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IMPACTS OF POLICY CHANGES ON DISCOUNTS FOR INSECTS  
IN FARM-STORED WHEAT

Bryan Schurle, Steve Duncan, Carl Reed,  
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Abstract

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# IMPACTS OF POLICY CHANGES ON DISCOUNTS FOR INSECTS IN FARM-STORED WHEAT

## Abstract

New grading standards became effective in 1988 to encourage improved grain quality. This paper reports the results of two surveys designed to identify changes in discounting policies and a comparison of discount data collected in 1986 to data collected in 1991. Evidence indicates increases in discounts and improved management practices.

Since the 1988 changes, the Federal Grain Inspection Service (FGIS) has put into place new grading standards in an attempt to encourage the market to more accurately reflect the quality of grain it handles. Specifically, the FGIS designated insect damaged kernels (IDK) as a separate quality factor. They also reduced the number of live insects allowed from a maximum of 5 per 100 gram sample to 1 per 100g before designating a lot as infested.

Several studies have been conducted regarding discounting practices of elevators (Fleming, Schulte, Duvall, and Reed; Benson, Schulte, Fleming, and Reed), storage practices on farms (Reed and Padgett), storage practices of local elevators (Reed, Schulte, and Fleming) and risk management strategies (Anderson, Schulte, Reed, and Padgett). These studies primarily used data collected prior to 1988 and have provided a baseline that can be compared to current discounts and practices. The central issue is whether the policy changes made in 1988 have had an impact on the marketing channels and storage practices of those in the marketing chain.

# IMPACTS OF POLICY CHANGES ON DISCOUNTS FOR INSECTS IN FARM-STORED WHEAT

## Introduction

Grain quality and insect infestations are major concerns in the U.S. grain industry for several reasons. One reason is that these are characteristics by which the industry competes in the export market. Exports are extremely important to the grain industry, so efforts to improve quality, decrease insect infestations, and increase competitiveness in the export markets are always of interest. The domestic market and flour mills also are very interested in increased quality and decreased insect infestation in order to produce a high quality product and reduce insect fragments in flour.

Because of these continuing concerns regarding grain quality, the Federal Grain Inspection Service (FGIS) in 1988 put into place new grading standards in an attempt to encourage the market to more accurately reflect the quality of grain it handled. Specifically, the FGIS recognized insect damaged kernels (IDK) as a separate quality factor. They also reduced the number of live insects allowed from a maximum of 5 per 100 gram sample to 1 per sample before designating a lot as infested.

Several studies have been conducted regarding discounting practices at elevators (Fleming, Schurle, Duncan, and Reed; Duncan, Schurle, Fleming, and Reed), storage practices on farms (Reed and Pedersen), storage practices at local elevators (Reed, Schurle, and Fleming), and risk management strategies (Anderson, Schurle, Reed, and Pedersen). These studies primarily used data collected prior to 1988 and have provided a benchmark that can be compared to current discounts and practices. The central issue is whether the policy changes made in 1988 have had an impact on the marketing channels and storage practices of those in the marketing chain.

The purpose of this paper is to report the results of several studies that are currently nearing completion and to compare these results to the previous studies to examine whether the policy changes have had an impact on the grain industry. Results from a survey of farmers will be compared to a previous farmer survey, results from a survey of elevators will be compared to a previous elevator survey, and discount data from elevators in 1991 will be compared to discount data from elevators in 1986. USDA funding has provided this unique opportunity to study issues before and after a policy change so that impacts of the policy change can be identified.

#### Farmer Survey

The list of farmers who were surveyed in 1986 contained 312 names. The same list was used in 1991, after deleting those who were no longer farming. Of the 289 potential respondents, 129 returned completed forms and 81 no longer stored wheat.

The substantial number who no longer store wheat reflects a general decline in the amount of farm-stored wheat in Kansas during the last half of the 1980's. According to Kansas Agricultural Statistics reports, the proportion of the annual Kansas wheat crop stored on Kansas farms in October declined from an average of approximately 26% between 1984 and 1986 to less than 15% in 1990 and 1991. A shift in storage to elevators would be expected, if discounts for quality deterioration were larger or more frequently received.

Pest control strategies also could be expected to change. The percentages of respondents that reported using particular types of pest control were very similar to those in 1986 with two exceptions. The

proportion of respondents that reported using a grain protectant increased from about half in 1986 to nearly three-quarters in 1991. This appears to indicate a recent trend toward increased reliance on grain protectants. However, use of a fumigant as a precautionary measure decreased from 27% to 17% of the respondents. Use of fumigation as a corrective measure was virtually unchanged; one half (50.8%) of the respondents indicated that their farm-stored wheat had been fumigated during the previous storage season. About 16% used neither protectant nor fumigant compared to about one-third who held wheat with no chemical treatment in 1986.

Anderson et al. completed a study of discounts and farmer practices using insect discounts before the grain standards changed in 1988. The conclusion was that discounts received by producers at that time were not consistent enough nor large enough to provide substantial encouragement for incurring large costs to control insect infestations in stored grain. The pest control information of this most recent survey indicates that the use of prevention strategies has increased slightly.

The motivations and methods of fumigation varied among respondents. More than 40% (41.8%) of those who fumigated said they did so to avoid a damaging infestation. One in five said they fumigated to destroy an existing, known infestation, whereas 38.2% indicated that the fumigation was both corrective and preventative. Sixty-one percent of those who claimed to have fumigated in the previous year said they accomplished the fumigation themselves. Over one-third (39.0%) said someone else had done the fumigation. This included 35.6% that had hired a commercial pest control operator to fumigate the grain. The use of commercial fumigators appears to have increased markedly since 1986, when 12.5% reported hiring a commercial fumigator.

More than half (56.4%) of the respondents said they had received price discounts for grain quality factors in wheat they delivered from farm storage. Respondents were asked to identify reasons for the discounts. Test weight was cited by about two-thirds as a reason for discounts, whereas excess dockage and insect-related factors were both cited by about one-third of the respondents.

About one in five respondents who had received price discounts said the discount was due either to live insects or insect damage. This is consistent with other Kansas studies, which indicate that insect-related quality characteristics are less often the cause of discounts than are test weight or purity factors.

As reported by farmers, the value of the price discount for live insects ranged from 2¢ to 5¢ per bushel with a mean of 4.3¢/Bu. When only the respondents who sold out of farm storage were considered, one-third said the discount was 3¢/Bu and two-thirds said it was 5¢/Bu. The costs of insect control, by comparison, were approximately 1.6¢/Bu for the most effective grain protectant, 0.8¢/Bu for fumigation, and 0.5¢/Bu for cooling by aeration (Reed, Petersen, Caperus).

The 1988 changes in U.S. grain standards for wheat were expected to affect grain merchandisers' policies on accepting infested or damaged wheat. About a quarter (23.7%) of the farmers indicated that the value of discounts for these factors had increased during the past 3 years. Others (33.0%) said that, although discounts had not changed, more attention was now paid to insect-related quality issues than previously. The rest did not know (8.2%) or had not noticed any change (35.1%). Twenty-four persons declined to answer.

Respondents were asked to indicate their agreement or disagreement with a general question related to the cost of quality maintenance. With 22.3% abstaining, the majority (88.3%) agreed that the likely loss of income from price discounts was greater than the sum of costs incurred to maintain grain quality. This provides evidence that farmers are now more cognizant of issues surrounding the loss of grain quality during storage than they were in 1986. At that time, nearly half of the same respondents declined to answer the question, whereas 74.5% of those answering agreed with the statement.

### Elevator Survey

An interview survey of managers of 72 country elevators was conducted in 1991 to identify changes in elevator practices that had occurred since 1986. The elevators represent approximately 25% of those in approximately 25% of the largest wheat-producing counties in Kansas. These 72 elevators were a subset of the 85 elevators surveyed in 1986, so the managers' 1991 responses can be compared to those in 1986 (Reed et al., 1988).

Elevator managers were asked if they had a standard policy for insect discounts or whether their policies varied depending on circumstances. About two-thirds indicated that they have a standard policy (down from 85% in 1986), whereas the remaining one-third adjusted their policies to circumstances.

Changes in price discounting for insects could indicate that policy changes have had an impact on the markets for stored grain. Of the 72 elevator managers surveyed in 1991, 64% (45) said that insect discount policies had changed since 1988. Of the 45, 44 thought they were now stricter. Changes made are as follows: 14% used greater discounts, 39% used the same discount but applied them more carefully and more often, 27% used greater

discounts and applied them more often, and 20% indicated other changes such as passing on discounts or not taking large quantities of infested wheat. Thus, most elevator operators indicated that insect policies are more strict than in 1986. Of those who thought the policies had changed, 75% said they changed in 1988, 18% in 1989, and 7% in 1990. Therefore, the majority of the elevators changed policies in the same year that FGIS changed its policies.

Surprisingly, and contrary to stated changes, the mean discount for live insects in farm stored wheat from the 1991 survey was 4.4 cents per bushel, significantly lower ( $P < 0.01$ ) than the mean discount for the 1986 survey of 5.3 cents per bushel. These figures may not be directly comparable, because the discounts could have been related to different quality wheat drawn from farm storage. This is due to a substantial amount of very long-term farm storage, which had resulted from farm programs in the mid 1980's (Fleming et al.) and was not present during the 1991 survey. Discounts for this grain could have been higher because of heavier damage and infestations.

The country elevator managers also were surveyed concerning their opinions of terminal discount policies. Of those surveyed, 74% thought terminal elevator policies had changed and that they were now stricter. Most (80%) said terminal practices had changed in 1988, and 20% thought they had changed in 1989.

The country elevator managers who indicated that policies had changed in the past 3 years also were asked an open-ended question concerning farmer responses to policy changes. About 50 percent indicated that farmers were now more careful with farm storage, and over 30 percent thought farmers stored less in their farm storage facilities. Eleven percent thought farmers complained a lot but had changed little, and 13 percent thought farmers had

just accepted the situation. Almost 10% said farmers look for more lenient places to sell grains, including feedyards or elevators that do not dock. About 50% of the elevator managers who identified a change indicated that the new policies had caused them to lose customers or sales. A frequent complaint in 1991 was that terminal elevators did not discount farmers for poor quality wheat, a practice that made it hard for country elevators to maintain high standards.

One issue that could not be compared with 1986 concerned actions taken by elevator managers who identify insect damaged kernels (IDK) in samples from farm-stored wheat delivered to the elevator. IDK was officially recognized as a separate grading criterion with the FGIS policy change in 1988. Elevator managers were surveyed regarding their actions when they identified IDK in farm stored wheat delivered to the elevator. Almost 50% indicated that they refuse to take wheat with high IDK (defined as 20 to 32 IDK/100 grams). Because much of the grain with high IDK is now diverted to animal feed, this could increase grain quality by not allowing it to be blended with higher quality wheat for human consumption.

#### Discount Data

Few studies of price discounts have been done and most of these have relied on questionnaires regarding discounts rather than observation of actual behavior. Ingemansen, Reeves, and Walstrom and Barak and Harein are examples of studies using questionnaires, whereas Reed asked 50 elevator managers how much they would discount samples he presented to them.

The data used in this study were collected by asking elevator managers to retain samples of farm-stored wheat taken at time of delivery. In

addition, they were asked to complete a card indicating date, size of lot, value of discount, and reason for discount. Samples were then analyzed in laboratories at Kansas State University and characteristics of each sample were recorded (Reed). Between November 1986 and May 1987, 465 samples were collected, before the changes in U.S. wheat standards took effect May 1, 1988. The same collection procedure was used again between November 1990 and May 1991. During the latter period, 249 samples were collected, which should provide some indication of the discounting behavior after the change in policy.

Table 1 shows the distribution of discounts and wheat characteristics for the two data sets. The average discount given in the 1986 data set was over 1¢ per bushel greater than that given in the 1991 data set. Average discounts for the 2 years were significantly different at the 1% level. Discounts can differ for two important reasons: the average wheat quality may be different between the 2 years or elevators may have changed their discounting policies.

Table 1 indicates that the average quality of the wheat, in fact, was different between the 2 years. Test weights were significantly lower and moisture content, insects, and dockage were significantly higher in 1986 relative to 1991. The average number of live insects dropped by over 50%, and the number of dead insects dropped by over 67%. Because wheat characteristics do exhibit year-to-year variation in level, it is inappropriate to attribute the large drop in insect numbers solely to the change in standards in May 1988. Regression analysis, however, can be used to identify whether, in addition to wheat quality, elevator discounting practices changed between the 2 years.

The total discount levied on the wheat was available for 1986 and 1991, but the discounts for individual wheat characteristics were not. Therefore, a hedonic model of wheat discounts was estimated. From this model, statistical tests can be made of hypothesized changes in discounting practices.

Table 2 presents the estimated regression coefficients for the hedonic model. The variables included in the model were test weight, moisture content, number of insects, trash, and whether the wheat sample had an objectionable odor. The coefficients on each of the variables were allowed to differ between 1986 and 1991. The dummy variable Year was included as an intercept shifter between the 2 years. The adjusted r-squared for the model was 0.41, and all coefficients had the expected sign. The T-ratios and statistical significance also are presented in Table 2.

The regression results indicate that a high test weight could reduce the total discount received in both years. Moisture content was significant only in 1986. The variable Insects, which is the number of live internal, live external, and dead insects, was significant in 1986 but not in 1991.

The variable Trash, the sum of the percent dockage and the percent shrunken and broken kernels, was intended to indicate how dirty the wheat was. With all else constant, insect infestations are more likely in trashy wheat than in clean wheat. Trash was significant in 1986 but not in 1991. The presence of an objectionable odor in the wheat sample increased the discount significantly in both years. The presence of odor added 8.6 cents to the discount in 1986, but added just over 27 cents in 1991.

An F-test was conducted to test the null hypothesis that none of the coefficients of the hedonic model changed between 1986 and 1991. The null hypothesis was rejected at the 1% level of significance. The conclusion is

that a significant change in the discounting practice of elevators did occur between 1986 and 1991.

Table 3 examines the net effect of the estimated changes in discounting practices between the 2 years. Because the average wheat quality differed between the 2 years, two standardized samples of wheat were used to identify differences in discounts levied. The first wheat sample considered had characteristics equal to the average of the wheat samples received in 1986. Likewise, the second wheat sample considered had characteristics equal to the average of the wheat samples received in 1991. Discounts were estimated for these two wheat samples for the two discounting regimes: pre-May 1988 standard change and post-May 1988 standard change.

The 1986 (pre-May 1988) discounting regime had substantially lower discounts relative to the 1991 (post-May 1988) discounting regime. For the relatively low quality sample from 1986, the difference in the discounts was 2.11 cents per bushel, or a discount nearly 80% higher using the 1991 regime. For the relatively high quality sample from 1991, the difference in the discounts amounted to 1.21 cents per bushel, or a 400% higher discount using the 1991 regime.

The results of Table 3 support the notion that the standard change in May 1988 had the effect of increasing discounts. Given this change in discounting practice, the standard change may be responsible for at least part of the improvement in wheat quality between 1986 and 1991.

#### **Summary and Conclusions**

Data from a survey of farmers suggest that farmers' behavior regarding storage of grain has changed since 1986. In particular, fewer farmers store

wheat, more farmers use grain protectants, slightly fewer fumigate, more have commercial applicators do the fumigation, and fewer do nothing to protect wheat from insects. More farmers perceive that the cost of a discount is greater than the cost of maintaining grain quality.

Data from a survey of elevators suggest that most elevators have a stricter policy now than in 1986. This is consistent with farmer perceptions; over half perceived elevator policies to be stricter now. Most county elevator operators (74%) thought that terminal elevator discounts also were stricter now.

Finally, regression analysis of discount data lends some support to the notion that the 1988 standard change had an impact on the discounting practice of Kansas elevators. The results indicate that, after accounting for differences in wheat quality between 1986 and 1991, elevators in 1991 levied much larger discounts than in 1986. Additional analysis is being undertaken in an attempt to better estimate the probability of receiving a discount and the size of discounts related to insect infestation.

In conclusion, evidence is mounting that the change in grading policies has had an impact on the marketing chain for grain. Although work is continuing, evidence indicates that grain quality in the system may already be improved.

Table 1. Distribution of Discounts and Selected Characteristics for Stored Wheat Delivered to Elevators in 1986 and 1991.

Variable	1986 data			1991 data			Diff. in Means
	Low	Avg	High	Low	Avg	High	
Discount (¢/Bu)	0	2.7	60.0	0.0	1.5	77.0	***
Test Weight (Lb/Bu)	45.6	57.6	62.5	54.4	60.1	64.0	***
Moisture Content	8.8	11.0	16.3	6.8	10.0	13.8	***
Live Insects (100g)	0.0	1.8	95.0	0.0	0.8	48.0	**
Dead Insects (100g)	0.0	6.7	249.0	0.0	2.2	85.0	***
Dockage	0.0	0.8	4.9	0.0	0.5	1.6	***

\*\* Indicates significant difference in means at 5% level.

\*\*\* Indicates significant difference in means at 1% level.

Table 2. Estimated Regression Coefficients for 1986 and 1991.

Variable	Coefficient	T-Ratio
Intercept	21.977	3.36 ***
Year (1 if '91)	21.088	1.61
Test Weight '86	-0.460	-5.06 ***
Test Weight '91	-0.719	-4.04 ***
Moisture '86	0.521	2.09 **
Moisture '91	0.085	0.36
Insects '86	0.023	2.44 **
Insects '91	0.002	0.09
Trash '86	0.301	2.47 **
Trash '91	0.207	0.62
Odor '86	8.601	9.92 ***
Odor '91	27.062	13.07 ***

Adjusted R-squared: 0.41.

\*\* Indicates significance at the 5% level.

\*\*\* Indicates significance at the 1% level.

Table 3. Predicted Discounts for 1986 and 1991 Discounting Regimes for Two Average Wheat Samples.

Variable	Average Wheat Sample from 1986	Average Wheat Sample from 1991
	¢	¢
Predicted Discount Using 1986 Regime	2.67	0.30
Predicted Discount Using 1991 Regime	4.78	1.51
Difference in Predicted Discount	+2.11	+1.21

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