                    |                                 |
| NW              | 0                          | 33                                    | 0                                  | 67                              |
| W               | 33                         | 67                                    | 0                                  | 0                               |
| SW              | 12                         | 63                                    | 12                                 | 12                              |
| NC              | 25                         | 50                                    | 0                                  | 25                              |
| C               | 8                          | 25                                    | 58                                 | 8                               |
| SC              | 14                         | 29                                    | 29                                 | 29                              |
| Region:         |                            |                                       |                                    |                                 |
| North           | 14                         | 43                                    | 0                                  | 43                              |
| Central         | 13                         | 33                                    | 47                                 | 7                               |
| South           | 14                         | 41                                    | 23                                 | 23                              |
| Zone:           |                            |                                       |                                    |                                 |
| West            | 14                         | 57                                    | 7                                  | 21                              |
| Central         | 13                         | 30                                    | 37                                 | 20                              |
| Size:           |                            |                                       |                                    |                                 |
| Small           | 7                          | 29                                    | 50                                 | 14                              |
| Medium          | 27                         | 36                                    | 18                                 | 18                              |
| Large           | 11                         | 47                                    | 16                                 | 26                              |

a. Five elevators did not take large quantities with high IDK (one used for feed), two brought policy up to new standards, one passed on discounts, and one started discounting at lower level of IDK.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 21. Perceived Farmer Response to Elevator Policy Change Concerning Stored Grain Insects in Farm-Stored Wheat

| Number Elevators | Percent Farmers <sup>a</sup> | Response   |
|------------------|------------------------------|--|
| 18               | 40                           | More careful with farm storage   |
| 13               | 29                           | Do less on-farm storage  |
| 1                | 2                            | Treat farm-stored wheat more often   |
| 5                | 11                           | Complain a lot, and have changed little  |
| 1                | 2                            | Farm storage for feed grain only   |
| 4                | 9                            | Look for more lenient place to sell, including:<br>- Places that do not dock<br>- Feed yards |
| 6                | 13                           | Accept the situation   |
| 1                | 2                            | Get excess seed wheat to elevator sooner   |
| 1                | 2                            | More educated understand, others think all wheat is #1 and the problem is the grain handlers |
| 1                | 2                            | Don't have or don't use aeration long enough   |
| 1                | 2                            | Don't like "passback" of discount, write congressmen   |
| 4                | 9                            | Manage better with information provided by elevator  |
| 1                | 2                            | Dump seed wheat  |

49% (22) of the 45 managers who identified a change in policy in the last three years indicated that the policy change caused them a loss of customers or sales.

- Ownership: 44% Coops and 15% Independents
- Level: 45% Headquarters and 26% Branches
- Districts: NW and W = 67%, SW = 12%, NC = 25%, C = 38%, and SC = 36%
- Region: 43% North, 44% Central, and 27% South
- Zone: 36% West and 35% Central
- Size: 21% Small, 55% Medium and 35% Large

a. Based on responses from 45 managers who indicated that policy has changed in past 3 years. Multiple responses per farmer, so percent adds to more than 100%.

Table 22. Ranking of Factors Considered in Determining Discounting Policy

| Factor                    | Order of Importance |                  |                 |                  | Weighted Score <sup>a</sup> |
|---------------------------|---------------------|------------------|-----------------|------------------|-----------------------------|
|                           | First (Percent)     | Second (Percent) | Third (Percent) | Fourth (Percent) |                             |
| Competition (n=66)        | 33                  | 30               | 35              | 2                | 195                         |
| Pass discounts (n=66)     | 56                  | 30               | 14              | 0                | 226                         |
| Av Wheat Quality (n=66)   | 8                   | 44               | 46              | 2                | 163                         |
| Other <sup>b</sup> (n=10) | 60                  | 10               | 20              | 10               | 34                          |

Descriptive characteristics with significant variation,  $P < 0.05$ ,  $\chi^2$ -test. <sup>c</sup>

Competition:

Size:

|        |    |    |    |   |    |
|--------|----|----|----|---|----|
| Small  | 26 | 16 | 53 | 5 | ** |
| Medium | 16 | 47 | 37 | 0 |    |
| Large  | 50 | 29 | 21 | 0 |    |

Pass on Discounts:

Ownership:

|             |    |    |    |   |    |
|-------------|----|----|----|---|----|
| Coop        | 61 | 33 | 7  | 0 | ** |
| Independent | 45 | 25 | 30 | 0 |    |

Size:

|        |    |    |    |   |    |
|--------|----|----|----|---|----|
| Small  | 61 | 33 | 6  | 0 | ** |
| Medium | 80 | 15 | 5  | 0 |    |
| Large  | 36 | 39 | 25 | 0 |    |

Average Wheat Quality:

District:

|    |    |    |    |    |    |
|----|----|----|----|----|----|
| NW | 0  | 20 | 80 | 0  | ** |
| W  | 25 | 0  | 50 | 25 |    |
| SW | 0  | 80 | 20 | 0  |    |
| NC | 0  | 50 | 50 | 0  |    |
| C  | 11 | 44 | 44 | 0  |    |
| SC | 10 | 40 | 50 | 0  |    |

- Weighting scheme: first place=4, second=3, third=2, fourth=1, weighted scores are summed with the highest having the greatest importance.
- Other factors considered: cover cost of fumigation (4), where wheat was marketed, elevator stocks, how farmer worked with elevator, meet company standards, "treat people right", and whole quality issue.
- Descriptive characteristics considered: Ownership (Coop or Independent), Level (Headquarters or Branch), District (NW, W, SW, NC, C, SC), Region (North, Central, South), Zone (West, Central), and Size (Small, Medium, Large).

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 23. Standard versus Adapted Policy in Implementing Discounting <sup>a</sup>

| Factor          | Standard Policy (Percent) | Adapt Policy (Percent) |
|-----------------|---------------------------|------------------------|
| Overall (n=71): | 47                        | 34                     |
| Ownership:      |                           |                        |
| Coops           | 65                        | 35                     |
| Independents    | 68                        | 32                     |
| Level:          |                           |                        |
| Headquarters    | 59                        | 41                     |
| Branches        | 73                        | 27                     |
| Districts:      |                           |                        |
| NW              | 40                        | 60                     |
| W               | 80                        | 20                     |
| SW              | 67                        | 33                     |
| NC              | 71                        | 29                     |
| C               | 50                        | 50                     |
| SC              | 82                        | 18                     |
| Region:         |                           |                        |
| North           | 58                        | 42                     |
| Central         | 56                        | 44                     |
| South           | 76                        | 24                     |
| Zone:           |                           |                        |
| West            | 64                        | 36                     |
| Central         | 67                        | 33                     |
| Size:           |                           |                        |
| Small           | 68                        | 32                     |
| Medium          | 61                        | 39                     |
| Large           | 69                        | 31                     |

a. Standard discount policy was applied the same to everyone while adapted discount policy was adjusted to the circumstances.

Table 24. Ranking of Factors Considered in Adapting Discounting Policy

| Factor                              | Order of Importance |                  |                 |                  | Weighted Score <sup>a</sup> |
|-------------------------------------|---------------------|------------------|-----------------|------------------|-----------------------------|
|                                     | First (Percent)     | Second (Percent) | Third (Percent) | Fourth (Percent) |                             |
| Elevator circumstances (n=19)       | 42                  | 21               | 26              | 11               | 56                          |
| Grain business from customer (n=19) | 32                  | 37               | 26              | 5                | 56                          |
| Other business from customer (n=18) | 11                  | 33               | 44              | 11               | 44                          |
| Other <sup>b</sup> (n=11)           | 64                  | 18               | 9               | 9                | 37                          |

Descriptive characteristics with significant variation,  $\chi^2$ -test. <sup>c</sup>

Amount of grain business:

Ownership:

|             |    |    |    |       |
|-------------|----|----|----|-------|
| Coop        | 50 | 42 | 0  | 8 *** |
| Independent | 0  | 29 | 71 | 0     |

Amount of other business from customer:

Ownership:

|             |    |    |    |      |
|-------------|----|----|----|------|
| Coop        | 0  | 42 | 58 | 0 ** |
| Independent | 33 | 17 | 17 | 33   |

- a. Weighting scheme: first place=4, second=3, third=2, fourth=1, weighted scores were summed with the highest having the greatest importance.
- b. How much wheat the farmer had and how "bad" it was (8); age of farmer and size of farm; attempt to educate person who consistently brings problem wheat; and if need more feed, then demand determines price.
- c. Descriptive characteristics considered: Ownership (Coop or Independent), Level (Headquarters or Branch), District (NW, W, SW, NC, C, SC), Region (North, Central, South), Zone (West, Central), and Size (Small, Medium, Large).
- \*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.
- \*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 25. Elevators Which Pay Premiums for Wheat

- 44% (32) of the elevators pay premiums for wheat
- Ownership: 43% Coops and 48% Independents
  - Level: 49% Headquarters and 41% Branches
  - Districts: NW = 33%, W = 100%, NC = 50%, SW = 57%, C = 40% and SC = 32%
  - Region: 46% North, 52% Central, and 38% South
  - Zone: 57% West and 39% Central
  - \*\* - Size: 20% Small, 48% Medium and 59% Large

The 32 elevators which paid premiums, paid their premiums for the following factors. Seven of the elevators paid premiums for more than one factor.

- 22 (69%) paid a premium for high protein
- 11 (34%) paid a premium for high test weight
- 3 (9%) paid a premium for low dockage
- 3 (9%) paid a premium for other reasons including:
  - If the elevator can receive a premium for the grain
  - If the elevator needs to fill a contract

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 26. Changes in Discount Policy for Stored Grain Insects in Wheat Made by Terminal Elevators During Last Three Years

74% (50) of the elevator managers thought that discounting policies of terminal elevators to which they ship wheat had changed <sup>a</sup>

- Ownership: 79% Coops and 62% Independents
- Level: 73% Headquarters and 74% Branches
- Districts: NW = 80%, W and SW = 75%, NC and SC = 71%, and C = 74%
- Region: 75% North, 74% Central, and 73% South
- Zone: 76% West and 72% Central
- Size: 84% Small, 68% Medium and 70% Large

| Factor          | Year of Change    |                   |
|-----------------|-------------------|-------------------|
|                 | 1988<br>(Percent) | 1989<br>(Percent) |
| Overall (n=68): | 80                | 20                |
| Ownership:      |                   |                   |
| Coops           | 76                | 24                |
| Independents    | 92                | 8                 |
| Level:          |                   |                   |
| Headquarters    | 79                | 21                |
| Branches        | 81                | 19                |
| Districts:      |                   |                   |
| NW              | 100               | 0                 |
| W               | 100               | 0                 |
| SW              | 100               | 0                 |
| NC              | 60                | 40                |
| C               | 64                | 36                |
| SC              | 80                | 20                |
| Region:         |                   |                   |
| North           | 78                | 22                |
| Central         | 71                | 29                |
| South           | 88                | 12                |
| Zone:           |                   |                   |
| West            | 100               | 0 **              |
| Central         | 71                | 29                |
| Size:           |                   |                   |
| Small           | 69                | 31                |
| Medium          | 73                | 27                |
| Large           | 95                | 5                 |

a. Based on 68 managers answering the question.

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

Table 27. Buyers Specify Insect-free Wheat in Sales Contract

| Factor          | Require<br>Insect<br>Free<br>(Percent) | Not<br>Insect<br>Free<br>(Percent) | Don't<br>Know<br>(Percent) |
|-----------------|--|------------------------------------|----------------------------|
| Overall (N=72): | 46                                     | 34                                 | 20                         |
| Ownership:      |  |                                    |                            |
| Coops           | 47                                     | 35                                 | 18                         |
| Independents    | 46                                     | 32                                 | 23                         |
| Level:          |  |                                    |                            |
| Headquarters    | 59                                     | 35                                 | 6 **                       |
| Branches        | 35                                     | 32                                 | 32                         |
| Districts:      |  |                                    |                            |
| NW              | 17                                     | 50                                 | 33                         |
| W               | 60                                     | 20                                 | 20                         |
| SW              | 67                                     | 25                                 | 8                          |
| NC              | 57                                     | 14                                 | 29                         |
| C               | 25                                     | 50                                 | 25                         |
| SC              | 57                                     | 29                                 | 14                         |
| Region:         |  |                                    |                            |
| North           | 38                                     | 31                                 | 31                         |
| Central         | 32                                     | 44                                 | 24                         |
| South           | 61                                     | 27                                 | 12                         |
| Zone:           |  |                                    |                            |
| West            | 52                                     | 30                                 | 17                         |
| Central         | 63                                     | 35                                 | 21                         |
| Size:           |  |                                    |                            |
| Small           | 25                                     | 50                                 | 25                         |
| Medium          | 43                                     | 30                                 | 26                         |
| Large           | 64                                     | 25                                 | 11                         |

\*\* Significant difference among variables at 5% level based on Chi-square test.

Table 28. Elevator Managers Perception of Changes Made by Mills in Regard to Stored Grain Insect Problems in Wheat

| Factor          | Changed Policy (Percent) | No Change (Percent) | No Shipments (Percent) | Don't Know (Percent) |
|-----------------|--------------------------|---------------------|------------------------|----------------------|
| Overall (n=69): | 43                       | 23                  | 12                     | 15                   |
| Ownership:      |                          |                     |                        |                      |
| Coops           | 40                       | 25                  | 12                     | 23                   |
| Independents    | 52                       | 19                  | 10                     | 19                   |
| Level:          |                          |                     |                        |                      |
| Headquarters    | 49                       | 27                  | 6                      | 18                   |
| Branches        | 39                       | 19                  | 17                     | 25                   |
| Districts:      |                          |                     |                        |                      |
| NW              | 40                       | 0                   | 0                      | 60                   |
| W               | 20                       | 40                  | 0                      | 40                   |
| SW              | 83                       | 0                   | 0                      | 17                   |
| NC              | 43                       | 14                  | 14                     | 29                   |
| C               | 37                       | 32                  | 11                     | 21                   |
| SC              | 33                       | 33                  | 24                     | 10                   |
| Region:         |                          |                     |                        |                      |
| North           | 42                       | 8                   | 8                      | 42                   |
| Central         | 33                       | 33                  | 8                      | 25                   |
| South           | 52                       | 21                  | 15                     | 12                   |
| Zone:           |                          |                     |                        |                      |
| West            | 59                       | 9                   | 0                      | 32 **                |
| Central         | 36                       | 30                  | 17                     | 17                   |
| Size:           |                          |                     |                        |                      |
| Small           | 16                       | 37                  | 32                     | 16 ***               |
| Medium          | 50                       | 23                  | 5                      | 23                   |
| Large           | 57                       | 14                  | 4                      | 25                   |

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 29. Ranking of Enterprises in Terms of Dollar Contribution to Elevator Profitability

| Factor                                 | Order of Importance |                  |                 |                  |                 | Weighted Score <sup>a</sup> |
|--|---------------------|------------------|-----------------|------------------|-----------------|-----------------------------|
|  | First (Percent)     | Second (Percent) | Third (Percent) | Fourth (Percent) | Fifth (Percent) |                             |
| Grain merchandizing and storage (n=71) | 86                  | 11               | 3               | 0                | 0               | 343                         |
| Feed sales (n=54)                      | 6                   | 39               | 26              | 26               | 4               | 171                         |
| Fertilizer sales (n=55)                | 11                  | 58               | 24              | 7                | 0               | 180                         |
| Animal health product sales (n=34)     | 0                   | 0                | 15              | 32               | 53              | 55                          |
| Petroleum product sales (n=39)         | 3                   | 13               | 56              | 28               | 0               | 113                         |
| Other <sup>b</sup> (n=7)               | 14                  | 14               | 43              | 14               | 14              | 21                          |

Descriptive characteristics with significant variation,  $\chi^2$ -test. <sup>c</sup>

Grain merchandising and storage:

District:

|              |     |    |    |   |   |     |
|--------------|-----|----|----|---|---|-----|
| Northwest    | 50  | 17 | 33 | 0 | 0 | *** |
| West         | 100 | 0  | 0  | 0 | 0 |     |
| Southwest    | 100 | 0  | 0  | 0 | 0 |     |
| Northcentral | 100 | 0  | 0  | 0 | 0 |     |
| Central      | 95  | 5  | 0  | 0 | 0 |     |
| Southcentral | 71  | 29 | 0  | 0 | 0 |     |

Region:

|         |    |    |    |   |   |     |
|---------|----|----|----|---|---|-----|
| North   | 77 | 8  | 15 | 0 | 0 | *** |
| Central | 96 | 4  | 0  | 0 | 0 |     |
| South   | 82 | 18 | 0  | 0 | 0 |     |

Feed sales:

Ownership:

|             |    |    |    |    |   |    |
|-------------|----|----|----|----|---|----|
| Coop        | 2  | 31 | 21 | 33 | 2 | ** |
| Independent | 17 | 33 | 42 | 0  | 8 |    |

a. Weighting scheme: first place=5, second=4, third=3, fourth=2, fifth=1, weighted scores are summed with the highest having the greatest importance.

b. Seed operation (including cleaning and certified seed)(4); agrichemicals; consulting services; and milling.

c. Descriptive characteristics considered: Ownership (Coop or Independent), Level (Headquarters or Branch), District (NW, W, SW, NC, C, SC), Region (North, Central, South), Zone (West, Central), and Size (Small, Medium, Large).

\*\* Significant difference,  $P < 0.05$ ,  $\chi^2$ -test.

\*\*\* Significant difference,  $P < 0.01$ ,  $\chi^2$ -test.

Table 30. Mean Trade Area Radius Reported by Elevator Managers

| Factor          | Mean<br>(Miles) <sup>a</sup> | Standard<br>Deviation<br>(Miles) |
|-----------------|------------------------------|----------------------------------|
| Overall (n=72): | 17.3                         | 16.1                             |
| Ownership:      |                              |                                  |
| Coops           | 15.6                         | 2.3                              |
| Independents    | 21.0                         | 3.3                              |
| Level:          |                              |                                  |
| Headquarters    | 20.6                         | 2.7                              |
| Branches        | 14.3                         | 2.6                              |
| Districts:      |                              |                                  |
| NW              | 20.5                         | 6.5                              |
| W               | 32.4 x                       | 7.1                              |
| SW              | 15.0 y                       | 4.6                              |
| NC              | 14.4                         | 6.0                              |
| C               | 13.4 y                       | 3.5                              |
| SC              | 18.8                         | 3.4                              |
| Region:         |                              |                                  |
| North           | 17.2                         | 4.5                              |
| Central         | 17.2                         | 3.3                              |
| South           | 17.5                         | 2.8                              |
| Zone:           |                              |                                  |
| West            | 20.3                         | 3.3                              |
| Central         | 16.0                         | 2.3                              |
| Size:           |                              |                                  |
| Small           | 15.1                         | 3.6                              |
| Medium          | 15.0                         | 3.3                              |
| Large           | 20.7                         | 3.0                              |

a. Factors with different letters (x,y) have significantly different means,  $P < 0.05$ , t-Test.

Table 31. Competitors within Trade Areas Reported by Elevator Managers

| Factor   | Mean | Stand Dev |
|--|------|-----------|
| Grain merchandizing and storage competitors (n=70) | 4.53 | 2.96      |
| Feed sales competitors (n=54)                      | 3.87 | 3.12      |
| Fertilizer sales competitors (55)                  | 4.36 | 2.83      |
| Animal health products competitors (n=30)          | 3.57 | 2.13      |
| Petroleum competitors (n=34)                       | 5.09 | 3.74      |
| Other competitors (n=7) <sup>a</sup>               | 4.29 | 2.81      |

Significant difference in means were encountered for the following factors: <sup>b</sup>

Grain merchandising and storage competitors:

Level:

|              |        |      |
|--------------|--------|------|
| Headquarters | 5.29 x | 0.49 |
| Branches     | 3.81 y | 0.48 |

Districts:

|    |         |      |
|----|---------|------|
| NW | 7.50 a  | 1.14 |
| W  | 6.40 x  | 1.24 |
| SW | 4.75    | 0.80 |
| NC | 5.29    | 1.05 |
| C  | 3.47 by | 0.64 |
| SC | 3.81 b  | 0.61 |

Region:

|         |        |      |
|---------|--------|------|
| North   | 6.31 a | 0.80 |
| Central | 4.08 b | 0.59 |
| South   | 4.15 b | 0.50 |

Zone:

|         |        |      |
|---------|--------|------|
| West    | 5.83 a | 0.59 |
| Central | 3.89 b | 0.41 |

Fertilizer sales competitors:

Size:

|        |        |      |
|--------|--------|------|
| Small  | 3.33 x | 0.80 |
| Medium | 3.90   | 0.62 |
| Large  | 5.30 y | 0.57 |

Petroleum competitors:

Size:

|        |        |      |
|--------|--------|------|
| Small  | 3.57 x | 1.31 |
| Medium | 3.83 x | 1.01 |
| Large  | 6.93 y | 0.93 |

- a. Seed operation (including cleaning and certified seed) (4); agri-chemicals; consulting services; and milling.
- b. Factors with different letters (a,b) have significantly different means,  $P < 0.01$ , t-Test. Factors with different letters (x,y) have significantly different means,  $P < 0.05$ , t-Test.

APPENDIX A

Stored Grain Insects Management Project

Elevator Questionnaire II  
Country Elevator Study

1990 Edition

County: \_\_\_\_\_  
City: \_\_\_\_\_  
Date: \_\_\_\_\_  
Name: \_\_\_\_\_  
Elevator: \_\_\_\_\_  
Phone: \_\_\_\_\_

Coop \_\_\_\_\_ Ind. Owned \_\_\_\_\_

SUBSIDIARY OF \_\_\_\_\_

O. Does this elevator receive wheat which has been stored on farm?  
 Yes \_\_\_\_\_ No \_\_\_\_\_ Other \_\_\_\_\_

About how many farmers bring you farm stored wheat in a year? \_\_\_\_\_

If yes, approximately how many bushels of farm stored wheat is handled a year? \_\_\_\_\_

I. SAMPLING PRACTICES

A: Which of the following factors are determined when you receive wheat at the elevator? (DO NOT PROMPT)

| <u>Factor</u>          | <u>At Harvest</u> | <u>From Farm Storage</u> |
|------------------------|-------------------|--------------------------|
| Test Weight            | _____             | _____                    |
| Protein                | _____             | _____                    |
| Wheat Variety          | _____             | _____                    |
| Moisture               | _____             | _____                    |
| Dockage                | _____             | _____                    |
| Foreign Material       | _____             | _____                    |
| Shrunken & Broken      | _____             | _____                    |
| Damaged Kernels        | _____             | _____                    |
| Live Insects           | _____             | _____                    |
| Insect Damaged Kernels | _____             | _____                    |
| Rodent Pellets         | _____             | _____                    |
| Odor (Sour)            | _____             | _____                    |
| Other _____            | _____             | _____                    |

(IF LIST FOREIGN MATERIAL DETERMINE IF IT IS DOCKAGE OR ACTUAL FOREIGN MATERIAL)

(PROMPT ON REST OF QUESTIONNAIRE)

B: Do you sample wheat being loaded out for shipment?

|                | <u>Trucks</u> | <u>Railcars</u> | <u>Both</u> |
|----------------|---------------|-----------------|-------------|
| Do not sample  | _____         | _____           | _____       |
| Some shipments | _____         | _____           | _____       |
| All Shipments  | _____         | _____           | _____       |

C: If you sample wheat being loaded out for shipment, which of the following quality factors are determined:

|                  |       |              |       |
|------------------|-------|--------------|-------|
| Test Weight      | _____ | Damage       | _____ |
| Moisture         | _____ | Live insects | _____ |
| Dockage          | _____ | IDK          | _____ |
| Foreign Material | _____ | Protein      | _____ |
| Odor             | _____ | Other        | _____ |

D: Do you submit samples for official grade? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, do you submit samples on all loads? Yes \_\_\_\_\_ No \_\_\_\_\_

What determines whether samples are submitted?

\_\_\_\_\_

II. PRACTICES IN DEALING WITH INFESTED WHEAT AND STORAGE

- A: How do you handle insect infested wheat when it is received from farm storage?
- B: Did you change your policies (or practices) regarding the handle of insect infested wheat from farm storage because of the 1988 change in Federal Grain Inspection Standards regarding live insects and/or insect damaged kernels? Yes \_\_\_\_\_ No \_\_\_\_\_ More aware \_\_\_\_\_
- C: How did you handle insect infested wheat from farm storage prior to the 1988 changes?

|    |  | <u>Farm stored wheat</u> |                 |
|----|--|--------------------------|-----------------|
|    |  | <u>Now</u>               | <u>Pre-1988</u> |
| 1. | Refuse it completely<br>Refuse until farmer<br>fumigated | _____                    | _____           |
| 2. | Fumigate & Store<br>Plus Segregate<br>Plus Blend         | _____                    | _____           |
| 3. | Store as is (No Treatment)<br>But Segregate<br>But Blend | _____                    | _____           |
| 4. | Other _____  | _____                    | _____           |

- D: Do you apply a protectant (Reldan<sup>R</sup> or malathion) on any of the wheat you store? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, do you apply protectant to:

All stored wheat \_\_\_\_\_ Flat storage \_\_\_\_\_  
 Long term storage only \_\_\_\_\_ Upright storage \_\_\_\_\_  
 Short term storage only \_\_\_\_\_  
 Other: \_\_\_\_\_

- E: How do you handle wheat that becomes infested in your storage? (Indicate all that apply)

- |                                 |                 |
|---------------------------------|-----------------|
| 1. Turn it to another bin _____ | 2. Blend _____  |
| 3. Fumigate while turning _____ | 4. Aerate _____ |
| 5. Fumigate in the bin _____    | 6. Sell _____   |
| 7. Other _____                  |                 |

- F: If wheat is fumigated, who does the fumigation?

Elevator personnel \_\_\_\_\_ Pest control operator \_\_\_\_\_

Other: \_\_\_\_\_

G. If you fumigate, do you fumigate based on a pre-determined schedule or only if an insect infestation is found?

Do you fumigate: all wheat, long-term storage, or short term storage, flat storage or upright storage?

|                    | Pre-Determined Schedule | Only if Infested |
|--------------------|-------------------------|------------------|
| All wheat          | _____                   | _____            |
| Long-term storage  | _____                   | _____            |
| Short-term storage | _____                   | _____            |
| Flat storage       | _____                   | _____            |
| Upright storage    | _____                   | _____            |
| Other: _____       | _____                   | _____            |

H. How long must grain be stored before it is considered "long term" storage?

\_\_\_\_\_ (months)

III. DISCOUNTS

A: If you discounted for INSECT PROBLEMS in wheat during the period June 1989 through June 1990, how much did you discount? (Is that in cents per bushel or percent?)

| Factor                              | Amount | Unit  |       |
|-------------------------------------|--------|-------|-------|
|                                     |        | c/bu  | %     |
| Live Insects                        | _____  | _____ | _____ |
| Dead Insects or<br>Insect Fragments | _____  | _____ | _____ |
| Insect damaged kernels              | _____  | _____ | _____ |
| Odor (COFO)                         | _____  | _____ | _____ |
| Other _____                         | _____  | _____ | _____ |

B. Do any of your buyers specify insect-free wheat in their sales contract?  
 Yes \_\_\_\_\_ No \_\_\_\_\_ Don't know \_\_\_\_\_

C. Who applies greater discounts for insect problems in wheat?

This elevator? \_\_\_\_\_  
 Elevators to whom you ship wheat? \_\_\_\_\_  
 Mills to whom you ship wheat? \_\_\_\_\_  
 Insect discount policy is the same? \_\_\_\_\_

D. What percent of your wheat is shipped to other elevators? \_\_\_\_\_

E. What percent of your wheat is shipped to mills? \_\_\_\_\_

F. Is there a feed mill as part of this elevator? Yes \_\_\_ No \_\_\_

G. Has THIS ELEVATOR'S discounting policy for insect problems changed in the past three years? Yes \_\_\_\_\_ No \_\_\_\_\_

If Yes:

When were your policies more strict? Previously \_\_\_\_\_ Now \_\_\_\_\_

How have policies changed? \_\_\_\_\_

\_\_\_\_\_

In what year did your policies change? \_\_\_\_\_

H. If your policies are more strict now, how did farmers respond to higher insect discounts?

\_\_\_\_\_

\_\_\_\_\_

I. Do you feel that this action has cost you in terms of lost customers and/or sales? Yes \_\_\_\_\_ No \_\_\_\_\_

J. Over the past three years, has the discounting policy for insect related factors changed at TERMINAL ELEVATORS to which you ship wheat?

Yes \_\_\_\_\_ No \_\_\_\_\_

If Yes, when were their policies more strict? Previously \_\_\_\_\_ Now \_\_\_\_\_

In what year did their policies change? \_\_\_\_\_

K. Over the past three years, has the discounting policy for insect problems changed at MILLS to whom you sell wheat?

Yes \_\_\_\_\_ No \_\_\_\_\_ None \_\_\_\_\_

If Yes, when were their policies more strict? Previously \_\_\_\_\_ Now \_\_\_\_\_

In what year did their policies change? \_\_\_\_\_

L. Rank the importance of the following factors in determining an overall discounting policy for farm-stored wheat for your elevator (1 = most important):

\_\_\_\_\_ Competition: match or beat the competition in your trade area.

\_\_\_\_\_ Discounts you receive: pass along the discounts you receive from sub-terminals, terminals, and mills.

\_\_\_\_\_ Average wheat quality: the average quality of farm-stored wheat in your area (station average)

\_\_\_\_\_ Other: \_\_\_\_\_

M. Are your discounts for **INSECTS** ....

A standard policy that is consistently applied? \_\_\_\_\_  
(i.e. is the same for every customer)

A policy that may be adapted depending on circumstances at the time? \_\_\_\_\_

N. If the policy may be adapted, rank the importance of the following factors:

\_\_\_ Elevator circumstances at the time (i.e., is there space, can the grain be blended off).

\_\_\_ The amount of grain business the customer brings you.

\_\_\_ The amount of other business the customer brings you (i.e., feed, fertilizer, services performed by the elevator)

\_\_\_ Other: \_\_\_\_\_

O. Rank the importance (in terms of dollars of contribution) of the following enterprises at your elevator (1 = most important):

\_\_\_ Grain merchandising and storage

\_\_\_ Feed sales

\_\_\_ Fertilizer sales

\_\_\_ Animal health products sales

\_\_\_ Other services: \_\_\_\_\_

P. What radius (distance to furthest typical customer) would you estimate for your trade area? \_\_\_\_\_ miles

Q. How many competitors do you face within your trade area in:

\_\_\_ Grain merchandising and storage

\_\_\_ Feed sales

\_\_\_ Fertilizer sales

\_\_\_ Animal health products sales

\_\_\_ Other services: \_\_\_\_\_

R. Do you ever provide premiums when purchasing wheat?

Yes \_\_\_\_\_ No \_\_\_\_\_

For which factors do you provide premiums?

\_\_\_ Protein

\_\_\_ Test weight

\_\_\_ Low dockage

\_\_\_ Other: \_\_\_\_\_

