29 Economics of Commodity Grading and Segregation

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Measures of Grain Quality

The quality of grains and other commodities can be measured in various ways. To some extent "quality" depends on the needs of the end user. The quality properties of a grain are affected by genetic traits, growing period, harvest timing, grain harvesting and handling equipment, drying system, storage management practices, and transportation procedures. In general, measures of the quality of grains can be separated into physical, sanitary, and intrinsic traits.

Physical traits relate to the physical appearance or characteristic of the kernel. Examples of physical traits include test weight, kernel size, moisture content, damaged kernels, and other properties of the grain that can be determined by physical inspection or mechanical separations. Sanitary traits relate to the cleanliness of the grain. Sanitary traits include the presence of dockage and foreign material, as well as other undesirable materials such as fungi and mycotoxin, insects and insect fragments, rodent excrements, toxic seeds, pesticide residue, or commercially objectionable odors. Intrinsic traits are often critical to the functionality of the grain but usually can only be determined by analytical tests. Traits such as protein, ash and gluten content, milling yield, oil content, starch content, hardness, germination percentage, and feed value are all examples of intrinsic traits which could affect the value of a grain for a particular use.

In addition to these measures of quality, there are market-based quality measures. An obvious example would be the designation of organic. While it is difficult to distinguish organic grain based on physical appearance, cleanliness, or analytical tests, the property may have value to particular end users and thus result in a difference in value. Market-based traits are usually reflected by premiums or discounts. The importance of these traits also often varies across markets. For example, the absence of genetically modified varieties might be important in one market and have no value in another.

Grain Grading System

A system of grades and standards improves the efficiency of the marketing system by communicating to buyers and sellers the properties of the commodity being marketed. Grades provide a common trading language, or common reference, so buyers and sellers can more easily determine the quality (and value) of commodities. Grade and standards improve price discovery, the process by which buyers and sellers arrive at the transaction price for a given quantity and quality of grain at a given time and place. Uniform grades and standards are essential in order for electronic commodity markets and futures markets to function. Grades and standards also communicate what commodity characteristics are or are not permissible.

An efficient grading system must have a number of characteristics. It must measure characteristics that are important to users and that can be accurately and uniformly measured. It must be easily applied and not slow the process of handling and transportation. It must measure quality characteristics that are available in significant volume and important to a significant number of users to justify the costs of measuring the characteristic and segregating the grain. Ideally, a set of grain standards should measure the difference in the value of the grain to the end user. Achieving this ideal is complicated by the fact that some traits cannot be efficiently measured and by the fact that different end users have different standards as to what traits are important.

Commodity Inspection and Grading

The system for inspecting and grading grains in the United States is based primarily on physical inspection. Grain is inspected for quality characteristics, damage, foreign material, and dockage. The Federal Grain Inspection Service (FGIS) operates under the oversight of the Grain Inspection, Packers and Stockyards Administration (GIPSA). The USDA oversees federal grain inspection and weighing programs. These programs were established by the U.S. Grain Standards Act (USGSA) of 1976. Standards exist for 12 grains (listed from largest to smallest volume inspected): corn, wheat, soybeans, sorghum, barley, oats, rye, flaxseed, sunflower seed, triticale, mixed grain, and canola. Many grains have several classes. For example wheat is divided into hard red winter, hard red spring, durum, soft red spring, hard white wheat and soft white wheat. Commodities such as rice, pulses, and hops have similar standards for grade and factors. In contrast to the system used in some other countries, grain grades and standards in the U.S. are not adjusted for year-to-year differences in crop quality.

Grain can be inspected numerous times as it moves through the marketing chain between the producer and final end user. Grain can be inspected and graded by both private individuals who are licensed to grade grain and by FGIS employees. The only mandatory inspection and grading is for grain that is exported from the U.S. (with exemptions for some grain exported to Canada and Mexico). Grain delivered to a state or federally licensed warehouse is also required to be inspected, graded, and weighed by a licensed inspector.

Grain may be officially or unofficially graded. Unofficial graded grain is graded by state or federally licensed graders that are not under the direct supervision of FGIS. Guidelines are provided by FGIS for collecting samples for officially graded grain samples but a license is not required for the person collecting the samples. The person weighing and grading the grain must be federally or state licensed. Grain delivered to the first handler (country elevator) is typically unofficially inspected by licensed graders at the facility. The first handler often sells the grain to a regional elevator, export elevator or end user on the basis of an official grade. The first handler therefore bears the risk of grading inaccuracy.

Official grades are determined by graders trained, licensed, and periodically tested by the Federal Grain Inspection Service. Inspectors may be employees of FGIS/USDA, a private company, states with a cooperative agreement with GIPSA or employees of the Canadian Grain Commission with GIPSA oversight. The person obtaining the sample and the person grading official graded grain must be licensed by the FGIS.

U.S. grain grades are based on a number of factors, which are based on visual observation and physical measurement. The grain grading system includes numerical grades for each grain as well as special grades and non-grain information, which is officially measured and included on the grade sheet. In order to achieve a numerical grade the grain must meet or exceed the minimum level for each characteristic that is specified for that grade. For example, grades on wheat are based on test weight, shrunken and broken kernels, foreign material, damage, heat damage, and total damage. Any one or a combination of those factors could be the binding grade factor that determines the grade of a sample of wheat. Other factors may be officially measured and indicated on the grade sheet but do not influence the numerical grade. In wheat, moisture, dockage, and protein are factors that can be officially measured but are not grade factors. Insect infestation is a special grade factor that is also listed on the grade sheet but does not change the numerical grade. All of the factors, both grade and non-grade, as well as other characteristics such as milling and baking test or feed value, may be specified in grain contracts and affect the value of the grain.

Segregation

Segregation involves testing and separating grain with specific characteristics so that it can be comingled only with grain with similar characteristics. Segregation often occurs at the farm and first handler level. Many grain facilities are not well suited for segregation because they are designed for bulk storage and rapid handling. Grain generally becomes more commingled as it progresses through the marketing system.

Segregation can generate value by creating a more uniform product. It also can add value by aggregating lots of grain with properties that have value to a particular user. For example, a flour miller might be willing to pay a premium for a certain variety of wheat that they believed had superior milling characteristics. In some cases the value that is created by segregation is through minimizing the reduction of value from grain with undesirable traits. Grain with high moisture might be segregated so that it can be dried or conditioned. Corn with a high level of aflatoxin might be segregated so that it can be marketed to an end user with less stringent standards for aflatoxin levels. This segregation might be preferable to comingling the affected corn with higher quality corn, reducing the value of the entire bin or elevator.

Blending

Blending grain can also increase value. In this case segregation is performed as a vehicle to separate categories of grains with different characteristics so that they can be combined in a manner that maximizes the total value of the grain to the end users. A simple example would be three lots of grain which each received a No. 2 grade for a different binding grade factor but with levels of the other grade factors above the required minimums. In theory the three lots of No. 2 grain could be combined into one lot of No. 1 grain.

Blending can also occur as part of a storage strategy. Grain in concrete storage structures may be turned from one bin to keep it cool or to treat it to control insects. When multiple bins are simultaneously turned, the grain is often intentionally blended. Grain in all types of storages can also be blended during unloading. Because the fine material in the grain tends to move to the outside of the bin as the bin is loaded, the last portion of a bin will have a disproportionate amount of undesirable material. Blending the last portion of one bin with initial grain from one or more other bins can help to maintain shipments within the contract specifications.

As mentioned previously, grain is also unintentionally blended (comingled) as it passes through the handling and storage systems. Bulk handling and storage systems, by their very nature, commingle grain from multiple loads. Many conveying systems are not completely self-cleaning and commingle some grain after the destination bin is changed. A more important source of unintended or structural blending occurs due to the mismatch between storage units and efficient transportation units. For example, the most efficient rail shipment, a unit train, requires more than 300,000 bushels. Grain from multiple bins is typically commingled as the unit train is loaded.

Identity Preservation

The concept of identity preservation is to produce grains with a particular trait and keep them segregated such that they are only commingled with grains of the same trait throughout the marketing chain. Almost all grains are identity preserved with respect to some trait. Corn separated from soybeans is identity preserved with respect to type of grain. Hard red winter wheat separated from hard white wheat is identity preserved with respect to class. As commonly used, the term identity preserved grain refers to separation of grain with or without specific traits such as genetic modified traits (GMO), high oil corn or high oleic oil soybeans, specific production practices such as variety or organic production. The most stringent form of identity preservation would separate the grain from an individual producer through the marketing process.

Identity preservation results in additional costs in the storage and marketing system. A greater number of bins may be needed to maintain more categories of grain. Large bins may be underutilized if there is insufficient grain of a particular category to fill the bin. The opportunity to create value through blending is obviously eliminated. It may not be possible to use the bulk transportation system. More costly shipping methods such as shipping containers may be required. Any link in the storage system where a significant amount of grain can remain after cleanout is potential problem with identity-preserved storage. Poorly designed augers, dump pits, and other transfer points are common causes of commingled grain. When designing a grain-handling system for identity-preserved grain, transfer points can minimized by installing clean-out panels to allow easy access. Special handling equipment such as dedicated bucket elevators and conveyors may help minimize cross contamination of ordinary grain with high value grain, but they also require proper cleaning procedures.

Grading, Segregation, and Blending Implications for Storage Management

An understanding of the role of grading, segregation, blending, and identity preservation highlights some of the structural challenges to the management of stored grain and other commodities. Grain is marketed on the basis of grade standards and additional contract specifications, which often are more stringent. While it is obvious that quality deterioration during handling and storage can decrease grain value, the exact mechanism is difficult to describe and model. For example, consider the implication of stored grain insects. The presence of live insects in a sample would result in the special grade of "infested" and would likely trigger market discounts. Insects could be present in the grain but not detected in the sample. Insects could create insect damaged kernels (IDK). IDK is both a special grade factor and a component of the measure of total damaged kernels. If the number of insect damaged kernels is below the special grade threshold, then the implication of the damage depends on whether it resulted in a change in numerical grade. Market-based discounts for IDK that are included in contract specifications could have additional consequences for grain shipped to particular buyers.

The strategies of segregation and blending also have implications for stored grain management. If storage management were the only criteria, high risk grain would be moved out of storage at the first marketing opportunity. But because of the value of the grain in the future blending process – for example, high protein – the elevator manager may dictate that it remain in storage. Blending, both intentional and unintentional has the effect of spreading insects and storage damage throughout the facility.

Identity preservation also creates unique storage issues. In addition to bin size, bin utilization, and handling systems implications, the penalties for storage damage in identity-preserved systems are often higher. Identity-preserved grain is typically sold to a smaller set of buyers, often on a contract basis. Contract specifications for damage and insect presence are usually much stricter than those for commodity grain. In some cases such as organic grains, the contract may restrict the use of chemical controls.

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