AN INDEPENDENT ACTUARIAL REVIEW OF QUALITY ADJUSTMENT 5.6.3 SECTION 107 OF ARPA

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INTRODUCTION

Milliman USA, Inc. (Milliman) was engaged by the Risk Management Agency (RMA) of the United States Department of Agriculture (USDA) to perform a review of quality adjustment procedures as required by Section 107 of the Agricultural Risk Protection Act of 2000 (ARPA). This report presents the results of that review.

The following sections present the (1) Scope of Analysis, (2) Conclusions and Recommendations, (3) The Economic Significance of Quality Adjustment and Crop Insurance in Crop Production and Marketing, (4) Current Program Review, (5) Market Research Analysis, (6) Risk Analysis and (7) Closing.

SCOPE OF ANALYSIS

Section 107 of ARPA requires a review of current quality loss adjustment procedures in order to develop procedures that more accurately reflect local quality discounts. Based on the results of this review, RMA may make adjustments to the current program, after consideration of actuarial soundness and prevention of fraud, waste and abuse[1]. The Statement of Work issued by RMA further requires that the recommended procedures be easy to maintain, have a low maintenance cost, be national in scope, and be uniform for all crops. In the broadest sense, this report contains our review of current nationwide discounts and the development of recommendations regarding alternative indemnification methods consistent with the above considerations.

Our analysis includes a review of current quality discount adjustment factors for the following agricultural commodities: corn, soybeans, grain sorghum, wheat, barley, oats, rye, flax, canola, sunflower and safflower. This review is based on a study of the procedures used to develop the discount factors for these crops and an econometric analysis based on discount schedules from a representative sample of major purchasers, warehouses and country and terminal elevators.

Our analysis further develops new quality discount adjustment factors for rice, dark roast confectionary sunflowers and buckwheat, consistent with the recommended procedures developed in the analysis described above.

A separate analysis is performed for cotton quality adjustment. The goal of this analysis is to simplify the current procedure and incorporate an option of selecting coverage on an individual bale basis rather than a farm unit. The proposed procedure must also promote equity amongst policyholders and minimize the potential for price manipulation.

The following presents a description of the deliverables included in this report with respect to the above analyses.

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[1] Including the possibility of price manipulation.

Current Program Review. This section presents our comprehensive review of the current procedures for quality discount adjustments. This portion of the analysis is based on our study of agricultural quality adjustment procedures, which includes interviews with grain inspectors and a review of the available literature.

The current program review includes a study of the quality discount perils (quality deficiencies that affect grade and market price). Each peril is identified, its insurability is discussed, and recommendations are made as to which perils should be covered or excluded.

Market Research. In this section we discuss the research approach, data sources and study on the uniformity of the variations in quality discount rates on the regional level. The data sources are identified and reviewed for effectiveness based on conversations with personnel from RMA, the Farm Services Agency (FSA), Economic Research Service (ERS), industry grain associations, commodity associations and data collection services. The analysis also addresses the potential economic impact of changes to quality adjustment procedures, and provides supporting discussion of the recommendations presented in this report.

Risk Analysis. The risk analysis section will discuss hazard risk and compare the risk of insuring by unit versus insuring by bale for cotton.

Implementation Support. After adoption of any new procedures based on the conclusions of this analysis, Milliman will assist RMA in developing handbooks and guidelines. We are further able to assist in systems implementation upon request; however, that task is outside the scope of this current assignment.

CONCLUSIONS AND RECOMMENDATIONS

During the course of this assignment, Milliman interviewed various crop science experts, staff of trade associations, staff of state crop commissions, approved insurance providers, major purchasers and crop elevators; conducted direct surveys of elevators and purchasers; obtained data from FSA and the Agricultural Marketing Service (AMS) of the USDA; and performed extensive analysis of both the survey data and data obtained from USDA agencies. The following are our main conclusions for crops in general and for cotton specifically.

Local Quality Discount Rates

Our research indicates that quality discounts applied at a local elevator can be heavily influenced by local supply and demand factors, particularly with respect to the average quality of the crop currently stored at the elevator. Therefore, actual discounts may deviate from the elevator's published discount schedule; that is, in some instances, local elevator transactions may not reflect the published local area discount related to the covered quality deficiency, but instead may reflect discounts related to factors prevalent at a given local elevator on the day and time the transaction takes place.

In addition, quality loss adjustment based on local elevator transactions can be problematic in that it may be:

1. Not objective,
2. Not applied uniformly, and
3. Not auditable.

As a consequence, the use of local elevator transactions would likely not meet the objective that the procedure should prevent fraud, waste and abuse[2].

To accomplish the stated goal of developing quality loss adjustment procedures that more accurately reflect local quality discounts, we evaluated the following three options:

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[2] It may be for similar reasons that revenue based coverages avoid reliance upon local transactions as a basis for determining the harvest price used of "Calculated Revenue". For example, a Crop Revenue Coverage (CRC) policy typically bases the harvest price on the average daily settlement rates for the commodity's farmers contracts on the Chicago Board of Trade 15 to 45 days prior to contract expiration, rather than the price the producer receives at the local elevator.

1. Develop regional quality adjustment factors based on an econometric analysis of quality discount schedules of local elevators grouped into regional markets.

2. Develop a system whereby producers are allowed to select from prescribed optional quality adjustment schedules when purchasing coverage.

3. Develop quality adjustment schedules that follow the discount schedules of terminal elevators.

We developed an econometric model to analyze these options, and implemented that model by conducting an extensive survey of local and terminal elevator discount schedules. During the course of our survey, we contacted by phone 360 individual grain terminals, elevators and warehouses, to request current discount schedules and discuss the uses and application of these schedules. In addition, at the recommendation of FSA, we also contacted six major national grain buyers, because the volumes of their transactions are extremely large and their discount schedules appear to be very influential in the market.[3] After repeated follow-up, we ultimately received responses from 121 entities, for a response rate of approximately 33%.

Based on our survey results, we conclude the following about the discount schedules issued for crops in general:

1. Quality discount schedules are generally highly correlated across elevators in different regions. That is, the proportionate change in the discount for a given change in quality is comparable within and across regions.

2. While the discount schedules are highly correlated, the absolute level of discounts can vary significantly, both within and across regions.

3. The current quality adjustment rates in some cases may need to be updated to be consistent with current market discount rates.

4. Most discount schedules are not updated frequently. Sampling schedules every one to three years should be sufficient to determine whether an update of the quality factors is required.

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[3] During our phone interviews, many local elevators indicated that they follow the schedules of these market leaders, such as ADM, Cargill, and the like.

Recommendations. Of the three options noted above, it is our opinion that Option 1 – developing regional discount schedules – best satisfies the stated criteria[4]. Options 2 and 3 are valid in terms of actuarial soundness, however, the administrative complexity of Option 2 lacks low maintenance costs, and the data available to implement Option 3 would likely not reflect local quality discounts applied to agricultural commodities as well as Option 1.

For Option 1, we considered developing schedules based on the optimal clustering of published local elevator discount levels per crop. That is, we tested which discount schedules were statistically "closest" to each other, and developed regions which aggregated the discount schedules within those clusters. However, while this procedure is statistically sound, we concluded that it does not satisfy the criteria of low maintenance costs, in that different sets of regions would have to be developed and maintained for each crop.

We therefore tested the option of developing a set of regional definitions that is consistent across all crops. Our analysis indicates that by defining regions as those serviced by the various RMA Regional Offices, the differences in average discount levels among these regions are frequently statistically significant.[5] Thus, using RMA regions satisfies the primary criteria that local discounts are more accurately reflected by the recommended quality adjustment procedures. Furthermore, the task of periodically sampling and updating the local regional schedules may be delegated to the Regional Offices, where personnel are likely to be familiar with the local markets and in a position to efficiently maintain the discount schedules. This would imply that the proposed procedures are likely to be relatively low in maintenance costs. Finally, because this option is intended to apply to all crops, it is both national in scope and uniform for all crops.

We note that in some cases a crop may not have a high volume of production in a given region, in which case it may not make sense for that Regional Office to maintain separate discount schedules. In these

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[4] We recognize that regional discount schedules may result in differences in indemnities paid to producers on different sides of regional boundaries. However, as with any regional or territorial classification system in insurance, there are, of necessity, territorial boundaries, across which circumstances (usually premium rates) will differ. It is often the case that the cost conditions that underlie premium rates change continuously over territories, so that on either side of the territorial boundaries, costs are roughly similar, and hence rates should be as well. One of the problems of classification ratemaking is striking a balance between precision in classification and the costs of administering the system.

The same is true of different territorial or regional discount schedules. While it would be possible to construct a "tapered" discount schedule which varied continuously across regions, the overhead and administrative costs would be prohibitive, and the schedules would be much more complicated to compute. It would require a far more extensive survey of warehouses to provide all of the data points required to produce a reliable grid system of rates. It would also require a much larger database, much more costly database management, and much more elaborate software system for price determination. We believe that the recommended system, while imperfect, reasonably balances the theoretical ideal and the administrative cost burden.

instances, we recommend one of two options. First, the Regional Office could adopt the schedules of a neighboring Regional Office, perhaps with a minor adjustment to reflect the local market's differences if necessary. Alternatively, we also present a "National" discount schedule, which represents the average of all the regional schedules along with several schedules that are used nationally by specific purchasers. In cases where a Regional Office could not adopt the schedule of a neighboring region, the Office might choose to rely on the National schedule instead.

In addition, even though we considered the regional and updated quality discount schedules to be one step forward in providing quality adjustments more reflective of local market conditions, it is inevitable that at times local transactions may deviate substantially from recommended discounts. We thus further suggest that quality discount could be determined based upon an Olympic average[6] price offered by five local buying points owned by at least five separate entities if:

- the loss is an allowable quality deficiency that is due to insurable causes as defined in the applicable crop provisions,

and if it satisfies any of the following conditions:

- the grain has a market value of 50% or less of local market price as defined by the applicable crop provisions, as a result of an allowable quality deficiency that is due to insurable causes as defined in the applicable crop provisions;
- the discount received is more than 150% of the chart listed discount; or
- there are no data in the discount chart.

In addition to the quality deficiencies enumerated in each crop policy, there are also quality factors, such as mycotoxins, that are identified by the Food and Drug Administration or other public health organizations of the U.S. as being injurious to human or animal health. In most instances, these quality characteristics were not in any of the discount schedules we received, but they are covered by the crop insurance policy. For these quality factors, we suggest one of two options. If there is current data from FSA on discounts for such conditions, then RMA should rely on those data. Otherwise, if the presence of these conditions causes the crop to be graded at or below the grade required to qualify for quality

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[5] For four of the major program crops – corn, wheat, soybeans and grain sorghum - the differences were statistically significant.
[6] An Olympic average is derived by discarding the high and low observations and averaging the remaining data.

coverage (usually grade 5 or sample grade) then we suggest that RMA uses the Olympic average price of five local buying points as discussed above.

Insurability of Covered Perils

In the course of our research, we also considered the question of the insurability or uninsurability of covered quality perils for each crop. Our conclusions are based on the extent to which each peril is controllable by the producer. The purpose of this criterion of controllability is to encourage good farming practices, and to avoid the potential incentive problems created by offering compensation for perils that are entirely under the control of the insured producer.[7]

Regarding this issue, we emphasize that our findings throughout this report are based on extensive discussions and interviews with agricultural experts as to those dimensions of crop quality which are controllable by producers. Milliman does not take any position on the validity of those expert opinions. Rather, we simply note that it can be economically inefficient to provide insurance coverage against perils that are largely within the control of the insured.

Our findings are that there are no currently covered quality perils that are entirely within the control of the producers. Furthermore, indemnification of a covered quality deficiency is contingent upon the deficiency resulting from a covered cause of loss, which in the case of quality deficiencies would primarily result from adverse weather conditions. Therefore, we conclude that even for perils which may be partially within the control of the insured, indemnification would result only in the event of loss outside of the producer's control.

We further note that there is a partial "experience rating" effect for covered quality deficiencies. Quality adjustment is applied to production-to-count, which in the event of an insured loss becomes a part of the producer's actual production history (APH). Therefore, future coverage is in some part a function of past quality deficiencies, which helps to provide a more equitable distribution of rates.

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[7] If insurance is available for a particular peril that is controllable, a producer may take less care in preventing a loss due to that peril. This is familiarly known as the "moral hazard" problem.

Construction of Schedules

The regional (or national) discount schedules were constructed by calculating the arithmetic mean of the individual discount schedules of the relevant regions (or the whole nation), using the procedures described below.

At the outset, we note that we were repeatedly told that while the published schedules were a guide, actual discount rates might deviate from the published schedules at times due to variations in market supply and demand. Nonetheless, we believe that the printed schedules are likely to be the most frequently used discount schedules, and we were given no reason to believe that the schedules are biased – meaning that on average, the deviations from the schedule will be zero. Thus, we believe that relying on the published schedules is reasonable.[8]

Turning to the development of the discount schedules themselves, we adopted certain rules for applying discounts by grade and insured peril, which are described below. We note that there is no standardized method among elevators of structuring grade or specific deficiency discounts; to the contrary, different elevators may discount for certain deficiencies and not others, may have different ranges for specific deficiencies, and may reject crops entirely if they exceed a particular level of a given deficiency.

In light of the variations in industry practice, we have developed the following rules based on extensive discussions with the Federal Grain Inspection Services (FGIS), individual elevators and industry trade associations as to typical industry practices and reasonable applications of discounts to market rates:

1. Grade discounts are uniform regardless of the deficiency that causes a particular grade, and there is no "double discounting". For example, if a crop is grade 3 due to test weight and grade 4 due to total damage, the crop receives a single grade 4 discount (i.e., the lesser grade of the two).

2. If a crop is sample grade, the crop receives the sample grade discount plus the incremental discount below the sample grade threshold. For example, wheat at test weight 49 lbs. receives the sample grade discount plus the incremental discounts from 51-50 and 50-49 (i.e., below the sample grade threshold of 51 lbs.).

3. If a crop is sample grade due to two perils, the crop receives a SINGLE sample grade discount plus the incremental discounts beyond sample grade for BOTH perils. For example, if the crop in Item 2, above, also has total damage 16%, the discount would be as above PLUS the total damage discount for 15-16% (i.e., above the sample grade threshold of 15%).

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[8] There is an analogous situation with compensation for a yield loss under the MPCI policy; the price election does not reflect daily variation in local supply and demand conditions which may affect the price the producer actually receives for his crop.

4. Odors are treated differently. Smutty, garlicky and ergoty are "special" grades; i.e., they do not affect the numerical grade (a US no.1 could also carry the special grade "smutty"). These discounts apply independent of grade.

5. Musty, sour and commercially objectionable foreign odor (COFO) are more serious and are automatically sample grade. They receive the sample grade discount in addition to the listed odor discount. (Also, for some crops musty may be easier for the elevator to blend than sour, which is easier to blend than COFO. For example, FSA wheat discounts for these perils are .10, .25, and .50, respectively, and all apply on top of the .70 sample grade discount.)

6. Most elevators do not provide separate discounts for grade, and many elevators have different discounts for different perils that could produce a given grade. (For example, wheat grading #5 due to total damage may have a different discount than wheat grading #5 due to test weight). Since quality deficiencies generally have to be sufficient to cause a crop to grade below a certain level – such as below grade 4 or 5 – it is important to have number and sample grade discounts available for the loss adjustment process. Therefore, for each elevator without identified grade discounts, we have constructed the average grade 5 and/or sample grade discounts (depending on the given crop's coverage), based on an analysis of the reported discounts for each quality deficiency that is covered under the crop's policy (provided the elevator reports a discount for that peril).

We note that these procedures are generally consistent with the "Pre-established DF's from the Chart" section of the *FCIC Loss Adjustment Manual Standards Handbook* (Section 5, Part 85, Page 140-141), with respect to type/level of damage and special/specific allowable Sample Grade defect DF's[9]. The treatment of the DF's for U.S. Sample Grade is the same as described in the *Handbook* (5.85.G.(1).(b).1.b.(ii)), with the exception that only the portions of the type/level of damage DF's that are in excess of the Sample Grade DF are applied to determine the total quality discount.

Results of Analysis

The results of our analysis by crop are reported in relevant subsections of the Market Research Section. In each case, we display a Table which shows the following information:

- the quality deficiencies covered under the policy;
- the current discounts for those perils based on the current FSA discount schedules;
- the proposed regional discounts based on the data collected from individual elevators, warehouses and terminals; and
- a national discount schedule, based on the average of all the regional schedules.

[9] "Discount factors"

As is evident from those Tables, it is only for the major program crops that there was sufficient data to construct regional schedules, and in no instances were discount schedules (for specific crop) provided by the elevators in all ten RMA regions. Indeed, in many cases there were only a handful of elevators with discount schedules for given crops. Thus, many of the proposed discounts are based on very small samples. This is to some extent due to the nature of the market for some crops; in some cases crops are produced in only a few areas, are traded in very small volume or may be grown predominantly under contract. As a result, many elevators will not have discount schedules applicable to those crops. We have reported the sample sizes used to construct the proposed schedules, and recommend that where the samples are small RMA may consider the option of applying the Olympic average.

We have also reported a "National" discount schedule for each crop, based on an average of each of the individual elevator schedules along with several schedules that are used nationally (and are therefore not assigned to any specific region). If a specific region has no data for a particular crop, we have suggested that the RMA Regional office be authorized to utilize a neighboring region's schedule, or to select the National schedule if desired.[10] We note that for many crops the National schedule is the only one displayed, due to the small sample problems reported above, or the fact that the regional schedules appear to be statistically identical.

Our suggested discount rates for each crop based on the survey results are displayed in the relevant subsection for the crop in the Market Research Section. The following briefly summarize the magnitude of the suggested discounts in comparison with the current discounts.

- For corn, the suggested discount rates are somewhat higher for sample grade and test weight discounts, but somewhat lower for musty, sour and COFO discounts.
- For soybeans, the suggested discounts are somewhat lower for sample grade, COFO and sour, but somewhat higher for musty.
- For grain sorghum, the suggested discounts are significantly lower for sample grade, and somewhat lower for all other quality factors except kernel damage, which is higher.
- For wheat, the suggested discounts are significantly lower for grade 5, sample grade, COFO and sour, but somewhat higher for test weight and kernel damage.

[10] As will be discussed in detail later in this report, the data collection process for this study was extensive, but we were still unable to obtain discount schedules for certain crops in certain regions. In such cases, the national discount schedule can be perceived as an update of the current national discount schedule. In addition, we have recommended an option for a producer to elect the Olympic average discount if there is no tabular discount available for a particular crop/deficiency.

- For barley, the suggested discounts are lower for grade 5 and sample grade, but higher for test weight, kernel damage, thin, sour, musty and COFO.

- For oats, the suggested discounts are lower for test weight and sound-cultivated barley, but significantly higher for sample grade.

- For rye, the suggested discount is based on only one discount schedule and is slightly lower for sample grade.

- For rice, we suggest using the FSA discount rates, but for areas outside of California only.

- For buckwheat, we suggest a 1% discount for each pound of test weight below 45 and a 100% discount for soundness, musty, garlicky .

- For the oilseed crops, the suggested discounts are much higher for flax and are based on a single major purchaser.

- For canola, the suggested discounts are higher for sample grade, but slightly lower for kernel damage, and are also based on a single major purchaser.

- For oil sunflower, the suggested discounts are lower for test weight, musty, sour and sample grade discounts, but higher for kernel damage discounts.

- For confection sunflower, the suggested discounts are uniformly much higher than current discounts. We suggest a 50% discount rate for dark roast confection sunflower.

- For safflower, the suggested discounts are based on only one purchaser and are substantially higher than the current discounts.

Grading – Monitoring and Compliance

For purposes of quality adjustment in crop insurance, RMA requires that graders be licensed under the United States Grain Standards Act (USGSA), or the United States Warehouse Act (USWA). In addition to demonstrating the requisite skills that are required to obtain a license, obtaining the credentials conveys an economic benefit to the holder that helps to ensure honesty and integrity when performing the task.

Our interviews with USDA graders and approved insurance providers reveal that grading at local elevators is not always performed by an employee of the elevator who is a licensed grader. Graders licensed under the USGSA are generally state employees leased to the elevators or employed by private agencies; thus they lack the potential conflict of interest of being employed by the elevator. In addition to our recommendations listed above, we emphasize the importance of the RMA requirement that unofficially graded grain is not acceptable for quality loss adjustment, and that a USGSA license is the preferred standard for measuring quality deficiencies.

Cotton Quality Adjustment on a Basis Smaller than a Unit

Our risk analysis includes a measure of the relative frequency and severity differential between cotton quality loss adjustment on a unit basis and quality loss adjustment on a per-bale basis. The scope of the alternate coverage was confirmed through discussions with RMA and Kent Lanclos, an economist with the National Cotton Council (NCC).

According to the NCC, cotton is generally marketed on a per-bale basis, and individual quality grades are attached to each bale, making this particular commodity unique among field crops. The primary difference between the current and alternative coverage is that currently, individual quality deficiencies on a per-bale basis are aggregated across a unit and applied to production to yield production-to-count. If the production-to-count does not fall below the yield guarantee, then no indemnity is paid. Under the alternate coverage, quality deficiencies are paid for each bale regardless of whether there is a yield loss. At the levels of coverage presented below, this results in approximately a 10% increase in loss costs.

The above estimate is based on the quality adjustment factor estimation of all upland cotton classified in the crop year 2000. The cotton quality data comes from the USDA AMS Cotton Program's weekly cotton quality data file, which contains classification information for all bales classified in a given week as well as the classing office number. The cotton prices are from the AMS daily market price for the last day of the respective workweek.

THE ECONOMIC SIGNIFICANCE OF QUALITY ADJUSTMENT AND CROP INSURANCE IN CROP PRODUCTION AND MARKETING

Crop insurance is one of an integrated set of federal government programs aimed at protecting farmers against crop failure and crop market volatilities. Yield-based insurance protects farmers against the yield deficiencies in either quality or quantity. The role of insurance varies with the unique production and marketing process of each crop. This section reviews the production and marketing process and the importance of crop insurance for the various crops within the scope of this assignment.

Corn

Production and Marketing. Corn is the largest crop and the principal feed grain of the United States (U.S.). It had a farm value of $18.6 billion in 2000 and accounts for more than 90 percent of total feed grain production. Historically, U.S. corn acres declined from 113 million during the Great Depression to 64 million in 1969. Since then, corn acres have climbed back and stabilized at around 80 million acres in recent years.

The major corn production areas include Illinois, Iowa, Indiana, eastern portions of South Dakota and Nebraska, western Kentucky and Ohio, and the northern two-thirds of Missouri. Iowa and Illinois, the top corn producing states, produce around one-third of the total crop. According to the National Grain Farmers Association, there are three types of corn produced in the U.S. Dent corn accounts for 99% of total corn production, with the other types being sweet corn and popcorn. Dent corn is further divided into yellow, white and mixed corn, with the majority being yellow corn.

Corn is planted in early April through late May and is harvested in early October through mid November, depending on the region. About one-third of the crop typically remains on the farm to be used as animal feed. The rest is sold by the farmer, usually to a country elevator located near the farm. The country elevator dries, stores and conditions the corn. It then sells the corn to possibly a livestock feeder, feed mill, dry corn miller, wet corn miller, terminal elevator or export elevator.

Economic Significance of Quality Adjustment and Crop Insurance. In 2000, corn producers paid $739.4 million in insurance premiums for protection against yield failures, far exceeding any other crop. Based on conversations with country elevators, over the last ten years around 10% of the total crop was discounted for quality deficiency. This seems to reflect the consistency of recent harvests. Part of the reason for the increase in quality consistency could be innovations in agricultural technology, which should continue into the future. Nonetheless, quality requirements by the market may also increase over time, keeping quality adjustment a potentially important factor for crop insurance in the future. In addition, there appears to be a trade-off between quantity and quality in crop production. Larger farmers may not be able to play a hands-on role and thus may target quantity more than quality, while small farmers may be able to target quality more effectively.

Based on conversations with elevator operators and agronomists, there are essentially two factors that affect corn quality - weather and the farmer's machinery and decision-making. Farmers can affect the quality of the crop to some extent by managing the timing of the harvest and the care and effort they invest into the storage, handling and transportation processes. In recent years, the most important discount factors for corn have been, in the order of importance: damage, foreign material and others. In southern areas such as Georgia, where the temperature is relatively high, bug damage seems to be more important; it is however, less important in the major corn production areas such as the Midwest.

Based on a conversation with Dr. Robert Caldwell at the University of Nebraska, there are several quality measures which can be affected by farming procedures and equipment. Specifically, farmers have good control over heat damage (often caused by overheating with propane heaters during the drying process), and reasonable control over foreign material (the farmer can adjust the combine to exclude foreign matter during harvest).

In contrast, farmers have less control over other quality deficiencies. Specifically, we were told that farmers have very little control (perhaps 10%) over test weight; the other 90% is caused primarily by dry weather. Dry weather causes the plant's growth to cease and leads to low test weights. Also, natural conditions are estimated to cause about half of all aflatoxin[11] discounts, while the other half is potentially farmer controlled. Discounts listed in the "other" category include sour, musty, waxy, buggy, infested, etc. Farmers may have some control over these discounts some of the time, while in other instances they are uncontrollable due to varying weather conditions.

We have also interviewed trade organization and country elevator staff on the issue of controllability of quality deficiencies. The general response from these groups is that for most quality factors, even if there is an opportunity for control, it can be costly for producers to spend the resources necessary to minimize damage. This is further aggravated by the uncertainty regarding the effectiveness of some of the measures available to mitigate damage. Therefore, it is reasonable to assume that most of the quality problems that occurred were not really within the control of the producers. This has been the predominant view of the country elevator and trade organization staff that we interviewed for almost all crops, except those otherwise discussed. We note that the reason why lengthy passages were used to describe the opinions of agronomists is simply because of the diversity of their opinions in comparison to the relatively uniform opinions we received from other parties on all quality factors and all crops. This applies to all crops discussed in this report.

We emphasize that our discussion of discount factors is based on the results of interviews with agricultural experts as to those dimensions of quality that are controllable by producers. Milliman does not take any position on the validity of those expert opinions. We simply note that it can be economically inefficient to provide insurance coverage against perils that are well within the control of the insured. Thus, if it is widely agreed upon that a particular quality dimension is outside of the farmer's control, then it should be subject to discount under the insurance program.

Soybeans

Production and Marketing. Soybeans are the second largest crop produced in the U.S. The total farm value of U.S. soybean production in 2000 was $13.1 billion. As the world's leading producer of soybeans, the U.S. produces more than 50% of the world crop and exports about 40 percent of its output. More than 80 percent of U.S. soybean acreage is concentrated in the upper Midwest.

Of the more than 150 varieties of soybeans produced in the U.S., the yellow soybean is the dominant class used in commercial markets. It accounts for around 99% of U.S. soybean production. Other minor classes include green, brown and black soybeans.

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[11] Aflatoxin is a naturally occurring byproduct of a fungus that grows on corn and is toxic to animals, especially young animals. Aflatoxin targets corn grown in the southern region of the U.S. due to this region's unique humid weather conditions.

Soybeans are usually planted in May and harvested in late August or early September. Most of the soybeans grown by farmers are sold to a nearby country elevator. The country elevator dries, stores and conditions the soybeans. Some farmers may sell directly to a soybean processor located in the growing area.

Soybean acres have increased nearly 30% since 1990, to 74.5 million acres in 2000. The main reasons for this rapid expansion of soybean acreage include[12]:

- Increased planting flexibility under the 1996 Farm Act;
- Rising yields from narrow-rowed seeding practices;
- More half-corn, half-soybean rotations; and
- Lower production costs (partly due to widespread adoption of herbicide-tolerant varieties).

Economic Significance of Quality Adjustment and Crop Insurance. For crop year 2000, producers paid $455.3 million in premiums for soybean crop insurance. Although the quality of soybean crops has been extremely consistent, there is a general consensus among country elevators that quality adjustment remains very important. The consistent soybean yield could be related to the increased use of herbicides and new farming technology. Most of the elevators we interviewed estimate that only 5% to 10% of their crop is discounted in any given year. There is some concern, however, that small country elevators are not enforcing the same strict standards for quality as the larger terminals. This has made making money at the elevator level more difficult and has lowered the overall quality of soybeans at the terminal level. This trend could force country elevators in the future to levy higher discounts for below-average quality soybeans and therefore make quality adjustment an even more important factor for crop insurance.

Soybean production has had a very stable decade, partly because soybeans tend to be a relatively durable crop. There are approximately 11 different basic quality measures for soybeans, but test weight discounts make up the majority of soybean quality adjustments. Test weight is unpredictable and mainly due to genetic variation and weather conditions. Even with effective management, however, producers can only control this discount to a limited extent.

As for other quality deficiencies, according to James Beuerlein at the Ohio State University, farmers may have some control over many of the important quality measures. For instance, farmers can eliminate some soybean discounts through the use of herbicides. Also, splits are a handling problem that farmers can control because it is usually during the harvest process. Further, there is minimal discounting for heat damage, the result of farmers providing excess heat during the drying process. Heat damage also can be caused by poor aeration in storage bins, and therefore may be the result of poor management. Discounts covered by the "other" category include sour, musty, cofo, dirt, stones, sticks, etc. These quality deficiencies are typically rare for soybeans, but when they do occur, they are frequently due to human error.

In addition to these factors, there was serious doubt about the justification for a frost discount. Frost damage usually occurs only in locations where there is double cropping and very low temperatures. In regions of generally milder weather such as Iowa or Illinois, this is a preventable quality deficiency. In states such as Minnesota, according to Dr. Seth Naeve at the University of Minnesota, frost is a seasonal concern with little or no farmer control. Green discounts are fairly rare as well, and are closely related to weather.

Damage is a "catch all" category that includes a variety of defects that may be caused mainly by negligence in the harvesting, handling and transporting processes. Damage probably can never be eliminated entirely, but, according to crop scientists, there is certainly some ability on the farmer's part to mitigate damage. Discounts for other colors being present on the soybeans have nothing to do with quality. These discounts are taken for cosmetic reasons rather than for a loss in quality. Producers can mitigate this problem by keeping their fields clean.

Other quality measures are harder for farmers to control. Foreign material discounts come in two varieties for soybeans. One is trash and other debris, and the other is chipping of soybeans caused by low moisture content. Around 50% of the time, foreign material can be controlled through proper combine adjustment.

As with corn, careful monitoring of the soybeans while they are stored in bins can lessen the degree to which a farmer is discounted at the elevator. There appears to be a slight tradeoff in soybean production between quantity loss and quality loss, although the extent of the tradeoff is still questionable. Conversations with country elevator operators revealed the belief that farmers have a strong desire to push for higher output volume.

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[12] Source: ERS, USDA

Cotton

Production and Marketing. Cotton farming had a crop year 2000 production value of $4.78 billion. The harvest acres in the U.S. have fluctuated in the last four decades, declining from around 5.9 million acres to around 3 million acres in 1983 and then climbing back to around 5.3 million acres currently.

Primary cotton production areas in the U.S. include:

- The Texas High and Rolling Plains;
- The Mississippi, Arkansas, and Louisiana Delta;
- California's San Joaquin Valley;
- Central Arizona; and
- Southern Georgia.

Texas, which produces the most cotton of any state, accounted for about 21% of the total value of U.S. production. Five other major production states, - California, Georgia, North Carolina, Mississippi and Arkansas - accounted for 54% of total U.S. production.

While all 17 southern cotton-producing states harvest upland cotton, pima cotton is the predominant choice in California, Southern Texas, Arizona and New Mexico.

Upland cotton constitutes about 96% of the cotton produced in the U.S. Pima cotton, which has relatively low yield but also relatively long, strong and fine fibers, accounts for the remainder. Technological developments have helped improve the quality of cotton over time. For example, between 1985 and 1995, the average fiber strength for upland cotton tested by the USDA increased by 17%, while the average length has increased by 8.7%.

Economic Significance of Quality Adjustment and Crop Insurance. Cotton crop insurance plays an important role in this industry. Cotton producers face numerous production hazards during the season, such as hail, drought, insects and diseases. Production hazards lead to yield deficiencies in both quantity and quality. Many producers purchase crop insurance to protect themselves against production hazards. For the crop year 2000, producers paid a total of $371.6 million in insurance premiums.

Cotton is classified by the following quality factors: color; extraneous matter; fiber diameter; fiber length; fiber length uniformity; fiber strength; and elongation before breakage. According to Professor Wayne

Smith of Texas A&M University, extraneous matter is the only quality aspect that farmers can partially control through proper plant preparation, defoliation and other measures. All other quality aspects are mostly genetically and environmentally determined. Producers have limited control over the color of cotton through timely harvesting. However, harvesting time is also frequently determined by weather.

Grain Sorghum

Production and Marketing. The value of grain sorghum farming was $823 million in crop year 2000. Both harvested area and production levels have been declining in the last two decades.

Economic Significance of Quality Adjustment and Crop Insurance. Grain sorghum crop insurance premiums totaled $49.9 million in 2000. The consensus among country elevators with a focus on grain sorghum production is that quality adjustment does not play a very large role in determining prices. This is mainly due to the fact that grain sorghum is used predominantly for cattle feed and ethanol manufacturing. However, in Kansas the 2001 crop suffered from excess dry weather and upwards of 50% was discounted for low test weight. Outside Kansas, in Texas (for example) only 10% of the grain sorghum was deemed below quality and subject to test weight discounts. Thus, there is some regional importance to quality adjustment, especially when the quality of farmer-stored grain sorghum is examined. In addition, although U.S.-produced grain sorghum is essentially only used for feed and ethanol manufacturing, there is an increasing trend toward growing food-grade grain sorghum domestically, according to Dr. Dale Fjell of Kansas State University. This would place a higher importance on grain sorghum quality and therefore, quality adjustment.

Almost all grain sorghum quality variation comes from weather cycles and patterns. Dr. Fjell explained that grain sorghum behaves similar to other crops in that there are certain quality measures that are completely weather related. These include test weight, heat damage and, to a certain degree, moisture. At country elevators the only measures that are consistently graded are moisture and test weight. The only way a farmer can influence test weight, and this is to a very limited extent, is to avoid planting late in the season and thus having a shorter growth span and more cold weather. Grain sorghum is grown in warm weather climates. The plant develops well in dry, hot climates. Heat damage can occur in the field during exceptionally hot seasons. More often than not, the hot weather lowers the test weight. Conversations with country elevators revealed that quantity loss is much more important than quality loss because of grain sorghum's intended usage. For every farmer the production of the maximum amount of bushels is an economically superior strategy to producing only high-quality grain sorghum.

Farmers have a high level of control over tannin and damage discounts. Dr. Fjell explained that in the U.S., grain sorghum with tannin in the seed coating of the kernel has been bred out and is not typically grown. Farmers can easily avoid growing grain sorghum with tannin by using the correct seed variety. Damage discounts are reduced through the proper adjustment of combines. With grain sorghum, the cleaner a farmer gets the crop, the higher the test weight will be because the foreign material is generally lighter than the grain sorghum itself.

Wheat

Production and Marketing. Wheat is the largest volume food grain produced in the U.S. It had a farm value of $6 billion in crop year 2000. Among U.S. varieties, 70% to 80% of wheat production is "winter wheat," while the remainder is "spring wheat." Winter wheat is sown in the fall and usually becomes established before entering dormancy when cold weather arrives. In the spring, the plants resume growth, which is rapid until summertime harvest. In the Northern Plains, where winters are harsh, spring wheat and durum wheat are planted in the spring and harvested in the late summer or fall of the same year.

According to ERS, the following are the major wheat classes in the U.S.:

- Hard red winter (HRW) wheat accounts for about 40% of total production and is grown primarily in the Great Plains (Texas and north to Montana). HRW wheat is principally used to make bread flour.
- Hard red spring (HRS) wheat accounts for about 25% of production and is grown primarily in the Northern Plains (North Dakota, Montana, Minnesota and South Dakota). HRS wheat is valued for its high protein levels, which make it suitable for specialty breads and blending with lower-protein wheat.
- Soft red winter (SRW) wheat, which accounts for 15% to 20% of total production, is grown primarily in states along the Mississippi River and in the eastern states. Flour produced from milling SRW wheat is used for cakes, cookies and crackers.
- White wheat accounts for 10% to 15% of total production, and is grown in Washington, Oregon, Idaho, Michigan and New York. Its flour is used for noodle products, crackers, cereals and white-crusted breads.
- Durum wheat accounts for 3% to 5% of total production, and is grown primarily in North Dakota and Montana. It is used in the production of pasta.

Due mostly to declining returns (relative to other crops) and alternative options under government programs, wheat acres have been declining slowly in the last two decades.

Economic Significance of Quality Adjustment and Crop Insurance. For the crop year 2000, producers paid $331.8 million in premiums for wheat crop insurance. From information gathered through conversations with country elevators and terminals, there seems to be a genuine concern for quality adjustment. Although consistent harvests have been achieved in some locations, there are areas that have suffered from excess dockage, or easily removable foreign material. This stems from country elevators not strictly enforcing discounts for objectionable amounts of foreign material. Larger elevators and export terminals stated that this issue is being addressed and there could be an increased rate of discounting going forward. In the future, a lack of tolerance toward average or below-average wheat could make quality adjustment potentially a more important component of crop insurance. Among larger grain terminals there is the expectation that discounts will rise in the export channel, signaling to suppliers that low-quality wheat will not be tolerated.

Wheat yields and quality do not vary greatly unless the weather fluctuates from season to season. Rainfall seems to have the greatest effect on quality: too much or too little rainfall can have equally detrimental effects on quality measures such as protein and test weight. However, there are many categories of quality deficiency for wheat, some of which may be controllable to some extent by the producer.

As one example, in some areas of the country a downward trend has occurred in wheat quality, at least in part as a result of a lack of attention toward dockage. We were told that farmers have some ability to control dockage by adjusting their combines more precisely, but this requires time and patience, which can be hard to come by during harvest time. As another example, it appears that fertilizers and chemicals can have a positive effect on protein content and cleanliness; however, the application of these products can be a significant expense to a farmer.

According to Dr. Brent Bean of Texas A&M University, farmers can have a modest impact (around 20%) on protein levels, based on their control of nitrogen levels in the soil. Test weight is highly weather related, but to a certain degree can be influenced in wheat by the last irrigation date. Procedures and techniques also tend to impact each variety of wheat differently in terms of test weight. HRW wheat, for example, is typically grown on dry land and its test weight is solely affected by late weather patterns. Sprout damage depends on harvest timing, but more importantly is affected by weather patterns late in the growth cycle.

Some quality factors are easier to control. As mentioned earlier, dockage is a farmer-controlled deficiency. Frost typically is a rare deficiency, but in locations in which it does occur it usually is a byproduct of double cropping and is closely related to this procedure. Dr. Bean also suggested that wheat of other classes, contrasting classes and rye should be considered controllable. Most fungi that affect wheat can be deterred somewhat through the use of herbicides, but this deficiency is also largely affected by weather. Fungi can be controlled around half the time depending on the severity of the condition. Based on a conversation with Dr. Emerson Nafziger of the University of Illinois, fungi, germs, insects and other adverse conditions are more prevalent in humid areas, and some of these problems may be mitigated by technology and investment in new equipment.

Barley

Production and Marketing. The U.S. produced $632 million of barley in crop year 2000. The varieties are either malting or non-malting. While the total crop value is still sizable, both production and harvested acres have been declining for the majority of the last four decades, in both the U.S. and globally. The total planted acres in the U.S. were 15.6 million in 1961, but are only around 5.8 million currently. In recent years, Idaho, North Dakota, Montana and Washington have produced over 70% of the total U.S. yield.

Barley can be planted either as a winter or summer crop. In the northern states, where winters are severe, barley is planted in April or May and harvested in the fall. In the warmer states, barley is planted sometime from mid-September through May and harvested in June.

The majority of barley grown in the U.S. is used as feed for livestock. The farmer sells the barley crop to the country elevator located near the farm, or a terminal elevator in some cases. The elevator then determines the quality of the barley before cleaning, drying, storing and conditioning it. The elevator eventually sells the barley to a buyer. If the barley is feed quality, it may be sold to a feed manufacturer. If it is malting quality, it may be sold to a brew master or food processor. Malting barley has rigid quality requirements, including uniform high quality, plumpness, relatively free of broken and skinned kernels, and brightness of color.

Economic Significance of Quality Adjustment and Crop Insurance. In crop year 2000 producers paid $18.2 million for barley crop insurance. Estimates made by country elevators put the average discount on quality deficiencies over the past year at around $0.40 to $0.50. It was also estimated that around 80% of the entire barley crop suffered from DON, a toxin, which led to the high discounts. As a result, only a small portion, perhaps 5%, of the barley crop made it into the malting channels. This means that up to 95% of barley supplies went solely to the feed channels due to imperfections. Quality deficiencies therefore make quality adjustment very important to crop insurance within the barley growing industry.

According to Dr. Rich Horsley of North Dakota State University, fluctuating weather patterns have caused the quality variation in recent barley crops. Poor barley growth has been a direct result of high moisture and humidity. The sustained poor weather and adverse effect on quality and quantity have caused some farmers to switch their acreage to more profitable crops. Farmers are extremely concerned with the recent quality loss. The cost of the discounts and the amount of barley being discounted is forcing farmers to focus solely on the quality of their yield. The most consistent cause of barley imperfection has been toxin. Large discounts have caused vomitoxin to take center stage over previous measures of quality such as plumpness, sprout damage, and protein due to the increase in humid weather and the lack of resistant varieties and fungicides that prevent DON.

There are a few discounts that farmers can affect to a limited degree. Dockage and foreign material levels can be reduced, but not entirely eliminated, through the precise use of combines and by controlling weeds. Farmers can alter the protein content of their crop by varying the nitrogen levels in the soil. For malting barley this means not allowing the protein content to become very high by adding too much nitrogen to the soil. Equipment, facilities, and timely harvesting also have some effect over moisture. Most farmers in the prime barley-growing regions of the upper Midwest, however, do not have drying facilities at all. The skinned and broken kernels discounts, like the dockage and foreign material discounts, can be reduced by setting the combine properly. This is especially important when the crop is particularly dry.

Quality deficiencies that are strictly weather related include test weight, thinness, plumpness, DON and sprouting. Dr. Horsley stated that all of these discounts are uncontrollable and tend to cause the least amount of quality adjustment when there is timely rain, moderate temperatures and drier conditions during the grain fill.

The current quality issues affecting barley farmers are beyond farming techniques and procedures. The single cause of DON is weather. Farmers are suffering the same problems across all levels and regions, meaning that different farming techniques, procedures and equipment cannot reverse the present causes of quality adjustment.

Oats

Production and Marketing. The total value of oats produced in the U.S. was less than $165 million in 2000. Both the acres planted and the value of production have been declining almost uniformly since 1946. The number of acres planted was around 46.5 million in 1946, compared to only 4.5 million acres in 2000. This could be the result of the sharp decline in nominal prices relative to the increase in yield. From 1980 to 2000, yield increased from 53 to 64.2 bushels per acre (21% increase), while price per bushel declined from $1.79 to $1.05 (41% decline).

Economic Significance of Quality Adjustment and Crop Insurance. Oats insurance premiums totaled $3.35 million for the crop year 2000. Based on conversations conducted with country elevators, the likelihood of an elevator discounting for various quality measures is slim. In addition, it was discovered that most farmers in the regions contacted, including Wisconsin and Minnesota, preferred to chop down their oats for hay rather than bring them to market. However, this is probably because the majority of the elevators we contacted dealt primarily with oats at the lower end of the scale or crops that are destined for feedlots.

Weather conditions in recent years have not been conducive to successful oat yields and thus oats that do make it to the food channels are experiencing heavy quality adjustment. Although oats are a small crop with declining acreage, quality adjustment may play an important role in crop insurance for oats food production.

Oats have experienced consistent deficiencies for several years now. According to the elevators, although oats normally have good quality, there have been 3 to 4 successive years of low-quality harvests. Test weight discounts are being seen across the board for all farmers, due to extreme temperatures and moisture in the prime growing regions of North Dakota, South Dakota, Minnesota and Wisconsin. Oats are a relatively small crop for which yield increases cannot offset defects in quality. The incentive to produce a high-quality crop is always present, and it is quite possible that some farmers sacrifice a bit of quantity to generate higher quality.

According to Dr. Mike McMullin of North Dakota State University, oats mainly suffer quality deficiencies as a result of changes in weather conditions during the late stages of growth. Therefore, all of the discounts for oats, to a high degree, are unexpected and uncontrollable. The same discounts are seen across the board for farmers in any one region regardless of the procedures, equipment or technique. Specifically, foreign material is affected mainly by weather conditions, as certain conditions may lead to unexpected germination or high weed content. It is possible, however, for farmers to reduce the probability of these events by selecting a high-quality seed or spraying the proper types and amounts of herbicides.

Damage discounts are also almost entirely the result of adverse weather conditions. Most damage to oats comes in the form of sprouting or heating. Dr. McMullin mentioned that this is due more to luck than anything else. Test weight discounts are primarily weather related as well, although early planting seems to reduce the probability of a poor test weight yield. Garlic discounts are very rare in North and South Dakota, and Dr. McMullin believes that they are mainly seen in the corn belt region of the U.S. These discounts are certainly controllable as they reflect some inadvertent mixing of crop varieties. Dockage is graded in oats on the basis of foreign material and therefore is influenced by the prevailing weather conditions. Discounts listed in the "other" category, such as sour, musty, infested, etc., are usually the result of high moisture content. Therefore it is difficult to predict their arrival or to control them once they have affected the oat crop.

Agronomists have succeeded in finding the best oats seed for a particular type of soil and this has helped improve the standard for oats quality. Weather patterns like those that have occurred over the past few growing seasons, however, ensure that there will be unpredictable behavior in oat yields and qualities.

Rye

Production and Marketing. The U.S. produced about $22 million from rye farming in 2000, down from $30.4 million in 1998 and $25.1 million in 1999. Acres harvested declined steadily from 1.7 million in 1960 to around 302 thousand in 2000. Based on conversations with extension agronomists, rye is now mainly grown as cover crop or for forage. Georgia and Oklahoma are the two biggest production states, combining for about half of the total U.S. production.

Economic Significance of Quality Adjustment and Crop Insurance. The economic significance of rye appears to have declined to a point where it is now a relatively less significant crop than most other crops considered in this study. Producers paid $98,638 in insurance premiums in crop year 2000. As harvested acres and production continue to decline, which appears likely considering the persistent historic trend, total crop insurance premiums will likely decline as well. Hence, the economic significance of crop insurance for rye appears modest at this point. Based on conversations with country elevators, rye has become a fairly insignificant cash crop. Among those we contacted in the Midwest and Georgia, rye had little financial value to farmers. It was deemed a “rotation” or “cover” crop, or one that is planted the season before another cash crop is to be introduced on the same tract of land. Therefore, quality adjustment had little effect on farmers in those areas.

According to Dr. Robert Hall of South Dakota State University, for those farmers who do produce rye, there are a few discounts that are controllable. Foreign material discounts are taken typically for a wide range of items such as trash, weeds and other objectionable debris. Combine adjustment can eliminate much of these types of debris. Discounts listed under the “other” category, including sour, musty and infested, can be curtailed by limiting the moisture content of the rye and by initiating programs of herbicides, fungicides and insecticides. On the other hand, like all other cash crops, test weight discounts are 99% weather related. Under unique circumstances, according to Dr. Hall, farmers may be able to affect their crop’s test weight, but this is highly unusual.

Flaxseed

Production and Marketing. The U.S. produced about $35 million of flaxseed in crop year 2000. The two major production states, North and South Dakota, contributed about 93% and 3% of total U.S. production, respectively. Minnesota and Montana are two other significant flaxseed production states. Flax is typically planted in the spring and harvested in the fall. After harvesting, the producer usually hauls the flaxseed directly to a processing plant. About 88% of the flaxseed is crushed for oil and meal. The rest is mainly exported (about 8%) or used for seed. The stalk is used to produce flax linen. The straw or stubble from the flax plant is used by the paper industry.

Economic Significance of Quality Adjustment and Crop Insurance. Producers paid $2.5 million in flaxseed insurance premiums in crop year 2000.

According to agronomist Dr. Duane Berglund, test weight, damage problems and stones are difficult for farmers to control. Farmers have more control over other quality problems such as foreign material, dockage, heat damage, heating and moisture content.

Canola

Production and Marketing. The total value of U.S. canola production in crop year 2000 was $135 million, 80% of which is attributable to North Dakota. Planted acres in the U.S. have increased from 140 thousand in 1992 to over 1.5 million in 2000. Most canola is grown under contract, which provides a guarantee of price.

The canola plant produces yellow flowers that in turn produce pods. These pods contain tiny round seeds that are crushed to obtain canola oil. Each seed contains approximately 40% oil. The remainder of the seed is processed to be used as livestock feed. Because it is perceived as a "healthy" oil, canola use is rising steadily both as a cooking oil and in processed foods. The consumption of canola oil is expected to surpass corn and cottonseed oils, becoming second only to soybean oil.

Economic Significance of Quality Adjustment and Crop Insurance. Canola producers paid $12.4 million in crop insurance premiums during crop year 2000. Conversations with trade association staff suggest that quality adjustment has not been an important issue for the industry as crops have been free of quality problems in the last ten years. However, green damage, which is mainly caused by unexpected weather conditions, has been a quality problem for producers in recent years. Quantity has been a more important problem overall.

According to extension agronomist Dr. Duane Berglund, of the many kinds of quality problems, farmers have limited control over green damage and almost no control over other damages such as mold and sprouting. These damages are primarily caused by adverse weather conditions. The presence of stones is another problem that is extremely costly for farmers to control. Many other problems, including admixtures and heat damage, can be largely controlled by farmers.

Sunflower

Production and Marketing. The total value of all U.S. sunflower crops produced in 2000 was $241 million. Of this total, $169 million belongs to oil-type sunflower, while $72 million belongs to confectionary sunflower. The major production areas are North and South Dakota, which constitute about 78% of the total U.S. production. The other production areas are Colorado, Kansas, Minnesota, Nebraska and Texas.

Economic Significance of Quality Adjustment and Crop Insurance. Producers paid about $21.5 million in insurance premiums for crop year 2000. Information gathered from elevators, terminals, and other sunflower purchasers reveals that sunflowers, both confectionery and oil, have suffered from a variety of defects over the past few years. There has been some variation in the entire crop yield in terms of quality. A rough estimate had the share of discounted sunflower at 33% to 40% of the entire yield. This estimate includes sunflowers that were discounted for any one of a number of reasons, but the majority of discounts in the 2001 season were the result of insect damage. With such a large share of the sunflower yield suffering from one defect or another, quality adjustment is an important factor for crop insurance now and in the future.

Most of the variation in quality appears to be the result of weather conditions. Although there appears to have been some volatility in quality from one pocket of farmers to another, hot and humid weather conditions have attracted a large number of insects. Insects were responsible for almost the entire damage caused to the sunflower crop in 2001. In 2000, for comparison, the entire damage was caused by sclerotinia. With both types of sunflower, but particularly with confectionery sunflower, there is a need for farmers to protect quality in order to maximize yields; this is the consensus of both the elevator and terminal operators.

For confectionary sunflower, agronomist Duane Berglund suggested that most quality problems are not controllable by the producer. As for oil-type sunflower, producers appear to have reasonable control over heat or heating damage.

Safflower

Production and Marketing. The total value of U.S. safflower production was $30 million in crop year 2000. Most safflower is grown and sold under contract. Major production areas include North and South Dakota, Montana, California, Washington, Idaho and Utah.

Economic Significance of Quality Adjustment and Crop Insurance. Producers paid $666,969 in safflower insurance premiums for the crop year 2000. Safflower production over the past few years has been fairly stable in terms of quantity and quality. However, the Dakotas tend to have more problems with toxins and diseases than Montana and the other western states. According to Dr. Gerald Bergman, the acreage should continue to yield high-quality safflower if weather conditions remain as they have over the recent years.

Many of the discounts levied on safflower for quality deficiencies can be reduced or eliminated through better crop management. According to Dr. Bergman, dockage, foreign material and moisture, for example, should be eliminated. Dockage is determined by a dockage machine and usually includes empty seeds or hulls that are the result of planting late in the season. Discounts for foreign material are taken for excess weeds. Farmers have control over the weed presence in safflower fields, although there is a small amount of unpredictable variation in weed levels.

Two safflower discounts that are more difficult to control by the farmer are oil and heat damage. Oil discounts are taken when the crop has been harvested and there are seeds that are not completely filled or mature. Disease and fungi play a big part in determining a yield’s oil content. However, timely management and frequent use of fungicides can mitigate this effect. We note that the available fungicides are not 100% effective, and Dr. Bergman stated that the industry is currently testing new fungicides with the potential for increased success against diseases.

Rice

Production and Marketing. U.S. rice farming produced $1.1 billion in income in crop year 2000. Rice acres have followed a dramatic upward trend for most of the last century, until the 1990s. The number of acres appears to have leveled at 3 million in recent years. In the last few years, while the total acres planted has not been increasing, there seems to be a shifting of locations, from relatively low-yield areas outside of California to higher-yield areas within California. Domestically, per capita rice consumption has been increasing for the past two decades, currently standing at about 26.5 pounds per year.

The following six regions produce more than 99% of U.S. rice:

- The Arkansas Grand Prairie;
- Northeastern Arkansas and the Bootheel of Missouri;
- The Mississippi River Delta (in Arkansas, Mississippi and northeast Louisiana);
- Southwest Louisiana;
- The Coastal Prairie of Texas; and
- California's Sacramento Valley.

Almost all of the remainder is produced in Florida. Arkansas, with more than 45% of U.S. rice acreage, is the largest producing state. California is the second largest, producing more than 18% of the U.S. crop and boasting the highest yields.

Rice is referred to by length of grain: long, medium and short. Long grain is typically indica rice, while the medium and short grains are typically japonica. Long grain rice, grown almost exclusively in the South, accounts for more than 70% of U.S. production. Medium grain rice, grown both in California and the South, accounts for more than a fourth of total U.S. production and forms the bulk of California's rice crop. California grows more than two-thirds of the U.S. medium grain crop. Arkansas and Louisiana account for almost all of the southern medium grain production. Short grain rice is grown mostly in California and accounts for 1% to 2% of total U.S. production.

Economic Significance of Quality Adjustment and Crop Insurance. Rice has a much higher farm value than many other crops such as grain sorghum, but has a relatively modest crop insurance premium. For crop year 2000, producers paid $20.3 million in insurance premiums for protection against yield failures, which is smaller than grain sorghum or sunflower. Several of the industry people we spoke with concurred that crop insurance is not as important for rice as for other crops. Accordingly, the reasons are:

- Rice is mostly grown in the south, which has relatively mild weather and therefore is less susceptible to yield failures.
- Rice fields are irrigated and thus are insulated from drought or water deficiency, which frequently affects other crops such as soybeans. The only potential problem is persistent flooding, which may affect a farmer's ability to drain the fields; but even that would unlikely cause a catastrophic loss of the crop.
- Perhaps more importantly, rice yield has been increasing every year for the last few years, therefore the value of insurance is perceived to be low by farmers. (Some farmers seem to infer further that the insurance is thus very expensive.)

As for quality adjustment, we were told that it is very infrequent (less than 10% of the time) that farmers would bring deficient-grade rice to the cooperatives or mills. One industry contact suggested that most of the quality problems could be controlled by farmers through proper application of pesticides, drying and other means to safeguard the crops, although these efforts do come at a cost to the farmers. Also, a staff person in a farmers' cooperative in California told us that a substantial proportion of quality problems are caused by the storage process, such as warehouse roof leakage. Furthermore, an extension crop scientist suggested that about half of the time quality problems are caused during storage and processing, while the remaining time the problems are caused during harvesting. Of the problems during harvesting, he estimated that the producer has 50% to 75% control of the quality through timely harvest. Weather and other abnormal situations have 25% to 50% control.

Buckwheat

Production and Marketing. According to Zepp, Harwood, Hamond and Somaru (1996), the farm value of buckwheat output likely ranges from $4 million to $6 million annually, making it the smallest crop in terms of farm value in this study. The leading buckwheat production areas are North Dakota, South Dakota, Minnesota, Washington, New York, Montana and Pennsylvania. About three quarters of the U.S. buckwheat acreage is located in North and South Dakota and Minnesota. The factors affecting buckwheat yield include local growing conditions, variety, soil type and management practices. Yield varies dramatically among states and across time. Yield can range from 184 to 1,840 pounds per acre in New York, or from 500 to 2,000 pounds per acre in Wisconsin and Minnesota. From 1980 through 1995, yield varied from 170 pounds per acre in 1980 to 807 pounds per acre in 1987 in North Dakota. Buckwheat should be sold within a few months of harvest because quality deteriorates continually during storage.

Buckwheat has many uses, including human food, feed, honey crop, etc., but its major use today is for human food, such as an ingredient for pancake mix or oriental noodles. It is almost always grown under contract, with the seed furnished by the contracting company. The main contracting company for the northern Midwest area is Minn-Dak Growers, Ltd. The main contracting company for the New York/Pennsylvania area is Birkett Mills in Penn Yan, New York.

Economic Significance of Quality Adjustment and Crop Insurance. Production perils for buckwheat include excessive heat, drought, wind damage, heavy rainfall, pesticide residues, hail and fall frosts. According to agronomist Duane Berglund, most of the production perils lead to quantity loss instead of quality problems, so even though yield is highly volatile, quality adjustment should be relatively unimportant for buckwheat crop insurance. Agronomist Dr. Thomas Bjorkman also concurred that only 10% of the variation in income from buckwheat production is caused by quality problems.

Buckwheat is primarily examined for three different criteria in the U.S. These criteria (or quality measures) are dockage, moisture content and test weight. Dr. Bjorkman mentioned that farmers have control over dockage and have a minimal level of control over test weight. Farmers typically, however, do not attempt to clean the buckwheat thoroughly with proper combine adjustment because they often have a higher paid weight even after the dockage discount than they would if they had cleaned their crop entirely. Other minor discounts that are rarely assessed are odor discounts from poor storage combined with high moisture content and damage discounts, which are usually part of the dockage discount. These discounts are both controllable, yet highly infrequent.

CURRENT PROGRAM REVIEW

Prior to 1995, quality deficiency adjustments were created using the actual price received for a given producer's commodity (excluding quality discounts for non-covered causes of loss) compared with the U.S. No. 2 price. This method had the advantage of making a direct measurement of a producer's loss due to quality deficiencies, rather than approximating the loss using national average discounts. However, RMA determined that this advantage was outweighed by the following drawbacks:

- Low prices due solely to supply and demand effects;
- The potential for price manipulation by producers or warehouses; and
- Daily price variations.

The current procedure indemnifies producers for covered quality deficiencies using predetermined quality discount factors (DF). The discount factors are based on FSA loan discounts for crop years 1997 through 1999. These discount factors thus represent a national average of quality discounts which may vary from local or regional discounts.

A grader licensed by the United States Grain Study Act or United States Warehouse Act is required to determine many of the factors that affect quality. The quality adjustment factor (QAF) is unity less the sum of the pre-determined DFs. (The QAF is limited to a minimum of zero.) The production is multiplied by the QAF in determining the production-to-count.

Following is a partial list of crop quality perils[13].

- **Harmful Substances:** Crops found to be contaminated with harmful substances are graded as "U.S. Sample grade." Examples of harmful substances include animal filth, glass and stones.
- **Objectionable Odors:** Commodities with musty, sour or commercially objectionable foreign odors are labeled U.S. Sample grade.
- **Heating:** Heating refers to commodities that are spoiling due to insect infestation or the action of microorganisms in grain with high moisture content. These commodities are graded U.S. Sample grade.
- **Insect Infestation:** The presence of live insects results in a grade of "infected."

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[13] Source: USDA; *Inspecting Grain*, *Practical Procedures for Grain Handlers*.

- **Test Weight:** Test weight refers to the weight of a commodity of a standard volume (for example, one Winchester bushel). "Dockage" (extraneous material that may be removed with sieves or other cleaning devices) is removed before weighing. Lower test weights reduce the commodity's grade.

- **Foreign Material:** A higher amount of extraneous material, other than dockage, reduces a commodity's grade.

- **Damaged Kernels:** Kernels may be damaged due to heat, frost, rot, mold or other causes that generally result in a change in color or kernel texture. A higher percentage of damaged kernels reduces a commodity's grade.

- **Aflatoxin:** Harmful levels of aflatoxin may be produced by certain types of mold that may be found in corn or grain sorghum grown under stressful conditions such as drought.

- **Vomitoxin:** Scab or head blight may result from vomitoxin, a naturally occurring mycotoxin (toxin produced by fungus).

The perils currently covered for each crop are listed in Exhibit 1.

MARKET RESEARCH

Objective

We conducted a substantial amount of market research to determine how discount schedules vary among regions and over time. More specifically, we attempted to identify the patterns by which discount rates varied across regions in the U.S. The answers to these questions provide the basis for our recommendations on the optimal quality adjustment program which balances costs and accuracy.

Data Sources

We spoke with various trade organizations, different agencies of the USDA and USDA extension service agronomists, and extensively reviewed the relevant literature on agricultural economics and crop insurance. Based on these efforts, we identified the following potential data sources:

AMS daily market price and weekly cotton quality data: The AMS daily market prices are market prices for the standard grades of most crops in major terminal areas, based on daily surveys of elevators. Among them, AMS cotton market prices include complete daily prices for all classes of cotton traded in each of the seven spot markets. The AMS Cotton Program's weekly cotton quality data file contains classification information for all bales classed in a given week, as well as the state or number of the relevant classing office.

FSA Loan Program: FSA maintains a significant amount of data containing transaction information and market prices and discount rates used in the marketing assistance program. The FSA data include:

- The quantity and quality of the crops used to take out non-recourse loans for each customer for the last three years. Limited payment information by customer is also available up to the last ten years. Also, data by entities obtaining loan deficiency payments is maintained, but with far more limited information on the quality of the crop used to obtain the payments.
- Posted daily county prices for various crops based on daily surveys of market prices from the AMS and price differentials across counties; the price differentials are based on surveys conducted in the 1980s and timely updating based on changes in market conditions.
- Annual countrywide quality deficiency discount rates for various crops: the discount rates are based on surveys of producers.

ERS surveys of producers: ERS, in conjunction with other USDA agencies, conducted various surveys of the marketplace for different research projects, both in the past and on an ongoing basis. These data elements revealed many issues including the extent of information problems in the agricultural production process, which provided background information for this analysis. In general, however, these data do not contain enough quality adjustment information for them to be directly useful for this analysis.

Milliman Survey. Other than the cotton market data, we are unaware of any other source of data that would provide U.S. regional quality discount rates for the crops within the scope of this study. We thus concluded that to obtain local discount rates, a direct survey of local elevators and oilseed purchasers was essential.

Survey of Elevators

Milliman contacted by phone 360 different grain terminals, elevators and warehouses. These terminals or elevators were chosen from the FSA list of the uniform grain and rice storage agreement approved warehouse list. We first chose all of the states that produce at least ten percent of the crops within the scope of this study. We then contacted one elevator from each county until we had obtained at least ten responses.

In addition to the above procedure, we also directly contacted six major grain purchasers or terminal elevators based on recommendations from Mr. Tim Murray of the FSA. We received limited response from these companies. The reasons for separately contacting these corporations include:

- They may have a better record of discount schedules;
- They have large amounts of information because they purchase many crops through their elevators in various locations; and
- They are particularly representative or influential of the actual market condition because their volume of transactions is large.

Ideally, we wanted to have a target number of responses for each crop. However, a number of factors hindered our goal. We did not know which elevator was selling which crop and some elevators did not send us discount schedules for all of the crops they purchase. Thus, the response rate was unpredictable.
In the end, we received responses from over 200 sources. We obtained faxed discount schedules from 113 elevators, 8 were relayed over the phone, and eighty two replied that they followed other elevators. The

schedules included corn, soybeans, HRW wheat, SRW wheat, soft white wheat, spring wheat, dark northern spring wheat, white club wheat, durum wheat, barley, oats, rye, flax, canola, oil sunflower and confectionary sunflower. The elevators that imitated a terminal's schedules tended to conduct business with that particular terminal and would transfer the exact same discounts down to the farmer.

Of the terminals and elevators that responded to us, 117 purchase corn, 85 purchase soybeans, 72 purchase wheat,[14] 30 purchase oats, 33 purchase barley, 17 purchase sunflower, and one purchases rye. We received 45 discount schedules for soybeans, 58 discount schedules for corn, 11 discount schedules for oats, 8 discount schedules for barley, and 7 discount schedules for sunflowers (confectionary and oil). The elevators and terminals that make up the difference between the number of purchasers and the number of suppliers of discount schedules either did not provide any information or simply followed the schedules of a larger terminal.

Analysis Procedure

The quantitative analyses comprise the following steps:

1. data transformation;
2. analysis of the distribution of average discount levels and correlation coefficients among discount schedules;
3. cluster analysis of discount schedules;
4. nonparametric tests of the equality of discount levels for the average discount rates across RMA regional office regions;
5. computation of the average discount schedules for regional office regions.

Step 1 transforms discount schedule data to common units and common quality ranges so that comparisons and groupings of different discount rates are feasible. Based on step 2, we found that in general, while discount schedules tend to be highly correlated (indicating that they have similar pattern of

[14] Originally, we also analyzed the discount schedules for different classes of wheat separately. For the 7 different types of wheat listed, 32 discount schedules were received via fax or phone out of 64 contacted elevators and terminals that purchase HRW wheat; twelve schedules were received out of 23 contacted elevators and terminals that purchase SRW wheat; nine schedules were received out of 29 contacted terminals and elevators that purchase spring wheat; six schedules were received out of 16 contacted terminals and elevators that purchase soft white wheat; three schedules were received out of 9 contacted terminals and elevators that purchase durum wheat; four schedules were received out of four contacted elevators and terminals that purchase white club wheat; and six discount schedules were received via fax or phone out of 10 contacted terminals and elevators that purchase dark northern spring wheat.

variations), discount levels vary by large magnitudes. Step 3 determines how elevators group together if we group them based on the similarity in discount rates.[15] In general, cluster analysis suggested that similar discount schedules are frequently widely scattered in groups that are not geographically contiguous. Having geographically discontinuous regions does not pass the tests of reasonableness or administrative efficiency. We further applied judgment and cluster analysis results to draw regions with relatively similar discount schedules. As it turned out, it appeared that there was significant correlation between the regions drawn by cluster analysis and the regions under the geographic domains of the RMA regional offices. Considering that using the domains of RMA regional offices should significantly reduce the administrative costs of regional discount schedules, we turned to that as a preferred approach.

Step 4 explores whether RMA regions improve the accuracy of quality discount rates by testing if there is statistical evidence that average discount schedules vary by RMA regions. The statistical tests we relied upon were repeated for each peril. Based on the results of step 4, it appears that RMA regions have different discount schedules for corn, soybean, wheat, and grain sorghum. However, it was frequently the case that the discount rates did not differ across regions for all of the perils covered. We recommended regional discount schedules for all perils as long as there were enough discount rate differences for some important perils for the crop. Based on our experience with the survey, as long as country elevators provided the discount schedules, they usually included multiple perils. Step 5 computes the regional discount rates for these four crops, as well as the countrywide discount rates for all other crops.

Two common problems emerged in step 5. First, for each crop we did not receive any discount schedules for some RMA regions. (Typically, this was the case in regions that are not the major producers of the crop in question.) We considered two options for choosing the discount schedules for these regions. One was to use discount schedules applied to all regions in the country that we received from major terminal elevators, and the other was to use the average of all discount schedules. Upon review of the discount schedules computed, it appears that using the average of all discount schedules might be a better approach. The problem with using the countrywide discount schedules is that there were only a few of them; as a result, the average of those discount schedules sometimes has erratic patterns such as large fluctuations in discount rates in different quality ranges, which appears unreasonable.

Another common problem encountered in this step is that many of the discount schedules cover different levels of deficiency of the quality factor. For example, one discount schedule would cover 5% through

[15] The measure of similarity is the Euclidean distance between two discount schedules, which is the square root of the sum of

15% damage, one would cover 10%-20% and then indicate that prices for damage above 20% were subject to negotiation, and yet another would specify a discount rate per percent above 15% without specifying an ending point or maximum damage amount. For the last case, we simply could not determine if this discount rate would apply all the way up to 20%, 30%, or higher damage, and when we inquired of a few country elevators about this issue, the responses were frequently vague (such as "farmers rarely or never bring in anything below a certain level"). We thus picked the ending points of the discount ranges simply by looking at where most other schedules stop. If beyond a certain point the discount rate is based on negotiation, then data entry would stop at that point. Indeed, even if the discount schedule specifies an end point, based on conversations with country elevators, it is possible that the country elevator would still accept crops beyond that point of quality problem with a discount, depending on market conditions, relationship with the producer, and the like. It is thus difficult to determine the ending point for a discount schedule.

The results of all of the analyses are voluminous. To minimize the volume in the main text of this report, we present only selected results from the comparisons of discount levels, the nonparametric tests of the equality of discount levels across RMA regions, and the recommended discount schedules based on the average discount levels computed. Summary statistics for the correlation coefficients among the discount schedules of elevators are provided in the Appendix. For the convenience of reporting, the regions belonging to each of the RMA regional offices are assigned a number as shown in the following table.

Table 1. Definition of RMA Regions (in random order)

Region No.	States
1	IA, MN, WI
2	MT, ND, SD, WY
3	CO, KS, MO, NE
4	IL, IN, MI, OH
5	AK, ID, OR, WA
6	NM, OK, TX
7	AZ, CA, HI, NV, UT
8	AR, KY, LA, MS, TN
9	AL, FL, GA, SC
10	CT, DE, ME, MA, MD, NH, NJ, NY, NC, PA, RI, VT, VA, WV

Data Transformation. For each particular quality factor, the discount schedules of various elevators are frequently in a mixture of percentage and dollar discount units. In such a case, the data must be transformed to a common unit so that comparisons and groupings are feasible. For that purpose, we either multiplied percentage discounts by the average December 2001 FSA relevant posted county price to

square distance between the discount rates across all common quality ranges.

obtain the dollar discount or divided dollar discounts by the same posted county price to obtain the percentage discount. The average posted county price appears to be the relevant price because, based on conversations with elevators, the discount schedules do not vary with daily price variations, and the survey was conducted during December 2001.

For certain terminal elevators or large corporations purchasing crops through multiple elevators from different locations, their discount schedules may apply to large regions or the whole country. In that event, we used the simple average of the PCP prices of all counties included in the relevant region as the PCP price.

In addition, the discount schedules of different elevators often have different increments. For example, company A's discount schedule might state an incremental discount of 2 cents for every 2% kernel damage from 14% up to 20%. Company B's discount schedule might state 1 percent discount for each additional 0.5% from 15% up to 19.5% kernel damage. To make them consistent, we would convert the discount schedule of company A to the scale of every half percent from 14% up to 20% using linear interpolation (drawing a straight line to join the two adjacent points).

Corn Analysis

The corn crop insurance contract applies quality adjustment for low test weight, kernel damage, musty, sour, or commercially objectionable odor (COFO) leading to a quality level of U.S. Standard Grade 5 or worse; or substance or conditions injurious to human or animal health.

Discount Level Comparisons. Since not all discount schedules cover the same range of deficiencies, it is not meaningful to compare the averages of each discount schedule for each quality factor. Instead, we compare the average discount rates for the ranges of deficiency shared by all discount schedules. The distribution of the averages is shown in the following tables. It indicates two general patterns:

- large discount variations, and
- highly skewed discount distribution.

The first suggests that there is potential for regional discount rates to improve the accuracy of quality discount rates. The second suggests that parametric analysis of variance, which usually assumes normal distribution in the underlying variables, is not the proper approach for testing the similarity of discounts across different regions.

Table 2. Average Discounts for Test Weights 52-53 (cents)

	ID	Discount		ID	Discount		ID	Discount
1	NE166	-7	19	NE184	-2	37	NE205	-1.5
2	SD056	-7	20	NE186	-2	38	IL206	-1.5
3	KS037	-6	21	IL009	-1.5	39	IL207	-1.5
4	KS121	-6	22	CO012	-1.5	40	IL212	-1.5
5	NE071	-5.5	23	WI029	-1.5	41	KS214	-1.5
6	MN026	-5	24	MN031	-1.5	42	MO215	-1.5
7	IA088	-3.5	25	NE051	-1.5	43	NE216	-1.5
8	SD002	-3	26	CO102	-1.5	44	IO218	-1.5
9	SD049	-3	27	IA114	-1.5	45	IL219	-1.5
10	SD067	-3	28	IL117	-1.5	46	IL221	-1.5
11	TX068	-3	29	IA122	-1.5	47	US222	-1.5
12	NE069	-3	30	WI156	-1.5	48	IL223	-1.5
13	IA074	-3	31	IA163	-1.5	49	IL224	-1.5
14	IL119	-3	32	KS172	-1.5	50	MN225	-1.5
15	SD127	-3	33	NE181	-1.5	51	IL226	-1.5
16	KS013	-2.5	34	AX182	-1.5	52	IA227	-1.5
17	WI148	-2	35	IA198	-1.5	53	WI171	-1
18	IA157	-2	36	IL200	-1.5			

Table 3. Average Discounts for 5%-7% Damage (cents)

	ID	Discount		ID	Discount		ID	Discount
1	SD046	-5	15	IA122	-2	29	NE181	-1
2	SD056	-4	16	IA157	-2	30	IL200	-1
3	KS037	-3	17	NE184	-2	31	IL206	-1
4	KS172	-3	18	NE186	-2	32	IL207	-1
5	MN031	-2.5	19	SD002	-1	33	IL212	-1
6	IA114	-2.3	20	IL009	-1	34	IO218	-1
7	IA198	-2.3	21	SD049	-1	35	IL221	-1
8	NE051	-2	22	GA065	-1	36	US222	-1
9	SD067	-2	23	IL117	-1	37	IL223	-1
10	TX068	-2	24	SD127	-1	38	IL224	-1
11	NE069	-2	25	WI148	-1	39	MN225	-1
12	NE071	-2	26	WI156	-1	40	IL226	-1
13	IA074	-2	27	IA163	-1	41	IA227	-1
14	IL119	-2	28	WI171	-1			

Table 4. Discount for COFO (cents)

	ID	Discount		ID	Discount		ID	Discount
1	IL119	-20	7	IL207	-10	13	IA114	-5
2	MN026	-20	8	NE069	-10	14	IA198	-5
3	IL200	-10	9	NE184	-10	15	IL206	-5
4	IL219	-10	10	NE186	-10	16	IL212	-5
5	IL226	-10	11	WI148	-10	17	NE216	-5
6	IL117	-10	12	IA074	-5			

Table 5. Discount for Musty (cents)

	ID	Discount		ID	Discount		ID	Discount
1	AX182	-10	15	IA074	-5	29	MO215	-5
2	IA088	-10	16	IA114	-5	30	NE051	-5
3	IL119	-10	17	IA198	-5	31	NE216	-5
4	KS172	-10	18	IA157	-5	32	NE069	-5
5	KS013	-10	19	IL223	-5	33	NE181	-5
6	MN026	-10	20	IL206	-5	34	NE205	-5
7	NE184	-10	21	IL224	-5	35	SD002	-5
8	NE186	-10	22	IL200	-5	36	SD127	-5
9	NE071	-10	23	IL212	-5	37	US222	-5
10	WI171	-10	24	IL219	-5	38	WI156	-5
11	IA122	-7	25	IL226	-5	39	WI029	-5
12	TX068	-7	26	KS037	-5	40	IL117	-3
13	GA065	-5	27	KS214	-5	41	IL207	-3
14	IA163	-5	28	MN031	-5	42	IO218	-3

Table 6. Discounts for Sour (cents)

	ID	Discount		ID	Discount		ID	Discount
1	IL119	-15	14	NE184	-10	27	IA198	-5
2	AX182	-10	15	NE186	-10	28	IL206	-5
3	GA065	-10	16	NE205	-10	29	IL224	-5
4	IA163	-10	17	NE071	-10	30	IL200	-5
5	IA088	-10	18	SD127	-10	31	IL212	-5
6	IA157	-10	19	TX068	-10	32	IL219	-5
7	IL223	-10	20	US222	-10	33	IL117	-5
8	IL226	-10	21	WI156	-10	34	IL207	-5
9	KS037	-10	22	WI171	-10	35	NE051	-5
10	KS172	-10	23	WI148	-10	36	NE216	-5
11	KS214	-10	24	IA122	-7	37	SD002	-5
12	MO215	-10	25	IA074	-5	38	WI029	-5
13	NE069	-10	26	IA114	-5			

Statistical Tests. We performed the Kruskal-Wallis test for the equality of the average discount rates across RMA regions. The KW test is a nonparametric test that does not assume that the discount rates have a particular distribution. The results are shown in the table below. Except for Sour, all of the p-values are significant at the 5% level. This indicates that the average discounts differ significantly across regions.[16]

Table 7. Results of Testing the Equality of Discounts Across RMA Regions

Analysis Variable	Kruskal-Wallis Statistic	Degree of Freedom	p-value
Damage	16.1	4	0.003
TW	15.3	4	0.004
Musty	9.3	4	0.055
Sour	4.8	4	0.307

Discount Schedules Computation. The statistical tests suggest that discount schedules based on RMA regions could be more accurate than a national schedule. We thus computed the actual average discount schedule for each region.

[16] The p-value is an indicator of the significance of a test. The lower the p-value, the less likely that the observed difference across regions is a coincidence instead of a pattern. A p-value of 10% is a common convention used by academic studies as an evidence of statistical significance.

For U.S. Standard Grade discounts, the average discount for Grade 5 due to test weight, kernel damage or total broken and foreign material was computed for each elevator. Some elevators have discounts for only one or two of the three quality factors, in which case the missing item was ignored for this computation. Based on the average of each elevator, we computed the average discount for Grade 5 for each region. This process was repeated to obtain the regional discount rates for sample grade. Similarly, the averages for musty, sour, COFO, and the incremental discounts for test weight, damage, aflatoxin, and TB & FM were computed separately. For these computations, the discount schedules for each region were based on the elevators that purchase crops exclusively from that region. Although some terminal elevators may have provided a discount schedule applying to the whole country, we could not identify the parts of the country from which they purchase crops. Thus, these discount schedules were included in the computation of the national average.

The average discount rates are displayed in the table below. Discounts for RMA regions 1, 2, 3, 4, and 6 are based on survey discount schedules from these regions. The national discount schedule is the average of all discount schedules. The current discount schedule is also displayed to allow for a comparison of the current and the computed discount schedules. Discounts for aflatoxin and infested are also included, in case that they are covered perils. We obtained only one discount schedule for aflatoxin, hence the recommendation is based on one discount schedule only.

Regional discount schedules for corn are broadly similar, and generally comparable to the current schedule. (An exception to this is that the proposed incremental discounts for test weight are greater than the current discounts.) Although the current schedule shows discounts for test weight below 54 lbs., the requirement for indemnity under the corn policy is a quality deficiency that renders the corn grade 5 or below. We provide a grade 5 discount, and note that the lowest test weight for grade 5 is 46 lbs., hence our proposed schedule shows an incremental discount only below that weight. This is consistent with the basic principle that quality discounts should be used when a crop falls below the threshold specified in the policy, and that incremental discounts should be applied beyond that level.

Table 8. Current Discount Schedule and Average Discount Schedules Based on Survey Corn

		Region					
	Current	1	2	3	4	6	National
Grade 5		15	19	21	10	16	15
Sample Grade	15	20	20	21	14	18	20
TW (lbs) below 54	1/lb	N/A	N/A	N/A	N/A	N/A	N/A
TW (lbs) below 50	2/lb	N/A	N/A	N/A	N/A	N/A	N/A
TW (lbs) below 46	2/lb	4/lb	5/lb	4/lb	3/lb	3/lb	3/lb
Kernel Damage (%) above 5	2/%	N/A	N/A	N/A	N/A	N/A	N/A
Kernel Damage (%) above 15	3/%	3/%	2/%	4/%	4/%	2/%	2/%
Musty	10	7	5	7	5	7	6
Sour	10	8	8	9	7	10	8
COFO	10	9	9	9	10	9	9
Aflatoxin	N/A	25/20-120 ppb; 40/121-200 ppb; 60/201-250 ppb; 75/251-300 ppb					
Infested	N/A	7	10	6	8	10	7
Observations		16	5	17	12	1	53

Notes:
1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. "Observations" is the number of discount schedules used to compute the regional averages. It is possible that not all entries in the same region used the total number of observations.

Soybean Analysis

The current soybean crop insurance policy applies quality adjustment to US sample grade soybeans caused by weight or kernel damage, musty, sour, commercially objectionable odor, or garlicky; or substances or conditions injurious to human or animal health.

Comparisons of Average Discount Rates. For kernel damage and other damages, the discount rates vary by up to a few hundred percents from elevator to elevator and are highly skewed. The test weight discounts are still skewed, but less so than damage discounts. More than half of the average discounts are about 1 cent/bushel for test weight 52-54 pounds/bushel.

Table 9. Average Discounts for 2% - 3% Damage

	ID	Discount		ID	Discount		ID	Discount
1	SD049	-0.78%	9	IA074	-0.35%	17	IL009	-0.22%
2	KS003	-0.62%	10	MS204	-0.35%	18	IL224	-0.22%
3	IA122	-0.54%	11	WI006	-0.25%	19	IL200	-0.15%
4	SD067	-0.52%	12	MN225	-0.25%	20	SD127	-0.14%
5	IL119	-0.44%	13	IA227	-0.23%	21	MN050	-0.12%
6	NE184	-0.37%	14	KS081	-0.23%	22	WI148	-0.12%
7	NE069	-0.36%	15	IL226	-0.23%	23	IL207	-0.11%
8	NE051	-0.36%	16	IL206	-0.22%	24	IL117	-0.11%

Table 10. Average Discounts for Test Weights 52 – 54 lbs.

	ID	Discount		ID	Discount		ID	Discount
1	SD067	-2	15	IA122	-1	29	NE069	-0.5
2	IL119	-2	16	WI148	-1	30	KS081	-0.5
3	SD127	-2	17	IA163	-1	31	IL200	-0.5
4	NE184	-1.3	18	IL206	-1	32	MN202	-0.5
5	SD002	-1	19	IL207	-1	33	MS204	-0.5
6	WI006	-1	20	IL217	-1	34	NE205	-0.5
7	IL009	-1	21	US222	-1	35	OK210	-0.5
8	WI029	-1	22	IL223	-1	36	IA211	-0.5
9	MN050	-1	23	IL224	-1	37	NE213	-0.5
10	NE051	-1	24	IL226	-1	38	IA220	-0.5
11	NE071	-1	25	SD049	-0.6	39	MN225	-0.5
12	IA074	-1	26	KS003	-0.5	40	IA227	-0.5
13	IL117	-1	27	NE004	-0.5			
14	KS121	-1	28	KS013	-0.5			

Table 11. Average Discounts for COFO

	ID	Discount		ID	Discount		ID	Discount
1	WI148	-25	6	IL117	-10	11	NE184	-10
2	IL119	-20	7	IL200	-10	12	NE205	-10
3	IL207	-15	8	IL206	-10	13	NE213	-10
4	IA211	-10	9	IL217	-10	14	OK210	-10
5	IA220	-10	10	NE004	-10	15	IA074	-5

Table 12. Average Discounts for Musty

	ID	Discount		ID	Discount		ID	Discount
1	IA088	-10	13	NE213	-10	25	IL206	-5
2	IA163	-10	14	OK210	-10	26	IL207	-5
3	IA211	-10	15	SD002	-10	27	IL223	-5
4	IL119	-10	16	SD127	-10	28	IL224	-5
5	IL217	-10	17	WI006	-10	29	IL226	-5
6	KS013	-10	18	WI148	-10	30	KS003	-5
7	KS081	-10	19	IA122	-7	31	MS204	-5
8	MN202	-10	20	IA074	-5	32	NE051	-5
9	NE004	-10	21	IA157	-5	33	US222	-5
10	NE069	-10	22	IA220	-5	34	WI029	-5
11	NE184	-10	23	IL117	-5			
12	NE205	-10	24	IL200	-5			

Table 13. Average Discounts for Sour

	ID	Discount		ID	Discount		ID	Discount
1	IL119	-15	13	MN202	-10	25	MN050	-10
2	IA088	-10	14	NE004	-10	26	IA122	-7
3	IA163	-10	15	NE069	-10	27	IA074	-5
4	IA211	-10	16	NE184	-10	28	IA157	-5
5	IA220	-10	17	NE205	-10	29	IL200	-5
6	IL117	-10	18	NE213	-10	30	IL224	-5
7	IL206	-10	19	OK210	-10	31	KS003	-5
8	IL207	-10	20	SD002	-10	32	MS204	-5
9	IL217	-10	21	SD127	-10	33	NE051	-5
10	IL223	-10	22	US222	-10	34	WI029	-5
11	IL226	-10	23	WI006	-10			
12	KS081	-10	24	WI148	-10			

Statistical Tests. We then performed a nonparametric Kruskal-Wallis test on the average discount rates of elevators among the RMA regions. The results of the KW tests are displayed in the table below. The results are somewhat mixed; there is strong statistical evidence suggesting that the discount rates for musty are different, and less strong evidence (about 10% statistical significance) that discounts for kernel damage are different among the regions. For test weight discounts, there is an almost 10% level statistical significance for the variation of test weight discounts among RMA regions. The evidence in general suggests that discounts for sour and COFO are not significantly different across RMA regions.

Table 14. Results of Testing the Equality of Discounts Across RMA Regions

Analysis Variable	Kruskal-Wallis Statistic	Degree of Freedom	p-value
Damage	7.1	3	0.070
TW	7.1	4	0.132
COFO	2.1	3	0.555
Musty	13.6	4	0.009
Sour	5.7	4	0.225

Discount Schedules Computation. The computation procedure for the regional discount schedules is similar to that for corn. The regional discount schedules are displayed in the following table. The current crop insurance policy also specify quality adjustment for substances or conditions injurious to human or animal health. We have included discounts for green, frost and infested damage, in case that they are covered perils. The recommendation for frost damage is based on the only one discount schedule for frost we obtained.

There is considerable variation in the sample grade discount rates across regions. Other than that, the proposed discount levels seem relatively similar to the current discounts. Also, the current schedule has discounts for test weight and kernel damage beginning at levels before those required to reach sample grade. Since quality deficiency due to a covered peril must at least equal the amount of the deficiency required to reach sample grade, our recommended incremental discounts begin at those levels.

Table 15. Current Discount Schedule and Average Discount Schedule Based on Survey Soybeans

<table>
<tr><th></th><th></th><th colspan="6">Region</th></tr>
<tr><th></th><th>Current</th><th>1</th><th>2</th><th>3</th><th>4</th><th>6</th><th>National</th></tr>
<tr><td>Sample Grade</td><td>15</td><td>8</td><td>18</td><td>13</td><td>11</td><td>N/A</td><td>12</td></tr>
<tr><td>TW (lbs) below 54</td><td>.5/lb</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>TW (lbs) below 49</td><td>1/lb</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>TW (lbs) below 48</td><td>N/A</td><td>1/lb</td><td>2/lb</td><td>1/lb</td><td>1/lb</td><td>1/lb</td><td>1/lb</td></tr>
<tr><td>Damage (%) above 2</td><td>1/half %</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Damage (%) above 8</td><td>2/half %</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Damage (%) above 9</td><td>N/A</td><td>1.5/half %</td><td>2/half %</td><td>2.5/half %</td><td>2/half %</td><td>2/half %</td><td>2/half %</td></tr>
<tr><td>Musty</td><td>5</td><td>8</td><td>10</td><td>9</td><td>6</td><td>10</td><td>8</td></tr>
<tr><td>Sour</td><td>10</td><td>8</td><td>10</td><td>9</td><td>9</td><td>10</td><td>9</td></tr>
<tr><td>COFO</td><td>20</td><td>13</td><td>11</td><td>10</td><td>13</td><td>10</td><td>11</td></tr>
<tr><td>Garlicky</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Green</td><td>N/A</td><td>2/% above 9 up to 15%</td><td>N/A</td><td>3/% above 9 up to 15%</td><td>1% for 10% green</td><td>N/A</td><td>2/% above 9 up to 15%</td></tr>
<tr><td>Frost</td><td>N/A</td><td colspan="6">2/half % above 9</td></tr>
<tr><td>Infested</td><td>N/A</td><td>9</td><td>10</td><td>N/A</td><td>8</td><td>N/A</td><td>9</td></tr>
<tr><td>Observations</td><td>N/A</td><td>13</td><td>4</td><td>11</td><td>10</td><td>1</td><td>40</td></tr>
</table>

Notes:
1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. "Observations" is the number of discount schedules used to compute the regional averages. It is possible that not all entries in the same region used the total number of observations

Grain Sorghum Analysis

The current quality adjustment factors for grain sorghum crop insurance are sample grade caused by test weight damage, kernel damage, musty, sour and COFO; or substances or conditions injurious to human or animal health.

Comparison of Average Discount Rates. The following tables display the variations of discount rates across elevators. In general, discount rates vary a great deal among elevators, suggesting that there might be improvements in accuracy in using regional discount schedules.

Table 16. Average Discounts for 5% - 10% Damage (cents)

	ID	Discount		ID	Discount		ID	Discount
1	US222	-6	4	NE184	-5	7	KS037	-3
2	IL224	-6	5	NE186	-5	8	NE188	-3
3	KS081	-5	6	KS209	-5	9	KS003	-1

Table 17. Average Discounts for Test Weights 51 - 54 lbs.

	ID	Discount		ID	Discount		ID	Discount
1	IL223	-2.50%	9	MO215	-1.81%	17	KS081	-1.33%
2	KS121	-2.38%	10	NE205	-1.76%	18	KS037	-1.22%
3	TX062	-2.33%	11	US222	-1.75%	19	KS013	-1.07%
4	KS021	-2.13%	12	TX147	-1.59%	20	NE184	-0.87%
5	OK210	-2.06%	13	KS214	-1.55%	21	NE186	-0.87%
6	KS209	-1.85%	14	NE181	-1.38%	22	KS010	-0.66%
7	TX060	-1.84%	15	NE216	-1.37%	23	NE188	-0.65%
8	IL224	-1.82%	16	NE071	-1.36%	24	KS003	-0.61%

Table 18. Average Discounts for Musty

	ID	Discount		ID	Discount		ID	Discount
1	NE216	-20	7	NE071	-10	13	IL223	-8
2	KS081	-15	8	NE184	-10	14	IL224	-5
3	KS013	-10	9	NE186	-10	15	KS003	-5
4	KS209	-10	10	NE205	-10	16	KS037	-5
5	KS214	-10	11	OK210	-10	17	US222	-5
6	MO215	-10	12	TX147	-10	18	NE188	-3

Table 19. Average Discounts for Sour

	ID	Discount		ID	Discount		ID	Discount
1	NE216	-20	7	KS214	-10	13	OK210	-10
2	KS081	-15	8	MO215	-10	14	TX147	-10
3	KS209	-12	9	NE071	-10	15	US222	-10
4	IL223	-10	10	NE184	-10	16	IL224	-5
5	KS003	-10	11	NE186	-10	17	NE188	-3
6	KS037	-10	12	NE205	-10			

Table 20. Average Discounts for COFO

	ID	Discount		ID	Discount		ID	Discount
1	NE216	-20	2	NE184	-10	3	NE186	-10

Statistical Tests. The test results displayed below suggest that there is statistical evidence of significant variation in test weight discounts among RMA regions, but not for other quality factors. Considering that test weight is an important quality factor which is frequently due to insurable cause, we believe that this provides a reason to suggest regional discount schedules.

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Table 21. Results of Testing the Equality of Discounts Across RMA Regions

Analysis Variable	Kruskal-Wallis Statistic	Degree of Freedom	p-value
Damage	1.2	1	0.27
TW	6.8	2	0.03
Musty	2.6	2	0.28
Sour	3.2	2	0.20

Discount Schedules Computation. Based on the statistical test results, we compute the regional average discount rates. They are shown in the table below. We included Tan discounts in case that it is a covered peril. All Tan discount schedules we received are identical. The recommended Tan discount schedule is identical in all regions.

The proposed sample grade discount for grain sorghum is substantially lower than the current discounts for sample grade, musty sour and COFO. The proposed discounts, however, has higher discounts for kernel damage. Also, the current schedule has discounts for test weight and kernel damage beginning at levels before those required to reach sample grade. Since quality deficiency due to a covered peril must at least equal the amount of the deficiency required to reach sample grade, our recommended incremental discounts begin at those levels.

Table 22. Current Discount Schedule and Average Discount Schedule Based on Survey Grain Sorghum

		Region			
	Current	**3**	**4**	**6**	**National**
Sample Grade	30	12	13	19	14
TW (lbs) below 55	2/lb	N/A	N/A	N/A	N/A
TW (lbs) below 51	4/lb	N/A	N/A	N/A	N/A
TW (lbs) below 50	4/lb	3/lb	4/%	5/%	4/%
TW (lbs) below 44	4/lb	4 /lb	4/%	5/%	4/%
Kernel Damage (%) above 5	2/%	N/A	N/A	N/A	N/A
Kernel Damage (%) above 6	3/%	N/A	N/A	N/A	N/A
Kernel Damage (%) above 16	3/%	2/%	3/%	2/%	2/%
Kernel Damage (%) above 20	3/%	3/%	3/%	3/%	3/%
Kernel Damage (%) above 25	2/%	3/%	3/%	3/%	3/%
Musty	10	10	7	10	9
Sour	20	11	8	10	10
COFO	20	13	13	13	13
Special Grade Reqd. for Smutty	N/A	N/A	N/A	N/A	N/A
Tan	N/A	4/% above 1% Tan			
Observations		17	2	4	24

Notes: 1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. "Observations" is the number of discount schedules used to compute the regional averages. It is possible that not all entries in the same region used the total number of observations.

Wheat Analysis

The current wheat policy applies quality adjustment to Grade 5 or Sample grade wheat caused by test weight damage, kernel damage, shrunken or broken kernels defects, musty, sour, COFO, grading garlicky, light smutty, smutty, or ergoty, and substances or conditions injurious to human or animal health.

Discount Rates Comparison. The following tables compare the average discount rates among RMA regions for each peril covered by the current policy. Only six elevators have separate grade discounts in the quality discount schedules.

Table 23. Average Test Weight Discount Rates in 58-56 lbs.(cents/bushel)

	ID	Discount		ID	Discount		ID	Discount
1	ND034	-30	17	KS121	-6	32	IL117	-4
2	ND145	-16	18	TX022	-6	33	IL201	-4
3	ID112	-7	19	US222	-5	34	NE184	-4
4	KS214	-7	20	SH113	-5	35	NE186	-4
5	MO215	-7	21	KS021	-5	36	TX083	-4
6	NE205	-7	22	WI029	-5	37	WI148	-4
7	NE228	-7	23	US187	-4	38	CO072	-4
8	SD002	-7	24	NE166	-4	39	OK066	-3
9	US175	-7	25	NE180	-4	40	WA208	-3
10	IL119	-7	26	SD127	-4	41	KS209	-3
11	IL223	-7	27	OK160	-4	42	CO012	-3
12	IL226	-7	28	OK210	-4	43	CO102	-3
13	IL123	-6	29	MT058	-4	44	NE181	-2
14	IL224	-6	30	OK176	-4	45	TX060	-1
15	KS013	-6	31	CO141	-4			

Table 24. Average Discount Rates for Grade 5

	ID	Discount		ID	Discount		ID	Discount
1	MT058	-8	3	WA208	-4	5	TX022	-2
2	MN050	-8	4	US187	-3	6	SH113	-2

Table 25. Average Discount Rates for 4-5% Damage (cents/bushel)

	ID	Discount		ID	Discount		ID	Discount
1	ND034	-45	10	NE184	-5	19	IL119	-2
2	ND145	-23	11	NE186	-5	20	IL117	-1
3	SD049	-15	12	KS214	-4	21	IL123	-1
4	MN225	-14	13	MO215	-4	22	IL223	-1
5	MN050	-12	14	NE205	-4	23	IL224	-1
6	SD002	-11	15	NE228	-4	24	IL226	-1
7	US175	-11	16	KS209	-3	25	US222	-1
8	SD127	-10	17	NE180	-3			
9	NE166	-5	18	OK210	-3			

Table 26. Average Test Weight Discount Rates for White Club Wheat and Hard Red Spring Wheat in 58-54 lbs. (cents/bushel)

	ID	Discount		ID	Discount		ID	Discount
1	NE166	-14	5	MN225	-5	9	ND034	-4
2	WI029	-11	6	ND145	-5	10	MT058	-3
3	CO141	-7	7	SD049	-5	11	WA208	-3
4	SD127	-5	8	MN014	-5	12	US187	-2

Table 27. Average Discount Rate for 5-6.5% Shrunken and Broken

	ID	Discount		ID	Discount		ID	Discount
1	US175	-7	8	NE184	-3	15	IL117	-2
2	CO012	-6	9	NE186	-3	16	IL123	-2
3	SD127	-6	10	KS214	-2.8438	17	IL226	-2
4	MN225	-4	11	MO215	-2.8438	18	IL223	-0.75
5	TX022	-4	12	NE205	-2.8438	19	IL224	-0.75
6	KS209	-3	13	OK160	-2.4063	20	US222	-0.75
7	NE180	-3	14	OK210	-2.4063			

Table 28. Discounts for COFO

	ID	Discount		ID	Discount		ID	Discount
1	US175	-25	7	KS081	-20	13	SH113	-10
2	US175	-25	8	US187	-20	14	OK160	-10
3	ID112	-25	9	IL119	-20	15	NE184	-10
4	US187	-20	10	US187	-20	16	NE186	-10
5	SD002	-20	11	TX022	-15			
6	SD002	-20	12	NE180	-15			

Table 29. Discounts for Garlicky

	ID	Discount		ID	Discount		ID	Discount
1	US187	-20	5	ID112	-15	9	OK160	-10
2	WA208	-15	6	US187	-12	10	NE180	-10
3	WA208	-15	7	US187	-12	11	NE184	-5
4	WA208	-15	8	SH113	-10	12	NE186	-5

Table 30. Discounts for Light Smutty

	ID	Discount		ID	Discount		ID	Discount
1	ID112	-20	9	OK160	-10	17	US187	-5
2	MT058	-15	10	NE205	-10	18	WA208	-5
3	MT058	-15	11	WA208	-10	19	NE180	-5
4	MT058	-15	12	OK210	-10	20	US222	-5
5	IL119	-15	13	KS214	-10	21	IL226	-5
6	MT058	-15	14	MO215	-10	22	US187	-5
7	WA208	-10	15	NE228	-10	23	WA208	-5
8	SH113	-10	16	IL123	-10			

Table 31. Discounts for Musty

	ID	Discount		ID	Discount		ID	Discount
1	US187	-20	17	WA208	-10	33	IL123	-10
2	US187	-20	18	SD002	-10	34	IL201	-10
3	ID112	-20	19	KS013	-10	35	IL224	-10
4	MT058	-15	20	TX022	-10	36	KS209	-7
5	WA208	-15	21	CO072	-10	37	KS081	-5
6	MT058	-15	22	KS121	-10	38	SH113	-5
7	MT058	-15	23	US175	-10	39	SD127	-5
8	MN225	-15	24	NE184	-10	40	OK160	-5
9	IL119	-15	25	NE186	-10	41	NE180	-5
10	MN225	-15	26	NE205	-10	42	MN014	-5
11	MT058	-15	27	WA208	-10	43	WI029	-5
12	WA208	-15	28	OK210	-10	44	SD127	-5
13	US187	-12	29	KS214	-10	45	WI029	-5
14	US187	-12	30	MO215	-10	46	US222	-5
15	SD002	-10	31	NE228	-10	47	IL223	-5
16	US175	-10	32	IL117	-10	48	IL226	-5

Table 32. Discounts for Smutty

	ID	Discount		ID	Discount		ID	Discount
1	ID112	-50	11	NE205	-20	21	SH113	-15
2	MT058	-25	12	OK210	-20	22	OK160	-15
3	MT058	-25	13	KS214	-20	23	WA208	-15
4	MT058	-25	14	MO215	-20	24	US187	-10
5	MT058	-25	15	NE228	-20	25	WA208	-10
6	US187	-20	16	IL117	-20	26	NE180	-10
7	TX022	-20	17	IL119	-20	27	IL201	-10
8	NE184	-20	18	IL123	-20	28	US222	-10
9	NE186	-20	19	WA208	-15	29	US187	-10
10	US187	-20	20	CO072	-15	30	WA208	-10

Table 33. Discounts for Sour

	ID	Discount		ID	Discount		ID	Discount
1	SD002	-20	17	US187	-12	33	NE228	-10
2	US175	-20	18	US187	-12	34	MN014	-10
3	US187	-20	19	WA208	-10	35	IL117	-10
4	SD002	-20	20	KS013	-10	36	IL123	-10
5	US175	-20	21	TX022	-10	37	IL201	-10
6	US187	-20	22	CO072	-10	38	US222	-10
7	ID112	-20	23	KS081	-10	39	IL223	-10
8	MT058	-15	24	KS121	-10	40	IL224	-10
9	MT058	-15	25	NE180	-10	41	IL226	-10
10	WA208	-15	26	NE184	-10	42	SH113	-5
11	MT058	-15	27	NE186	-10	43	SD127	-5
12	WA208	-15	28	NE205	-10	44	OK160	-5
13	MN225	-15	29	KS209	-10	45	WI029	-5
14	IL119	-15	30	OK210	-10	46	SD127	-5
15	MN225	-15	31	KS214	-10	47	WI029	-5
16	MT058	-15	32	MO215	-10			

Statistical Tests. We then performed nonparametric tests on the average discount rates of elevators among the RMA regions. The results, as displayed in the table below, indicate strong statistical evidence suggesting that the discount rates are different across regions for damage, test weight, shrunken and broken (SB), sour, smutty, and garlicky.

Table 34. Results of Testing the Equality of Discounts Across RMA Regions

Analysis Variable	Kruskal-Wallis Statistic	Degree of Freedom	p-value
Damage	19.96	4	0.001
TW	6.58	3	0.086
SB	12.49	4	0.014
COFO	6.17	4	0.187
Musty	7.09	5	0.214
Sour	10.21	5	0.069
Light smutty	6.81	4	0.146
Smutty	9.53	4	0.049
Ergoty	0.47	1	0.495
Garlicky	6.48	2	0.039

Quality Discounts Computation. The computation procedure for the regional discount schedules is similar to that for corn, except that Grade 5 and sample grade discounts are based on the average of grade discounts, when the elevator has one, or else average Grade 5 or sample grade discounts due to test weight, kernel damage, or SB from each elevator. The average discount rates are displayed in the table below. Discounts for RMA regions 1, 2, 3, 4, 5 and 6 are based on survey discount schedules specifically for these regions. We also included mold, sprout and infested discounts, in case that these perils may be covered by the current crop insurance policy.

Table 35. Current Discount Schedule and Average Discount Schedule Based on Survey Wheat

		Region						
	Current	1	2	3	4	5	6	National
Grade 5	65	37	19	24	45	9	N/A*	24
Sample Grade	70	51	26	34	63	12	N/A*	37
TW (lbs) below 51	6/lb	10/lb	3/lb	6/lb	12/lb	3/lb	7/lb	12/lb
TW (WCL & HRS) (lbs) below 50	2/lb	10/lb	5/lb	20/lb	7/lb	2/lb	7/lb	9/lb
TW (WCL & HRS) (lbs) below 47	2/lb	10/lb	8/lb	20/lb	7/lb	2/lb	7/lb	9/lb
TW (WCL & HRS) (lbs) below 45	3/lb	10/lb	8/lb	20/lb	7/lb	2/lb	7/lb	9/lb
TW (WCL & HRS) (lbs) below 40	6/lb	10/lb	8/lb	20/lb	7/lb	2/lb	7/lb	9/lb
Damage (%) above 15	3/%	4/%	8/%	2/%	4/%	2/%	3/%	2/%
Damage (%) above 20	3/%	4/%	8/%	4/%	4/%	2/%	3/%	4/%
S.B. (%) above 20	N/A	2/%	2/%	2/%	2/%	2/%	1/%	2/%
COFO	50	18	20	14	20	25	13	18
Ergoty		18	18	18	18	14	18	18
Light Smut	10	10	15	9	10	10	10	10
Smut	20	19	25	18	18	20	18	19
Garlic	1/bulblet	12	12	7	12	15	10	12
Musty	10	9	11	9	9	14	8	10
Sour	25	10	14	10	11	15	8	12
Mold above 1%	N/A	N/A	5/%	N/A	4/%	N/A	N/A	4/%
Sprout above 1%	N/A	N/A	9/%	1/%	5/%	7/%	N/A	7/%
Sprout above 8	N/A	N/A	N/A	6/%	N/A	N/A	N/A	N/A
Sprout above 5	N/A	N/A	N/A	N/A	N/A	8/%	N/A	N/A
Sprout above 4	N/A	N/A	N/A	4/%	N/A	N/A	N/A	N/A
Infested	N/A	15	15	8	11	11	8	11
Observations	N/A	2	8	19	7	4	7	54

Notes:
1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. N/A* means not enough observations to derive reasonable results.
4. "Observations" is the number of discount schedules used to compute the regional averages. It is possible that not all entries in the same region used the total number of observations.

The proposed discounts from the survey are considerably lower than the current grade 5, sample grade, sour and COFO discounts; however, they are substantially higher for test weight. Also, with the exception of ergoty, there is considerable variation in discounts from region to region, consistent with the results of the statistical tests.

Barley Analysis

The barley policy specifies quality adjustment for test weight, percentage sound barley, kernel damage, thin, black, musty, sour, COFO, grading blighted, garlicky or ergoty; or substances or conditions injurious to human or animal health. We received only 8 discount schedules for barley, but since they covered different quality factors, the highest number of discount schedules for any individual factor is only 6. There are few (and in some cases no) discount schedules for some of the minor quality factors such as black discount.

Comparison of Average Discount Rates. The following tables display the distributions of the average discount rates for the quality factors with the largest number of observations. Similar to all other crops, the discounts vary a great deal among elevators. We thus performed statistical tests to find out whether they vary by RMA regions.

Table 36. Average Discount for Test Weights 40 – 45

	ID	Discount		ID	Discount		ID	Discount
1	MT234	-9	3	MT234	-9	5	MN026	-7
2	ND174	-8	4	ND174	-8	6	ND193	-4

Table 37. Average Discounts for 5% - 8% Thin

	ID	Discount		ID	Discount
1	MT233	-28	3	US175	-8
2	MT234	-26	4	ND191	-3

Table 38. Average Discount for Musty

	ID	Discount		ID	Discount
1	MT233	-25	3	MN026	-10
2	MT234	-25	4	WI029	-5

Statistical Tests. Considering that no more than 4 observations are available for other quality factors, we only performed statistical tests of the equality of test weight discounts across regions. The p-values of the Kruskal-Wallis test are 1, indicating no evidence that the regional differences are statistically significant.

This could easily be due to the fact that there are only a small number of observations. On the other hand, one reason that after contacting 360 elevators, we have only received a small number of discount schedules for barley is that barley is a relatively minor crop in comparison to corn, or soybeans. The volume of insurance premium is also relatively small. It is thus the case that the benefit of regional discount schedules is less likely to outweigh the additional administrative costs. Considering all these, we recommend a national discount schedule for barley.

Table 39. Results of Testing the Equality of Discounts Across RMA Regions

Analysis Variable	Kruskal-Wallis Statistic	Degree of Freedom	p-value
Test Weight	0	1	1

Discount Schedules Computation. The following table is the computed average national discount rates. Discounts for Don, Plump and Stones are also included, in case that they are covered perils. The computed schedule for barley is reasonably comparable to the current schedule; it shows that the grade discounts are somewhat lower than the current FSA schedule, but that the individual deficiency discounts are somewhat greater than current. Thus, when the proposed schedule is applied, the fact that the incremental discounts are greater than current will tend to offset the lower grade discounts. Only a national schedule is shown because there was no statistical evidence that the regional discount schedules differed significantly. A few covered deficiencies are shown as N/A because we were unable to obtain any FSA discounts for these perils.

Table 40. Current Discount Schedule and Average Discount Schedule Based on Survey
Barley

	Current	National
Grade 5	30	22
Sample Grade	30	25
TW (lbs)	3/lb below 36	4/lb below 36
Thin (%)	5/5% above 75%	10/5% above 75%
Black	5/5% above 75%	N/A
Damage (%)	2/% above 10% 5/% above 15%	5/% above 10%
Don	N/A	17/1 ppm, 28/1.1-2 ppm, 35/2.1-3 ppm, 52/3.1-4ppm.
Plump	N/A	2/% below 70 7/% below 65
Stones	N/A	10 up to 8 stones 1.5/stone in excess of 8
Garlicky	5	N/A
Musty	10	15
Sour	10	20
COFO	10	20
Blighted Smutty	N/A	N/A
Ergoty	N/A	N/A
Mycotoxins	N/A	N/A
Observations		6

Notes: 1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. "Observations" is the number of discount schedules used to compute the column averages. It is possible that not all entries used the total number of observations.

Oats Analysis

The oat crop insurance policy specifies quality adjustment for sample grade oats due to test weight, percentage of damage, musty, sour, COFO, or smutty; or substances or conditions injurious to human or animal health. According to agronomists, these perils are all difficult to control by producers.

Comparison of Average Discount Rates. We received 11 discount schedules for oats. Of the quality factors covered by the current program, only test weight and musty discounts have more than 4 schedules.

The distribution of the discounts for these two factors is shown below. There are substantial variations across schedules and across regions.

Table 41. Average Discounts for Test Weight 33

	ID	Discount		ID	Discount		ID	Discount
1	IA122	-16	5	ND034	-10	9	IA074	-2
2	SD049	-14	6	KS081	-6	10	IA157	-2
3	IL223	-12	7	KS121	-6	11	WI029	0
4	MN026	-10	8	IA163	-5			

Table 42. Average Discounts for Musty

	ID	Discount		ID	Discount
1	IA163	-10	3	KS081	-5
2	MN026	-10	4	WI029	-5

Statistical Tests. Similar to barley, only test weight has enough observations for a meaningful statistical test of the equality of discounts among regions. The p-value of Kruskal-Wallis test indicates no evidence that the regional differences are statistically significant. Further considering that the farm value of oat is not as large as some other crops, we recommend a national discount schedule for oats.

Table 43. Results of Testing the Equality of Discounts Across RMA Regions

Analysis Variable	Kruskal-Wallis Statistic	Degree of Freedom	p-value
MTW	3.5	3	0.321

Discount Schedules Computation. The average national discount rates are computed and displayed in the following table. Discounts for infested are also included, in case that they are covered perils.

Table 44. Current Discount Schedule and Average Discount Schedule Based on Survey
Oats

	Current	National
Sample Grade	15	25
TW (lbs)	5 from 32.5-32 3/lb below 32	4/lb below 26 6/lb below 25
Sound-Cultivated (%)	2/% below 94 3/% below 80	1/% below 75
Garlicky	5	N/A
Smutty	N/A	N/A
Ergoty	N/A	N/A
Infested	N/A	7
Observations		11

Notes: 1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. "Observations" is the number of discount schedules used to compute the regional averages. It is possible that not all entries in the same region used the total number of observations.

The proposed schedule is considerably different than the current FSA discounts: the sample grade and test weight discounts are higher, but the sound cultivated discount is lower. Also, the FSA schedule shows discounts for test weight below 32.5 lbs., whereas the test weight requirement for sample grade oats is 26 lbs. or less. Also, none of the schedules we received had discounts for smutty, garlicky or ergoty oats.

Rye Analysis

We obtained only one discount schedule for rye, most likely due to the fact that the farm value of rye is now relatively modest. Based on conversations with breeders, extension agronomists and elevators, rye is mainly used as a cover crop or as forage. The current total crop insurance premium is only $98,638.

Table 45. Current Discount Schedule and Average Discount Schedule Based on Survey Rye

	Current	National
Grade 4	N/A	28
Sample Grade	48.3	44
Test Weight	N/A	4/half lb below 49.0
Thin	N/A	N/A
Smutty	N/A	N/A
Garlicky	N/A	N/A
Ergoty	$0.98/3.51-3.6% 4/0.1% below 3.6% 5/0.1% below 4% down to 5%.	N/A

Notes: 1. All discounts are in cents/bushel.
2. N/A implies no data available.
3. The survey discount is based on one purchaser.
4. The current discount levels are the latest FSA rye discount rates.

The proposed discount for sample grade is quite similar to the current schedule; otherwise, the current schedule (which we understand became effective in 1995 and has not been updated since) contains no other quality discounts.

Flax Analysis

The current crop insurance policy allows quality adjustment for sample grade flax due to kernel damage; or substances or conditions injurious to human or animal health. With assistance from Jan Topp of the North Dakota Oilseed Council, we obtained one discount schedule for flax. According to Ms. Topp, this discount schedule is fairly standard in North and South Dakota and Minnesota, and has been in use for a long period of time. We thus relied on this discount schedule to make recommendations for the quality adjustment factors shown in the following table. We also included discounts for stones and test weights, in case that they are covered perils.

Table 46. Current Discount Schedule and Average Discount Schedule Based on Survey
Flaxseed

	Current	National
Sample Grade	7%	100%
Damaged Kernels (%)	24%/15.1-16% 7%/% below 16%	100%
Stones	N/A	100%
Test Weight	N/A	100% below 40 lbs.

Notes: 1. The survey discounts were based on a single purchaser's discount schedule, which specifies rejection for all sample grade flaxseeds.
2. Cents/cwt discounts were converted to % discounts based on average FSA flaxseed PCP for December 2001.

The schedule above is based on the discount schedule of a single purchaser. In this case, the schedule indicated that any flax at sample grade would be subject to rejection. If a crop is rejected, the producer would suffer a 100% loss, unless the crop could be sold for an alternative purpose (presumably at substantial discount). We do not necessarily recommend a 100% discount in the presence of sample grade for flax; however, we have no basis for developing an alternative schedule. One possible solution would be to base the flax discount on the observed discounts for similar crops.

Canola Analysis

The current canola crop insurance program applies quality adjustment on U.S. sample grade canola caused by kernel damage, musty, sour, COFO and sources or conditions injurious to human or animal health. We also included discounts for stones and green damage, in case that they are covered perils. We obtained discount schedules from two of the largest canola purchasers. Of all of the quality factors covered by the current insurance policy, only one of the two companies specifies the damage discount. Therefore, we are able to make recommendations only for damage discounts based on this discount schedule.

Table 47. Current Discount Schedule and Average Discount Schedule Based on Survey Canola

	Current	National (cents/bushel)
Sample Grade	50	68
Kernel Damage	50/% above 20%	45/30.1-40% 45/40.1-50%
Stones	N/A	20
Green Damage	N/A	40/increment of up to 5% below 20%
Musty	40	N/A
Sour	40	N/A
COFO	70	N/A

Notes: 1. All discounts are in cents/cwt.
2. N/A implies no data available.
3. The survey discount is based on one purchaser.

Although the proposed sample grade discount is higher than current, the incremental discounts above 20% kernel damage are smaller than current, tending to offset some of the sample grade difference.

Oil Sunflowers Analysis

The current crop insurance policy applies quality adjustment for weight damage, kernel damage, musty, sour and COFO; or substances or conditions injurious to human or animal health. We also included discounts for oil and stones, in case that they are covered perils. We obtained four discount schedules for oil type sunflowers which are almost all identical to each other. There are, however, no discounts for COFO in any of the four discount schedules. Based on this information from the four discount schedules we obtained, we recommend a uniform national discount schedule. The recommended discount schedule is shown in the following table.

While the sample grade discounts for the current and proposed schedules are similar, the test weight and kernel damage discounts differ. Also, we were informed that significant quality deficiencies cause sunflowers to be useless except for sale as birdseed, and in such cases the producer would expect to sell the crop at a discount of approximately 50%. Thus the discounts should not exceed 50%, the approximate salvage value of the crop.

Table 48. Current Discount Schedule and Average Discount Schedule Based on Survey Oil Sunflower

	Current	National
Sample Grade	6%	5%
TW (lb)	2.5%/24.9lbs-24 lbs 2.5%/lb below 24 lbs.	1%/half lb below 25
Kernel Damage (%)	22/5.1%-6% 22/% above 6% 44/% above 10%	2%/percentage point above 10%, but no more than 50% total discount
Oil	N/A	3%/% below 38%, 3.5%/% below 32%
Stone ($/cwt)	N/A	0.01/each stone in excess of 10
Musty	6%	2%
Sour	6%	2%
COFO	9%	N/A

Notes: 1. The survey discounts were based on 4 purchasers. Since all 4 purchasers used % discount in their discount schedules, we converted all discounts to % discounts for averaging and comparison.
2. Cents/cwt discounts were converted to % discounts based on average FSA oil sunflower PCP for December 2001.
3. N/A implies no data available.

Confection Sunflower Analysis

The current crop insurance policy applies quality adjustment for test weight below 22 lbs, damage in excess of 5%, musty, sour, and COFO; or substances or conditions injurious to human or animal health. Based on our conversations with major purchasers, kernel damage includes black damage and dark roast damage.

We received three quality discount schedules for confection sunflower, from three companies within 80 miles from each other. Contrary to oil type sunflowers, the discount schedules for the three purchasers differ in both range and magnitude. Also, transactions appear to frequently be based on negotiations. Furthermore, conversations with the major purchasers indicated that they purchase the product for different markets which may have very different quality requirements. Thus, some buyers may be less tolerant of low quality sunflower than others.

We also included discounts for burrs, insects and sclerotinia, however we note that discounts or these factors should apply only if they are covered perils (i.e., if they are injurious to human or animal health). Since there is no current value, we specify the discounts for the levels of damage when the magnitude of discount reaches 50% or beyond; 50% is the lowest discount rate for all other perils.

Table 49. Current Discount Schedule and Recommended (FSA) Discount Schedule Confection Sunflower

	Current	National
TW (lb)	5%/22.9-22.1 lbs.	50% below 22 lbs.
Black Kernel Damage (%)	N/A	50%/above 5%.
Burrs	N/A	50%/above 0.5% 100%/2.5% or above
Insects	N/A	50%/above 4.5%.
Sclerotinia	N/A	50%/above 1%.
Musty	5%	N/A
Sour	5%	N/A
COFO	8%	N/A

Notes: 1. The survey discounts were based on 3 purchasers. Since 2 out of 3 purchasers used % discount in their discount schedules, we converted all discounts to % discounts for averaging and comparison.
2. Cents/cwt discounts were converted to % discounts based on the average of FSA confection sunflower posted county prices for December 2001.
3. N/A implies no data available.

The three schedules we received were from the largest purchasers of sunflowers. In discussions with these purchasers, we were informed that any quality deficiencies in excess of the levels shown in the table would render the crop useless except for sale as birdseed. As a consequence, the proposed national discounts are considerably larger than the current FSA discounts, but are still limited to a maximum of 50%.

Safflower Analysis

The safflower policy does not require reaching any specific grade before quality adjustment; however, it specifies that kernel damage will be adjusted for quality if such damage exceeds 25%. Also quality adjustment is allowed if test weight is below 50 lbs./bushel. We received two discount schedules, only one of which has a discount for heat damage. Thus, the proposed discounts reflect the discount that would be applied at the 25% level for heat damage, along with incremental discounts thereafter.

Safflower production is usually contracted. The best price and discount information are available from contracts of a small number of major purchasers. We suggest that, if possible, RMA survey the major purchasers before the beginning of each season and update the discount schedules accordingly.

Table 50. Current Discount Schedule and Average Discount Schedule Based on Survey
Safflower

	Current	National
Test Weight	N/A	N/A
Damage	42%/ 25.1-26% 3%/% above 26%.	62.5% for 25% damage 2.5%/percentage point above 25.5%

Notes: 1. The survey discounts were based on a single purchaser's discount schedule.
2. Cents/cwt discounts were converted to % discounts based on average FSA safflower PCP for December 2001.
3. N/A implies no data available.

Rice Analysis

We contacted staff members of the U.S. Rice Federation, major rice farmer cooperatives in Arkansas and California, and rice mills in Arkansas and Louisiana. The following summarizes the information we gathered from these sources.

There are two distinct regions of rice production in the U.S.: California and the rest of the country, including Arkansas, Louisiana, Mississippi, Texas and Missouri. The two markets have very different pricing behavior.

For the areas outside of California, we were told consistently that the FSA discount schedule reflects the typical discount rates used by the industry for quality deficiencies down to grade 6. For grade 6 and sample grade, the market is so sparse that it has the tendency to rely on the results of bargaining on a case-by-case basis. Nonetheless, the FSA discounts are still frequently used as a reference point in these bargaining processes. For these grades we were unable to obtain any information on the recent or historic transaction prices. We were also informed that all mills strictly follow the FSA discount schedule for purchasing rice lower than grade two. We were, however, unable to verify this information. This credibility problem is important in light of the fact that many of the people we spoke to opined that quality adjustment, and to a lesser extent crop insurance, is not as important for rice farmers as for some other crops.

As a whole, it seems to be commonly agreed upon that the market for deficient rice, which is anything lower than grade 2 outside of California, is so thin that the FSA discount schedule is what buyers and sellers would use as a commonly agreed upon price in their bargaining process.

For areas outside of California, anything lower than grade 1 is considered off-grade and is subject to deep discounts. Thus, the FSA discount schedule is largely inapplicable for the California market. The off-grade market is so limited that there is no established marketing channel to sell off-grade rice other than as animal feed. Nonetheless, rice harvested from the field is almost always grade 1, and when it is less than grade 1, the vast majority of the time it is due to damage during the storage process, such as warehouse roof leakage. It is thus considered unimportant for rice farmers to purchase crop insurance. It was suggested to us that grade 2 rice would receive a 50% discount in California, although the figure could fluctuate greatly from case to case. Anything grade 4 or less is considered almost useless and would be dumped.

Based on all this information, it is our opinion that the current FSA discount schedule is appropriate for quality adjustment for areas outside of California. For California, assuming that the average quality is extremely high, it appears that the economic value of quality adjustment is probably limited such that the cost of administrating a quality adjustment program would exceed the benefit of the program.

As evident from the table below, we recommend using the current FSA discount schedule for rice. As noted, we make this recommendation based on discussions with the Rice Federation of America, rice cooperatives and rice mills in different locations across the U.S., which suggested that most purchasers outside of California rely on the FSA schedules only.

Table 51. Current Discount Schedule and Average Discount Schedule Based on Survey
Rice

	Current	National
Grade 4	$0.60	$0.60
Grade 5	$1.00	$1.00
Grade 6	$2.00	$2.00
Sample Grade	$5.50	$5.50

Note: 1. Discount data are from FSA of USDA.

Dark Roast Confection Sunflower Analysis

Of the three schedules we received for confection sunflower, one indicates purchase for birdseed for dark kernel damage more than 1.5%, one does not specify a discount for more than 2% dark kernel damage, and one specifies rejection or negotiation for dark kernel damage above 1%. Based on our conversations with one of the purchasers, confection sunflowers with significantly dark kernels can be used only for birdseed, where the percentage of dark kernels is of little importance. Therefore, we suggest a 50%

discount for more than 5% dark roast for confection sunflower. (We start the discount at 5% because the current policy indicates that quality adjustment applies only if dark roast exceeds that amount.)

Buckwheat Analysis

Buckwheat is a very thinly traded crop with major production in only two areas of the U.S. There appears to be only two major buyers, and one failed to provide a discount schedule despite repeated requests. Of the discount schedule we received, we were told that this schedule had been in use for three years and was last changed when a new buckwheat variety was adopted. Currently, there is no crop insurance for buckwheat. Of all of the quality factors covered by the discount schedule we received, we suggest quality adjustment for test weight, soundness, musty, garlicky, and aflatoxin for two reasons. First, agronomists suggested to us that these perils are not well within the control of producers. Second, they are the kind of perils usually covered by the insurance policies of other major grains. It would thus be fair to producers producing other grains.

The proposed national schedule shows 100% discount for four of the five covered perils because the single schedule stated that the presence of the indicated conditions made the crop subject to rejection. Assuming the crop is rejected, the producer would suffer a 100% loss, unless the crop could be sold for an alternative purpose (presumably at substantial discount). We do not necessarily recommend a 100% discount in the presence of these quality deficiencies, however, we have no basis for developing a discount specifically for buckwheat in the presence of these conditions. One possible solution would be to base the buckwheat discount for these deficiencies on the observed discounts for similar crops.

Table 52. Current and Average Discount Schedules Based on Survey Buckwheat

	Current	National
Test Weight (lb)	N/A	1%/each half lb below 45.
Soundness	N/A	100%
Musty	N/A	100%
Garlicky	N/A	100%
Aflatoxin	N/A	100%/5 p.p.b. aflatoxin or above

Note: 1. The discount schedule is based on one purchaser only.

RISK ANALYSIS

We performed risk analysis to address two issues:

- For all crops, we identified the relative importance of different perils, as well as the relative costs of insuring those perils.
- For cotton, we estimated the additional costs of insuring by bale instead of insuring by unit.

Crops in General

To identify the relative importance of different perils, one approach would be to estimate the frequency and severity of loss for each peril. There is, however, no data available for this approach as quality data is not available in the RMA claim database and we are not aware of any other database that contains sufficiently complete yield and quality data for this type of analysis. As a consequence, we used a different approach. We interviewed elevator operators and agronomists and obtained estimates of the relative frequency and severity of the quality factors for each crop. For most crops, we obtained what appeared to be credible opinions on the relative importance of each quality factor for each crop. In the section on the economic importance of quality adjustment in crop insurance, we discuss the estimates provided to us by the warehousemen, elevator operators and agronomists we interviewed.

In addition, we recommend that, if possible, resources be invested in the future to collect complete quality information in the RMA insurance database. This information will be useful for both projecting future quality of output for producers and estimating the expected loss frequency and severity of the program.

Cotton

Objective. For cotton, risk analysis was performed to estimate the difference in loss frequency and severity when coverage is by bale instead of by unit of insurance.

Data Source. The data used here are the daily price data for upland cotton in each of the seven cotton regions, and the weekly quality of classified cotton, both obtained from AMS for the crop year 2000.

Analysis. The cotton quality data from AMS reports, for each bale, the classing office number and a description of the quality of the bale. For each bale of classified cotton, we matched the quality description to the price data of the relevant market in the last weekday of the week. Based on suggestions from the AMS staff, we used the following to match the classing offices with the cotton markets:

Table 53. The Relevant Spot Market for the Cotton Classing Offices

Classing Office	Cotton Market
Abilene, Corpus Christi	East Texas-Oklahoma
Florence, Macon, Birmingham	Southeastern
Rayville, Dumas	South Delta
Lubbock, Lamesa	West Texas
Memphis	North Delta
Phoenix	Desert Southwest
Visalia	San Joaquin Valley

We then computed the ratio between the price of each bale of cotton to 85% of the price of the base grade cotton of the respective spot market. If this ratio is less than one (that is, if the actual price is less than 85% of the base grade), then the quality adjustment factor is defined as the ratio; otherwise the quality adjustment factor is set to equal one. The average of the quality adjustment factors for each bale is then used as the expected quality adjustment factor. Then, under the assumption that quality variation is independent of yield variation, and given the historic distribution of yield variation as a percentage of expected yield[17], we computed the relative indemnity between quality adjustment coverage by bale versus by unit. However, since the unit of indemnity is a percentage of expected yield, we then divided the indemnity by the level of coverage to obtain an estimate of indemnity as a percentage of the level of coverage. This measure provides a better approximation of the percentage impact of quality adjustment coverage by bale on the premium levels.

The following tables show the difference in expected indemnities between quality adjustment coverage by bale versus by unit. It appears that on average, coverage by bale leads to around 10% higher indemnity level, although the percentage difference is the highest (at around 14%) at the lowest coverage level of 50% and then decreases to around 5% as the coverage level increases to 85%.

[17] The distribution of yield variation is based on the underwriting experience of the RMA crop programs.

Table 54. Indemnity Comparison:
QA Coverage by
Bale vs. by Unit

	Expected Indemnity			
Level of Insurance	**by Bale**	**by Unit**	**Difference from by Unit**	**% Difference from by Unit**
50%	12.50%	10.95%	1.55%	14.14%
65%	13.83%	12.67%	1.15%	9.10%
85%	16.88%	16.08%	0.79%	4.92%

Table 55. QA Portion of Indemnity Comparison:
Insurance by
Bale vs. by Unit

	Expected Indemnity		
Level of Insurance	**by Bale**	**by Unit**	**Difference from by Unit**
50%	1.59%	0.04%	1.55%
65%	1.22%	0.07%	1.15%
85%	0.93%	0.14%	0.79%

We caution that this is an estimate based on the 2000 crop year data alone. Several factors could cause this estimate to be biased. First, the absolute levels of discounts do not appear to fluctuate over time, as do the base prices. It is thus possible that as the base prices declined since the year 2000, both the frequency and severity of quality adjustment could be higher now. In contrast, if the base prices increase in the future (above the year 2000 levels), then our estimates would be biased upward. Second, advances in technology may improve the quality of cotton in the future, which would reduce quality adjustment frequency and severity, unless base quality is also adjusted upward in the future accordingly. Third, a major determinant of quality adjustment is weather, and crop year 2000 may not represent the typical weather over time. Our estimates would likely be underestimates for future years when the weather is less favorable than the 2000 crop year, or overestimates for future years when the weather is more favorable for the cotton crop than 2000.

We strongly recommend RMA implement any coverage changes on a pilot basis, monitor results, and make adjustments accordingly.

CLOSING

We appreciate the opportunity to provide this actuarial review to the Risk Management Agency. We would like to acknowledge the assistance and efforts of the numerous parties mentioned throughout the report who provided all of the expert advice, suggestions, program materials and other information necessary for our analysis.

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Milliman USA, Inc.
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APPENDIX A

The following displays the minimum and mean of the autocorrelation coefficient tables for each discount schedule for various quality deficiencies as well or the autocorrelation coefficients themselves when the number of discount schedules is only two. For example, the first four columns in row 1 of the following table indicate that elevator IL009 has an average correlation coefficient with all other elevators to be 0.997. Its minimum correlation coefficient with all other elevators is 0.894. In general, the correlation coefficients between each discount schedule and all other discount schedules are very high, indicating that the discount schedules usually vary in proportions.

Corn

Table A1. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IL009	0.997	0.894	22	IL206	0.996	0.982
2	MN031	0.987	0.894	23	IL207	0.996	0.982
3	SD049	0.996	0.968	24	IL221	0.996	0.982
4	WI156	0.986	0.968	25	NE181	0.996	0.982
5	KS172	0.996	0.968	26	NE184	0.996	0.982
6	IA163	0.996	0.968	27	NE186	0.996	0.982
7	IA227	0.996	0.968	28	IO218	0.990	0.983
8	IL117	0.996	0.968	29	IL200	0.999	0.985
9	NE051	0.996	0.968	30	IL223	0.999	0.985
10	GA065	0.996	0.968	31	NE071	0.999	0.985
11	IA114	0.996	0.971	32	SD056	0.999	0.985
12	IA198	0.996	0.971	33	TX068	0.999	0.985
13	WI148	0.995	0.973	34	US222	0.999	0.985
14	IL224	0.996	0.976	35	IA122	0.995	0.986
15	SD067	0.997	0.982	36	MN225	0.995	0.986
16	IA157	0.997	0.982	37	SD127	0.993	0.986
17	NE069	0.997	0.982	38	SD002	0.995	0.986
18	IL212	0.991	0.982	39	WI171	0.992	0.990
19	IL226	0.992	0.982	40	IA074	0.997	0.990
20	SD046	0.996	0.982	41	KS037	0.996	0.991
21	IL119	0.996	0.982				

Table A2. Maximum and Minimum Correlation Coefficients Among Total Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	CO012	0.986	0.973	6	MO215	0.998	0.984
2	IA165	0.995	0.973	7	NE205	0.998	0.984
3	NE216	0.996	0.978	8	AX182	0.994	0.986
4	IA088	0.997	0.984	9	IL219	0.997	0.986
5	KS214	0.998	0.984				

Table A3. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IA114	0.993	0.980	22	IL226	0.998	0.989
2	IA198	0.993	0.980	23	IL206	0.997	0.990
3	IL223	0.996	0.980	24	SD049	0.997	0.990
4	US222	0.996	0.980	25	WI148	0.997	0.990
5	IL117	0.992	0.983	26	MN031	0.999	0.992
6	IA088	0.997	0.984	27	KS172	0.996	0.992
7	IA122	0.997	0.984	28	NE069	0.997	0.992
8	SD056	0.997	0.984	29	TX068	0.997	0.992
9	IA074	0.997	0.984	30	WI029	0.998	0.992
10	IL119	0.997	0.984	31	WI171	0.998	0.992
11	NE051	0.997	0.984	32	KS214	0.998	0.992
12	GA065	0.997	0.986	33	MO215	0.998	0.992
13	NE184	0.997	0.986	34	NE071	0.998	0.992
14	NE186	0.997	0.986	35	NE205	0.998	0.992
15	IA165	0.997	0.986	36	SD002	0.999	0.993
16	IA227	0.997	0.986	37	KS037	0.998	0.993
17	IL009	0.999	0.986	38	NE216	0.997	0.994
18	WI156	0.997	0.986	39	IL224	0.998	0.995
19	IA163	0.998	0.987	40	IA157	0.998	0.996
20	IL221	0.998	0.987	41	MN225	0.998	0.996
21	SD127	0.997	0.988				

Table A4. Maximum and Minimum Correlation Coefficients Among Total Broken & Foreign Material Discount Schedules[18]

	ID	Mean	Min		ID	Mean	Min
1	IL207	0.986	0.951	6	IL212	0.988	0.965
2	SD067	0.974	0.951	7	IL219	0.987	0.965
3	IO218	0.987	0.965	8	IL200	0.987	0.968
4	CO012	0.978	0.965	9	AX182	0.997	0.992
5	CO102	0.978	0.965				

Table A5. Maximum and Minimum Correlation Coefficients Among Heat Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	NE216	0.849	0.655	14	IL219	0.979	0.845
2	IA088	0.982	0.655	15	AX182	0.989	0.845
3	IA227	0.982	0.763	16	IL212	0.985	0.845
4	KS037	0.982	0.792	17	KS172	0.988	0.845
5	IL221	0.982	0.792	18	MN225	0.989	0.845
6	IA163	0.986	0.792	19	WI148	0.978	0.845
7	IL117	0.986	0.792	20	GA065	0.991	0.866
8	IL119	0.986	0.792	21	IO218	0.985	0.866
9	WI171	0.986	0.792	22	IL224	0.977	0.868
10	IL207	0.985	0.792	23	NE069	0.971	0.868
11	IL226	0.972	0.823	24	TX068	0.971	0.868
12	SD127	0.952	0.845	25	IL200	0.961	0.878
13	IL206	0.979	0.845				

[18] Total Broken & Foreign Material is a discount some elevators Used to include all discounts for broken, shrunken and foreign material combined.

Table A6. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	GA065	0.981	0.391	28	MN031	0.990	0.849
2	US222	0.909	0.391	29	KS172	0.988	0.852
3	IA157	0.864	0.599	30	IL206	0.992	0.870
4	IL009	0.986	0.599	31	IO218	0.992	0.870
5	KS214	0.986	0.599	32	NE166	0.993	0.872
6	MO215	0.986	0.599	33	SD056	0.987	0.873
7	NE205	0.986	0.599	34	MN026	0.987	0.873
8	WI156	0.982	0.630	35	NE069	0.992	0.874
9	NE184	0.987	0.632	36	IA122	0.992	0.890
10	NE186	0.987	0.632	37	WI148	0.985	0.894
11	IL223	0.986	0.642	38	IL200	0.994	0.894
12	NE071	0.988	0.657	39	NE181	0.994	0.894
13	IL224	0.982	0.681	40	IA088	0.984	0.898
14	AX182	0.987	0.700	41	MN225	0.993	0.906
15	NE216	0.987	0.700	42	WI029	0.993	0.906
16	SD049	0.989	0.724	43	IA114	0.989	0.906
17	IL221	0.989	0.739	44	IA163	0.989	0.906
18	IL212	0.990	0.767	45	IA198	0.989	0.906
19	SD002	0.992	0.769	46	WI171	0.989	0.908
20	IL207	0.987	0.785	47	IL117	0.993	0.914
21	SD067	0.987	0.806	48	NE051	0.993	0.914
22	IA227	0.985	0.820	49	IA074	0.993	0.916
23	KS121	0.987	0.825	50	IL226	0.991	0.922
24	KS013	0.991	0.828	51	KS037	0.991	0.923
25	IL219	0.988	0.830	52	TX068	0.993	0.935
26	CO102	0.992	0.841	53	SD127	0.992	0.940
27	CO012	0.992	0.841	54	IL119	0.987	0.945

Soybean

Table A7. Maximum and Minimum Correlation Coefficients Among Corn Admixture Discount Schedules

	ID	Mean	Min
1	NE004	1	1
2	NE205	1	1
3	OK210	1	1
4	SD002	1	1

Table A8. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IA122	0.974	0.853	13	IL117	0.992	0.970
2	MN050	0.977	0.853	14	IA227	0.993	0.970
3	MN225	0.993	0.892	15	KS003	0.994	0.971
4	MS204	0.987	0.892	16	SD127	0.995	0.977
5	WI006	0.994	0.930	17	NE069	0.994	0.980
6	WI148	0.983	0.941	18	IL226	0.995	0.981
7	IL207	0.991	0.959	19	NE184	0.995	0.981
8	IL009	0.990	0.970	20	KS081	0.995	0.981
9	IL206	0.988	0.970	21	IL119	0.995	0.981
10	IL224	0.989	0.970	22	NE051	0.995	0.981
11	IA074	0.991	0.970	23	IL200	0.995	0.981
12	SD067	0.991	0.970	24	SD049	0.994	0.986

Table A9. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IA157	0.997	0.920	21	IL117	1.000	1.000
2	IL200	0.987	0.920	22	IL207	1.000	1.000
3	IA165	0.997	0.938	23	IL217	1.000	1.000
4	NE184	0.997	0.938	24	IL223	1.000	1.000
5	SD046	0.997	0.938	25	IL224	1.000	1.000
6	SD067	0.997	0.938	26	KS013	1.000	1.000
7	WI029	0.997	0.938	27	KS081	1.000	1.000
8	KS003	0.998	0.978	28	KS121	1.000	1.000
9	NE004	0.998	0.978	29	MN101	1.000	1.000
10	OK210	0.998	0.978	30	MN225	1.000	1.000
11	NE051	0.998	0.979	31	MS204	1.000	1.000
12	MN202	0.998	0.979	32	NE069	1.000	1.000
13	IA088	0.998	0.982	33	NE071	1.000	1.000
14	IL226	1.000	1.000	34	NE205	1.000	1.000
15	IA074	1.000	1.000	35	NE213	1.000	1.000
16	IA163	1.000	1.000	36	SD002	1.000	1.000
17	IA211	1.000	1.000	37	US222	1.000	1.000
18	IA220	1.000	1.000	38	WI006	1.000	1.000
19	IA227	1.000	1.000	39	WI148	1.000	1.000
20	IL009	1.000	1.000				

Table A10. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN050	0.915	0.517	16	IL206	0.981	0.845
2	MN225	0.956	0.517	17	IL217	0.981	0.845
3	MN202	0.925	0.686	18	IA163	0.982	0.888
4	IA211	0.979	0.717	19	WI006	0.982	0.888
5	NE213	0.979	0.717	20	IL117	0.993	0.966
6	IA220	0.973	0.717	21	US222	0.993	0.966
7	SD002	0.956	0.783	22	IA122	0.993	0.966
8	SD127	0.940	0.797	23	IL223	0.993	0.966
9	IL226	0.987	0.839	24	IL207	0.993	0.966
10	IA227	0.990	0.839	25	NE205	0.995	0.967
11	IL224	0.988	0.839	26	KS003	0.995	0.967
12	IL119	0.990	0.839	27	OK210	0.995	0.967
13	NE004	0.981	0.845	28	WI148	0.995	0.967
14	MS204	0.981	0.845	29	IL200	0.993	0.967
15	NE069	0.969	0.845	30	IA088	0.999	0.972

Table A11. Maximum and Minimum Correlation Coefficients Among Split Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IA088	0.977	0.911	16	OK210	0.990	0.966
2	MS204	0.975	0.911	17	IA227	0.990	0.966
3	IL217	0.975	0.911	18	SD067	0.991	0.966
4	IL223	0.986	0.921	19	SD049	0.978	0.968
5	US222	0.986	0.921	20	MN050	0.997	0.969
6	NE069	0.987	0.925	21	IL224	0.997	0.969
7	IL200	0.985	0.927	22	MN225	0.997	0.969
8	NE213	0.985	0.927	23	IA211	0.997	0.969
9	KS003	0.991	0.943	24	WI006	0.997	0.969
10	KS013	0.991	0.943	25	NE004	0.997	0.969
11	IL226	0.991	0.943	26	IA220	0.997	0.969
12	SD002	0.992	0.946	27	WI148	0.997	0.969
13	IL207	0.996	0.948	28	IL117	0.997	0.969
14	MN202	0.970	0.948	29	SD127	0.997	0.969
15	NE205	0.988	0.948	30	NE051	0.995	0.977

Table A12. Maximum and Minimum Correlation Coefficients Among Total Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SD002	0.991	0.979	9	IA163	0.993	0.985
2	IA220	0.990	0.979	10	IA165	0.993	0.985
3	IL217	0.991	0.980	11	NE213	0.995	0.987
4	OK210	0.991	0.980	12	MN202	0.994	0.989
5	IL223	0.992	0.982	13	IA211	0.995	0.989
6	NE004	0.992	0.985	14	NE069	0.996	0.990
7	IA088	0.993	0.985	15	NE205	0.995	0.990
8	US222	0.994	0.985				

Table A13. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN202	0.978	0.958	21	IA227	0.996	0.981
2	IA122	0.997	0.958	22	MN225	0.996	0.981
3	IA163	0.997	0.958	23	IL224	0.996	0.981
4	IL009	0.997	0.958	24	IL226	0.996	0.981
5	IL117	0.997	0.958	25	KS013	0.997	0.981
6	NE051	0.997	0.958	26	NE069	0.997	0.981
7	NE071	0.997	0.958	27	KS003	0.997	0.981
8	IA074	0.997	0.972	28	SD067	0.997	0.981
9	IA211	0.997	0.972	29	IL119	0.997	0.981
10	IA220	0.997	0.972	30	IL217	0.996	0.981
11	IL223	0.997	0.972	31	WI029	0.991	0.985
12	KS081	0.997	0.972	32	NE184	0.996	0.986
13	KS121	0.997	0.972	33	MN050	0.999	0.986
14	NE004	0.997	0.972	34	WI148	0.992	0.986
15	NE205	0.997	0.972	35	IL206	0.992	0.986
16	NE213	0.997	0.972	36	IL207	0.992	0.986
17	OK210	0.997	0.972	37	IL200	0.989	0.986
18	US222	0.997	0.972	38	SD002	0.989	0.986
19	SD049	0.995	0.974	39	SD127	0.989	0.986
20	MS204	0.995	0.981	40	WI006	0.989	0.986

Table A14. Maximum and Minimum Correlation Coefficients Among Green Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS121	0.995	0.986	5	IL217	0.997	0.991
2	NE213	0.995	0.986	6	KS013	0.996	0.991
3	MN202	0.995	0.986	7	IL200	0.998	0.991
4	IA211	0.995	0.986				

Table A15. Maximum and Minimum Correlation Coefficients Among Other Color Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS003	1	1	8	IL207	1	1
2	MS204	1	1	9	IL217	1	1
3	NE004	1	1	10	MN225	1	1
4	NE069	1	1	11	NE205	1	1
5	NE051	1	1	12	NE213	1	1
6	IA211	1	1	13	IL200	1	1
7	IA227	1	1				

Wheat

Club Wheat

Table A16. Maximum and Minimum Correlation Coefficients Among Contrasting Color Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	US187	1	1	3	WA208	1	1
2	WA118	1	1	4	MT058	1	1

Table A17. Maximum and Minimum Correlation Coefficients Among Dockage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.973	0.904	3	US187	0.996	0.991
2	WA208	0.974	0.904	4	WA118	0.999	0.995

Table A18. Maximum and Minimum Correlation Coefficients Among Frost Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	WA208	1	1
3	US187	1	1

Table A19. Maximum and Minimum Correlation Coefficients Among Germ Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	US187	1	1
3	WA208	1	1

Table A20. Correlation Coefficients Among Grade Discount Schedules

	US187	WA208
US187	1	0.997
WA208	0.997	1

Table A21. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	US187	1	1
3	WA208	1	1

Table A22. Maximum and Minimum Correlation Coefficients for Insect Damaged Kernels Discounts

	ID	Mean	Min
1	US187	1	1
2	WA208	1	1
3	MT058	1	1

Table A23. Maximum and Minimum Correlation Coefficients Among Mold Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	US187	1	1
3	WA208	1	1

Table A24. Maximum and Minimum Correlation Coefficients Among Stone Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	WA208			3	WA118	0.974	0.949
2	US187	0.974	0.949	4	MT058	1	1

Table A25. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min
1	MT058	0.998	0.996
2	WA208	0.997	0.996
3	US187	0.998	0.997

Table A26. Maximum and Minimum Correlation Coefficients Among Wheat of Other Classes Discount Schedules

	ID	Mean	Min
1	MT058	0.998	0.995
2	WA208	0.996	0.995
3	US187	0.998	0.995

Durum Wheat

Table A27. Correlation Coefficients Among Contrasting Color Discount Schedules

	ND034	ND145
ND034	1	1
ND145	1	1

Table A28. Correlation Coefficients Among Damage Discount Schedules

	ND034	ND145
ND034	1	1
ND145	1	1

Table A29. Correlation Coefficients for Falling Numbers Discounts

	ND039	ND034
ND039	1	
ND034		1

Table A30. Maximum and Minimum Correlation Coefficients for Hard Vitreous Amber Kernels Discounts

	ID	Mean	Min
1	ND039	1	1
2	ND145	1	1
3	ND034	1	1

Table A31. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ND034	ND145
ND034	1	0.993
ND145	0.993	1

Dark Northern Spring

Table A32. Maximum and Minimum Correlation Coefficients Among Black Tip Fungus Discount Schedules

	ID	Mean	Min
1	MT058	0.968	0.946
2	US187	0.977	0.946
3	WA208	0.981	0.958

Table A33. Maximum and Minimum Correlation Coefficients Among Contrasting Color Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	WA208	1	1	4	US175	1	1
2	MT058	1	1	5	US187	1	1
3	WA118	1	1				

Table A34. Maximum and Minimum Correlation Coefficients Among Dark and Hard Vitreous Kernels Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	US187	1	1
3	WA118	1	1

Table A35. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min
1	MN050	1	1
2	SD002	1	1
3	US175	1	1

Table A36. Maximum and Minimum Correlation Coefficients Among Dockage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.964	0.935	4	WA118	0.989	0.956
2	MN050	0.980	0.935	5	US187	0.991	0.970
3	US175	0.973	0.945	6	WA208	0.990	0.975

Table A37. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN050	0.811	0.693	4	MT058	0.887	0.825
2	SD002	0.901	0.693	5	US187	0.965	0.859
3	US175	0.903	0.693				

Table A38. Maximum and Minimum Correlation Coefficients Among Frost Discount Schedules

	ID	Mean	Min
1	US187	1	1
2	WA208	1	1
3	MT058	1	1

Table A39. Maximum and Minimum Correlation Coefficients Among Germ Discount Schedules

	ID	Mean	Min
1	US187	0.998	0.994
2	WA208	0.997	0.994
3	MT058	0.999	0.997

Table A40. Maximum and Minimum Correlation Coefficients Among Grade Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN050	0.997	0.986	3	MT058	1.000	1.000
2	WA208	0.997	0.986	4	US187	1.000	1.000

Table A41. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min
1	MT058	0.989	0.968
2	WA208	0.989	0.968
3	US187	1.000	1.000

Table A42. Maximum and Minimum Correlation Coefficients Among Insect Damaged Kernels Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	US175	1	1	3	US187	1	1
2	MT058	1	1	4	WA208	1	1

Table A43. Maximum and Minimum Correlation Coefficients Among Mold Discount Schedules

	ID	Mean	Min
1	WA208	0.995	0.988
2	US187	0.996	0.988
3	MT058	0.999	0.996

Table A44. Maximum and Minimum Correlation Coefficients Among Scab Discount Schedules

	MT058	WA208
MT058	1	1
WA208	1	1

Table A45. Maximum and Minimum Correlation Coefficients Among Sprout Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	US187	1	1
3	WA208	1	1

Table A46. Maximum and Minimum Correlation Coefficients Among Stone Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058			4	US175	0.934	0.868
2	WA118	0.934	0.868	5	US187	0.934	0.868
3	WA208	0.934	0.868				

Table A47. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SD002	0.9987	0.9978	4	WA208	0.9991	0.9978
2	US175	0.9987	0.9978	5	MT058	0.9991	0.9978
3	US187	0.9991	0.9978				

Table A48. Maximum and Minimum Correlation Coefficients Among Wheat of Other Classes Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.987	0.979	3	US187	0.995	0.982
2	WA208	0.993	0.979	4	US175	0.995	0.988

Hard Red Winter

Table A49. Maximum and Minimum Correlation Coefficients Among Black Tip Fungus Discount Schedules

	ID	Mean	Min
1	WA208	1	1
2	MT058	1	1
3	US187	1	1

Table A50. Maximum and Minimum Correlation Coefficients Among Contrasting Color Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	1	1	4	WA208	1	1
2	US187	1	1	5	US175	1	1
3	WA118	1	1				

Table A51. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS214	0.987	0.894	8	KS209	0.994	0.989
2	MO183	0.967	0.894	9	NE184	0.997	0.991
3	MO215	0.987	0.894	10	NE186	0.997	0.991
4	NE205	0.987	0.894	11	OK210	0.997	0.991
5	NE228	0.987	0.894	12	NE166	0.996	0.992
6	SD002	0.994	0.985	13	US175	0.996	0.993
7	NE180	0.994	0.986				

Table A52. Maximum and Minimum Correlation Coefficients Among Dockage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	CO102	0.870	0.563	13	NE205	0.971	0.823
2	KS013	0.952	0.563	14	NE228	0.971	0.823
3	CO012	0.882	0.612	15	CO141	0.969	0.828
4	KS121	0.960	0.614	16	MT058	0.947	0.828
5	KS081	0.954	0.689	17	OK210	0.973	0.831
6	MO183	0.942	0.689	18	KS209	0.974	0.836
7	US175	0.957	0.733	19	OK066	0.925	0.837
8	WA208	0.947	0.733	20	TX022	0.978	0.846
9	SH113	0.970	0.777	21	US187	0.979	0.850
10	OK176	0.966	0.800	22	OK160	0.978	0.872
11	KS214	0.971	0.823	23	WA118	0.976	0.876
12	MO215	0.971	0.823	24	TX083	0.978	0.881

Table A53. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	OK210	0.968	0.862	11	CO072	0.985	0.924
2	SD002	0.962	0.862	12	OK160	0.979	0.931
3	US175	0.959	0.873	13	KS214	0.991	0.965
4	TX022	0.964	0.877	14	MO215	0.991	0.965
5	MO183	0.959	0.878	15	NE205	0.991	0.965
6	SH113	0.986	0.878	16	KS121	0.991	0.969
7	SD127	0.984	0.878	17	KS209	0.992	0.969
8	NE166	0.979	0.884	18	NE180	0.990	0.972
9	US187	0.981	0.884	19	CO141	0.994	0.984
10	OK066	0.978	0.888				

Table A54. Maximum and Minimum Correlation Coefficients Among Frost Discount Schedules

	ID	Mean	Min
1	WA208	0.998	0.994
2	US187	0.997	0.994
3	MT058	0.999	0.996

Table A55. Maximum and Minimum Correlation Coefficients for Germ Discount Schedules

	ID	Mean	Min
1	MT058	0.999	0.996
2	US187	0.998	0.996
3	WA208	1.000	1.000

Table A56. Maximum and Minimum Correlation Coefficients Among Grade Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	US187	0.995	0.988	4	SH113	0.997	0.992
2	WA208	0.995	0.988	5	MT058	1.000	1.000
3	TX022	0.996	0.989				

Table A57. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.954	0.866	8	US187	0.986	0.943
2	CO072	0.940	0.866	9	WA208	0.986	0.943
3	KS214	0.963	0.866	10	OK160	0.986	0.943
4	MO215	0.963	0.866	11	OK210	0.986	0.943
5	NE205	0.963	0.866	12	SH113	0.986	0.943
6	NE180	0.966	0.939	13	KS209	0.991	0.971
7	TX022	0.986	0.942				

Table A58. Maximum and Minimum Correlation Coefficients for Insect Damaged Kernels Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SH113	0.982	0.932	13	NE205	0.997	0.988
2	KS021	0.995	0.932	14	NE228	0.997	0.988
3	NE166	0.992	0.932	15	CO072	0.997	0.988
4	OK176	0.989	0.938	16	TX022	0.997	0.988
5	NE184	0.996	0.949	17	OK210	0.995	0.988
6	NE186	0.996	0.949	18	KS013	0.996	0.988
7	KS081	0.996	0.954	19	OK160	0.997	0.993
8	US175	0.993	0.971	20	SD127	1.000	0.999
9	KS209	0.997	0.986	21	US187	1.000	1.000
10	MT058	0.999	0.986	22	WA208	1.000	1.000
11	KS214	0.997	0.988	23	MO183	1.000	1.000
12	MO215	0.997	0.988				

Table A59. Correlation Coefficients Among Mold Discount Schedules

	MT058	WA208
MT058	1	0.941
WA208	0.941	1

Table A60. Maximum and Minimum Correlation Coefficients Among Rye Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	NE184	0.990	0.961	4	CO012	0.990	0.961
2	NE186	0.990	0.961	5	CO102	1.000	1.000
3	OK176	0.977	0.961				

Table A61. Maximum and Minimum Correlation Coefficients for Shrunken and Broken Kernels Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	NE180	0.977	0.931	9	KS209	0.994	0.981
2	TX022	0.981	0.931	10	NE184	0.994	0.981
3	OK160	0.988	0.941	11	NE186	0.994	0.981
4	OK210	0.988	0.941	12	SD127	0.994	0.981
5	US175	0.983	0.941	13	CO012	0.994	0.983
6	KS214	0.991	0.965	14	MO183	0.999	0.986
7	MO215	0.991	0.965	15	SH113	1.000	1.000
8	NE205	0.991	0.965				

Table A62. Maximum and Minimum Correlation Coefficients Among Sprout Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	WA208	0.989	0.957	3	MT058	0.989	0.957
2	KS081	0.979	0.957	4	US187	1.000	1.000

Table A63. Maximum and Minimum Correlation Coefficients Among Stone Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.910	0.820	4	WA118	0.954	0.868
2	US175	0.911	0.820	5	WA208	0.934	0.868
3	US187	0.954	0.868				

Table A64. Maximum and Minimum Correlation Coefficients Among Total Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS214	0.991	0.943	6	US175	0.970	0.943
2	MO215	0.991	0.943	7	OK160	0.996	0.986
3	NE205	0.991	0.943	8	SH113	0.992	0.987
4	NE228	0.991	0.943	9	SD127	0.992	0.987
5	OK210	0.991	0.943	10	TX022	0.995	0.989

Table A65. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	US175	0.991	0.805	18	NE228	0.993	0.975
2	MO183	0.980	0.805	19	CO102	0.992	0.976
3	TX060	0.973	0.894	20	CO012	0.991	0.976
4	SH113	0.990	0.894	21	TX083	0.992	0.978
5	MT058	0.989	0.894	22	OK160	0.994	0.979
6	US187	0.989	0.894	23	OK210	0.994	0.979
7	NE180	0.992	0.952	24	SD127	0.992	0.979
8	NE166	0.988	0.955	25	KS121	0.995	0.980
9	WA208	0.993	0.955	26	CO072	0.994	0.982
10	OK066	0.986	0.969	27	KS209	0.994	0.982
11	SD002	0.991	0.970	28	KS021	0.995	0.983
12	NE184	0.993	0.974	29	TX022	0.996	0.983
13	NE186	0.993	0.974	30	OK176	0.995	0.986
14	NE181	0.995	0.975	31	KS081	0.995	0.986
15	KS214	0.993	0.975	32	KS013	0.995	0.986
16	MO215	0.993	0.975	33	CO141	0.996	0.986
17	NE205	0.993	0.975				

Table A66. Maximum and Minimum Correlation Coefficients Among Wheat of Other Classes Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SH113	0.917	0.894	7	MO183	0.981	0.894
2	MO215	0.979	0.894	8	WA208	0.979	0.896
3	NE205	0.979	0.894	9	NE180	0.979	0.896
4	NE228	0.979	0.894	10	US175	0.980	0.914
5	KS214	0.979	0.894	11	US187	0.980	0.914
6	OK160	0.917	0.894	12	MT058	0.982	0.919

Spring Wheat

Table A67. Maximum and Minimum Correlation Coefficients Among Contrasting Color Discount Schedules

	ID	Mean	Min
1	ND034	1	1
2	MN225	1	1
3	ND145	1	1

Table A68. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SD049	0.986	0.972	4	ND034	0.996	0.986
2	NE166	0.993	0.972	5	ND145	0.996	0.986
3	SD127	0.996	0.984	6	MN225	0.997	0.992

Table A69. Correlation Coefficients Among Dockage Discount Schedules

	CO141	ND034
CO141	1	0.780
ND034	0.780	1

Table A70. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN225			5	CO141	0.994	0.981
2	ND145	0.993	0.972	6	SD127	0.996	0.981
3	NE166	0.982	0.972	7	ND034	0.996	0.982
4	WI029	0.995	0.976				

Table A71. Maximum and Minimum Correlation Coefficients Among Falling Numbers Discount Schedules

	ID	Mean	Min
1	ND145	0.984	0.962
2	MN014	0.983	0.962
3	ND034	0.992	0.986

Table A72. Correlation Coefficients Among Insect Damaged Kernels Discount Schedules

	NE166	SD127
NE166	1	1
SD127	1	1

Table A73. Correlation Coefficients Among Protein Discount Schedules

	ND034	SD049
ND034	1	0.999
SD049	0.999	1

Table A74. Correlation Coefficients Among Shrunken and Broken Kernels Discount Schedules

	MN225	SD127
MN225	1	0.987
SD127	0.987	1

Table A75. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SD049	0.991	0.979	6	CO141	0.995	0.987
2	SD127	0.994	0.979	7	NE166	0.996	0.987
3	MN014	0.996	0.982	8	ND145	0.997	0.989
4	ND034	0.993	0.984	9	WI029	0.997	0.991
5	MN225	0.996	0.986				

Soft Red Winter

Table A76. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IL117	0.992	0.985	5	IL226	0.998	0.986
2	IL224	0.998	0.985	6	IL123	0.999	0.993
3	IL119	0.998	0.986	7	MN225	1.000	1.000
4	IL223	0.998	0.986	8	US222	1.000	1.000

Table A77. Maximum and Minimum Correlation Coefficients Among Dockage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IL119	1	1	4	IL223	1	1
2	IL226	1	1	5	IL224	1	1
3	IL201	1	1	6	US222	1	1

Table A78. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IL117	0.952	0.746	6	IL119	0.985	0.952
2	IL223	0.922	0.746	7	IL226	0.987	0.961
3	IL123	0.960	0.795	8	IL224	0.987	0.961
4	IL201	0.987	0.939	9	US222	0.984	0.962
5	WI029	0.988	0.939				

Table A79. Maximum and Minimum Correlation Coefficients Among Garlic Discount Schedules

	ID	Mean	Min				
1	IL201	0.985	0.922	5	IL224	0.985	0.922
2	IL123	0.947	0.922	6	IL117	0.992	0.970
3	US222	0.985	0.922	7	IL119	0.991	0.970
4	IL226	0.985	0.922				

Table A80. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IL119	0.858	0.548	4	IL223	0.995	0.974
2	US222	0.910	0.548	5	IL123	0.999	0.994
3	IL226	0.955	0.775				

Table A81. Maximum and Minimum Correlation Coefficients Among Shrunken and Broken Kernels Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN225	1	1	5	IL223	1	1
2	IL123	1	1	6	US222	1	1
3	IL224	1	1	7	IL117	1	1
4	IL226	1	1				

Table A82. Maximum and Minimum Correlation Coefficients Among Total Damage Discount Schedules

	ID	Mean	Min
1	IL201	1	1
2	IL223	1	1
3	IL226	1	1

Table A83. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MN225			7	IL123	0.994	0.959
2	IL224	0.985	0.891	8	WI148	0.995	0.966
3	IL226	0.974	0.891	9	US222	0.996	0.966
4	IL119	0.983	0.896	10	IL117	0.995	0.966
5	IL201	0.969	0.950	11	IL223	0.998	0.997
6	WI029	0.994	0.953				

Soft White

Table A84. Maximum and Minimum Correlation Coefficients Among Black Tip Fungus Discount Schedules

	ID	Mean	Min
1	ID112	1	1
2	MT058	1	1
3	WA208	1	1

Table A85. Maximum and Minimum Correlation Coefficients Among Contrasting Color Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	US187	1	1	4	MT058	1	1
2	WA118	1	1	5	ID112	1	1
3	WA208	1	1	6	CO141	1	1

Table A86. Maximum and Minimum Correlation Coefficients Among Dockage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.966	0.900	4	US187	0.993	0.974
2	CO141	0.978	0.900	5	WA118	0.999	0.995
3	WA208	0.982	0.904	6	ID112	0.999	0.997

Table A87. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min
1	CO141	0.998	0.997
2	ID112	0.999	0.997
3	US187	0.999	0.997

Table A88. Maximum and Minimum Correlation Coefficients Among Frost Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MT058	0.999	0.997	3	US187	0.999	0.997
2	WA208	0.999	0.997	4	ID112	1.000	1.000

Table A89. Maximum and Minimum Correlation Coefficients Among Germ Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ID112	1	1	3	US187	1	1
2	MT058	1	1	4	WA208	1	1

Table A90. Maximum and Minimum Correlation Coefficients Among Grade Discount Schedules

	ID	Mean	Min
1	US187	0.999	0.997
2	WA208	0.999	0.997
3	MT058	1.000	1.000

Table A91. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ID112	1	1	3	US187	1	1
2	MT058	1	1	4	WA208	1	1

Table A92. Maximum and Minimum Correlation Coefficients Among Insect Damaged Kernels Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ID112	0.993	0.978	3	US187	1.000	1.000
2	MT058	0.993	0.978	4	WA208	1.000	1.000

Table A93. Maximum and Minimum Correlation Coefficients Among Mold Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ID112	1	1	3	US187	1	1
2	MT058	1	1	4	WA208	1	1

Table A94. Maximum and Minimum Correlation Coefficients Among Sprout Discount Schedules

	ID	Mean	Min
1	MT058	1	1
2	WA208	1	1
3	ID112	1	1

Table A95. Maximum and Minimum Correlation Coefficients Among Stone Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ID112	0.848	0.691	4	WA208	0.932	0.780
2	MT058	0.845	0.691	5	WA118	0.972	0.949
3	US187	0.932	0.780				

Table A96. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	CO141	0.992	0.983	4	ID112	0.995	0.991
2	WA208	0.995	0.983	5	US187	0.997	0.992
3	MT058	0.996	0.989				

Table A97. Maximum and Minimum Correlation Coefficients Among Wheat of Other Classes Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ID112	0.997	0.986	3	MT058	0.999	0.995
2	WA208	0.994	0.986	4	US187	0.999	0.995

Grain Sorghum

Table A98. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	IL224	0.996	0.985	6	NE186	0.996	0.986
2	KS003	0.993	0.985	7	KS081	0.997	0.995
3	US222	0.996	0.985	8	KS209	0.997	0.995
4	KS037	0.993	0.985	9	NE188	1.000	1.000
5	NE184	0.996	0.986				

Table A99. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS037	0.976	0.950	8	NE188	0.994	0.969
2	KS081	0.990	0.950	9	NE205	0.994	0.969
3	NE216	0.973	0.957	10	OK210	0.994	0.969
4	KS003	0.993	0.966	11	IL224	1.000	1.000
5	KS209	0.994	0.969	12	NE184	1.000	1.000
6	KS214	0.994	0.969	13	NE186	1.000	1.000
7	MO215	0.994	0.969				

Table A100. Maximum and Minimum Correlation Coefficients Among Heat Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	MO215	0.833	0.655	5	KS209	0.850	0.655
2	NE216	0.833	0.655	6	TX147	0.850	0.655
3	OK210	0.833	0.655	7	IL224	0.937	0.868
4	KS003	0.850	0.655				

Table A101. Maximum and Minimum Correlation Coefficients Among Tan Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS214	1	1	3	NE205	1	1
2	MO215	1	1	4	OK210	1	1

Table A102. Maximum and Minimum Correlation Coefficients Among Total Broken and Foreign Material Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS037	0.987	0.949	7	NE188	0.987	0.976
2	NE216	0.987	0.949	8	OK210	0.991	0.976
3	TX147	0.984	0.949	9	KS214	0.991	0.976
4	KS003	0.987	0.964	10	NE205	0.991	0.976
5	US222	0.987	0.966	11	IL223	0.989	0.978
6	MO215	0.991	0.976	12	KS209	0.993	0.985

Table A103. Maximum and Minimum Correlation Coefficients Among Total Damage Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	KS214	0.999	0.995	5	MO215	0.999	0.995
2	NE205	0.999	0.995	6	NE216	0.998	0.996
3	OK210	0.999	0.995	7	IL223	1.000	1.000
4	TX147	0.997	0.995				

Table A104. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	TX147	0.981	0.949	13	KS021	0.996	0.984
2	IL223	0.991	0.949	14	NE181	0.997	0.984
3	US222	0.991	0.949	15	NE071	0.996	0.984
4	KS081	0.994	0.967	16	OK210	0.996	0.986
5	IL224	0.995	0.967	17	KS121	0.996	0.986
6	NE216	0.995	0.967	18	KS214	0.995	0.986
7	KS037	0.992	0.967	19	NE184	0.996	0.986
8	NE188	0.993	0.967	20	NE186	0.996	0.986
9	KS003	0.995	0.967	21	NE205	0.995	0.986
10	KS209	0.995	0.967	22	MO215	0.996	0.986
11	TX060	0.983	0.967	23	KS013	0.996	0.986
12	KS010	0.994	0.980	24	TX062	0.996	0.986

Barley

Table A105. Correlation Coefficients Among Germination Discount Schedules

	US175	ND191
US175	1	1
ND191	1	1

Table A106. Maximum and Minimum Correlation Coefficients Among Plump Discount Schedules

	ID	Mean	Min
1	ND034	0.997	0.992
2	US175	0.997	0.992
3	ND191	1.000	1.000

Table A107. Correlation Coefficients Among Protein Discount Schedules

	ND191	US175
ND191	1	0.99
US175	0.99	1

Table A108. Correlation Coefficients for Shrunken and Broken Discount Schedules

	ND191	US175
ND191	1	1
US175	1	1

Table A109. Correlation Coefficients Among Thin Discount Schedules

	ND191	US175
ND191	1	1
US175	1	1

Table A110. Maximum and Minimum Correlation Coefficients Among DON Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	ND034	0.90	0.73	4	US175	0.94	0.88
2	ND191	0.87	0.73	5	ND145	0.94	0.89
3	ND174	0.90	0.73				

Table A111. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	WI029	0.998	0.993	3	ND174	0.997	0.995
2	ND193	0.997	0.993	4	MN026	0.999	0.996

Oats

Table A112. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min
1	IL223	0.999	0.998
2	MN02	0.999	0.998
3	WI029	1.000	1.000

Table A113. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min		ID	Mean	Min
1	SD049	0.994	0.985	7	IA157	0.996	0.986
2	WI029	0.994	0.985	8	KS081	0.993	0.986
3	IA163	0.994	0.985	9	KS121	0.994	0.986
4	ND034	0.995	0.985	10	IA122	0.996	0.986
5	MN02	0.996	0.985	11	IL223	0.999	0.993
6	IA074	0.996	0.986				

Canola

Table A114. Correlation Coefficients Among Green Discount Schedules

	US170	US196
US170	1	0.98
US196	0.98	1

Table A115. Correlation Coefficients Among Heat Discount Schedules

	US170	US196
US170	1	0.82
US196	0.82	1

Table A116. Correlation Coefficients Among In Admix Discount Schedules

	US170	US196
US170	1	0.99
US196	0.99	1

Oil Sunflower

Table A117. Maximum and Minimum Correlation Coefficients Among Damage Discount Schedules

	ID	Mean	Min
1	KS013	1	1
2	KS121	1	1
3	KS197	1	1

Table A118. Maximum and Minimum Correlation Coefficients Among Foreign Material Discount Schedules

	ID	Mean	Min
1	KS197	0.999	0.997
2	KS013	0.998	0.997
3	KS121	0.999	0.998

Table A119. Correlation Coefficients Among Heat Discount Schedules

	KS121	KS197
KS121	1	1
KS197	1	1

Table A120. Maximum and Minimum Correlation Coefficients Among Oil Discount Schedules

	ID	Mean	Min
1	KS01	1	1
2	KS12	1	1
3	KS19	1	1

Table A121. Maximum and Minimum Correlation Coefficients Among Test Weight Discount Schedules

	ID	Mean	Min
1	KS01	1	1
2	KS12	1	1
3	KS19	1	1

APPENDIX B

Covered Quality Deficiencies

Table B1: Summarized Provisions by Crop

Crop	Provision to be met for Quality Adjustment	Exception	Notes
Barley	U.S. Grade 5 or worse Weight or kernel damage Percentage of sound barley Thin or black barley Musty, sour, or commercially objectionable odor Grading smutty, garlicky or ergoty Substances (including mycotoxins) or conditions injurious to human or animal health	Smut or garlic odor	As identified by FDA or other U.S. health organizations
Buckwheat	N/A	N/A	N/A
Canola	U.S. Sample Grade Kernel damage Musty, sour, or commercially objectionable odor Substances (including mycotoxins) or conditions injurious to human or animal health	Heat damage	As identified by FDA or other U.S. health organizations
Corn	U.S. Grade 5 or worse Weight or kernel damage Musty, sour, or commercially objectionable odor Substances (including mycotoxins) or conditions injurious to human or animal health	Heat damage	As identified by FDA or other U.S. health organizations
Cotton	Price quotation "A" is less than 75% of price quotation "B" Ginning must have been completed at a gin Using roller equipment	Colored cotton lint	
Flax	U.S. sample grade Damaged kernels Substances (including mycotoxins) or conditions injurious to human or animal health		As identified by FDA or other U.S. health organizations
Grain Sorghum	U.S. sample grade Weight or kernel damage Musty, sour, or commercially objectionable odor Smutty grain sorghum Substances or conditions injurious to human or animal health	Heat damage Smut odor	As identified by FDA or other U.S. health organizations
Oats	U.S. sample grade Weight damage Percentage of sound oats Grading smutty, garlicky or ergoty Substances (including mycotoxins) or conditions injurious to human or animal health		As identified by FDA or other U.S. health organizations

Source: "Crop Provisions" documents, www. RMA.USDA.GOV

Crop	Provision to be met for Quality Adjustment	Exception	Notes
Rice	U.S. Grade 4 or worse Total milling yield of less than 68 pounds per hundredweight Whole kernel weight is less than 55 pounds per hundredweight of milled rice Whole kernel weight is less than 48 pounds per hundredweight of milled rice Substances conditions injurious to human or animal health		Because of red rice, chalky kernels, or damaged kernels For medium and short grain varieties For long grain varieties As identified by FDA or other U.S. health organizations
Rye	U.S. Grade 4 or worse Weight or kernel damage Thin Rye Grading smutty, garlicky or ergoty Substances (including mycotoxins) or conditions injurious to human or animal health		As identified by FDA or other U.S. health organizations
Safflower	Test weight below 35 pounds per bushel Seed damage in excess of 25% Substances injurious to human or animal health		As identified by FDA or other U.S. health organizations
Soybeans	Grade U.S. sample grade Weight or kernel damage Musty, sour, or commercially objectionable odor Garlicky soybeans Substances injurious to human or animal health	Heat damage Garlic odor	As identified by FDA or other U.S. health organizations
Sunflower (Oil Type)	U.S. sample grade Weight or kernel damage Musty, sour, or commercially objectionable odor Substances injurious to human or animal health	Heat damage	As identified by FDA or other U.S. health organizations
Sunflower (Non-Oil Type)	Test weight below 22 pounds per bushel Kernel damage in excess of 5% Musty, sour, or commercially objectionable odor Substances injurious to human or animal health	Heat damage	As identified by FDA or other U.S. health organizations
Wheat	U.S. Grade 5 or worse Weight or kernel damage Shrunken or broken kernels Defects Musty, sour, or commercially objectionable odor Grading garlicky, light smutty, smutty or ergoty Substances (including mycotoxins) or conditions injurious to human or animal health	Heat damage Foreign material and heat damage will not be considered defects	As identified by FDA or other U.S. health organizations

Source: "Crop Provisions" documents, www. RMA.USDA.GOV

FSA Quality Discounts

Table B2: Summarized Provisions by Crop

Crop	Unit	Provision to be met for Quality Adjustment	Discount	Notes
Barley	Bushel	U.S. Sample Grade	$0.30	For 2001 crop
		U.S. Grade 5	$0.30	
		Weight Damage	$0.02	$0.02 for test weight of 35.9 to 35.0 pounds and $0.02 for each whole or fraction of a pound under 35.0 pounds per bushel
		Heat-Damaged Kernels	$0.02	$0.02 for 3.1 percent plus an additional $0.02 for each 10^{th} of a percent over 3.1 percent
		Damaged Kernels (Total) Percent	$0.02	$0.02 for 10.1 percent plus an additional $0.02 for each whole percent or fraction of a percent over 11.0 percent through 15.0 percent plus an additional $0.05 for each whole percent or fraction of a percent over 15.0 percent
		Thin or Black Barley	$0.05	$0.05 for thin percentages from 75.1 to 80.0 plus $0.05 for each additional thin percentages in 5% increments
		Special Grade Discount of Garlicky	$0.10	Plus $0.01 for each whole percent or fraction of a half percent over 4.5 percent
		Musty, Sour	$0.10	
		Foreign Material	$0.01	$0.01 for 5.1 to 6.0 percent plus an additional $0.01 for each whole percent or fraction of a percent over 6.0 percent through 10.0 percent plus an additional $0.02 for each whole percent or fraction of a percent over 10.0 percent
Buckwheat	N/A	N/A	N/A	N/A
Canola	Hundredweight	Damaged Kernels (Total) Percent	$0.25	$0.06 for 2.1 to 3.0 percent, with an additional $0.06 for each percent or fraction of a percent up to 9.0 percent, an additional $0.10 for each percent or fraction of a percent up to 10.0 percent, an additional $0.25 for each percent or fraction of a percent up to 15.0 and, above that, it is an additional $0.50 for each percent or fraction of a percent
		U.S. Sample Grade	$0.50	For 2001 crop
		Musty, Sour	$0.40	

Source: "Premiums & Discounts" schedules, www.FSA.USDA.GOV

Crop	Unit	Provision to be met for Quality Adjustment	Discount	Notes
Corn	Bushel	U.S. Sample Grade	$0.15	For 2001 crop
		Weight Damage	$0.01	$0.01 for test weight of 53.9 to 53.0 pounds, with an additional $0.01 for each pound or fraction of a pound down to 50.0 pounds, and, below that, it is an additional $0.02 for each pound or fraction of a pound
		Damaged Kernels (Total) Percent	$0.02	$0.02 for 5.1 to 6.0 percent, with an additional $0.02 for each percent or fraction of a percent up to 15.0 percent, and, above that, an additional $0.03 for each percent or fraction of a percent
		Broken Corn & Foreign Material	$0.02	$0.02 for 3.1 to 4.0 percent, with an additional $0.02 for each percent or fraction of a percent up to 8.0 percent, an additional $0.03 for each percent or fraction of a percent up to 10.0 percent, and, above that, it is an additional $0.04 for each percent or fraction of a percent
		Sour	$0.10	
		Musty	$0.05	
Cotton	N/A	N/A	N/A	N/A
Flax	Hundredweight	U.S. Sample Grade	$0.50	For 2001 crop
		Heat-Damaged Kernels	$0.12	$0.06 for 0.3 to 0.5 percent, with an additional $0.06 for each half percent or fraction of a percent up to 1.0 percent, an additional $0.12 for each half percent or fraction of a percent up to 1.5 percent, an additional $0.24 for each half percent or fraction of a percent up to 2.0 percent, an additional $0.52 for each 1.0 percent or fraction of a percent up to 3.0 percent, and, above that, an additional $1.00 for each 1.0 percent or fraction of a percent
		Damaged Kernels (Total) Percent	$0.50	$0.22 for 10.1 to 11.0, with an additional $0.22 for each 1.0 percent or fraction of a percent up to 14.0 percent, and, above that, it is an additional $.50 for each 1.0 percent or fraction of a percent

Source: "Premiums & Discounts" schedules, www.FSA.USDA.GOV

Crop	Unit	Provision to be met for Quality Adjustment	Discount	Notes
Grain Sorghum	Hundredweight	U.S. Sample Grade	$0.30	For 2001 crop
		Weight Damage	$0.02	$0.02 for 54.9 to 54.0 pounds, with an additional $0.02 for each pound or fraction of a pound down to 51.0 pounds, and an additional $0.04 for each pound or fraction of a pound below that
		Damaged Kernels (Total) Percent	$0.02	$0.02 for 5.1 to 6.0 percent, with an additional $0.03 for each percent or fraction of a percent up to 15.0 percent, an additional $0.03 for each percent or fraction of a percent up to 25.0 percent, and an additional $0.02 for each percent or fraction of a percent above that
		Broken Kernels, Foreign Material	$0.01	$0.01 for 7.1 to 8.0 percent, with an additional $0.02 for each percent or fraction of a percent up to 15.0 percent, and an additional $0.03 for each percent or fraction of a percent above that
		Musty	$0.10	
		Sour	$0.20	
Oats	Bushel	U.S. Sample Grade	$0.15	For 2001 crop
		Weight Damage	$0.05	$0.05 for 32.5 to 32.1 pounds, with an additional $0.03 for each half pound or fraction of a pound below that
		Sound-Cultivated Oats	$0.02	$0.02 for 93.9 to 93.0 percent, with an additional $0.02 for each percent or fraction of a percent down to 80.0 percent, and an additional $0.03 for each percent or fraction of a percent below that
		Garlicky	$0.05	
		Foreign Material	$0.01	$0.01 for 3.1 to 3.5 percent, with an additional $0.01 for each half percent or fraction of a half percent up to 8.0 percent, an additional $0.02 for each half percent or fraction of a half percent up to 15.0 percent, and an additional $0.01 for each half percent or fraction of a half percent above that
Rice	Hundredweight	U.S. Sample Grade	$5.50	
		U.S. Grade 4	$0.60	
		U.S. Grade 5	$1.00	
		U.S. Grade 6	$2.00	
Rye	N/A	N/A	N/A	N/A
Safflower	Hundredweight	Total Damage	$0.05	$0.05 for 3.1 to 4.0 percent, with an additional $0.05 for each percent or fraction of a percent up to 10.0 percent, an additional $0.10 for each percent or fraction of a percent up to 15.0 percent, and, above that, an additional $0.25 for each percent or fraction of a percent

Source: "Premiums & Discounts" schedules, www.FSA.USDA.GOV

Crop	Unit	Provision to be met for Quality Adjustment	Discount	Notes
Soybeans		U.S. Sample Grade	$0.15	For 2001 crop
		Weight Damage	$0.005	$0.005 for 53.9 to 53.0 pounds, with an additional $0.005 for each pound or fraction of a pound down to 49.0 pounds, and, below that, an additional $0.01 for each pound or fraction of a pound
		Total Damage	$0.02	$0.02 for 2.1 to 3.0 percent, with an additional $0.02 for each percent or fraction of a percent up to 8.0 percent, and, above that, an additional $0.02 for each half percent or fraction of a half percent
		Musty	$0.05	
		Sour	$0.10	
		COFO	$0.20	
Sunflower (Oil Type)	Hundredweight	U.S. Sample Grade	$0.50	For 2001 crop
		Weight Damage	$0.20	$0.20 for 24.9 to 24.0 pounds, below that, with an additional $0.20 for each pound or fraction of a pound
		Total Damage	$0.44	$0.22 for 5.1 to 6.0 percent, with an additional $0.22 for each percent or fraction of a percent up to 10.0 percent, and, above that, with an additional $0.44 for each percent or fraction of a percent
		Musty, Sour	$0.50	
Sunflower (Non-Oil Type)	Hundredweight	Musty, Sour	$0.50	
Wheat	Bushel	U.S. Sample Grade	$0.70	For 2001 crop
		U.S. Grade 5	$0.65	
		Weight Damage	$0.06	$0.06 for test weight of 50.9 to 50.0 pounds and $0.06 for each whole pound or fraction of a pound under 40.0 pounds per bushel
		Total Damage	$0.03	$0.03 for 15.1 percent plus an additional $0.03 for each whole percent or fraction of a percent over 16.0 percent
		Smut	$0.20	$0.10 for Light Smutty
		Garlic	$0.01	
		Musty	$0.10	
		Sour	$0.25	

Source: “Premiums & Discounts” schedules, www.FSA.USDA.GOV